AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

A Journal of Automotive Engineering and Construction

PUBLISHED WEEKLY

VOLUME XL
January 2, 1919, to June 26, 1919

The Class Journal Company
239 West 39th Street
NEW YORK CITY

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL — NEW YORK, JANUARY 2, 1919, TO JUNE 26, 1919 — NOS. 1 TO 26

Index to Volume XL

AIRPLANES AND AERIAL INFORMATION

ASSOCIATIONS

S. A. E.

BOOK REVIEWS

CONDITIONS

CONTESTS

DESCRIPTIONS

Accessories

EDITORIALS

EFFICIENCY

EXPORTS AND IMPORTS

FINANCIAL STATEMENTS, INCORPORATIONS, CAPITAL, ANNUAL MEETINGS, ELECTION OF OFFICERS, DIVIDENDS, ETC.

FOREIGN

FORUM

LEGAL

NEW COMPANIES

NEWS

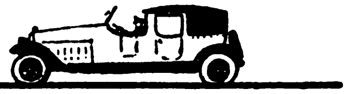
PRODUCTION

REGISTRATION

SHOWS

TABLES

TECHNICAL



AUTOMOTIVE INDUSTRIES

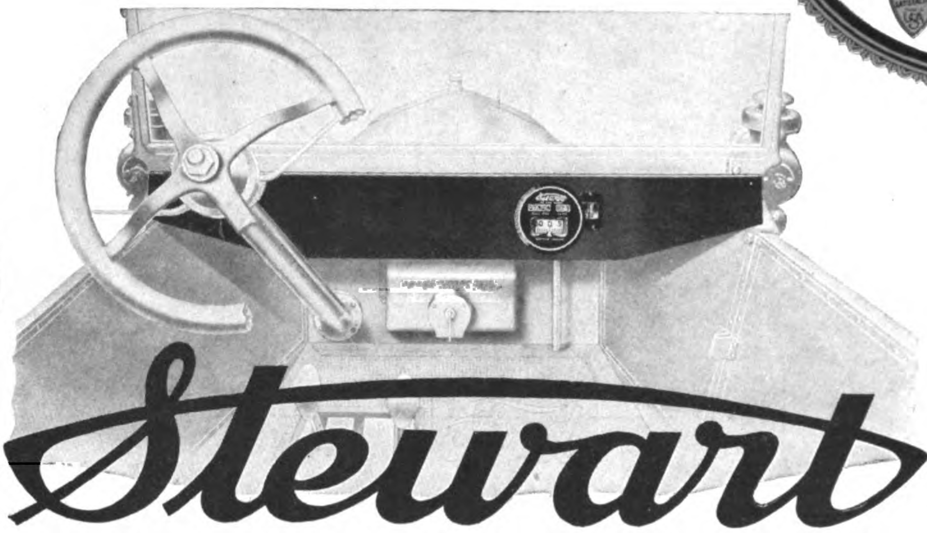
THE AUTOMOBILE

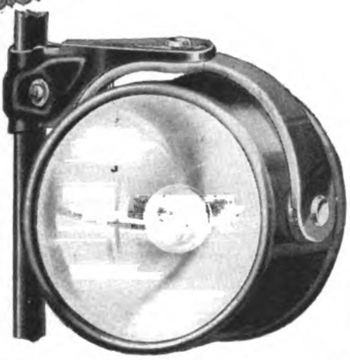
Vol. XL
Number 1

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, JANUARY 2, 1919

Fifteen cent
Three dollar

Stewart Speedometer and Instrument Board for Fords $13

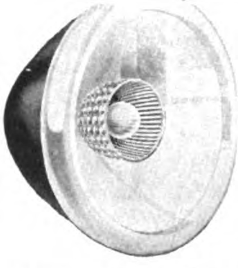




Stewart V-Ray Searchlight $6

Stewart

Accessories For Ford Cars



Stewart V-Ray Spark Plug $1

Stewart Lens Per Pair $2

The Stewart line of accessories for Ford cars represents a big opportunity for dealers.

Too many dealers overlook this big field. There are nearly 2,000,000 Ford cars in use today. Think of the thousands of Stewart Speedometers, Searchlights, Signals, Autoguards, etc., you could sell to these Ford owners if you would only go after the business.

Every Ford car should be equipped with Stewart Accessories. At the very least they should have a Stewart Speedometer and Instrument Board.

All it takes is a little effort on your part. If you will only take the trouble to look over the Ford cars that come to you—note the accessories that are lacking. Then tell the owner a few of the reasons why he should have a Stewart Speedometer, Searchlight, Autoguard, and so on. The results from this little effort will surprise you. And, if you go after the business with some enthusiasm and determination, you will soon realize a very handsome profit from the sale of Stewart Accessories.

Other dealers are doing this—why shouldn't you?

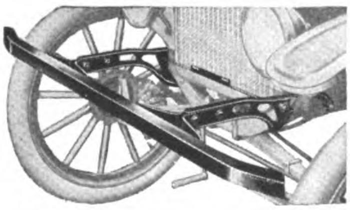
The Stewart Accessories are the easiest line to sell. They are so well known, so extensively advertised that they are already half sold before you stock them.

Nearly every Ford owner would buy more accessories if you—the dealer—would make it easy for him to get them. The only way is to carry a stock so you can show them to your prospects. But don't stop there. Show the accessories. Tell the car owners why they should have them. That is the way to bigger business and better profits.

Stewart Warning Signal Hand Operated $4.50
(Motordriven type $7.50)

Stewart Automobile Accessories are sold by leading accessory dealers, jobbers and garages—everywhere.

Stewart-Warner Speedometer Corporation
CHICAGO, U. S. A.



Stewart Autoguard for Ford Cars $10
With Nickel Channel Bar, $11.00

Stewart Speedometer and Instrument Board for Ford Sedan and Coupelet models. Price Complete. $15

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL	NEW YORK—THURSDAY, JANUARY 2, 1919—CHICAGO	No. 1

France's Post-War Automobile Program

Industry Disturbed Over Import Duties—Plants Greatly Expanded But Unable to Get Into Quantity Production for Some Time—Types of Cars Reduced—Preference for Vertical Six—Small Four to Be Most Popular—Expect Big Tractor Development

By W. F. Bradley

THE armistice, coming much quicker than was ever thought possible, found the French automobile industry generally ill-prepared for normal business. There are two dominant questions troubling the leaders: The first is what import duty will be established by France and the other, whether England will depart from its free trade policy.

For over a year there has been a 70 per cent ad valorem import duty on automobiles and parts brought into France. This, however, was admittedly a temporary war measure, the ordinary duty being on a weight basis and being roughly equivalent to 10 per cent on the price of the machine.

French manufacturers would like to see this 70 per cent duty continued for one year after the signature of the peace terms, to be followed for a period of one year by 50 per cent, then 20 per cent. This protection is obviously directed against America, the only nation in a position to make quick deliveries of automobiles.

While anxious to get a protective wall for themselves, the French trade is nervous less England put up a protective tariff. The anxiety can be understood, when it is remembered that France, before the war, was the biggest motor exporting nation in the world, with a value of $45,000,000 in 1913, and that it was in England or through England that the greatest volume of business was transacted.

Now the English motor industry—which must not be confused with the English nation—is just as anxious to get protection as are the French automobile manufacturers. And this protection is desired primarily against America.

There are all kinds of scares abroad in France to show the necessity of a protective tariff. The latest is that the British and the American Governments have stipulated that none of their automobiles, sent over for war purposes, shall be allowed to return to the country of their origin. There is not a grain of truth in the whole thing, for the English are preparing to receive all their war worn trucks from France, and the Motor Transport Corps of the American Army is arranging to ship across the Atlantic all such vehicles as are worth returning. This is known to the scare-mongers, but they have not taken the trouble to correct the false reports. Other "authoritative" persons state that the American Air Service will turn all its vehicles over to the Belgians. The fact is that the Air Service has no authority to dispose of any automobile, the control being in the hands of the Motor Transport Corps.

France Has Little to Fear

France really has little to fear from an invasion of her own territory. If the old tariff goes into force again some of the cheapest makes of American cars can be sold on a price basis. In the medium car class local competition will be so keen that it is doubtful if American firms will be interested in the market.

The highest class of American automobiles never have threatened France. Trucks can be produced very much quicker than touring cars, so that there will be no

gap during which the American maker will have the market to himself. Further, the military subsidy scheme puts all foreign truck makers at a disadvantage. What France needs much more than protection for her own shores is protection for her export trade—a thing not easy to obtain.

French factories cannot possibly make deliveries in any quantities before the middle of 1919, and there is a fear that America, whose industry has been less disturbed than that of France, will have got a good hold of the foreign markets in the meantime.

As the automobile factories, in common with other engineering concerns, have been increased in size and have been modified in order to meet the needs of the nation, it is quite natural that the Government should be interested in getting them back to normal working conditions.

The Ministry of Armaments has been transformed into the Ministry of Industrial Reconstruction, with Mr. Laucheur at its head, and will have as its big task the organization of the resources of the country for peace. Measures are to be taken to facilitate the transformation of factories having worked for the Government, and among these measures will be important orders given to the automobile factories for agricultural tractors and machinery, internal combustion motors for the merchant-marine, and work for the postal and telegraph departments.

This Ministry will also be responsible for the allotment of raw material to the factories. For more than 2 years it has been impossible to secure an ounce of metal without a military order. Although the war is practically over, this restriction still remains, and the automobile industry is looking to the Government for action to release supplies of raw material. In very many cases the supply of raw material will be the determining factor in the production of trucks and cars for civilian use.

French Plants Greatly Expanded

The French automobile factories have two features in common: they have all increased enormously in size, and they have all completely modernized their plants. The number of workpeople at the present time engaged on purely automobile work is estimated at 800,000. During the war not a single one of the factories has been kept exclusively on automobile work; yet the change has made itself felt in varying degrees.

The biggest automobile producers during the war have been Renault, Berliet, Panhard-Levassor, Saurer, Delahaye, De Dion Bouton. But these firms have not by any means been exclusive producers of trucks and cars. Renault specialized on aviation engines right at the beginning, then extended to planes, and for the last year has been a big producer of tanks. Berliet has been a producer of aviation engines and tanks. De Dion Bouton has built Hispano-Suiza aviation engines, gun carriages, searchlights and motorized artillery.

There are automobile factories which for 3 years have not built a single automobile. Darracq is in this class, the whole factory having been turned over to aviation engines and planes, machine guns, etc. Delage transformed his modern plant into a shell producing factory right at the beginning; in 12 months he had covered the whole of the ground he considered would suffice for 10 years' normal development, and during the last 18 months he has been building series of passenger cars for staff use. Hispano-Suiza, whose aviation motor has been produced in bigger numbers than any other in the world, has been forced to abandon all thought of automobile production.

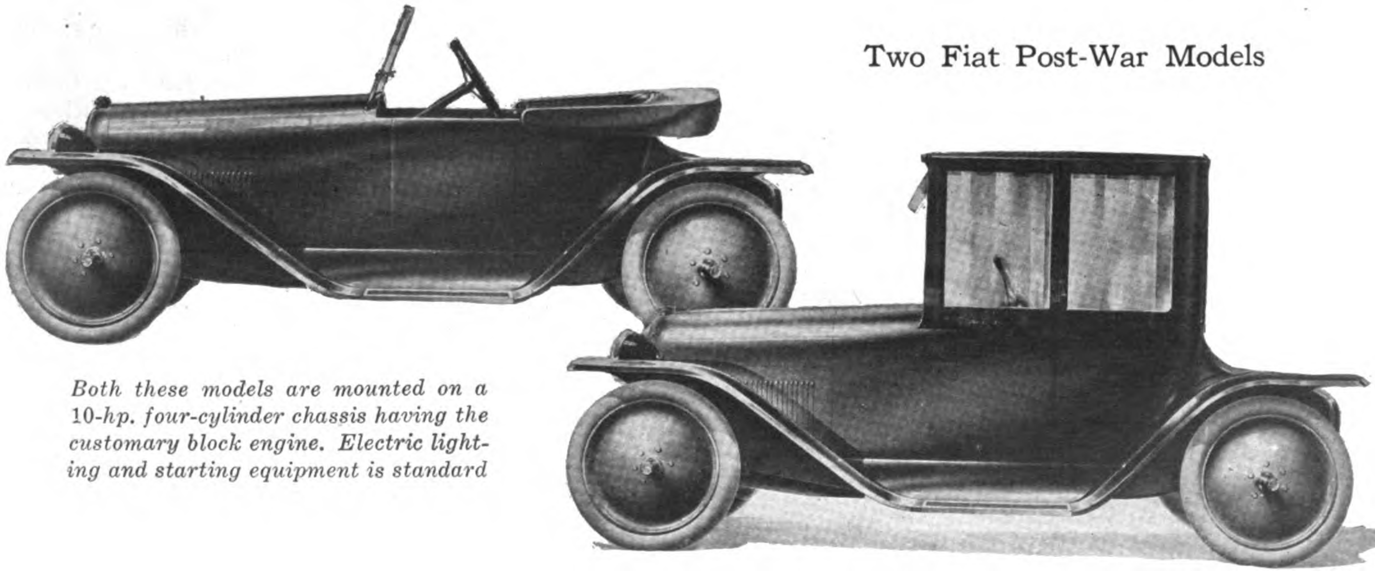
Firms which have received army orders for passenger cars are naturally in a better position than those having worked on other classes of goods. Some of these firms have been building what may be considered as peace models for over a year, and have had the opportunity of watching them in service with the army. Thus, while some will soon be ready to settle down to production, other firms are still confined to drawing office activities.

What the Future Holds

It is possible to give a general forecast of what future lines of development will be. Throughout France and Italy the tendency of the war has been to make the big firms more and more independent of outside supplies. The specialist idea has not taken hold. Some of the newcomers will produce cars with engines from A transmission from B and rear axle from C, but all the big, well-known firms have become entirely independent.

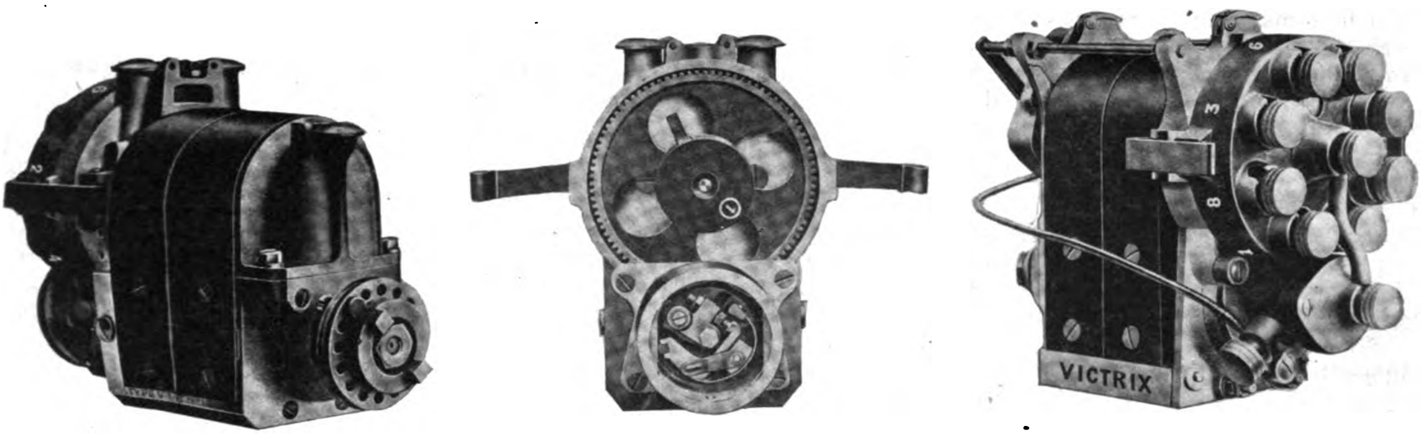
The most notable example is the Fiat Co., at Turin, Italy, which has grown to 40,000 workpeople, and now produces its own castings, forgings, ball bearings, magnetos and bodies—in fact everything but tires.

In France, Renault has followed on the same general lines, for although he does not build his own magnetos he controls the company supplying him with these organs. De Dion Bouton has been building magnetos in its own factory for 2 years and will continue to supply its own wants and meet those of some outsiders.



Two Fiat Post-War Models

Both these models are mounted on a 10-hp. four-cylinder chassis having the customary block engine. Electric lighting and starting equipment is standard



Victrix magneto which is being built in the De Dion Bouton plant for use on De Dion cars

As practically every European after-the-war car will be built with electric lighting and starting, designers no longer look upon the magneto as an absolute necessity and several have eliminated it in favor of battery ignition. Others admit that if they have not done so at once it is because they are afraid of public opinion. French motorists in particular have been educated to the belief that the only perfectly reliable ignition is by high tension magneto.

All firms have cut down on the number of types of cars, but very few have decided on a single model. Two will probably be the average. The big firms, too, are going to continue building touring cars and trucks, with, in many cases, agricultural tractors in addition. Four cylinders are going to remain in the majority, but there will be many more multi-cylinder engines than was the case in 1914.

Vertical Six Preferred

The preference appears to be for the vertical six, followed by the eight, with the twelve last. Thus, the Hispano-Suiza company, which has been all out on aviation eights for three and a half years, considers that six cylinders are sufficient for a high-grade touring car. Fiat, after building sixes and twelves for air work, limits itself to sixes for touring car work.

Detachable cylinder heads will be adopted much more extensively; thermo-syphon cooling will gain some ground for the smaller motors, but not for the big ones; unit construction of motor and gearbox is going to be a very strong feature; the tendency is to get away from chains for driving camshaft and auxiliaries; cylinder capacity of motors is being reduced; at the same time there is an important saving in the total weight of cars; high-grade alloy steels, which before the war were used only in aviation motors and a few racing and special cars, will be made use of for the normal production.

With unit construction of motor and gearbox both brakes are being put on the rear wheels, but in all cases they are internal expanding, not external. There will be several cases of brakes on the propeller shaft, behind the axle. Front wheel brakes are going to be used on many of the higher class cars. Gearsets will remain with four speeds and reverse. Springing is strongly towards cantilever, with a tendency in the direction of quarter elliptic for light cars. Wheels will be metal, to the exclusion of wood. The vacuum gasoline supply system is going to be adopted rather extensively.

Not many firms have announced their complete post-war program. The De Dion Bouton company, which was erroneously stated a few weeks ago to have passed into new hands, has just made it known that it will establish an erecting plant in England, this to be supplied with motors and transmissions from the French factory.

The program of this firm covers two eight-cylinder motors and two fours fitting into two chassis. Thus, one chassis will be furnished with an eight-cylinder V motor of 60 by 100 mm. (2.3 by 3.9 in.) or with a four-cylinder monobloc of 70 by 120 mm. (2.7 by 4.7). The second chassis will be equipped with an eight of 70 by 120 mm. (2.7 by 4.7) or a four of 85 by 130 mm. (3.3 by 5.1 ins.).

Fours and Eights for De Dion

In all four cases motor and gearset will form a unit construction mounted in the main frame by three point suspension. In all models the De Dion Bouton engineers have decided on a two bearing crankshaft. They will not be alone in this line of development, although 85 by 130 mm. is a bigger motor than has usually been considered suitable for a two bearing shaft.

De Dion Bouton has been building the Victrix magneto in his own shops for a considerable time and will use these on all passenger cars and trucks. Electric lighting and starting will be found on all passenger cars, a single unit being employed, and the whole installation built in the De Dion Bouton factory.

Fiat has announced much of its new program. The models will be four in number: an 8-hp. two seater (built with both open and closed body); a 12-hp. four-cylinder light touring car, with open body; a six-cylinder of less than 3 in. bore, and a high-class six of about 3½ in. bore. Some of the new features are electric lighting and starting for all models, detachable cylinder heads, unit construction of motor and gearbox, spiral bevel rear axle.

Delage is producing a high-class six, with unit construction, electric lighting and starting, and front wheel brakes. The Hispano-Suiza company, which was fully expected to come out with an aluminium eight, states that its leading model will be a high-grade six with valves in the head.

Small Four Will Be Popular

The most popular type of car is going to be a 10 hp., four cylinder with electric lighting and starting and a 2, 3 or 4 passenger body. The Citroen company announced that it will build a car of this type with a four-cylinder motor of 65 by 100 mm. bore and stroke (2.5 by 3.9 in.). It is commonly reported that the price will be around $1,000, but this is really mere speculation, for it is doubtful if even the Citroen company knows exactly at what price the car can be sold.

With the price of most steels five times higher than in 1914, it is going to be a difficult task for any firm to build a $1,000 car in France for the first year after the war. The Citreon company is one of the biggest

and best managed in France. Before the war the firm was chiefly interested in cutting gears, but Andre Citroen, the president of the company, was also president of the Mors Automobile Company and had other and close connections with the automobile industry. There is no doubt that Citroen will be a leading figure in the popular car class.

Peugeot is another firm having already got into this 10-hp. class, with a popular four cylinder model of 68 by 100 mm. bore and stroke. Some of these have been delivered during the war to the French army. Fiat is going to appear in about the same class.

Whereas before the war the most popular type of automobile in France had cylinder dimensions of about 80 by 130 mm. (168 cu. in. piston displacement) the post-war corresponding type will be reduced to about 90 cu. in. Some of the engineers claim that as there has been a corresponding reduction in weight and an increase in efficiency, these smaller motors will do all that was obtained from the larger ones in 1914.

Expect Big Tractor Development

Important developments can be expected in the production of agricultural tractors. Apart from the fact that the efficiency of French farms was low by reason of old-fashioned methods, horses have become so rare since the war that there is no alternative but to make use of gasoline tractors on the land. Many of the automobile factories are looking to agriculture to keep their works running, and the Government has pledged itself to encourage the development of the French agricultural tractor by all possible means.

One of the most important problems to be solved without delay is the supply of gasoline for civilian uses. The whole question has been put into the hands of the Government Committee known as the General Gasoline Committee, which has authority not only to improve methods of transportation, but to discover national supplies of fuel. No automobile owner can obtain fuel without an official permit, and these permits are only given parcimoniously to persons doing work of national importance. Travel restrictions have become easier since the signing of the armistice, but owing to the impossibility of getting gasoline it is not possible to use a car for anything but local service.

Since the General Gasoline Committee got to work there has been some improvement, although it is hardly visible to the private owner. In 1917 the imports of gasoline were 400,000 tons per annum. In 1918 they had been increased to 1,000,000 tons a year, and the reserve stocks had been increased sufficiently to allow private interests being considered. Not much improvement took place, however, owing to defective transportation methods in the interior of France.

Many Districts Without Gasoline

Certain important districts have been six months without receiving a single drop of gasoline for any civilian use. The number of tank cars has been increased; permission has been given to fill cans from the tanks in railroad stations; in certain districts army automobile trucks are to be used to deliver gasoline. The one gallon cans which are so extensively used in France are to be replaced in an important measure by 10 gal. cans, and the supply of cans has to be pooled. In the past refiners only received their own empty cans.

An early improvement in the gasoline situation is now being promised by the authorities. In October last Marshal Foch reserved 10,000,000 gal. of gasoline for the monthly use of the French army alone. The military requirements have decreased to such an extent that for the present month of December it is expected to be able to allot an extra 15,000 tons of gasoline for civilian use. It is quite probable that in a short time all gasoline restrictions will be removed.

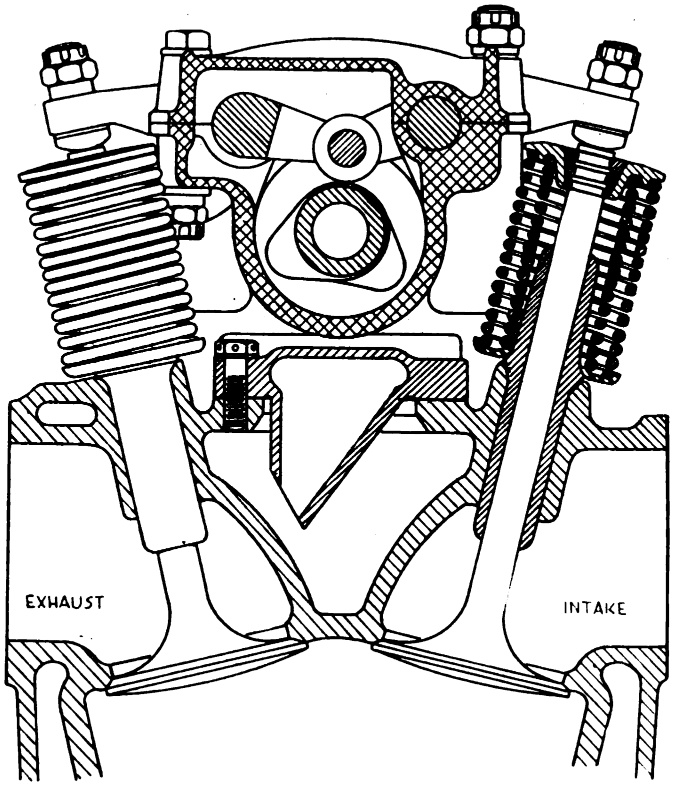
Mixed Fuels to Be Used

The present price of gasoline in the neighborhood of Paris is $1 per gallon, running to $1.25 in out of the way districts. For truck work in particular it is believed that the national fuel will be a mixture of 50 per cent of alcohol, 25 per cent benzol, and 25 per cent gasoline. An important group of truck owners, among which is the Paris General Omnibus Company, has announced its intention of absorbing as much of this fuel as can be produced in France during the next four or five years.

There is a decided tendency toward both racing and competition work. One of the best suggestions made is that a race or an important touring competition should be held in Alsace or in Lorraine during 1919. There is every reason to believe that this suggestion will be acted on, though it is not yet known what form the competition will take.

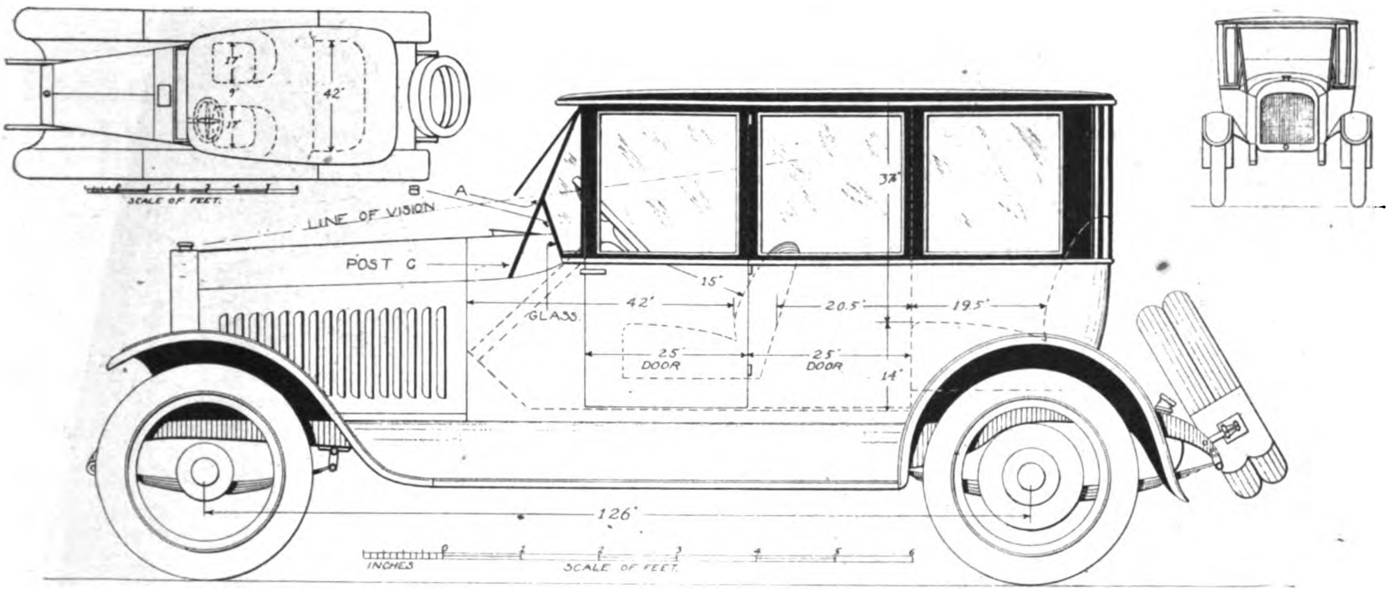
The only racing cars in Europe are a set of Sunbeams in England, two Fiats in Italy, and three Peugeots of only 2½ litres cylinder capacity. These latter were built for a race interrupted by reason of the war. Several firms have the advisability of racing under suggestion. One important organization has guaranteed to get a set of cars ready and a complete team together in 4½ months. These cars would be available for either America or France, according to which country takes up racing first. A month ago the idea of any race or road competition being held in 1919 was considered foolish; now it is very much to the fore.

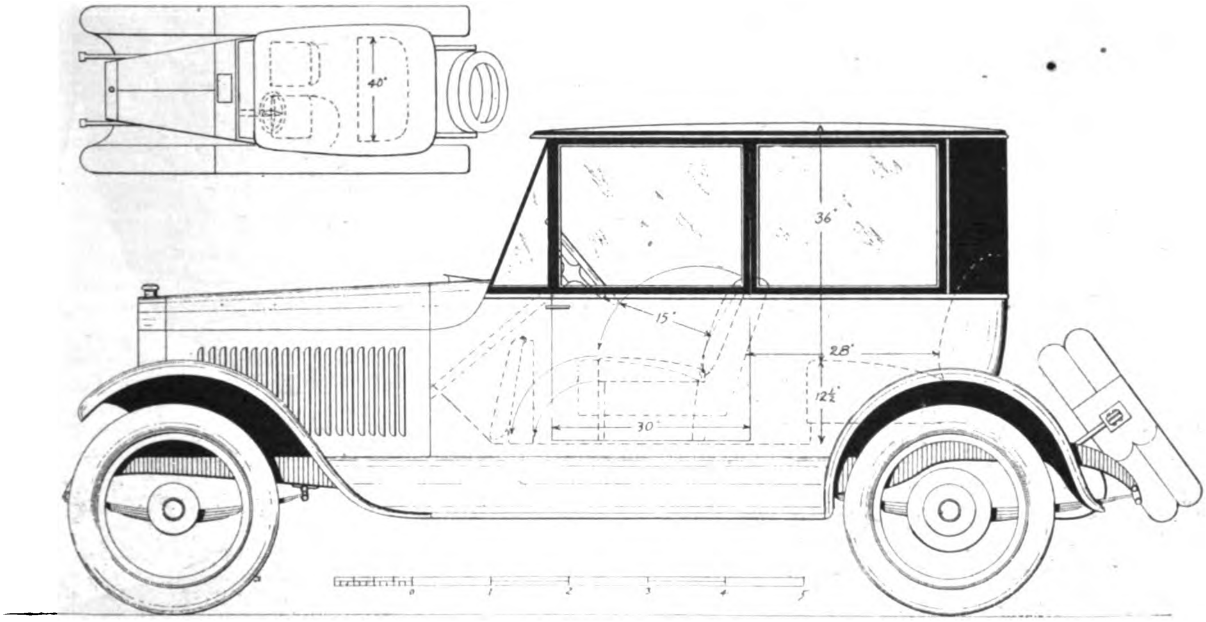
The automobile paper *l'Auto* has announced that it will hold a competition for marine motors at the end of May and a competition for farm tractors at the end of April. It is undoubtedly in this direction that there is the greatest need for improvement in France.



Large-scale view of Liberty valve mechanism

Front Entrance Inside Drive Body





THE tendency at this time to make all inside drive bodies as small as possible has brought into favor the front entrance type, with the collapsible seat on the right side.

The illustration shows how this works. The driving seat on the left side is comfortable and stationary, and the seat at the rear is a good width for two passengers, with ample room back of the front seat. In addition this seat is forward of the axle and for that reason will be very comfortable to ride in.

The folding seat, as indicated in the side view, is shown in the two positions, the position for use and when folded down. It is intended that when the door is opened for entrance this seat will always be folded, and when there are only three passengers the seat can be left in the folded position.

The stock seat sold for this purpose is not suitable; a special seat will have to be made, as it must be more comfortable and with larger seat cushion and higher back than the regulation auxiliary seat. This must be made to be used for continuous riding and should be just as satisfactory to ride on as the driving seat, with the exception that the cushion cannot be so thick on account of its being made to fold.

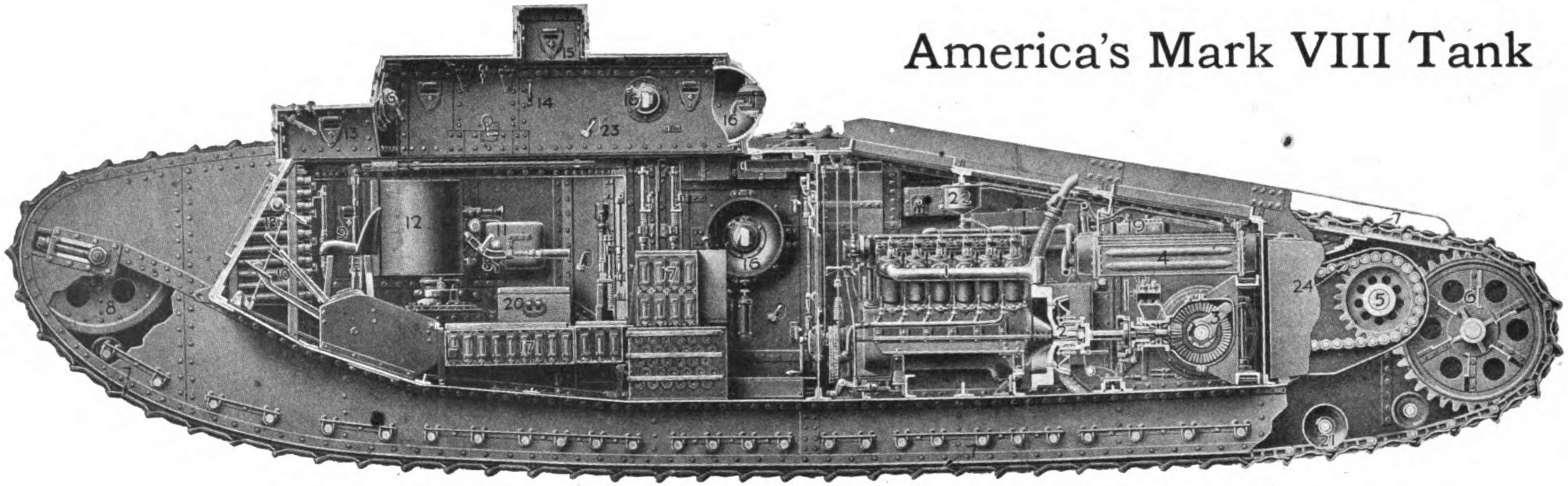
One of the advantages of this design is that the windows are very large, and all side windows, except the triangular one at the front, are made to drop flush, so that the side will be entirely open, except the slight obstruction made by the door pillars, which, as illustrated, are very small. All windows are designed to be operated by regulators.

The large side windows necessitate large doors, which are an advantage, as the doors open almost direct to the rear seat. It is customary for the passengers in the rear and the driver to be seated when the folding seat is set in position for the fourth passenger. It is possible, however, for the driver to get in from the left side without disturbing the passenger at his right.

The height of this body is less than the average, being

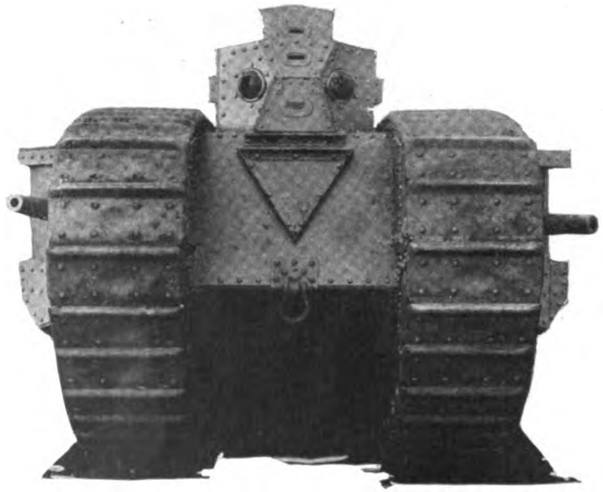
(*Continued on page* 39)

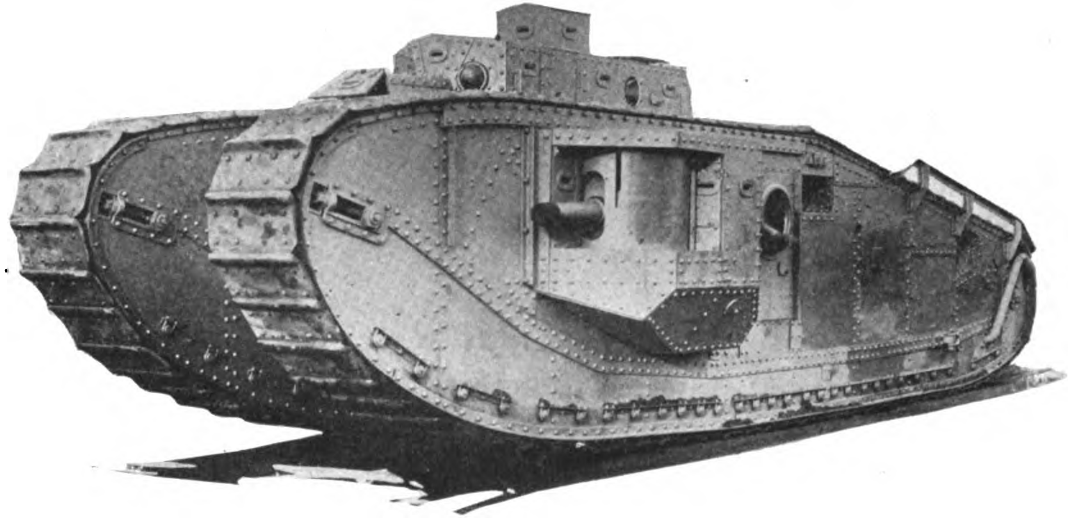
America's Mark VIII Tank



Section through the Mark VIII tank showing the layout of the interior with the locations of the most important parts in the fighting compartment and in the engine room.

1—*Liberty Engine*
2—*Clutch*
3—*Epicyclic transmission*
4—*Radiator*
5—*Roller sprockets*
6—*Road track driving wheels*
7—*Road track*
8—*Road track adjusting wheel*
9—*Driver's seat*
10—*Control levers*
11—*Six-pounder gun*
12—*Right hand sponson*
13—*Driver's turret*
14—*Main turret*
15—*Lookout turret*
16—*Machine gun mount*
17—*Machine gun ammunition*
18—*Six-pounder ammunition*
19—*Gasoline tank*
20—*Officers' kit box*
21—*Road track rollers*
22—*Gasoline regulator tank*
23—*Revolver hole*
24—*Drive chain*





The Mark VIII Land Cruiser

Technical Description of Large Sized Battle "Tank" Developed During the Latter Period of the War—Equipped with an Adaptation of the Liberty Aircraft Engine; Weight Complete, 40 Tons

By J. Edward Schipper

THE cessation of hostilities upset the plans of the War Department for the production of 1500 of the largest tanks ever made. These tanks, known as Mark VIII, were to be a joint product of Great Britain and the United States, the hull, armament and parts of the equipment being furnished by Great Britain, while the powerplant and most of the propulsion units were to be supplied by the United States. Assembly was to have taken place in France.

The tank is 34 ft. 2½ in. long, carries a crew of eleven men and is propelled by a Liberty engine, modified to a certain extent to make it more suitable for this class of service. This large machine is bigger than the British Mark V tank, which proved so successful during General Byng's attack last year at Cambrai. The principal modification to the Liberty engine consists in the substitution of cast iron for steel cylinders. The Navy "20 per cent" piston is employed.

The Mark VIII tank is an armored track-laying type of fighting tank in which the hull or body acts as the structural frame as well as a housing for the propelling and fighting units and crews. It has no chassis or supporting frame structure, and rather resembles naval craft, as the hull carries within it the entire mechanism and all of the running gear except the track links, which pass around the hull in the form of a continuous belt on each side of the tank.

From the twelve-cylinder Liberty engine the power is transmitted through a planetary gearbox and through a chain drive, which latter turns the driving sprocket of the track. The length of the track belt allows the tank to accommodate itself to inequalities of the ground, while at the same time providing a rail surface for the supporting rollers.

The tank is 12 ft. in width and the overall height is 10 ft., 3 in. The engine and driving members, including the clutch, the planetary transmission and chain drive, are located in the rear of the hull. The engine, together with the clutch and planetary gearing and other necessary engine parts, occupies the engine room, which is 9 ft. 9 in. in length.

Fighting Room Ahead of Engine

From the rear of the engine room back to the center of the track-driving wheel is 4 ft. 8⅛ in. In front of the engine room is the fighting and operating room, at the forward end of which is the driver's seat with the control levers. On either side of the fighting compartment there is a sponson or projecting swinging structure carrying a 6-pounder gun. The sponsons contain gun mountings capable of giving a wide radius of fire with the 6-lb. guns. In addition, the sponsons themselves may be swung back into the interior of the fighting compartment to reduce the width of the machine to permit it to be located on a standard railway car.

Mounted above the fighting compartment is the main turret, which carries five machine guns. Above the main turret is the directing officer's conning tower, from which it is possible to obtain vision on all sides of the machine and from which its movements may be directed. Within the fighting compartment are sufficient ammunition storage provisions for both 6-pounder and machine guns. The fighting compartment is entered through a door on either side and machine guns are also mounted in the doors. This gives a total of seven machine guns, five in the main turret and two in the doors; and two 6-pounders, one located in each sponson.

The fighting compartment is separated from the engine room by a bulkhead fitted with sliding doors.

The sides of the hull are extended to provide a guide for the track. The rear extension contains the housing for the chain drive and the track-driving sprocket, and the forward extension carries the track adjusting wheel, which can be moved forward or backward to tighten or loosen the track chain.

Steering Effected by Track

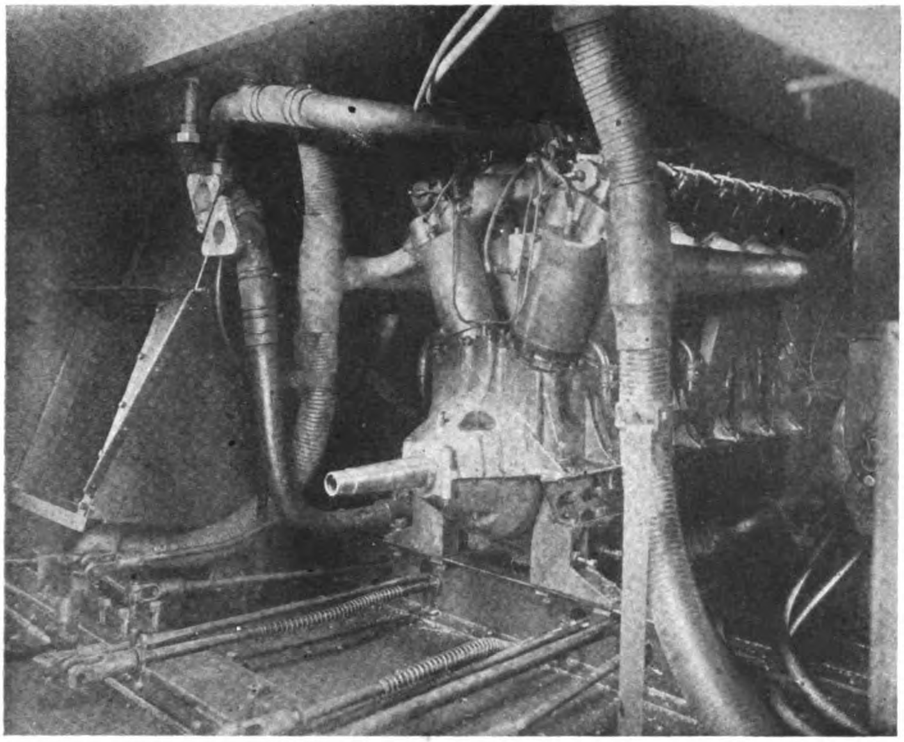
Steering is effected by allowing the track on one side to move at a faster rate than the track on the other, which tends to swing the machine in the direction of the slow-moving track. If one track is locked and the other track is allowed to move ahead, the machine will be turned in the shortest possible radius. The radius in which the machine can be turned depends to a large extent upon the nature of the ground, as, owing to its weight, it will dig up the ground to the side as it is being turned, which will impede the rate at which it can be swung around and will sometimes necessitate a wider turning arc.

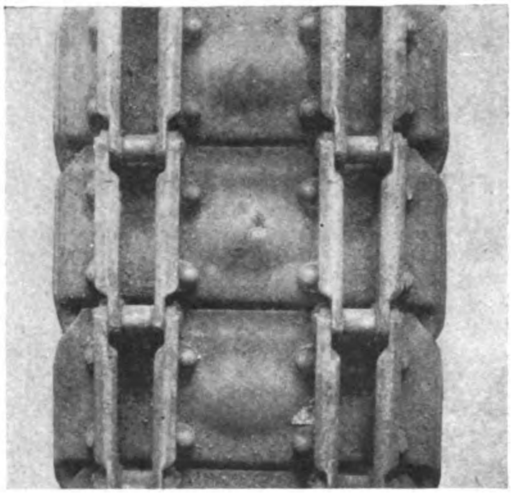
Control of the engine, clutch, planetary gear reduction, steering, etc., are all taken care of from the driver's seat, which is located in the forward end of the hull. It is of such a height that the driver's head is within a box-like structure at the front end of the main turret. Slits are cut in this compartment which allow the driver to look either side or ahead. The slits can be closed by rotating protecting shields when under fire, and when not under fire the driver can raise a hinged door at the front of the turret, affording an unobstructed view ahead of the machine.

In addition to the spark and throttle levers and other engine controls, the driver has four levers and a pedal. The two inside levers control the planetary transmission. The left outside lever controls the clutch and the right outside lever is for reversing the pedal, which is in the center of the track brake. When either transmission control lever is in neutral the track brake on that side can be applied, so that shifting both levers to neutral permits applying track brakes to both tracks.

The gasoline supply is carried in three tanks, of 80 gal. capacity each, mounted near the rear of the machine, just below the top plating. These tanks are all similar, and are mounted side by side. The gasoline is forced by pressure from these three tanks to a gravity tank mounted directly above the engine, from which it flows by gravity and pressure to the two carbureters. Pressure is supplied by the engine-driven air pump, a four-cylinder design, operated by the camshaft. The gasoline tanks are placed to the rear of the engine room and separated from it by the bulkhead.

The air pump is mounted just above the clutch, and is driven by a belt from the pulley on the engine shaft brake. The pulley on the air pump operates a camshaft, which works directly against the pistons or plungers of the pump. With the engine at rest sufficient pressure can be secured to start the flow of fuel by means of a hand pump, which is located





Above—A view of the engine room, with the Liberty motor in position. Right, top—Method of guiding in track. Right, bottom—Inside of track, showing rollers, links and rail surfaces

on the bulkhead between the engine room and fighting compartment. Each of the three tanks communicates with the gravity tank above the engine through a pipe containing a cock, and each tank can be turned on or off at will.

The hull of the tank is composed of armor plate of various thicknesses, ranging from ¼ in. to a little more than ½ in. This armor plate, which is 0.6 in. thick in practically all exposed parts of the hull, is capable of withstanding direct hits from machine guns or rifles and will turn heavier ammunition if struck at an angle. It takes a direct hit from a fairly large piece of artillery to put one of these tanks out of commission. For this reason it is invulnerable to the fire of infantrymen or machine gunners.

Complete Machine Weighs 40 Tons

Inasmuch as the complete machine weighs approximately 40 tons, the clutch has been designed to gradually overcome the inertia of the heavy mass, providing first a slipping and then a positive engagement. The slipping engagement is secured by means of an asbestos-faced cone clutch which comes into play first as the asbestos facing and the cone-shaped surface of the flywheel come in contact. Later positive engagement of the clutch is secured by splines or teeth on the clutch sleeve, which mesh with corresponding splines or teeth on the end of the crankshaft.

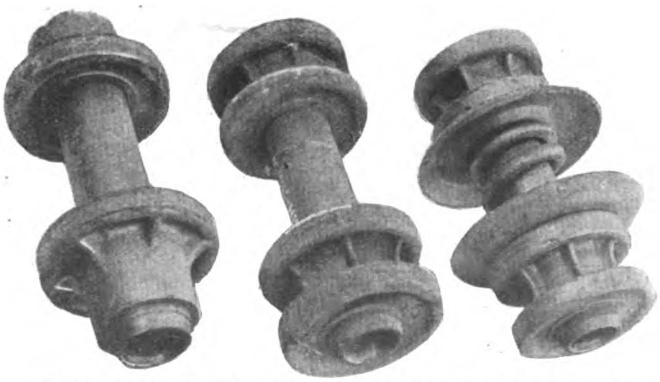
The function of the frictional part of the compound clutch is to pick up the load, setting the transmission drums in rotation. After the frictional part of the clutch has accomplished this the positive clutch is engaged. The driving clutch unit is bolted to the flywheel of the engine and is a conical frustrum of carbon steel. Pressure is applied to the cone by a large clutch spring concentric upon the clutch shaft. This spring is 5⅝ in. in diameter and has a coil length of 4¼ in. The clutch sliding collar or sleeve and the cardan shaft are joined by a nickel steel coupling.

The planetary gearset has two forward and two reverse speeds. It is mounted transversely on the machine in the rear end of the engine compartment. It provides the necessary gear reduction between the engine drive and the track propulsion units, and also carries the drive outward on both sides from the center line of the machine to the outside track mechanism.

The planetary gearset is not direct-connected to the engine but is driven from it through a pair of bevel gears. For reversing, the gears are shifted in relation to one another by means of a shifter fork mechanism, and the high and low speeds are secured by means of brakes, which act on drums forming part of the planetary gearbox. The reductions in the box are 5 to 1 on low and 1.285 to 1 on high. The reduction by the bevel gearset is 14:46. The reduction between the chain sprocket and the roller pinion is 12:23, and that between the roller pinion and the track driving wheel 9:37. This gives a total reduction between the engine and track of 32,545:1 on high speed, and 126.64:1 on low speed.

The use of the planetary type of gearbox on a machine of this weight does away with the necessity for shifting gears except for changing from forward to reverse. It is highly necessary, therefore, to strictly observe the precaution of allowing all moving parts to come to rest before shifting from forward to reverse,

The bevel gear drive from the engine to the planetary gearset comprises two bevel wheels. Facing toward the front of the machine, the left bevel wheel provides the reverse motion and the right bevel wheel gives the forward motion. The proper bevel wheel for either direction of motion is engaged by means of a dog clutch, which slides on the splines of the cross shaft. Both bevel wheels are in constant mesh with the bevel pinion, but only one is fast upon the shaft at a time;

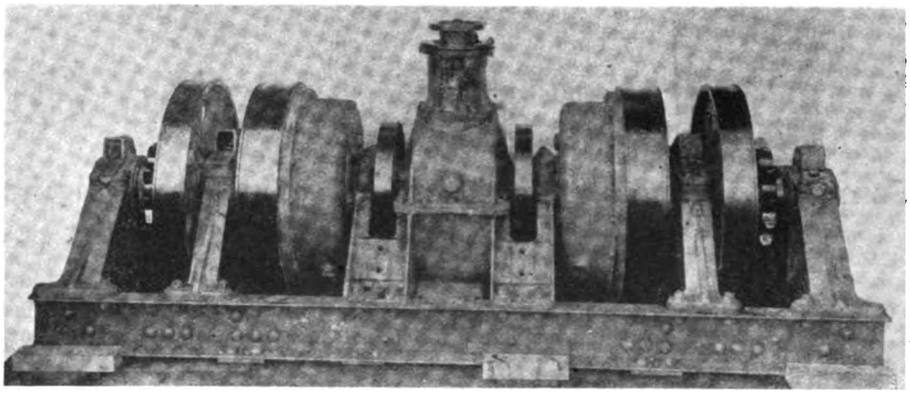


Left—Upper road track roller. Center—Lower road track roller without springs. Right—Lower road track roller with springs

the other acts simply as an idler, and has no part in the driving.

From the bevel wheel engaged by the dog clutch the drive passes to the cross shaft and thence to the sun pinion at the opposite end of the cross shaft from the bevel wheels. The sun pinion meshes with the large planet pinion, and this in turn meshes with the ring gear secured to the gear casing. This casing carries with it the low speed brake, the same bolt passing through the ring and the two halves of the casing.

When not restrained by the application of the brake the casing carries the drive back to the chain drive sprocket. The gear casing also carries a pin, upon which is mounted a small planet pinion, which meshes with a small gear ring carried on a disk, which in turn is splined to the cross shaft. Revolving with the disk which carries the spindle for the small pinion is the high speed brake.

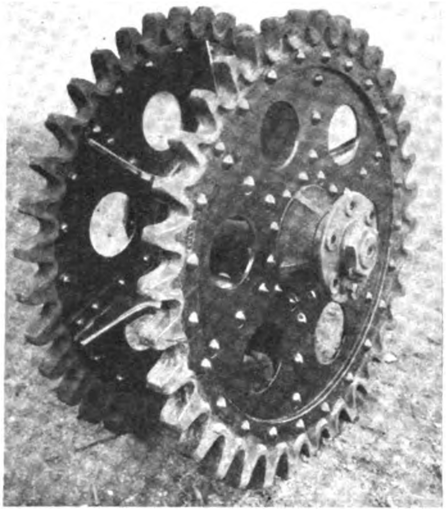


Exterior of the double compound epicyclic transmission on Mark VIII tank

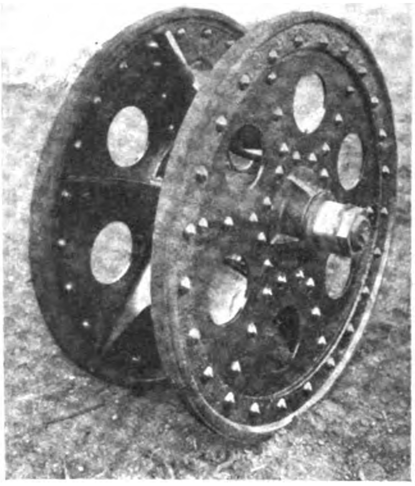
Driving Sprocket

From the planetary gear the power is transmitted to the track by means of a driving chain. The driving sprocket is mounted on the planetary cross shaft and connects through the chain with the sprocket wheel at its center and which is located midway between the two roller pinions. These roller pinions mesh in turn with the road track driving wheel, which engages directly with the track.

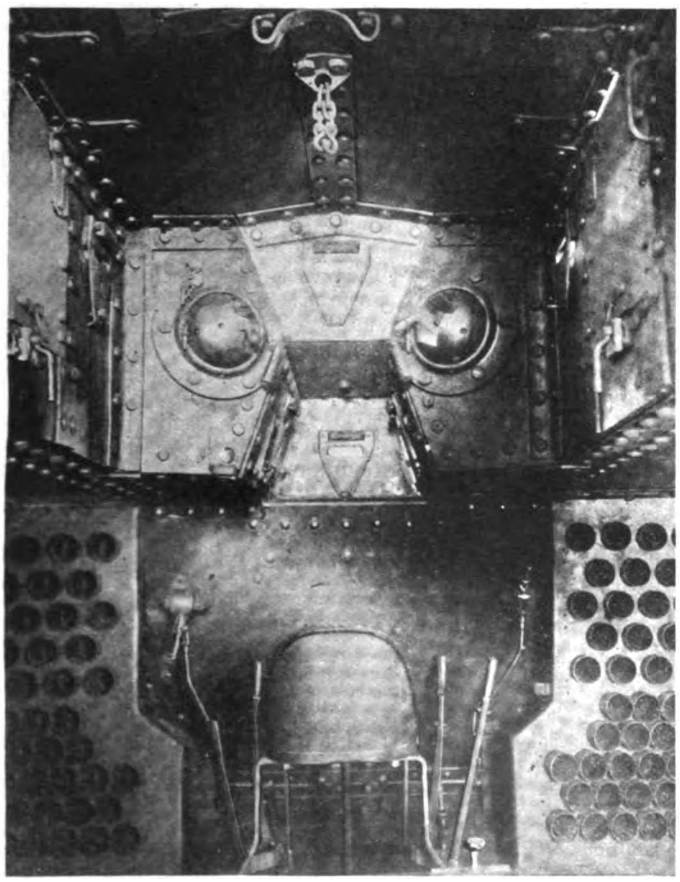
The road track, in the form of a continuous belt, runs around the entire hull. There are fifty-eight rollers which carry the weight of the machine. In addition to these lower rollers there are two upper rollers serving as guide for the track. Of the fifty-eight rollers, twenty-eight are fitted with spring plates which act as spacers. Since the road track is double, these spacers keep the rollers the proper distance apart. The two top road track rollers are alike. One is located on each side at the point where the track makes its sharpest angle and where, consequently, the greatest strains may be expected. Elsewhere along the top the track slides on the top track rails.



Road track driving wheels



Road track adjusting wheels



Driver's seat and driving compartment of Mark VIII tank

Track Links

The track links are of drop-forged steel, having a length, from pin center to pin center, of 11.154 in. These links must be very accurately assembled, the allowable limit between pin centers being 0.004 in.; *i. e.*, when links are assembled in pairs they must agree to within .004 in. between pin centers. The links perform the double duty of binding the chain together, and also of forming a rail surface upon which the machine rolls. It takes a left and right link bar to make up one link assembly. These bars are connected by the pins, which are driven through. The pins are surrounded by carbon steel bushings, which take the wear due to meshing with the road track driving wheel. Riveted to the links are the track shoes, which are in contact with the ground. These are pressed from armor plate, and so shaped that they link one over the other. The track shoe is 26½ in. in width. Under normal conditions there is a total of 41.052 sq. ft. of track surface in contact with the ground.

The machine is operated entirely from the driver's seat, located at the forward end of the hull proper. The driver's seat and the forward control unit, including the necessary levers, shafts and linkage, are made up as a single assembly.

The change speed levers for the left and right tracks are similar. The lever is adapted to engage in two quadrant jaws, the outside taking care of the high speed and the inside of the low speed. When the lever is engaged with either jaw and pulled back, the corresponding speed is engaged.

High-Compression Oil Engines

Some New Injection Methods for Heavy-Fuel Engines Described in Paper Read Before S. A. E. Mid-West Section

A COUPLE of new types of fuel injection heavy oil engines were described and compared with the older engines of this type, the Diesel and Hvid, by W. G. Gernandt at the monthly meeting of the Mid-West Section of the Society of Automotive Engineers. Mr. Gernandt summarizes the advantages and disadvantages of the Diesel method of fuel injection as follows:

ADVANTAGES

1—The fuel injection is mechanically timed.
2—The fuel is thoroughly atomized prior to injection.
3—Widely different fuels may be used without alteration.
4—The rate of burning can be controlled mechanically.
5—The two-stroke principle can be used successfully.

DISADVANTAGES

1—Refrigeration during injection.
2—Reduced flexibility.
3—The use of a high pressure fuel pump.
4—The use of an air compressor, coolers and tanks.
5—Troublesome to start.

Similarly he summarizes the advantages and disadvantages of the Hvid method as follows:

ADVANTAGES

1—No working parts for the injection of the fuel.
2—The fuel is thoroughly atomized prior to injection.
3—The fuel is heated prior to injection.
4—Flexibility much greater than Diesel.
5—Easily started.
6—Fuel economy greater than Diesel because of heating of fuel.

DISADVANTAGES

1—The fuel injection is not mechanically timed.
2—Inability to use the two-stroke principle of operation.
3—Necessity of changing fuel cup for widely different fuels.

The two new systems of fuel injection described are the McClintock and the Gernandt.

McClintock Method of Injection

In the McClintock engine the fuel is injected into the combustion chamber by means of compressed air trapped in a separate chamber during compression. The operation of this engine is as follows: When the pressure in the cylinder is the least, or during inspiration, fuel, which is under a slight pressure maintained on the fuel tank by a small air pump, is deposited in a small chamber in direct communication with the combustion chamber through small injection tubes. During the compression stroke the air is compressed into a separate chamber through an automatic valve. As the clearance between the head and the piston is only that necessary for mechanical clearance, practically all of the air in the cylinder is compressed into this chamber.

When the piston starts on its power stroke, the air from the chamber is by-passed into the combustion chamber through a mechanically timed valve and a venturi-shaped port into which project the fuel tubes. Because of the shape of the air port the fuel is drawn from a small chamber and an intimate mixture of air and fuel takes place, with a result that the combustion takes place immediately, and with a close resemblance to the Bunsen burner. The amount of fuel as well as the duration of combustion is controlled mechanically by the load on the engine. With this method of burning, extremely high temperatures result and the materials for the injector and venturi tubes must be carefully selected.

From a standpoint of combustion, this engine possesses the advantage of an intimate mixture between the fuel and the air necessary for combustion. However, as the piston must move on its down stroke a considerable distance before the transfer of air takes place, combustion comes late in the stroke, with a resultant high exhaust pressure and temperature. The engine is, by the way, just as flexible as the majority of automobile engines.

Summarizing the advantages and disadvantages of the McClintock engine, they are as follows:

ADVANTAGES

1—The fuel is thoroughly atomized and mixed with the air.
2—The fuel is heated prior to injection.
3—Flexibility extremely good.
4—The rate of burning can be mechanically controlled.
5—The two-stroke principle can be used successfully.
6—Fuel economy higher than Diesel.
7—Widely different fuels may be used without alteration.

DISADVANTAGES

1—Quite complicated valve mechanism.
2—The fuel injection is not mechanically timed.
3—Somewhat troublesome to start—similar to Diesel.
4—Advantage of high-compression partially lost prior to combustion.

Gernandt Method of Injection

In this engine the fuel is injected into the combustion chamber by super-compressing a portion of the products of combustion which have been trapped at a time when the pressure in the cylinder has attained its maximum. Mechanically, this may be accomplished in various ways, depending upon the general design of the engine, and the trapping chamber may be actually sealed by the use of valves between the super-compressing means and the combustion chamber, or it may be in direct communication with the combustion chamber through the very small injection holes. The injection method is identical in both cases and takes place as follows:

During the suction stroke in a four-cycle, or during simultaneous exhaust and inspiration in a two-cycle engine, fuel is deposited in a small chamber between the combustion chamber and the super-compressing means, either by gravity or under a slight pressure maintained on the fuel in the tank. The fuel is metered and passes through a mechanically timed valve. During the compression stroke the fuel attains temperature and the pressure rises in the fuel chamber. When the piston reaches its upper dead center, the products of combustion, previously trapped, are super-compressed mechanically and forced through the fuel chamber and into the combustion chamber.

Thorough atomization takes place during the injection period. as in the Diesel engine, but in this case the injection gas is highly heated and refrigeration has been practically eliminated, the amount of the products of combustion necessary for injection being so small that the burning effect has not been impaired. Also there is no burning of the fuel until it is actually injected into the combustion chamber. In this engine the fuel, the injection and the rate of injection are mechanically timed, and with an increase in the crankshaft speed there will be a corresponding increase in the rate of fuel injection because the fuel must enter the combustion chamber during a certain angular travel of the crankshaft and not during a certain fixed time. Thus the flexibility of this motor will be very good.

Summarizing the advantages and disadvantages in this method of injection, they are as follows:

ADVANTAGES

1—The fuel injection is mechanically timed.
2—The fuel is heated prior to injection.
3—The fuel is thoroughly atomized prior to and during injection.
4—The rate of burning is mechanically controlled.
5—Widely different fuels may be burned without alteration.
6—The fuel economy is greater than Diesel because of preheating.
7—Greater flexibility.
8—The two-cycle principle can be used.
9—The engine is very easily started.

DISADVANTAGES

1—Addition of super-compressing means, making engine more complicated than the Hvid but much less than the Diesel.

Automobile Performance Analyzed by Mechanical Differentiation

Acceleration, an Important Factor in Automobile Operation, Is Best Determined from Time and Distance Observations by Means of a Mechanical Differentiometer

By Armin Elmendorf, M. Sc.*

IN automobile tests the motor is the usual object of investigation. While considerable valuable data about automobile performance are obtained in motor tests, such tests are cumbersome and yield only a part of the information desired. The purpose of this article is to show how much more complete information may be secured from a single curve which is obtained with less preparation than that required for an engine brake test. The curve referred to is the velocity-time curve of an automobile which is first accelerated under the best running conditions from its minimum speed to nearly its maximum speed and then allowed to coast by cutting off the ignition. With no other data than this curve and the weight of the machine with its occupants, it is possible to obtain the following information about automobile performance:

(a) The grade the car can "make" at various speeds.
(b) Total power losses, which include that due to wind resistance, friction in the machine and losses at the tread of the tires.
(c) The horsepower required to drive the car at any constant speed.
(d) The excess power available at any speed beyond that needed to keep the car going at that speed.
(e) The indicated or cylinder power of the engine at any speed.
(f) The efficiency of the automobile as a machine at any speed.

Theory and Definition of Terms

Average and Instantaneous Acceleration—Fig. 1 shows an actual experimental velocity-time curve for a 6-cylinder car running in low gear. It is desired to know what its acceleration is at the end of three seconds. By the usual definition of the term, acceleration is the time-rate of change of velocity. If then we subtract the velocity of the automobile at the end of three seconds from its velocity at the end of five seconds we have the change of velocity that took place during two seconds and may obtain the average acceleration during this period by dividing the difference in velocity by 2. The difference in velocity is given in the diagram by the distance B′C′. This distance divided by AC′ is the average acceleration for the period under consideration. It will be observed that the average acceleration is given by the slope of chord connecting two points on the curve. Similarly, the average acceleration for the second following the third is given by the slope of AB″, and for the one-half second following the third second by the slope of AB‴. Decreasing the time interval in this way shortens the chord and gradually changes its direction until the limiting case is reached where the time interval is indefinitely small and the chord has the direction of the tangent and the average acceleration becomes the *instantaneous* acceleration. Thus the instantaneous acceleration of the car under consideration at the end of the third second is given by the slope of the tangent AC drawn at A. If the magnitude of this slope is plotted for each point as an ordinate from a convenient axis we obtain the instantaneous acceleration curve, usually called simply the acceleration curve. This curve is shown by M N O in Fig. 1.

In the terminology of calculus, the acceleration curve is the first derivative curve of the velocity curve, and acceleration is the derivative dv/dt where v is velocity and t is time.

Traction Effort—By carrying out the division mentioned, it will be seen that the acceleration of the car when t = 3 sec. is 4.4 ft. per sec.^{2} The question arises, how much force would a second car pulling this one have to apply to impart to it this acceleration, assuming that the car pulled is absolutely frictionless? Applying this elementary relation between force, mass, and acceleration, we obtain for this car, which weighed 3225 pounds with its occupants,

$$F = \frac{3225}{32.2} \times 4.4 = 440 \text{ pounds.}$$

A force of 440 pounds applied to an actual car would, however, not impart this acceleration, because friction must also be overcome. If we denote the pull which is

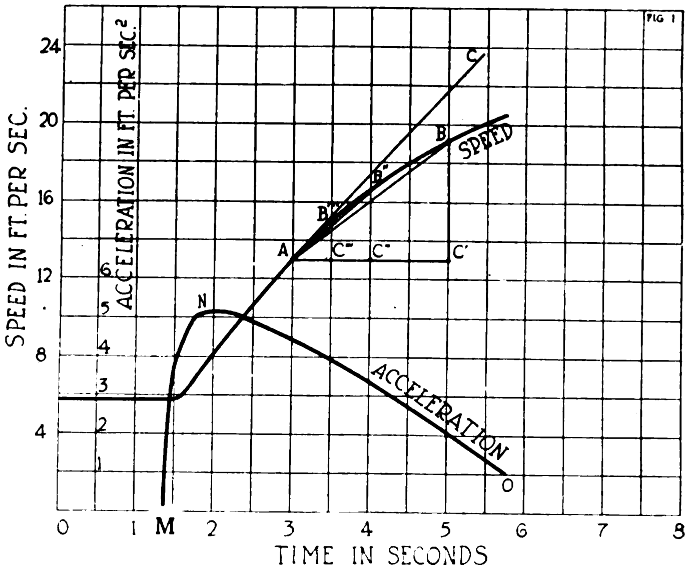


Fig. 1—Speed-time and acceleration-time curves of 6-cylinder car

*Madison, Wis.

just large enough to keep the car going at constant speed by R, we see that the total force required to impart the desired motion to the car is the sum of F and R. This force we will denote by the term, traction effort. It is obvious that when the car is proceeding at a constant speed the traction effort to pull it is equal to its total resistance.

Traction Power and Indicated or Cylinder Power—The power expended by one car in pulling a second we will call "traction power." Let us forget for the moment the usual power formulas and go back to the more fundamental definition of power as the rate of doing work. Assuming that a force of 100 lb. will keep the car going at a constant speed of 13 ft. per second, we have a total force of 540 lb. acting on the car, which is moving at the instantaneous speed of 13 ft. per second and being accelerated at that instant at the rate of 4.4 ft. per sec.², we see that work is being done at the rate of

$$540 \times 13 = 7020 \text{ foot-pounds per second.}$$

Dividing by 550, the horsepower constant, we obtain as the horsepower expended in imparting an acceleration of 4.4 ft. per second² to the car and overcoming its total friction, the value of $7020/550 = 12.8$ hp.

We will suppose that the clutch had been left in so that the pistons were in motion while the car was being pulled along, introducing the friction of all moving parts. This, added to the wind resistance, is the total friction which necessitated the pull of 100 lb. in the present problem. Now, if the rope pulling the car were suddenly cut and the spark thrown in so that the car propelled itself and imparted to itself, through the force at the rims of the wheels, the same acceleration, it is seen that the cylinders must do just as much work per second as the first car did in pulling this one. In other words, the cylinder or indicated power of the second car is equal to the traction power of the first.

This equality between traction power and indicated power is in reality only approximate. Two slight errors are introduced, one of which cannot be corrected and is probably quite insignificant, and the other may be corrected but not without considerable labor. The first error arises from assuming the friction losses in the mechanism when the engine is running under compression equal to the friction losses when the charge is exploded.

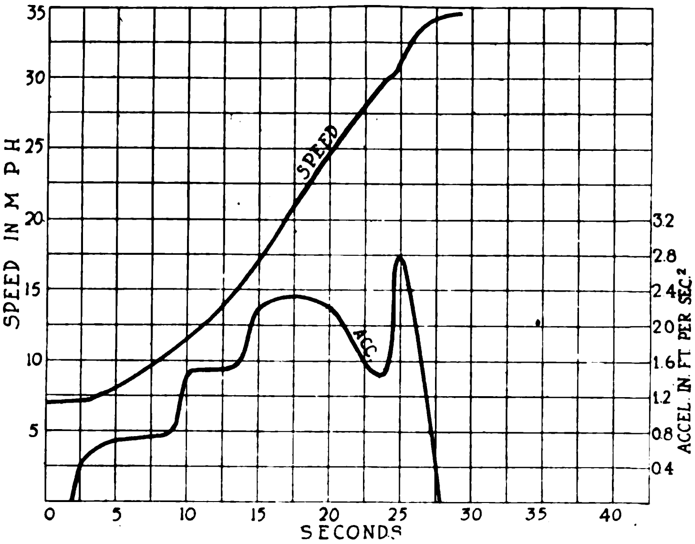


Fig. 4—Performance curves of 4-cylinder car in high gear

The second error arises in neglecting the power required to give all rotating parts an angular acceleration. Using the following notation we may correct for this after determining the angular acceleration of the major rotating parts corresponding to each value of the linear acceleration of the car as a whole, and the moment of inertia of the rotating part about its axis of rotation. Let

I = the moment of inertia about the axis of rotation.

α = the angular acceleration.

ω = the angular velocity corresponding to α.

Then at any instant the total torque required to impart angular acceleration to all the rotating parts is given by $\Sigma I\alpha$, where both I and α may be different for each part and the horsepower consumed in imparting angular acceleration is $\Sigma I\alpha\omega/550$, where I is in slung-ft.², α is in radians per sec.², and ω is in radians per second.

The main rotating masses are, of course, the wheels and the engine flywheel, for which the moments of inertia may be readily obtained experimentally.

Automobile Efficiency.—It is desirable that power losses due to friction and wind resistance be as low as possible. The lower the friction losses, the greater the ratio of the power available to accelerate the car to the total or indicated power. The latter ratio expressed in percentage we will denote by *automobile efficiency.*

Hill Climbing Ability—In order to keep a car going up a grade at a constand speed it is necessary

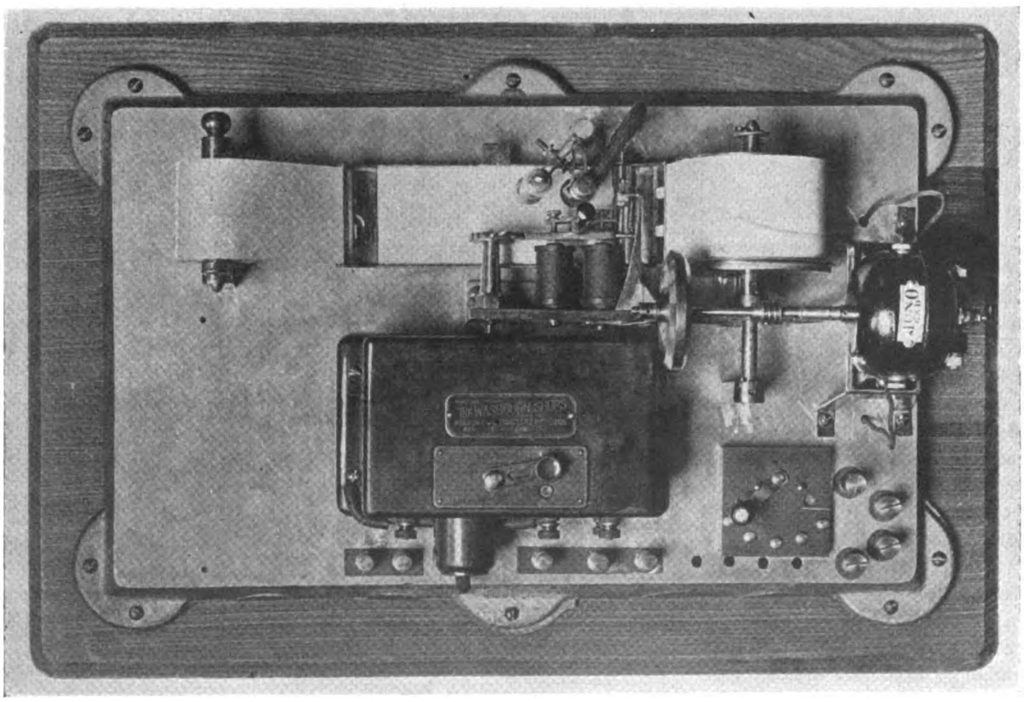


Fig. 2—Instrument for obtaining a graphical record of automobile speed

that the force driving it forward be equal to the component of its weight acting down the incline. Or, if the acceleration of gravity be resolved into two components, one acting down the incline, and the other normal to the incline, it is obvious that the engine must be able to impart an acceleration to the car on a level equal to the former component in order that the car may proceed up the given grade at a constant speed. Thus, in order to climb a 20 per cent grade the car must be able to attain an acceleration of 6.4 feet per sec.[2*]

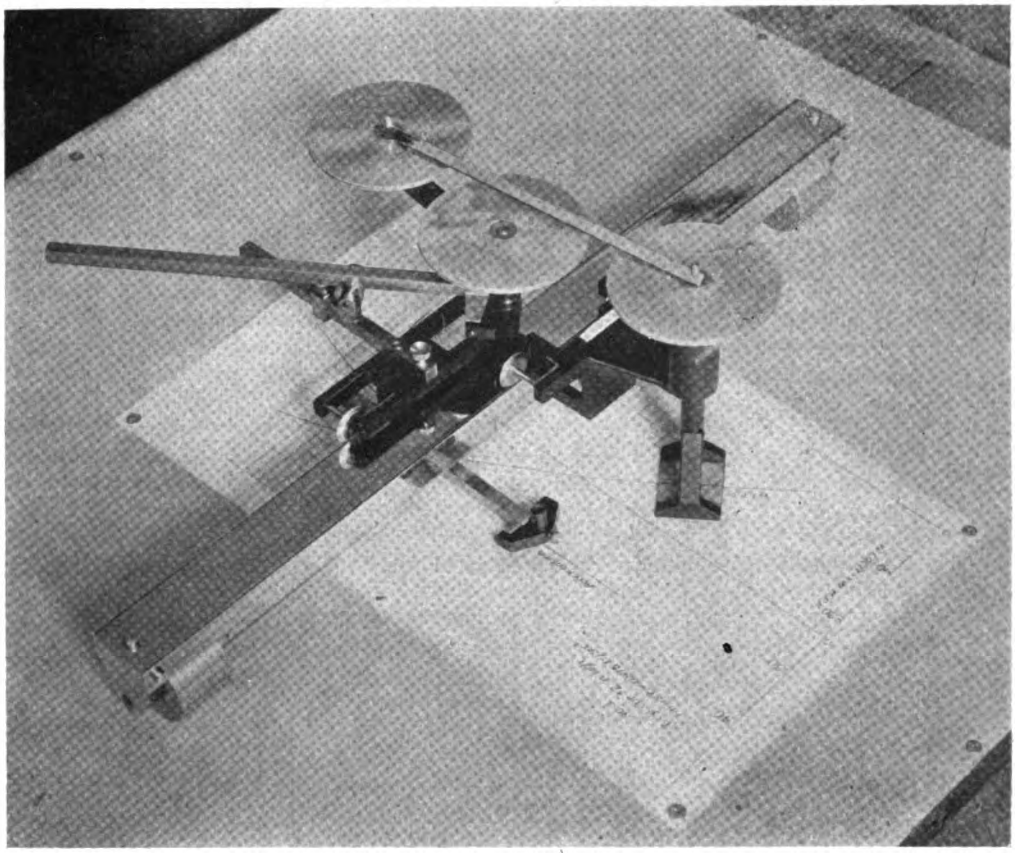


Fig. 3—The author's differentiating machine

The velocity data from which all speed-time curves were plotted were obtained by Messrs. Barker and Safford and presented to the faculty of Worcester Polytechnic Institute in a thesis for an engineering degree in June, 1917. The tests were made on the straight-away of the Narragansett Speedway. In starting to accelerate the car under test the driver used his discretion about the best throttle position. Acceleration runs were made usually by starting very near the minimum car speed and proceeding to nearly the maximum speed for the gear ratio used.

Tests were made on two six-cylinder cars, an eight-cylinder, a twelve-cylinder, and a four-cylinder car, each of which was given one or more trials when running in low gear, high gear, and intermediate gear. A coasting run was made on the eight-cylinder car and a brake test was made on the four-cylinder car, which was equipped with a vacuum brake.

The apparatus used for getting the speed-time record is described in the June, 1917, Report of the Research Division of the Standards Committee of the S. A. E., which report may be referred to for more details. In its essentials it consists of a mechanism for winding a broad paper ribbon which receives perforations from electric sparks sent across a gap each time contact is made by a make-and-break device attached to the wheel steering arm of one of the front wheels. A magnet actuated by current from a timing device indicates periods of one second upon the ribbon by notching the line made by a

*Here again, as was observed in the previous footnote, an error is made, so that the method is only approximately true.

The power which is consumed in imparting angular acceleration to the rotating parts when the car is running on a level becomes available to climb the grade if the car goes uphill at a constant speed, so that the grade established by computations from the observed linear acceleration of the car on a level is slightly low.

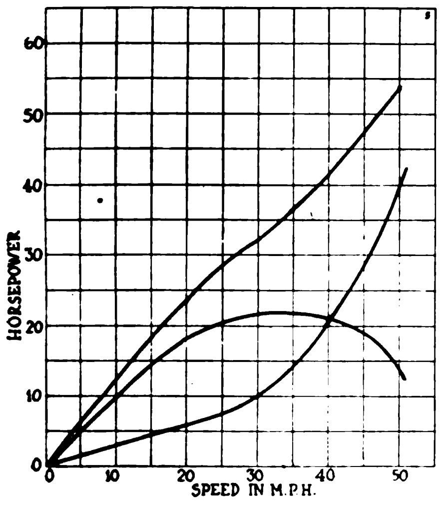


Fig. 5—I. H. P. 8-cylinder car in high gear (rated hp., 81)

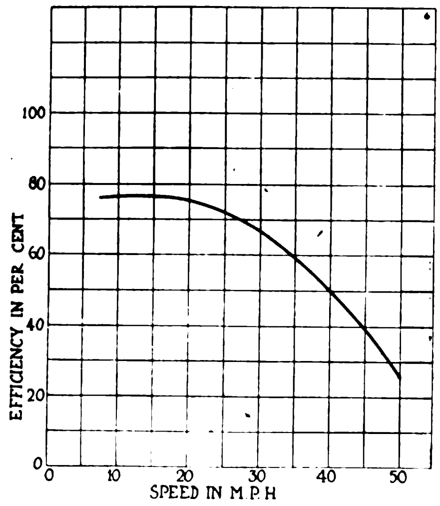


Fig. 6—Automobile efficiency, 8-cylinder car in high gear

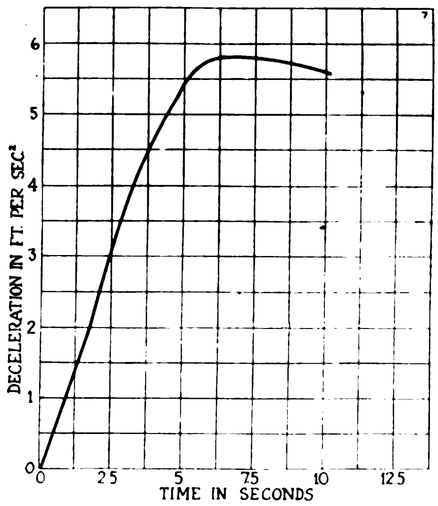


Fig. 7—Vacuum-brake test, 37 m.p.h. when applied; 8 m.p.h. after 10 sec.

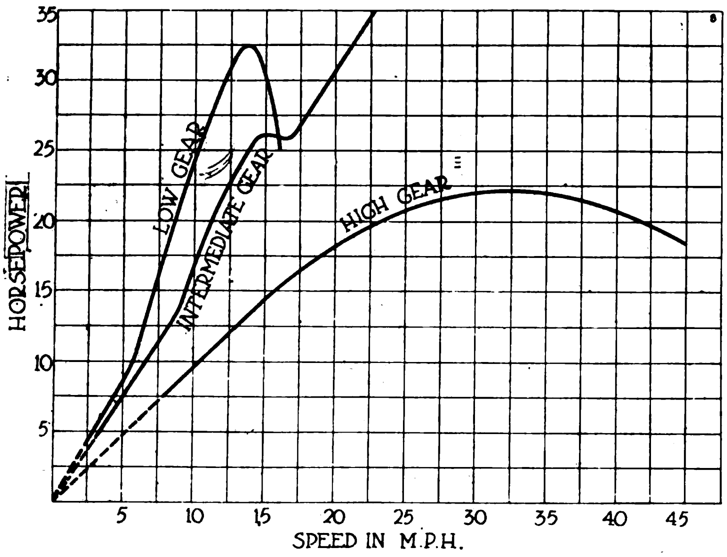


Fig. 8—Traction hp., 8-cylinder car rated at 31 hp.

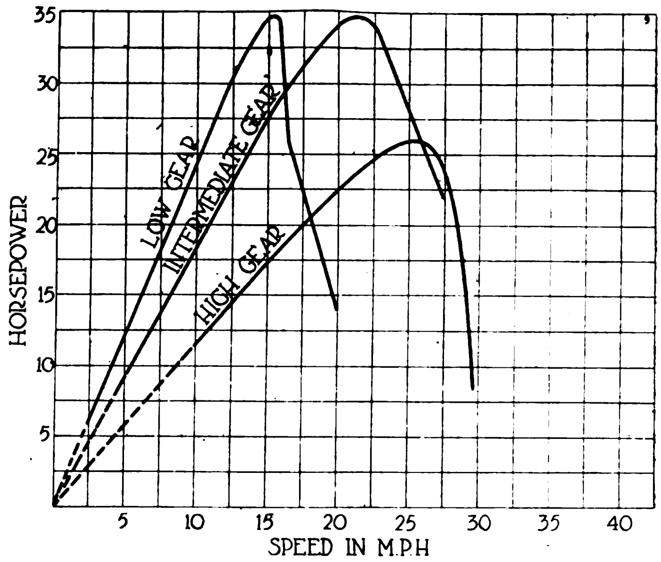


Fig. 9—Traction hp., 12-cylinder car rated at 36 hp.

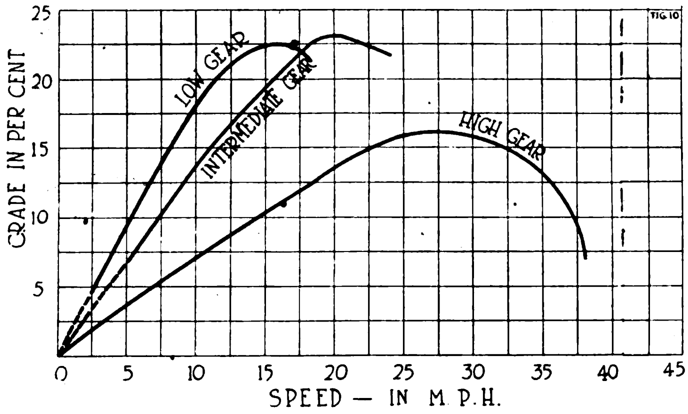


Fig. 10—Traction hp., 6-cylinder car No. 2, rated at 29.4 hp.

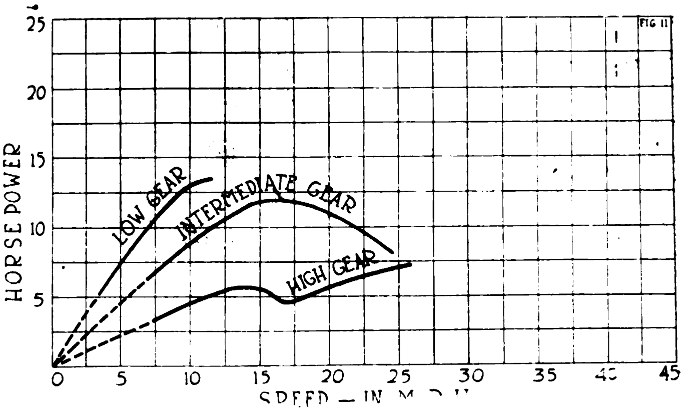


Fig. 11—Traction hp. of 6-cylinder car No. 1, rated at 31.5 hp.

pen. The number of sparks between second gaps represents the distance the car has traveled in a second, that is, the average speed for the second. The difference in the number of sparks represents the difference in average speeds between seconds, hence the average acceleration for a second. It is only necessary to determine by measurement the distance the car travels for each spark and the record may be calibrated to read in feet.

By plotting the speed-time data a curve is obtained that lends itself well to mechanical differentiation. A top view of the instrument is shown in Fig. 2.

Differentiation of the speed-time curve gives the acceleration-time curve as previously explained, in which every ordinate represents the instantaneous acceleration at a given instant. The author's differentiating machine with which the acceleration-time curves were developed is shown in Fig. 3. It is simply a device for giving a graphical record of the rate dv/dt, or slope at any point of the speed-time curve. Two hair lines crossing each other at right angles are ruled upon a transparent plate and serve to get the direction of the tangent at any point on the given curve. The slope of the curve at this point is plotted as an ordinate by the pen shown in Fig. 3 as resting upon the acceleration curve. A number of points are obtained in this way, and a smooth line is drawn through them by hand giving the desired acceleration-time curve. Except for steep slopes it can be depended upon to give results accurate to 1 per cent.*

(a) *Detecting Irregularities in Engine Performance*—Assuming that the driver operated the car to best advantage in this run, as far as he could judge, such curves as those shown in Fig. 4 would indicate poor performance, inasmuch as maximum acceleration is not reached until several seconds have elapsed after starting, and the acceleration is very non-uniform in that it fluctuates considerably in magnitude.

(b) *Traction, Friction, and Indicated Horsepower*—In Fig. 5 the curve of traction horsepower was obtained, as previously explained, by multiplying the mass of the car by the acceleration and velocity at any instant. The friction horsepower was obtained similarly by multiplying the mass by the deceleration at any instant and the velocity at that instant. The power obtained in this way was plotted against the speed. The sum of the total friction power and the traction power, as previously shown, gives the total power of the engine; that is, the indicated power. It is interesting to note how nearly straight the indicated horsepower curve is, showing that the indicated power of the engine, for this car at least, is practically proportional to the speed; and, further, that at the maximum speed attained the indicated power is almost double the rated engine power. The rapid increase with speed of the friction horsepower after a speed of 30 m.p.h. has been attained is also of interest in that it tends to show that the power lost due to air resistance increases more rapidly than does the speed

*For a description of the general subject of mechanical differentiation and a description of an earlier model of the instrument, the author's papers in the Journal of the Franklin Institute for January and February, 1918, may be referred to.

beyond 30 m.p.h. The power available for traction remains practically constant between 20 m.p.h. and 40 m.p.h., reaching its maximum at about 30 m.p.h.

One of the most valuable of curves to show automobile performance is the curve showing the power required to drive a car without acceleration, that is at any constant speed. The friction-power curve is exactly such a curve, for it shows how much power the engine must deliver at any speed to overcome all friction; that is, to propel the car at a constant speed. Variations in body design may, for example, affect the friction power considerably at high speeds. Differences in power losses in the tires may possibly be detected by varying the air pressure or by changing the tires.

(c) *Automobile Efficiency*—The proportion of the total power in the cylinder available for traction falls from about 80 per cent at 15 m.p.h. to about 30 per cent at 50 m.p.h., as shown in Fig. 6.

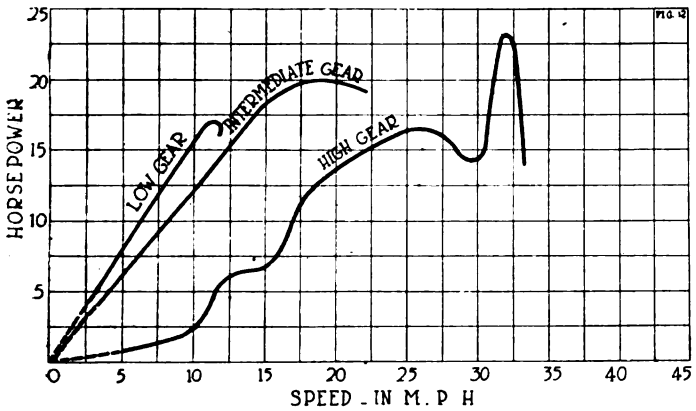


Fig. 12—Traction hp. of 4-cylinder car rated at 19.6 hp.

(d) *Brake Performance*—Fig. 7 shows that in this particular brake test the maximum deceleration was not reached until six seconds had elapsed from the time the brakes were first applied; that is, the retarding force was gradually increased, thereby eliminating the undesirable jar resulting from a sudden gripping of the brakes. The maximum deceleration was no higher than the *acceleration* of several cars when the throttle is opened wide and the gears are in low.

(e) *Traction Horsepower*—Figs. 8 to 12 show the differences in traction horsepower of various cars when running in high, low, and intermediate gears. In general, the maximum traction horsepower attainable is obtained by driving the car in intermediate gear. The low-gear maximum is attained at a slower car speed than the former and at a higher speed than that for the maximum traction horsepower when running in high gear. Fig. 8 shows a peculiarity in that the power curves for the low and intermediate gears are not directed toward the intersection of the co-ordinate axes over a large section of the curve. Fig. 9 shows the traction power curves for a 12-cylinder car. The proportionality of traction power to the speed is clearly brought out. It is interesting to note that at any given speed, within limits, the traction horsepower in low gear is double that in high gear. In Fig. 10 the curves for the 6-cylinder car No. 2 show a value somewhat greater than 2 for the ratio of low gear to high gear traction horsepower at any given speed, within limits.

Fig. 11 shows very poor performance, in that the traction horsepower with any gear ratio is very much below the rated horsepower of the engine. A closer study of power losses in this car should have been very profitable.

The irregularities in the curve for traction power in high gear for the 4-cylinder car are due to fluctuations

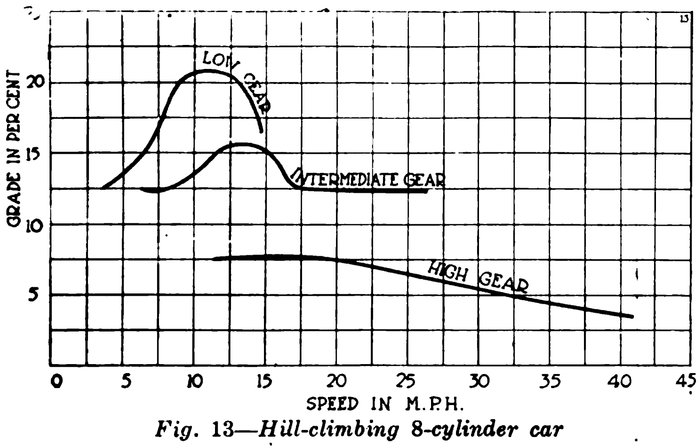


Fig. 13—Hill-climbing 8-cylinder car

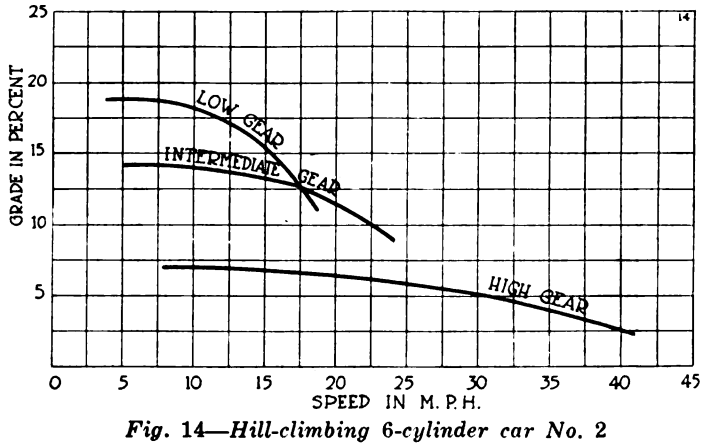


Fig. 14—Hill-climbing 6-cylinder car No. 2

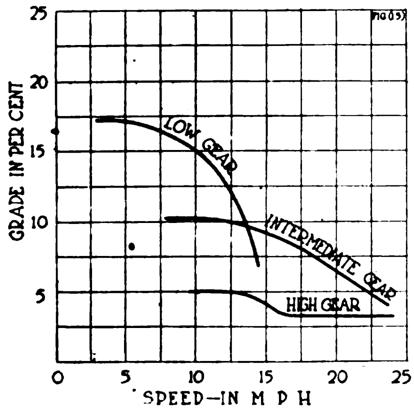


Fig. 15—Hill-climbing 6-cylinder car No. 1

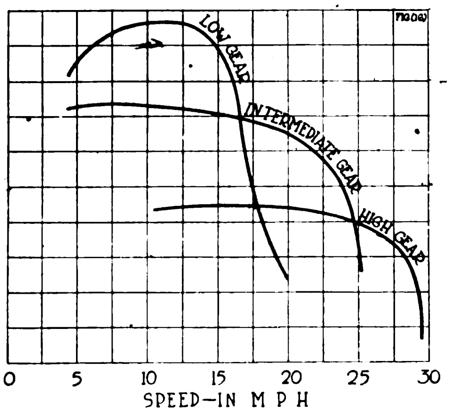


Fig. 16—Hill-climbing 12-cylinder car

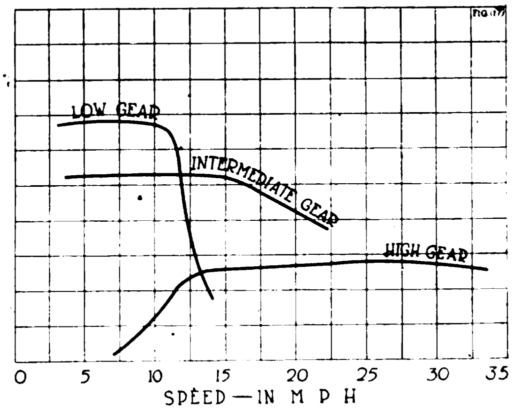


Fig. 17—Hill-climbing 4-cylinder car

in the acceleration brought out in Fig. 4. The traction power slightly exceeded the rated engine power for both the intermediate gear and the high gear runs.

(f) *Hill Climbing*—Fig. 13 shows that the 8-cylinder car can climb a grade of 21 per cent at a constant speed of 11 miles per hour. The curve is rather peculiar in that the maximum grade-climbing capacity is not attained until this speed is reached. The great reduction in ability to climb hills when running on high gear is very marked. The curves of Figs. 14 and 15 for the 6-cylinder cars are different from the curves for the 8-cylinder car in that they have maxima at the speeds at which the tests were begun. The curve for the run of the 12-cylinder car in low gear in Fig. 16 shows the highest grade-climbing capacity of all cars tested, in that this car can make a 24 per cent grade at a constant speed of 14 m.p.h. Fig. 17 shows the curve for the 4-cylinder car. The high-gear curve is only approximate, but the low-gear curves are quite accurate, and show a constant grade-climbing ability over a considerable range of speed.

The author believes that the data obtained with the apparatus the Research Division developed for recording the speed of a car under acceleration or deceleration, when operated upon with a differentiating machine, yield information that should be of value in improving car design. The power rather than the acceleration curves should be used to study car performance, because power measures energy consumption, while acceleration in itself does not. Energy consumption is identical with fuel consumption, and involves economy, while acceleration merely illustrates the behavior of the car from the point of view of kinematics, which is of more interest to the mathematician than to the engineer and car user.

Meso-Thorium as an Ingredient of Luminous Paint

THE increasing demand for radium for medical work, but more particularly for luminous paint, has made the question of possible radium substitutes of considerable importance. Radium luminous paint has been used in the war for a number of purposes, more particularly on the dials of instruments used on airplanes, so that these instruments can be read at night; for electric push buttons, door numbers and small images for shrines, etc. The paint is permanently luminous in the dark and contains from 0.1 to 0.25 milligrams radium element to one gram of zinc sulphide. A luminous watch face usually has from ten cents to twenty cents of radium on it.

An excellent substitute for radium for certain purposes is meso-thorium. This is a radio-active element found in monazite sand and other thorium minerals. When first extracted it is not in a satisfactory condition for luminous paint, but must be allowed to "ripen" for several months or even a year before it can be used. During this time the alpha radiation which is required for luminous paint becomes sufficiently strong. On the other hand the beta and gamma radiation of meso-thorium grows rapidly and it can be used for medical purposes within a few days after preparation.

Radium has a long life, half of it decaying in approximately 1600 years. Meso-thorium on the other hand has a short life, 5 or 6 years being its useful life for luminous paint purposes. The price in the past has varied from 40 to 60 per cent of that of radium, the comparison being on products of equal activity. For medical purposes therefore it cannot compete with radium as long as there is plenty of the latter; for luminous paint, to be used on objects which themselves have a short life, it is an excellent substitute for radium and will tend toward the saving of radium for medical purposes.

It undoubtedly has been used during the war especially by the Germans. Some of the first luminous watch dials in this country probably contained meso-thorium imported from Europe.

Until recently no meso-thorium was recovered in the United States, although large quantities of monazite sand are annually treated for the manufacture of incandescent gas mantels. Such a condition has represented an important mineral waste.

Shortly after the United States entered the war the Bureau of Mines made a co-operative agreement with the Welsbach Co. of Gloucester, N. J., for the study of methods of extraction and recovery of meso-thorium. The work was carried on at the Rocky Mountain station of the Bureau of Mines at Golden, Col., under the direction of Dr. R. B. Moore, superintendent of the station, Dr. Herman Schlundt being assigned to the detailed work on the problem. Successful methods of extraction and recovery have been worked out and connected up with the regular metallurgical processes of the Welsbach company. Meso-thorium is now one of the regular products made by this company. The next largest producers of thorium salts in the country about the same time became interested in the recovery of meso-thorium and worked out its own methods. Consequently at the present time meso-thorium is recovered from practically all the monazite sand treated in the United States.

The details of the work of the Bureau of Mines will be published later. A preliminary announcement was made by Dr. Moore in a paper given at the September meeting of the American Institute of Mining Engineers at Colorado Springs. Incorrect press reports of this announcement gave rise to some serious misstatements of facts, hence this statement.

The Bureau of Mines has never claimed the discovery of meso-thorium, as this element was first identified and described by Hahn in 1905.

Transatlantic Airplanes

NOW that the war is over and aircraft manufacturers are confronted with the problem of finding new outlets for their production we may soon see serious attempts made to cross the Atlantic Ocean. The cash prize offer of the London *Times* for the achievement, which was withdrawn during the war, has been restored, and work on machines which are to try the flight is reported from different centers. Thus our own Naval Aircraft Factory in Philadelphia is reported to be working on a flying boat for the purpose. The Grahame-White Co. of England is advertising for the services of an experienced navigator who is also a pilot to undertake the journey on a machine now being built. At the Farman works in Boulogne-sur-Seine a giant commercial type of airplane, referred to as the Goliath, has recently been completed. It is said to be capable of the Atlantic voyage when fitted with floats. It is capable of carrying 20 passengers, making 100 miles per hour and to travel 1900 miles on one supply of fuel.

We are informed that at the Bleriot works two new large four-engined aeroplanes are nearing completion, which will, it is expected, be suitable for aerial transport in the colonies, where roads are none too good and railways non-existent. In such cases the aeroplane will link up by postal air service one colony with another, and with the capital, while numerous other spheres will doubtless be found, in which the large weight-carrying aeroplane will be of inestimable service.

What Should Organization Achieve?

It Should—

1—Pr vide Incentive to Work
2—Settle Individual Grievances
3—Settle General Disagreements
4—Improve the Working Force
5—Decrease Labor Turnover
6—Reduce Friction Between Departments

By Harry Tipper

SOME time ago the various branches of one of the important industries in this country were involved in continual disputes and in a form of competition which was very destructive in its character.

It occurred to a few of the leaders in this industry that a co-operative organization, formed of the various branches by the election of a few delegates from each branch, would provide machinery by which these disputes would be ironed out and action taken.

The organization was formed. In its character and constitution it was not binding upon any of the branches, or their individual concerns, to agree to any of the decisions made.

When it had been operating for about three years, an examination of its files showed that only three cases had been brought to it which had required regular record decision and promulgation of the decision. The disputes and disagreements, which had filled the air so much before the organization was formed, had vanished without the registering of any complaint when the machinery had been running for a little time.

Some of the members were inclined to question the value of this organization because it did not appear to be doing much work. The fact was, its greatest work had been accomplished in providing a common meeting place with regularly scheduled occasions for meeting at which the disputes of the various branches of the business had died away in a measure of understanding.

These meetings are still being held regularly, although they do not take up very much time, because it is generally understood by the individual concerns in the industry that the better understanding which prevails between the different branches is due to this co-operative organization and it must be maintained by the same means.

Number of Cases No Criterion

In considering the success of co-operative industrial organization, created within the industrial unit for the purpose of settling the matters of disagreement, it is obvious that the number of cases which have been settled is no criterion as to the value of the work and in some of those organizations, where the machinery for the settlement of these matters has been in existence for the longest period of time, the number of cases called to the attention of the organization becomes smaller each year.

What, then, should come out of the efforts of such an organization in order to justify it industrially, after it has been working three or four years?

It is obvious that it should provide a greater incentive to work and to remain at work in the same establishment.

It should show evidence of having settled individual grievances and reduced the number of those grievances.

It should show evidence of having settled general disagreement upon wages and hours, and having reduced the number of such disagreements, or, at least, settled them amicably without the interruption of production or the formation of strikes.

It should also show evidences of providing permanent machinery for the improvement of the working force, for important matters of welfare and for the development of other activities for the mutual benefit of the concern and its employees. This evidence would accumulate in the form of a decrease in the turnover of the labor, this showing gradually in the operation from year to year; a decrease in the friction between departments and employees, as evidenced by the reduction in the number of cases of personal grievances; an adjustment of the wage question by amicable arrangement, and the operation of the welfare department by the employees themselves in just and proper relation to the concern's necessities.

Of the several concerns whose co-operative organizations have been established along the lines outlined in the last article, some of these have been operating for a sufficient length of time to make it possible to examine the records and determine the relation which they bear, in their industrial results, to the former condition.

The Effect Upon Turnover

In one of these organizations, where the experiment has been tried for four years, the turnover has been reduced so that instead of 40 per cent of the number of employees having a record of more than six months continuous work 80 per cent of the employees now qualify under that requirement. This has meant a very large reduction in the turnover and a very great increase in the stability of the organization.

It has, of course, shown itself also in the marked difference in the spirit of the various departments where the stability of labor has introduced a co-operative spirit greatly to the benefit of the productive capacity of each department. This important factor is again increased in its value when examination is made of the action taken by the organization upon the question of wages in general and upon the question of individual increases.

The Adjustment of Personal Grievances

The record of the adjustment of personal grievances is not in such shape that it can be determined with accuracy from the statistics. A careful examination of the matter indicates that these personal grievances have decreased to such an extent that the Betterment Committee, or the Board of Review, by whichever name it happens to be called, is rarely required to enter into this question at the present time.

It is indicated from the conversation of the heads of departments and the officers of the company that the personal grievances are more freely discussed between the employee of a department and the supervisor and settled more largely in that amicable way, without being brought to the organization machinery for decision.

It is perhaps principally in the matter of discharges that the greatest progress has been made. As stated in the last article, there are certain causes for which an immediate discharge without the right of review is retained, and the experience is that the discharges from these causes have decreased very greatly since the establishment of the judicial machinery, so that they are now very infrequent.

It has been noted, further, that the establishment of the committee empowered to review the discharge of any person, not guilty of one of the offences stated above, has had the effect of eliminating the discharges for trivial causes, which, while infrequent, were unnecessary.

It has also improved the morale in each department by the feeling of confidence engendered by the knowledge that the employee has the right of review and the fair and careful investigation which has preceded the decision in each case. While the statistics are not available, it is gathered from conversation with various department heads that the reduction in discharges of this kind amounts to a little more than 60 per cent of the total number over a given period.

Wage Adjustments

It is in the matter of wage decisions, perhaps, that this type of organization receives its greatest justification in those individual industrial units where it has been tried out. In four years, in one unit, eight decisions have been made upon the wage question without involving a strike, without interrupting the orderly process of production and without the turmoil and lack of confidence which usually arise in such cases.

It is to be noted that, in this number of cases, there were three decisions affecting wages and raises in the first year, two decisions in the second year and one decision in the third year, which finally led to the establishment of a permanent committee to deal with that question exclusively and the establishment of a basis which automatically settled the general system upon which wage increases would be allotted.

Any one of these decisions would have been sufficient to cause a strike in many plants, or greatly reduce the productive efficiency, create dissatisfaction among the workers and increase the turnover and the loss of production.

It should be remembered, in considering these decisions, that they were made by the full discussion of the combined representatives of the general employees and the representative department heads and supervisors, so that they were the result of a full and free discussion between the parties at interest who were familiar with all the details of the case.

To the writer the most remarkable thing is the fairness exhibited by the records of the discussions and the resolutions passed, and the fact that such discussions have gone much further, in actual understanding of the employer's position by the employee, and vice versa, than any of the discussions which have occurred and been brought to his attention between the general organized labor groups and the groups of manufacturers.

The operation seems to have worked out in this general way: The employees who felt that they were entitled to an increase in wages, change in the hours, extra holidays, or something of that kind, presented the matter to their representative. The representative, better informed as to conditions on account of his contact with such questions through his participation in the discussions of the house, would be able to secure a modification of these demands before the final instructions were given to him to be presented to the house of representatives.

When such instructions were taken upon the floor of the house of representatives, all other departments would be able to further modify the demands in their full discussion of the matter from all points of view.

The presentation of the matter to the senate would then result in further modifications unless the matter was already cleared, so that when the matter was finally presented to the company the proposition represented a fair basis for action.

It is in this respect indeed that the organization has justified itself more strongly than in any other respect and that the use of the supervisors and heads of departments, as a second body, has been justified more thoroughly.

The general executives could not inform themselves readily upon the total advantage and disadvantage of any course of action, and matters could not be brought out so freely in discussion before a decision was to be made.

By the interposition of the body of department heads, the total disadvantage and advantage in operation have been thoroughly threshed out and the matter brought into some general co-ordination with the development and interests of the business before being passed up to the heads of the firm for final action.

The records show that the employees have secured wage increases a number of times in common with all other employees. They also show, however, that they have agreed to take care of wage increases on a more permanent basis and upon better grounds than the average industrial organization. They have created permanent machinery to deal with the question which will give them an opportunity to improve and develop the matter upon the basic principles already admitted in these dealings between the workers and the individuals of the same industrial unit.

Information. By Harvey E. Phillips. Auto Electric Systems Publishing Co., Dayton, Ohio. Price $2.50.

This is a volume of some 400 pages, containing very elaborate information on elementary electricity, motor car electric systems, the gas engine from an ignition point of view, and driving the car. Mr. Phillips has had extensive experience with the Bell Telephone Co., the Dayton Engineering Laboratories Co., and has been consulting engineer to Aviation Mechanics Training School. He has also published a number of smaller booklets on electrical subjects, especially pertaining to automobile ignition.

In the present book not only are the elementary principles of electricity taken up and thoroughly explained, but the different systems are gone into in detail and there is a considerable amount of information given on driving the car correctly. In the next part of the book are published a considerable number of wiring diagrams of starting, lighting and ignition systems on automobiles up to and including 1917 models.

AT the annual meeting of the German Association of Gas and Water Engineers, which was held in Berlin recently, the question of the continued demand for coal gas for road vehicles after the war was discussed. The belief in a future increasing demand is based chiefly on the shortage of horses. There are, however, also, other advantages connected with the use of gas. Experience in Berlin with a 3-ton motor truck shows that the consumption of gas is about one cubic meter per kilometer, or 60 cu. ft. per mile of travel.

Left-Side Drive for Export Cars

Difficulties Involved in Building One Model in Both Right and Left Hand Drive Types—The Left-Hand Drive Has the Same Advantages in Most Foreign Countries as Here—Action by N. A. C. C. Suggested

By A. C. Woodbury

ONE of the serious difficulties connected with export business as conducted by the average American automobile builder during the past few years has been the demand for right-hand drive in most of the world outside America. Catering to this demand is the cause of much expense and inconvenience throughout the whole history of a model.

When the design is first laid out on the drafting board it is necessary to provide clearance for the steering gear on both sides of the engine, often either causing the shifting of engine accessories from one side to the other, or preventing the best arrangement that would be possible if the position of the steering gear were fixed. Many times resort is had to expedients on control rods, brake connections and exhaust pipes for right drive models that would not add luster to the reputation of the engineering department were the stripped chassis exhibited to the critical gaze of a National show. From the inception of the design to the time when the last "right drive only" part is sold for service the production of right drive cars concurrently with left drive cars is a source of bother, errors and expense. With the market of the world in its present state it is worth while now to consider whether the demand for right drive cars has really any basic foundation which must be respected, or whether it is one of those bugbears for which we have entertained a groundless fear.

The prevalence of right drive in foreign countries is often ascribed to the different rule of the road requiring meeting cars to turn to the left instead of to the right and causing all vehicles to keep to the left side of the road. That this is not a really serious reason is seen from the fact that for years almost every car built and sold in this country with its turn-to-the-right rule had right-hand drive. Also several instances are on record of models brought out with left drive, later to be changed to right drive because the public demanded the arrangement to which it was accustomed. In France, where the rule of the road is the same as our own, the right drive still prevails.

Advantages Claimed for Left-Hand Drive

It is true that many drivers will tell you that the left drive is the best because they can see best from the left position how close to drive to a car they are meeting, but it is equally true that the right position enables them to better judge the distance to the edge of the finished surface of the road and the clearance from cars or teams they are passing, while there is also a little gain in getting sooner out of the dangerous zone in meeting a glaring headlight. None of these arguments are the determining ones. To find the real reason for the change from right to left drive in this country we will recall a little history.

Eight or nine years ago nearly all cars had right drive, and the front compartments were not enclosed by doors. At about this time the "fore door" body made its appearance, after being introduced by early attempts at stream line or "gun boat" bodies. Up to this time the right side of the driver's seat was usually quite inaccessible. The brake lever, gear shift lever and steering wheel were too much in the way to permit easy ingress or egress, and spare tires usually completed the enclosure. So there was no compunction against providing only one real door in the front compartment and closing the right side by a panel.

However there was real difficulty in arranging the control levers so they were accessible and sightly without encroaching on the position of the driver. Some designers put both levers outside where they were both inconvenient and unsightly, others placed them inside, resulting either in cramping the position of the driver or making an unsightly bulge in the body, while still others compromised by putting one lever inside and the other outside. This compromise was even worse than the others as to knuckle clearance. One maker went so far as to enclose the gear shift lever in the body panel with an elongated gear shift gate in place of the molding at the top.

Control Levers Moved to Center

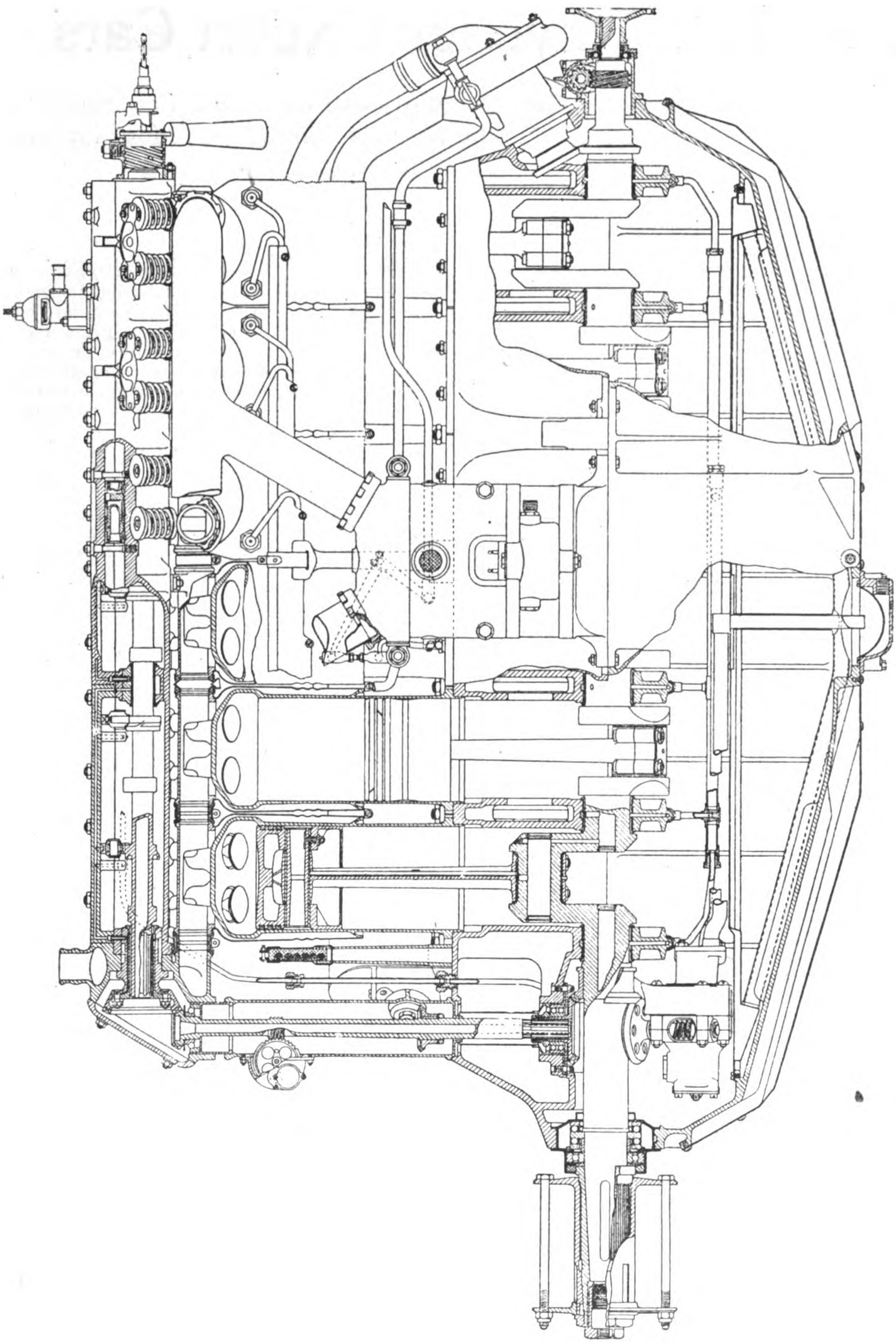
Next, one or two manufacturers hit upon the scheme of mounting the control levers in the middle, directly on the transmission in the case of a unit transmission, but still kept the steering wheel at the right, making it necessary to shift gears with the left hand. This position of the levers was a happy thought. It not only got well clear of all interference between body and levers but it proved a simpler and better manufacturing arrangement than mounting the levers independently on the frame.

While many cars requiring gear shifting with the left hand have been manufactured, and those who are accustomed to them say they are just as convenient as any, still the public generally seems not to have taken kindly to the idea and the logical step was to move the position of the driver to take full advantage of the newly found best position of the control levers. The majority of American manufacturers seem to have reached this conclusion at once, as most of them changed to left drive and center control the same year.

If this arrangement is such an advantage in American cars why has it not been taken up by the leading European makers? I believe that is largely because of the different organization of the industry in Europe, particularly because the cars are not ordinarily built with standard bodies. The result is that problems of the body builders do not so promptly react on chassis design. I believe Europe will eventually follow America's lead in this respect.

It thus appears that the reasons for left drive for export cars are about the same as for cars for domestic use, with the additional reason that any such extensive change in the design of part of the product of a factory causes much greater confusion and expense than would

(*Continued on page* 25)



Six-cylinder 200-hp. Austro-Daimler engine. Cylinder dimensions, 135 x 175 mm.

Austro-Daimler 200-Hp. Aircraft Engine

Report on an Austrian Aircraft Engine Issued by the Technical Department of the British Air Ministry—The Engine Described Was Fitted to a Berg Single-Seater Scout

THE following detailed report on the design, construction and general performance of the latest type of Austro-Daimler engine is based on an examination and tests carried out at the R. A. E. on the engine (No. 19,218) taken from a captured Austrian Berg scout (R. A. F. No. A. G. 6). This machine, a single-seater biplane brought down on the Italian front in April, 1918, was captured in very good condition; the engine had apparently only been in use for a few hours.

With the exception of its high stroke—bore ratio—and the construction of a detachable inlet valve seating in each cylinder, the design of this engine shows no great resemblance to the earlier types of Austro-Daimler engines; generally speaking, the new 200-hp. Austro-Daimler possesses more than the usual amount of originality in design found in aircraft engines.

The general construction of the 200-hp. Austro-Daimler is shown in the photograph of the complete engine, Fig. 1, and also in the accompanying cross-sectional and general arrangement drawings.

Following the usual German practice, the engine is of the six-cylinder, vertical, water-cooled type with separate built-up steel cylinders. The principal characteristics of the design and its general performance are given in the following leading particulars:

Number of cylinders	Six, vertical.
Bore	135 mm.
Stroke	175 mm.
Normal b.m.e.p.	123.3 lb. per sq. in.
Average b.h.p. and speed	200 b.h.p. at 1400 r.p.m.
Compression ratio	5.02:1.
Fuel consumption per hour	111.0 pints.
Fuel consumption per b.h.p. hour	0.555 pint.
Oil consumption per hour	7 pints.
Oil consumption per b.h.p. hour	0.035 pint.
Total weight of engine, dry	728.5 lb.
Weight per b.h.p. (normal)	3.64 lb.

High Compression Ratio

The compression ratio is considerably higher than that of any of the enemy engines except the Maybach, and from the complete data published at the end of this report it will be seen that the general efficiency of the engine is good, the hp. per cu. ft. of stroke volume being 377.3 and the hp. per sq. ft. of piston area being 216.6.

During calibration and endurance tests carried out at the R. A. E. the running of the engine was very good, being very steady and between 700 and 1700 r.p.m. The engine was remarkably clean, having no trace of oil or water leakages during tests.

Compared with the usual high weight standard of enemy engine design, the weight per b.h.p. of 3.64 is quite normal. From our own standard of weights, however, the weight per b.h.p. is disproportionately high. This is chiefly due to the heavy construction of the crank chamber and oil base, rather than to the design of the cylinders and reciprocating parts, which are well designed and are of light construction compared with other enemy engines.

As a preliminary survey of the general design of the 200-hp. Austro-Daimler engine, the principal features of the engine are briefly described and illustrated in the following summary:

The six separate cylinders are of the usual built-up steel construction with pressed steel water jackets and are fitted with twin inlet and exhaust valves in the cylinder heads, which are integral with the cylinder barrels. The valve pockets are welded into position, with the exception of one inlet valve pocket in each cylinder, which is constructed so as to be easily detachable with its valve seating and guide, as in previous Austro-Daimler engines, so that all the valves can be removed without dismounting the cylinder.

Aluminum pistons are adopted, and, with the exception of those recently fitted to the 230-hp. Benz engines, were at the time of capture apparently the only aluminum pistons in use in enemy engines, although since this engine was captured a Rumpler biplane has been brought down fitted with a 270-hp. Bassé-Selve engine using aluminum pistons. A detailed report of this engine is in course of preparation and will be published shortly.

The H section connecting rods are of normal design, and the crankshaft runs in seven white metal bearings, which are carried by the top half of the crankcase. The bottom halves of the journal bearing housings are steel forgings and are very deep in cross section, being similar in design to the journal bearings fitted to the Maybach engines.

The design of the valve gear and camshaft drive presents several interesting details. As shown in the illustrations of the engine, the overhead camshaft is driven by a vertical shaft off the front end of the crankshaft. The camshaft runs in four phosphor bronze bearings in the center of an aluminum camshaft case.

A compression release gear, very similar to the Mercédès type, is provided. The water circulation passage from the cylinders to the top of the radiator is taken through to the front end of the cast aluminum camshaft-casing, just behind the driving bevel gear.

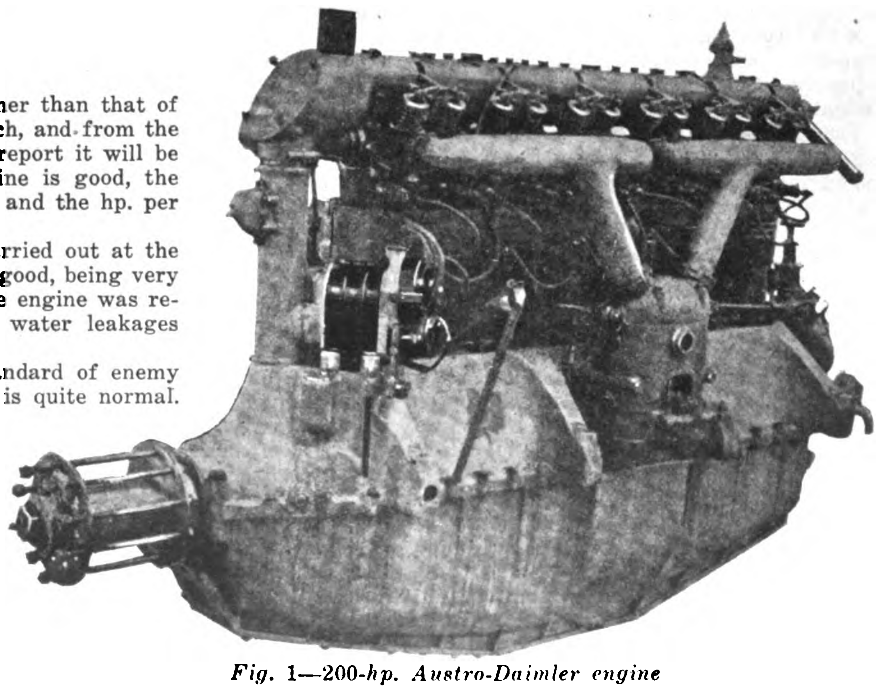


Fig. 1—200-hp. Austro-Daimler engine

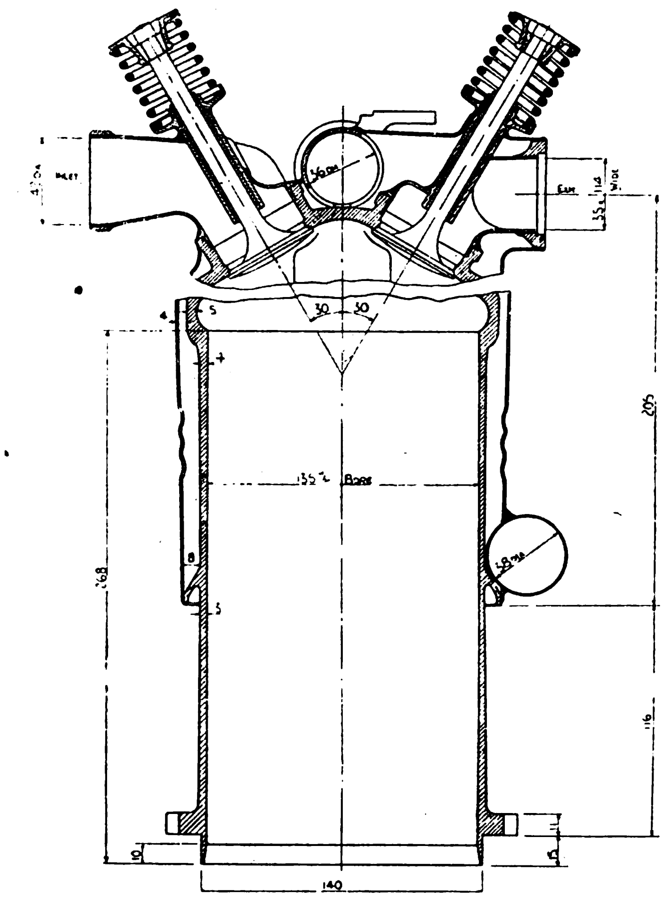


Fig. 2—Cross section of cylinder

A reciprocating plunger type oil pump is fitted in the front end of the oil base. This pump is driven by bevel and worm gearing directly off the crankshaft and is unusually heavy, but of interesting design.

The lubrication is on normal principles and embodies a large air-cooled oil sump at the bottom of the base chamber, which is supplemented by an auxiliary fresh oil reservoir cast in the front end of the top half of the crank chamber. The fresh oil is delivered by a small auxiliary plunger, working in conjunction with the main oil pump, to the front end of the camshaft, the lubrication of which is well carried out.

A "V" type honeycomb radiator is fitted directly behind the propeller, and the centrifugal water pump, which is driven obliquely off the rear end of the crankshaft, is of ordinary design.

Two Bosch Z.H.6 magnetos are driven diagonally at 52 deg. off the vertical camshaft driving shaft at the front of the engine, and two plugs are provided in each cylinder. The magneto controls are interconnected with the throttle control, so that the ignition is automatically retarded when throttling down.

A heavy duplex carbureter feeds the cylinders through two separate steel induction manifolds, which are galvanized, and lagged with asbestos; each manifold feeds three cylinders. The carbureters are water-jacketed and heated by the cylinder water circulation system in the usual way.

Main and slow-running jets are fitted, the two annular floats being housed in chambers surrounding the choke tubes. The main air intake is taken through a passage cast in the two halves of the crankcase, leading to the chamber below the false bottom of the oil sump.

An air pump of the spring plunger type is driven off the camshaft and is mounted on the top of the camshaft casing toward the rear end of the engine. A transverse shaft driven off the rear end of the crankshaft carries two cams for the synchronized gun interrupter gear. No exhaust manifold is provided, each cylinder being fitted with a short streamline section exhaust pipe about 12 in. long, as shown in the illustrations of the engine.

The six separate cylinders are made entirely of steel. The cylinder barrels, which are integral with the heads, are built up of steel forgings. The barrels are machined all over, and are ground to 135 mm. bore; the thickness of the cylinder walls tapers on the outside from 3.0 mm. at the center to 4.0 mm. at the top, and 4.0 mm. at the base. The water-jackets are pressed in the usual way from sheet steel 1.0 mm. thick, and are very short. The bottom of each water-jacket is flanged over and welded to a beveled flange which is machined on the cylinder barrel; three annular corrugations are formed in the water-jackets to allow for expansion.

Two inlet and two exhaust valves are fitted in each cylinder head, and work at angle of 30 deg. to the vertical axis of the cylinders. These are clearly shown in the cross-sectional drawings of the cylinder, Fig. 2.

In each cylinder two of the exhaust pockets and one of the two inlet pockets are pressed and welded into the head. The other inlet valve, with its seating and guide, is carried in a separate detachable pocket, fixed in position by a large gunmetal union nut, as in previous Austro-Daimler and Beardmore engines. This allows the other valves to be withdrawn from the cylinder through the opening left on the removal of the pocket, without disturbing the cylinder.

The flanges at the base of the cylinders are 11.0 mm. thick, and the cylinder spigots extend 15 mm. into the crankcase. Lugs are machined in the base flange of each cylinder to take the eight studs which bolt each cylinder to the crankcase. Four of the studs are of larger diameter, *i. e.*, 19.0 mm., and pass through the crankcase upper half; they act as main holding-down bolts and secure the lower portion of the journal bearings, thus relieving the crankcase of most of the working stress.

The total weight of each cylinder, bare, is 18.4 lb.

Pistons

These are of cast aluminum; the crowns are very slightly concave, and are supported by eight radiating ribs, as shown in detail in the sectional drawing, Fig. 3. It will be noticed that these ribs are not spaced equidistantly, the two ribs over each of the piston pin bosses being closer together and extending downward so as to support each boss from below.

This design undoubtedly provides a much better distribution of the stress than in the design of the new 230-hp. Benz aluminum pistons. Steel bushes are cast into the piston pin bosses in the pistons, and the piston pin is fixed only by a large split pin, which passes through a hole drilled in the boss; these holes are also fitted with steel bushes.

Three plain cast-iron rings are fitted above the piston pins, and an annular groove is machined around each piston on the piston pin level for lubrication.

The weight of each piston is 3.52 lb. with rings, and the weight of each piston pin is 0.66 lb.

The connecting rods are of H section and exceptionally long for the size of the engine; from the German standard of

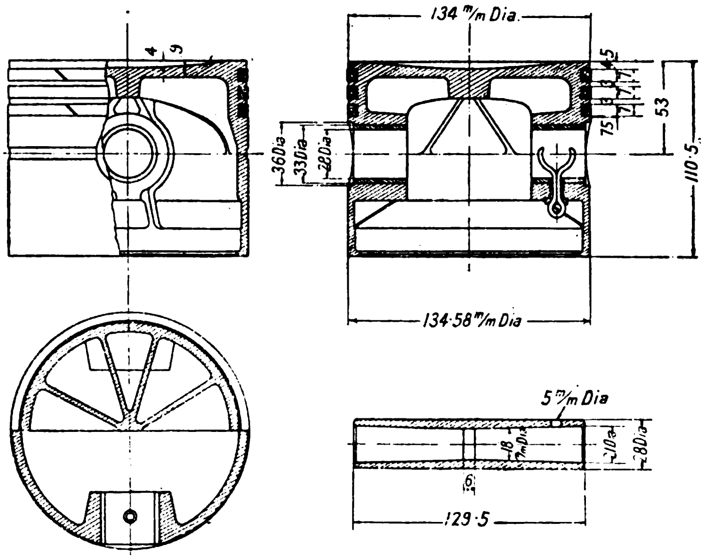


Fig. 3—Piston and piston pin

weight they are of comparatively light section, but the central webs of the rods are not drilled. Four bolts are used to hold the halves of the big-end bearings. These bolts are 10 mm. dia., and each pair is locked by a sheet steel clip.

The white metal lining of the bronze big-end bearing shells is 1 mm. thick, and the small ends are fitted with phosphor bronze bushes for the piston pin bearings, which are lubricated by small diameter pipes attached to the central web of the rods in the usual way. Two horizontal oil grooves are cut in the lower halves of the big-end white metal bearings, and a short transverse oil groove in the top halves, while the small-end bushes are provided with three longitudinal oil grooves.

Weight of the complete connecting rod.. .... = 4.84 lb.
Weight of big end .... = 3.18 lb.
Weight of small end .... = 1.66 lb.
Length of connecting rod between centers...... = 315 mm.

Valves and Valve Gear

The twin inlet and exhaust valves are all of the same dimensions and are interchangeable, and, as previously mentioned, work at 30 deg. to the vertical cylinder axis. The largest diameter of the valve heads is 48 mm., and the effective diameter is 44 mm., which gives a combined inlet valve opening area of 4.24 sq. in. The mean gas velocity through the inlet valves is 140 ft. per second.

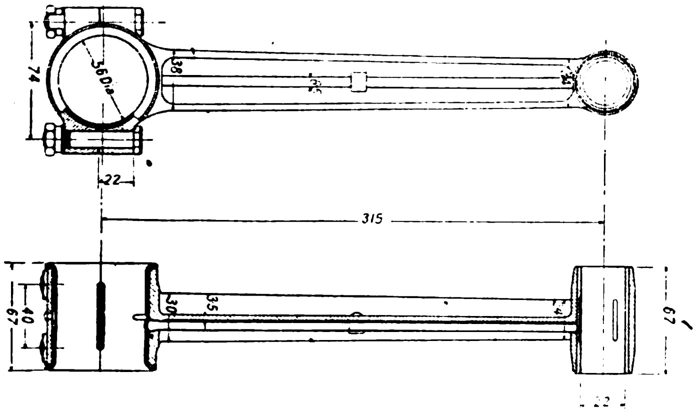


Fig. 4—Connecting rod

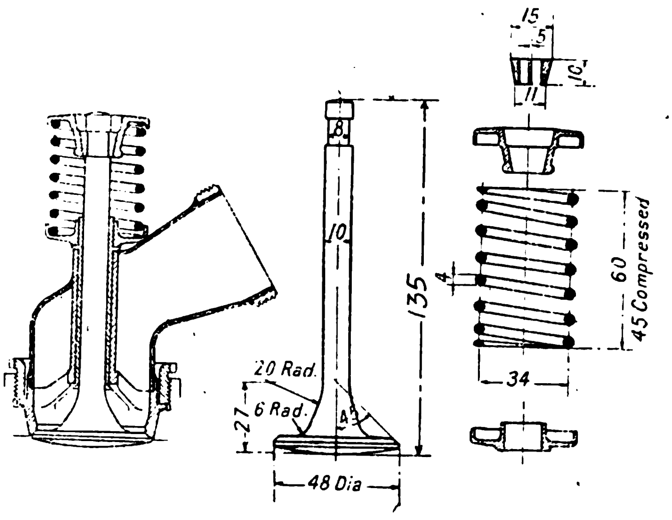
Single helical valve springs are fitted to each valve, and the valve spring collars are held in position by split cones, which register with the recess cut in the end of the valve stem, as shown in Fig. 7. This spring locking device is similar to that used in the Benz engines. The valves are operated by a single overhead camshaft which is carried in an aluminum case, running the whole length of the engine in one piece. This case is attached to each cylinder by two studs screwed into lugs formed in the cylinder heads.

The camshaft runs in four phosphor bronze bearings; these bearings are split and mounted in aluminum housings, and are located in the camshaft casing by small taper grub screws. The cover of the camshaft is in three parts, with very close joints. These detachable covers permit easy access to the valve gear of any or all of the valve rockers and cams.

Valve Rocker Spindle

Each valve rocker spindle is carried in three separate phosphor bronze bushes, which are housed half in the lower portion of the aluminum camshaft casing and half in the camshaft case cover. For ease of manufacture the boring of the cover and case is carried out as two continuous holes running the whole length of the case, and forming long semicircular grooves in both halves, in which the valve rocker spindle bearings lie. These bearings are held in position by dowel pins, and the center bearing of each set is of course split.

With the exception of the bridge pieces, which operate the valve stems, the valve rocker levers are machined from single steel forgings, and the bridge pieces, which carry the adjustable tappet screws, are pressed and riveted on to the ends of the rocker arms against a shoulder. The bridge pieces are prevented from swivelling by being let into a recess cut in the base of the shoulder. The ends of the adjustable tappet screws are hardened and are fitted with the usual type of transverse locking bolt.



Figs. 5, 6 and 7—Valve seat, valve and spring

Hardened steel rollers are fitted to the inside arms of the rocker levers, and a deep oil groove is milled in the top of these arms to convey oil through the hollow spindles to the bearings and also to the cam rollers.

Camshaft Driven from Front End

Compression release cams are formed on the exhaust cams, and the lateral movement of the floating camshaft is effected by a long hand lever at the rear end of the engine. This lever is attached to a gun-metal collar, which is fitted with a square thread screw, the design of this compression release gear being very similar to that used on all the Mercédès engines.

The camshaft is driven from the front end (which is quite unusual in enemy engines) through a bevel gear, which floats on eight splines cut on the end of the camshaft. The camshaft vertical driving shaft is driven directly from the front end of the crankshaft by bevel gears. The top end of the vertical spindle runs in a combined thrust and radial bearing, and the lower end (which has six splines cut in it) floats in the lower bevel gear, which with its bearing and housing forms a separate unit, and need not be disturbed when withdrawing the vertical spindle.

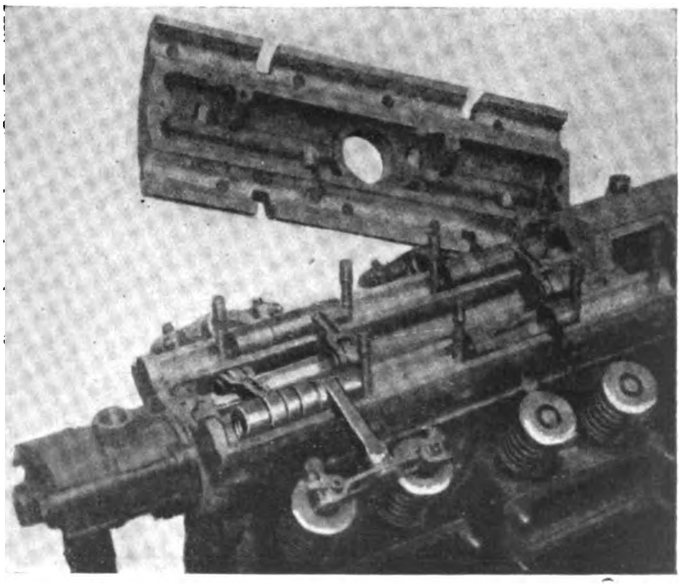


Fig. 8—Camshaft and housing, with cover removed

Details of Crankshaft

Number and type of main bearings	Seven bronze cage, lined white metal
Cylinder centers	166.0 mm. (6.53 in.)
Journals	
Outside diameter	58.0 mm. (2.28 in.)
Inside diameter (front two)	21.0 mm. (0.82 in.)
Inside diameters (others)	30.0 mm. (1.18 in.)
Length airscrew end	56.0 mm. (2.20 in.)
Length rear end	43.5 mm. (1.71 in.)
Length center	50.0 mm. (1.97 in.)
Length intermediate	50.0 mm. (1.97 in.)
Crankpins	
Outside diameter	56.0 mm. (2.20 in.)
Inside diameter	30.0 mm. (1.18 in.)
Length	68.0 mm. (2.67 in.)
Crank Webs	
Width	74.0 mm. (2.91 in.)
Thickness (front two)	24.5 mm. (0.96 in.)
Thickness (others)	24.0 mm. (0.94 in.)
Radius at end of journals and crankpins	4.5 mm. (0.17 in.)
Weight of complete shaft	96.5 lb.

The six-throw crankshaft is of normal design and requires little description. The usual type of plain white metal bearings are used. The diameter of the journals is 58 mm. and of the crankpins 56 mm.; the length of all the journal bearings is 50 mm., with the exception of the front bearing, which is 51 mm.

All the crankpins and journals are bored 30 mm. dia., except the two front journals, which are 21 mm. bore; and the webs are drilled with 5 mm. oil leads in the usual way for pressure lubrication. Brass discs are used to plug the ends of the holes bored in the journals and crankpins. These are expanded into grooves cut in the ends of the holes. Other details of the design of the crankshaft are given in the drawing, Fig. 9, and the construction of the front ball bearing and propeller double thrust race is clearly shown in the general arrangement sectional drawing of the engine on page 20.

Propeller Hub

The method of attaching the airscrew hub by serrations cut on the outside of a sleeve which fits onto the tapered extension of the crankshaft follows the original design of the previous Austro-Daimler and Beardmore engines. In other respects the construction of the airscrew hub is of ordinary design, but compared with those used on most other enemy engines the weight of the airscrew hub is considerably below the average—viz., 11.3 lb.—less the crankshaft extension. Details of the propeller hub are given for reference in Fig. 10.

Crankcase (Top Half)

The construction of the cast aluminum crankcase is proportionally heavy, both in the design of the top and bottom halves. The top half weighs—with main journal bearings complete and cylinder holding down bolts and studs—133.4 lb., and the bottom half, which forms the oil base and sump, weighs no less than 73.5 lb. dry. This makes a total weight

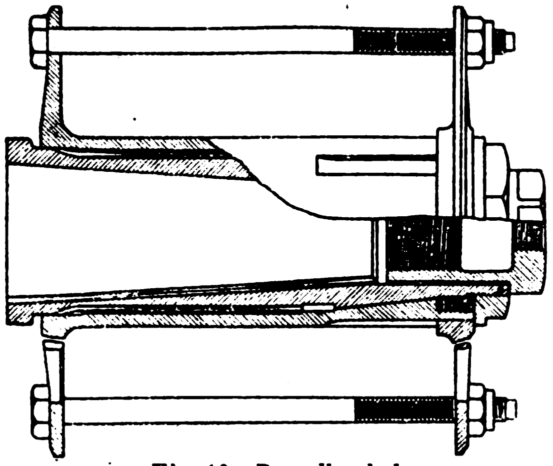


Fig. 10—Propeller hub

of 207 lb., approximately, for the complete crank chamber, which works out at 28 per cent of the total weight of the engine.

The transverse webs which form the crankshaft journal bearing housings are of the usual box section, and the eight engine bearer arms cast on the crank chamber, four on either side, are made as continuations of the transverse webs, and are of the same section; they are exceptionally deep.

The front portion of the top half of the crankcase is constructed to form the feed oil tank. This tank, as shown in the section on the general arrangement drawing of the engine, encloses the bottom portion of the camshaft vertical driving shaft, and is fitted with a filling cap and oil filter and also with a glass sight-level oil gage. The capacity of the feed tank is approximately one gallon.

The efficient ventilation of the crankcase, as in most of the enemy engines, has been well provided for. Two breathers of normal design are fitted on the exhaust side of the crankcase, and a passage is formed in the body of the carbureter, which communicates with the interior of the crank chamber through a large port cast in the side of the crankcase.

This passage also communicates with the crank chamber by two large holes cast in the webs of the central bearing housing. The primary function of this passage is, of course, to assist in heating the carbureters, which are also water-jacketed.

The average thickness of the walls of the crank chamber is 9 mm. *(To be continued)*

In view of the wide public interest taken in the British Scientific Products Exhibition, held at King's College, London, during the past summer, the British Science Guild has decided to organize another exhibition next year. The main object of the exhibition will be to stimulate national enterprise by a display of the year's progress in British science, invention and industry. A large part of the recent exhibition has been transferred to Manchester, where it will be on view at the Municipal College of Technology toward the end of next month.

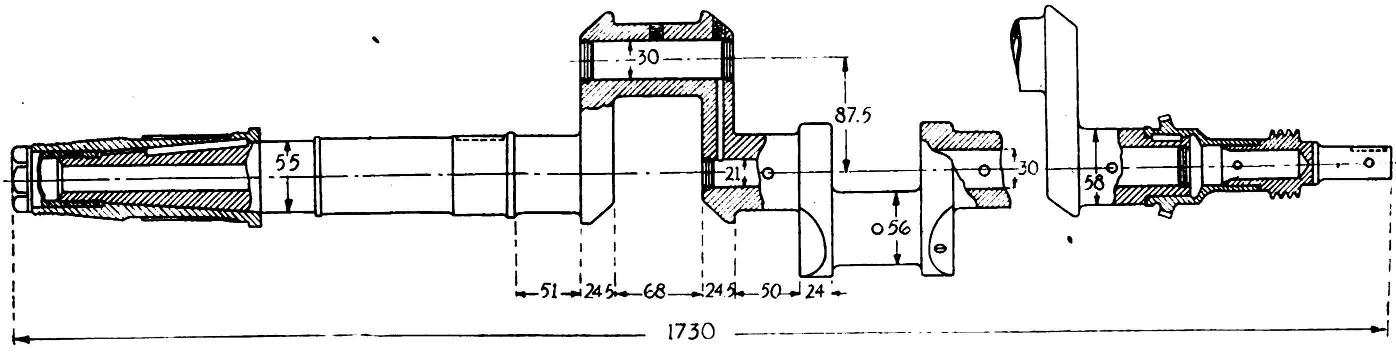


Fig. 9—Sections of the crankshaft

Effect of Temperature on Spark Plug Insulations

Experiments Carried Out in England Show That Minimum Permissible Insulation Resistance Varies with Frequency of Sparks and Compression Pressure

IN a recent issue of AUTOMOTIVE INDUSTRIES was published an article by Dr. Cunningham on the effect of temperature on the insulation of spark plugs. This subject is of considerable interest in connection with aircraft engines, as these operate at high compression, and all parts exposed to the flames reach extraordinary temperatures.

The subject seems to have received some attention also in England, and a brief article dealing with it is published in *Engineering* of Nov. 8, by J. D. Morgan. Mr. Morgan divided his investigation into two parts, the first relating to the leakage resistance of the insulation which would just prevent firing of the plug, and the second to the variation of the insulating properties of different plug insulators with temperature.

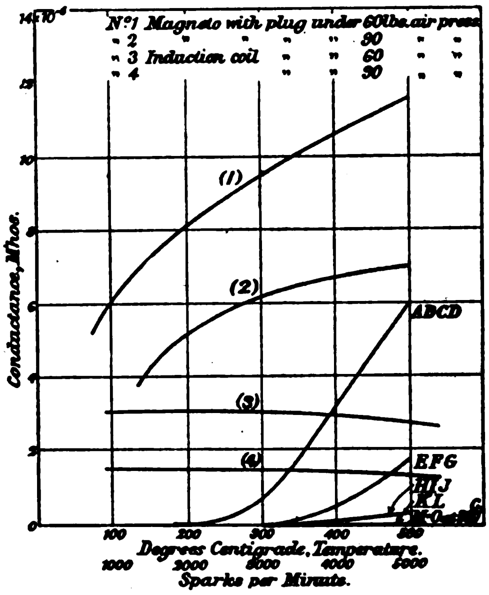
For the purpose of determining the leakage resistance which would just cause a spark plug to fail, a plug was secured to a compressed air chamber (of the kind frequently used for testing plugs and spark generators) and in parallel with the plug was arranged a variable water resistance. This system was connected in turn to a magneto and an induction coil, and the resistances just capable of putting out the spark at different speeds were measured by a "megger." Each apparatus was tested with the plug gap under air pressures of 60 lb. and 90 lb. per sq. in., the sparking voltages being respectively 6400 and 8800. Mr. Morgan states that the magneto was capable of overcoming a larger plug leakage than the induction coil.

In the test of the plug insulations, each plug was tested as a whole, that is to say, with the insulation contained in its metal body as in service, and each plug in turn was heated in a small electric muffle. A "megger" was connected by wires with the central electrode and the body, and the temperature of the muffle interior was indicated by a thermocouple instrument. Before each test, the plug was heated for one hour at 500 deg. C., and the resistances were taken at intervals during the subsequent cooling.

All of the results are plotted in the chart. Curves 1, 2, 3 and 4 show the insulator conductance in mhos which will just suffice to completely prevent sparking by a magneto or an induction coil under 60 and 90 lb. air pressure respectively. The other sets of curves, A to M, show the conductances of the insulators of the spark plugs at different temperatures. In this connection it may be pointed out that the conductance in mhos is the reciprocal of the resistance in ohms. All of the insulators were of porcelain, with the exception of K, L and M, which were of mica. It will be seen that the limiting conductance increases with the number of sparks produced per minute. This latter basis of comparison was chosen by Mr. Morgan, rather than speed of rotation, because his battery set was a six-cylinder set and his magneto a four-cylinder machine.

From the diagram it will be seen that with insulators A, B, C and D, the conductance at 340 deg. C. (644 deg. Fahr.) has increased so much that when working with battery ignition under 60 lb. compression, ignition fails. With a magneto under conditions corresponding to line 2 (60 lb. compression) sparking would cease at 500 deg. C. In the case of plugs H to M, temperatures up to 500 deg. C. would have no effect on the ignition with either the coil or the magneto.

In interpreting the results of these tests it is necessary to bear in mind that the spark voltages, while of the order used in the testing of spark generators, are undoubtedly higher



The temperature scale is to be used in connection with the lettered curves and the "sparks per minute" scale with the numbered curves

than those used in engine practice. There the spark voltage is usually of the order from 5000 to 6000. The difference between these figures and those of the tests may be accounted for by the higher temperature of the gases. In the tests the temperature in the compressed air chamber was that of the atmosphere.

The net result of the investigation is that insulation leakage due solely to temperature is not so serious a matter as curves showing the resistance variation with temperature seem to indicate.

—

Left-Side Drive for Export Cars

(*Continued from page* 19)

result from changing the design of the whole product. The additional expense must, of course, be borne by the export trade. It only remains for us to get together and show our foreign customers that we can build cars for them both better and cheaper as we build them for home consumption than we can with special export features. Once the novelty of the left drive has worn off they will not object to it any more than our domestic customers do now.

A few years ago the members of the National Automobile Chamber of Commerce got together on the elimination of sixty-inch tread for Southern roads. Why should they not now agree upon the elimination of this greater nuisance of both left and right drive models?

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, January 2, 1919 No. 1

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142.

Cable Address - - - Autoland, New York
Long Distance Telephone - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - One Year, $3.00
Canada - - - One Year, 5.00
Foreign Countries - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.
Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.
Member of the Audit Bureau of Circulations.
Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

The Passing of National Shows

EVER since it became customary to hold automobile shows in all of the more important cities there has been a certain anomaly in the show situation. With the exception of two of these shows—at New York and Chicago—they were held by local dealers' organizations. The dealers of Detroit, Cleveland, Buffalo, etc., each year held their show, but the dealers of New York and Chicago were deprived of this privilege. In these cities the shows were held under the auspices of the automobile manufacterers' association. They were called national shows, while the shows in the other cities were designated local shows. Yet the character of all of these shows was not materially different. In the early years New York and Chicago undoubtedly had a great lead in the number of exhibits, but this gradually vanished, and of late several of the local shows, including those held at Boston and Minneapolis, have outstripped the former leaders in this respect.

The situation in the show field is the natural result of historical development. When automobile manufacturers first decided to promote their business by holding shows they settled upon New York and Chicago as the cities where this could be done most effectively. Local promoters soon made efforts to get them to exhibit in other cities also, but the manufacturers felt that two shows each year were all they would want to patronize, and so resolutions were passed which prevented manufacturers from taking part in other shows.

Later, when the system of selling automobiles through local agencies became well established and agencies in the larger cities had become quite numerous, these agents saw in the show a means of stimulating automobile interest locally. Local dealers' organizations were formed and shows put on, first in the more important cities, such as Boston, Philadelphia, Kansas City, etc., and later also in smaller places. A regular show circuit was soon arranged, with dates set so that exhibits could be conveniently moved from one show to the next. Thus, of the local shows the Philadelphia show was generally the first, coming immediately after New York.

There are two things that made the New York show stand out among others. The first was that it was generally the first of the season, at which new models of cars and new accessories and parts were first exhibited to the public, so that there was much more novelty attached to this than to the other shows. The other point in which the New York show was ahead was that it was held in the greatest purchasing center of the country. This held especially in the earlier period before the automobile had become a necessity on the farm. Of late years, however, the demand for automobiles has spread much more evenly throughout the country. While for a great many years New York State held the leadership in respect to number of cars owned in proportion to population, this lead has now passed to Iowa.

Although the New York show, even up to last year, undoubtedly drew visitors from more States than any of the so-called local shows, it was in no sense a truly national show. In the early years it was to quite an extent a trade show, held for the purpose of securing agents in the Eastern territory. However, as agency connections became more permanent, changes in models less radical, and the dates of the show and the beginning of the business year of most firms more widely separated, this feature lost much of its one-time importance. The show has always had the character of a great public entertainment, with decorations sometimes rather extravagant, concerts, and a general holiday air. There have been spasmodic attempts on the part of individual manufacturers to put a stop to the show, but everybody always felt that as long as the show was held he could not afford to be absent. The momentum acquired in a decade and a half kept the thing a-going in the old channels, and it required the disruptive influence of a world war to bring about a change for which many manufacturers had been yearning for years.

Hereafter, New York and Chicago will have the same sort of show as in previous years, with just as

many car models and probably as many accessories on exhibition as formerly. But the shows will be in charge of the local dealers who control the sales in this territory. One advantage to be expected from the new arrangement is that there will be less interference with production at show time, which usually coincides with the busiest period of the year in the factories.

France as a Future Competitor

PREVIOUS to the war France was the largest automobile exporter in the world, her exports in 1913 having amounted to 24,167 tons, which may be taken to represent about that number of chassis. Even then, however, the United States, owing to the low prices at which it furnished reliable vehicles, had become a formidable competitor. The outbreak of hostilities entirely stopped French exports, while in the case of the United States, after a slight flurry due to disorganization of transport and financial services, it had the effect of greatly stimulating the export of both passenger cars and trucks, until the record set by France was greatly exceeded. With the entrance of this country into the war and the restrictions placed upon the production of both passenger cars and trucks, our exports of cars have dwindled away, and as by Jan. 1 next all our manufacturers would have been on a 100 per cent war work basis, our foreign automobile trade by this time would have reached about the same low level as that of France, had not the war come to a timely end.

In the future France will undoubtedly be our most formidable competitor in foreign markets. Like every other industrial country, she is dependent upon the export of manufactured goods in order to maintain a favorable trade balance. Until now a very important item in her exports to the United States has been that of wines and liquors, and it now looks as though this business might be permanently stopped. The resulting decline in exports would be an incentive to France to force export business in other lines, particularly automobiles.

It must be remembered that the French automobile industry is well organized. There are numerous firms engaged in this line and French designers are admittedly very talented. In production methods France has been somewhat behind other countries, and this prevented her from selling cars on a strictly competitive basis, but it is quite conceivable that the war, together with the extensive importation of American machine tools, has wrought a change in this respect. Moreover, France now has possession of the minette iron ore deposits in Lorraine which will greatly add to her iron production and no doubt give a great impetus to all branches of her mechanical manufacturing industry.

That French manufacturers are alive to the situation that will confront them now that free competition for the world's automobile market has begun once more, is evidenced by the publication of a book on "The Automobile After the War," by Georges Cote, a well-known manufacturer. Mr. Cote seems to have discovered much that is good in American methods both of production and distribution, and he advocates the adoption of similar methods by his fellow-manufacturers. It is quite refreshing to see a French manufacturer recognize the merits of American automobiles. Previous to the war they sought to belittle our cars by the use of such artful phrases as "absolutely lacking in grace of lines," or "thrown together like coffee grinders," but the numerous cars of American construction which found their way to France during the war have evidently given a good account of themselves and convinced Frenchmen that although our machines may not conform to their ideas of attractiveness they are nevertheless most serviceable.

Our Available Petroleum Resources

IT is not necessary to note statistics in order to convince a thinking person that the consumption of petroleum is increasing at an enormous rate and that in a not very remote age there must appear signs of exhaustion of our oil fields. Drilling for petroleum in the United States began only in 1859, and for the first two decades the production was insignificant as compared with the amount now taken from the wells each year. In 1900, when the automobile was first put on a production basis, the mining of petroleum received a great impetus, the census of production showing a very sharp deviation from its previous direction at this point. From 1900 to 1910 the production substantially quadrupled and since then there has been a further increase of about 60 per cent.

So far what has worried the internal combustion engine interests mainly has been that the increase in the demand for the light fractions, which are most suitable for use in small, high-speed engines, has been much more rapid than that of the other fractions, with the result that the prices of the lighter fractions have gone up very much more than those of the others. During the past year, however, in consequence of the unprecedented industrial activity, there was a decided shortage of fuel oil. While this was in no way due to there being insufficient oil in the ground to meet the requirements still it draws attention to the fact that the increased consumption of petroleum is not solely due to the rapidly increasing use of internal combustion engines in automobiles, motor boats, tractors, airplanes, etc., but that industrial uses also called for increased supplies.

In a report presented to Congress in 1916 on the productive possibility of all known pools in operation and estimates of undeveloped areas, the petroleum reserve of the United States per capita based on a population of 100,000,000 is given as about 70 barrels. The meaning of this figure can be gaged when it is stated that in 1917 alone the production was 3.4 barrels per capita and during the period 1859-1917 the aggregate production was 42 barrels. These figures are most portentous.

Latest News of the

Want Prompt Action on Dent Bill

Measure Validating "Illegal" Contracts Urgently Needed to Help Transmission

WASHINGTON, Dec. 28—Prompt action by Congress on the bill authorizing the Treasury to pay on contracts which were not "legally" executed was impressed upon the House Committee on Rules to-day by Secretary of War Baker and his assistant secretaries, Crowell and Stettinius.

The bill, which was published last week in AUTOMOTIVE INDUSTRIES, provides for the payment of all just contracts which were made by telegraph, telephone, letter or verbal agreement and which the Controller of the Treasury has refused to recognize.

The House Committee voted to report a special rule January 2 providing for immediate consideration of the bill. Secretary Baker pointed out the need of prompt action to enable the Government to meet its honest obligations and deal equitably with business firms that have gone ahead with hurry-up work for the war emergency.

He said that large sums of money are at present tied up, making undue hardships and threatening serious consequences if action is not taken. Assistant Secretary Crowell stated that more than $1,675,900 is involved in contracts which were not legally executed with manufacturers in the United States.

Inability of these concerns to resume work because of lack of funds is already apparent, he said, by increasing unemployment following the return of discharged soldiers. "These contractors have their working capital tied up," Mr. Crowell explained, "and resumption of their business cannot proceed. A few of these industries have gone to work." The War Department has received telegrams from many saying that bankruptcy proceedings would result in a week or two unless they got a settlement. Banks also are looking skeptically at these contracts.

The most serious objection to the bill drawn up by Congressman Dent and which will be considered Thursday is that it eliminates all profits, even the 10 per cent profit which was to be allowed. This feature, it is expected, however, will be overcome by an amendment offered when the bill is on the floor. Many of the contracts which were not legally executed are with manufacturers in Great Britain, France and Italy and these countries, in settlement of contracts, always recognize that the contractor is entitled to a profit and for this reason alone it will be necessary to allow for the payment of some margin of profit.

No More Supplies to Air Service

WASHINGTON, Dec. 30—No aviation supplies of any kind are being shipped to the American Expeditionary Forces and none will be. The air forces abroad are being demobilized as rapidly as possible. This information was made public here to-day by General Peyton C. March, when he stated that "the air forces are being demobilized with the greatest rapidity."

Reeves Leaves Washington

WASHINGTON, Dec. 30—Albert Reeves, General Manager of the National Automobile Chamber of Commerce, who has been in Washington for some time conducting the office here, will return permanently to New York City Jan. 3. The Washington office will be continued indefinitely and will be conducted by Harry Perry.

Gerstner Field Destroyed

WASHINGTON, Dec. 30—Gerstner Flying Field, Louisiana which was destroyed by a hurricane Aug. 6, will be reconstructed. The cost will probably amount to $130,000.

Ford Makes Basic Rate $6 a Day

DETROIT, Jan. 2—The Ford Motor Co. which in 1914 established a basic daily rate of pay for its employees of $5, has raised this to $6 effective with the opening of the new year. The increase affects 28,000 men employed in both the passenger car and tractor factories as well as Ford employees in the various assemblying plants throughout the country. The resignation of Henry Ford as head of the Ford Motor Co. is confirmed and his son Edsal has been formally elected president of the company at a salary of $150,000 a year. Henry Ford is to devote his time to his tractor interests and to the publication of a newspaper, as previously made public. B. G. Craig, assistant treasurer for the Ford company, has been elected secretary and Ernest G. Liebold, personal secretary to Henry Ford, will follow him to Dearborn to assume an executive position with the tractor company.

Baker Sales Manager of Kelly-Springfield

SPRINGFIELD, O., Jan. 2—John Baker, Jr., has been appointed general sales manager of the Kelly-Springfield Motor Truck Co.

Military Aeronautics on Peace Basis

Colonel Edgar Heads Organization Board—Half of Personnel Wants Release

WASHINGTON, Dec. 30—A peace time organization for the Department of Military Aeronautics has been arranged under Major General William L. Kenly as follows:

BOARD OF ORGANIZATION

Colonel C. G. Edgar, Colonel F. R. Kenney, Colonel A. Woods, Major E. Hubert Litchfield, Recorder.

Operating under this Board are the following sub-boards:

DEMOBILIZATION

Lt. Colonel George B. Hunter, Chairman, Lt. Colonel Rush B. Lincoln, Major Walter George Rogers.

OPERATIONS IN PEACE TIMES

Colonel William E. Gillmore, Chairman, Colonel Gerald C. Brant, Lt. Colonel Thomas Duncan, Lt. Colonel Barton K. Yount, Lt. Colonel Ira Longanecker, Lt. Colonel Benjamin F. Castle, Captain John W. Davis.

MUSTERING OUT

Major E. Hubert Litchfield, Chairman, Lt. J. J. O'Brien.

COMMITTEE ON TRAINING

Colonel Milton F. Davis, Chairman, Lt. Colonel John Armstrong Drexel, Lt. Colonel Seth W. Cook, Major William A. Robertson, Professor Edward L. Thorndike.

INVENTION AND RESEARCH

Captain Adelbert Ames, Jr., Chairman, Captain Robert R. McMath, Professor Wallace C. Sabine.

SUPPLY

Lt. Colonel Thomas G. Gallagher, Chairman, Lt. Colonel Harold Bennington, Major C. S. Benton, Major Walter G. Rogers, Major Eugene E. Deacon, Major Harold R. Eyrich, Capt. David R. Wheeler.

The officer in charge of demobilization announced recently that reports from all Air Service activities show the following preference on the part of the personnel, both commissioned and enlisted: One-eighth request complete separation from the service. Three-eighths request to enter the Regular Army. One-half request to enter the Reserve Corps.

Detroit Field Named "Morrow"

WASHINGTON, Dec. 30—The Air Service Acceptance Park at Detroit will be known officially as Morrow Field in honor of Lt. Karl Clifton Morrow, aviator, who lost his life Nov. 11.

Automotive Industries

48 Get Show Space in New York

Dealers Draw for Places in Garden—62 Car and 27 Truck Men Get Chicago Space

NEW YORK, Dec. 28—Drawings for the New York and Chicago shows have been held by the dealers in those cities, and plans for the biggest and best shows ever are going forward in a gratifying manner.

The space has been nearly all disposed of and it looks now as though there would be a considerable number of applicants who won't be able to get in at all.

Reports being received by Manager Charles A. Stewart of the New York show indicate that the manufacturers will visit the big city as in former years, and that there will be the usual big influx of dealers from everywhere.

The Hotel Astor, just before the show dates were selected, urgently telephoned the dealers' association and asked for the show dates in order that a big pile of room reservations might be taken care of. When Stewart asked the Prince George Hotel, opposite the Garden, for a room for the use of the show committee, he was informed that the hotel was booked solid for the whole show period.

With the coming of peace and the resumption of production the indications are that the show crowds will be bigger than ever. Visitors are requested by the show committee to make their hotel reservations at once in order to be sure of a place to sleep.

The dates of the show are Feb. 1-15. The Chicago show is Jan. 25-Feb. 6. In each case the first week will be devoted to passenger cars and the second week to trucks.

Monday noon of this week the New York show committee and the New York newspaper men met at lunch at the Astor and laid plans for promoting the show and making it the best ever held. Newspaper men stated that this year they had begun their promotion work several weeks earlier than usual and that they were going to stay behind the project and boost it in all their travels throughout the manufacturing zones.

Manager Stewart stated that season tickets were to be sent to all the dealers within 700 miles of New York, and that any other dealers who came from anywhere would be given a cordial reception by the New York Automobile Dealers' Association and a season pass.

The annual meeting of the National Automobile Dealers' Association will be held during the Chicago show, and a big dealer mass meeting is being planned for Wednesday noon of the New York show. This will be addressed probably by President F. W. A. Vesper and some other speakers of national prominence.

The decorative schemes for both shows are, it is said, to be unusually attractive.

(*Continued on page* 40)

Canada May Cut War Tax

OTTAWA, Dec. 30—Announcement may be made shortly of the removal or modification of the war tax on automobiles. Representatives of the organized automobile industries of Canada waited on Sir Thomas White, acting Prime Minister, and Hon. A. K. MacLean, acting Minister of Trade and Commerce, and urged that the excise war tax on automobiles be removed. The tax which was imposed in the last budget amounts to 10 per cent on automobiles, and is applicable to all imported into or manufactured in Canada and unsold on April 30, 1918. The request of the automobile manufacturers is being considered at Ottawa.

Bruske Leaves Harroun

DETROIT, Dec. 30—Paul Hale Bruske, after spending 2 years as advertising director for the Harroun Motors Corp., Wayne, Mich., has returned to the Power, Alexander & Jenkins Co., advertising agents. He will continue to supervise Harroun advertising. He will also have the supervision of the advertising campaigns of a number of Detroit manufacturers.

S. A. E. Membership Increases

NEW YORK, Dec. 31—Membership in the Society of Automotive Engineers increased 717 during the year just closed. On Dec. 1, 1918, there were 3780 members, including affiliate membership representatives and enrolled students but not Section associates, as compared with 3063 on Dec. 1, 1917. During the year nearly 900 applications for membership were received as compared with 1400 during 1917. The percentage of applicants who qualified, however, increased from 72 per cent in 1917 to 84 per cent in 1918.

At the meeting of the council of the society, held Dec. 11, 313 applicants were approved for various grades of membership and one for student enrollment.

The following members were appointed to Standards Committee Divisions: Berne Nadall (Miscellaneous), Lieut.-Col. V. E. Clark (Aeronautic), Wayne H. Worthington (Tractor). President Kettering was appointed to represent the society on the Advisory Committee of the Engineering Division of the National Research Council.

Automotive Stock Transactions

Price Tendencies Have Been Almost Uniformly Upward During 1918

NEW YORK, Jan. 2—Transactions in automotive stocks on the New York Exchange during the past year show that the general tendency in price has been upward. Reference to the analysis on page 33 shows that as a rule automotive stocks touched their lowest points during the early months of 1918 and their highest during the fall. The last transaction of the year in each listed stock represents a price which is much nearer the highest than the lowest. Taking the list as a whole, a very healthy condition is indicated.

(*Continued on page* 33)

Steering Wheels From Mansfield

MANSFIELD, O., Jan. 2—The Allerding Products Co. has been formed here and is to specialize in the production of steering wheels and wood rims for aircraft and other purposes. The company has a capital stock of $50,000, the directors being: C. N. Allerding, E. S. Walter and John H. Coss, of Mansfield; Charles S. Munson, Detroit; James Israel, Mt. Vernon, N. Y.; Fred R. Jones, Cleveland, and C. F. Allerding, Mt. Vernon. C. N. Allerding heads the company; other officers being: vice-president, Charles S. Munson; secretary-treasurer, E. S. Walter.

Post Office Returns Airplanes

WASHINGTON, Dec. 31—The Post Office Department has turned back to the War Department 100 DeHaviland 4 airplanes, which, it is said, have proven utterly unfit for cross country mail flying. This action followed extensive flight and service tests between New York and Chicago and Washington and New York, which, it is said, showed the planes to be unadaptable for the heavy postal work. Postal officials stated here that a number of the planes crumpled in making landings and taking off for flights and several accidents, including one fatality, resulted. These planes were turned over to the Post Office by the War Department under the recent act of Congress.

The War Department has also furnished the Post Office 12 two-engined Handley-Page planes which will shortly be assembled and put on the New York-Chicago mail route. Until these planes are assembled the New York-Chicago mail service will be postponed.

Aircraft Exhibition Assured

To Be Staged Feb. 27-Mar. 6 in Madison Square Garden —Dinner on Jan. 7

NEW YORK, Dec. 30—There will be an aircraft exposition in New York Feb. 27 to March 6, both dates inclusive. The Aircraft Manufacturers Association has obtained an option on Madison Square Garden for that week, and though definite plans for the show have not been completed, it is stated that sufficient exhibitors are assured to make the event the most complete of its kind ever held.

Plans for the show are to be made public at a dinner to be held by the Aircraft Manufacturers Association at the Waldorf on Tuesday, Jan. 7. It is expected that probably 500 persons will attend, including as guests of honor representatives of the military, legislative and executive branches of the Federal Government. Arrangements for the dinner are in the hands of J. G. White, of the J. G. White Engineering Co.

It is planned to make the exhibit truly international in character. It will include exhibits of various American and Allied military airplanes as well as exhibits of engines and accessories.

The show has been made possible by the revocation of the Presidential proclamation forbidding aircraft exhibitions as inimical to the best interests of the country during the course of the war. This proclamation was issued on Jan. 1 of this year. Recently the Aircraft Manufacturers Association took up with Washington the matter of holding a show now that the war has ended. The War Department apparently was willing to extend its co-operation but could do nothing in view of the President's proclamation.

The matter was then presented to the Judge Advocate General, with the result that the whole matter was cabled to France. In the meantime the State Department had prepared a new order rescinding the former one and this, in turn, was cabled abroad for the President's approval. In consequence, the following statement has been made public by Washington:

"At the request of the Secretary of War, the President has authorized the issuance of a proclamation revoking the proclamation of last January prohibiting the exhibition of aircraft during the war. Pending the formal signing of the new proclamation, the Secretary of State has requested the Attorney-General not to prosecute any infringement of the earlier proclamation."

Packard Develops National Service Bureau

NEW YORK, Dec. 30—The Packard Motor Car Co. of New York has formed an organization to serve particularly the transportation requirements of companies doing a national business. A. C. Harrington, for the past year vice-president of distribution for the New York company, will have charge of the new organization, and associated with him are F. H. Pietsch, manager of truck distribution for the Packard Motor Car Co. of Chicago, and James T. Adams, until recently manager of the Washington office of the company.

Better Facilities for Tractor Show

KANSAS CITY, Dec. 30—Erection of the temporary building on the Union Station Plaza, where the Fourth National Tractor Show will be held Feb. 23-March 1, has begun. Steam pipes are being laid from the heating plant in the Union Station. A feature of the building at this show will be the suites of rooms for the use of exhibitors who plan meetings of salesmen, distributers and prospective dealers. Rest rooms, nursery and playrooms will be provided—eliminating one of the hindrances of previous shows, the children who have to be taken with parents looking at tractors. Inquiries and announcements indicate that many foreign governments will send representatives to the Kansas City show, where the tractors can be seen, and where touch can be effected with people from the districts using tractors most largely. Among the visitors announced are the Russian mission, the Italian delegation of agricultural engineers, a technical expert from the British minister of agriculture, a commissioner of the French government, commissions from South American countries, and representatives of foreign distributers of American equipment.

Not All Plugs Certified

WASHINGTON, Dec. 30—The Federal Trade Commission to-day ordered the Silvex Co., Hellertown, Pa., to discontinue representations that its "Bethlehem aviation" spark plug has been "certified by the United States Bureau of Standards." The commission found that while large numbers of Silvex plugs had been furnished the Government and had been subjected to the usual Bureau of Standards tests, the Bethlehem aviation plug had not been "certified" by the bureau, as represented in a circular letter sent out by the company. The commission's order was issued by agreement with the company, which waived right to introduce testimony in support of the act.

Now It's Captain Rickenbacker

PARIS, Dec. 6—Ex-race driver Eddie Rickenbacker is now captain and squadron commander in the American Air Service. Soon after the signing of the armistice Captain Rickenbacker was given orders to prepare to move his squadron forward into German territory. This move was made a few days ago, and Captain Rickenbacker is now flying from a German aerodrome. Before actual fighting stopped he had attained the position of Ace of Aces in the American Army.

First Post-War Car Exhibit

Will Be Lyons, France, Sample Fair—Number of American and Foreign Entries

PARIS, Dec. 4—The first post-war automobile show in Europe will be a portion of the Lyons Sample Fair to be opened in the Silk City on March 1, 1919. In order to take care of automobile manufacturers a special building has been erected in the fair grounds for automobiles only, and the participation of automobile manufacturers is being encouraged by the French manufacturers' associations.

The list of exhibitors which has already been gotten together shows that this automobile section will be of considerable importance. American firms are Goodrich and Overland. European automobile manufacturers who will have cars on exhibit comprise the following: Berliet, Blum, La Buire, Chiribibi, Cottin & Desgouttes, Delage, Delahaye, D. F. P., F. I. A. T., Hotchkiss, Panhard-Levassor, Rochet-Schneider, Th. Schneider, Turcat-Mery, Unic, Lorraine-Dietrich, De Dion Bouton, Peugeot, Rolland-Pilain, Vinot & Deguingand. In addition a large number of tire and accessory firms have booked space, among them being Bergougnan, Nilmelior Magneto Co., S. E. V. Magneto Co., Zenith Carbureter Co., Dunlop Tire Co., Lavalette Magneto Co. and Oleo Spark Plug Co.

In 1918 there were 3182 exhibitors at the Lyons Fair, and the amount of business transacted was $150,000,000. The 1919 fair will undoubtedly be the biggest ever held, for on Nov. 1 of this year 2103 firms had secured space, compared with only 978 twelve months previous. The exhibition is open to all allied and neutral nations, and space can be reserved until the last day of December.

Wisconsin Good Tractor Market

MILWAUKEE, Dec. 30 — Wisconsin will furnish the tractor industry with an exceptionally fertile market during 1919, according to manufacturers and dealers who have given thought and studied figures issued by the State Department of Agriculture that in 1918 a total of 8,784,761 acres of crops were raised in this state, compared with 8,689,354 acres in 1917 and 7,915,904 in 1910, federal census year. While the increase since 1910 is considered a good one, it is felt that with more favorable means of prosecuting farm work such as the farm tractor provides a much larger acreage would have been yielded.

It is estimated that Wisconsin absorbed from 1200 to 1500 tractors during 1918. This made it possible to increase the crop acreage over 1917 by 95,407 acres despite the fact that approximately 50,000 Wisconsin farmer boys were called to the colors within the period.

At this time it is figured that 3000

Wisconsin farmers own tractors. In view of the fact that this state contains more than 80,000 farms of more than 100 acres each, the ratio is regarded as low and indicative of the large number of farms now without power machines which tractor dealers have available as potential tractor purchasers.

Dort Men Get $40,000

FLINT, Dec. 30—Three hundred or more men and women sat down to a Christmas dinner in Flint. The occasion of this dinner was not only to meet and eat and exchange greetings, but to distribute $40,000 among 111 employees of the Durant-Dort Carriage Co. The recipients of bonuses were men and women who had worked continuously in the company's service for six years or more, and the size of the checks passed out ranged from $60 up to more than $2,500.

The plan under which the distribution was made is known as the "Loyalty and Merit" plan and was originated and executed by J. D. Dort, now president of the Dort Motor Car Co.

Philadelphia-Atlantic City Passenger Airplane Route

PHILADELPHIA, Dec. 28—An airplane route to Atlantic City is planned, the cost of transportation to passengers to be $50 one way, but if a passenger decides to make a round trip $25 will be deducted on the return. Construction of a hangar and factory with a 25-ft. beach front has been started near the inlet. It is expected that the company will begin carrying passengers soon after Easter.

Commercial Plane Service Planned

CHARLOTTETOWN, P. E. I., Dec. 30—At a meeting of business men of this city yesterday it was resolved that a company be formed to be known as the Prince Edward Island Aerial Transportation Co., capitalized at $25,000. A committee of five was appointed to solicit subscriptions and organize if the necessary financial support was forthcoming. The initial route proposed is Moncton, Summerside, Charlottetown, Georgetown, Pictou, New Glasgow and Halifax, with a double daily service summer and winter. Mails and express are to be handled first and later passengers. The proposition was submitted to the meeting by Major Kennedy, of the Royal Air Service, expert of the Aircraft Company, with headquarters in London.

Norway Good Car Market

WASHINGTON, Dec. 30—Bergen, Norway is reported by Consular R. C. Busser, as an excellent market for passenger cars and motor trucks, for which it is said there is a great demand. Bergen merchants and inhabitants generally have enjoyed prosperous business although in some lines operations have ceased because of lack of raw materials.

Fuel Important at S. A. E. Meeting

Subject Will Have Prominent Place—Program Rapidly Being Completed

NEW YORK, Dec. 30—The program for the winter meeting of the Society of Automotive Engineers to be held in the Engineering Societies Building, New York, Feb. 4-6, is rapidly rounding into shape. Among other engineering discussions considerable time will be devoted to the fuel situation, and it is stated that an authoritative statement regarding the new "Liberty" fuel will be made.

The fuel discussion will be led by President C. F. Kettering, who will summarize the situation to date with particular reference to the need for improving the thermal efficiency of engines. In addition, there will be an analysis of the supply of petroleum in the United States by a representative of the United States Geological Survey and a discussion of modern refinery practice. Dr. Joseph E. Pogue, of the Bureau of Oil Conservation of the Bureau of Mines, will present an interpretation of the fuel situation.

It is expected that that portion of the sessions devoted to aircraft matters will be of prime importance. J. G. Vincent, formerly lieutenant-colonel and chief of the airplane engineering division of the Bureau of Aircraft Production, will deliver a paper on engines of the fixed type with radially arranged cylinders. He will also give a lot of information on the Liberty engine in addition to what has already become public. A paper on proportioning planes to their engines is in course of preparation.

Henry M. Crane, vice-president and chief engineer of the Wright-Martin Aircraft Corp., will address the gathering on the effect of aeronautic experience on automobile design and construction.

Major Arthur B. Brown is scheduled to present a paper on Better Truck Performance. The future development of lighter and more efficient passenger cars will be discussed by A. Ludlow Clayden, consulting engineer of the Wright-Martin Aircraft Corp. D. McCall White will talk on light, efficient automobile engines.

It is planned to cover tractor engineering in a comprehensive manner, and it is expected that a number of hitherto hidden matters with regard to the development of war automotive apparatus may be revealed.

Imports and Exports Modified

WASHINGTON, Dec. 26—Several additional modifications have been announced by the War Trade Board regarding tin, copper ore, shellac and shipments to the United Kingdom.

All restrictions on the export of tin and tin plate have been removed. The limitations on the import of mahogany, shellac, other lacs and on varnish gums have been lifted.

Applications for the import of copper ore will now be considered where the shipment originates and comes from Korea, Newfoundland, West Indies, France, England, West Coast of South America, Cuba, Canada or Mexico, irrespective of the content of copper. Shipments will be allowed from Spain when containing more than 2 per cent of copper. Copper concentrates will be allowed for import from Cuba, Canada or Mexico irrespective of content and of copper concentrates from any non-enemy country other than these only when containing 50 per cent or over of copper. All restrictions on the import of copper matte or blister copper are removed.

Individual licenses for shipments to the United Kingdom will no longer be referred to the British War Mission in view of the elimination of the permit-to-purchase system by the Controller of Import Restrictions, London Board of Trade, which means that permits to purchase in England for import are no longer required.

Articles which are prohibited import, however, must be covered by an import license which can only be obtained by the consignee. Exporters are therefore advised before making shipment to obtain an import license from the consignee or learn definitely from the British Import Restrictions, Agricultural Machinery Department, or other department interested, that an import license is not necessary. Where the British permit to purchase has been issued it remains valid.

Canada Wants Standard Gas Price

TORONTO, Dec. 30—A standard price for gasoline all over Canada is aimed at by the Retail Automobile, Garage and Accessory Dealers' Association. Acting through the Retail Merchants' Association they are taking up the matter with the producing companies. At a meeting held the past week in Toronto it was reported that the firms that had been interviewed so far by the committee had reported favorably upon the proposal. The Ontario dealers are behind the move, and it is stated that the Western dealers are lending active co-operation and that dealers in all the Provinces want the standard price adopted.

Good Business for Boston

BOSTON, Dec. 28—The uncertainty and indecision which hovered about the motor district in Boston among people about to buy cars who were holding off because they expected to see prices drop is disappearing. During the past few days the inquiries and callers have again become normal and sales are being booked for future delivery.

New York Office for Twin City

NEW YORK, Dec. 30—The Minneapolis Steel & Iron Co. has opened a New York office in the Tribune Building, 154 Nassau Street.

MOTOR TRANSPORT CORPS EQUIPMENT

FLOATED TO A. E. F. BY TEN DAY PERIODS

Name of Vehicle	Capacity	Total Floated to July 1, 1918	July, 1918				Total to Aug. 1, 1918	August, 1918				Total to Sept. 1, 1918	September, 1918				Total to Oct. 1, 1918	October, 1918				Total to Nov. 1, 1918	November, 1918				Total to Dec. 1, 1918	Total Losses at Sea	Total Landed Overseas
			A	B	C	Total July		A	B	C	Total Aug.		A	B	C	Total Sept.		A	B	C	Total Oct.		A	B	C	Total Nov.			
MOTOR CARS																													
*Ford	Light	660					660	66	48	77	191	851	50	53	55	158	1009	131	288	260	682	1691	42	243	134	419	2110	9	2101
*Dodge	Medium	1145		263	232	495	1640	91	143	89	323	1963	128	83	145	356	2319	382	72	62	516	2835	59	31	258	348	3183	231	2952
*Cadillac	Heavy	426	2	41	167	210	636	58	36	15	109	745	35	52	84	171	916	116	65	21	202	1118	54	112	136	302	1420	21	1399
Total		2231	2	304	399	705	2936	215	227	181	623	3559	213	188	284	685	4244	629	425	346	1400	5644	155	386	528	1069	6713	261	6452
Misc. American and foreign		1189		1		1	1190					1190					1190					1190			1	1	1191	12	1179
Total motor cars		3420	2	305	399	706	4126	215	227	181	623	4749	213	188	284	685	5434	629	425	346	1400	6834	155	386	529	1070	7904	273	7631
AMBULANCES																													
*Ford	Light	2611			40	40	2651		16	3	19	2670	106	30	478	614	3284	121	500	178	799	4083	72	58	6	136	4219	30	4189
*G.M.C.	Heavy	1381	55	127	132	354	1695	100	52	119	271	1966	3			3	1969	60	212	280	552	2521	56	187	475	718	3239	74	3165
Total		3992	55	127	172	354	4346	100	68	122	290	4636	109	30	478	617	5253	181	712	458	1351	6604	128	245	481	854	7458	104	7354
Misc. American and foreign		237					237		12		12	249					249					249					249		249
Total ambulances		4229	55	127	172	354	4583	100	80	122	302	4885	109	30	478	617	5502	181	712	458	1351	6853	128	245	481	854	7707	104	7603
TRUCKS, LIGHT DELIVERY																													
*Ford	600 lbs.	1347		13	62	75	1422	25	512	573	1110	2532	648	1128	911	2687	5219	397	166	122	685	5904	154	200	454	808	6712		6712
TRUCKS, LIGHT REPAIR																													
*Dodge	1000 lbs.	151	2	40	1	43	194	44	47	100	191	385	31	1	2	34	419	65	10	18	93	512	125	6	312	443	955	65	890
†Dodge, Special OD														23	132	155	155	75	67	29	171	326		110		110	436	24	412
Total		151	2	40	1	43	194	44	47	100	191	385	31	24	134	189	574	140	77	47	264	838	125	116	212	553	1391	89	1302
TRUCKS, CLASS AA																													
*G.M.C.	¾ ton																			132	132	132	7	26		33	165		165
†Commerce	1 ton							29		55	84	84		2	37	39	123	4	31	51	86	209	2	2	38	42	251		251
†White	1 ton	17		20	1	21	38		50	55	105	143	23	23	117	163	306		72	13	85	391	2	182	174	358	749	16	733
Ford	¼ ton	1682					1682					1682	60	1		61	1743		28	1	29	1772					1772		1772
Total		1699		20	1	21	1720	29	50	110	189	1909	83	26	154	263	2172	4	131	197	332	2504	11	210	212	433	2937	16	2921
Misc. American and foreign		199					199					199					199					199					199		199
Total, Class AA		1898		20	1	21	1919	29	50	110	189	2108	83	26	154	263	2371	4	131	197	332	2703	11	210	212	433	3136	16	3120
Total, under 1½ tons		3396	2	73	64	139	3535	98	609	783	1490	5025	762	1178	1199	3139	8164	541	374	366	1281	9445	290	526	978	1794	11239	105	11134
TRUCKS, CLASS A																													
*White	1½ tons																	94	2	161	257	257	283	233	292	808	1065		1065
†Garford	1½ tons	418	4	10	25	39	457	24			24	481		2	4	6	487	6	5		11	498					498		498
†Light aviation	1½ tons	152	84	78	192	354	506	360	4		364	870		25	9	34	904	157	2	196	355	1259	55	34	222	311	1570		1570
†Pierce	2 tons	256	9	74	30	113	369			4	4	373	5	34	1	40	413	2			2	415		58	2	60	475	10	465
Packard	1½ tons	377					377					377					377					377		7	126	133	510		510
White (Non-standard)	1½ tons	57	8			8	65					65	10	109	148	267	332					332					332		332
Total		1260	105	162	247	514	1774	384	4	4	392	2166	15	170	162	347	2513	259	9	357	625	3138	338	332	642	1312	4450	10	4440
Misc. American and foreign		764					764					764					764					764					764		764
Total, Class A trucks		2024	105	162	247	514	2538	384	4	4	392	2930	15	170	162	347	3277	259	9	357	625	3902	338	332	642	1312	5214	10	5204
TRUCKS, CLASS B																													
*Standard B	3-5 tons	30					30	10	80	12	102	132	191	407	538	1136	1268	171	1322	1069	2562	3830	946	850	832	2628	6458		6458
†Heavy aviation	3 tons	787			2	2	789	61			61	850					850	119	188	116	423	1273	77	150	434	661	1934		1934
†Packard	3 tons	1908	107	150	338	595	2503	185	243	121	549	3052	2		89	91	3143	29	27	112	168	3311	93	49	26	168	3479	27	3452
†Mack	3½ tons	53	12	2		14	67					67					67		135	71	206	273		5		5	278		278
†Riker	4 tons	605	27		23	50	655	223	47	39	309	964	1	37	131	169	1133	12	21	73	106	1239	21	79	9	109	1348	75	1273
†Pierce-Arrow	5 tons	829		47	132	179	1008	200	139	137	476	1484	110			110	1594	19		25	44	1638		1	20	21	1659	37	1622
†Mack	5½ tons	467		107	73	180	647	72			72	719	26	3	24	53	772	32	47	88	167	939	286	68	21	375	1314	6	1308
White	3 tons	279		1		1	280					280					280					280					280		280
Packard	5 tons	17					17					17					17					17					17		17
White	5 tons	34					34					34					34					34					34		34
Total		5009	146	307	568	1021	6030	751	509	309	1569	7599	330	447	782	1559	9158	382	1740	1554	3676	12834	1423	1202	1342	3967	16801	145	16656
Misc. American and foreign		2185					2185					2185					2185					2185					2185	15	2170
Total Class B trucks		7194	146	307	568	1021	8215	751	509	309	1569	9784	330	447	782	1559	11343	382	1740	1554	3676	15019	1423	1202	1342	3967	18986	160	18826

F. W. D. TYPE																													
†Nash	2 ton	2061	253	34	......	287	2348	94	273	370	737	3085	219	250	104	573	3658	107	547	1025	1679	5337	522	355	491	1368	6705	59	6646
†F.W.D.	3 ton	939	......	91	......	91	1030	248	119	4	371	1401	10	113	116	239	1640	249	369	297	1545	3185	376	631	300	1307	4492	27	4465
Total		3000	253	125	......	378	3378	342	392	374	1108	4486	229	363	220	812	5298	356	916	1952	3224	8522	898	986	791	2675	11197	86	11111
Grand total, all trucks		15614	506	667	879	2052	17666	1575	1514	1470	4559	22225	1336	2158	2363	5857	28082	1538	3039	4229	8806	36888	2949	3046	3753	9748	46636	361	46275
MOTORCYCLES																													
*Harley-Davidson *Indian		4257	13	1052	700	1765	6022	909	817	593	2319	8341	575	579	830	1984	10325	2304	1064	1353	4721	15046	599	481	1344	2424	17470	62 88	17820
Cleveland	Solo	......	......	......	......	......	......	......	......	......	......	......	......	......	111	111	111	......	......	261	261	372	171	121	*119	411	783	......	783
Total		4257	13	1052	700	1765	6022	909	817	593	2319	8341	575	579	941	2095	10436	2304	1064	1614	4982	15418	770	602	1463	2835	18253	150	18103
SIDECARS																													
*Harley-Davidson *Indian		2956	273	298	1277	1848	4804	974	1307	531	2812	7616	604	2118	680	3402	11018	1111	503	1013	2627	13645	1302	533	1281	3116	16761	272 164 436	16325
BICYCLES																													
*Westfield		8701	......	38	1324	1362	10063	443	425	2244	3112	13175	2457	2602	......	5059	18234	1252	......	288	1540	19774	791	1548	1512	3851	23625	......	23625
Miscellaneous		900	......	......	......	......	900	......	......	......	......	900	......	......	......	......	900	350	......	......	350	1250	......	......	......	......	1250	......	1250
Total		9601	......	38	1324	1362	10963	443	425	2244	3112	14075	2457	2602	......	5059	19134	1602	......	288	1890	21024	791	1548	1512	3851	24875	......	24875
TRAILERS, all types		......	......	......	......	......	......	......	......	......	......	‡3094	205	526	59	790	3884	401	142	321	864	4748	277	162	349	788	5536	308	5228
Total, all vehicles		37121	576	2189	3474	6239	43360	3242	3063	4610	10915	57369	4895	6083	4125	15103	72472	6655	5382	1256	3954	91765	5070	5989	8087	19146	110911	1196	109715
Spare parts (in tons)		......	......	......	......	......	......	......	......	......	......	......	663	989	1190	2842	2842	676	3135	2770	6581	9423	1998	1705	2342	6045	15468	......	15468

*Indicates Standard Vehicles. †Indicates Approved Temporary Substitute. Others are Miscellaneous Purchases. ‡Reported in inventory, August 24, 1918, Headquarters, M.T.C., A.E.F. Losses at sea reported by Embarkation Service.
Sidecars not included in "Total, all vehicles."

Automotive Stock Transactions on the New York Exchange for 1918
(Corrected to Close, Dec. 20) (*Continued from page* 29)

Name	Highest		Lowest		Last	Net Change
Advance-Rumely	26¾	Nov.	11	Jan.	23⅜	+ 9½
Advance-Rumely, pf	63	Nov.	25⅞	Jan.	59⅜	+31⅜
Ajax Rubber	72¼	Dec.	49	Jan.	66	+19
Allis-Chalmers	37	May	17¾	Jan.	32½	+13¾
Allis-Chalmers, pf	86½	May	72¼	Jan.	84¾	+12
Chandler Motor	109⅞	Dec.	68¼	Jan.	104	+36⅝
Fisher Body	43	June	26	Jan.	36	+11
Fisher Body pf	93	Dec.	70¼	Jan.	93	+18
General Electric	158½	Oct.	127¾	Jan.	148¾	+15⅞
General Motors	164	Aug.	106¾	Jan.	129	+24¼
General Motors, pf	88	Feb.	75⅜	Oct.	81¼	+ 1¼
Goodrich, B. F.	59⅞	Oct.	38	Jan.	55	+17¼
Goodrich, B. F., pf	104	Dec.	96	Jan.	100	+ 8
Int. Harvester	72	Feb.	53	Mar.	70	+13
Int. Harvester, pf	106½	Sept.	95	May	106	+14
Int. Harvester N. J	138	Oct.	111½	Jan.	138	+26
Int. Harvester N. J., pf	112	July	104	Sept.	106¾	— ¼
Int. Harvester (new)	121	Nov.	104	Oct.	112	+ 7½
Int. Harvester (new, pf)	114⅝	Dec.	107	Oct.	114	+ 7
Kelly-Springfield Tire	72	Dec.	41	April	69¾	+25¼
Kelly-Springfield Tire, pf	90⅛	Dec.	76⅝	Feb.	90	+12½
Kelsey Wheel	35	Oct.	24⅝	July	27⅝	— ⅜
Kelsey Wheel, pf	90	Mar.	81	Jan.	90	+20
Lee Tire	24	Dec.	12	April	21¾	+ 7
Maxwell Motors	42⅛	Nov.	23½	Jan.	28	+ 3
Maxwell Motors, 1st pf	69⅞	Nov.	50	Dec.	50	— 6¼
Maxwell Motors, 2nd pf	32⅜	Nov.	19	May	19⅛	— 3⅜
Pierce-Arrow	51¾	Nov.	34	Jan.	42⅞	+ 6⅜
Pierce-Arrow, pf	104	Dec.	89	Jan.	101¾	+11¾
Savage Arms	80½	May	52⅞	Dec.	52⅞	— 2⅛
Saxon Motor	18	Nov.	4¾	Aug.	7⅛	+ ⅛
Studebaker	72⅞	Nov.	33⅞	April	50	+ ½
Studebaker, pf	100	Nov.	80½	July	92¼	+ 1¼
Stutz Motor	55	Dec.	36½	Nov.	48¼	+10⅜
U. S. Rubber	79¾	Dec.	51	Jan.	79¼	+26¾
U. S. Rubber, 1st pf	110	Dec.	95	Jan.	108⅞	+13⅞
Westinghouse Electric	47½	May	38½	Jan.	42¼	+ 1⅞
Westinghouse Electric, 1st pf	64½	Feb.	59	Jan.	64½	+ 7
White Motor	50	Nov.	36¾	Jan.	43	+ 6⅜
Willys-Overland	30	Nov.	15½	Jan.	25	+ 4½
Willys-Overland, pf	89¼	Nov.	75	Jan.	87⅝	+14⅝

M. T. C. Shipped 110,911 Vehicles To A. E. F.

WASHINGTON, Dec. 31—The Motor Transport Corps of the United States Army shipped 110,911 vehicles, including motor trucks, passenger cars, ambulances, motorcycles, bicycles and side cars, to the American Expeditionary Forces from the beginning of the war to Dec. 1, 1918.

Of this number 1196 vehicles were lost by sinkings at sea.

During the same period 15,468 tons of spare parts were shipped, of which none were lost. These figures are contained in a report just completed by the Motor Transport Corps.

On pages 32 and 33 is the complete report.

Capt. Finkenstadt Returns to Peace Duties

WASHINGTON, Dec. 30—Capt. E. R. Finkenstadt, Assistant Chief of the Truck Section, Motor Vehicles Division, Quartermaster Department, who was formerly assistant to Christian Girl, president of the Standards Parts Co., will complete his work here by Jan. 10 and at that time return to the Standard Parts Co. Capt. Finkenstadt was for many months Chief of the production of the B standardized truck, officially known as the Liberty truck.

Combination Under Webb Bill

WASHINGTON, Dec. 31—That American manufacturers are commencing to take advantage of the Webb bill is evidenced by reports from the Federal Trade Commission. One of the first to cooperate for export trade is the office equipment industry. The Globe Wernicke Co., The B. L. Marble Chair Co., and the Commercial Furniture Co. have arranged a combination and filed a statement with the Federal Trade Commission. The statement shows that the concerns will appoint a joint representative to manage their association which will be known as the United States Office Equipment Export Association. Necessary funds for the enterprise have been contributed, with the Globe Wernicke company investing $10,000, the Marble company $5,000 and the Commercial company $5,000.

All foreign business of the three concerns excepting Canadian will pass through the association. The costs will be prorated among the three on the basis of volume of sales of each party through the association. Bad debts will be treated as joint expense.

British Post-War Cars Exhibit Radical Ideas

LONDON, Nov. 1—By mail—Although British manufacturers of motor cars are still far removed from quantity production of motor cars, the trend toward post-war models is becoming more marked every day, and already some details of cars which before the war would have been considered nothing if not radical have been permitted to become public.

It is expected that aeronautic experience will have a profound effect on design and that lighter, more efficient cars will be the result. For example, it is stated that one manufacturer of international repute has designed a car fitted with a five-cylinder air-cooled radial engine and having a chassis which has many other departures from orthodox practice. The cylinders are set star-fashion around the crankcase. Another maker proposes to use a tubular frame carried on transverse semi-elliptic springs front and rear.

Eagles Proved Fit for Navy

WASHINGTON, Dec. 28—Trials of Eagle boats have convinced Navy constructors that the little craft turned out by the Ford plant at Detroit to fight submarines are worthy of taking their place as permanent units of the fleet. It was learned yesterday that official reports to the Navy Department giving full details of the trials show that in speed, seaworthiness and maneuvering ability the new boats exceed all contract requirements.

An average sustained speed of 18.3 knots was made by the boat used in the tests. The vessel showed no signs of "buckling" when the speed was forced still higher for short periods.

Three Eagles recently sent through the Welland Canal into the Atlantic arrived at their destination on the coast after passing through two gales of unusual severity. The crews reported the boats had been more comfortable than certain types of destroyers and the hulls had not strained at any point. Most of the Eagles completed under the war contract will be utilized as gunboats.

Commerce Guarantees Prices

DETROIT, Dec. 30—To eliminate the uncertainty of the price question, the Commerce Motor Truck Co. has guaranteed distributers against any reduction in the price of Commerce trucks that may be on order, in transit or on the floor of the distributer should a reduction in list price be made.

Capital Issues Committee Inactive

WASHINGTON, Dec. 28—The Capital Issues Committee of the U. S. Treasury Department, which has controlled the sale of stock and bond issues during the war, will discontinue active work beginning Dec. 31, 1918, and will remain as an inactive body to be called back to service if the need arises in the future. This committee has passed upon all stocks and bond issues planned during the war, deciding whether or not these were compatible with the national interests during the emergency. Its retirement at the end of the year means that with the new year the Government removes all restrictions on capital increases or the flotation of new companies, and so forth. The committee in announcing its inactive part in the future mentions the existence of numerous fraudulent plans for stock and bond sales and warns against them, asking for some special legislation to examine into and supervise all future capital issues.

Foreign Drivers for 500-Mile Race

PARIS, Dec. 30—Special Cable—Already interest is awakening in the promised revivals of the 500-mile race on the Indianapolis Speedway which has been set for May 31. It is stated that probably four, and perhaps more, foreign drivers will start. Those who have indicated a desire to participate are Louis Wagner and Jack Scales, who probably will drive Fiats; Chassagne and Christianes, who likely will hold the wheels of British Sunbeam cars.

All Garages Can Handle Ford Parts

DETROIT, Dec. 26—After Jan. 1 any garage can handle Ford parts and secure the regular dealers' discount on them. The Ford Motor Co. has been trying this method out in a limited way and has found it successful and intends to make it a plan of national scope starting on Jan. 1. This will not only increase the distribution of the Ford parts but will also in a broad way militate against the large number of so-called fake parts.

This is only another step in the Ford policy to broaden the sales policy to such a degree as to make the car and its parts almost a matter of general merchandising. The removal of territorial restrictions on Ford sales last year was the first step in this direction. There is no restriction on the part of the garageman regarding the number of parts nor the amount of money he need expend in laying in a stock.

Contracts Placed

WASHINGTON, Dec. 28—Following is a list of contracts placed by the Motor Vehicle Division, Quartermaster Department, on Dec. 17, 1918:

Trailmobile Co., Cincinnati, 1000 cargo trailers, $596,000.
Goodyear Tire & Rubber Co., Washington, 5750 casings, 600 tubes, $230,720.
Kelly-Springfield Tire Co., Cleveland, 2000 tires, $80,680.
Fisk Rubber Co., Washington, D. C., 3765 casings, $57,003.50.
Firestone Tire & Rubber Co., Akron, 1965 casings, 5875 tubings, $76,874.25.
United States Tire Co., New York City, casings and tubes, $388,112.50.
Pennsylvania Rubber Co., Jeannette, Pa., 3000 casings, $31,500.

Briscoe Price to Stand

NEW YORK, Dec. 30—The Briscoe Motor Car Co. has made public the fact that there will be no changes in the price of Briscoe cars before July 1, 1919.

Packard Prefers Returned Soldiers for New Workers

DETROIT, Dec. 28—The Packard Motor Car Co. will give preference to the returned soldier's application for re-employment, in recognition of his service and his sacrifice. Since the declaration of war considerably more than 3000 Packard employees have left the factory to serve in the Army, Navy or in other departments of the Government. Some already released have applied for re-employment, and it is the company's wish to treat them all with a uniform consideration. The rules which Packard has adopted under the policy with reference to former employees who joined the colors are as follows:

An employee who left to enter Government service, and who has been honorably discharged, shall receive preference over other applicants for any vacancy which he may be competent to fill. Whenever possible, Packard employees honorably discharged from uniformed service will be assigned to their former positions or to work equally remunerative. If they are not able to resume their former occupation, every effort is to be made to place them in accordance with their present ability.

To facilitate the operation of this rule, department heads are authorized to replace whenever necessary employees who have entered Packard service since April 6, 1917. Applications for re-employment from employees who entered salaried civilian positions under the Government will be considered on their merits, and every effort will be made to provide employment if a suitable vacancy exists.

To receive consideration under these rules, an employee must have entered the Government service within 30 days of leaving Packard employ, and must make application, for re-employment within 60 days of his discharge. In administering these rules, employees who have served under the governments of any Allied nations will rank equally with those who have been in United States service. Absence in Government service will not be deducted in determining length of service in Packard employ.

American Chamber of Commerce in Buenos Aires

WASHINGTON, Dec. 28—The American Chamber of Commerce has been established in Buenos Aires, succeeding the American Commercial Club. It has 85 members who contributed 60,000 pesos as an initial fund in addition to annual dues of 240 pesos each. The organization is prepared to give information and advice to American manufacturers, to consider arbitration questions, and to assist the development of trade.

Col. Wall Will Return to Peace Duty

WASHINGTON, Dec. 30—Lt. Col. W. G. Wall, who was the Chief Engineer of the National Motor Car Co., Indianapolis, and who during the war has been in the Ordnance Department engaged in the design and construction of tractors and tanks, will remain in Washington until Jan. 15 at which time he will resign to return to the National company in his former capacity as chief engineer.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Evinrude May Expand

MILWAUKEE, Dec. 30—The Evinrude Motor Co., a pioneer manufacturer of detachable rowboat engines, expects to make a decision soon on the question of erecting and equipping a complete new plant at the northern limits of Milwaukee, a project which was to have been undertaken a year and a half ago, but indefinitely postponed because of conditions growing out of the declaration of a state of war. The company early in 1917 purchased a large tract of land for the proposed new plant and had prepared tentative plans for the new works. When this is built the Evinrude company intends to enlarge its line of production to include crude oil engines in various types, continuing its present principal product. J. F. Koch is treasurer of the company.

Export Office for Gibson

NEW YORK, Dec. 30—The Gibson Co., Indianapolis jobber, has opened an export office at 27 William Street. It is in charge of I. B. Moers until recently Pacificic Coast's manager for the King Motor Car Co., Detroit.

Bodies Coming from Milwaukee

MILWAUKEE, Dec. 30—The Wisconsin Body & Sales Co. has been incorporated with a capital stock of $15,000 to manufacture motor car and truck bodies for the commercial and custom trade. The incorporators are W. A. Rosenwald, G. Steger and B. M. Rosenwald.

Michigan City Foundry to Start

CHICAGO, Dec. 30—The Michigan City Foundry and Machine Co. will break ground here early in the spring for a foundry which will make a specialty of castings. Albert F. Fort is the moving spirit behind the venture and associated with him will be W. K. Greenebaum, as secretary of the company.

Becker Mfg. Co. Incorporates

MILWAUKEE, Dec. 30—The Becker Mfg. Co., Two Rivers, Wis., which has been operating an iron foundry in that city for many years, has incorporated its business under the same style, with a capital stock of $25,000. Michael P. and Frank T. Becker, the principal owners, continue to hold the controlling interest and will be the officers of the new corporation.

To Sell Monroe Plant

PONTIAC, MICH., Dec. 28—The plant of the defunct Monroe Motor Co. will be sold on the premises Saturday, Jan. 25, 1919, by the receiver, Robert T. Armstrong. The factory contains 100,000 sq. ft. of floor space.

Coast Office for Wellman-Seaver-Morgan

CLEVELAND, Dec. 30—The Wellman-Seaver-Morgan Co. has opened a San Francisco office at 415-417 Rialto Building, in charge of Norman S. Ross. Business originating from California, Nevada west of the 115th meridian, lower California and the counties of Josephine, Jackson and Klamath in Oregon will receive the prompt attention of Mr. Ross.

Castings from Hartford, Wis.

HARTFORD, WIS., Dec. 30—A new gray iron and semi-steel foundry is being established here by Robert LaPointe and Samuel B. Powers, who have leased the casting shop erected and equipped several months ago by Irving L. Bonniwell. The foundry will be operated under the style of Hartford Foundry Co. and will specialize in automotive parts.

Hel-Fi Buys Motor Accessories

CHICAGO, Dec. 28—The Hel-Fi Co., Belvidere, Ill., has purchased and taken over the entire assets and business of the Motor Accessories Mfg. Co., formerly located at Marshalltown, Iowa, and will continue the manufacture and distribution of the Hel-Fi line of spark plugs. C. C. Eldridge, formerly president of the Motor Accessories company, is president of the new organization, which has been organized to provide for further financing.

Everwear Rubber Buys Plant

MILWAUKEE, WIS., Dec. 30—The Everwear Rubber Co., Milwaukee, organized recently with a capital stock of $200,000 to manufacture a patented semi-pneumatic inner tire, has purchased the plant of the Petley Rubber Mfg. Co., 241-247 Oregon Street, which has been manufacturing rubber bumpers, mechanical rubber goods and specialties. The Everwear company will continue that business as a department.

More Room for Gillette

EAU CLAIRE, WIS., Dec. 30—The Gillette Rubber Co., which some time ago established a new department for the manufacture of solid tires, is enlarging its works by the erection of a brick addition, 40 x 125 feet, to accommodate inspection, shipping and warehouse departments. The space thus released will be used for manufacturing.

Dividends

Pierce-Arrow Motor Car Co., quarterly, $1.25, payable Feb. 1.

Curtiss Aeroplane & Motor Co., semi-annual, 3½ per cent on preferred, payable Jan. 15.

Emerson-Brantingham Co., quarterly, 1¾ per cent, preferred.

Falls Tractor Engine Coming

MILWAUKEE, Dec. 30—The Falls Motors Corp., Sheboygan Falls, Wis., will place in operation on Jan. 2 a large plant addition representing an investment of more than $225,000, enabling it not only to increase its output of passenger and commercial car power units, but also to engage in the production of a special tractor type, heavy duty motor. A considerable volume of business in the new tractor engine has been booked, and with the other orders now in hand, the operation of the enlarged plant at full capacity for many months ahead already has been assured.

Mitchell Toolmakers Return

RACINE, Dec. 30—Between 100 and 150 toolmakers employed by the Mitchell Motors Co., returned to work Dec. 20 after a strike of 10 days' duration. Differences arose over working hours and these have been adjusted by federal labor conciliators. It is said the Mitchell company desired to establish a 10-hour day, but the men insisted on an 8-hour day, with time and one-half for overtime.

Stinson Tractor to Build

SUPERIOR, WIS., Dec. 30—The Stinson Tractor Co. will commence operations in its new assembling plant at Superior, Wis., on Jan. 2, with a force of about 60 operatives. The work of equipping the former plant of the Continental Motor Truck Co. in Superior has been completed and material and parts have been provided in sufficient quantity to insure a daily output of one tractor, which will be increased as rapidly as equipment and stock are sufficiently enlarged.

New York Office for Hess

BALTIMORE, Dec. 30—The Hess Steel Corp. has established a branch office at 50 Church Street, New York City. Daniel V. Foster, who is now representing the Hess corporation in that district, will be in charge.

Government Still Needs Tires

WASHINGTON, Dec. 30—Government purchase of tires for motor trucks in this country and abroad continue in large quantities. Orders were placed on Dec. 17 for $1,000,000 worth of tires with the Goodyear, Kelly-Springfield, Fisk, Firestone, United States and Pennsylvania tire companies. An order at the same time was given to the Trailmobile Co., for 1000 cargo trailers. Following is the list:

Trailmobile Co., Cincinnati, Ohio, 1000 cargo trailers, $596,000.

Goodyear Tire and Rubber Co., Washington, 5750 casings, 6000 tubes, $230,720.

Kelly-Springfield Tire Co., Cleveland, 2000 tires, $80,680.

Fisk Rubber Co., Washington, 3765 casings, $57,003.50.

Firestone Tire and Rubber Co., Akron, 1965 casings, 5875 tubings, $76,874.25.

United States Tire Co., New York, casings and tubes, $388,112.50.

Adopt Standards for Women

Department of Labor Specifies Equal Pay and 48-Hour Week—Complete Rules

WASHINGTON, Dec. 30—Standards have been arranged by the Department of Labor to deal with working conditions for women, including wages, hours, employment and training. Equal pay for equal work, 48-hr. week and joint negotiation between employers and groups of employees are among the standards. Inquiries regarding the employment of women and all problems connected with this can be addressed to the Woman in Industry Service, Department of Labor, Washington, D. C. Following is the complete outline of the standards as approved by Secretary of Labor Wilson:

Hours of Labor

1. **Daily hours.**—No women shall be employed or permitted to work more than eight hours in any one day or 48 hours in any one week. The time when the work of women employees shall begin and end and the time allowed for meals shall be posted in a conspicuous place in each work room and a record shall be kept of the overtime of each woman worker.
2. **Half holiday on Saturday.**—Observance of the half holiday should be the custom.
3. **One day of rest in seven.**—Every woman worker shall have one day of rest in every seven days.
4. **Time for meals.**—At least three-quarters of an hour shall be allowed for a meal.
5. **Rest periods.**—A rest period of ten minutes should be allowed in the middle of each working period without thereby increasing the length of the working days.
6. **Night work.**—No women shall be employed between the hours of 10 p. m. and 6 a. m.

Wages

1. **Equality with men's wages.**—Women doing the same work as men shall receive the same wages with such proportionate increases as the men are receiving in the same industry. Slight changes made in the process or in the arrangement of work should not be regarded as justifying a lower wage for a woman than for a man unless statistics of production show that the output for the job in question is less when women are employed than when men are employed. If a difference in output is demonstrated the difference in the wage rate should be based upon the difference in production for the job as a whole and not determined arbitrarily.
2. **The basis of determination of wages.**—Wages should be established on the basis of occupation and not on the basis of sex. The minimum wage rate should cover the cost of living for dependents and not merely for the individual.

Working Conditions

1. **Comfort and sanitation.**—State labor laws and industrial codes should be consulted with reference to provisions for comfort and sanitation. Washing facilities, with hot and cold water, soap, and individual towels, should be provided in sufficient number and in accessible locations to make washing before meals and at the close of the work day convenient. Toilets should be separate for men and women, clean and accessible. Their numbers should have a standard ratio to the number of workers employed. Workroom floors should be kept clean. Dressing rooms should be provided adjacent to washing facilities, making possible change of clothing outside the workrooms. Rest rooms should be provided. Lighting should be arranged so that direct rays do not shine into the workers' eyes. Ventilation should be adequate and heat sufficient. Drinking water should be cool and accessible, with individual drinking cups or bubble fountain provided. Provision should be made for the workers to secure a hot and nourishing meal eaten outside the workroom, and if no lunch rooms are accessible near the plant, a lunch room should be maintained in the establishment.
2. **Posture at work.** — Continuous standing and continuous sitting are both injurious. A seat should be provided for every woman employed and its use encouraged. It is possible and desirable to adjust the height of the chairs in relation to the height of machines or work tables, so that the worker may with equal convenience and efficiency stand or sit at her work. The seats should have backs. If the chair is high a foot rest should be provided.
3. **Safety.** — Risks from machinery, danger from fire and exposure to dust, fumes, or other occupational hazards should be scrupulously guarded against by observance of standards in State and Federal codes. First-aid equipment should be provided. Fire drills and other forms of education of the workers in the observance of safety regulations should be instituted.
4. **Selection of occupations for women.**—In determining what occupations are suitable and safe for women, attention should be centered especially on the following conditions which would render the employment of women undesirable if changes are not made:
   A. Constant standing or other postures causing physical strain.
   B. Repeated lifting of weights of 25 pounds or over, or other abnormally fatiguing motions.
   C. Operation of mechanical devices requiring undue strength.
   D. Exposure to excessive heat—that is, over 80 deg., or excessive cold—that is, under 50 deg.
   E. Exposure to dust, fumes, or other occupational poisons without adequate safeguards against disease.
5. **Prohibited occupations.**—Women must not be employed in occupations involving the use of poisons which are proved to be more injurious to women than to men, such as certain processes in the lead industries. Subsequent rulings on the dangerous trades will be issued.
6. **Uniforms.**—Uniforms with caps and comfortable shoes are desirable for health and safety in occupations for which machines are used or in which the processes are dusty.

Home Work

No work shall be given out to be done in rooms used for living or sleeping purposes or in rooms directly connected with living or sleeping rooms in any dwelling or tenement.

Employment Management

1. **Hiring, separations, and determination of conditions.**—In establishing satisfactory relations between a company and its employees, a personnel department is important charged with responsibility for selection, assignment, transfer or withdrawal of workers and the establishment of proper working conditions.
2. **Supervision of women workers.**—Where women are employed, a competent woman should be appointed as employment executive with responsibility for conditions affecting women. Women should also be appointed in supervisory positions in the departments employing women.
3. **Selection of workers.**—The selection of workers best adapted to the required occupations through physical equipment and through experience and other qualifications is as important as the determination of the conditions of the work to be done.

Co-operation of Workers

The responsibility should not rest upon the management alone to determine wisely and effectively the conditions which should be established. The genuine co-operation essential to production can be secured only if definite channels of communication between employers and groups of their workers are established. The need of creating methods of joint negotiation between employers and groups of employees is especially great in the light of the critical points of controversy which may arise in a time like the present. Existing channels should be preserved and new ones opened if required, to provide easier access for discussion between employer and employees.

Champion Machine to Build

CLEVELAND, Dec. 30—The Champion Machine & Forging Co. has purchased a block of land adjoining its plant at 3695 East Seventy-eighth Street, on which a forgeshop is now being erected.

Canada Has 250,000 Motor Cars

Dominion Has One Car for Every 32 Persons—Eleven Manufacturing Plants

WASHINGTON, Dec. 30—Two hundred and fifty thousand automobiles are in use in Canada at present, according to a Consular Report, which states that in 1914 there were 67,415 and in 1917 there were 189,320 cars in use.

With an estimated population of 8,000,000 there is one passenger car in use at present for every 32 inhabitants, as against one for every 118 inhabitants 4 years ago. The number of cars in use in Ontario this year is estimated at 110,000.

Statistics have been compiled showing the occupations of car owners throughout the country, according to Consul Felix S. S. Johnson, Kingston, Ontario, and from this, says the report, it is apparent that 90 per cent of all the cars in use are owned by persons whose occupations are such that the automobile in their hands is a utility enabling them to do more and better work. Nearly one-half the cars in use are the property of farmers.

A preliminary report of a census of the automobile and other allied industries has been compiled by the Dominion Bureau of Statistics. The census covered the operations of establishments engaged in the manufacture of (1) automobiles, (2) automobile accessories and (3) automobile repairs.

The number of establishments classed as manufacturers of automobiles in Canada in 1917 was 11, in automobile accessories 24 and in repair work 497.

The total capital invested in these industries was $35,780,677, apportioned as follows: In automobiles $28,192,858, in accessories $3,155,893 and in repairshops $4,431,926.

The number of persons employed on salaries was 730 males and 174 females in automobile plants, 106 males and 21 females in accessory plants, and 254 males and 48 females in repairshops and garages. The total salaries paid were respectively $1,376,692 in automobile plants, $266,147 in plants making accessories and $334,780 in repairshops.

The number employed on wages in each class and the amount paid in wages were as follows:

	Number Males.	Number Females.	Wages
Automobile plants	4,852	164	$4,862,779
Accessory plants	1,405	122	1,198,596
Repairshops	1,508	34	1,200,958

The value of materials used in manufacturing and repair work in each class was (1) automobiles $35,585,820, (2) accessories $3,788,308 and (3) repairs $1,961,773.

The total value of production and repair work for all classes was $66,053,207, of which automobiles amounted to $54,466,273, accessories to $6,495,868 and repairs to $5,091,066.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. ...... .02 -.03
- Phosphoric (85%) .. .35 -.39
- Sulphuric (60), lb.. .006

Aluminum:
- Ingot, lb. .... .33
- Sheets (18 gage or more), lb. .... .42

Antimony. lb. .... .18 -.13¼

Burlap:
- 8 oz., yd.......... .17¼-.17½
- 10½ oz., yd......... .21½-.22

Copper:
- Elec., lb. .... .26
- Lake, lb. .... .26

Fabric, Tire (17¼ oz):
- Sea Is., combed, lb.1.65-1.70
- Egypt, combed, lb.1.25-1.35
- Egypt, carded, lb.1.20-1.30
- Peelers, combed, lb.1.05-1.20
- Peelers, carded, lb. .95-1.05

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
- Ceylon, lb. .... .09 -.22
- Madagascar, lb. .... .10 -.15
- Mexico, lb. .... .03¾

Lead, lb. .... .06¾-.07¼

Leather:
- Hides, lb. .... .18 -.35¼

Nickel, lb. .... .40

Oil:
- Gasoline:
  - Auto, gal. .... .24½
  - 68 to 70 gal....... .30½
- Lard:
  - Prime City, gal..2.25-2.30
  - Ex. No. 1, gal...1.62
- Linseed, gal. 1.58-1.59
- Menhaden (Brown), gal. 1.35-1.36
- Petroleum (crude),
  - Kansas, bbl. 2.25
  - Pennsylv'a, bbl...4.00

Rubber:
- Ceylon:
  - First latex pale crepe, lb. ...... .58
  - Brown, crepe, thin, clear, lb. .... .50
  - Smoked, ribbed sheets, lb. ..... .56
- Para:
  - Up River, fine, lb. .61
  - Up River, coarse, lb. .... .36
  - Island, fine, lb.. .53

Shellac (orange), lb.. .70-.72

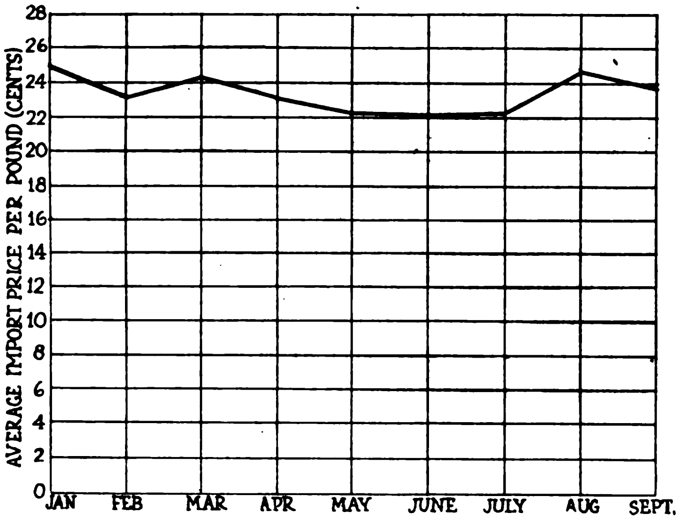
Spelter .... .08¼

Steel:
- Angle beams and channels, lb. ..... .03
- Automobile sheet (see sp. table).
- Cold rolled, lb.... .06½
- Hot rolled, lb..... .03½

Tin .... .71-.72

Tungsten, lb. 2.00-2.50

Waste (cotton), lb... 12¾-.17



Monthly average import prices of copper—pigs, ingots, bars, etc.

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock................	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock...............	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping..............	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Black Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.

Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

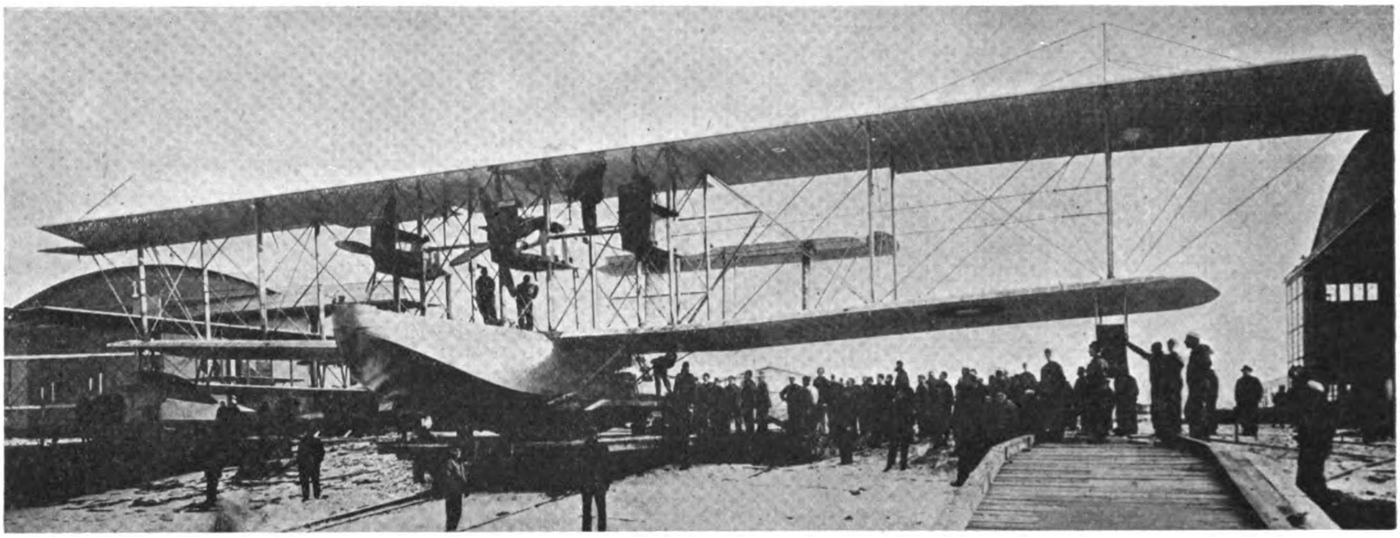
Automobile Securities on the Chicago Exchange at Close Dec. 28

	Bid	Asked	Net Ch'ge
Auto Body Company........	5	8	..
Briscoe Motor Car, com.....	11	..	..
Briscoe Motor Car, pfd......	40	55	..
*Chandler Motor Car.......	102	104	—3
Chevrolet Motor Car........	149	151	..
Cole Motor Car Co..........	90	105	..
Continental Motors, com....	8	8⅝	..
Continental Motors, pfd.....	94	97	+2
Edmunds & Jones, com.....	20	22	..
Edmunds & Jones, pfd......	75	90	..
Electric Storage Bat........	49	57	..
Federal Motor Truck.......	32	35	..
Fisher Body Co., com.......	35½	38	..
Fisher Body Co., pfd........	92	94	..
Ford Motor of Canada......	220	230	—15
General Motors, com........	129¾	130¾	— ¾
General Motors, pfd.........	79	81	—2
Hupp Motor Car, com.......	4½	5	..
*Hupp Motor Car, pfd......	83	88	—1
Kelsey Wheel Co., com.....	26	30	..
Kelsey Wheel Co., pfd......	85	90	..
Manhattan Electric S., com.	..	48	..
Maxwell Motor, com.........	27½	28½	—1½
Maxwell Motor, 1st pfd.....	50¼	51¼	—1⅞
Maxwell Motor, 2nd pfd....	19	20	—2
McCord Mfg., com..........	32	35	+2
McCord Mfg., pfd...........	93	96	+3
Mitchell Motor Co..........	25	35	..
Motor Products Corp.......	40	..	..
Nash Motors Co., com......	175	200	..
Nash Motors Co., pfd.......	90	95	..
National Motor Co..........	9	12½	..
Packard Motor Car, com....	107	..	—1
Packard Motor Car, pfd.....	98½	..	+1
Paige-Detroit Motor, com..	23¼	24¼	+ ¼
Paige-Detroit Motor, pfd...	8¾	9¾	..
Peerless Motor Truck.......	18	21	..
Pierce-Arrow Mot. Car, com.	42	43	+ ½
Pierce-Arrow Mot. Car, pfd..	103	104	..
Premier Motor Corp., com..	5	..	..
Premier Motor Corp., pfd...	..	75	..
Prudden Wheel Company...	15½	17½	..
*Reo Motor Car Co..........	20½	21½	..
Republic M. Truck, com....	35½	38	..
Republic M. Truck. pfd.....	87	90	..
Saxon Motor Car, com......	6	8	—1⅝
Scripps-Booth Corp..........	21	25	..
Stewart Warner Speed. Corp.	77½	79½	— ½
Stromberg Carburetor Co...	33	38	..
Studebaker Corp., com......	50	51	—1¾
Studebaker Corp., pfd.......	90	92	..
Stutz Motor Car Co........	48⅝	50⅝	—1¼
United Motors Corp.........	33¼	35¼	— ¼
*White Motor Co...........	44¼	45¼	+ ¾
Willys-Overland, com.......	24⅝	25⅝	— ¼
Willys-Overland, pfd........	88	89	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.............	66	68	..
Firestone T. & R., com.....	136	140	+11
Firestone T. & R., pfd......	100	101½	+1
Fisk Rubber Co., com.......	70	75	+10
Fisk Rubber, 1st pfd........	97	103	..
Fisk Rubber, 2nd pfd.......	85	95	—5
Fisk Rubber, 1st pfd. conv..	90	97	..
Goodrich, B. F., com........	56	57	..
Goodrich, B. F., pfd.........	103⅝	106	..
Goodyear T. & R., com.....	221	230	+9
Goodyear T. & R., 1st pfd...	103¼	106	..
Goodyear T. & R., 2nd pfd..	102	104	+2
Kelly-Springfield, com.	68½	69½	..
Kelly-Springfield, 1st pfd....	80	91	..
Lee Tire & Rubber Co......	23	24¼	..
Marathon Tire & Rubber...	..	55	..
Miller Rubber Co., com......	142	148	..
Miller Rubber Co., pfd......	96	98	+1
Rubber Products Co..........	..	101	..
Portage Rubber Co., com...	145	149	..
Swinehart T. & R. Co......	50	60	..
U. S. Rubber Co., com......	77	78	..
*U. S. Rubber Co., pfd......	109	110	..

*Ex Dividend.



The mammoth navy seaplane, which is designated N. C. 1, and which it is now admitted is being held in readiness for an attempt at a transatlantic flight. It is the first American plane to be equipped with three Liberty engines. The wingspread is 126 ft. and the length is 70 ft. from bow to tail. The wings have a gap of 12 ft. and are 12 ft. broad. The flying weight of the machine is 22,000 lb. and it has climbed to 2000 ft. in 10 min.

Government Price of Dodge Cars

WASHINGTON, Dec. 30—A supplementary contract made to Dodge Bros., Detroit, by the Quartermaster Department fixes the price of boxed Dodge cars for export at $51 per crate, on 1500 5-passenger cars, making a total allowance of $76,500 increase in contract No. A-46 for 1500 Dodge cars to $1,327,500. A supplement to contract A-45 calling for 500 Dodge cars at $478,000 includes allowance for crating at $59 per crate, increasing the contract $29,500 to a total of $507,500. Estimated on this basis Dodge 5-passenger cars on contract A-46 have been sold to the Government at a cost of $885 each while on contract A-45 the price was $856 each not including the cost of crating.

Hong Kong Trade Good

WASHINGTON, Dec. 30—Trade in Hong Kong during the past 9 months has been satisfactory, according to a Consular report. Decreasing tonnage, due to the demand for shipping service elsewhere and increasing difficulty of securing supplies, have prevented any great pressure in favor of imports, while on the other hand, the high exchange value of silver has made it impossible to move most lines of Chinese produce. Nevertheless the Hong Kong industry including the shipyards, sugar refineries, knitting and preserve factories have done excellent business and exportation from the United States should find good trade there as quickly as shipping facilities allow. Among the principal items imported to Hong Kong in the past 9 months were $300,000 worth of automobiles and parts.

Foreign Trade Opportunities

WASHINGTON, Dec. 30—An agency is desired by a man in France for the sale of tractors and also by an individual in Switzerland. Further information can be secured on this by addressing the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and mentioning Foreign Trade Opportunity Nos. 27,883 and 27,886.

A commission merchant is desirous to secure an agency of American motor cars and motor trucks. The Bureau of Foreign and Domestic Commerce will give further details on receipt of inquiries asking about Foreign Trade Opportunity No. 27,891.

An agency for the sale of motor car bodies, especially leather, varnishes and trimmings is desired by an individual in France—Foreign Trade Opportunity No. 27,902.

Steel Available in Canada

WASHINGTON, Dec. 30—Millions of tons of steel will now be available for automobile and agricultural implement manufacture in Canada, according to a Consular report, which states that manufacturers in these lines, there are far behind in their orders. A reduction in the high wage of the war is expected but at the same time it is expected that there will be ample employment for all at good wages in Canada. Manufacturers, says the report, do not look for a drop in prices for some time.

New Allen Sedan

FOSTORIA, Dec. 21—The Allen Motor Co. has brought out a new five-passenger sedan on its 112-in. wheelbase, standard chassis. It has disappearing side windows, staggered doors and a passageway between the front seats, and is upholstered in gray and green worsted with a gray top lining and carpet to match. The windows are fitted with silk roller curtains at the rear, and the interior upholstery is over double-decked cushion springs. There is an etched center dome light, robe strap, foot rest and full interior equipment.

The windshild is sloping, with full ventilating features, and has an adjustable rain visor. There is a ventilating fixture on the driver's door, and the door is locked by a thumb latch. On the right hand door there is a Yale lock.

The standard Allen chassis upon which this new sedan is mounted has a four-cylinder 3¾ by 5 engine, a two-unit Autolite starting and lighting system with Connecticut ignition, Stromberg carbureter, Borg & Beck clutch and a full Hotchkiss drive. Gasoline feed is by Stewart-Vacuum system from a 13-gal. tank at the rear. Tires are 33 by 4 and the car sells for $1,795 f.o.b. Ohio.

One of the features of the car is the rotary switch, whcih is mounted on the steering column, directly beneath the steering wheel, controlling the entire electric system, including the starter, ignition, head and tail lamps, dimmers and motor-driven horn. The light for the interior dome light is controlled by a switch within the rear compartment.

Army Planes Head for Washington

WASHINGTON, D. C., Dec. 30—The four army training planes which flew across the continent from San Diego to Jacksonville, and which later flew the length of Florida and back, have started north to Washington, D. C. They left Dorr Field, Arcadia, Fla., at 3:30 p. m., December 27 and arrived at Daytona, Fla., at 6:00 p. m. the same day, flying the last hour of this leg in the rain. The fliers spent the night at Daytona and left this morning for the North. They will continue to collect data and statistics for the army air map and locate sites for landing fields as they proceed. Allowing time for this work and their stops for gasoline it is figured they should arrive at Bolling Field, Anacostia, about January 4.

N. A. C. C. Meeting Jan. 8

WASHINGTON, Dec. 30—The next directors' meeting of the National Automobile Chamber of Commerce will be held in New York on January 8.

Men of the Industry

Changes in Personnel and Position

F. J. Pardee, for the past three years general sales manager for the Diamond T. Motor Car Co., Chicago, has been appointed Western sales manager of the company, and will open headquarters in San Francisco. A. J. Whipple, who has been a special representative of the company in Washington, D. C., has been made general sales manager.

—

A. S. Canton, formerly purchasing agent for the automobile accessories department of the Oliver Bros. Co., New York, is now associated with the A. S. Canton Co., accessory jobber.

—

Glenn B. Miller has been appointed general sales manager of the Nelson Motor Truck Co., Saginaw, Mich.

—

Chester L. Newman, for 20 years manager of the Kansas City branch of the National Analine & Chemical Co., has bought stock in the Employers' Indemnity Corporation, Kansas City, and on Dec. 27 became vice-president of the corporation. He will manage the new department of reinsurance, which is growing rapidly. The department reinsures both insurance companies and firms which carry their own insurance, on automobile liability, employers' liability and compensation, carrying the excess above the maximum amounts which such reinsured concerns care to cover for themselves. The corporation also provides a special coverage in automobile collision insurance "as interest may appear."

—

John F. Evans, Evans Motor Sales Co., National distributer in Detroit has been appointed representative of the Gillette Rubber Co. He will be general manager of the Detroit Gillette branch which will be styled Gillette Rubber Co. of Michigan.

—

A. W. Dunop, connected with the railway sales department of the United States Light & Heat Corp., Niagara Falls, N. Y., has been promoted district manager and engineer in charge of the San Francisco branch.

—

George L. Ritter has been appointed assistant sales and advertising manager of the Duplex Engine Governor Co., Brooklyn, N. Y. He was formerly secretary to the president of the company.

—

T. B. Fogg has been appointed branch supervisor of the Garford Motor Truck Co., Lima, O., and is head of a new Department of Supervision.

—

J. F. Bowman has been appointed Detroit sales manager of the Garford Motor Truck Co., Lima, O. He succeeds S. M. Williams who has taken charge of the company's new Highway Development Department.

—

Wade H. Leach assumed the duties of general sales manager of the Dort Motor Car Co., Dec. 1. For the past 2 years he has been interested in the Chicago Motor Co., Chicago, Jordan distributer.

—

A. G. Cameron, manager of the Goodyear Tire & Rubber Co. at St. Louis, has been promoted to charge of the Australasia trade. He will spend several months each year in the South Seas. P. D. Winnings, assistant manager at St. Louis, is in charge pending a permanent appointment.

C. L. Fox, assistant sales manager of the Saxon Motor Car Corp., Detroit, has returned from the officers' training school at Jacksonville, Fla., where he was in training in the Motor Transport Corps. He will resume his work at the Saxon factory Jan. 1.

—

Leo Lunenschloss, for 6 years manager of the principal Wisconsin sales office of the Avery Co., Peoria, Ill., in Madison, Wis., has been promoted to the position of foreign sales agent, with headquarters for the time being at the Peoria works. He is succeeded by R. B. Lyman, Watertown, S. D., as manager at Madison.

—

Horace N. Trumbull, who has recently received his discharge from the Engineers Officers' Training School at Camp A. A. Humphreys, Virginia, has been appointed advertising manager of the Wellman-Seaver-Morgan Co., Cleveland, Ohio. Before entering the service, Mr. Trumbull was advertising manager of the S. K. F. Ball Bearing Co., Hartford, Conn.

—

Fred D. Williams, formerly head of the power specialties department of the H. W. Johns-Manville Co., and who associated himself with the L. H. Gilmer Co., Philadelphia, as assistant general manager on April 29 last, has now been appointed general manager.

—

Prohibit All Price-Fixing

WASHINGTON, Dec. 30—Concerted price fixing by any industry after the Government ceases to exercise price control on Jan. 1, will be regarded as in restraint of free competition by the Department of Justice, it was stated to-day. This explanation was made in reply to an inquiry as to what would happen to war time price fixing when the War Industries Board ceases to function on Dec. 31.

Front Entrance Inside Drive Body

(*Continued from page 5*)

only 48½ in. between floor and roof. This is 3½ in. less than would be considered fair or average height, but the design must be lower than usual, as the body is short, and this makes it look pyramid-like unless the perpendicular dimension is cut down.

This design is intended to use the regular form of metal panel and wood frame construction with a heavy line molding at the belt or middle, and a slight round corner at the rear. It can, however, be considerably modified in weight if the material forming the back and side quarters be of cloth as well as the roof. This construction will be used in the near future, as there is a strong tendency now to have the upper part of the body lighter. There is no reason from the standpoint of durability or comfort that will prevent it, but it is at present thought to be so radical that builders hesitate to suggest it. So far no material is just satisfactory; the khaki cloth is the best-looking material and is satisfactory in keeping out the rain and cold, but it does not wear well; it loses its clean-cut appearance in a short time and cannot be satisfactorily and easily cleaned to look like new.

Of many other materials, principally black in color, the same objection exists as far as service is concerned. Nearly all look cheap when used for this purpose; leather is ideal for appearance and service, but is not cheap, considering the length of time that it will stay in shape. When any of the cloth or leather materials are used the body is made square cornered at the rear, as this is more practical, as well as more easily constructed.

The design has been made to accommodate the prevailing tendency to make the most lasting job—that is, with the metal panel construction; the short digression above is simply to help in a missionary way the wish of all body builders to have the bodies made lighter than they now are, and when the public shares to the same extent the views of the practical man this will be quite easy of accomplishment.

Dealers Who Will Exhibit at New York Show Feb. 1-15

Car	Exhibitor	Space	Building
Apperson	C. T. Silver and L. A. Mulford Co.	61 & 62	Armory
Buick	Buick Motor Co.	13	Garden
Buick	Buick Motor Co.	60	Armory
Cadillac	Detroit Cadillac Motor Car Co.	3	Garden
Chalmers	Chalmers Sales Co.	4	Garden
Chandler	Brady-Murray Motors Corp.	8	Garden
Chevrolet	Chevrolet Motor Co. of New York	28	Garden
Cole	Russell L. Engs	27	Garden
Crow-Elkhart	Crow Motor Sales Co.	74	Armory
Cunningham	Cunningham Auto Sales Co.	78 & 79	Armory
Daniels	A. Elliott Ranney Co.	11	Garden
Dodge	Colt-Stratton Co.	23	Garden
Franklin	Franklin Motor Car Co.	64	Armory
Haynes	Haynes Automobile Co. of New York.	9	Garden
Hudson	Hudson Motor Car Co. of New York	75 & 76	Armory
Hupmobile	Hupmobile Auto. Co. of New York	54	Armory
Jordan	McCurdy-Brainerd Co., Inc.	72	Armory
King	King Car Corp. of New York	77 & 78	Armory
Kissel	Crown Motors Corp.	61 & 62	Armory
Lexington	Lexington Motors New York Corp.	55 & 56	Armory
Locomobile	Locomobile Co. of America	18	Garden
Marmon	Marmon Auto. Co. of New York	16	Garden
Maxwell	Maxwell Motor Sales Corp.	62 & 63	Armory
McFarlan	McFarlan Six Sales Co.	51 & 52	Armory
Mercer	Whiting Motor Co.	32	Garden
Mitchell	Mitchell Motor Car Co. of N. Y.	10	Garden
Moon	Moon Motor Car Co. of New York	6	Garden
Murray	Morton W. Smith Co., Inc.	68	Armory
Nash	Kauffman-Morris Co.	52 & 53	Armory
National	Poertner Motor Car Co.	12	Garden
Oakland	Sidney B. Bowman Auto. Co.	22	Garden
Oldsmobile	Cutting-Larson Co.	19	Garden
Overland	Willys-Overland	5	Garden
Owen Magnetic	Owen Magnetic Car Co.	66 & 67	Armory
Packard	Packard Motor Car Co.	14	Garden
Paige	Paige-Detroit Co. of New York	65 & 66	Armory
Pierce-Arrow	Harrolds Motor Car Co.	20	Garden
Peerless	Van Cortlandt Vehicle Corp.	2	Garden
Reo	Reo Motor Car Co. of New York	33	Garden
Roamer	Roamer Motor Car Co.	56 & 57	Armory
Saxon	Saxon Motor Co. of New York	73	Armory
Scripps-Booth	Poertner Motor Car Co.	12	Garden
Standard	Taylor Motors Corp.	58	Armory
Stearns	F. B. Stearns Co.	15	Garden
Stutz	William Parkinson Motor Sales Co.	21	Garden
Studebaker	Studebaker Corp. of America	1	Garden
Velie	Garland Auto. Co.	31	Garden
Westcott	Allen-Westcott Motor Car Co.	59	Armory
Winton	Winton Co.	17	Garden

48 Get New York Show Space

(*Continued from page 29*)

In Madison Square Garden a balcony will be built, but not as large as that used in former years. It will house the accessories. Instead of cars being placed on a balcony in the Garden as heretofore there will be a second show in the Sixty-ninth Regiment Armory, a few steps from the Garden. A two-piece ticket will admit to both buildings. This will permit all the cars to be shown on the ground floor.

So far as the shows are concerned the visitor will never know whether they are promoted by the N. A. C. C. or the dealers. The old cars, the old faces and all the old atmosphere will be there. The Chicago show even has the manager of other years, Sam Miles, who was engaged a few days ago to manage that exposition.

In the drawing for the New York show, held at the Automobile Club of America last Saturday morning, the older members drew first, then a group of later members, and then the non-members who had made application. In addition to these there are quite a number of applicants expected, and there are only about a half dozen spaces left to allot.

The Chicago drawing was held at the Lexington at 3 o'clock Friday afternoon. There were 62 applications from passenger car dealers and 27 from truck companies. The New York truck drawings will not be held until Saturday of this week.

The receipts of the New York show will go to the New York Automobile Dealers' Association and the members. The receipts of the Chicago show will be divided among the Chicago Automobile Trade Association, the Chicago dealers, the N. A. C. C. and the Motor and Accessory Manufacturers' Association, which has sanctioned the Chicago and Boston shows. The New York show has not been sanctioned by the M. A. M. A.

The spaces allotted in the Chicago passenger car section follow:

Car	Space	Building
Overland	D-1	Coliseum
Buick	C-5	Coliseum
Dodge	B-2	Coliseum
Studebaker	A-6	Coliseum
Maxwell	B-6	Coliseum
Chevrolet	D-5	Coliseum
Cadillac	D-3	Coliseum
Hudson	B-4	Coliseum
Packard	C-1	Coliseum
Reo	C-3	Coliseum
Oakland	C-6	Coliseum
Chandler	A-2	Coliseum
Paige	A-4	Coliseum
Oldsmobile	D-2	Coliseum
Pierce-Arrow	C-2	Coliseum
Chalmers	B-5	Coliseum
Mitchell	K-1	Coliseum
Hupmobile	D-4	Coliseum
Franklin	A-3	Coliseum
Haynes	D-6	Coliseum
Marmon	C-4	Coliseum
Nash	A-k	Coliseum
Velie	E-2	Coliseum
Cole	F-3	Coliseum
Dort	F-4	Coliseum
Winton	F-1	Coliseum
Grant	E-1	Coliseum
National	B-3	Coliseum
Kissel	F-2	Coliseum
Stearns	G-1	Coliseum
Briscoe	A-5	Coliseum
Stutz	M-1	Coliseum
Peerless	A-1	Armory
Premier	E-3	Coliseum
Lexington	J-1	Coliseum
Scripps	E-4	Coliseum
Mercer	B-1	Coliseum
Fiat	B-4	Armory
Westcott	H-2	Coliseum
Paterson	Q-1	Coliseum
Moline	G-2	Coliseum
Liberty	O-1	Coliseum
Jordan	P-1	Coliseum
Stephens	H-1	Coliseum
Elgin	O-2	Coliseum
Holmes	N-3	Coliseum
Essex	Q-2	Coliseum
Locomobile	B-5	Armory
Daniels	Q-3	Coliseum
King	B-1	Armory
Case	B-3	Armory
Elcar	E-1	Armory
Davis	A-5	Armory
Standard	A-3	Armory
McFarlan	B-7	Armory
Biddle	C-1	Armory
Baker R. & L.	A-4	Armory
Owen Magnetic	A-2	Armory
Milburn	A-6	Armory
Detroit	A-8	Armory
Cunningham	B-6	Armory
Roamer	B-8	Armory

The Electric Vehicle Section heretofore set aside in the Armory will be continued. The concerns to which space is allotted in the truck sections follow:

Pierce-Arrow	Walker
G. M. C.	Paige
Autocar	Acme
Federal	Dearborn
Reo	La Peer
Nash	Republic
Garford	Indiana
Locomobile	Clydesdale
Kissel	Bethlehem
Maxwell	Brockway
Velie	Four Wheel Drive
Chevrolet	Shaw
Master	Graham Bros.
Service	Sandow
Dodge	

Post Office Motor Transport Service

WASHINGTON, Dec. 30—That there should be a Post Office Motor Transport Service connecting communities "like veins and arteries of the body," was the emphatic statement of Congressman M. Clyde Kelly Saturday before Congress. Mr. Kelly pointed out the important work performed in Europe during the war by the motor truck, and told how the soldiers were fed by motor transport. Using this description as a parallel instance, he stated himself emphatically in favor of the development of the Motor Transport Service in the United States.

Discuss Tax Elimination

WASHINGTON, Dec. 30—The Conference Committee representing the House and the Senate is now discussing the elimination from the Revenue bill of the 5 per cent tax on trucks, tractors, trailers and truck parts and it is expected that a satisfactory agreement will be reached to keep this from the bill. It is also considered possible that the 5 per cent tax on the parts and accessories of passenger cars will be removed.

National Tool to Make Trucks

ST. LOUIS, Dec. 30—The National Tool & Mfg. Co. is shortly to enter the market with a ¾ and a 1-ton truck. These will be placed on the market in six or eight months. The truck will be an assembled job.

Shop Committee Idea Spreading

WASHINGTON, Dec. 30—Shop committees for adjusting employees' grievances, and thus avoiding industrial disturbances, are being established and are working successfully in a number of American factories, according to bulletins issued by the Economics Division of the Information and Education Service, United States Department of Labor.

A large metal finishing plant in the State of New York started shop committees as a result of a strike, which it was found could have been avoided had there been means of discussion between the company and its men. Since the adoption of the plan every complaint has been adjusted satisfactorily. The plan is as follows:

Each department has an accredited representative on the committee, which elects an executive committee of five. The representatives meet every Friday, and two representatives of the management meet the executive committee in an office set aside for the purpose of discussing and adjusting grievances.

All complaints must be made in writing and submitted to the department representative by the complainant. The representative tries to adjust the matter with his foreman. If he fails he submits it to the next meeting of the shop committee. If the representatives can not adjust the grievance they turn it over to the executive committee, which takes it up with the representatives of the management. If they fail to agree the complaint is referred to the factory manager, who must take it up with a representative selected by the executive committee. In case this resort fails the dispute is passed on to an arbitration committee, whose decision is final and binding on both sides. The arbitration committee consists of five men, two selected by the management, two by the executive committee, and the fifth by these four.

Hanch Quits Washington Jan. 15

WASHINGTON, Dec. 30—C. C. Hanch, Chief of the Automotive Section, War Industries Board, will probably complete his official duties in Washington by Jan. 15 and will at that time return to the Studebaker Corp., South Bend, Ind., of which Mr. Hanch is the treasurer. The Automotive Section is winding up its affairs as rapidly as possible, now completing a report in conjunction with the other sections of the board to be compiled into one complete statement of the board's activities by Bernard M. Baruch.

To Provide Against Unemployment

WASHINGTON, Dec. 30—Felix Frankfurter, Chairman of the War Labor Policies Board, has been named by Secretary of Labor Wilson to take charge of the work of providing against unemployment "through stimulation of public works and state, county and municipal roads."

"Rick" To Fly For Loan

WASHINGTON, Dec. 30—Eddie Rickenbacher, American ace in the Flying Service in Eurpe, may make a series of flights through the United States this spring under the auspicies of the Treasury Department at the time of the next Liberty Loan. The Treasury Department is now negotiating with the War Department on this matter.

Managers' School to Be Opened

Thirty Representatives from 15 States Convene in Washington January 6

WASHINGTON, Dec. 23—The U. S. Employment Service of the Department of Labor will open its first school for employment managers on Jan. 6. The course will extend over two weeks. Thirty employees of the Employment Service of the Government, representing 15 states, will attend the first school, and upon completion of the course will be returned to their own state, where they will train their own examiners for service.

The purpose of the course is to produce a trained and efficient staff to make standard the use of a common agency under the Government for labor distribution and placement. Following are the subjects to be covered:

First Day—Explanation of Reasons for and Methods of Conference and Training in State. Purpose and Development of U. S. Employment Service. Present Industrial Conditions. Competitive Basis but maintaining Advanced Standards gained in War Periods. Necessity for knowing Local Conditions. The limited but vital part of the Employment Bureau in the field of Industrial Adjustment.

Second Day—Round Table on Office Layout. General Discussion of Work to Date. Functions of Director General. Contacts with Department of Labor, etc. What the Examiners Should Note in Modern Industrial Production. Special Agencies with Which Examiners Must Work. Need for Local Survey of Community. Industrial, Labor and Government Agencies. Knowledge of Their Standards.

Third Day—Round Table on Interviewing and Placement. Plans for Demobilization of Soldiers and War Workers. Enlightened Industry and the U. S. Employment Service.

Fourth Day—Interviewing Placement. Fiscal and Personal Regulations. Special Considerations in Placing Women.

Fifth Day—Round Table on Special Departments. Field Organization. Co-ordination of Sections and Groups within Service. The Examiner and his contact with employers, organized Labor and the Service.

Sixth Day—Trade Tests. The Morale of the Service. Dinner and good fellowship.

Eighth Day—Functions of Federal Director State Organization — Contact with Labor and Jobs. Clearance in States. Round Table on Reports and Forms. Trade Tests.

Ninth Day—Organization of Local District. Labor Community Boards. Survey of Community Needs and Possibilities. Clearance Summing Up. Round Table on Files and Filing.

Tenth Day—Organization and Work in Local Office. Sources of Work. Round Table on Job Soliciting. Employment Experiences Abroad and Successful Extension Here.

Eleventh Day—Special Problems in Junior Placement. Special Problems Relating to Handicapped. Round Table on Recruiting.

Twelfth Day—Round Table on Casual Labor: Industrial, Railroad, Farm, Day Work (Domestic). The Organization of the Casual Labor Market. Written examination. Summing Up Course and Methods of Training in States. The Potential Permanent Value of the U. S. Employment Service.

Thirteenth Day— Individual Conferences. Instructions on Methods of Training and Rating Examiners.

Moto-Meter Opens Detroit Branch

DETROIT, Dec. 30 — Following its policy of expansion, the Moto-Meter Co., Inc., Long Island City, New York, has opened a direct factory branch at 1432 Dime Bank Building, Detroit. The office will be in charge of J. J. Tobias.

Allied Tin Pact Broken by U. S.

WASHINGTON, Dec. 30—Cancellation of the inter-allied tin agreement has been announced by the War Industries Board. This places tin again under the control of the British Rubber and Tin Exports Committee. Negotiations for the protection of the American tin industry from price manipulation have been pending for many days between representatives of the tin industry and the importers favoring the inter-allied tin agreement, arrangements for which were not completed before Mr. Baruch and Vance McCormick left for Europe.

Prior to the negotiation of the inter-allied tin agreement the Rubber and Tin Exports Committee controlled the exports of tin from Great Britain and the export permits there were restricted to a limited number of merchants who enjoyed a monopoly thereby and were enabled to charge a premium of from 5 to 20 cents a pound.

At present the English market is about 10 cents below the American price and those favored concerns buying in England and selling here have enjoyed the high profit resulting. It may be necessary, it was said here to-day, to invoke the embargo power of the War Trade Board to secure equitable arrangements for the entire American tin industry.

International Harvester Head Quits

CHICAGO, Dec. 31—Cyrus H. McCormick has been succeeded as president of the International Harvester Co. by his brother Harold F. McCormick. Cyrus H. becomes chairman of the board of directors, having been continuously affiliated with the International company for 32 years, 16 years as head of the concern and 18 years as head of the McCormick Co.

Postpone Jobber Suit

NEW YORK, Dec. 31—The trial of the twenty-one members of the Automotive Equipment Association, formerly the National Association of Automobile Accessory Jobbers, on the charge of violating the Sherman anti-trust law has been postponed. It was originally scheduled for Jan. 6 but has been put off until Jan. 13 because Judge Hand, who is to try the case, is at present engaged with the Postal Telegraph demurrer action against the Government and will not be through with it until after Jan. 6.

Buick Price Down $100

FLINT, MICH., Jan. 2—The Buick Motor Co. has revised its prices effective at once. Following are the new and old prices:

Model	New Price	Old Price
3-Pass. open	$1495	$1595
5-Pass. open	1495	1595
4-Pass. closed	1985	2085
5-Pass. closed	2195	2195
7-Pass. open	1785	1885
7-Pass. closed	2585	2585

No alteration has been made in the construction of the various models.

Calendar

ENGINEERING

S. A. E. Meetings

1919

Jan. 8—Minneapolis Section, S. A. E.—Hotel Radisson. "Governors for Tractors and Truck Engines."

Feb. 4-6—New York. Winter Meeting. Society of Automotive Engineers, Engineering Societies' Building.

Feb. 6—Victory Dinner, Hotel Astor, New York.

Feb. 5—Minneapolis Section, S. A. E. — Hotel Radisson. "Radiator Cooling Fans."

March 5 — Minneapolis Section, S. A. E.—Hotel Radisson. "Tractor Service and Sales."

April 2—Minneapolis Section, S. A. E.—Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Jan. 11-18—Los Angeles, Cal. Automotive Exposition.

Jan. 15-18 — Spokane, Wash. Progressive Automotive Show in dealers' salesrooms. Auspices of Spokane Automobile Chamber of Commerce.

Jan. 20-25 — Hartford, Conn. Broad Street Armory. Auspices of Agricultural Interests.

Jan. 24-30 — Milwaukee, Wis. Eleventh Annual. Milwaukee Automobile Dealers, Inc., Auditorium. Bart J. Ruddle, Manager.

Jan. 25-Feb. 1—Chicago. Passenger cars, Coliseum.

February—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.

Feb. 1-15—New York. Automobile Dealers' Assn. Charles A. Stewart, Manager, Hotel Woodward, Broadway and 55th St.

Feb. 3-5 — Chicago. Trucks, Coliseum.

Feb. 10-15—Kansas City, Mo. Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 15 - 22 — Louisville, Ky. Louisville Auto Dealers' Assn.

Feb. 15-22—Newark, N. J. N. J. Auto Exhibition Co. Calude Holgate, Manager.

Feb. 15-22 — Cleveland, Ohio. Cleveland Auto Show Co. Fred H. Caley, Manager.

Feb. 15-22—Minneapolis, Minn. Minneapolis Auto Trade Assn. Walter B. Wilmot, Manager.

Feb. 15-22—Albany, N. Y. Albany Automobile Dealers' Assn. State Armory.

Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.

Feb. 17-22 — Passenger Cars: Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. I. Elliott, Manager.

Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 27-March 6—New York Aircraft Exhibition by Aircraft Manufacturers' Association, Madison Square Garden.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Pittsburgh. Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March — Great Falls, Mont.—Montana Automobile Distributers' Assn.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

March 1-10—San Francisco, Cal. Motor Car Dealers' Assn. G. A. Wahlgreen, Manager.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gardner, Manager.

Second or third week March—St. Louis, Mo. St. Louis Auto Mfrs. & Dealers' Assn. Robert E. Lee, Manager.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Chester I. Campbell, Manager.

March 22-29, Passenger Cars; April 1-5, Trucks—Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkham, Manager.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided — Harrisburg, Pa. Harrisburg Motor Dealers' Assn. J. Clyde Myton, Manager.

Not decided — Hartford, Conn. Hartford Automobile Dealers' Assn.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.

TRACTOR SHOWS

Feb. 24-Mar. 1—Kansas City, Mo. Fourth Annual Tractor Show. Sweeney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show, Wichita Tractor and Thresher Club. Forum.

CONVENTIONS

Feb. 4-6—New York. Meeting Society Automotive Engineers.

Jan. 7—New York. Dinner of Aircraft Manufacturers' Association, Waldorf.

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

S. A. E. Members at the Plant of the Standard Aircraft Corp

Some of the members of the Society of Automotive Engineers who made up the excursion party that visited the plant of the Standard Aircraft Corp., Elizabeth, N. J., recently, where they were, the guests of the company at a luncheon following an inspection of the factory and a number of flying demonstrations

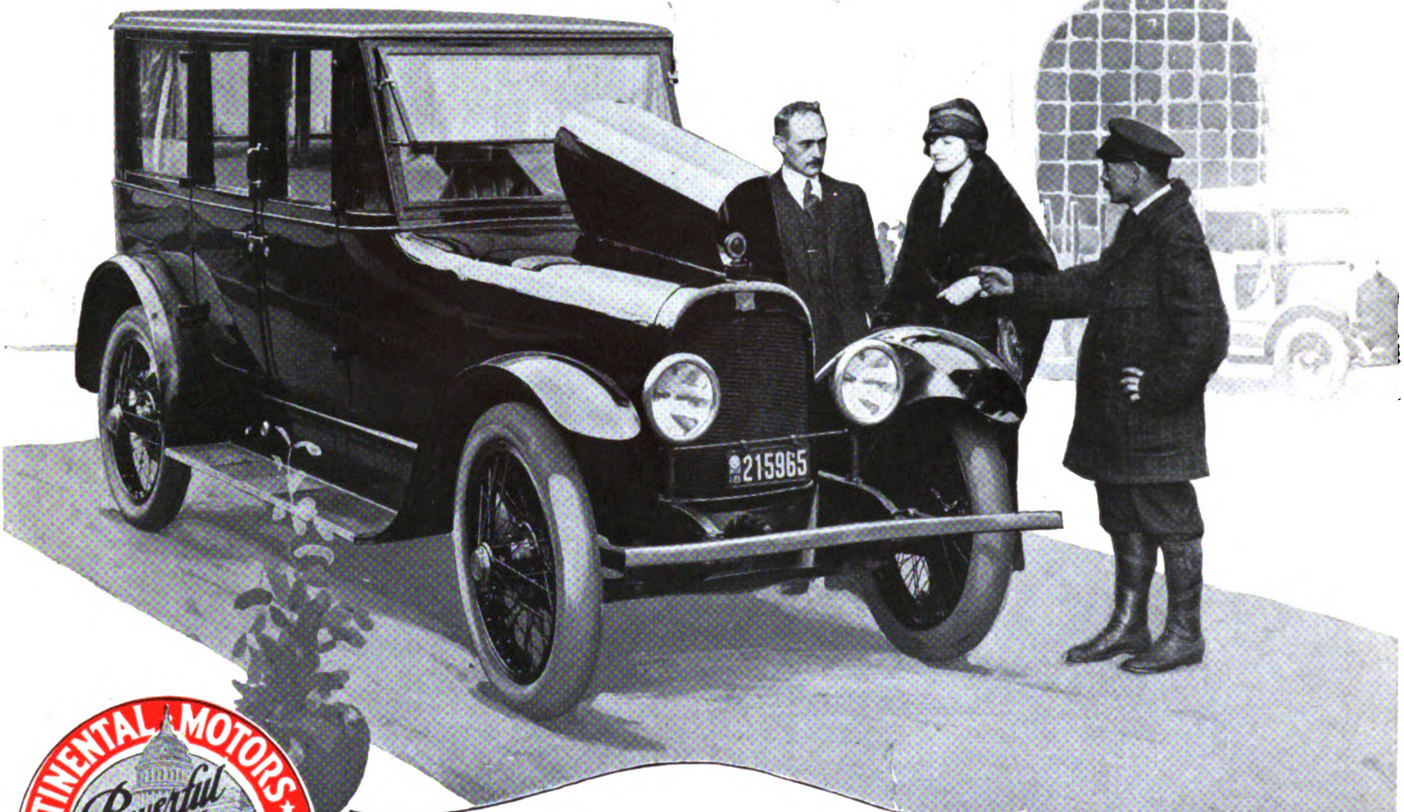
AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

Vol. XL
Number 2

PUBLISHED WEEKLY AT 239 WEST 39TH STREET
NEW YORK, JANUARY 9, 1919

Fifteen cents a copy
Three dollars a year

Entered as second-class matter Jan. [illegible] at the post office at New York, N. Y., under the Act of March [illegible]



CONTINENTAL MOTORS
Powerful as the Nation
AMERICA'S STANDARD

"Yes, That's the Motor for Us. There's the Continental Red Seal"

The more thorough and complete the knowledge of motor values, the stronger is the insistence upon the Red Seal Continental Motor.

For the experienced motorist knows that satisfaction in the ownership of an automobile depends largely upon the power, the speed, the economy, the reliability of the motor.

He knows also that the possession of these qualities can be determined with certainty only by past performance, the infallible test of motor worth.

For well over a decade the Red Seal Continental Motor has undergone the test of performance in hundreds of thousands of automobiles and trucks. Under every conceivable condition of service—in the arduous tasks of commerce, on the mud-drenched roads of France—it has proved its 100% dependability.

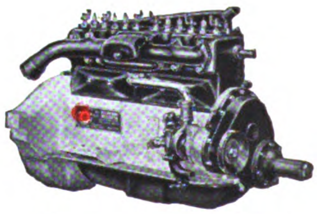
Today tens of thousands of owners will have no other motor. Upwards of 15,000 dealers base their business prosperity on Continental-equipped cars. More than 160 successful manufacturers of automobiles and trucks have selected the Continental after exhaustive tests and most careful analysis of its record.

Look for the Red Seal on the motor in the car or truck you buy—it's your guarantee of motor satisfaction.

CONTINENTAL MOTORS CORPORATION

Offices: Detroit, Michigan — **Factories:** Detroit—Muskegon

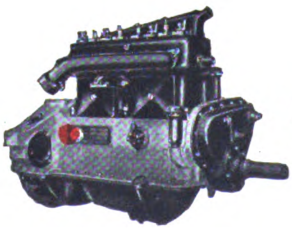
Largest Exclusive Motor Manufacturers in the World



America's Standard Passenger Car Motor. Look for the Red Seal Nameplate.

"Let's all keep industry humming by working together—employers and employees—in harmonious co-operation.
U. S. DEPARTMENT OF LABOR,
Wm. B. Wilson, Secretary."

Continental Motors



America's Standard Truck Motor. Look for the Red Seal Nameplate.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, JANUARY 9, 1919—CHICAGO No. 2

First Description of the Ford "Baby" Tank

A Two-Man Fighting Machine Having a Duplicate Ford Automobile Power Plant—Radiator Mounted at Rear in Most Protected Position—Worm Drive—Armor Plate Body Forms Chassis Frame

DURING the closing period of the war the U. S. Army Ordnance Department prepared plans for manufacturing by thousands a small tank officially known as the 3-ton special tractor. Popularly, these tanks were known as Ford tanks, because they were equipped with many standard Ford parts, and, in fact, were built around the Ford powerplant in such a way that the tremendous capacity of this factory could have been used to turn out hundreds of these special 3-ton tractors, or little two-man tanks, per day. It is difficult to imagine how far this program would eventually have been carried. These tanks might have largely taken the place of infantry to form the first two or three waves of an attacking force.

The 3-ton special tractor is an armored, two-man type, equipped with one Browning tank machine gun, U. S. caliber 30, Model 1918, mounted on the left side of the tractor, and operated through a ball mounting in the armor cover of the front of the tractor. The tractor is driven by two 4-cylinder Model T Ford engines, placed parallel to each other. Each of these engines drives one track, but there is an idler gear interposed between the two engines, meshing with a toothed ring on each flywheel, which synchronizes the powerplants and virtually makes the two a single unit. From the engines the power is transmitted through two standard Ford planetary transmissions with disk clutches, two worm gears, axle shafts and drive sprockets to the creeper track.

Powerplant in Rear

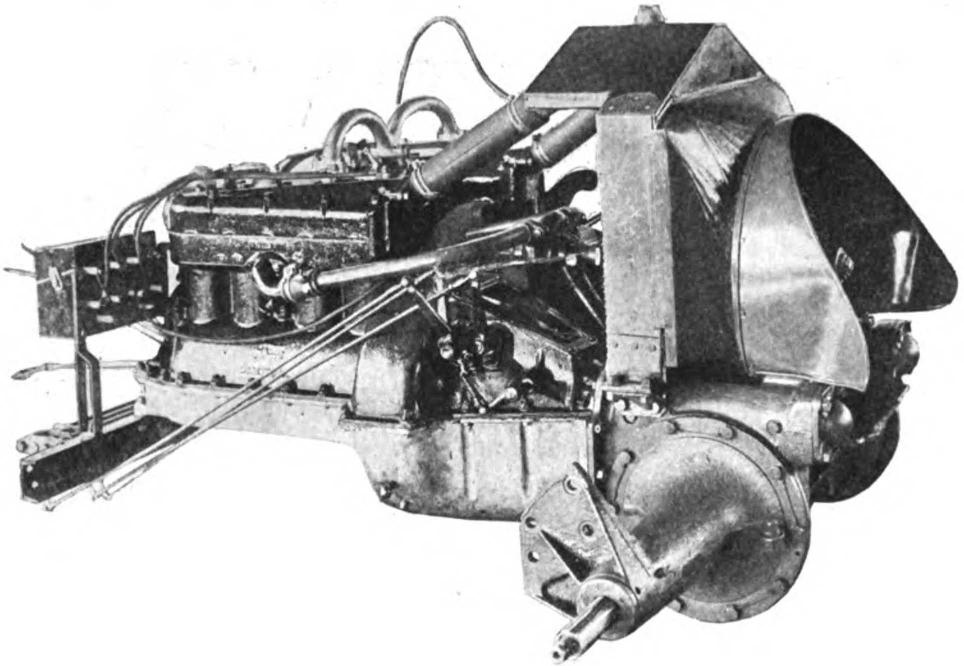
The powerplant is located in the rear, and the operator and gunner are in the forward end of the tractor, the gunner's position being at the left of the driver. The entire tractor is enclosed in armor plate, which varies in thickness from ¼ to ½ inch, this being sufficient to withstand machine gun and rifle fire.

Each engine delivers its power through a conventional multiple disk clutch, in a unit with and directly behind the planetary transmission, to the worm gear, and thence through a transverse shaft, on the outer end of which is mounted the sprocket that imparts the drive to the track itself. Releasing either clutch makes the track on that side of the tractor inoperative and the track on the other side operates to turn the tractor in a circle. If a shorter turning circle is desired, one track may be operated at low speed by manipulation of the planetary transmission.

Track Operation

Track operation is effected by large driving sprockets actuated by the worm gears within the body of the tractor. These driving sprockets are at the rear end of the tractor. At the forward end there are blank or idler sprockets of larger diameter than the driving sprockets, the only functions of these being to guide the track and to regulate its tension. There are two track-supporting rollers mounted above a semi-elliptic spring bracketed to the outside of the tractor armor, which carry the weight of the upper part of the track. The tractor has a nominal forward speed of between 10 and 12 m.p.h., and as a result of its great gear reduction and the peculiarities of its track-laying propulsion, is capable of obtaining traction up to any tractive angle and over ground unusually difficult, such as would be found in territory marked by shell craters.

The armor plate forms the body structure as well, there being no frame. The armor has continuous riveted steel joints, except the rear end, which is bolted so that it can be removed to give access to the powerplant.



Assembly view of powerplant, showing radiator over rear axle

Quarter-inch steel plate forms the floor of the body. The rear axle is bolted to the sides of the tractor at the extreme rear, the housings of the two worm gears hanging through openings in the floor. To the lower corners of each side of the tractor is fastened the light armor plate structure inclosing the track roller assembly, which includes the track chain and a built-up inverted U-beam in which the track roller mechanism is carried.

The powerplant is bolted directly to the rear axle housing, through the medium of flanges near the ends. The front end of the powerplant rests at two points on the U-beam that carries the control-lever assembly, which in turn is bracketed to the side of the armor plate.

The engine cylinders are block cast, and are of the L-head type, with the cylinder heads removable. The cylinders have a bore of 3¾ in. and a stroke of 4 in., the engine developing 34 hp. at 1700 r.p.m. The firing order is 1-7-2-5-4-6-3-8, No. 1 cylinder being the cylinder nearest the coil box on the right-hand side of the powerplant, looking from the rear of the tractor, and the opposite block numbering 5-6-7-8, No. 5 being opposite No. 1.

Each crankcase is a single casting of aluminum, with the oil base or sump integral. With this type of construction it is necessary to remove the entire powerplant from the tractor if the crankcase is to be removed or internal adjustments are to be made. The camshafts are gear-driven from the crankshafts. The magneto is a special Ford design, built in and made a part of the flywheel.

The fuel supply to the Kingston carbureter is by gravity. Lubrication is by splash, with gravity circulation, no oil pump being required. A brass tube running from the flywheel to the timing gear housing supplies oil for the timing gears and crankcase. The oil is collected by the funnel end of the tube, and, as the timing-gear housing end is lower than the flywheel housing end, it flows in the direction of the former.

Cooling water is circulated by a centrifugal pump which is driven by the same shaft as the fan, the pump being mounted between the two cylinder blocks. Both the pump and the fan are positively driven through a train of gears off the idler gear interposed between the two flywheels.

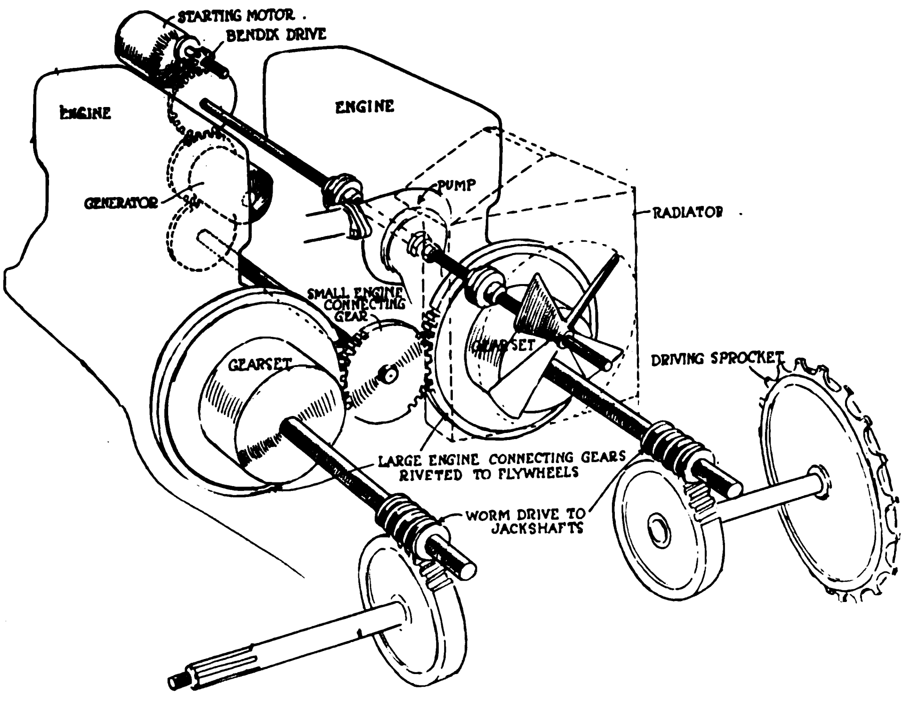
The cylinders are block cast, with integral waterjackets. Each block is drained separately by means of a petcock at the lowest point on the pipes leading from the pump to the cylinder blocks.

The pistons are of gray iron and have three rings each—two above the piston pin and one below.

The piston rings, of which there are three to a cylinder, are of the miter-cut type. All three are tapered from top to bottom; that is, the upper side is slightly smaller than the bottom. This provides a scraping edge to the lower side and prevents an excess of oil passing the piston and reaching the combustion chamber.

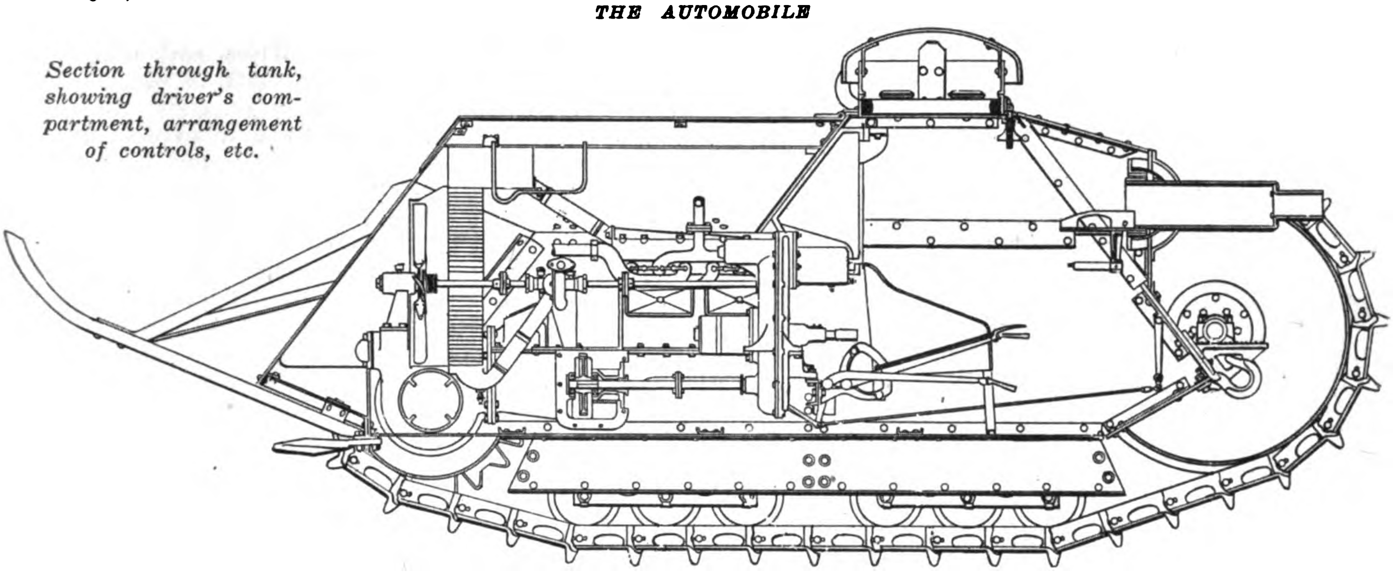
The piston pins are solidly clamped in the upper end of the connecting-rods, and oscillate within the bushings in the piston bosses. The piston pin is made of steel tubing, ground to size and case-hardened, and is ¾ in. in diameter.

The connecting-rods are of H-section, and measure 9.25 in. from center to center. The material is vanadium steel, drop forged. The large end of the connecting-rod has a poured babbitt bearing. The bearing cap is retained by two bolts with castellated nuts and cotter pins. Adjustment for wear can be made by filing off the sides of the bearing cap.



Sketch showing interconnection of engines and drive to rear axle

Section through tank, showing driver's compartment, arrangement of controls, etc.



The crankshaft is a drop forging, and is mounted in three babbitt bearings. The rear end is flanged to receive the flywheel, which is secured thereto by four cap screws. The front end of the crankshaft is key-seated for a Woodruff key, securing the crankshaft gear. Two oppositely located dowel pins in the flywheel mounting flange prevent the shearing of the flywheel cap screws. The flywheel also serves as the magneto magnet assembly support.

The crankcase is a one-piece aluminum casting. There is a passageway between the two crankcases at the flywheel end, which houses the idler gear between the two engines. A web cast in the left crankcase (looking from the flywheel end) prevents the idler gear (which turns clockwise) from pumping the oil out of the right-hand crankcase. Behind the idler gear is an unobstructed channel which serves to maintain an equal oil level in both crankcases.

The halves of the housing for the flywheel idler are held together by seven bolts with cotter-pinned, castellated nuts, six of these being accessible from the outside of the case, while one of the nuts is inside, directly over the gear. In addition, a cap plate, secured by six cap screws, locks the two crankcases together at the rear. The front ends of the two cases are secured in alignment by the aluminum housing for the train of gears that furnish power for the fan, water pump, generator and starter drive, and also by four bolts to the U-beam carrying the control assembly.

Camshaft Bearings

The camshaft has three bearings, all different in kind. The rear one is bronze-bushed, the center one of cast iron, unlined, and the front one babbitted. In assembling the rear bearing is pressed into position and reamed. The front and center bearings are reamed to size and placed on the camshaft before the latter is inserted. Two set screws screwed into the block from the outside hold the front and center bearings from revolving.

There are three manifolds, two exhaust and one inlet. The inlet manifold is cast in three sections, the center section serving as a support for the carbureter and connecting same to the other two sections which are mounted on the respective cylinder blocks.

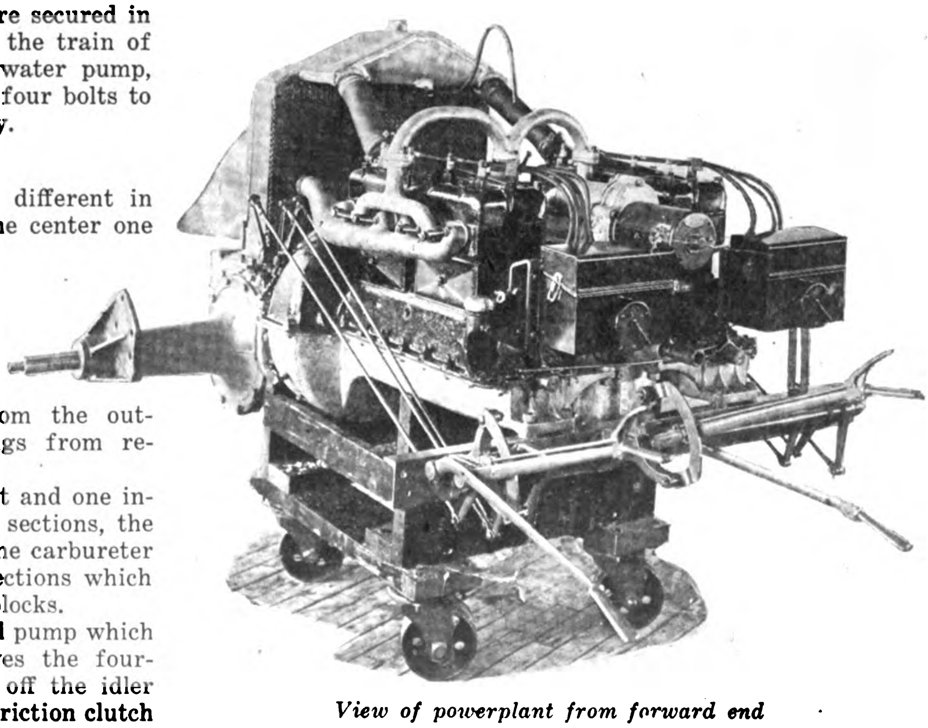
The water is circulated by a centrifugal pump which is driven by the same shaft that drives the four-bladed fan, from the gear train driven off the idler gear. As in all positively driven fans, a friction clutch is inserted in the drive to prevent injury to the fan by sudden fluctuations in engine speed. The fan is lubricated by means of a grease cup mounted on the bearing at the extreme end of the shaft. This cup must be turned down daily.

Radiator

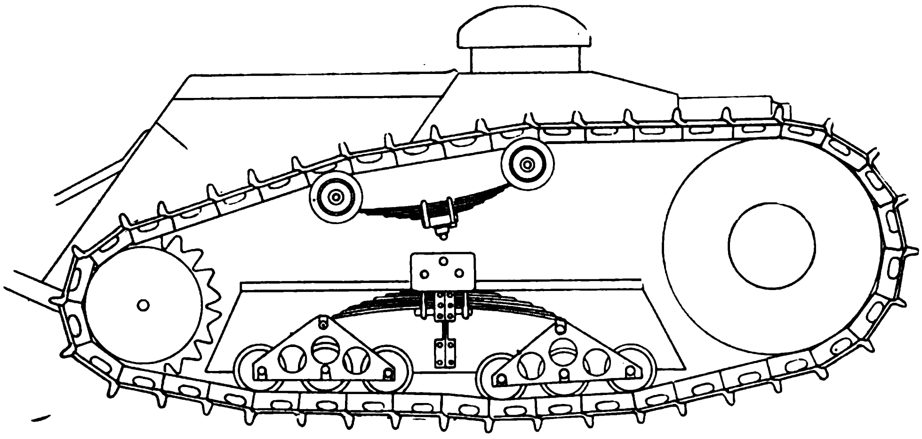
The radiator is a specially built honeycomb type, and is mounted at the rear of the tractor. The fan is located on the side of the radiator, and away from the engines, there being a cored passage through the center of the radiator through which the fan shaft extends. The radiator is mounted upon the rear axle housing, which has fins bolted to it that act as supports. The air for cooling is drawn upward from the lower rear part of the tractor body through a screen, and a housing surrounding the fan is so constructed as to aid in deflecting the air through the radiator core.

Fuel System

The main fuel supply tank is mounted in the top of the body, just back of and above the driver's seat. From this tank, which has a capacity of 15 gal., the fuel flows



View of powerplant from forward end



Side view of tank, showing spring mounting

by gravity to the carbureter. The fuel tank is of galvanized steel and is protected by armor plate. Between the armor plate and the tank proper there is a felt lining. The armor plate is spot welded together, being made up of several pieces to fit the irregular shape of the tank, which conforms to the outline of the interior of the tractor. The tank and its armor are a unit, which is mounted by two brackets on the armor-plate body. A Donaldson air cleaner is employed.

The 3-ton tractor magneto is of special design, although similar to the regular Ford type. Its magnets are fastened to the flywheel, and the stationary field coils are attached to the cylinder block.

The two 3-ton tractor clutches are of the multiple steel disk type, operating in oil. The interior of the brake drum serves as a support and housing for the steel disks, of which there are twenty-five, twelve driving and thirteen driven.

On the transmission gear shaft is keyed the transmission clutch disk drum, which is machined to receive the lugs of the small or driving disks. The interior of the brake drum is machined to admit the large or driven disks.

The 3-ton tractor final drive is composed of two distinct worm drives, each operating its own axle shaft, to which is attached the drive sprocket. The worm gears are of bronze and are bolted to a steel spider which is supported by the axle shafts, which are carried by roller bearings revolving within a steel sleeve at the outer and inner ends of the axle housing.

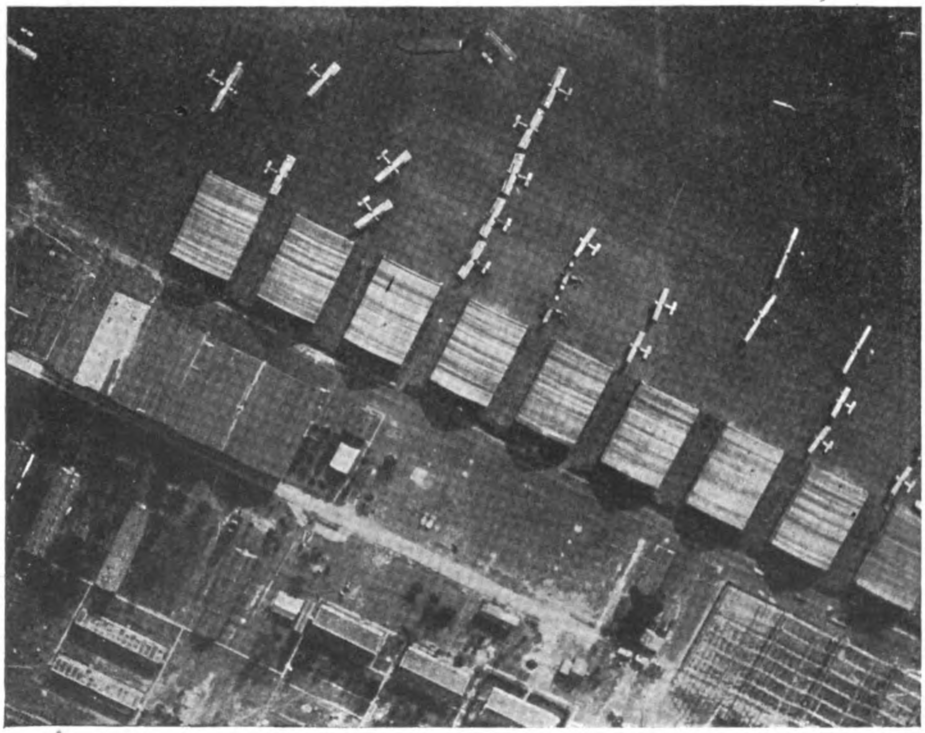
The worm is assembled with 0.010 to 0.015 in. end play and the bearings of the worm must not exceed 1.499 in. nor be less than 1.493 in. Axle shaft bearings should not exceed 1.623 in. nor be less than 1.615. The ratio of the final drive to the engine is 7¼ to 1.

The tracks of the 3-ton tractor form an endless steel roadway over which the tractor travels. They are composed of cast-steel links held together by steel pins. The track pin is held in place by a track-pin keeper—a steel pin similar to the ordinary cotter pin, only larger.

The weight of each track is 390 lb., and the length, when spread out, is 320 in., there being forty links to each track and each link being 8 in. in width.

Standardizing German Engineering Products

THE movement for standardizing German engineering products is making steady progress. Recently at Vienna, at the instigation of the Society of Engineers and the Ministers of War and Public Works, a committee was formed to carry out the proposed regulations in the several branches of engineering. The sub-committees appointed to deal with tools, screws, pipes, ball-bearings, bolts, and gear teeth have held numerous meetings, and have reached conclusions with regard to those objects of engineering manufacture. Locomotive construction is now under consideration. The scope of the standardizing movement is being extended to canal structures and to shipbuilding. The advantages of an all-round standardizing of engineering products have been made impressively evident by the war conditions through which European industries have passed.



American Flying Field in France

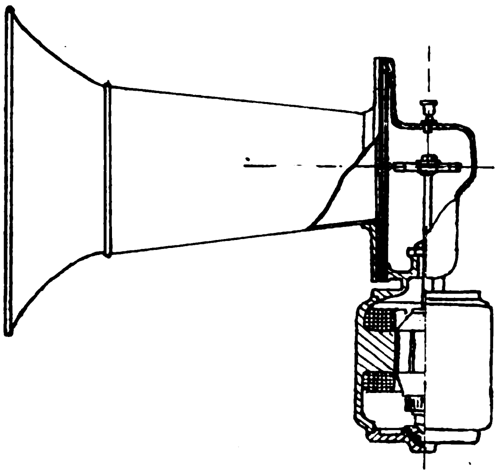
A most unusual and striking aerial picture taken in the Argonne forest just previous to the armistice. It shows a large American aviation camp with machines ready to fly. This picture has naturally been held up by the French and U. S. censors and was released only recently

Electrical and Mechanical Warning Signals for Automobiles

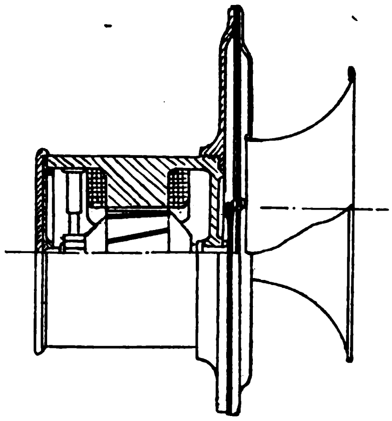
Principles Involved in the Operation of Diaphragm Signals—Relative Advantages of the Electric Motor Horn, the Electric Vibrator Horn and the Hand Operated Horn—Variety in Mechanism of Hand Horns

By Fred I. Hofman

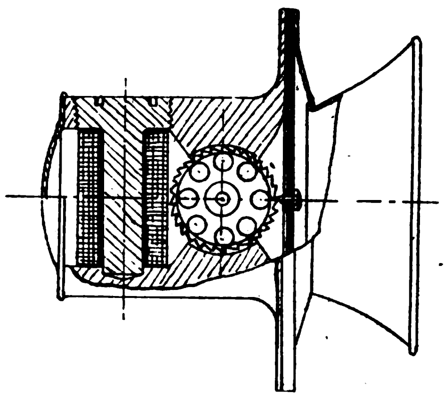
THE number of warning and signalling devices indicating the approach of vehicles driven by motive power has greatly increased in the last few years, and though the electrically operated instrument is the predominant one at the present time, still there are a few designs actuated by manual power. The reason why electrical devices are favored lies probably in the simplicity of their operation, for the actuation involves merely the pressing of a button switch on the steering wheel or some place near it. The greater attention required by this type of horn brought, however, a mechanical contrivance on the market with sound-producing qualities not unlike those of its electrical rival, and, considering both price and neatness, it certainly has become a very strong competitor to it. The popularity of the former pattern is no doubt due to the very excellent construction of the small driving motors used in the one class of electrically driven signals and the well-made magnetic vibrator parts embodied in the second. The current for operating same is now easily obtainable from every automobile, and this combined with its steadiness is probably another reason for its popularity. Taking, however, all at its face value, the real advantage is that one is able to alter the duration of the sound at will, and this so far cannot be said of any other mechanically worked horn.



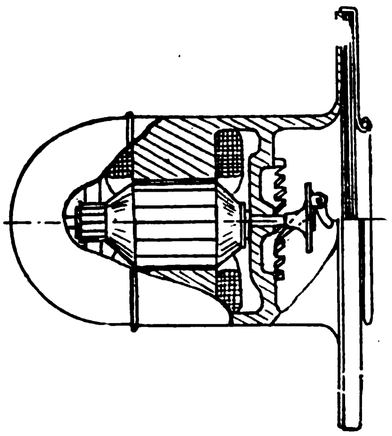
Horizontal ratchet wheel



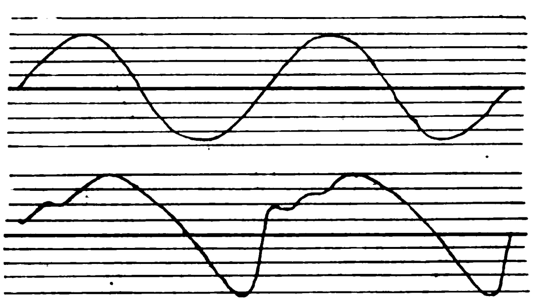
Vertical ratchet wheel



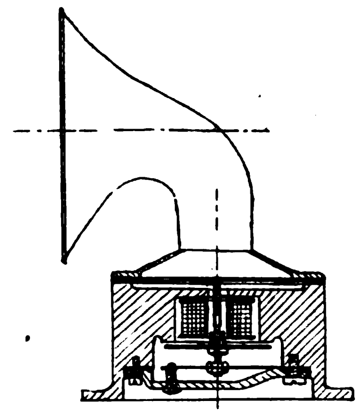
Armature periphery ratchet



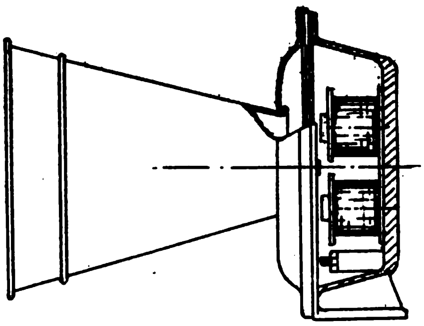
Stationary ratchet, indirect actuating hammer



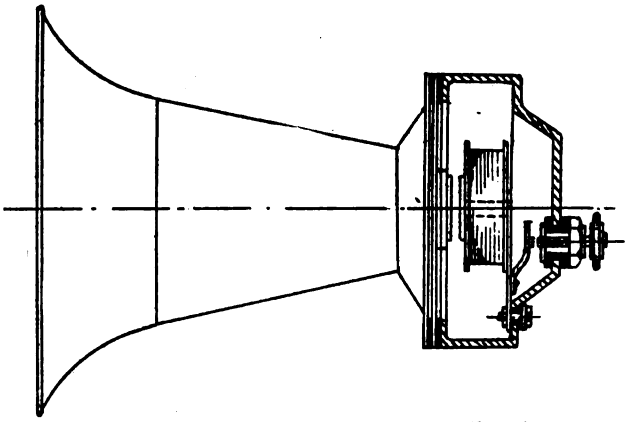
Above: Harmonic note, curve of tuning fork. Below: Curve of vibrator horn, showing chattering or contact blade and sudden acceleration due to magnetic pull



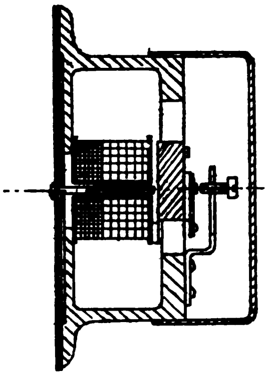
Single casting solenoid vibrator horn



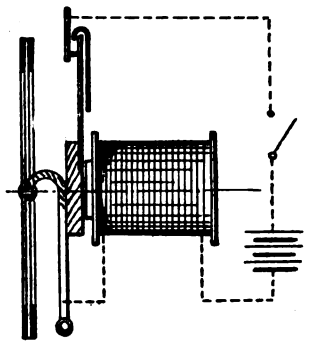
Type of horn with combined armature and diaphragm



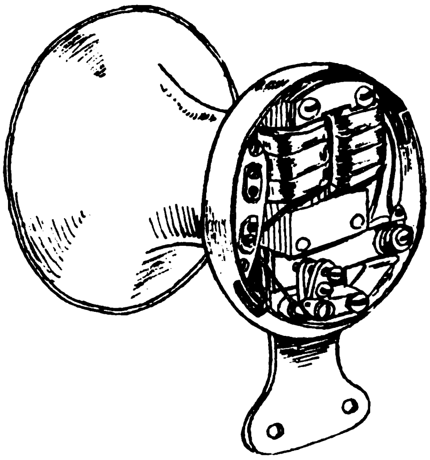
Type of horn with suspended and vibrating magnet



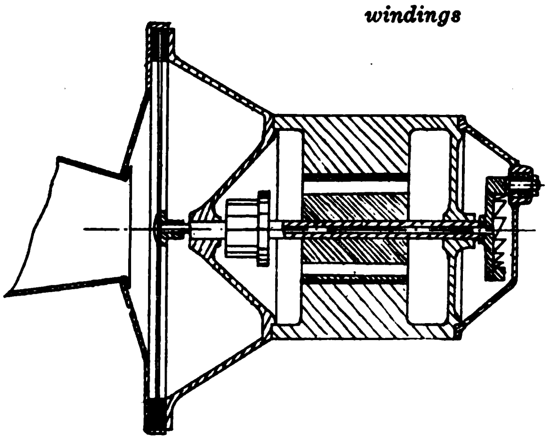
Double-tone, otherwise standard design vibrator horn. Note the two windings



Type having swivel and attached armature



Transformer-coil-shaped vibrator pattern

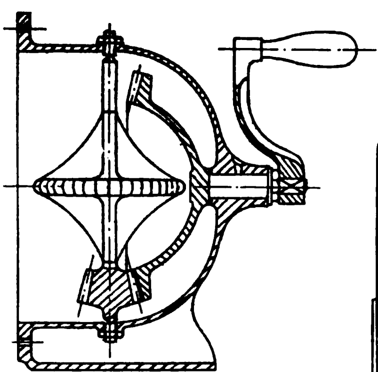


Motor horn giving warning note similar to that of vibrator horn

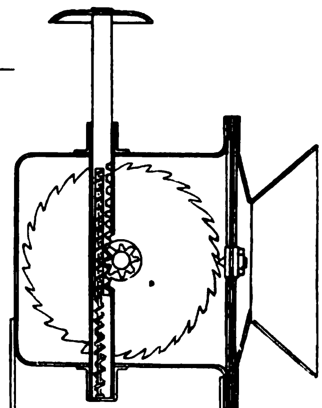
Warning signals of the electrical type can be subdivided into those that produce vibrations of the diaphragms (a) by a deflecting knock and (b) by a direct oscillatory movement similar to that of a hammer blow. The first named designs are the motor-driven variety and are all alike as regards the main principles involved. They comprise a small motor which is always series-wound on account of the greater tongue of this type, and sometimes works in a field with one or two coils and at other times in a field with permanent magnets similar to those of a magneto. The electromagnet pattern is, however, preferred, as it makes it possible to have a practically closed field case of so-called "ironclad" form and thus save a separate frame or supporting body, which the latter type requires. The armatures of these small motors are built up with from 3 to 12 sections or coils. The spindles run in ball bearings or have hardened and pointed ends revolving on recessed and adjustable screws. The sound actuating part consists in most patterns of a ratchet-like wheel which is fitted on one end of the spindle, or direct on the armature surface. There is, however, one make which is designed to transmit the knocks indirectly through a small governor-like weight agitated by a stationary ratchet.

The principle on which the ordinary electric or vibrating pattern horn is based is the same as that of the familiar electric house bell. The constructions differ only in the manner in which the magnetic systems are arranged. The coils are fixed or suspended and may be either single or double. Only the cheapest grades are built with a cast-iron solenoid. Most of the makes employ a continuous coil winding, but there are in one or two designs circuits with different resistances, so as to break the note and thereby enable the pitch to be altered. The oscillation of the discs is obtained also through quite a number of methods other than those specified above, and some of these are shown in the accompanying sections.

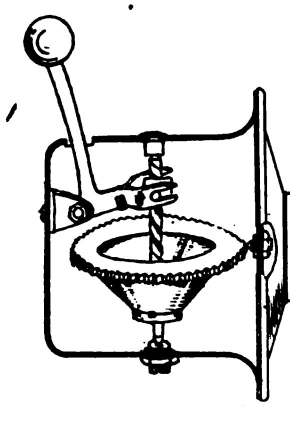
Every maker pins his faith on his own design, claiming it to be the best on the market. Volume of sound, current consumption, simplicity, efficiency and dur-



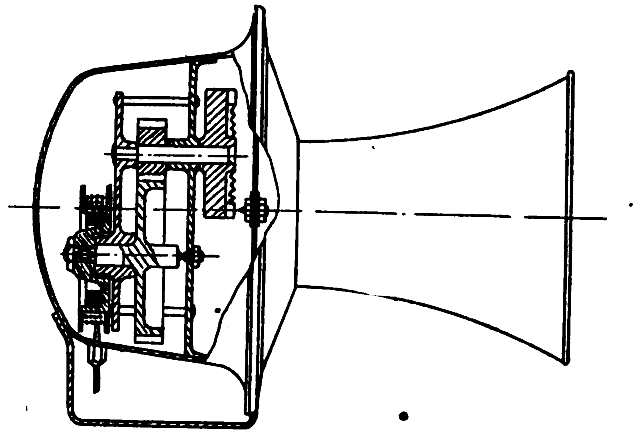
This mechanical horn employs no freewheel clutch and can be moved both ways, left and right. The sound can be prolonged at will of operator. Note the pivot bearings of the wheel shaft



The plunger when depressed sets the small gear and ratchet in motion, and consequently the toothed flywheel, which in its turn knocks on the anvil of the diaphragm



This design contains no gears. The bell crank when moved forward by the operator acts through a pawl clutch on a screw collar on a vertical rod having a very steep thread. The actuator, being solid with the screw, moves direct



The impetus given to the serrated driver wheel is obtained by the pull of a spring-operated pulley and cable, and through a double gearing. The spring is of the clock type and located inside the pulley for the cable

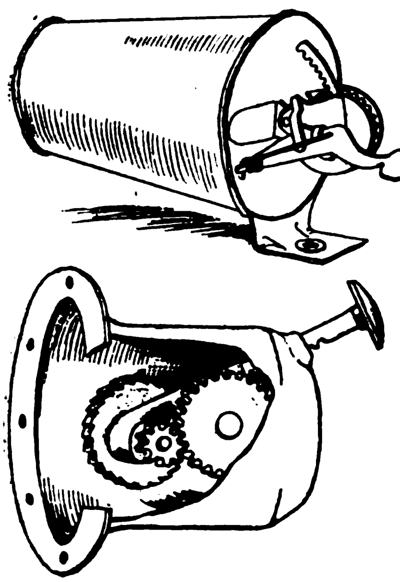
ability are factors for consideration when judging the value of the separate designs.

It is well known that one of the major troubles in connection with motor driven horns is the brushgear and in the vibratory magnetic pattern the pitting and sparking of the contact points. Brush trouble is difficult to entirely overcome, whereas sparking of the blades in the vibrator type can easily be remedied by shunting across a candenser. So far sparking has been obliterated by this method in only a few makes.

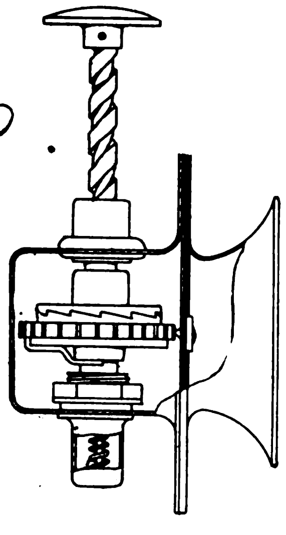
There exists still another pattern of horn, and that is the type in which the vibrator points against the diaphragm are oscillated by a motor. This, therefore, makes use of both the principles in question.

The diaphragms of most warning signals consist of hardened steel plate, often heat treated or also hammered to give stability, 4-5 in. in diameter and fitted with a cork or thick paper ring on the periphery in order to insulate it from the instrument box on one side and the conically shaped metallic projector trumpet on the other. A resilient partition layer is made use of so as not to impede or deaden the resonant sound by a direct contact with the steel surface of the body proper. The thickness of the diaphragm varies from one to two hundredths of an inch and is greater for hand than for electric horns. The note produced by the blows is dependent upon the relative thickness of the disc as compared with its diameter. The thicker the metal the higher the pitch; or with a given thickness of metal, the smaller the diameter of the diaphragm, the higher the pitch produced. With the stiffer diaphragm, however, the horn is rather more likely to become inoperative through sticking, and this should be taken into consideration when a tendency to produce a higher tone than normal is observed.

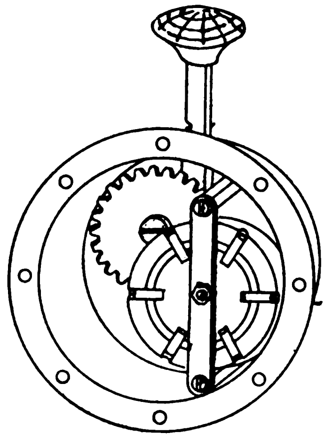
The purely mechanical type of horn, being perfectly enclosed, not prone to get out of order and easily adjusted from outside by simply advancing the anvil on the diaphragm, is very seldom interfered with or opened. To the man in the street, this design looks more like a box of tricks than any other instrument on the automobile and it should be worth while to describe the different constructions and details employed



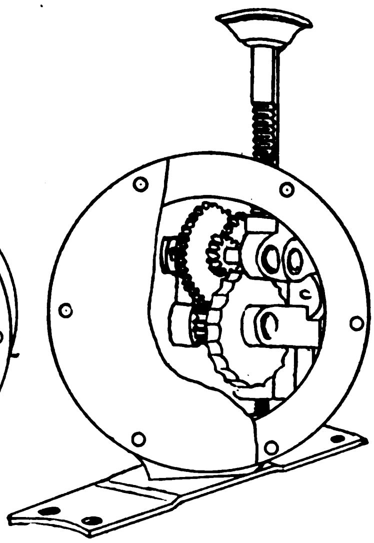
Above: The press-down lever, to which is attached a rack, engages with a pinion on the gear. Below: The mechanism in this type contains a double speeding-up gearset and circular plunger cut on one side with teeth



The threaded handle of this horn engages a ratchet clutch, and when pressed down turns the special tooth rotator, which displaces the sounding shield



In this horn, which embodies also a double train of wheels, the sounding is produced by small hardened rollers



This road clearer is the only design using a triple set of gears. The final speed of the flywheel being very great, gives a long sound

for obtaining the warning sound. It may be mentioned that in general the note is practically the same on all horns and never differs to a great extent.

The movement of the inner sound producing mechanism of these horns is brought into action in different ways by a vertical, oblique, horizontal or rotary thrust from outside. The pressure exerted on the plunger or lever of some construction is then transmitted either directly through a train of gearing to a disc. This disc, with its hardened and ground teeth, is knocking continuously on the hardened pin of the diaphragm while in motion. The gears used in the horns are of 32 or 24 diametral pitch and of steel. The spindles are of the plain pattern running on hardened steel brushes, less often on centers. Those designs using a geared-up movement have the whole of it fitted in a die-cast frame, whereas the single designs often make use of the steel outer casing as bearing support. The speeded up pattern horn is, of course, a more rugged and reliable job, but the one gear type is simpler, less liable to get out of order and cheaper to manufacture.

The amount of ingenuity displayed by the manufacturers in producing warning signals of both the electrical and mechanical type is astonishing and this will be best appreciated by studying the constructions of some of the leading and best advertised makes fully described in this article.

Four-Inch Guns Mounted on Motor Truck

By W. F. Bradley

THE biggest gun carried on and fired from an automobile chassis is an Italian weapon built by the Ansaldo company on a special truck chassis manufactured by the S. P. A. Co., Turin, Italy. This automobile gun was brought out soon after Italy entered the war, and has been made use of with very satisfactory results throughout the operations against Austria.

The gun is of 102 mm. bore (practically 4 in.) and fires 17 rounds a minute, with a range of 11 miles. The chassis follows standard lines of construction, and except for heavier frame members and a set of quick-acting jacks does not differ very much from the ordinary 4-ton truck built by the S. P. A. company.

The motor is a four-cylinder monobloc casting of 100 by 200 mm. (3.9 by 7.8 in.) bore and stroke. In accordance with the usual S. P. A. design, the water pump is inside the cylinder casting, instead of being a separate housing. As the cylinders have both an intake and exhaust manifold cast integrally, with valve stems inclosed, the appearance is remarkably clean. The drive is taken through a disk clutch, a four speed and reverse transmission, with final drive by side chains in metal housings. The wheels are cast steel, shod with single and dual solid rubber tires of Goodrich make.

The gun is mounted on the truck platform, back of the driver's seat, and when not in use is carried with its muzzle pointing forward between the driver and the mechanic. As the barrel of the gun is of considerable length, its mouth is practically flush with the radiator cap.

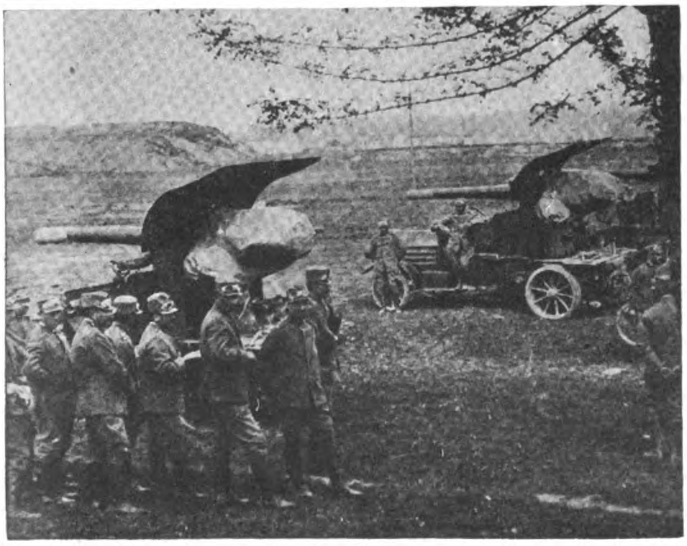
Being mounted on a pivoted platform permanently attached to the chassis, the gun can be swung in any direction when going into action, and is only placed in the pointing forward position when on the road. This position, incidentally, gives the best distribution of weight.

Under the frame members of the chassis are two quick-acting screw jacks, which are made use of to raise the chassis so that all load is taken off the springs when the gun goes into action.

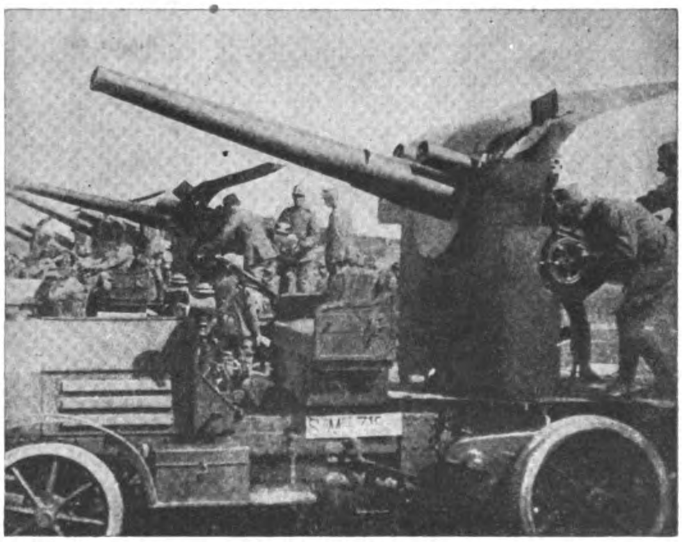
Protection is provided for the motor by means of 8 mm. chrome nickel steel armor plating in the form of a hood. Ample louvres are provided on front and side to assure a cooling draft of air. There is a gunner's shield, but no protection for the drivers. The vehicle is practically fireproof, for no wood whatsoever is used in its construction; the dashboard is metal and the wheels, as already stated, are cast steel. The gasoline tank is under pressure, so that in case of its being punctured or the line broken the fuel cannot flow to the exhaust pipe or other hot parts of the car.

The 102 mm. automobile artillery is formed into batteries with four guns to a battery, the whole being served by automobile transportation. In addition to the four gun cars there are twenty other vehicles, comprising telephone and signal car, mechanical workshop, and munition cars, all of them being of the one type. The commanding officer has a car and is attended by two motorcycle dispatch riders.

The entire battery of four guns and 20 supply cars is automobile mounted, and the automobiles are all of one type. This simplifies the work of maintenance and enormously reduces the quantity of spare parts to be carried. Every car in the battery has armor plated hoods, and in addition the ammunition cars have armor plated bodies. Each ammunition car carries the two drivers and four men seated on a broad seat at the rear.



Italian 4-in. motor artillery



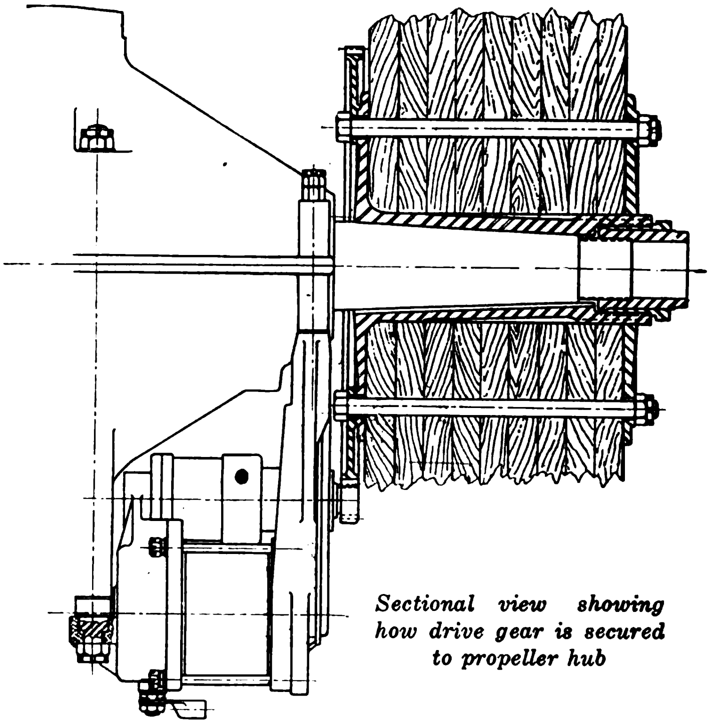
Sighting the motor-mounted gun

Bijur Starters for Seaplanes and Blimps

Fitted to Liberty Engines at Propeller End and Crank Engine Through a Double Reduction Gear with Bijur Automatic Screw Shift

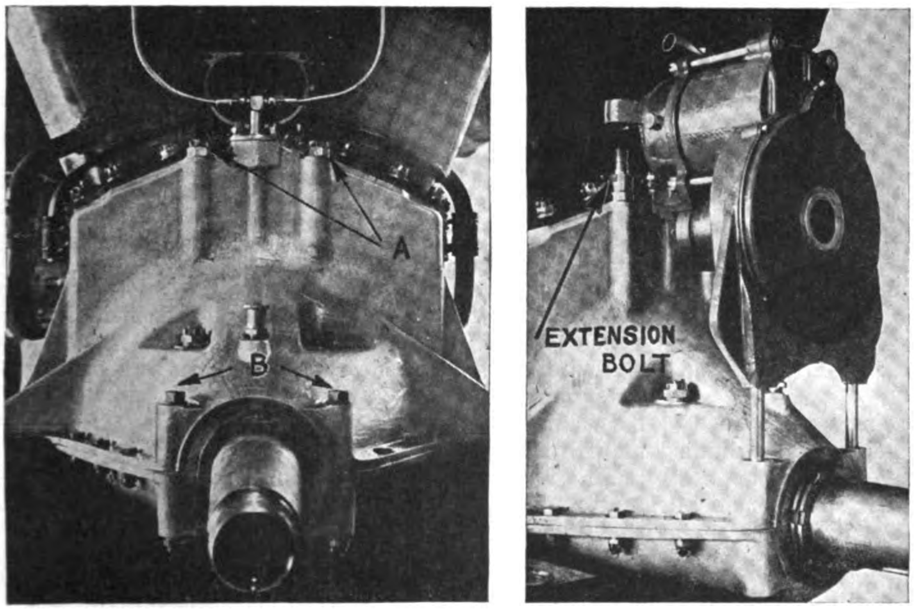
AMONG the war-time developments in the automotive field regarding which nothing has hitherto been published are the electric starters built by the Bijur Motor Appliance Company for the Liberty and other aeronautical engines, and supplied in some quantity to the Navy. Until recently there has been a federal injunction in force prohibiting the disclosure of this device without permission of the Secretary of War or of the Navy, but this has lately been vacated.

As will be noted from the accompanying illustrations, this device embodies several interesting features. The mechanism consists of a relatively small electric motor, of special design, fitted with a double gear reduction and a special form of the Bijur automatic shift. This mounts directly on the crankcase at the propeller end of the production Liberty engine, without the use of intermediate brackets and without making necessary any alteration to the engine. To mount the Bijur starter on the Liberty engine, two nuts at the base of the cylinders nearest the propeller end (marked A in illustration) are removed and special extension studs are screwed on. Two lugs on the starting motor casing fit over these and are retained by the original engine nuts, which are put on the extension studs. The two end bearing bolts at the extreme propeller end of the engine crankcase (marked B in illustration) are removed and are replaced by two long studs which project from the starter housing.



Sectional view showing how drive gear is secured to propeller hub

Normally there is no connection between the starting motor and the crankshaft. A gear ring is placed inside the propeller hub flange and held by the regular propeller bolts passing through holes jig-drilled for the purpose. The pinion of the starting motor is normally retained within the housing. When the starting switch is depressed the pinion meshes with the teeth of the gear ring and cranks the engine. The starting of the engine under its own power automatically unmeshes the pinion. Provision is made against the possibility of the teeth jamming, and they will not mesh with the gear ring if the switch is depressed while the engine is running. The use of an eight-tooth pinion is something of an innovation and makes possible a high gear reduction.



Bijur starter mounted on Liberty aircraft engine

The Bijur Liberty starter was originally designed for the Navy for use especially on seaplanes. At the suggestion of the Airplane Engineering Department of the Signal Corps the design was made such as to obtain a starter of minimum weight and current consumption combined with a maximum of cranking power. It was thought that this requirement would, of necessity, entail cutting down the cranking speed to a very low value, but this was found not to be the case. The success of the design as produced will be evident from the following data:

Weight of starting motor, 20.5 lb.

Normal cranking current, 100 amp. (12-volt battery).

Maximum torque available on engine crankshaft, 1300 lb.-ft.

Normal cranking speed (crankshaft), 40-50 r.p.m.

The reason for choosing the propeller end of the engine on which to apply the starter was that it makes possible the use of a simple and sturdy form of drive without clutches or couplings. It also makes use of space not available for other purposes.

Organization and Work of the Motor Transport Corps

¶ In Complete Control of All Vehicles Used by the A. E. F.—Maintenance Problems Aggravated by Number of Different Makes—Had to Provide 3000 Parts for Each New Vehicle Put in Service—Trucks Delivered Overland an Average of 380 Miles.

By W. F. Bradley
AUTOMOTIVE INDUSTRIES' *European Correspondent*

HAD America been a professional fighting nation, with every detail of its army organization perfected in theory and in practice, the task of providing automobile transportation for an expeditionary force of more than 2,000,000 men would have been a man-sized job.

But when Uncle Sam rolled up his sleeves his entire knowledge of automobile transportation under war conditions had been gained on the Mexican border and from very meagre official reports from Europe. The very little motor transportation he possessed was in the hands of the Quartermaster Corps and was altogether inadequate for a great European war.

When that steady stream of traffic began to flow across the Atlantic every individual organization fought for shipping space, and the most powerful got it. The automobile service being technically non-combatant and influentially weak, got squeezed out until the more powerful army organizations in France began to realize that by leaving the automobile service in the rear they had been abandoning their most valuable ally.

Thus, while automobile men in America were laying wonderful plans for standardized trucks, the automobile men in France were scouring the country for anything which had wheels and burned gasoline. They found these cars and trucks in France, in Italy, in England, in Spain, and even got some "orphans" born in Germany and Holland.

So, while it can be considered a man-size job to run an automobile service for a two-and-a-half-million army, when the organization is perfect and the supplies are regular, it has to be admitted that it adds considerably to the complexity of the task when it is necessary to organize a service and run it at the same time, when the main source of supply is 4000 miles away and unprepared, when the lines of communication are open to attack, and when the unsatisfactory expedient of begging vehicles from whatever European factory can furnish them has to be indulged in.

Total Vehicles in Use by the A.E.F. on Dec. 15, 1918*

Passenger Cars	7,575
Motor Trucks	32,500
Trailers	4,300
Motorcycles	18,000
Bicycles	19,000
Total Vehicles	81,375
Makes of passenger cars—	
Foreign	51
American	26
Total different makes	77
Makes of motorcycles—	
Foreign	5
American	3
Total different makes	8
Makes of American trucks—	
1½-ton	23
3-ton	21
6-ton	5
Total different makes	49
Makes of trailers—	
Foreign	34
American	20
Total different makes	54

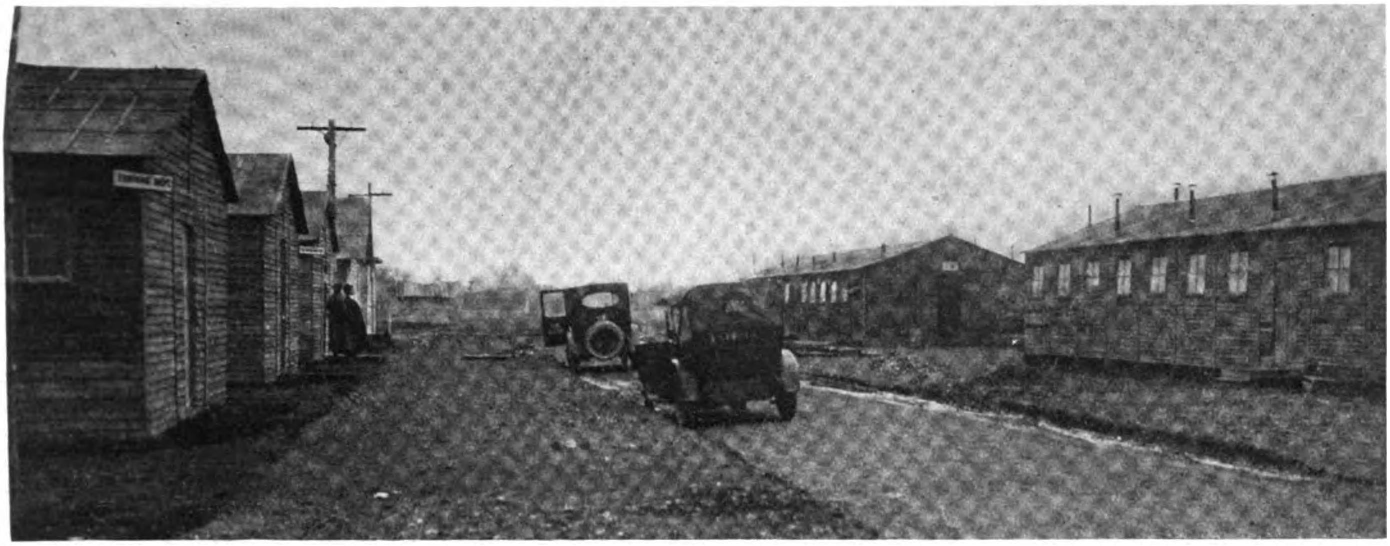
**The figures given in this table were obtained by W. F. Bradley from the Director of Motor Transport Corps, Overseas Division, and are official.*—EDITOR.

It was about a year ago that the army automobile service was taken out of the hands of the Quartermaster and vested in the Motor Transport Service, later, and at present, known as the Motor Transport Corps.

Boiled down and stripped of its legal and military phraseology, the general order which brought this change into effect gave the M. T. C. complete control over all motor vehicles in the Service of Supply of the American Expeditionary Forces and entrusted it with technical supervision over motor transportation in the zone of advance.

The organization is distinctive, differing entirely from that of the French Army and only corresponding in a general sort of way with that of England. The Overseas Division of the Motor Transport Corps has at its head Brigadier-General M. L. Walker, with headquarters of the corps in the town of Tours, less than half way up the main line of communication.

To give an idea of the size and importance of the Motor Transport Corps, it is only necessary to state that it has under its control about 81,000 vehicles, composed of 7575 passenger cars, 32,500 trucks, 18,000 motorcycles, about 4300 trailers and 19,000 bicycles. These, together with the stock of spare parts, tools and machinery which were in hand at the date of the armistice,



This "Western" town was built by the Motor Transport Corps in France. These are barracks and offices for men. One sees such groups of buildings every 5 *or* 6 *miles along the lines of communication*

represent a value of not less than $175,000,000. At the same date, the number of enlisted men in the Motor Transport Corps of the entire A. E. F. was 20,392, and the number of officers, 1032.

The Motor Transport Corps has charge of all the automobile transportation of the American Expeditionary Forces. In the early days, some of the corps had their own transportation. The most conspicuous example was the Aviation Section of the Signal Corps, which got together quite an important fleet of automobiles before the present M. T. C. came into existence.

It was felt that there should be an automobile service for the entire army, and not a separate service for each corps. The pooling of the automobiles met with a considerable amount of criticism, particularly from those services which had got automobile transportation together before the M. T. C. was formed.

This system of pooling is undoubtedly the most economical in the long run, for it simplifies supply and maintenance, and puts vehicles in service just where they are wanted. With divided control one set of vehicles may be idle or only partially employed, while a neighboring set is overworked or so inadequate in numbers that the efficiency of the whole army is impaired.

This system of pooling has been developed to an even greater degree in the French Army than in the American Forces, notwithstanding the fact that the French run a practically independent motor transport corps for aviation and artillery.

The work of the Motor Transport Corps was rendered difficult by reason of conditions for which the nature of the war alone was responsible. Troops and primary necessities were brought over faster than automobiles and automobile supplies, with the result that the first American forces to land in France went out and bought whatever happened to be available.

For any organization whose work was held up for lack of trucks and cars it was the most natural thing in

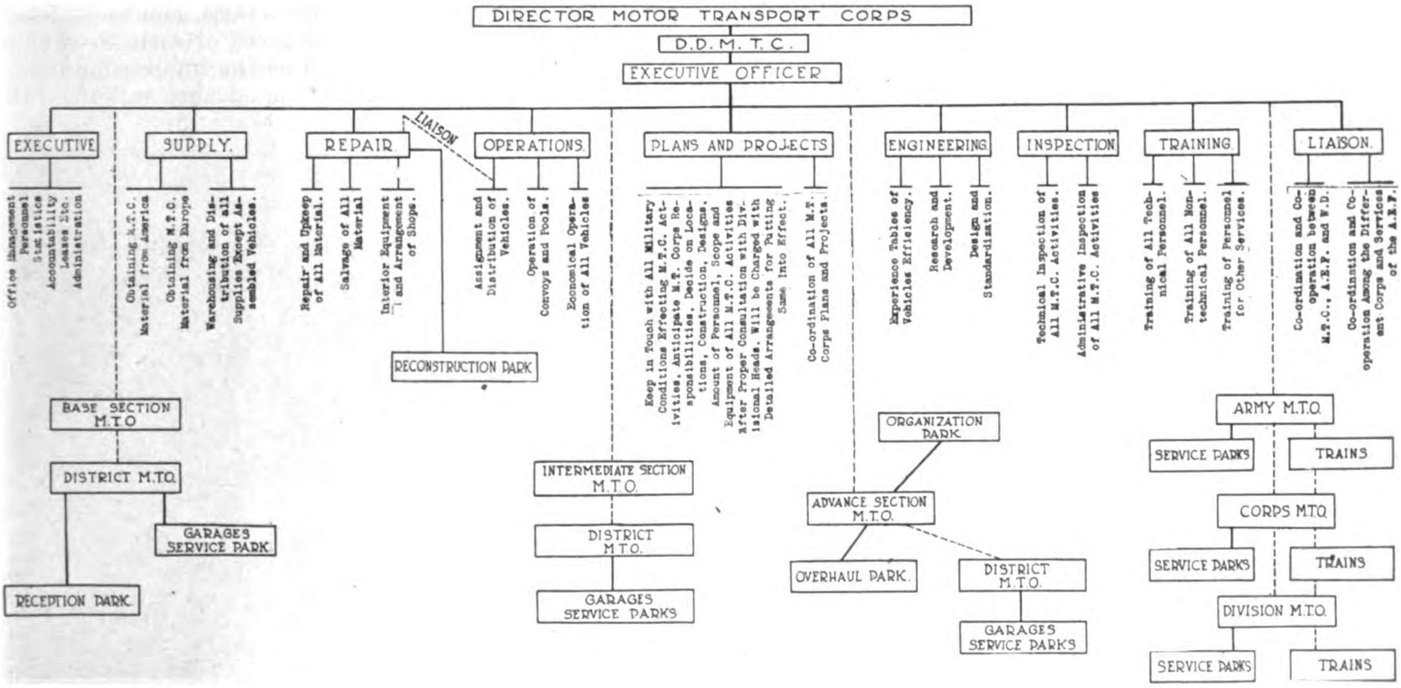
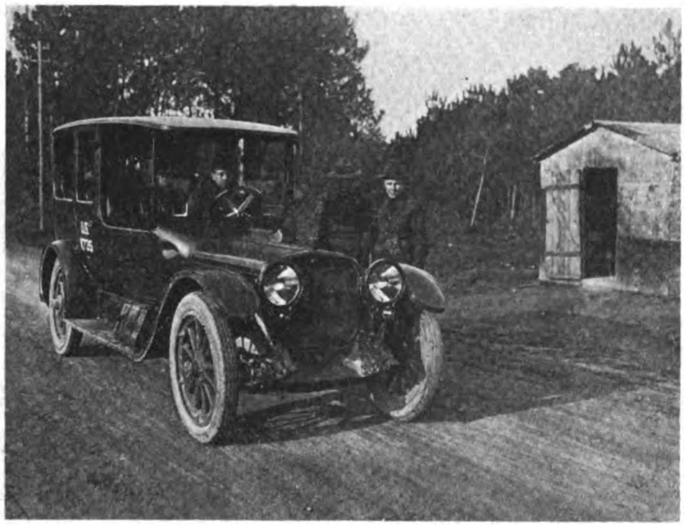


Chart showing the general organization of the Office of the Director of Motor Transport Corps. The solid lines represent direct control; the dotted lines, technical control



These Army police stop all cars and verify travel orders. At every street corner in the ruined towns and cities in the war zone these military police direct traffic with the same dispatch as at Fifth Avenue and Forty-second Street, New York, or Michigan and Jackson Boulevards, Chicago

the world to buy an urgently needed car without inquiring too closely how supplies were going to be obtained later to keep it in condition. Thus, the army which has made the greatest efforts toward standardization has at the present time fifty-one makes of foreign passenger cars, three makes of American motorcycles and five foreign makes. There are twenty-six different makes of American passenger carrying automobiles, twenty-three makes of 1½-ton trucks, twenty-one makes of 3-ton trucks, six makes of 5-ton trucks, thirty-four makes of American trailers, and at least twenty European makes.

Before some of the "orphans" were salvaged, there were 169 different makes of passenger cars—American and foreign—to be cared for.

Welfare Organizations Own 66 Foreign Makes

Outside organizations, such as the Y. M. C. A., the Salvation Army, K. of C., etc., own sixty-six foreign makes of cars or trucks and twenty-nine different American makes, all of which the Motor Transport Corps has to father. Many of these trucks and cars are altogether unknown to Americans at home and only slightly known to Europeans. This purchase was made under absolute necessity; but their maintenance always will be a very serious problem for the M. T. C.

A variety of types of automobiles is inevitable, no matter how thoroughly the standardization idea is followed. The M. T. C. is responsible for the motor transportation of the army with the exception of kitchen trailers, which belong to the Quartermaster; tanks, which are under the control of the Ordnance Corps, and a very small number of special vehicles for the Air Service.

Originally, some of the branches of the service had their own transportation, the most important of these branch transportation services being that of the Air Service. When they were all grouped under the M. T. C. a list was very carefully prepared of necessary types to cover the needs of the entire army, and although this list assumed that there would be but three makes of passenger cars it totalled 112 different types of cars. trucks and trailers. Later, by close team work, it was possible to reduce this number to rather less than 100 types which were essential to the needs of the army.

It is absolutely impossible to keep stocks of parts of every "orphan" car which gets into the service under dire necessity. But complete stocks are kept for forty-one makes of cars and trucks. This means that there are forty-one different makes of automobiles for which the M. T. C. is prepared to supply at a moment's notice any part liable to need replacement.

This supply organization is immense, for the number of parts listed and always on hand to meet requisitions total 90,000. No other branch of the service has anything like such a huge stock. It is believed that the engineers come second, but their stock of listed live articles is not half that of the M. T. C.

Substitute Parts Cannot Be Offered

Further, the M. T. C. list cannot be reduced nor can substitutes be offered. If the Quartermaster is out of beans, he can recommend rice as being just as good, but the M. T. C. supply officer who receives an urgent requisition for a French Renault crankshaft is unable to put forward a dozen Ford shafts in its stead.

The great cry in the M. T. C. is for standardization, and it is toward this end that they are working. With every new make of car which goes into service the possibility has to be faced of providing 3000 individual parts as replacements. So serious is this problem that M. T. C. supply officers would prefer to have in use one indifferent make of truck rather than an equal number of good trucks produced from six different factories.

Since the critical days when anything and everything on wheels had to be accepted and pressed into service, without any thought as to how long it could be kept running, a very complete system of supply has been evolved, under which every shipment, every package, can be traced from the moment it leaves America to the time it enters the main supply park 4000 miles away.

There were times when a truck or car having failed on account of some minor breakage had to be abandoned for lack of a replacement, and within a few weeks had been picked as clean as ever vultures picked a corpse on the desert. Now parts can be supplied on order; in some cases when they are not available from America, the M. T. C. manufactures them on the spot.

From the American Army standpoint, the whole of France is divided into three main portions. Around the coasts there are a series of base sections, numbered Base Section No. 1, Base Section No. 2, etc. Nearly the whole of the central portion is known as the intermediate section, and further to the east is the advance section, with

This Holt is working in its natural element—mud

German prisoners making roads for the Motor Transport Corps. Every road used by our motor trucks was kept in repair by gangs of workers spending all their time on them. This applies to every road in France

the actual battle front on its outer edge. The Motor Transport Corps receives its trucks and supplies at some or all of the base ports beginning with Marseilles in the south and ending with Havre in the north.

At practically each one of the base sections there is a big reception park at which the trucks and touring cars are received, unboxed, assembled, greased and prepared for the road. Owing to the shortage of railroad freight cars, all automobiles landing in France are sent to the front overland.

There is a single receiving station conveniently placed in the rear of the American armies, to which station all these trucks are delivered, and from which point they are distributed to the forces in the field. At this receiving station there is space available for storing 4000 vehicles, but as the American forces in France have always been far short of authorized motor transportation for the number of troops on hand, it is manifestly impossible to keep a reserve at this station. Urgent demands for motor transportation necessitated that vehicles be assigned as rapidly as they were made ready for issue.

The distance to be covered on these driveaways varies with the port from which a start is made, and averages about 380 miles.

Convoy routes have been mapped out from each port to the central distributing station, gasoline and service stations have been established along these routes, and all the roads have been marked with signs in English. To relieve the railroad shortage as much as possible, useful loads are always carried. Preference is given to M. T. C. stores, which have to be dropped en route or at the destination; but if no M. T. C. supplies are available, any load is picked up for any other corps, and, if necessary, the truck train will go a little distance out of its way in order to deliver these goods.

Truck Trains Always Running

During the whole of the summer of 1918 these truck trains were running from the base ports to the northeast of France without a break. As each one left, a telephonic communication was sent to the headquarters of the M. T. C., and every evening each officer in charge of a truck train telephoned his location to the main office.

In this way the commanding officer had continuous control over all the many truck trains proceeding from the south, the west and the northwest toward that main distributing station just in the rear of the American Army.

Usually, officers and men were engaged continuously on the task of bringing up trucks from the base ports to the front. Immediately one trip was finished they got aboard the train, returned to the port, and set out with another convoy. In some cases, however, where personnel was short and trucks urgently needed, the organizations for which they were intended sent their own men down to the port to bring the truck train up. The fine road system of France made it possible for a wonderfully reliable and efficient organization to be established; without these roads, or with indifferent roads, thousands of tons of freight would have been thrown on a congested railroad system.

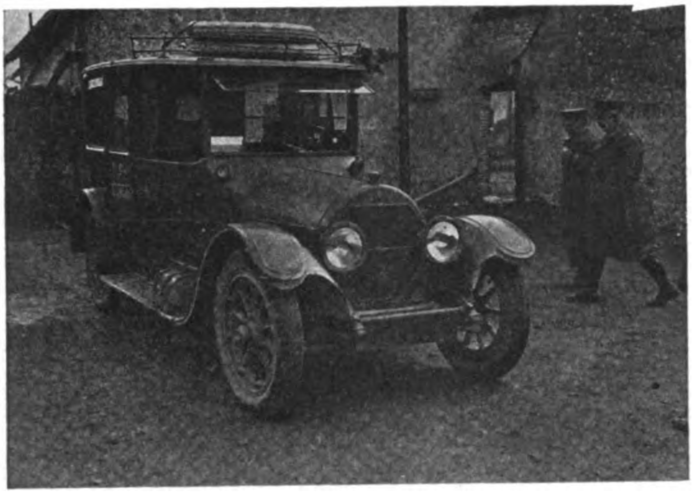
M. T. C. Has Technical Supervision

Under the American Army system, the Motor Transport Corps has technical supervision of all motor vehicles; it is responsible for the procurement, reception, storage and maintenance of all motor vehicles and parts; it has to establish and operate all M. T. C. garages, parks, depots and repairshops; it has charge of the technical training of personnel, and the salvage and evacuation of damaged vehicles. It is responsible for the operation of what are known as Class "A" vehicles—that is, automobiles and trucks used in the S. O. S.—under instructions from the proper commanding officer as to their employment.

When motor vehicles are assigned, in accordance with tables of organization, to such organizations as divisions, corps troops and army troops, they become known as Class "B" vehicles, and the rôle of the M. T. C. with regard to them is limited to technical supervision and maintenance.

At first sight, this would appear to diminish the importance of the Motor Transport Corps. In reality, however, this is not so. Even in the service of supply, where the Motor Transport Corps operates its own vehicles, the M. T. C. officer who controls the vehicles has no authority to determine the use to which they shall be put.

It is his duty to guarantee that the vehicles shall perform as efficiently as possible whatever work the commanding officer chooses to assign to them. When the vehicles are assigned to a combatant unit and moved



General and Colonel entering Cadillac staff car in France. The Cadillac limousine is seen everywhere on the roads behind the American Army in France

from the S. O. S. to the zone of advance, the Motor Transport Corps no longer has to provide the personnel and has no control over the work which these vehicles shall perform.

Full authority is vested in the commanding officer of the division, corps, squadron, group, etc., to use these vehicles on whatever work he may designate. But while having no voice in the tactical use of the motor vehicles, the M. T. C. maintains a very broad technical control; it supplies information on the proper methods of operation, care and maintenance, and has authority to enforce these methods.

Maintenance of First Importance

Maintenance of transportation nearly always comes as an afterthought. The first need is transportation, and after that has been provided necessity compels provision for its maintenance. Scores of examples of this have been found in the history of the American Expeditionary Forces in France.

The first attempt to solve the maintenance problem begins with the operator of the vehicle and the few simple tools placed at his disposal. This soon becomes inadequate, and the next step is to attach to a given number of vehicles a selected mechanic with an increasing number of tools. Then comes the service park, which provides maintenance of a more highly skilled character. The machine shop truck (or trailer) practically corresponds to the service park organization. Next in line comes the overhaul park, and, finally, the reconstruction park, which has as its main purpose the rebuilding, salvage and remanufacture of motor equipment.

The two most important reconstruction parks in France take care respectively of foreign made vehicles and light and heavy aviation trucks, and of all American built automobiles and trucks. This latter park is a huge organization with a staff of about 5000. It receives wrecked material by train load from the front; it undertakes the repair of this material wherever possible, and salvages it when its condition does not warrant rebuilding. The reconstruction park handling foreign built vehicles works on the same general lines, but on a smaller scale.

There is this unsatisfactory feature about the M. T. C. as it is organized in the American Army, that it only gets a vicarious kind of credit for the real work it performs. There are, however, plenty of occasions when the action of motor trucks has contributed largely toward saving the situation.

Trucks Saved Chateau-Thierry

When the German armies made their drive in the direction of Chateau-Thierry, and it looked as if the road to Paris were going to be opened by way of the Marne Valley, an entire division, with all its supplies, was moved from the east to this threatened point by means of motor transportation, and then moved back again when the danger was over. Truck trains carried fresh troops right up into the battle line; a few days later they carried those shattered troops back again; then came up with more fresh troops, thus keeping up such a steady supply of men and material that finally the morale of the enemy was broken.

From the day when the attack was launched on the St. Mihiel salient to the signing of the armistice the automobile service was kept going at full pressure practically day and night, and again contributed in a very important measure to the success of the armies.

The signing of the armistice brought little change in the work of the M. T. C. While there were no munitions to carry, the general supply of food had to be kept up and lines of communications were lengthened. The first few weeks following the cessation of hostilities brought calls for more jam and less hardtack—luxuries were needed where they could be dispensed with during actual fighting—and the M. T. C. had to meet this demand.

So long as an army of occupation remains, the M. T. C. will be kept busy; probably, too, when reconstruction begins an enormous amount of work will be thrown on the Motor Transport Corps. While the American Army remains in France it is intended to give to the men vocational training. The M. T. C. will do its share in this by training men as drivers and skilled mechanics.

Bridge over the Meuse at St. Mihiel used much by the Motor Transport Corps in September, 1918, during the great American drive. The original bridge was destroyed by the Germans. One truck at a time went over this bridge

Determining Gasoline in Natural Gas*

Description of a New Absorption Method Evolved at the Bartlesville Experiment Station

By W. P. Dykema and Roy O. Neal

IN its endeavors to minimize the gasoline losses at absorption and compression plants, which extract gasoline from natural gas, the Bureau of Mines has, through its Bartlesville Experiment Station staff, made a particular study of the apparatus to be used to determine such losses. This paper deals with a method of testing natural gas for gasoline content, which has been found satisfactory in testing rich or lean gases from wells or the residual gas of compression or absorption plants.

The natural gas gasoline industry has had a rapid growth since 1913, when the first absorption gasoline plant was erected for the extraction of gasoline from natural gas, and is now not only being applied successfully to dry gas but also to wet or casing-head gas, still vapors, and residual gas from compression gasoline plants.

According to J. D. Northrop (United States Geological Survey report) in 1917 there were 102 plants using the absorption process in the United States, which had an annual production of 49,017,549 gallons, valued at $9,592,026. This process has been one of the most important developments in the natural gas industry, for it has not only saved and utilized what was formerly wasted, but has helped producers to meet the ever increasing demand for motor fuels.

Tests of Small Samples Unreliable

Tests of small samples of gas by specific gravity determination, change in volume of gas in contact with an absorption medium, or increase in volume of absorption menstruum merely indicate the quantity of gasoline in the gas and often lead to ambiguous results. The only accurate method of determining the gasoline content of gases that contain less than a gallon of gasoline per thousand cubic feet is to allow a given quantity of the gas to come in contact with some absorption medium and to separate the absorbed gasoline from the oil by distillation. The method outlined in this paper is effected by using an absorption apparatus that differs somewhat in design from any previously described, although it embraces the same principle of operation—that of the Friedrick wash bottle. This absorber, designed by the senior writer, has the advantage of being a rigid unit, with a large capacity for oil and consequently a larger gas capacity. By using larger volumes, more representative determinations can be made and the opportunities for error are materially decreased.

Before a plant for recovering gasoline from natural gas is constructed, the quantity and quality of the gas to be used should be thoroughly examined. Often one sees plants that because of the lack of adequate testing of the gas were erected only to be abandoned as complete failures after a short period of operation. At present, there is no excuse for such conditions existing as a result of inadequate preliminary examination of the gas to be treated. Too much emphasis cannot be placed upon the importance of testing gas before the construction of a plant is planned.

The apparatus shown in Fig. 1 consists of a piece of 6-in. casing with five separate compartments, each of which is connected with a ¾-in. gas inlet and also with a 2-in. gas discharge pipe or separate chamber which extends to a point near the bottom of the casing. From the casing runs a ⅜-in. pipe coiled around a 3-in. core with seven turns, through which the gas being treated bubbles and in which most of the absorption takes place. Some small modifications and additions, optional in the design and not shown in the sketch, are the use of needle valves at each extremity of the apparatus in order that gas may not be introduced too rapidly or may be throttled to any desired pressure so as not to carry oil over from one compartment to the next; also the use of a needle valve on the discharge end to enable one to regulate more easily the rate of flow through the meter, especially in tests at low pressures, that is, when the gas flows through the absorber very slowly. It is advantageous to use gate valves instead of drain cocks for drawing off treated absorption oil from the oil chambers, as such valves facilitate rapid work and eliminate the possibility of volatilization losses when oil is allowed to spray through a stopcock under pressure into the container for collecting treated oil. Also time can be saved by using small bull-plugged nipples, in place of standard plugs, as they can be more easily removed and more rigidly connected to prevent leaks.

To make the test with this absorber, 2700 cc. of mineral

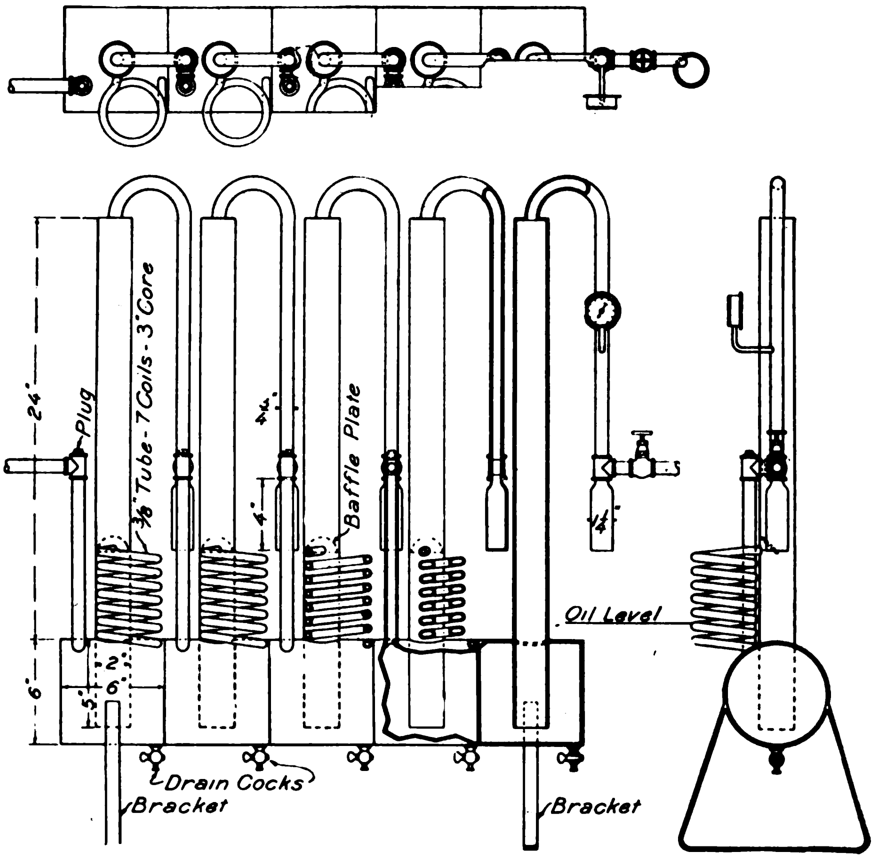


Fig. 1—Apparatus for making absorption test

*Published with the permission of the Director of the Bureau of Mines.

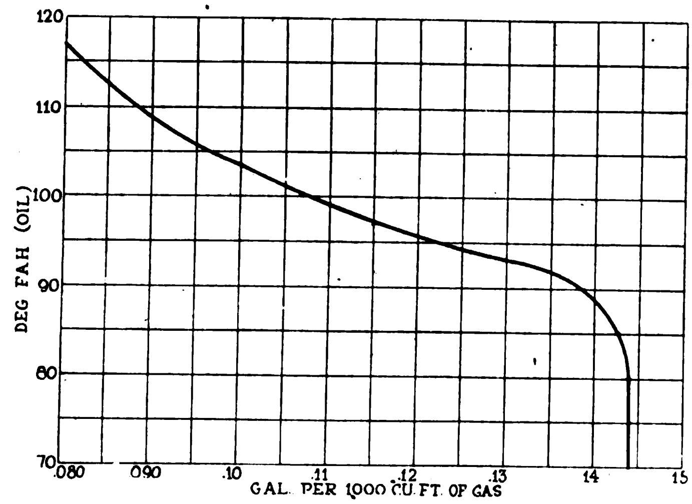


Fig. 2—Effect of temperature of absorbing oil

seal oil, or enough to bring the level of the oil about 2 in. above the top of the 6-in. casing and well above the coil inlet, is accurately measured and introduced into each compartment. The most important requisite for absorption media is high initial boiling point, in order that in the subsequent distillation a quantitative separation can be effected. The oil used in the tests described in this paper had the following physical properties:

Gravity	36.0° Be.
Initial boiling point	450° F.
Viscosity	51 Saybolt
Flash point (Pensky-Martens closed test)	271° F.
Fire test (Pensky-Martens open test)	307° F.

In most tests only the first three absorbers are used, but it may be expedient to fill the fourth compartment when examining rich gases at low pressures or when running a large volume of dry gas in paralleling a 12-hour, or day's, operation of an absorption plant to determine the extraction efficiency. The fifth division is not intended to be used as a container for oil but to serve as a separator or oil trap in case any oil is carried over from the preceding compartment. A meter capable of measuring from 1 to 1000 cu. ft. of gas accurately is connected to the discharge of the absorber.

The gas to be tested is allowed slowly to enter the apparatus with the discharge valve closed, and when pressure equilibrium with the gas to be examined is obtained, or when the desired pressure is attained, the discharge valve is opened enough to permit the desired rate of flow through the meter.

The gas entering the absorber bubbles up through the oil, the latter absorbing the gasoline. The function of the pipe coil is to provide a long and intimate contact between the oil and the gas as the gas passes through the absorber.

After the desired quantity of gas has passed through the absorber the supply is shut off and the pressure is released, through the needle discharge valve, allowing all the gas to flow through the meter. After the pressure has decreased to atmospheric pressure, all of the oil is withdrawn at the bottom of the casing and the oil from each compartment is accurately measured, 1000 c.c. of treated oil from each compartment being kept for distillation.

Distillation of Saturated Oil

Of the treated oil 400 c.c. is introduced into a 500-c.c. Engler distilling flask connected to a condenser made of ½-in. brass tubing and surrounded by cold (ice) water contained in a metal box. The flask is heated by direct fire, slowly at first, and the gasoline driven out of the oil is collected in a graduated cylinder. The flask is heated until the vapor reaches a temperature of 350° F., which usually requires 20 minutes. If the oil has a very high saturation, it is allowed to cool 20° or 30° and again raised to 350°. This procedure is followed until practically no more gasoline is driven over and collected from the condenser.

The extraction of gasoline by the oil will depend upon the rate of flow, gasoline content of the gas, volume of gas treated, pressure and the temperature of the absorbing oil. Optimum conditions as regards volumes of gas and rate of flow with gases at different pressures and gasoline content are given below.

Controlling factors in operation of test absorber:

Maximum rates of flow of gas Cu. ft. per hr.	Pressure Lb. per sq. in.
400	300
200	150
100	75
50	40
20	Atmospheric

Maximum Gas Capacity

Cu. ft. of gas	Gasoline, gal. per 1000 cu. ft.
800	.125
400	.250
200	.50
150	.75
100	1.00
66	1.50
50	2.00
35	3.00
25	4.00

The following data were obtained from a representative test made upon the intake gas at a compression plant in the Mid-Continent field:

TEST No. 2C

Intake Gas

Temperature of oil	94° F.
Pressure	204 lb.
Rate of flow	133 cu. ft. per hr.
Volume	302 cu. ft.

	Compartments 1st	2d	3d
Charge	2600 c.c.	2600	2600
Recovered	2700 c.c.	2660	2630
Gravity of oil	37.0° Be.	36.4	36.0
Distilled	400 c.c.	400	400
Initial C. B.	170° F.	185	308
Gasoline	19.5 c.c.	9.5	3.5
Total each	131.5 c.c.	63.2	23
	217.7 c.c. (78° Be. Gravity)		
Proportion extracted in each compartment	60.5 p. c.	29.0 p. c.	10.5 p. c.
Gasoline content	0.190 gal. per 1000 cu. ft.		

The gasoline content is calculated by using the following formula:

$$Q = \frac{1000}{G} \times \frac{C}{3785}$$

where Q is the gasoline content in gallons per 1000 cubic feet of gas, G is the volume (cubic feet) of gas treated and C is the *total* number of cubic centimeters of gasoline obtained from the treated absorption medium.

Much comment has been given as to the effect of pressure on the recovery of gasoline from natural gas by absorption methods. It has been stated that this is an objection to the use of a portable absorber in field testing, but it has been our experience that the effect of pressure can be entirely eliminated by adjusting the rate of flow of gas and the quantity of oil used in absorbers. In one test (data given) which was made at 17 lb. pressure with rich gas, the results checked up surprisingly close with the plant production (low gravity) plus the gasoline left in the residual gas.

TEST 11P

Intake Gas on High Compression

Pressure	17 lb.
Volume	149 cu. ft.
Temperature of oil	73° F. (av.)

	Compartment 1st	2d	3d
Charge	2600 c.c.	2600	2600
Recovered	3050 c.c.	2820	2650
Gravity (oil)	39.2° Be.	37.8	37.1
Initial B. P.	129° F.	138	162
Distilled	400 c.c.	400	400
Gasoline	48 c.c.	24.4	9.5
Total gasoline each	366 c.c.	172	63
Grand total	601 c.c.		
Proportion extracted in each compartment	60.9 p. c.	28.6 p. c.	10.5 p. c.
Gasoline content	1.07 gal per 1000 cu. ft.		

The temperature, above certain limits, of the absorbing oil has probably more effect on the efficiency of extraction than any other factor. In a series of tests of dry gas with all conditions constant, except the variable factor of temperature, a difference of 43 per cent in the volumetric recovery of gasoline for a gradient of 30° F. was obtained as is shown by the curve in Fig. 2. These changes took place between 90° F. and 120° F. and are undoubtedly due to the rapid increase in the partial vapor pressure of the gasoline fractions in the gas as the boiling points are reached. Probably no two gases will show the same results with the same variation in temperature, inasmuch as the characteristics of the gasoline hydrocarbons are distinctly not similar. The data from which this curve was plotted were obtained from a series of tests using a constant quantity of oil (2600 c.c. of oil in each of the first three compartments), a pressure of 130 pounds per square inch and a total volume of gas of 200 cubic feet which passed through the apparatus at the rate of 2 cu. ft. per min.

The test absorber and the method described in this paper are recommended in preference to the use of those scrubbers mentioned in other publications because they give more significant results when evaluating a gas with the idea of determining the feasibility of installing an absorption gasoline plant, or of ascertaining the efficiency of extraction at absorption or compression gasoline plants.

Emulsion Lubrication of Cutting Tools

ACCORDING to J. A. De Leuw, writing in *American Machinist*, mineral oil does not keep the tool as cool as it should do because of its low specific heat and poor thermal efficiency. It does not always give satisfactory lubrication of the penetrating surfaces, possibly on account of its viscosity. An excessive amount of oil remains attached to the work and shavings.

Where cutting speeds are not too great, an animal oil, such as neats-foot, may be blended with the mineral oil to increase its lubricating qualities.

There are certain classes of work where the cooling of the tools is as important as the lubrication. An aqueous solution is the best lubricant for a hot tool, because it has the greatest specific heat. The point then is, can an aqueous lubricant be made which will actually lubricate the tool?

The lubricating efficiency of emulsions depends upon the action that the suspended oil particles can exert toward reducing the friction on the tool surfaces which come into contact with other metal. As the oil particles in suspension are carried mechanically into contact with the hot tool surfaces some of them must be interposed between the contact parts and thereby produce some lubricating action. The coarser oil particles will be prevented by their size from penetrating as far between the surfaces as the aqueous medium, but the finer particles, which are microscopic in size, will not filter out, but will follow the solution and perform efficient service.

If the compound is diluted in water by means of pressure, using special apparatus and proper temperatures, so that instantaneous solution can take place, then the solvent may be diluted with water without breaking up its combination with the oil, and a diluted solution is obtained which resembles in character the original compound.

The lubricating power of such a solution has been shown to be much greater than if the same material had been broken up into emulsions, and this is explained by the fact that an aqueous solution of oil is in actual existence and the water really has lubricating value.

Natalite Fuel

Editor AUTOMOTIVE INDUSTRIES:

I HAVE before me your journal of July 18 and note on page 121 that you have an article on Natalite. I am pleased to see that your journal is interested in the new fuel, but I must correct certain misstatements in the article under review.

The article states in one paragraph "Although this fuel is not nearly so satisfactory as gasoline or kerosene due to carbonization of the engine," etc.

Now one of the main points in favor of Natalite is the fact that there is far less carbonization when using Natalite. This is a question that has been admitted by scientists and has been fully demonstrated in practice.

In another paragraph of the article it states: "In addition to carbonizing the engine, Natalite does not give as much power as gasoline and kerosene." There is not the slightest doubt that Natalite gives *more power* than petrol. I am inclosing herewith a few reports on Natalite by users who have done a few thousand miles on the new fuel, originals of which are in this office.

I inclose a little book on Natalite, which gives copies of the leading certificates and reports obtained on Natalite. The most important of these are:

The certificate, issued by the Royal Automobile Club of London. This certificate speaks for itself, as the R. A. C. is the leading institution of its kind and is recognized by the bulk of the automobile world. A few points in this certificate worthy of note are:

(a) The engine was an old type.

(b) The weight of the car and passengers was 32½ cwt.

(c) The weather was very wet on the first day, so wet in fact that the cape hood had to be down all day.

(d) The mileage worked out at 16.4 m.p.g.

(e) The engine started easily from cold or when warm.

(f) The valve caps and heads were found to be very clean after the trial.

(g) The distance covered was 501¾ miles.

The outstanding report is that given by the late Professor Vivian B. Lewes. He was one of the leading men in Great Britain on all questions of fuel and was retained by the British Admiralty for this purpose. His report you will find very thorough and very convincing. You will notice on page 15 of the little book that the best result obtainable on "Pratts Perfection," with the carbureter set for the best results on petrol, was 16.9 hp. at 1300 r.p.m., whereas on page 16 you will notice that when the carbureter was set in favor of Natalite the horsepower developed at 1300 r.p.m. was 18.85.

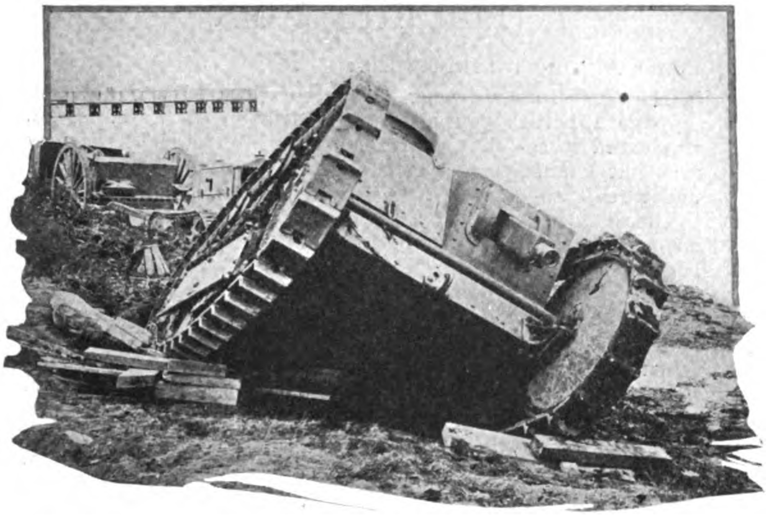
The next report of importance is that contained in the supplement and carried out by Percy L. Weston of Queensland University.

My company is the parent company and own letters patent in most places of the civilized world. We disposed of the manufacturing rights for the Union of South Africa to the Natal Cane By-Products, Ltd., whose shareholders consist of the leading group of sugar growers in Natal. They imported the necessary machinery from France and have now been manufacturing Natalite motor fuel for some months. The capital of the company is £130,000, of which £15,000 is held in reserve. The output of the present factory is, roughly, 1,000,000 Imperial gallons per annum. The shortage of petrol has been so great and the new fuel has given such satisfaction that the demand for "Natalite" is many times the capacity of the factory. The local selling price is between 2/6 and 3/ per Imperial gallon, against petrol at 4/ to 4/6 per Imperial gallon.

Under existing Government regulations Natalite has to be colored with an aniline dye, hence the coloration of the carbureter mentioned in one of the reports.

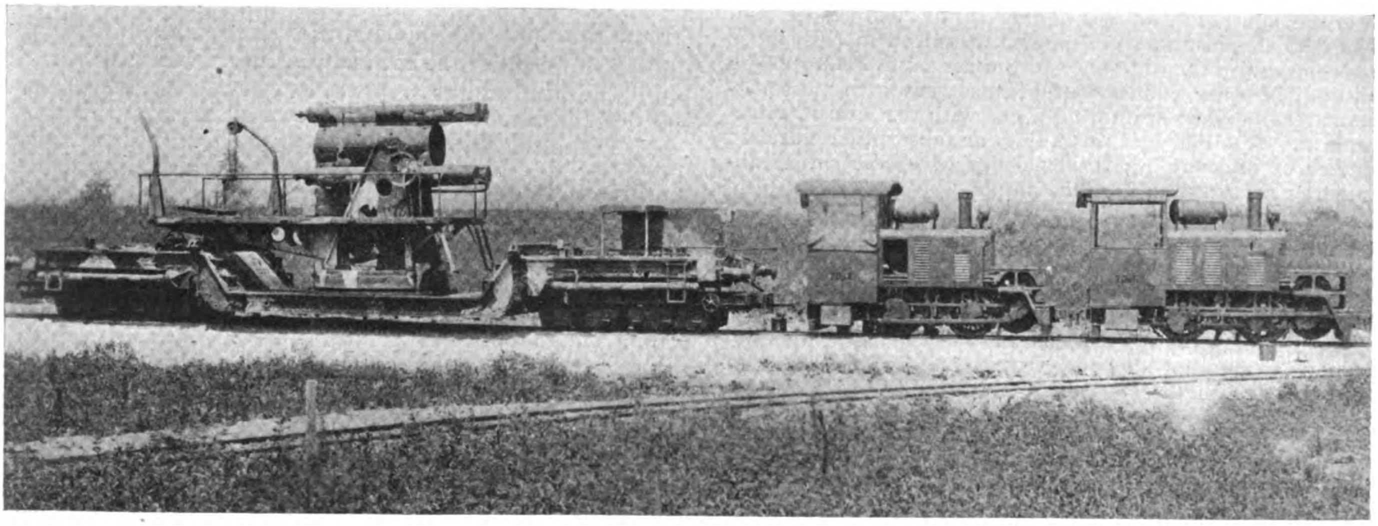
H. A. FINDLEY, Secretary.

[The copies of letters, etc., inclosed are too lengthy to permit of reproducing them here. They contain the statements quoted by Mr. Findley.—EDITOR.]

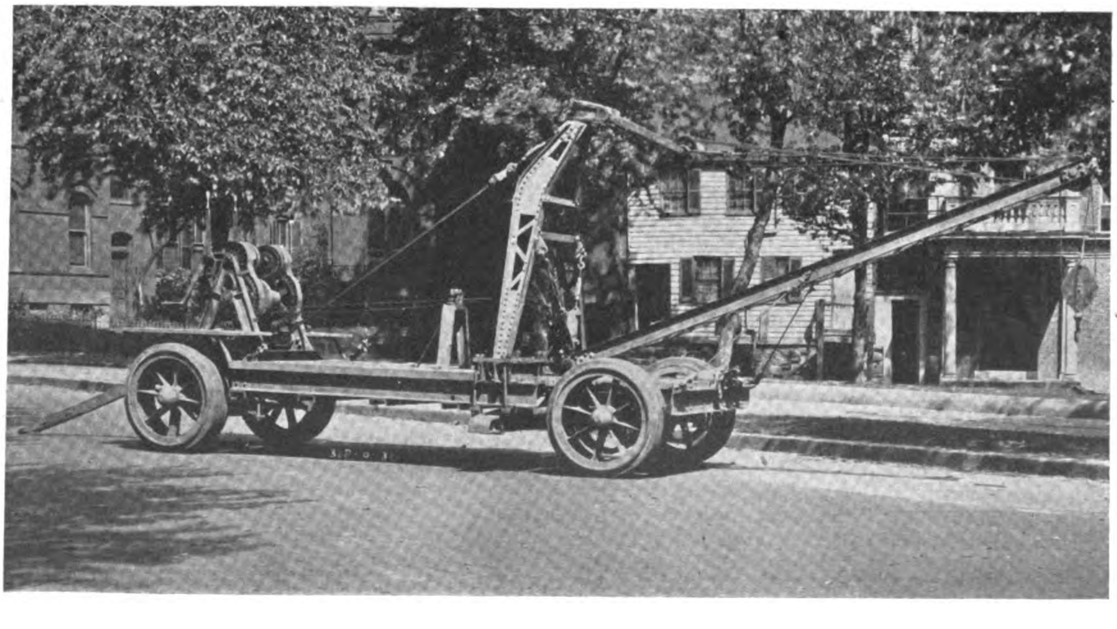


The Ford tank is equipped with two Ford engines. The gunner must sit in the small box from which the gun protrudes. He is huddled compactly in this space. The driver is granted but little more room and must drive the tractor by peering through the slots in the tower—which requires constant craning, as the seat is very low and only a tall man could look through the slots comfortably

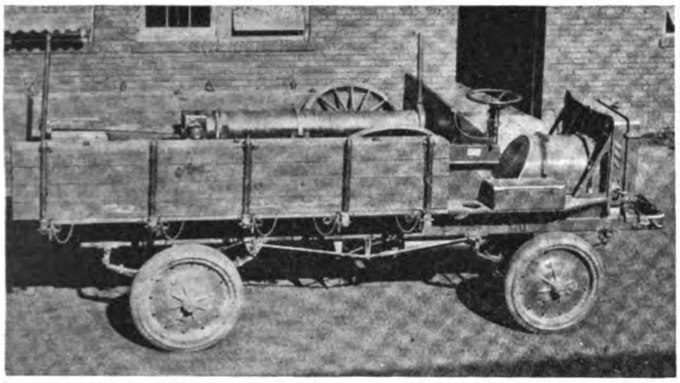
Army Automotive Equipment



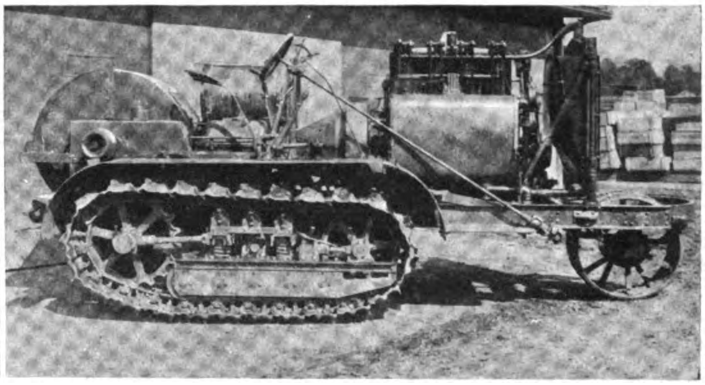
The standard gasoline electric locomotive used in France by the A. E. F. for moving large railway mounts to and at the front. This locomotive was used because it was considered desirable to eliminate the smoke which accompanies steam locomotives and which betrays them to the enemy



The 4-ton trailer equipped with a crane

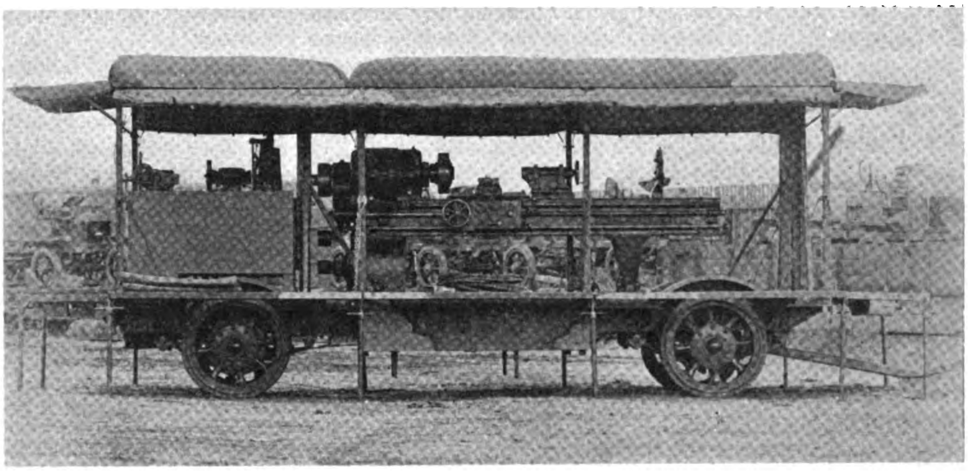


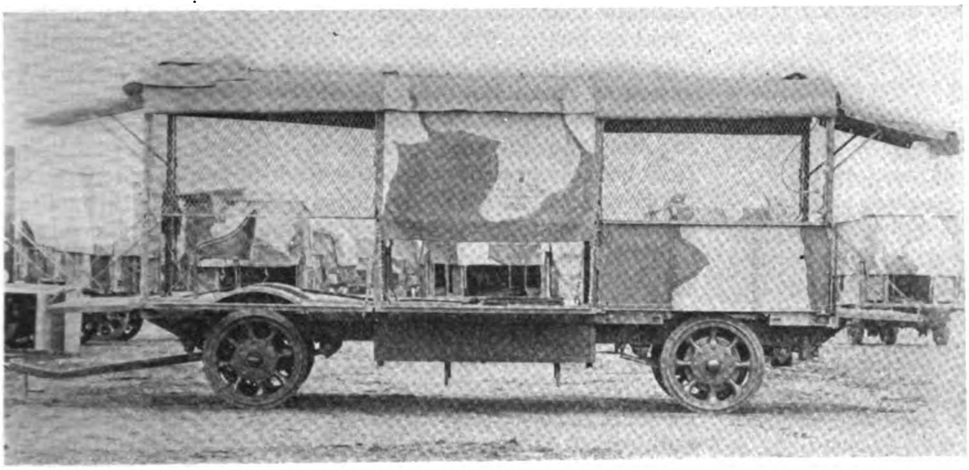
The trench mortar truck used by the A. E. F., with the mortar in the body



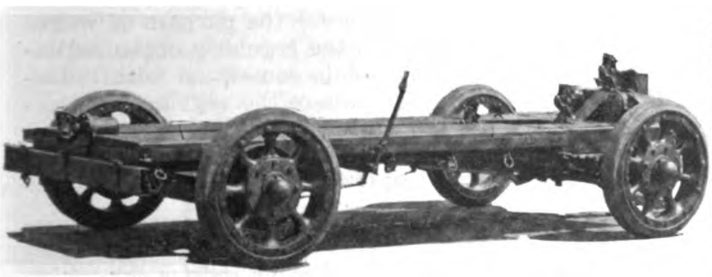
A close-up of the 15-ton artillery tractor—a 75-hp. machine produced by the Holt Co.

The lathe trailer. One of the units of the mobile repairshops. These repairshops comprise 12 trucks and trailers. As a rule they were hauled to convenient locations either along well traveled roads or near the front where they were parked compactly and conveniently and formed into repair depots

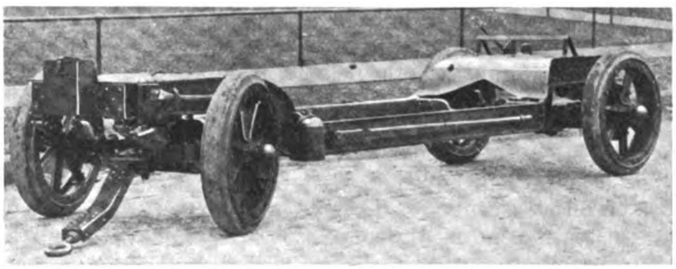




The parts and stockroom trailer —one of the units of the mobile repairshop



The 3-in. field gun trailer



The anti-aircraft gun trailer

Wage Questions Must Be Handled from Inside the Industrial Unit

Here, Workers' and Employers' Interests Are Concerned with the Same Common Problems of Production and Environment—Profit-Sharing and Collective Agreement of Highest Importance

By Harry Tipper

THERE are still some men who contend that the worker has no right to organize and that their employees have no right to join a union, and there are plenty of labor leaders who contend that the worker should be forced to organize and that nobody should work who is not a member of a union.

Both these conceptions are concerned with extending control in order to force the situation upon the opposite party. They are concerned with emphasizing the differences and minimizing the similarities. They create as much unrest as they claim to settle, because they are based upon unrest and turmoil and not upon agreement and peace.

In the last analysis this wage question must be handled from inside the industrial unit, where the workers' and employers' interests are concerned with the common problems of production and the common necessities of locality and social environment.

PRACTICALLY all the discussions which have occurred in connection with questions of contracts, collective bargaining, and the major points of industrial relations, particularly collective bargaining or wage systems, have assumed the necessity for the establishment of contracts between organized labor bodies and organized groups of employers and have based their conclusions upon argument starting from this assumption.

Most of the discussion, of course, centers around the wage system and the question of collective bargaining because of the fact that, while the question of wages is not the only question involved in the troublesome problem of industrial relations, it is the point of contact at which all other reasons for dissatisfaction acquire sufficient momentum to become active.

The lack of incentive, the desire to escape from work, the tendency to float from one organization to the other, personal grievances, competitive disadvantages and other items which enter ihto the causes of industrial unrest, and which are frequently the primary cause, do not become active causes until they are associated with the wage question.

The assumption, however, that this question of wages must be discussed upon the premise of collective bargaining between organized groups of labor and organized groups of manufacturers is not justified by the evidence contained in the history of labor and industrial development and it confuses the issues by preventing an examination of this question of wages in a fundamental manner.

The organized labor bodies in this country represent so small a proportion of the total labor that the aims and purposes of such organizations cannot be regarded as the primary cause of all the strikes and other evidences of industrial unrest which are occurring from time to time in all fields of industry and in all parts of the country. It is true that the aims and purposes of the labor organizations, being the only concrete and definite representation of the desires of the workers of industry, have been seized upon by all large bodies of unorganized workers in the endeavor to improve their own working condition.

Organization Influence Far-reaching

It is, furthermore, necessary to remember that the influence of the labor organization extends far beyond the confines of its own membership. At the same time the records of membership in the regular labor organizations indicate that the question of wages is decided for the great majority of the workers in this country without the intervention of the labor organization or the necessity for action of a manufacturers' group.

The fundamental difficulties, as all present systems of handling the wage question show, arise from the fact that they have grown up out of the tradition of free contracts between employer and employee determined only by the competition, the relative demand and supply and, consequently, the bargaining strength of the two parties involved.

From the standpoint of the employer, wages have been governed by necessity, and not considered from any human values. From the labor standpoint, wages have been governed by free competition, and they have been controlled almost directly in proportion to the collective bargaining strength developed in any one organization in any industry or at any particular time.

It is evident from an examination of the extent to which collective bargaining has grown, in the decision upon wages, that organization for the purpose of wages decision has gone far beyond the regularly organized labor bodies and has been used in connection with industries and bodies of workers where the regular labor organizations have little or no foothold.

Fundamental of Free Contracts

The reason for this is obvious. A fundamental condition of free contract is that either party must be at liberty to withhold the commodity or service for which he is bargaining. There can be no advantage to the worker in withholding his individual service, for that in-

dividual service is quickly replaced and he secures only the disadvantage of losing the bargain altogether by such action.

On the other hand, with the growth of industrial establishments in size and capacity, one individual manufacturer can withhold the possibilities of employment from a large number of workers at the same time and amplify the disadvantages to the worker which result from the inability to decide upon a given basis for operation.

So long as wages are based upon the ability to bargain, it is to be expected that organization for the purpose of securing bargaining strength will continue and enlarge itself, and that there will be a definite attempt to coordinate such organizations with regularly constituted labor bodies, unless the other necessities of industrial organization are recognized by the employers in their industrial field.

Aims of Labor Organization

The aims and purposes of the labor organization are the result of its fight for its existence and the extension of its power, and they are not concerned with the merits or demerits of the action; they are altogether concerned with the question of whether such action will increase the power of the labor body and place it in a better position to make that power felt when the necessity for bargaining arises.

Under this assumption of adjustment of wages, it is obvious that no thorough agreement can be reached at any time, but that all contracts must be in the nature of a temporary compromise, representing the present comparative strength of the two parties engaged in forcing the bargain. Whenever the strength of the two groups has changed in comparison, then the temporary terms, previously arranged, will inevitably go by the board in the clash of strength for a new adjustment of the bargain to the changed circumstances.

Several of the writers and industrial employers, who have attempted to suggest the development of other methods of adjusting wages, proceed upon the assumption that organized labor bodies and groups of manufacturers must control the newer collective arrangement as they have controlled the older collective bargaining, and they suggest standardization of wages, not in amount but through the different units of an industry and through joint standard boards functioning along the lines of those created in Great Britain and this country for war purposes.

Apparently these writers have not recognized the fact that the present organizations of labor, having been created and developed for the purpose of forcing bargains, and the present organization of employers, having been created for the purpose of defending the employers in such exhibitions of force, would be governed in their action upon joint committees by the constitution, the tradition and the precedent which make up their aims and purposes.

No Hope in Such Standards

It is impossible to find any great hope in such standards, based as they are merely upon the prevention of strikes and the adjustment of troubles by arbitration, instead of being the result of examination of the causes of these troubles and their settlement by the adjustment of the causes.

Furthermore, no man who has studied carefully the tendency in labor and employer organizations, especially in the latter part of their development in other countries, can view with any equanimity the prospect of a strengthening of these divisions of industry in their opposition, by the legalizing of joint committees appointed from these bodies and the power to compel the settlement of industrial questions through these means.

There is no will o' the wisp more alluring to the employer of labor than the compulsory arbitration suggested by these writers and attempted in some countries. A superficial examination of the work of such boards for a few years lends an appearance of success to the proposition.

Inasmuch as the organizations themselves are concerned with the use of force in obtaining the advantage in a bargain and not with securing co-operation in the attainment of a full agreement, the attempt at compulsory arbitration would simply transfer the strength from the semi-public atmosphere to the political atmosphere. There would be an endeavor to secure through politics what has been removed from the sphere of private action.

The effect of the labor organization in the collective bargaining system, through the history of its work up to the present, has been to increase the class consciousness of workers in various industries. In some countries it has solidified the class consciousness in a sufficient measure to make it formidable.

The grave danger in industrial relations, the gravest danger of all, is the increasing solidarity of class and the increasing divisions between classes emphasized by this form of organization.

An attempt to standardize the wage system by extending this method of collective bargaining until it carries over the whole surface of industry, headed by joint committees of workers and employers, legalized under a compulsory arbitration system, would but increase the class division and class solidarity which has so frequently been noted as the great danger.

In Great Britain to-day the strength of organized labor in the political life of the country is something which must be reckoned with by every thinking man and which finds its expression at every turn in connection with the legislative outlook. It is not in the direction of an attempt to solve the wage question by general systems of collective bargaining and arbitration that industrial satisfaction and efficiency lie.

Must Treat Industrial Unit as a Whole

Again it must be emphasized that the industrial unit is an organization and not a division of organizations, and no suggested method can bring any hope of prospective solution which does not treat the organization of the industrial unit as a whole, and particularly no solution can be expected by any system which emphasizes the division of interest that has been brought into the question by the attempt of both sides to gain more strength in the final action of collective bargaining upon the wage question.

The speeches of the labor leaders within the last few weeks indicate that the aims and purposes of the labor organization have not changed any but are still concerned with the control of the working conditions and not with any agreement with the employers as to those working conditions, while the statements publicly made by some of the employers and those representing employers' organizations have indicated the intention of the employers to retain control of the working conditions and not to give up any part of that control in the endeavor to arrive at an agreement.

For these reasons the profit-sharing systems within the organization and other systems of collective agreement upon wages inside the unit are of the highest importance to the manufacturer and should be considered with the utmost patience.

Austro-Daimler 200-Hp. Aircraft Engine

PART II

Details of Crankcase Construction—Ignition, Fuel and Cooling Systems—Results of Power and Endurance Tests—Analysis of Weights and Materials of Construction

THE lower half of the crank-chamber is complicated in design, and excessively heavy, weighing 73.5 lb., complete with false bottoms.

The walls are 6 mm. thick and are strengthened inside and out by ribs spaced 130 mm. apart.

A perforated plate of galvanized sheet steel is screwed onto a flange cast about half-way down the chamber. This plate has shallow oil sumps formed on it at each end and a large hole cut in it in the center; other holes, 25 mm. in diameter, are pierced in it in various places. Over this bottom is screwed a sheet of finely perforated steel, covered on the underside with very fine wire gauze. Below the filter plate the bottom of the base-chamber slopes sharply to the center portion, which is flat and has a small sump bolted on underneath it. Cooling ribs are cast in the two sloping portions, both inside and out; the sides of the base-chamber are carried down 40 mm. below the bottom and a strip of sheet aluminum is screwed on to their lower edge, thus forming an air chamber along the whole underside of the engine. The aluminum plate has three air ports covered with wire gauze at each end. According to a report these ports are fitted with a vaned shutter.

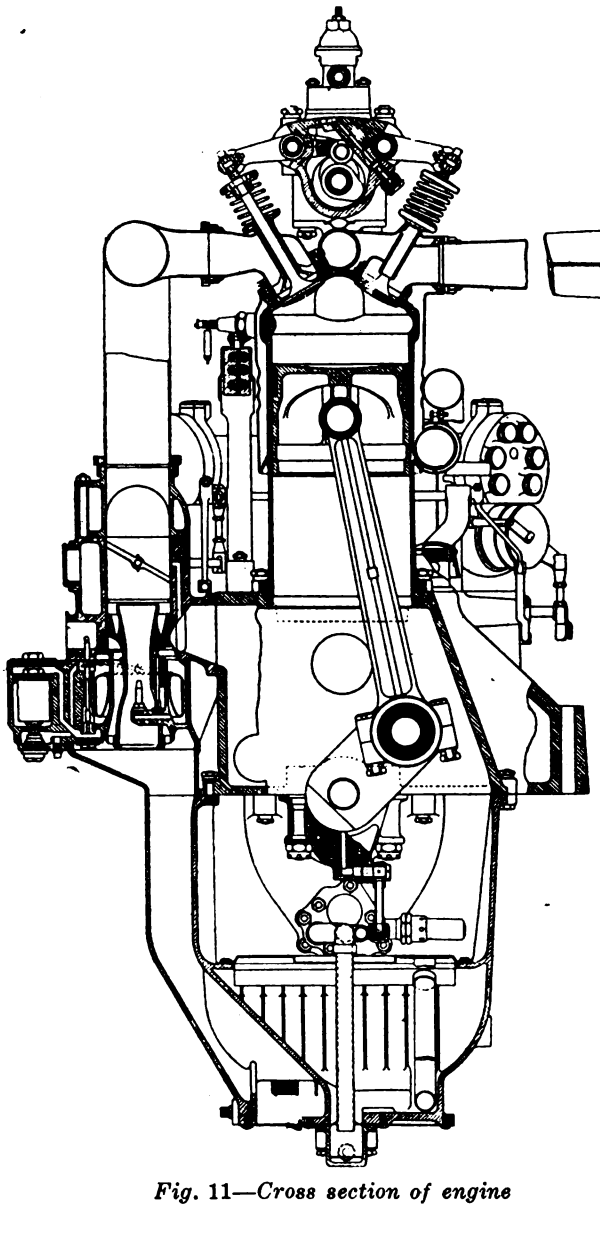


Fig. 11—Cross section of engine

The main air supply for the carbureter is taken from this false bottom through a passage cast in the side of the crank-chamber. The purpose of the false bottom is to cool the lubricating oil and warm the incoming air.

The lubrication system of this engine is on the wet sump principle, having one large pump to keep the main oil in circulation and a smaller sump to supply a small charge of fresh oil to the system at each pump stroke.

In this engine the main pump sucks oil from the sump, which is approximately of 7 gal. capacity, and delivers it under pressure to the main journal bearings.

Oil Pump and Lubrication System

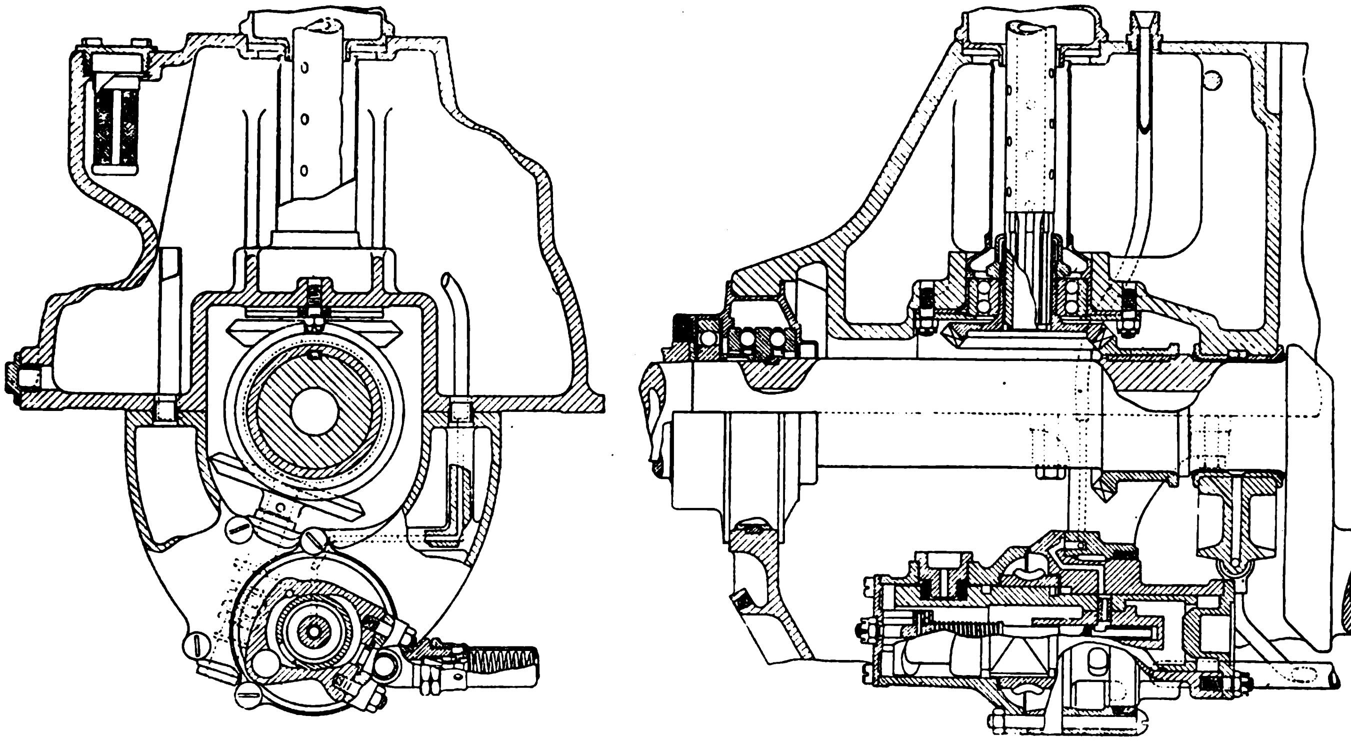
The small pump supplies the camshaft with fresh oil taken from the tank cast in the top half of the crankcase. The main oil pump consists of a steel plunger 40 mm. in diameter, working in a cast iron barrel. This plunger is hollow and has another plunger or ram, 7 mm. in diameter, fitted inside it. Both the barrel of the pump and the small plunger remain stationary, while the large plunger is rotated by means of a bronze worm wheel, which floats on a square formed on the plunger. The worm wheel is driven from the crankshaft by a worm cut on a small inclined shaft. Besides rotating, the plunger is made to reciprocate by means of a scroll cam machined in the plunger, which works against a hardened steel roller fixed into the pump barrel, and thus transmits the reciprocating motion to the plunger, the end of which is plugged and forms the piston of the main pump.

The small ram fitted inside is also hollow and works on the same principle, though in this case the barrel moves while the ram remains stationary. A port cut in the side of this small plunger is put in communication alternately with the supply pipe from the tank and the delivery pipe to the camshaft, by means of an oil way drilled radially in the main plunger. From the main oil pump the oil is forced along a delivery pipe to the center of the engine, where it feeds the main oil lead running beneath the crankshaft and connected to each of the journals by vertical branch pipes.

The crankshaft is bored and plugged in the usual manner and conveys oil from the journals to the crankpins, whence the oil is forced up the small pipes attached to the connecting-rods into the little-end bearings.

The delivery pipe from the small pump to the camshaft is taken up the front end of the engine and runs along outside the camshaft casing, being connected to the oil ways drilled in the cover plates by six inclined channels formed in the cover plates.

From this central oil lead in the cover plates the oil is conveyed to the camshaft bearings by the vertical holes drilled in the ends of the cover plates, and to the rocker arms by



Figs. 12 and 13—Vertical shaft drive and thrust bearings

short cross channels, which deliver the oil into grooves milled in the rocker arms, whence it finds its way to the journals of the hollow rocker spindles and their bearings, and also to the cam rollers and cams.

The camshaft is always kept half full of oil, and provision is made for filling up before starting by three holes fitted with threaded plugs, which are placed in the top of the cover plates.

From the camshaft casing the oil overflows through two grooves formed in the side of the front camshaft bearing and thence finds its way to the sump down the vertical spindle casing, lubricating the vertical spindle bearings and gears on its way.

The oil sump is exceptionally deep and is fed from the sheet steel false bottom by three pipes, one from each end and one from the center.

Ignition

The two Bosch Z.H.6 type magnetos are driven by bevel gears off the bottom end of the camshaft driving spindle at the front of the engine. The magnetos are mounted on aluminum brackets which are bolted to the top face of the crank chamber, which forms an extension over the auxiliary oil tank.

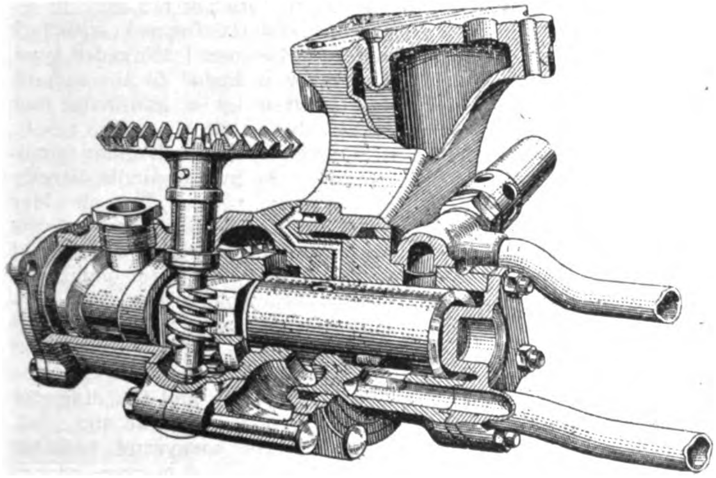


Fig. 14—Combined main and make-up oil pump

As will be noticed in the illustrations of the engine, the magnetos are placed diagonally, each magneto being driven at an angle of 52 deg. to the crankshaft axis, in a horizontal plane.

Two Bosch three-point spark plugs are fitted to each cylinder on the same side of the engine, being screwed into the combustion heads just below each inlet valve; each magneto, of course, serves one plug of each cylinder. The magneto controls are interlinked with the throttle control, so that when the engine is throttled down the ignition is automatically retarded. The order of firing is as follows: Propeller, 1, 5, 3, 6, 2, 4.

As shown in the illustration of the induction side view of the engine, Fig. 1, all the high tension leads from the magnetos are carried in a particularly neat form of cable carrier, which is made of red sheet fibre and is carried on cast aluminum brackets attached to the top of the crankcase.

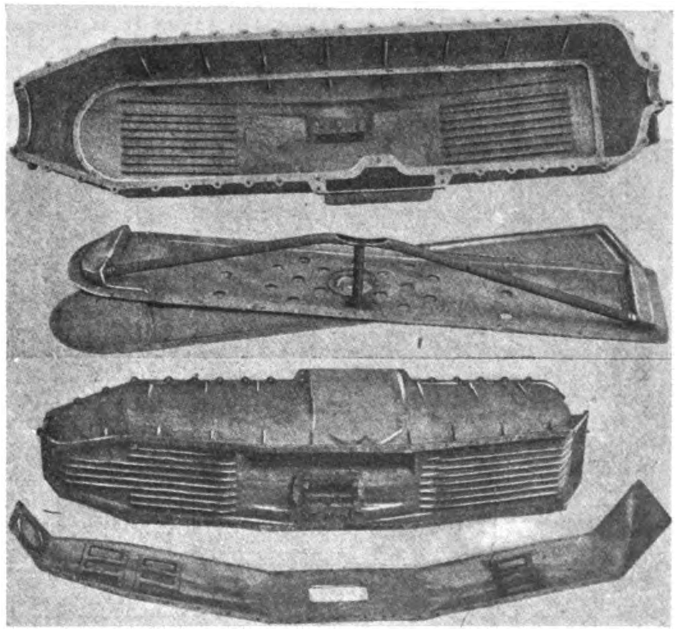


Fig. 15—Crankcase sump

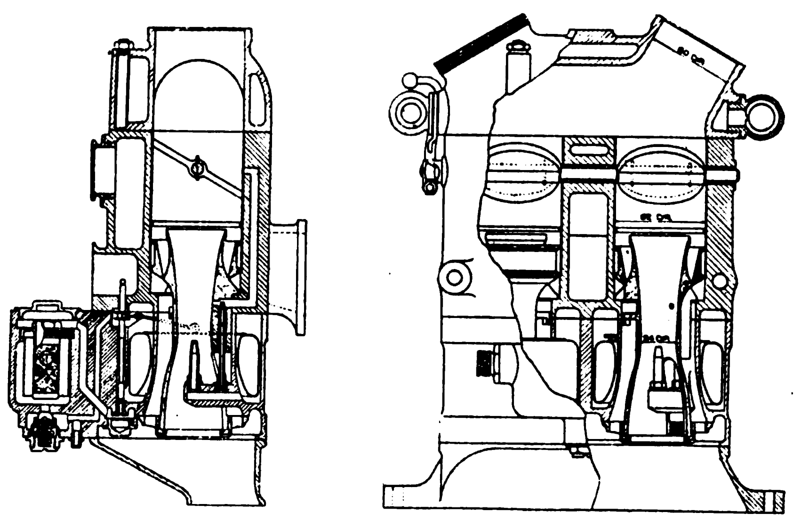


Fig. 16—Two sectional views of the carbureter

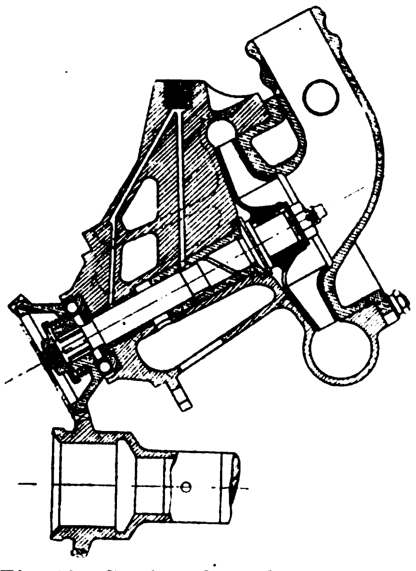


Fig. 18—Section through water pump

The large duplex carbureter is placed on the left side of the engine, and supplies the mixture through two separate galvanized steel induction manifolds; each manifold feeds three cylinders and is lagged with asbestos. The carbureter is built up in three sections. The bottom section—which is made of gun-metal—contains the two float chambers and the four jets. A common filter chamber fitted with the usual gauze strainer is cast on the front of this portion. The center portion of the carbureter—which is made of aluminum—contains the butterfly throttles and the upper portion of the choke tubes.

A large air chamber, cast round the throttle barrels, is used as the outlet for hot air from the crankcase, and thus helps to warm the mixture. The top portion of the carbureter consists of a cast aluminum chamber, in which the supply for the two carbureters is united, thus insuring an equal supply to each manifold. This chamber has a waterjacket cast round it, which is connected to the main water circulation system by a pipe at each end.

The annular float chambers encircle the choke tubes. Two jets are fitted in each carbureter, the capacity of the main jet being 35 cc. per minute, and that of the pilot jets 5.8 cc. per minute.

The filter is fitted with a pressure release valve which discharges into a small chamber below the filter, where it unites with the overflow from the float chambers.

The air supply to the carbureters is taken from the false bottom, through a passage cast in the side of the crank chamber. An extra air valve is fitted round the choke tubes.

In the Austrian "Berg" biplane scouts, fitted with these Austro-Daimler engines, the main fuel tank is under pressure and is situated at the bottom of the fuselage, behind the engine. A small gravity tank holding 3½ gal. is also fitted as an emergency fuel tank, just behind the engine in the upper part of the fuselage, and the total air endurance according to report is given at 2½ hr. at 1000 ft.

Air Pump

The air pump for the fuel tank pressure is of the spring-loaded plunger type, and is operated by a separate cam on the camshaft between the two rear cylinders. As shown in the sectional arrangement drawing of the compression release gear, it is mounted on the cover of the cast aluminum camshaft casing.

A hand pressure pump is also fitted in the machine.

Water Pump

In Fig. 18 is given a sectional view of the complete water pump. This is of the centrifugal type, and as shown in the views of the engine is driven directly off the rear end of the crankshaft by a bevel gear which is integral with a sleeve forming an extension shaft. This is attached to the rear end of the crankshaft, and also drives the gun interrupter gear through a worm gear on a transverse shaft.

The water pump spindle is inclined at an angle of 30 deg. to the crankshaft and runs in phosphor bronze bearings. The driving bevel gear floats on the end of the pump spindle, and is fitted with a large diameter thrust ball race and retaining spring, which, being at the bottom end of the spindle, are as far away as possible from the rotor of the water pump. Both the pump spindle bearings are well lubricated, through two drilled holes in the pump body and oil grooves cut in the spindle bearings, by a large self-acting grease lubricator which is screwed into the cast aluminum water-pump body.

The pump rotor is 112 mm. in diameter and is formed with six vanes of the usual Mercedes type. The rotor is keyed to the spindle and secured by a gun-metal nut and washer.

A conically faced shoulder is machined on the pump spindle directly beneath the rotor. The shoulder beds into the beveled face of the bronze bearing, forming an efficient water joint. The water pump, although somewhat heavy in its construction, is well designed and is very accessible. The diameter of the intake passage through the cover is 36 mm., and the diameter of the delivery is also 36 mm.

A "V" type honeycomb radiator is used with this engine, and is mounted at the front of the engine, directly behind the propeller.

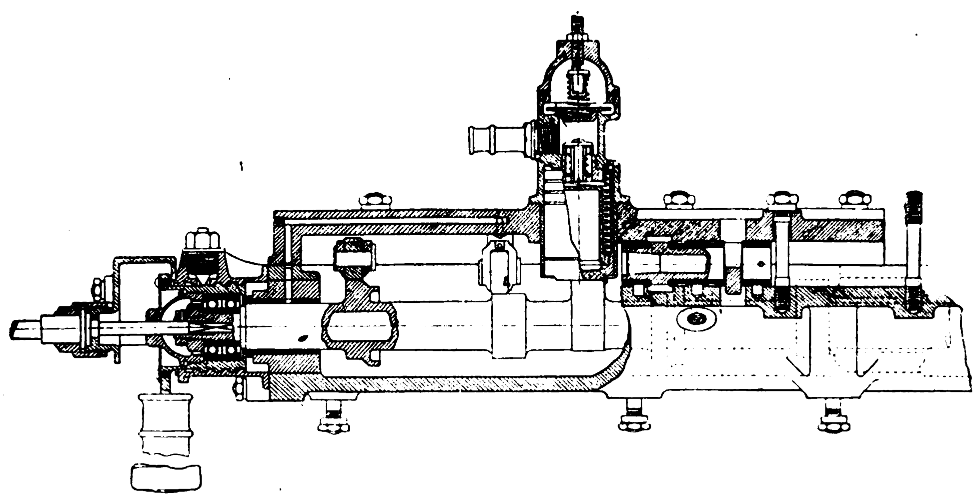


Fig. 17—Camshaft and air pump

The capacity of the radiator is approximately 4 gal., and a small barrel-shaped condenser, 4 in. in diameter and 5 in. long, is provided on the top of the radiator, apparently to prevent boiling water from escaping and blowing back. No louvres or blind are fitted to prevent over-cooling.

From the bottom of the radiator water is circulated through the steel pipe to the inlet of the water pump and is delivered into the bottom of each of the cylinder waterjackets. These are coupled together in the usual way by rubber joint rings and clips, both at the bottom of the waterjackets and in the water passages above the valves in the cylinder heads. The construction of these joint rings is interesting, consisting of beveled rubber rings, reinforced in the center with a steel spring ring. The rubber joint rings are expanded into the outside of the conical faces of the steel water connections on the cylinders by the halves of a split aluminum ring, which are clamped together by a band clip of ordinary design. From the results and appearance of the engine during tests these water joints are very efficient. Circulating through the cylinder waterjackets, the water passes to the top of the radiator through two passages cast in the front end of the aluminum camshaft casing. These water passages encircle the camshaft just behind the driving bevel gears.

Revolution Indicators

A flexible drive for the engine speed indicator is driven directly off the rear end of the camshaft in a small extension chamber, and some form of revolution indicator was apparently mounted in the center of the "V" radiator. Unfortunately the instrument is missing, but a portion of the driving mechanism is shown in the general arrangement drawing, from which it will be seen that the gear employs a small diameter worm mounted about half-way up the vertical driving shaft. This engages with a worm pinion which drives a grip-gear pinion at a speed ratio of approximately 1:100.

Wireless Generator

A flange is machined on the rear extension of the crankshaft to take a belt driving pulley for the wireless dynamo. This pulley is probably of the standard friction clutch type used on all enemy engines.

No exhaust manifold or muffler is provided, but a separate short exhaust pipe about 12 in. long of streamline section extends from each cylinder.

Conclusions

The design of this new type Austro-Daimler engine, as set out in the foregoing detailed description, and the following data and test results, shows a careful study of details.

Both in its general lay-out and in most of its details of construction this engine undoubtedly possesses more originality in design than the majority of enemy engines up to the present time.

The design of the lubrication and oil-cooling system has evidently been carefully considered, as have also the carbureter and induction systems.

The new type of scroll cam oil pump is interesting, but in its present form is excessively heavy. This type of oil pump, however, it is interesting to note, is now used on the new 270 hp. Bassé-Selve engines. In these engines the oil pump works on exactly the same principle, but is duplex and is relatively much lighter, the body of the pump being made of cast aluminum instead of cast iron.

R. A. E. Calibration and Endurance Test Report

The 200 hp. Austro-Daimler engine was coupled to a Heenan & Froude dynamometer, and run for the usual calibration and one-hour endurance tests. Power, throttle, and consumption curves are given in Fig. 19.

Calibration Results

R.p.m.	1300	1400	1500	1600
B.hp.	186	200	212	222
Brake m.e.p.	123.5	123.3	122	119.7
Fuel consump. in U. S. gal./ b.hp./hour	.086	.085	.0852	.0854

The engine was submitted to an endurance test of one hour's duration at normal revolutions, *i. e.*, 1400 r.p.m., with the following results:

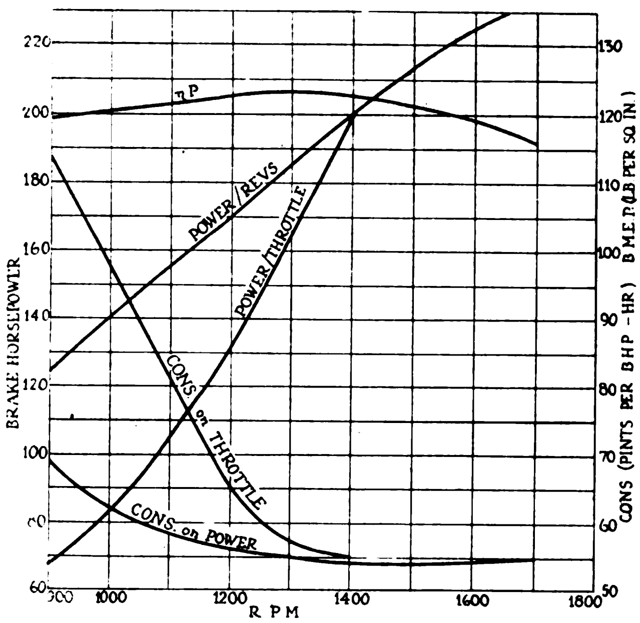


Fig. 19—Performance curves

Average output	202 b.hp.
Average speed	1400 r.p.m.
Fuel consumption per hour	16.8 U. S. gal.
Fuel consumption b.hp. hour	0.665 U. S. pints/b.hp./hr.
Oil consumption per hour	8.4 U. S. pints.
Oil pressure	5 lb./sq./in.
Oil temperature	50 deg. C.
Water temperature (inlet)	54.5 deg. C.
Water temperature (outlet)	60 deg. C.
Total duration of tests	10 hr. 25 min.
Complete weight of engine	728.5 lb. dry.

Weight per B.hp.

At 1300 r.p.m. = 3.81 lb. per B.hp.
1400 r.p.m. = 3.64 lb. per B.hp.
1500 r.p.m. = 3.43 lb. per B.hp.
1600 r.p.m. = 3.28 lb. per B.hp.

Running During One Hour Endurance Test

Very steady between 700 and 1700 r.p.m.

At 500 r.p.m. vibration was bad, and below this speed running was generally unsteady.

Distribution

Very good.

Cleanliness

Throughout the test the engine kept remarkably clean. No trace of oil or water leakage was observed.

Troubles Experienced on Test

The K.L.G. spark plugs fitted for the test gave trouble by shorting internally.

The valve tappets required to be readjusted during the test.

Test of Water Pump

Speed of the water pump spindle = 1.894:1 crankshaft revolution.

The delivery of the water pump under varying pressures has been made the subject of a separate test The pump was coupled to an electric motor and run with the following results:

R.P.M.	Pressure	Delivery
1800	2 lb. sq. in.	50.5 U. S. gal. per min.
1800	4 lb. sq. in.	44 U. S. gal. per min.
1800	6 lb. sq. in.	36 U. S. gal. per min.

The weight of the complete water pump = 7.6 lb.

(To be continued)

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

PUBLISHED WEEKLY

Vol XL Thursday, January 9, 1919 No. 2

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE J. Edward Schipper
WASHINGTON OFFICE Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142.

Cable Address - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES.

United States and Mexico	One Year,	$3.00
Canada	One Year,	5.00
Foreign Countries	One Year,	6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Engine Bearing Proportions

ALTHOUGH automobile design, and especially engine design, has attained to a high state of perfection, there is no doubt that further progress is possible in many details. But the more nearly perfect the design the more difficult it becomes to make improvements. It was pointed out at a recent meeting of the S. A. E. Buffalo Section that the best results cannot be achieved by measuring up existing engines and striking an average. While this method is a fairly safe one and may commend itself to the designer with little experience, no progress can be hoped for from it.

There are just two methods by which present design can be rationally improved. The first is to carefully observe the behavior of engines in practice or study reports to the service department, noting what parts give most trouble and considering the causes of these troubles. The other method consists in studying the forces on the different parts of the engine analytically and proportioning the parts in accordance with the loads they will have to bear.

An interesting illustration of the way in which engine design is gradually being improved through observation of the frequency of different repairs and through analytical investigation is afforded by the central main bearing of a four-cylinder crankshaft.

In the earlier four-cylinder engines this bearing was generally made short, owing—in one sense—to lack of space. The designer would settle upon his cylinder center distance in accordance with the dimensions of cylinder bore, depth of waterjacket and wall thicknesses, placing the cylinders as close together as possible, and this would unnecessarily leave little room for the central bearing. The rear bearing was made long because it had to support the flywheel, and the forward bearing generally also was liberally proportioned because there was plenty of space in front. Anything added to the length of the central bearing meant that much added to the length of the crankcase and the whole engine.

It was observed, however, in practice by manufacturers having numerous four-cylinder engines in service that the central bearing invariably required renewal first. A little reflection readily suggested the reason for this. The greater part of the load on any crankpin is taken by the main bearing adjacent to that crankpin, and as there are two crankpins adjacent to the central bearing the latter supports the pressure of the explosion twice to once on each of the other bearings. This determines the distribution of bearing loads at low speeds.

At high speeds the inertia of the reciprocating parts is the most important of the factors determining bearing loads. Now, adjacent to the central bearing there are two sets of reciprocating parts which move in unison, and their inertia forces add together. The same applies to centrifugal forces, and the result is that the mean or average load during the complete cycle is much greater on the central than on either the front or rear bearing. In a four-cylinder engine the weight of the flywheel is small as compared with the inertia and centrifugal forces at high speed, and it is a rather curious fact that while designers have always been very conscientious in providing in the bearings for this weight they have paid little or no attention to the inertia and centrifugal forces.

An analysis of main bearing pressures on four-cylinder crankshafts has been made by Otto M. Burkhardt and presented in a paper read before the S. A. E. Buffalo Section. Mr. Burkhardt's figures show that under full load at normal speed the average bearing load on the central bearing is 70 per cent greater than the load on either end bearing, and while idling at high speed the average load on the central bearing is even twice as great as that on either end bearing. In determining the relation between the bearing lengths it should be borne in mind that the engine works at nearly full load only part of the time. Account can be taken of this by giving different "weights" to the relative load factors, these weights depending upon the proportions of the time the engine runs under these load conditions.

Wishing Is Not Winning

"IF the United States is to have any foreign trade, she has got to get busy."

In just so many words has the situation been sized up by an American business man, a returned traveler who is a keen observer, whose experience gives weight to his opinions and who is accustomed to look far into the future.

To-day, the markets of the world are open to us as they never were open before. Our neighbors across the seas need our products as they never needed them before.

But "America has got to look out for herself."

The industrial plants of our international trade rivals have been far more disrupted than have those of America. Production of peace-time essentials has been cut to the bone. The resources of our Allies have been centered on the production of the sinews of war to a far greater extent than have those of America. Our Allies must overcome the handicap of four years of war as against our one.

But they have also the advantages of that four years—they have learned the lesson of quantity production, which under normal conditions might have taken much longer to learn. They are living in the midst of the realization that foreign trade must be developed to the utmost to help pay their war indebtedness. And they undoubtedly will grasp the opportunity which the learning of the lesson has put within their reach.

"America should go quickly after the markets of the world."

America has never been in a better position to enter world trade on that comprehensive scale the world now wants. Our factories have been marvelously expanded. They have learned to diversify their lines. They have been compelled to supply demands which hitherto have been supplied from abroad. They have been thrown upon their own resources to produce, not alone for ourselves, but for our Allies as well, hundreds of products which hitherto have come from our enemies.

And last but not least we have the ships. Already we have seen reductions of one-fourth to one-third in existing ocean freights to South America, Australia, and Africa—a reduction which has been made to induce American shippers to take advantage of the tonnage now available.

Wishing is not winning. "Foreign countries are going after world trade in a way that will make America sit up and take notice." Nothing but an aggressive policy based upon a well-formulated plan, will give to American industry that share of world trade which is its just due—and which it must have.

Prospects of Civil Air Transport

DURING the past two months a number of forecasts of the future of commercial aeronautics have appeared in the press from men at the head of aircraft manufacturing corporations, aero clubs, etc. Most of these have taken a rather roseate view of the prospects of this new means of travel, though practically all admit that the immediate future is beset with difficulties.

In England, where forced development of the aircraft industry began about 3 years before it did here, and where the industry has grown to an enormous size, anxiety concerning its fate at the end of the war began to be felt more than a year ago. In order to pave the way for commercial applications of aircraft as soon after the war as possible, a Civil Aerial Transport Committee was formed to report to the Air Board with regard to the steps which should be taken.

This committee has recently made a report. Unfortunately considerable material has been deleted from the published text; what remains, however, makes quite interesting reading. The problem is dealt with under five headings, namely, Municipal Control and Legislation, Technical and Practical Questions as to the Possibilities of Performance of Aircraft, and as to the Requirements of Aerial Services, Business Questions Relating to the Possibilities of the Aircraft Manufacturing Industry After the War, Questions of Labor and Problems of Scientific Research and the Education of Expert Designers, Engineers and Pilots.

The tone of the report is a most reserved one and quite in contrast to some of the optimistic predictions made by others recently. It is pointed out that the conditions of success are radically different in developed and undeveloped countries respectively, as in the former aerial transport must compete with existing means of transport and communication, while in the latter it would practically be without competition. The committee holds the view that while carriage of mails, passengers and certain kinds of light, valuable merchandise by airplane will be successfully developed after the war, the amount of business in sight in these lines is altogether inadequate to keep the highly developed industry going, and state aid is advocated, in view of the fact that the maintenance of the aircraft industry's productive capacity is considered essential to the safety of the Empire. As to what form the assistance should take, whether the Government should give assistance directly to private enterprises or should assume exclusive ownership or participate in the ownership of air transport lines, the committee does not feel prepared to say.

From comments in the British aircraft press it appears that the aircraft industry has been somewhat disappointed in the report. While it is urged that "The British Empire should not be allowed to lag behind other nations in preparing for civil aerial transport," the recommendations made are all limited to further investigation and preliminary action, so that the prospect of immediate outlets for the products of the aircraft industry is not visibly improved by the report.

□ Latest News of the

Sales for Export Not Taxable

But Domestic Sales, Subsequently Exported at Instance of Buyer, Pay Tax

NEW YORK, Jan. 6—Passenger cars and trucks sold by the manufacturer on a bona fide export order are not taxable under the provisions of the present War Revenue Bill, according to a ruling which the National Automobile Chamber has just received from the Treasury Department. But where a car or truck is sold to a domestic concern and subsequently exported at the instance of the buyer the tax is collectable.

The ruling makes plain that a sale to a concern doing business in the United States is a domestic sale unless the terms of the original order or contract of sale show that the seller is to export the vehicle, or that he is to make such delivery of it as will result in its exportation; in the latter case the tax is not to be collected. Where a car or truck is sold by a manufacturer, and subsequently exported, the manufacturer must pay the tax. To claim exemption from payment of the tax, the person making the claim must show that he is the exporter.

The Treasury Department originally ruled that cars and trucks may normally be exported in the following ways:

1—They may be shipped by the manufacturer to an agent in a foreign country and after reaching there may be sold by the agent.
2—They may be shipped by the manufacturer to a foreign purchaser to fill orders received by an agent in a foreign country.
3—They may be shipped by the manufacturer to a foreign purchaser to fill orders received by the manufacturer in the United States.
4—They may be shipped by the manufacturer to a foreign purchaser to fill orders solicited by mail and received by mail from the foreign purchaser.

Examples of sales by a manufacturer which are taxable, notwithstanding ultimate exportation of the articles sold, are:

1—A sale to a dealer in the United States, effected by compliance with his shipping instructions to export, given subsequent to the contract of sale which did not require export shipment.
2—A sale to an export commission house in the United States, which is effected by a shipment consigned to the commission house at a domestic port which is followed by immediate exportation by the commission house to a foreign buyer, in whose behalf it made the purchase.
3—A sale to a corporation in the United States which immediately exports to a foreign concern of which it is a subsidiary.
4—A sale to a member of a foreign partnership who conducts a buying business in the United States for his firm and exports the articles bought. In these cases the application of the taxes is not affected by a provision in the contract of sale requiring the buyer to use or dispose of the article sold only in some foreign country (T. D. 2781).

The new revenue bill, if enacted in its present form, gives authority to the Secretary of the Treasury to make provision for the exemption from tax of all cars that are ultimately exported.

—

Trego Motors to Make Passenger Car Engine

NEW HAVEN, Jan. 8—The Trego Motors Corp., of which Frank Trego, formerly chief engineer of the Packard Motor Car Co., is head, is shortly to place on the market a high class six-cylinder engine designed for passenger car use. The Trego company was formed about a year ago for the production of Liberty aircraft engines, but in July of this year transferred its manufacturing activities from aircraft to ordnance work. It is understood that the new engine will be of the L-head type designed for maximum efficiency. No particulars regarding the design or construction have been made public.

—

Four Army Planes Reach Atlantic

NEW YORK, Jan. 8—The four army airplanes which left San Diego Dec. 4 arrived at Hazelhurst Field, Mineola, L. I., last night, having covered the 3800 miles in 55 hours of actual flying time during the 34 days consumed in making the trip. The trip was started originally to map an aerial postal route between San Diego and El Paso. Plans were later changed to take the four planes completely across the continent.

—

Average 172 M.P.H. in Martin Bomber

CLEVELAND, Jan. 8—In the first bombing plane turned out by the Glenn L. Martin factory, Pilot Eric Springer and one passenger flew the 215 miles between Dayton and this city in 1 hr. and 15 min., averaging 172 m.p.h. The machine is one of a new type, weighing 2500 lb., and being equipped with two Liberty engines.

—

Beecroft Due Back Jan. 23

LONDON, ENGLAND, Jan. 7—Special Cable—David Beecroft, directing editor of the Class Journal Co., who has been in Europe since Oct. 26 as a member of the party of business paper representatives who have been the guests of the British Government, will sail for New York on the Adriatic on Jan. 15. The steamer is due in New York Jan. 23 or 24. All of the party returned on Jan. 2 except Mr. Beecroft, who remained to make a tour of manufacturing industries in Italy.

N. Y. Truck Show Space Allotted

Forty-Seven Dealers Get Space in Garden and Armory—M.A.M.A. Approves Event

NEW YORK, Jan. 6—Practically every inch of available truck space in both Madison Square Garden and the Sixty-ninth Regiment Armory was contracted for at the drawing for floor space in the commercial vehicle section of the nineteenth annual New York Automobile Show, which took place Saturday at the Automobile Club of America.

There are still four spaces unallotted, but for these there are thirty applicants. The only opportunity prospective exhibitors who did not secure space will have to obtain any will be in the event of some exhibitor cancelling space. Practically all of the established motor truck dealers from New York's automobile row, numerous factory representatives and out-of-town dealers were present at the drawing.

Both Garden and Armory Used

This commercial section of the show will be held Feb. 10-15, immediately following the passenger car exhibit, Feb. 1-8. So large are both sections of the show to be that no single building in New York is adequate to hold either. The Garden and Armory together will house the passenger car section during the first week, and the second week the commercial vehicle section, including motor trucks, delivery wagons, tractors, etc., will occupy both of the show buildings.

Yesterday it was a source of great gratification to the members of the Automobile Dealers' Association, under whose auspices the show is being held, to learn that members of the Motor and Accessory Manufacturers Assn. have decided to exhibit this season as they have at the New York and Chicago automobile shows of the past.

An enormous display of accessories is now assured for both sections of the show. In fact, it should be a record-breaking array for the reason that more floor space is available for accessories than was the case in former years when the entire show was housed in a single building.

Each season numerous accessory makers have been unable to obtain space because of not having applied early enough in advance. With the augmented space a number of these can be accom-

(Continued on page 74)

Automotive Industries

Commercial Aviation Here in Few Years

Is Surely Coming, Say Profession's Leaders at Big Meeting of Manufacturers' Aircraft Association—Wise Progress Urged—Exposition to Be Held

NEW YORK, Jan. 8—That commercial aviation is a reality of the not distant future, and that the demands upon aviation in peace will surpass the demands made by war, was asserted on numerous occasions last evening at the dinner of the Manufacturers' Aircraft Association at the Waldorf-Astoria.

The dinner brought together the many factors that have been operative in aviation during the period that America was engaged in combat. There were men who designed engines and planes, men who guided their output, men who had to do with their despatch to the front, and the men who flew them over the German lines and brought the war to an end much sooner than the world expected.

And all of these men, speaking from an intimate experience that is not the good fortune of those who have been more remotely placed, spoke confidently of transatlantic flights, planes engaged in mail and commercial work, long flights and safe landings in now impossible spots, made possible by the designs that will come through the demands of peace just as present designs came in response to the demands of war.

As a first step in the big future that all expect for aviation is the Aeronautical Exposition which the association will hold in Madison Square Garden Feb. 27 to March 6. It is expected that at least fifteen complete planes can be shown in the Garden, and with them the detail of the many designs and engineering features that have hastened into being during recent months.

It was urged that there be schools of aviation, just as there is an army school at West Point and a navy school at Annapolis. The country now has hundreds of trained fliers, all anxious to keep on flying, and it was held that if progress is wise and not too forced the science and art can be developed highly within about five years. It was suggested that present aircraft manufacturers be encouraged to continue their aviation activities in parts of their plants.

I think, said John D. Ryan, former head of air work, the peace requirements—and I don't believe I am overoptimistic—will in time startle the world. I don't think it is coming to-day, and I should regret very much if it were pushed too much. I think with care and caution and development, and trial, that the aeroplane can be made as necessary in peace almost as it is in war, and I believe it is in good hands. I believe the manufacturers of this country, who are in the aircraft business to-day, will see it to their own interests to proceed cautiously, carefully, and make as few false starts as possible, develop it on broad lines and bring it to the fruition it deserves.

I should think that it would be plain to almost anybody that in the necessity for the defense of a great country like ours, with a great coastline like ours a very extensive aircraft program is a very desirable thing.

I think the science of aviation should be encouraged in every possible way. I would have an academy of aviation, just as we have a military academy at West Point and a naval academy at Annapolis. I would educate the boys of this country from the time they are boys, in aviation, strictly, and almost exclusively, and I think that with the proper expenditure and the proper direction, within five years from now an enemy fleet that attempted to reach the shores of the United States would be detected and located so far out at sea that it would be put out of business three or four hundred miles beyond the reach of the shore. (Applause.)

I don't think there is anything in the nature of a dream about that. I don't think that any one who studies what has been accomplished in aviation, and who thinks what might be accomplished, can consider that at all a dream.

We now have planes that have a long range. We will have planes with a longer range, not necessarily the fastest planes, but planes with a long range that could absolutely detect the presence of a hostile fleet on its way to these shores, at least five or six hundred miles before they could reach us. Not deprecating in any way the great naval defense that we want in this country, and that we must have, I would say the planes could locate the fleet and the navy could destroy it; it could be told where it was and destroyed before it could reach us.

I think it is a great pity that the brains in the aircraft organization, naval, as well as in the army, should be scattered. I think that the civilians who have come into this work, able engineers who have gone so far in this work, should be used, should be kept, should teach the younger generation all they know, pass it along, and that these great organizations that have been got together under the stress of war should not be dissipated and go back to their civilian employments without leaving with the country the benefit of all they have learned.

I think that the great manufacturing organizations should not be destroyed or allowed to fall into disuse. I don't advocate the building of great numbers of aircraft for military purposes. I don't think it is necessary. But I think that sufficient encouragement and employment can be given to the well-developed aircraft factories of this country to keep them in the aircraft business, to induce them to make every discovery, to do everything they can to promote the science of aircraft. The organization should be kept intact, and the men who are able and who have done this thing should be kept together as far as possible. It would be a small expense, and God knows it might be a great measure of economy some day.

Some people have criticized our work in aviation on the front, some people have said we have been too reckless. People have told me that our boys were too reckless if anything; the French told me that our boys were too reckless; some of our own good friends have said that our boys were too reckless, but God bless them! That is what won the war, the fact that our boys were too reckless.

I saw them in France when the clouds were low, and when it wasn't a fit day for anybody to take the air, go out and fly 50 and 60 meters above the ground and bring back a complete record of what was ahead of them. General Pershing told me when I talked with him, on the second day of the battle of the Argonne, that no army ever went out with the information as to what was in front of it as the American army did in St. Mihiel and the Argonne.

Probably the loudest cheers of the evening were for Col. W. A. Bishop, Canada, who has an official record of having brought down 75 planes. A modest young man of 24, he is said recently to have been called a "coward" by a humorous friend because he was "afraid" to sit in the front of a box at a theater. However, last evening he was styled the "All American Ace," and, after telling a bit about aviation in war, he had this to say about aviation in peace:

Speaking of the future of aviation, one can only say that aviation has been made by this great war. At the beginning of the war it was a dream of the pioneer of fliers that flying machines should help to scout and do other work, and they did at the beginning of the war, but no dreams that those pioneer fliers could possibly have had could possibly picture the wonderful development which aviation has had during the past four years.

Each month of the whole course of those four years new improvements and new machines have steadily come to the different fronts, and with those improvements and those new machines new work has developed for the aeroplane, and instead of, as was at first thought, an aeroplane would simply do scouting work and the odd bit of looking around here and there, it now takes part in every action in any kind of warfare, and no action is complete without its perfect co-operation.

I feel convinced—and really I have seen aeroplanes do some extraordinary things—I feel absolutely convinced that the future of aviation is not in warfare; it is in commerce and I think that the wonderful record, the science of flying has had will be equaled and surpassed in the next few years by the development of commercial aviation. The first startling thing will be the transatlantic flight, and as every man here knows that is not far off, not for one machine, but for many machines. At the end of another year I feel quite confident that scores of machines will have crossed the Atlantic.

And a great number of men here to-night will doubtlessly take that trip. This trip will without doubt be done not only in the big machines, but in the small machines. Both of these types have their advantages for commerce. The general idea among the outside public seemed sometimes to be that the only machine fit for a commercial purpose is the big, many-engined machine. This machine undoubtedly has tremendous advantages in carrying weight, in going long distances, and by reason of its two, three or four motor engines, it may be more reliable, but the engines which have been turned out of late in your country, in England and France and Italy, have shown us that single engine machines may now be reckoned upon to be absolutely reliable, and that a person flying a machine with one engine, one of the good ones, may rely on that engine not to let him down.

This is undoubtedly the biggest step that

(*Continued on page* 78)

Massachusetts Wants Higher Fees

BOSTON, Jan. 4—Motor truck owners, and dealers in trucks and cars throughout Massachusetts will find that they will have to pay a very much larger sum to the State if the report submitted by the joint committee to investigate motor matters is accepted by the legislature. The most important, and drastic section provides for the fees for motor trucks. At present truck owners pay $5 for one ton and $3 for each additional ton.

The new fees provide:

1 ton, $15; 1½ tons, $30; 2 tons, $40;

2½ tons, $50; 3 tons, $75; 4 tons, $100; 4½ tons, $150, and 5 tons, $200.

For every additional ton there would be a charge of $200.

These fees would be paid by the owners of the motor vehicles.

The dealers at present are allowed a number of license plates for their cars, which are registered at a lower price than those in use all the time by owners. The report suggests that dealers pay the same fees as owners, and where a large dealer has a number of machines it will jump up his expenses considerably.

On top of that comes the division of motor dealers into three classes; those who sell machines, new and used; those who deal in used cars solely; and those who buy cars for junk.

They must all take out licenses in the city or town where they do business. And a fee for this may be charged as high as $100. Moreover, they must report every day to the Highway Commission every car or parts of machines taken in trade or bought.

Also those licensed under Classes II and III must hold their cars at least 4 days before reselling unless given special permission. This is the outcome of the hearings held for the past 2 years on the question of stopping the thefts of motor cars.

The load on trucks is restricted to 6 tons, and the length over all of trucks and trailers to 26½ ft.; height 11 ft.; width 92 in. Jitneys are to be limited to their carrying capacity for seats.

Remove Import Restrictions on Balata

WASHINGTON, Jan. 2—Restrictions on the import of balata, gutta-percha, gutta-joolatong and gutta-siak have been removed by the War Trade Board and licenses will be granted for any quantity providing that the bills of lading are endorsed by the Rubber Association of America, Inc. Government option prices on this rubber are withdrawn.

This relaxation of import restrictions does not authorize the importation of the above named rubbers from any country other than the primary or overseas markets.

Reo Guarantees Price

LANSING, MICH., Jan. 4—The Reo Motor Car Co. has guaranteed present prices on its various models until July 1. They are as follows: Five-passenger, $1395; three-passenger, $1395; four-passenger Coupe, $2175; five-passenger Sedan, $2175; Speed Wagon Chassis, $1250.

Workers Increase 3%; Wages, 23%

48 Automobile Makers Employ 117,290 in September and Pay Them $3,215,836

WASHINGTON, Jan. 3—Reports received by the Department of Labor from automobile manufacturers indicate a slightly increasing employment and a greatly increasing wage scale.

Forty-eight manufacturers reported 117,290 workers for September, 1918, 3 per cent more than the 113,889 workers employed in the same week of 1917. The wage scale for September, 1917, for these factories totalled $2,614,888, while in 1918 it amounted to $3,215,836, an increase of 23 per cent, which is highly significant as contrasted with the increase of 3 per cent in the number of workers.

Forty-three automobile manufacturers reported 103,931 workers for August, 1918, as compared to 105,673 for September, 1918, an increase of 1.7 per cent. The pay-roll for August, 1918, totalled $2,856,530, as compared with $2,924,456 in September, 1918, an increase of 2.4 per cent in contrast with the employment increase of 1.7 per cent, indicating that as late as September of this year wages were still increasing.

In a few instances, states the Department of Labor, there have recently been reports from some automobile manufacturers of slight decreases in the wage rate increase.

An average increase of 15 per cent affecting 30 per cent of the force was granted by one manufacturer. The shop employees in one factory and approximately 10 per cent of the organization in another received a 10 per cent increase.

One establishment reported 50 per cent of the force given a 5 per cent increase, while another establishment reported an increase of 5 per cent affecting 21 per cent of the employees. One-third of the force in one plant and the entire organization in another plant received increases, but no data were given as to the amount of the increase. A productive average hourly rate in one establishment was reduced approximately one-half cent.

Following is a complete comparison of employment in 13 important industries of the United States, indicating extraordinary increases in wages in every instance as compared to the increase of workers. Car building and repairing, it will be noted, has the highest rate of increase, with 104 per cent wage increase and 23 per cent workers' increase.

Good Coal Production for Year

WASHINGTON, Jan. 3—Bituminous coal production for the week ended Dec. 21 was 10,136,000 tons as compared with 10,616,000 tons the corresponding period of last year. Anthracite production for the week ended Dec. 21 totalled 1,839,000 tons as compared with 1,778,000 tons in the same period of 1917. The decrease in bituminous production was largely in Ohio, Pennsylvania and West Virginia. Illinois, Indiana, and South and West fields reported slight gains. From April 1 to Dec. 21 the total bituminous production was 441,361,000 tons compared with 402,824,000 tons in the same period of 1917. For the same period anthracite production totalled 72,541,000 tons this year as against 73,954,000 tons last year. During the week ended Dec. 14, coal production was 27 per cent less than 100 per cent due to the fact that there was no market, causing 11.3 per cent loss, labor shortage 7.4 per cent, car shortage 4.3 per cent, mine disability 2.9 per cent and all other causes 1.1 per cent.

Agricultural Implements Off Import List

WASHINGTON, Jan. 2—Agricultural implements have been removed from the list of restricted imports by the War Trade Board. The removals from the list also include nickel, zinc and grease. Licenses will now be issued for the importation of these commodities.

Vacuum Oil Company Restrained

WASHINGTON, Jan. 2—The Vacuum Oil Co., New York, was ordered to-day by the Federal Trade Commission to discontinue shipping its products without having previously sold or received orders for them from customers, prospective customers, or customers or prospective customers of its competitors. The order further prohibits the company from "inducing or attempting to induce in any manner whatsoever" consignees to accept such unbought or unordered shipments. The company has admitted, states the Federal Trade Commission, to have made shipments at market prices of "large quantities of its products without having heretofore sold or received orders for the same," and attempted to induce the consignees to accept by the extension of long-time credits and guaranteeing resale of such consignments and the assistance of the firm's salesmen in disposing of the

Summary of Labor Conditions During Month of September. Few Wage Decreases

Industry.	Establishments reporting for September both years.	Period of payroll.	Number on payroll in September. 1917	1918	Per cent of increase (+) or decrease (—).	Amount of payroll in September. 1917	1918	Per cent of increase (+) or decrease (—).
Automobile Manufacturing	48	1 week	113,889	117,290	+ 3.0	$2,614,888	$3,215,836	+ 23.0
Boots and Shoes	70	1 week	50,036	52,131	+ 4.2	715,729	980,828	+ 37.0
Car Building and Repairing	35	½ month	39,798	49,248	+23.7	1,489,856	3,051,904	+104.8
Cigar Manufacturing	57	1 week	18,393	18,326	— .4	224,559	269,453	+ 20.0
Men's Ready-made Clothing	39	1 week	22,941	21,568	— 6.0	357,572	416,878	+ 16.6
Cotton Finishing	16	1 week	10,970	10,334	— 5.8	162,001	204,386	+ 26.2
Cotton Manufacturing	54	1 week	52,525	50,506	— 3.8	596,853	845,032	+ 41.6
Hosiery and Underwear	55	1 week	28,412	28,507	+ .3	315,388	435,765	+ 38.2
Iron and Steel	95	½ month	157,524	158,361	+ .5	7,170,020	9,948,291	+ 38.7
Leather Manufacturing	34	1 week	14,583	14,741	+ 1.1	234,643	312,722	+ 33.3
Paper Making	56	1 week	26,513	27,200	+ 2.6	426,906	585,328	+ 37.1
Silk	43	2 weeks	14,877	13,127	—11.8	349,014	423,788	+ 21.4
Woolen	50	1 week	43,974	43,330	— 1.5	654,370	852,985	+ 30.4

shipment. The order was issued on agreement with the concern, which waived right to introduce testimony in support of the practice.

—

345,500,000 Bbl. Petroleum Marketed

WASHINGTON, Jan. 2—More than 345,500,000 bbl. of petroleum was marketed from oil wells and field storage tanks in the United States in 1918, according to a preliminary estimate made by the Geological Survey, Department of the Interior. This is a gain of 3 per cent over the output of 335,315,801 bbl. in 1917. The surface reserve of crude oil held by producers and pipe line companies at the end of this year was estimated at 123,000,000 bbl., compared with 150,000,000 bbl. at the end of 1917.

—

Shipments of Tank Cars

WASHINGTON, Jan. 2—The oil industry shipped 505,685 tank cars of oil and oil products from the mid-continent field between Jan. 1, 1917, and Nov. 1, 1918, according to figures made public by the Railroad Administration yesterday. Between April 20 and November 30, 1918, 3585 solid trains of tank cars moved from the Middle Western field, totalling 100,530 cars.

—

Exports to Greece Simplified

WASHINGTON, Jan. 3—A simplified procedure for handling applications for licenses to export to Greece has been arranged by the War Trade Board. None of the many supplemental sheets will be reuired hereafter, as the particulars of the applications will not have to be sent to the War Trade Board representative in Greece. Licenses for shipments to Greece will be valid until used or revoked and can be used for shipments either direct or indirect and without restrictions as to the flag under which the same is carried.

Oil and Gasoline Production Normal

Stocks Show Slight Decrease in October, But Ten Months' Figures Are Satisfactory

PRODUCTION

	October, 1918	September, 1918
Crude oil (bbl.)	29,237,767	28,390,431
Gasoline (gal.)	314,251,318	314,595,959

	Stocks on Hand Oct. 31, 1918	Stocks on Hand Sept. 30, 1918
Crude oil (bbl.)	15,438,756	14,462,100
Oils purchased to be re-run (bbl.)	1,308,744	1,312,275
Gasoline (gal.)	250,328,329	269,722,723
Kerosene (gal.)	419,409,944	436,628,907
Gas and fuel (gal.)	596,116,351	583,407,769
Lube. (gal.)	135,196,542	147,425,556
Wax (lb.)	195,797,590	181,044,508
Coke (ton)	23,905	16,866
Asphaltum (ton)	74,159	79,424
Miscellaneous (gal.)	457,222,127	444,353,139

NEW YORK, Jan. 6—Figures dealing with the output of oil refineries and stocks on hand for October disclose that both production and amount available are around normal, when compared with the totals for September. Production of crude oil has increased from 28,390,431 bbl. in September to 29,237,767 bbl. in October, but the production of gasoline has decreased from 314,595,959 gal. to 314,251,318 gal. The drop in gasoline is so small as to be almost negligible and is in all probability more than compensated for by decreased consumption.

Another factor which will tend to relieve the gasoline position is that smaller quantities of special spirit for aircraft will be needed, even although an increase in the amount required for aircraft employed in postal and commercial service may be expected. Taking gasoline on a daily production basis the average for 10,486,532 gal. per day for the 30 days of September may be compared with the 10,137,139 gal. per day for the 31 days of October.

Gas and fuel oil figures show a substantial increase for the 10 months of 1918, and the production for October was greater than for any other month in the ten. It is apparent that every effort will be made to accumulate a reserve of fuel oil to meet the demands of our new oil-burning merchant marine.

—

British Petroleum Prices Amended

WASHINGTON, Jan. 3—The London Board of Trade has arranged new wholesale prices for petroleum products effective Dec. 16, as follows:

Gas oil in bulk at wharf 17 cents per imperial gallon (1.2 United States gal.)

Fuel oil in bulk at wharf $48.67 per ton.

From Jan. 1, 1919:

Spirit in cans—aviation, 77 cents; special boiling points, 72 cents; No. 1, 70 cents; No. 2, 68 cents; No. 3, 66 cents.

Kerosene—long-time burning oil, in bulk, 30 cents; No. 1, 30 cents; No. 2, 28 cents. Raw white spirit ungraded and unrefined, to manufacturers, 55 cents.

All of the above, excepting where otherwise specified, are per imperial gallon, which is equal to 1.2 U. S. gallons.

—

Exports to Belgium

WASHINGTON, Jan. 2—Any commodity destined to Belgium and the Belgian Congo, excepting those included in the present War Trade Board Export Conservation List, can be shipped without application for a license under special export license RAC-65. It is only necessary for shippers to note on the package if it is shipped through the mails or on the export declaration, if shipment is made by express or freight the following:

"Shipped under special export license RAC-65."

Name and address of shipper.

Name and address of consignee.

Statement of contents.

There are no automotive products listed on the Export Conservation list.

Total Output of Refineries in the United States for 1917

1917	Crude (bbl.)	Other Oils (bbl.)	Gasoline (gallons)	Kerosene (gallons)	Gas and Fuel (gallons)	Lubricating (gallons)	Wax (pounds)	Coke (tons)	Asphaltum (tons)	Miscellaneous (gallons)	Losses (bbls.)
January	24,839,772		203,618,724	137,248,370	469,596,208	60,941,062	39,558,627	44,627	49,894	27,881,019	941,924
February	23,083,483	no account	184,602,595	129,074,504	446,964,925	54,631,765	36,370,297	42,047	40,619	23,685,686	941,110
March	26,230,138	1st 6 mo.	220,523,571	159,028,978	494,855,838	64,345,221	40,868,930	48,839	52,823	26,977,384	870,880
April	25,994,938	1917	228,945,164	157,826,945	462,846,339	63,218,215	41,037,511	46,099	52,849	30,959,901	957,533
May	27,253,391		238,816,209	147,894,846	504,859,695	65,926,007	38,686,364	48,535	67,612	31,086,377	979,245
June	26,453,210		233,671,746	151,477,333	496,742,434	61,045,757	38,075,280	42,513	67,931	30,205,172	1,011,568
July	26,776,856	2,435,533	244,145,292	161,679,053	599,454,966	64,335,905	40,158,033	42,641	65,272	92,359,401	1,111,511
August	27,900,623	2,376,580	254,464,491	149,528,513	632,151,971	64,107,817	38,999,341	46,240	73,878	92,708,312	1,286,141
September	27,529,022	2,632,988	256,132,050	143,203,644	629,914,572	60.757,049	48,300,033	42,986	62,520	80,386,471	1,182,560
October	27,698,023	2,863,518	271,891,234	140,559,542	621,492,374	68,516,071	41,181,400	48,849	73,886	91,804,160	1,355,219
Total first Ten months	263,759,406	10,308,619	2,336,811,076	1,477,521,728	5,358,879,322	627,824,869	403,235,816	448,376	607,284	527,503,833	10,637,191
November	26,215,979	2,519.700	264.888,709	125,893,202	592,490,037	64,861,375	39,694,595	45,815	73,289	87,115,002	1,203,110
December	25,155,996	2,069,351	248,846,638	123,354,046	561,954,921	61,090,596	38,269,670	45,175	58,852	87,548,408	1,233,528
Total	315,131,681	14,897,670	2.850,546,423	1,726,768,976	6,513,324,280	753,776,840	481,200,081	539,366	739,425	702,167,243	13,073,829

Total Output of Refineries in U. S. for First Ten Months of 1918

1918											
January	23,842,587	2,300,334	242,632,044	119,358,184	547,866,248	56,625,425	39,238,858	41,216	54,854	70,995,829	1,078,181
February	23,386,676	2,298,333	234,324,619	121,218,320	510,165,397	58,300,914	35,087,337	42,371	42,038	75,134,088	983,992
March	26,239,662	3,696,872	269,647,968	151,228,007	587,985,804	69,308,351	43,597,019	44,248	56,901	94,865,148	1,097,489
April	26,201,544	3,956,244	293,396,162	153,703,682	578,255,341	71,022,204	40,173,524	45,674	51,242	89,242,012	1,182,020
May	28,510,698	4,112,023	319,391,202	160,590,760	631,586,209	79,589,755	42,544,633	48,864	60,449	88,627,491	1,269,281
June	28,140,479	3,483,270	315,023,445	151,840,252	628,842,033	74,420,996	41,317,794	46.605	50,321	81,110,922	1,282,177
July	29,170,718	5,951,537	332,022,095	156,828,826	658,439,682	79,303,107	41,691,551	48,914	48,433	159,374,139	1,338,304
August	28,534,275	6,376,353	330,335,046	149,678,850	671,113,871	72,892,879	41,829,516	51,759	59,715	163,355,034	1,337,327
September	28,390,431	5,485,747	314,595,959	164,963,798	653,085,050	70,593,079	42,704,894	48,052	49,157	138,201,963	1,236,834
October	29,237,767	5,571,847	314,251,318	164,928,640	661,780,441	72,244,633	43,470,132	48,820	51,878	166,109,867	1,161,545
Total	271,654,837	43,232,560	2,965,599,858	1,494,339,319	6,129,120,076	704,299,323	411,655,258	466,523	534,983	1,127,006,493	11,967,250

Trucks To Be Exhibited at New York Show

AT MADISON SQUARE GARDEN

Truck	Exhibitor	Truck	Exhibitor
Atlas	Garland Auto Co.	HayDee Truck Attachment	Hayes-Diefenderfer Co.
Autocar	Autocar Co.	Lapeer Trailers	Owen Magnetic Sales Co.
Babcock Bodies	Hayes-Diefenderfer Co.	Master	C. H. Larson
Bethlehem	Graham Brothers.	Maxwell	Maxwell Motor Co.
Chevrolet	Chevrolet Motor Co.	Oldsmobile	C. H. Larson.
Columbia	A. Elliott Ranney Co.	Oneida	West Motor Co.
Day-Elder	Colt-Stratton Co.	Overland	Willys-Overland Co.
Denby	Cole & Dixon.	Packard	Packard Motor Car Co.
Dodge Bros.	Colt-Stratton Co.	Reo	Reo Motor Car Co.
Federal	Morton W. Smith, Inc.	Riker	Locomotive Co. of America.
Fulton	Fulton Motor Truck Co.	U. S.	W. C. Poertner Motor Car Co.
Giant	C. T. Silver, Inc.	Velie	Garland Auto Co.
Graham Truck Attachment	Graham Brothers.	West	West Motor Co.
Hall	R. & D. Motors Co.		

AT 69TH REGIMENT ARMORY

Truck	Exhibitor	Truck	Exhibitor
Diamond-T	Diamond-T Motor Truck Co.	Republic	W. J. B. Co.
Garford	Garford Motor Truck Co.	Schacht	Schacht Motor Truck Co.
Gramm-Bernstein	C. W. Moody	Selden	Manhattan Motors Co.
Hurlburt	Hurlburt Motor Truck Co.	Signal	R. E. Taylor Corp.
Kelly-Springfield	Kelly-Springfield Motor Truck Co.	Sterling	Sterling Motor Truck Co.
Maccar	Pitts Motor Car Co.	Stewart	Herrmann Motor Truck Co.
Menominee	Menominee Motor Truck Co.	Sullivan	Broadway Motors Co.
Nash	Kauffman-Storrers Co.	Titan	Kauffman-Storrers Co.
Paige	Paige-Detroit Motor Car Co.	Warner trailers	Kauffman-Storrers Co.
Rainier	Rainier Co.	Wilcox	Taylor Motors Corp.

New York Truck Show Space

(*Continued from page 70*)

modated, although the bulk of the space for parts and accessories already has been contracted for.

The M. A. M. A. relation to the show is not as is commonly called a "sanction." The M. A. M. A. does not sanction shows. It "participates" in them. It buys a block of space and sells it to its members. Or, as in this case, it takes a neutral attitude and is agreeable to exhibiting by any member who cares to do so, except that the member buys space from the show manager and not from the M. A. M. A. The M. A. M. A. buys a block of space at Boston and Chicago. The net result, however, is the same, and the M. A. M. A. is co-operating wherever possible with the New York dealers.

At one time there were rumors of friction, but it has all gone now. The success of the show is more assured now than ever.

A big N. A. D. A. meeting is planned for Feb. 5. Prominent men will speak. The show management requests dealers who plan to come to New York to send in requests for seats at this noon-day luncheon as there may be difficulty in getting a banquet hall large enuogh. It is planned to secure a luncheon at reasonable rates.

Expect Keen Bidding for Army Planes

HOUSTON, Jan. 4—There promises to be keen competition in bidding for the purchase of the 1200 airplanes and 2000 airplane engines, now stored at Houston, which the Government has announced it will sell on Feb. 1. Many of the men who will put in bids for airplanes are former army flyers, who want the machines for their private and business use. All bids will be opened at the office of the salvage branch, supply section, office of the director of military aeronautics, Washington, D. C.

The bids will be accepted on the plan of cash down before delivery, f.o.b. cars in Houston, and delivery promised within ninety days from the day the bid is accepted. Each bid must be accompanied by a check for 20 per cent of the proposal, and the Government reserves the right to reject any or all bids and also reserves the right to accept the bid on the unit basis. Bids will be accepted for one or more of the airplanes and the same applies to the airplane engines.

Chicago Accessory Space Allotted

CHICAGO, Jan. 6—Space for the nineteenth annual motor show in Chicago has been allotted to its members by the Motor and Accessory Manufacturers' Association, both for the passenger car exhibition, Jan. 25-Feb. 1, and the truck, Feb. 3-6. Ninety-five spaces were assigned for the former dates and fifty for the latter. Sam Miles, manager of the show, also has on file applications for space from forty manufacturers of accessories who are not members of the M. A. M. A.

American Forging to Meet

PONTIAC, MICH., Jan. 7—The annual meeting of the stockholders of the American Forging & Socket Co. will be held Jan. 15. Action to increase the capitalization from $250,000 to $350,000 is contemplated, and a resolution advocating the increase will be submitted to the board of directors to be chosen at that meeting. On Dec. 30 a 6 per cent dividend was declared. This is payable in four equal instalments of 1¼ per cent on Jan. 15, April 15, July 15 and Oct. 15.

Copper Production Increases

WASHINGTON, Jan. 2—Copper production in the United States in 1918, although slightly larger in quantity, showed a decrease of nearly $40,000,000 in value compared with 1917 figures.

At an average price of about 24.75 cents per lb. the 1918 output had a value of $473,000,000, as against $510,000,000 for the previous year, according to a report of the United States Geological Survey just made public.

Production of blister and Lake copper was 1,910,000,000 lb., as against 1,886,000,000 lb. in 1917. The supply of refined copper aggregated $2,450,000,000, compared with $2,362,000,000 during the year before.

Imports of copper in all forms during the yearly period amounted to 535,868,000 lb., and the exports totalled 1,126,082,000 lb.

Arizona, Montana and California mines showed an increase of production, while those of Michigan, Utah, Nevada and New Mexico fell below the 1917 output.

Nineteenth Used Car Market Report Out

CHICAGO, Jan. 8—The Nineteenth Edition of the National Used Car Market Report has just been issued by the Chicago Automobile Trade Association. It shows "as is" sales from June 21 to Nov. 21, and gives appraisal prices for December, January and February. To the long list of car names, representing both modern and ancient automotive history, have been added the names Bell and Templar. In the case of the Bell no figures are given, as only a 1919 model is listed and there has been little sale of used cars of this make. The same applies to the Templar, of which 1919 touring and roadster models are listed.

Samples Can Be Exported

WASHINGTON, Jan. 2—Samples can now be exported by mail, freight, express, in passengers' baggage or otherwise without individual export license. The new ruling issued to-day by the War Trade Board also authorizes the export without individual licenses of advertising matter to be used in connection with samples. The term "samples" is construed to mean any articles intended for use in soliciting orders but not to include any article intended to be sold as an article of commerce. It is necessary to note on the package of the sample if the shipment is made through the mail or on the export declaration, if the shipment is by mail or express:

"Shipped under Special Export License No. RAC-55."
The name and address of the shipper.
The name and address of the consignee.
A statement of contents.

The attention of exporters is called to the fact that the use of this special license number does not relieve the shipper of the responsibility of complying with the import restrictions of the country of destination. For example, exporters are advised that at present the customs restrictions of the United Kingdom forbid the entry into that country, as samples of motorcycles, auto-peds and complete motor cars. Other countries have similar restrictions and exporters should determine first what the restrictions are.

N. A. C. C. Takes Up Peace Problems

NEW YORK, Jan. 8—To-day's meeting of the Board of Directors of the National Automobile Chamber of Commerce extended an invitation to C. C. Hanch, chief of the Automotive Products Section of the War Industries Board, to visit the European countries to investigate automobile conditions in connection with the export trade of American manufacturers. While in Paris he will attend the Inter-Allied meeting called by the Chambre Syndicale des Constructeurs d'Automobiles as the representative of the automobile industry, to discuss custom rates, shows and other matters of international importance. Representatives of England, Italy and Belgium will also attend.

The traffic committee's report showed that the automobile industry is slowly getting back into production, although carload shipments for December were only 8210 as compared with 15,827 carloads in December, 1917, which is 51 per cent of normal. N. A. C. C. traffic officials reported on their meeting with the Packing Service Branch of the War Department, which is developing new methods of loading automobiles in freight cars, to permit the easier handling of vehicles with economy of space. The Packing Service Branch is establishing specifications for packing and loading articles of all kinds and the industry will co-operate with it in handling automobiles.

The meeting discussed the question of locking devices with a view to giving added safety to motorists from car stealing, which is becoming so prevalent. A complete investigation will be made and reports given to automobile manufacturers.

New standards for tires were considered, the plan calling for a continuance of the making of tires for all rims in use, but providing that after Jan. 1, 1920, the manufacturers will equip their cars with certain sizes that are being considered. Pneumatic sizes will run from 30 x 3½ to 36 x 5 for passenger cars and for trucks 36 x 6 to 40 x 8. There will be fourteen pneumatic sizes in all. Truck sizes call for fifteen sizes of solid tires. The whole program is expected to make for greater efficiency in manufacturing and the certainty of dealers' stocks being complete without being too heavy.

It is reported that Canada has virtually raised the embargo on the importation of motor cars by freely granting licenses for their importation into Canada.

The N. A. C. C. will hold a convention of motor truck manufacturers during the week of Feb. 10, coincident with the motor truck show in Madison Square Garden in New York, when standardization, sales and other plans for the industry will be discussed.

New Apperson Export Model

KOKOMO, Jan. 9—The Apperson Bros. Automobile Co. will shortly make public the details of a new moderate-priced model especially adapted for export trade. The company has arranged to maintain its export headquarters with C. T. Silver, Inc., former Apperson distributer for the Metropolitan territory. The export department will be in charge of Geo. H. Strout who henceforth will make his headquarters in the Silver establishment at 100 West 57th Street, New York.

Rules for Ending Contracts

Method of Procedure Outlined by Lt.-Col. Blyth—Individual Forms Available

WASHINGTON, Jan. 2—Instructions to manufacturers for the termination of contracts for war materials have been compiled by Lt.-Col. L. W. Blyth, Chief of the Settlements Division of the Purchase, Storage and Traffic Division, United States Army. The instructions include directions for making:

1—Inventory of unworked direct materials.

2—Inventory of indirect materials.

3—Inventory of worked direct materials.

4—Inventory of direct labor and overhead expense.

5—Statement of scrap from worked materials.

6—Commitments for materials.

7—Claim for other compensation.

8—Recapitulation sheet.

9—Statement of claim.

Following is the complete list of instructions. Individual forms will be furnished to the manufacturers.

Instructions to Contractors in Preparing Claims Based Upon the Suspension or Cancellation of Contracts.

1. For the purpose of submitting claims under contracts, contractors will be furnished with the following forms: Finance Form No. 1, Inventory of Unworked Direct Materials; Finance Form No. 2, Inventory of Direct Materials; Finance Form No. 3, Inventory of Worked Direct Materials; Finance Form No. 4, Inventory of Direct Labor and Overhead Expense; Finance Form No. 5, Statement of Overhead Expense; Finance Form No. 6, Statement of Scrap from Worked Materials; Finance Form No. 7, Commitments for Materials; Finance Form No. 8, Claim for Other Compensation; Finance Form No. 9, Recapitulation Sheet; Finance Form No. 10, Statement of Claim.

2. Wherever it is possible and practicable for the Contractor to fill out the forms submitted, the information should be furnished accordingly. When impracticable to use these forms, the information should be presented by the contractor in such a manner as may be approved by the settling authorities and as will allow of proper examination and determination. As all claims presented by contractors will be subject to complete verification before full reimbursement is made, unusual care should be taken in the preparation of any statement.

3. The heading on each form should be filled out to show the proper official title of the contracting firm or corporation as it appears in the contract; location of the plant and general offices; Department of the Army which issued the contract, such as Ordnance, Quartermaster, Signal Corps, etc.; contract or order number; name of the article contracted for; the number of each sheet, sheets to be numbered consecutively according to classification; date on which work was actually stopped; and date inventory was actually taken.

4. The quantities shown in the inventory should not be in excess of that required to finish the contract.

5. The following brief explanation of the use of each form is given for the guidance of contractors in their preparation:

Inventory of Unworked Direct Materials

After the term "classification" on this form the particular class of material as purchased should be shown. This material may be either raw material, such as steel, copper, brass, etc.; or it may be in the form of component parts purchased, such as forgings and castings of a particular pattern, copper bands, wheels, axles, transmissions, etc. For each class of material, as above stated, a separate sheet should be prepared. Only such component parts as have not entered into process of manufacture should be detailed on this form.

In the body of the form, under the heading "Full Description of Material, Name of Suppliers (Vendors)," such detailed information should be listed as may be necessary to easily identify the item in question. In the proper columns there should be entered the date upon which the item in question was actually received by the contractor; the quantity thereof; the unit of quantity, such as yards, pounds, tons, etc., and the cost of each unit (inclusive of freight). The last column should show the total amount of each item.

Inventory of Indirect Materials

On this form should be inventoried claims for all materials purchased and on hand at contractor's plant to be used in connection with the manufacture of the articles under the contract, but not to become a part of the articles themselves. Examples of indirect materials are oil, grease, waste and sundry factory supplies. Separate sheets should be prepared for each classification of such indirect materials, in the same manner as in the case of Unworked Direct Materials, previously explained. The body of the form should be filled out in the same manner.

Inventory of Worked Direct Materials

On this form should be inventoried all raw materials and component parts purchased which have actually entered into process of manufacture and have had labor and overhead expended upon them. It will not be necessary to classify this material as in the case of Unworked Materials, inasmuch as it is all to be listed as component parts of the articles to be manufactured.

Expenses, Direct Labor and Overhead

The purpose of this form is to show the direct labor and overhead applicable to the Worked Material as shown on the preceding form.

If it is impracticable to apply the amount of direct labor and overhead against the individual items as listed on the preceding form. The items need not be set forth at length, but the form should show the total amount of direct labor and overhead applicable to the Worked Materials as a whole.

Statement of Overhead Expense

The purpose of this form is to establish a rate of overhead to be applied to work in process on the basis of direct labor. This overhead rate is to be established on a basis of the contractor's overhead expenditures for a period of three months preceding the date of cancellation of the contract. The expense accounts should be listed on this form to show classification and amount. The total amount of direct labor on all contracts is to be ascertained for the same period as stated for the overhead. In order to obtain the percentage of overhead to be added to direct labor the total direct labor should be divided into the total overhead. For instance, if the direct labor for the period amounted to $16,000 and the total overhead for the same period amounted to $14,000, $16,000 divided into $14,000 would show a percentage of 87.5, which would be the rate to use.

In the majority of cases it is assumed that only one form sheet will be needed to list the expense accounts, and the form therefore provides for totaling such accounts, setting up the total direct labor on the line next below and showing the rate obtained. Where the expense accounts are too numerous to be listed on one sheet, the total may be carried forward to additional sheets and the direct labor and percentage shown only on the last sheet used.

Where the contractor has an established system for distributing overhead, this system may be used in connection with the Government contract, in so far as it may be applicable. In certain instances, it may be impracticable to distribute overhead on the basis of direct labor, and in such instances other equitable methods may be employed. In any event, the method used should be clearly set forth on this form, in the columns expressly provided therefor.

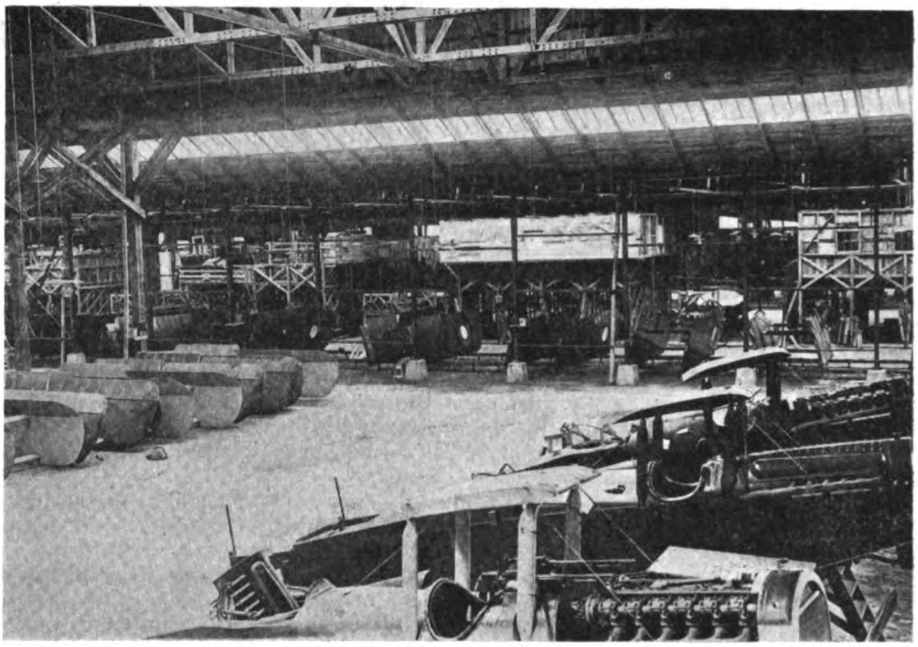
Items of overhead expense should be in accord with Ordnance Department pamphlet entitled "Definition of 'Cost' Pertaining to Contracts," a copy of which will be furnished contractors. In no event should expense accounts be listed which bear no relation to the department or departments of contractor's plant wherein the contract is performed.

Statement of Scrap from Worked Materials

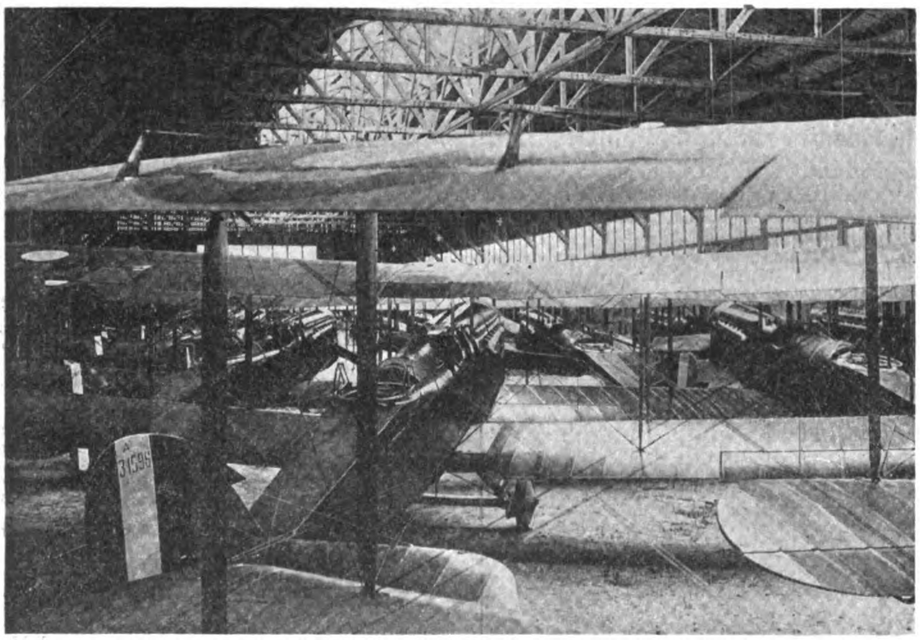
In cases where contractors make claim for the gross value of all raw material or

(Continued on page 77)

French Liberty Plane Depot



This Liberty plane depot, which is at Romorantin, is the largest assembly plant in France. This photograph was taken Nov. 11, 1918



The Romorantin Liberty plane assembly plant, of which this is another view, is located 180 *miles from Paris*

Fly From England to India

PARIS, Dec. 18—*By mail*—For the first time the journey from England to India has been completed by airplane. The trip which ended at Karachi, India, on Dec. 17, was made in a Handley-Paige bombing plane equipped with four Rolls-Royce Eagle engines and was piloted by Maj. A. S. MacLaren and Captain Halley. The total mileage was close to 6000 and was made in a number of stages varying in length from 652 to 1170 miles.

Two Long Seaplane Flights

NEW YORK CITY, Jan. 4—Two long flights in navy seaplanes have recently been completed, one from the Naval Air Station at Pensacola, and the other from Norfolk, Va. Lieut. T. C. Rodman, U. S. Marine Corps, on Dec. 30 flew 900 miles from the Pensacola station, carrying eleven passengers. The same day Lieut. Commander Bollinger, U. S. N., covered a distance of 651 miles from the Norfolk station without stop, carrying five passengers.

Altitude Record Now 30,500 Ft.

NEW YORK CITY, Jan. 4—A new world's record for altitude has been made by an American pilot flying a British plane and carrying one observer. On Jan. 2 Capt. Lang, R.A.F., attained an altitude of 30,500 ft. in 66 min. 15 sec. The best previous record was made by Capt. B. W. Schroeder, an American pilot, who reached an altitude of 28,900 ft. on Sept. 10, 1918, at the Wilbur Wright Aviation Field at Dayton.

Rickenbacker Again Cited

PARIS, FRANCE, Jan. 4—(Special Cable)—Capt. Edward Rickenbacker, foremost among American aces, has won further distinction. He has been awarded the French Legion of Honor in recognition of his military services.

Mexico May Remove Import Duty

MONTEREY, MEXICO, Jan. 4—Assurances have been received here from the City of Mexico that the Federal Government will issue a decree soon removing all import duties on automobiles, motor trucks and other motor vehicles. In anticipation of this being done arrangements are being made for a great expansion of the automobile trade in all the principal cities of the country. While the actual orders for motor vehicles of various lines will not be placed until the decree is issued, dealers and others are making up lists of their possible requirements in these respects and the purchases will be made with a rush when the duties are removed. It is expected that dealers in El Paso, San Antonio, Laredo, Eagle Pass and Brownsville will profit largely as a result of the proposed new decree. While during the last several years there has been a more or less continuous and large trade in used automobiles in Mexico, the time has arrived when the demand for new cars must be filled. This is true, it is stated, as to motor trucks. With a revival of mining and other industries in this country motor trucks are rapidly coming more and more into use. It is largely a virgin field for that trade and offers enormous possibilities in the way of expansion, according to American dealers who have been investigating the situation here.

Chandler Prices Revised

CLEVELAND, OHIO, Jan. 6—The Chandler Motor Car Co. has revised its prices as follows:

Model	New Price	Old Price
7-pass. tour	$1795	$2095
4-pass. road	1795	2095
Sedan	2495	....
Coupe	2395	....
Limousine	3095	....

Summary of Business Conditions as of Date Nov. 23, 1918

The following summary of general business conditions in the United States is compiled from reports received by the Federal Reserve Board from the twelve reserve bank districts:

District.	General business.	Crop condition.	Industries of the district.	Construction, building, and engineering.	Foreign trade.	Money rates.	Railroad, post office, and other receipts.	Labor conditions.
No. 1—Boston.....	Hesitating......	....	Busy...........	Increase in value..	Decrease........	Firm...........	Post office receipts mixed.	More plentiful.
No. 2—New York..	Volume decreasing, except retail sales; profits decreasing; collections good.	Good..........	Reduced activity; many orders canceled.	Normal seasonal inactivity; outlook improved by removal of Government restrictions.	Stimulated interest; some uncertainty.	Slightly lower...	Increase..........	Very little shortage since armistice was signed.
No. 3—Philadelphia	Very good.......	....do.........	Very busy.......	Building at low ebb, but prospects bright.	....	Continue firm...	Increasing........	No labor disturbance expected.
No. 4—Cleveland..	Satisfactory.....	....do.........	Busy...........	Inactive..........	....	Tendency to increase.	Increase..........	Scarce.
No. 5—Richmond..	Resuming activity after effects of influenza.	Tobacco active at high prices; cotton held for 30 cents.	Limited only by supplies and labor.	Preparations being made to resume activity.	Inactive........	Active demand, 6 per cent.	Railroad facilities improving post office in full volume.	Thought to be improving.
No. 6—Atlanta....	Satisfactory.....	Good..........	Continue active..	Very quiet........	Quiet...........	Stationary......	Stationary........	Fair.
No. 7—Chicago....	Good but reflecting conservatism.	Excellent.......	Active.........	Dull but showing improving tendency.	....	Firm at 6 per cent.	Post office receipts decrease.	Scarce and restless.
No. 8—St. Louis...	Good..........	Winter wheat excellent.	Readjusting to peace basis.	Quiet............	....	Firm...........	Increase in postal receipts.	Improving.
No. 9—Minneapolis	....do........	....	Slowing down...	Slow.............	....	....do.........	No change........	Good.
No. 10—KansasCity	Continues active.	Condition normal; outlook excellent.	Active..........	Dull but promising revival.	Heavy on meats.	Firm, 6 to 7 per cent.	Heavy...........	Recovering from influenza.
No. 11—Dallas....	Satisfactory.....	Condition good; outlook promising.	....do.........	Inactive..........	Increase in October.	No changes; firm at 6 to 8 per cent.	Railroad increased; post office 21.8 per cent increase in October.	Unsettled and unsatisfactory.
No. 12—San Francisco.	Volume large, collections good.	Good..........	....do.........	Decreased; new projects under consideration.	Increasing......	Firm and stationary.	Increasing........	Full employment.

Contract Termination Instructions

(*Continued from page* 75)

purchased components put into process of manufacture, the United States is entitled to scrap resulting, and credit for the full market value of such scrap must be given by contractors in preparing final statement of claim.

The scrap resulting from or applicable to materials in process of manufacture must be determined as accurately as possible and reported on this form. Care should be taken that separate classes are separately reported.

It is appreciated that in many instances it will be impossible to physically separate the particular scrap applicable to material in process. Where this is the case, it must be accurately estimated and full credit given, as contractors will be held strictly accountable for the proper proportion of scrap.

Commitments for Materials

This form is to be used to list purchase orders for materials for use on the contract which have not yet been invoiced to contractor by the supplier, but represent commitments on account of which contractor desires to make a claim. It is very important to show the name of the supplier in each instance, as well as a full description of the materials ordered. Classification is required as in the cases of material inventories and a new sheet should be used for each classification.

The date on which the order was given, together with full description of the quantity ordered, unit price and total amount, should be fully set out in the case of each item.

Claim for Other Compensation

In addition to claims based upon inventories and commitments, claims may be made by contractors to compensate for losses actually incurred by them on account of the termination before completion of a contract with the United States.

Contractors who contemplate making claims against the United States for losses incurred by them on account of termination of contract are advised that in every case conclusive evidence must be furnished. It is not sufficient that a contractor show cause for loss, but must submit proof of actual loss sustained.

Contractors are required to submit claims on this form, and support such claims by clear proof, documentary where possible, to the full satisfaction of the board or other agency of the United States having jurisdiction.

In adjusting a claim for other compensation with the prime contractor, in which there is included a settlement with sub-contractors, it will be necessary for the prime contractor to furnish proof of adjustment and settlement of sub-contractor's claim prior to payment.

Recapitulation Sheet

This sheet is to be used to recapitulate and tie together the various inventories and statements, and to avoid the necessity of a large number of signatures, certificates, etc.

A recapitulation sheet should be used in connection with each inventory or statement where more than one sheet is required. In making up inventories and statements, totals should not be carried forward from one sheet to the next, but should be posted to the recapitulation sheet and the final total of each inventory or statement obtained by totaling the amounts appearing on such recapitulation sheet.

On the reverse side of this form appear the various certificates which will be required before payments may be made on account of the various claims. Not all of these certificates will be required in every instance, but a person duly authorized by the contractor must sign the contractor's certificate in the case of every inventory or statement. The other certificates are for signature of War Department officials and will be filled in at a later date when required.

Statement of Claim

This form is prepared for the final presentation of contractor's entire claim to such board or other agency as may have authority to hear and determine it.

As explained on the face of the form, it is, in effect, a final recapitulation of all the elements of the claim as set forth on the various forms previously referred to.

It is not expected that in all instances contractors will make claim for the full amount of inventories and other items set out and in such cases proper deductions may be made on the face of this form, accompanied by a clear and concise explanation thereof.

On this form should also appear all proper deductions for advances previously made to contractors by the United States in connection with the contract upon which claim is made.

The final balance appearing on this form should represent the contractor's net claim on account of the suspension or termination of his contract.

On the reverse side of the form will be found the certification and affidavit required in connection with each contract, and these should be carefully filled out and executed before claim is forwarded.

General Remarks

1. Where a contractor has more than one contract with the United States, great care should be taken that claims on account of each are accurately separated and so reported, as all settlements will be made by contracts and not by contractors. A complete report must therefore be submitted for each contract, and in no case should inventories contain items to be used for more than one contract even though such contracts be for identical articles.

2. Material which is the property of the United States shall not be inventoried. Where advance payments have been made by the United States to contractors on account of materials, the title to such materials has passed to the United States and the contractor's claim for any balance due should be set up as a claim for other compensation on the form provided therefor.

3. One original and five copies of all papers must be forwarded to the Government agency having jurisdiction. Only the original should be signed; on the copies all signatures should be typed in.

4. Wherever these instructions cannot be followed to the letter, the greatest care should be taken to conform as nearly as possible. This is in the contractor's interest, inasmuch as claims properly prepared will be settled with the least confusion and delay.

5. Wherever it will be impossible or impracticable for the contractor to present his claim as set forth herein, he should immediately get in touch with the proper agency having jurisdiction in his district and assistance will be furnished him as rapidly as possible.

Commercial Aviation Here in Few Years

(*Continued from page* 71)

flying has taken, because in the past the people were very frightened of flying over bad country, continually worrying. I have done it myself, of landing in corn fields and like fields, woods and all sorts of things. Now with engines that one can rely on we feel absolutely confident that it will carry you through. The little machine will be cheaper in every way. It will, of course, not bring the same results with the one exception of speed, but it will always be the fast machine.

I think that it is an extreme case, but you might compare the big machine as you would compare an ordinary roadster to a bus, and I believe in the ordinary machine. I would certainly take it if I were going on a long trip from here to Chicago, preferring the roadster to the bus. The Atlantic will certainly be flown in the course of the next six months by more than one machine of the two, three and four passenger class.

Now, your country is full of young, keen, fully developed, wonderfully trained pilots. These people must have employment, they wouldn't want to give up flying either; there is no necessity for it. The future of aviation in the commercial sense will need every one of those men and you are a very lucky country to have such wonderful men trained and eager to fly.

While H. Snowden Marshall, who investigated the aircraft situation, was expected by the audience to say a lot about his investigation, he said little in detail. He stated that things were not as bad as painted and that the aircraft work done was a most creditable achievement. He also urged that the experience gained through the progress made thus far be not lost through a slump in aircraft development.

Lieut. H. H. Emmons, who was in charge of aircraft production, cited figures that reflect very favorably on the efforts of those engaged in aviation work during the war. He said:

For the eight years prior to 1916 the Army had ordered fifty-nine airplanes and had received fifty-four. During the year 1916 the Army had ordered 366 planes and had received 64. In other words, for the nine years prior to 1917 the Signal Corps of the Army had received the enormous sum of 118 airplanes. That was the equipment that they had had up to the date that we started this business and that was all that they knew about them. Now, from that we had to start with a program laid down by the joint army and navy technical board, calling for over 9,000 training planes and over 20,000 combating planes, and you gentlemen who have made any of this material know what it meant to tackle a job of that kind.

Now you made 9,000 of the training planes, you made the 16,000 training engines, and every one of them had been delivered and put into service, gentlemen, before the armistice was declared.

On the combat engine side we were oppressed with a multiplicity of advice; as a result of which it was determined to put our main effort upon the Liberty engine, going into the arguments for or against it. I am simply going to call your attention to this fact, that on the 19th day of May the first stroke of the pen was made to design the Liberty engine, the first engine was built complete and delivered in Washington on the fourth day of July, less than six weeks. It was extended into a 12-cylinder engine and the first one was built and passed the 54-hour test by the 25th day of August of that same year and was pronounced a success and ready for production.

We started to produce that engine, which was rated at a horsepower of 330. When we had tooled and jigged up for it and gotten the factory ready and had produced several hundred of them we were told to increase the horsepower. It was boosted to 375, with the resulting changes in the tools and equipment. When we had made some four or five hundred of them we received our final instructions from abroad, and I might say to you that most of the things you have felt disposed to criticize you will find were done by us because we were told by the authorities under whom we were working that that was what was wanted, and that we should do it.

We received our instructions from the other side that if we could produce an engine of 400 horsepower or upward we would have the engine that would do wonders in 1917 and 1918. Many changes were required to get that larger engine, and on the 29th day of May, 1918, one year after this engine was started to be designed, we had passed all those difficulties, had engineered and developed it, put it into a manufacturing proposition and delivered into service over 1100 of them.

Now that is an accomplishment that never has been equaled in industry anywhere. Those of you who are familiar with the automobile business know that no automobile motor of any size or strength has ever been put into service without at least a year of experimentation and development on it. This Liberty engine had no such year of development before it was put into production, and it did not need it, for the reason that the design was proper when it was made. You have heard about changes on that engine. From the date it has been made until now there have been no fundamental changes on that engine. We have changed the oiling system, but there aren't any fundamental changes.

The changes that you have heard about are of two classes: We know those were required by the two increases in horsepower that I have told you of, and the other the manufacturing changes that always are discovered in the process of production. And those are all the changes that have been made on this engine during the time that it has been in production.

Now from the 29th day of May until the armistice was declared the production of these engines jumped by leaps and bounds, until, during the month of October, the production of Liberty engines was 3878, or over 150 for every working day in that month.

Otto Praeger, Assistant Postmaster General, told of the future that lay in the mail service for planes. He said great climbing ability and such things were not so much in demand as were landing ability and other peace-time qualifications.

Early in the evening a large number of flyers from overseas marched into the hall behind a "Spirit of '76" drum corps amid the applause of the diners.

The meeting also had as a feature the presence of Major Albert D. Smith and others who at 5.30 o'clock the same afternoon completed a trans-continental flight, begun Dec. 4, for observation and mapping purposes.

The banquet was presided over by President Frank H. Russell, of the association, and at the speakers' table were:

Major General W. L. Kenly, Chief of the Division of Military Aeronautics; Charles F. Kettering, president of Society of Automotive Engineers; Major H. Dourif, French Aviation Mission; Hon. H. Snowden Marshall, former U. S. District Attorney; Captain N. E. Irwin, U.S.N., Director Naval Aviation Division; Hon. W. C. Potter, Assistant Director of Aircraft Production; Henry A. Wise Wood, vice-president Aero Club of America; Dr. S. W. Stratton, secretary of Bureau of Standards; Hon. Grosvenor B. Clarkson, Director of Council of National Defense; Benjamin S. Foss, secretary Manufacturers' Aircraft Association, Inc.; Rear Admiral William S. Smith, attached to Naval Consulting Board; Hon. John D. Ryan, Brigadier-General J. D. Cormack, R.A.F., British War Mission; Rev. Nehemiah Boynton, D.D.; Colonel J. A. Mars, Director of Aircraft Production; Hon. Otto Praeger, Second Assistant Postmaster General; Lieut. Alberto Cantoni, Italian Military Mission for Aeronautics in U. S. A.; Lieut. H. H. Emmons, U.S.N., Chief of Engine Production Department, Bureau of Aircraft Production Col. William A. Bishop, R.A.F., D.S.O., V.C.; Harry Bowers Mingle, treasurer Manufacturers' Aircraft Association, Inc.

Studebaker Government Orders Canceled

SOUTH BEND, Jan. 8—It is understood that all of the Government business under order to the Studebaker Corp. has been canceled. This includes the chassis order for Great Britain as well as the other various orders for the United States.

To Complete Galveston Naval Airplane Base

GALVESTON, TEXAS, Jan. 8—It is authoritatively announced that the construction of the ten buildings that are to comprise the industrial group and three hangars of the hydroplane training station which the Government is to establish here will be started about Sept. 1. There will be no change in the original plans as a result of the signing of the armistice, it is stated. The proposed station will cost approximately $2,000,000. Considerable work in the nature of preparing the site for the proposed buildings has already been done.

The bulkheading and filling necessary to raise the site of the plant, which has been moved 1100 ft. east of the original location, to an elevation of 6 ft. above mean low tide, is one-half completed. One dredge is at work and another will be added this week.

The plant, when completed, will be made easily accessible by shell road and rail trackage from the main lines of the Southern Pacific. The men in training will be provided with hospital facilities and means of entertainment during their rest periods. The machines used will be of two sizes, the larger, or bombing planes, having a carrying capacity of six men, in addition to their guns and bombs, and the smaller ships, as their users call them, will carry two men and their fighting apparatus. The larger machines will have a spread of wing of 127 ft.

According to present plans, between twenty-four and thirty planes of the largest type in use by the Government and 800 men will be on duty at the station by the middle of the present year.

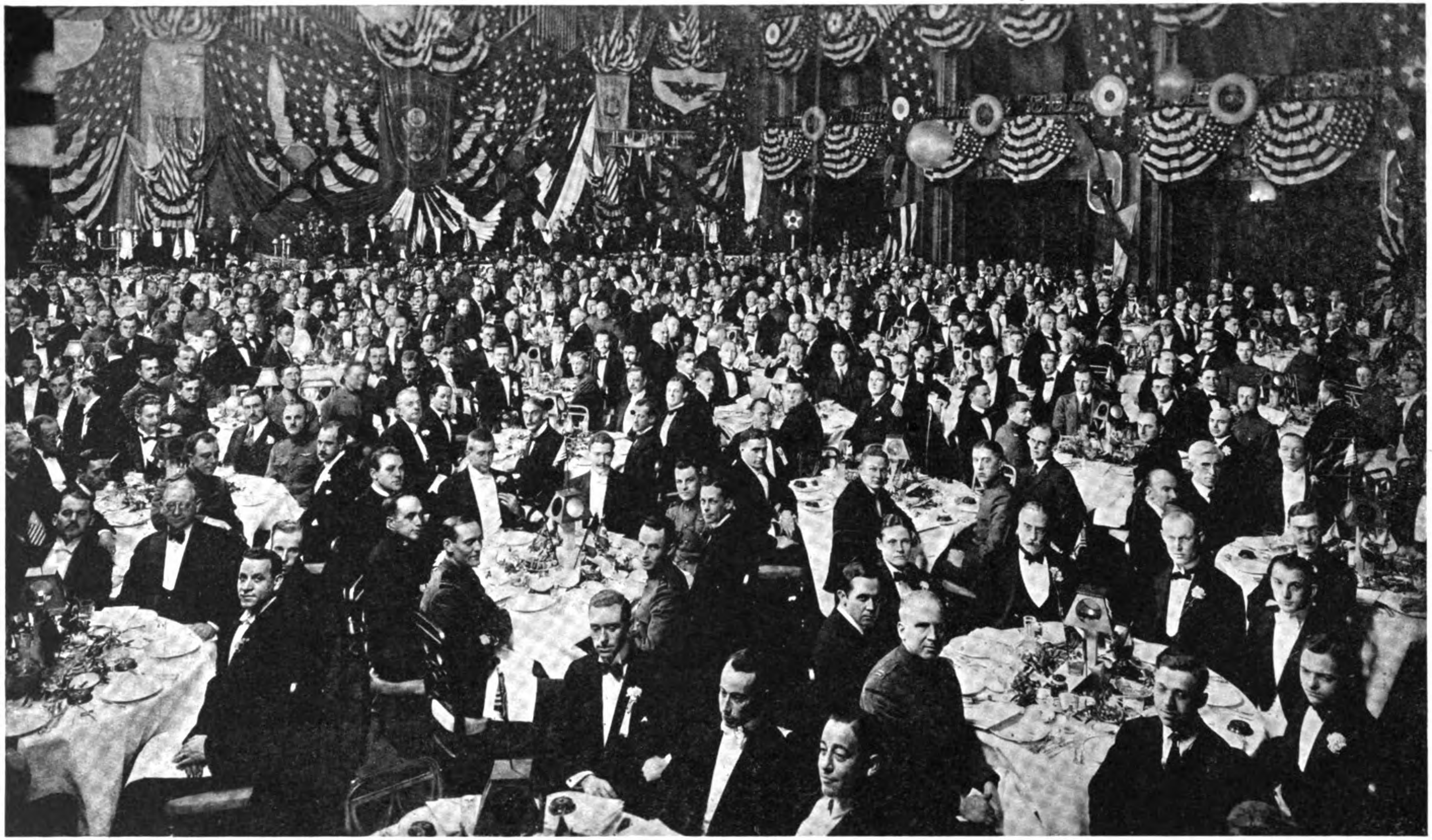
New Issue of General Motors Stock

NEW YORK, Jan. 8—Holders of Chevrolet common stock will be permitted to subscribe for a new issue of common stock of the General Motors Corp. at $118 a share. A holder of one share of Chevrolet stock will have the privilege of subscribing for one-tenth of one share of General Motors at the above price. A similar privilege will be accorded stockholders of the United Motors Corp. They are to be permitted to subscribe to the extent of one-fifth of the number of shares of General Motors common which will be received by the United Motors Corp. stockholders in the distribution of its assets based on holding of record Jan. 15. The price will be the same as to Chevrolet and General Motors stockholders.

No Empire 1919 Models

INDIANAPOLIS, IND., Jan. 8—The Empire Automobile Co. will not be in production with 1919 models, according to Charles B. Sommers, one of the financial heads of the concern. The lease on the 3-story plant in which the manufacturing activities of the company have been carried on expired in December and the company has not renewed it, as it is expected to lease or construct a building better suited to its needs.

Manufacturers' Aircraft Association Dinner, January 7, 1919



THERE were—somebody said—600 there. The diners represented many branches of aircraft manufacture and of the aviation branches of the army and navy. The flags of the Allies adorned the Waldorf-Astoria and an appropriate atmosphere was effected by numerous propellers, radiators, balloons and miniature planes. The miniature models, suspended everywhere, showed early types and late developments.

Graham W. Brogan will on Jan. 15 assume the duties of advertising manager for the Black & Decker Mfg. Co., Baltimore. He was formerly advertising manager for the Duesenberg Motor Corp.

—

Geo. H. Treviranus on Jan. 1 became sales manager of the Gemco Mfg. Co., Milwaukee. He succeeds L. A. Raash, who resigned to become affiliated with Walden-Worcester, Inc., Worcester, Mass.

—

A. H. Doolittle has been elected secretary and general manager of the Sunderman Corp., Newburgh, N. Y. He was formerly sales manager of the Zenith Carburetor Co.

—

F. C. H. Froesch has been made export manager of the American Rubber & Tire Co., Akron. He was formerly in the export department of the Firestone Tire & Rubber Co.

—

N. G. Rost, general sales manager of the Duesenberg Motors Corp., who has been in England and France for the past three months in the interests of the company, has returned and will take up his duties again at the 120 Broadway, New York, office.

—

Joseph P. Ripley, who has been in charge of the Fisk Rubber Co.'s Government sales at Washington for the past year, and was also Baltimore district manager, has been promoted to central district manager for the same company. The central district is one of the largest in the sales organization of the Fisk company, including twenty direct branches. Its headquarters are at Chicago, and it comprises the States of Illinois, Indiana and parts of Wisconsin, Iowa and Kentucky. Mr. Ripley succeeds Claude Platt, who has been appointed special factory representative.

—

Estep Died Doing His Duty

NEW YORK, Jan. 7—Estep was a part of American automotive history. Estep, Harry Perry and Herbert Stephens were co-editors of *The Automobile* when that publication was started in 1902. At one time he was editor of *Motor Age*. He was later advertising manager of the Packard Motor Car Co. and later with the Cheltenham Advertising Agency. He went "over" for *Leslie's*.

Editor AUTOMOTIVE INDUSTRIES: The mere fact that Ralph Estep had "gone West" in the final days of the fighting in the Argonne has been known among his friends for some time, but all details have been lacking. The following letter from my son, Herbert Stephens, 303d Engineers, with the accompanying clipping, furnishes the missing information. After working about Verdun and in Serbia two years ago as a war photographer for *Leslie's*, and doing the same work on this side throughout the different cantonments, Estep was serving in the Signal Corps of the A. E. F.

To those of us who know his high ideals of journalistic duty it will seem a mere matter of course that he sacrificed his life to them, and our sorrow will be tempered by the realization that "Esty" has "made good."—W. P. Stephens, 145 West 32nd Street, Bayonne, N. J.

Dear Dad: I am really crowding things by writing *you* at this time, as this letter should be addressed to Eleanor or Mother, but it is a special one prompted by my noticing the enclosed clipping in *The Stars and Stripes*. You can imagine how surprised and shocked I was to see it. Evidently Lt. Estep was in some way or other connected with our outfit, or one working in liaison with us, as we were working in that sector at the time he was killed. He, no doubt, passed within a short distance of me on his way up to the line, as the majority of the troops went up the main road on the last drive, of which I wrote you. We did not get as far as Sedan, as we were relieved by another division which carried on the work we had started; Lt. Estep was evidently with these men.

From all events he certainly died game, working right up till the last minute; there was a lot of this done, and in many cases the real stories of these men will never be told. For this reason the layman does not realize that a soldier does not necessarily mean a man who rushes madly ahead with either a loaded rifle or a bayonet and has a hand-to-hand fight with the enemy; for example, the infantry and artillery would be entirely lost without the work of such men as Lt. Estep, and in a good many cases these men are exposed to much greater danger and hardships and stand a much smaller chance of being recognized when it comes to writing up the story of the battle, as naturally their work is not as spectacular as that of a body of men working together.—Private Herbert Stephens, Company A, 303d Engineers, American Ex. Force, Venaray, 20 miles N. E. of Dijon, Dec. 3, 1918.

From The Stars and Stripes of Nov. 29, 1918.—"In the dark room of a photographic laboratory near Paris this week, two sensitized gelatine plates gave up the secret of the last minutes of Lt. Ralph Estep, who was killed within sight of Sedan after he had faced death almost daily for three months so that millions of people could see through the eye of his camera what modern war is like.

Gradually taking on lights and shadows, the two plates showed the crest of a barren hill, with shells bursting and casting up great spouts of earth, and, just beyond the crest, a valley black with the shadows of the late afternoon, a valley that holds Lt. Estep's grave.

Lt. Estep had snapped the photographs a few moments before another one of those big shells burst and left him lifeless at the side of his camera and plate pack. That was about 5 p. m. of Nov. 7, three days before the last guns of the war were fired. A dozen pencilled lines in his notebook, titles for the dozen pictures he had taken just before he was killed, make complete the story that the last photographs tell. He had written titles for every plate by numbers, and Plates Nos. 1, 2, 3, 4 and 5 showed the platoon forming for the reconnaissance. Plate 6 pictured a "slight brush," the first sight of the enemy.

The dramatic climax was shown in Plates 11 and 12, his last ones, and in his notebook the record stands:

"11 Burst. Killed."

"12 men crawling."

The pictures were all taken on a cloudy day and are full of shadows, with little contrast, and No. 11 shows only the edge of the hill and the huge, funnel-shaped shell burst. The word "killed" probably referred to what he had seen happen to the men just ahead of him. Picture No. 12 shows another huge column of flying earth with a line of doughboys dimly silhouetted against the darkness of the valley. The last writing on the page—the lieutenant's last words—were simply "Nov. 7 Pack 46." Lt. Estep had re-loaded his camera just before he fell.

Men of the Industry

Changes in Personnel and Position

Maun Joins Republic

ALMA, MICH., Jan. 3—W. E. Maun has been appointed chief assistant to G. R. Wilbur, director of purchases for the Republic Motor Truck Co., Alma, Mich., succeeding C. V. Marshall. Mr. Maun will have charge of production purchases.

Corporal Raymond Drown, son of J. W. Drown, advertising manager of the Standard Roller Bearing Co., is reported killed in France under sad circumstances. It appears that the engineering corps of which he was a member was for over 150 days under fire without losing a man. Corporal Drown was killed after the signing of the armistice while engaged in removing mines laid by the Germans to trap tanks.

—

Henry L. Hornberger has been made general sales manager of the Globe Rubber Tire Mfg. Co., Trenton, N. J. He will have his headquarters at the executive offices in New York. He was tendered a farewell luncheon Dec. 31, when he left the George Batten Co., with which he had been connected for some time.

—

Clarence A. Nelson, vice-president of the Nelson Motor Truck Co., and also vice-president of Nelson Bros. Co., both of Saginaw, Mich., recently died of acute indigestion.

—

Claude Platt, who has been district manager of the central district for the Fisk Rubber Co., has been promoted to special representative.

—

Lieutenant J. B. Howell has been mustered out of the Artillery service and will rejoin the Bound Brook Oil-less Bearing Co. in his former position.

—

G. W. Stephens has been appointed sales manager of the Detroit Twist Drill Co.

—

British Highways Authorities to Increase Weight of Trucks from 5 to 6 Tons

LONDON, ENGLAND, Dec. 30—By Mail—Highway authorities representing the Government propose to increase the maximum allowable weight of motor trucks from 5 to 6 tons and to adopt other regulatory measures concerning motor trucks in general.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Moon in Production Again

ST. LOUIS, Jan. 6—The Moon Motor Car Co. has again started production of the types of motor cars made before the war with slight refinements worked out during the period. It is announced that 50 per cent production will be reached by Feb. 15 and the percentage will be pushed rapidly to 100 per cent. Then the special buildings erected for the manufacture of 6-in. shells for the navy will be brought into use for the motor car plant, much of the machinery provided for that work being available for use with some alterations.

New Livingston Radiator Corporation

NEW YORK, Jan. 7—The rights to manufacture radiators for automobiles, trucks and airplanes under the Livingston patents formerly owned by the Livingston Radiator & Mfg. Co. of this city have been purchased by the Livingston Radiator Corp. The new corporation also takes over all the mechanical equipment and processes of manufacture of its predecessor, and will place the production of this type of radiator on a quantity basis. A new management will have charge of the affairs of the new organization. The inventor, D. McRa. Livingston, again becomes associated with the manufacture of radiators under his patents, and will be vice-president and consulting engineer. E. G. Hines is president and general manager.

Hinkley to Make Engine Line

DETROIT, Jan. 6—The Hinkley Motors Corp. will on Feb. 15 commence the manufacture and marketing of a full line of engines for trucks and tractors. C. C. Hinkley, who heads the organization, was formerly chief engineer of the Chalmers company, which position he left nearly 2 years ago to enter the manufacturing field at the head of a company of his own. During the past year the Hinkley company became one of the country's two largest producers of engines for the Class B standardized truck.

New Type Roller Bearings

CHICAGO, ILL., Jan. 4—The Perfection Roller Bearing Co. has been formed here and will place on the market several new types of roller bearings, including a non-lubricated bearing and one to install on Ford rear axles. The organization is headed by C. M. Carr, and associated with him is William R. Bullion, as secretary. The company has opened headquarters at 117 North Dearborn Street, with a factory in Englewood. C. C. Bombaugh is vice-president and treasurer.

Automotive Absorbs Consolidated

DETROIT, Jan. 6—For the manufacture and marketing of a complete line of automotive accessories the Automotive Productions Co. has been incorporated here. The new concern, capitalized at $600,000, contemplates the extensive manufacture of Dann radiator filler caps, Dann automatic oil caps, gasoline tank filler caps and top holders and a starting primer unit for Fords. The company has absorbed the Consolidated Machine Co., which has been manufacturing screw machine products. The officers are: President and director of sales, J. N. Smoot; vice-president and director of engineering, E. G. Dann, formerly with the Dann Products Co., of Cleveland; secretary and treasurer, W. C. Plummer, cashier of the Federal State Bank of Detroit.

A. B. & B. Specialty Expands

MILWAUKEE, Jan. 6—The A. B. & B. Specialty Co., 3302 Fond du Lac Avenue, manufacturer of motor car accessories, supplies and parts, has awarded contracts for the erection of a two-story brick factory addition, 50 x 100 ft., to provide much-needed facilities to relieve congestion in the present quarters. Charles Stilper is president and treasurer.

Ford Dividend of $4,000,000

DETROIT, Jan. 7—The Ford Motor Co. has declared a dividend of 200 per cent, which is equal to approximately $4,000,000. The first instalment of $2,000,000 was paid Jan. 1 and the second is due Feb. 1. It will be shared by seven stockholders. It is stated that other dividends will be declared in the next few months.

Milwaukee Forge Increases Capital

MILWAUKEE, Jan. 6—The Milwaukee Forge & Machine Co., organized several months ago by Milwaukee interests to manufacture automotive parts, specializing in tractor material, has increased its capital stock from $150,000 to $250,000. The company recently completed a new machine and forge works at 340 Oklahoma Avenue and the new issue is made to provide ample working capital. Officers of the company are: President, George B. Pillar; vice-president and treasurer, John Eckert; secretary, Paul J. Ramstack.

Madison-Kipp Drops "Lubricator"

MADISON, WIS., Jan. 6—The Madison-Kipp Co. is the new corporate style of the Madison-Kipp Lubricator Co., one of the largest exclusive makers of force-feed lubricating devices and systems in the United States. During the past year the company manufactured oilers for tanks, tractors and other war machinery, besides producing the oiling systems for nearly two-thirds of all the farm tractors manufactured in the country.

Globe Tube Rebuilds

MILWAUKEE, Jan. 6—Within three days after fire destroyed the receiving, shipping and storage building of the Globe Seamless Steel & Tubes Co., at Thirty-seventh Avenue and Burnham Street, on the morning of Dec. 29, contracts had been awarded for the construction and equipment of a new building. It will be 200 x 325 ft., of brick and steel, a story and a half high, and will be completed in 40 to 50 days.

More Room for Gray-Dort

CHATHAM, ONT., CAN., Jan. 4—The Gray-Dort Motors Co. has completed a new three-story addition to its plant. This will give an increase of 50,000 sq. ft. in floor space.

Canadian Plant for Republic

TORONTO, Jan. 2—It is reported that the Republic Motor Truck Co., Alma, Mich., will erect a Canadian plant in this city, where about 5000 trucks annually are to be made for the Canadian trade.

Victor Makes Ford Mats

SPRINGFIELD, OHIO, Jan. 7—The Victor Rubber Co. has just closed a contract with the Ford Motor Co. for rubber mats and has recently completed an enlargement of its plant. Four new men have entered the company. They are L. H. Cooke of the American Trust & Savings Co.; Ira A. Stowe, formerly of the Ellwood-Myers Co.; Frank X. Lothschuetz, formerly city auditor, and E. D. Valentine, formerly with the B. F. Goodrich Co.

More Money for Townsend

JANESVILLE, WIS., Jan. 6—The Townsend Mfg. Co., manufacturer of tractors, portable and stationary gas and kerosene engines, has increased its capital stock from $125,000 to $175,000. A large plant addition has been completed and placed in operation.

La Crosse Model "G" Renamed

LA CROSSE, WIS., Jan. 5—The La Crosse Tractor Co. has dropped the name Happy Farmer in connection with its Model G tractors, which are now to be known simply as La Crosse. The Model F will be called the La Crosse Happy Farmer.

Allis-Chalmers Adds

MILWAUKEE, Jan. 6—The Allis-Chalmers Mfg. Co. is erecting a large addition to its main works in West Allis, suburb of this city, where it will concentrate its tractor manufacturing department and greatly enlarge the output, in addition to producing two new types to supplement the standard model. Allis-Chalmers tractors now are being made in the Reliance works, located in Milwaukee, but operations in the new tractor plant at West Allis will begin early in the spring.

Adopt Program for N.A.D.A. Meeting

Graham and Willys Slated to Talk at Annual Gathering Jan. 28 and 29

ST. LOUIS, Jan. 6—A tentative program for the annual meeting of the National Automobile Dealers' Association in Chicago, Jan. 28 and 29, has been adopted. In this draft of the program, few speakers are named because the men invited, and who have accepted "if possible to be there," have not yet sent final acceptance.

There is little or no politics talked here. It appears to be a general impression that President Vesper would succeed himself. All meetings will be at the La Salle Hotel. The general meetings will be in the Red Room.

The big event, aside from the work of getting the association in shape for next year, will be the frolic, at which all hands will be guests of the Chicago Automobile Trade Association. The program as drafted follows:

TUESDAY, JAN. 28.

9.00 A.M. Registration of delegates.
10.00 A.M. Meeting called to order. President Vesper presiding. Appointment of committees. Credential, resolution, nominating. Report of standing committees.
11.00 A.M. President's address.
12.00 Noon Luncheon in the same room.

TUESDAY AFTERNOON.

2.00 P.M. Meeting called to order. President Vesper presiding. Addresses by Geo. M. Graham, Pierce-Arrow Motor Co.; John Willys, Willys-Overland Co.; to be followed by short talks on the following subjects: Good Roads, Salesmanship, Cost Keeping, Business Efficiency, Advertising.

WEDNESDAY, JAN. 29.

10.00 A.M. Meeting called to order. Short talks by officers on accomplishments of association, future policies and aims. Limited discussion by members. Four-minute men only.
12.00 M. Luncheon.
2.00 P.M. Meeting called to order. Report of committees. Election of officers. Adjournment.

WEDNESDAY EVENING

Banquet and trade frolic by Chicago Automobile Trade Association at La Salle Hotel.

Ocean Freights Reduced

WASHINGTON, D. C., Jan. 4—Ocean freight rates between Atlantic ports and ports in South America, Asia, Japan, Australia and Africa have been reduced from one-fourth to one-third, effective for January and February loadings.

The reductions have been made by J. H. Rosseter, director of operations of the Shipping Board, and are intended to stimulate the use of tonnage now available for American exporters.

South American rates are $22.50 per ton to North Brazil from Para to Pernambuco; $25 to Middle Brazil from Maceio to Santos; $30 from Pelotas to Porto Alegre; $25 to Montevideo and Buenos Aires; $27.50 to La Plata; $30 to Rosario, Bahia Blanca and Port Madrya, Argentina; $45 to Japan and China; $40 to Manila; $45 to Singapore and Saigon; $52.50 to Penang, Bangkok and Port Swettenham; $45 to Calcutta and Colombo; $50 to Bombay, Rangoon and Madras; $60 to South East Indies. For Brisbane, Sydney and Melbourne the rates are $40, with the same main tariff for New Zealand ports and $45 for Freemantle and Adelaide. The tariff to South African ports is $35 and to West African ports $25.

Automotive Products Corp. Specializes in Export

NEW YORK, Jan. 6—The Automotive Products Corp., Woolworth Building, has undertaken the export of cars, trucks, tractors, parts, accessories, etc., upon a comprehensive plan which provides not only for efficient service in the actual handling of the goods, but exercises control over the standards of the automotive products so as to insure their measuring up to a high standard. In addition, the corporation's program calls for serving the foreign merchant and looking after his interests in addition to the primary function of selling him.

The president, H. W. McAteer, and the vice-president, C. B. McElhany, of the new company, hold similar offices in the American Steel Export Co.; the general manager, E. P. Chalfant, has been prominently identified with the industry for many years, and the secretary-treasurer, C. A. Musselman, is also well known to the trade.

Emergency Stop for Chicago-New York Airplane Mail

NEW YORK, Jan. 8—Plans are being formulated to institute the often-postponed New York-Chicago airplane mail route at an early date, though no definite date has been set. The Post Office Department has established five landing fields and emergency stops. These are at Lehighton, Pa., 105 miles; Bellefonte, Pa., 115 miles; Clarion, Pa., 87 miles; Cleveland, 128 miles; Bryan, O., 157 miles; Chicago, 166 miles. A staff of 12 pilots has been engaged for the work.

Overland Had $80,000,000 War Contracts

TOLEDO, Jan. 7—War contracts, valued at $80,000,000, entailing an expenditure of $12,000,000 for new equipment and buildings, have been completed by the Willys-Overland Co. and allied plants. The contracts included Curtiss training plane engines, French 75-mm. gun carriages, machining 8-in. shells, Liberty eight and twelve-cylinder engines, Mark 111 adapters and lifting plugs for shells, Sunbeam airplane engines and military tractors for the British Government.

Wagon Makers Standardize Treads

CHICAGO, Jan. 8—Manufacturers of farm wagons and trucks have decided definitely to adopt the 56-in. tread and 38-in. width of bed as standard for all vehicles. It is considered likely that these standards will also be adopted in Canada. Manufacturers, however, will be permitted to sell wagons of the old pattern which were made up to Dec. 31.

Tractor Will Change Selling

Minnesota Implement Dealers Hear How and Why It Will Revolutionize Methods

MINNEAPOLIS, Jan. 8—That the tractor will revolutionize the selling of farm equipment is the opinion of F. W. Pettit, sales manager, the Wallis Tractor Co., who to-day addressed the fifteenth annual convention of the Minnesota Implement and Vehicle Association. Mechanical power supplements or displaces horse-drawn power on the farm of said Pettit. Types of implements change from horse-drawn to power-drawn and gradually but surely we realize that with the coming of a new type of power must come a new type of selling, for power farming not only will revolutionize methods of agriculture but methods of doing business as well.

The manufacturer must necessarily see that his plant and equipment are operating on a basis of constant production; therefore it is necessary for him to seek channels of distribution for a steady output and these dealers naturally will be selected who are best equipped to assimilate this production during twelve months of the year. He will select as his dealrs, those that are most likely to emerge from the final competition.

Pettit does not think the advent of the tractor means necessarily the passing of the implement dealers, but he does think that in order to survive with success and profit it is necessary for the implement dealer to make a stronger bid for tractor business than he has been doing; for beyond any doubt, with the tractor will go the tractor-drawn and tractor-driving machinery, and with the two unquestionably will go the horse-drawn line as well.

Pettit sees the development of a super-dealer who is sufficiently organized financially and otherwise to conduct a vigorous sales plan that will cover farm lighting equipment and water furnace systems, in addition to trucks, tractors and power farming machinery.

Whether the ultimate dealer be an implement dealer, or an automobile dealer, or both, it is unquestionably true, says Pettit, that in every community opportunity likely will knock first at the door of the implement dealer and when the latter has the ability and versatility to change his methods and conform to the change in conditions, he may become the ultimate dealer.

Otherwise, the outside forces which are coming into the trade, and which are accustomed to an aggressive type of salesmanship, will win. The implement dealer must meet this aggressiveness with aggressiveness, for he is certain to see arise the vigorous and hustling methods of the motor car salesman.

Prof. F. W. Peck of the University of Minnesota spoke on the tractor from the viewpoint of economical management of the farm. He indorsed the three-bottom tractor as the economical unit for Minnesota, but said the tractor, generally speaking, was no cheaper to operate than were horses, its value resting upon other considerations.

Peck said the greatest difficulty tractor owners experienced in power farming was an inability to get adequate service from dealers.

F. H. Retzlaff, dealer at Newulm, Minn., told the convention that the tractor business, without the right kind of service from the dealer, was not worth a damn.

They justify their indifference toward the tractor on the ground that it is necessary to give so much free service that prevalent discounts are not sufficient to pay for this service and give them a profit in addition. They object also to the requirement of a deposit in addition.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb. .... .02 -.03
Phosphoric (85%).. .35 -.39
Sulphuric (60), lb.. .008

Aluminum:
Ingot, lb. .... .33
Sheets (18 gage or more), lb. .... .42

Antimony, lb. .... .15 -.13¼

Burlap:
8 oz., yd.......... .10½
10½ oz., yd........ .16½

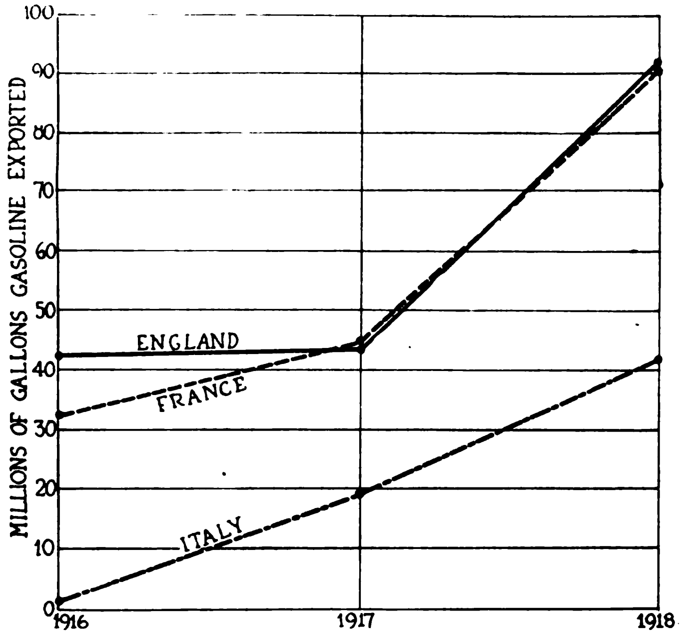
Copper:
Elec., lb. .... .23
Lake, lb. .... .23

Fabric, Tire (17¼ oz.):
Sea Is., combed, sq. yd. 1.62
Egypt, combed, sq. yd. 1.30
Egypt, carded, sq. yd. 1.27
Peelers, combed, sq. yd. .97
Peelers, carded, sq. yd. 95-1.05

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
Ceylon, lb. .... .09 -.22
Madagascar, lb. .... .10 -.15
Mexico, lb. .... .03¾

Lead, lb. .... .05¼-.06



England, France and Italy received 65 per cent of our petroleum product exports during ten months of 1918. The enormous demand for gasoline in the war zone is shown on this chart

Leather:
Hides, lb. .... .18 -.35¼

Nickel, lb. .... .40

Oil:
Gasoline:
Auto, gal. ...... .24½
68 to 70 gal...... .30½
Lard:
Prime City, gal..2.25-2.30
Ex. No. 1, gal...1.62
Linseed, gal. 1.58-1.59
Menhaden (Brown), gal. 1.35-1.36
Petroleum (crude),
Kansas, bbl. 2.25
Pennsylvan'a, bbl.4.00

Rubber:
Ceylon:
First latex pale crepe, lb. ..... .58
Brown, crepe, thin, clear, lb. .... .50
Smoked, ribbed sheets, lb. ..... .56
Para:
Up River, fine, lb. .61
Up River, coarse, lb. .... .36
Island, fine, lb... .53

Shellac (orange), lb.. .70-.72

Spelter .... .08

Steel:
Angle beams and channels, lb. ..... .03
Automobile sheet (see sp. table.)
Cold rolled, lb..... .06½
Hot rolled, lb...... .03½

Tin .... .71-.72

Tungsten, lb. 2.00-2.50

Waste (cotton), lb. .12¾-.17

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Black Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.

Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close Jan. 4

	Bid	Asked	Net Ch'ge
Auto Body Company	5	8	..
Briscoe Motor Car, com	11	..	..
Briscoe Motor Car, pfd	40	55	..
*Chandler Motor Car	106	108	+4
Chevrolet Motor Car	149	151	..
Cole Motor Car Co	90	105	..
Continental Motors, com	8	8⅝	..
Continental Motors, pfd	94	97	..
Edmunds & Jones, com	20	22	..
Edmunds & Jones, pfd	75	90	..
Electric Storage Bat	52	55	+3
Federal Motor Truck	32	35	..
Fisher Body Co., com	36	38½	+ ½
Fisher Body Co., pfd	92½	93¾	+ ½
Ford Motor of Canada	220	230	..
General Motors, com	131½	132½	+1¾
General Motors, pfd	81¼	83¼	+2¼
Hupp Motor Car, com	4½	5	..
*Hupp Motor Car, pfd	83	88	..
Kelsey Wheel Co., com	29	31	+3
Kelsey Wheel Co., pfd	85	90	..
Manhattan Electric S., com.	..	48	..
Maxwell Motor, com	28¼	29¼	+ ¾
Maxwell Motor 1st, pfd	50⅝	51⅝	+ ⅛
Maxwell Motor 2nd, pfd	18¾	19¾	— ¼
McCord Mfg., com	32	35	..
McCord Mfg., pfd	93	96	..
Mitchell Motor Co	23	28	—2
Motor Products Corp	40	..	..
Nash Motors Co., com	175	200	..
Nash Motors Co., pfd	90	95	..
National Motor Co	9	12½	..
Packard Motor Car, com	107	..	..
Packard Motor Car, pfd	98½	..	..
Paige-Detroit Motor, com	23¼	24¼	..
Paige-Detroit Motor, pfd	8¾	9¾	..
Peerless Motor Truck	17	20	—1
Pierce-Arrow Mot. Car. cm.	42½	43½	+ ½
Pierce-Arrow Mot. Car, pfd.	103	104	..
Premier Motor Corp., com	5	..	..
Premier Motor Corp., pfd	..	75	..
Prudden Wheel Company	15½	17½	..
Reo Motor Car Co	21½	22½	+ ½
Republic M. Truck, com	35½	38	..
Republic M. Truck, pfd	87	90	..
Saxon Motor Car, com	6½	8½	+ ½
Scripps-Booth Corp.	21	25	..
Stewart Warner Speed. Corp.	82¼	84¼	4¾
Stromberg Carburetor Co	33	38	..
Studebaker Corp., com	51	52	+1
Studebaker Corp., pfd	92	92½	+2
Stutz Motor Car Co	49¾	50¾	+1⅛
United Motors Corp	32¾	34¾	— ½
White Motor Co	44½	45½	+ ¼
Willys-Overland, com	25½	26½	+ ⅞
Willys-Overland, pfd	87	89	—1

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co	66	68	..
Firestone T. & R., com	139	142	+3
Firestone T. & R., pfd	100	101½	..
Fisk Rubber Co., com	70	75	..
Fisk Rubber 1st, pfd	97	103	..
Fisk Rubber 2nd, pfd	85	95	..
Fisk Rubber 1st pfd., conv.	90	97	..
Goodrich, B. F., com	56	57	..
Goodrich, B. F., pfd	103⅝	106	..
Goodyear T. & R., com	221	230	..
*Goodyear T. & R., 1st pfd.	103	105	— ¼
Goodyear T. & R., 2nd pfd.	103	105	+1
Kelly-Springfield, com	69	70	+ ½
Kelly-Springfield, 1st pfd	80	91	..
Lee Tire & Rubber Co	21	22	—2
Marathon Tire & Rubber	..	55	..
Miller Rubber Co., com	142	148	..
Miller Rubber Co., pfd	96	98	..
Rubber Products Co	..	101	..
Portage Rubber Co., com	145	149	..
Swinehart T. & R. Co	50	60	..
U. S. Rubber Co., com	80	81	+3
*U. S. Rubber Co., pfd	109½	110½	+ ½

*Ex Dividend.

Calendar

ENGINEERING

S. A. E. Meetings

Feb. 4-6—New York. Winter Meeting. Society of Automotive Engineers, Engineering Societies' Building.

Feb. 6—Victory Dinner, Hotel Astor, New York.

Feb. 5—Minneapolis Section, S. A. E. — Hotel Radisson. "Radiator Cooling Fans."

March 5 — Minneapolis Section, S. A. E.—Hotel Radisson, "Tractor Service and Sales."

April 2—Minneapolis Section, S. A. E.—Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Jan. 11-18—Los Angeles, Cal. Automotive Exposition.

Jan. 15-18 — Spokane, Wash. Progressive Automotive Show in dealers' salesrooms. Auspices of Spokane Automobile Chamber of Commerce.

Jan. 20-25 — Shreveport, La. Shreveport Automobile Dealers' Assn. Henry B. Marks, Manager.

Jan. 20-25 — Hartford, Conn. Broad Street Armory, Auspices of Agricultural Interests.

Jan. 24-30 — Milwaukee, Wis. Eleventh Annual, Milwaukee Automobile Dealers, Inc., Auditorium. Bart J. Ruddle, Manager.

Jan. 25-Feb. 1—Chicago. Passenger cars. Coliseum.

Feb. 1-15—New York. Automobile Dealers' Assn. Charles A. Stewart, Manager, Hotel Woodward, Broadway and 55th St.

Feb. 3-6 — Chicago. Trucks, Coliseum.

Feb. 5-8—Fargo, N. D. North Dakota Automobile Dealers' Assn., Auditorium.

Feb. 10-15—Rochester, N. Y. Rochester Automobile Trades Assn., Exposition Park. George C. Donahue, Manager.

Feb. 10-15—Kansas City, Mo. Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 15-22—Newark, N. J. N. J. Auto Exhibition Co. Calude Holgate, Manager.

Feb. 15-22 — Cleveland, Ohio. Cleveland Auto Show Co. Fred H. Caley, Manager.

Feb. 15-22—Minneapolis, Minn. Minneapolis Auto Trade Assn. Walter B. Wilmot, Manager.

Feb. 15-22—Albany, N. Y. Albany Automobile Dealers' Assn. State Armory.

Feb. 17 - 22 — Louisville, Ky. Louisville Auto Dealers' Assn.

Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.

Feb. 17-22 — Pittsfield, Mass. Pittsfield Automobile Dealers' Assn., State Armory. James J. Callahan, Manager.

Feb. 17-22 — Passenger Cars; Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. J. L. Elliott, Manager.

Feb. 17-22—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.

Feb. 18-22—Baltimore, Md. Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland, Fifth Regiment Armory. H. M. Lucius, General Manager.

Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 24-Mar. 1 — Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.

Feb. 27-March 6—New York Aircraft Exhibition by Aircraft Manufacturers' Association, Madison Square Garden.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March — Great Falls, Mont.—Montana Automobile Distributers' Assn.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

March 1-10—San Francisco, Cal. Motor Car Dealers' Assn. G. A. Wahlgreen, Manager.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gardner, Manager.

Mar. 10-15—Omaha, Neb. Fourteenth Annual. Omaha Automobile Trade Assn., Auditorium. Clarke G. Powell, Manager.

Mar. 12-19—St. Joseph, Mo. Sixth Annual, St. Joseph Automobile Dealers' Assn.

Second or third week March—St. Louis, Mo. St. Louis Auto Mfrs. & Dealers' Assn. Robert E. Lee, Manager.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Chester I. Campbell, Manager.

Mar. 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 22-29, Passenger Cars; April 1-5, Trucks—Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkham, Manager.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided — Harrisburg, Pa. Harrisburg Motor Dealers' Assn. J. Clyde Myton, Manager.

Not decided — Hartford, Conn. Hartford Automobile Dealers' Assn.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.

TRACTOR SHOWS

Jan. 20-25 — Hartford, Conn. Broad Street Armory.

Feb. 24-Mar. 1—Kansas City, Mo. Fourth Annual Tractor Show. Sweeney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show, Wichita Tractor and Thresher Club. Forum.

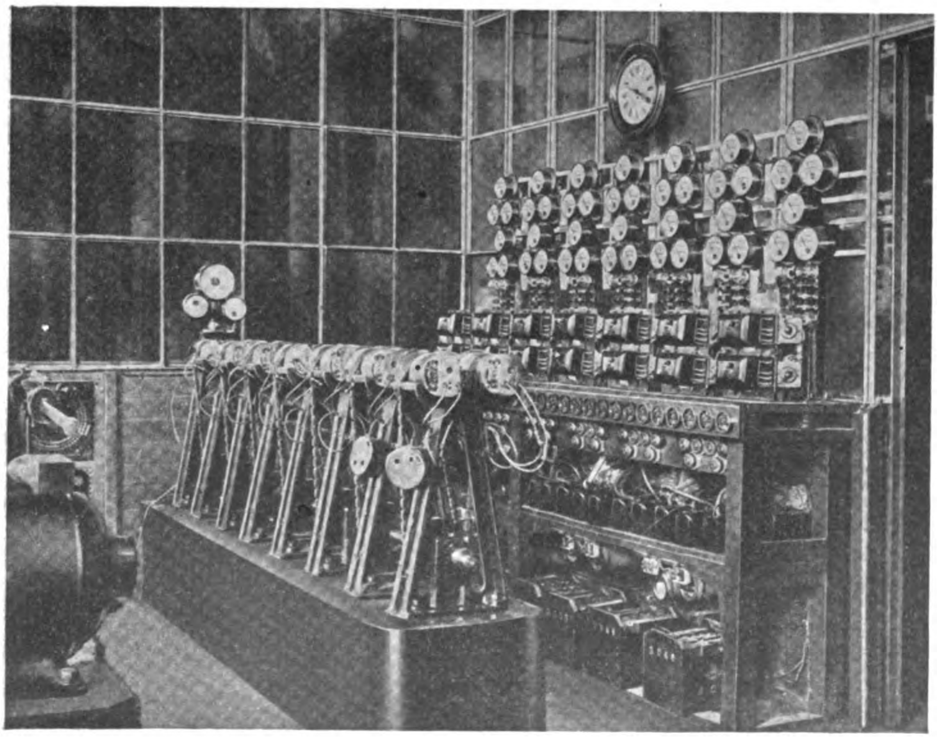
CONVENTIONS

Feb. 4-6—New York. Meeting Society Automotive Engineers.

Jan. 7—New York. Dinner of Aircraft Manufacturers' Association, Waldorf.

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

Testing Electrical Equipment at the Fiat Plant



A special testing apparatus has been developed by the Fiat Co., Turin, Italy, for the testing of a large number of lighting sets at the same time. The stand illustrated has a capacity for testing fourteen complete systems at once

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 3

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, JANUARY 16, 1919

Twenty-five cents a copy
Three dollars a year

EDITORIAL

Following Directions

ARE you one of the motorists who last winter used an anti-freeze compound in a manner which the maker of the preparation never specified and then condemned the stuff as being no good? If you did such a thing, you had better make sure that you followed directions to the letter. The manufacturers of anti-freeze compounds have met car and truck owners more than half way, and the complete directions printed on every label of their products are put there for but one purpose, and that is, to make sure the preparation will be used correctly.

OBVIOUSLY if the motorist does not do his part and merely dumps the stuff in his radiator, without following directions, he does wrong and one morning he will go to his unheated garage only to find the tubes of his radiator burst or the waterjacket cracked. The next thing he does is blame the anti-freeze substance, whereas, had he been careful to follow instructions he could have gone all winter without worrying about the cooling system.

MOST of the anti-freeze preparations have been put up in convenient form, but the amount of water in the cooling system together with the variation in temperature dictate to a considerable extent how the preparations must be used. All this is set forth in the maker's directions and in every case the big thing to watch is that the radiator has no leaks and that the hose couplings are in good shape. In fact, new hose is desirable before adding the anti-freeze, as after a season's use the inner layers become separated.

THE radiator should be washed out carefully with a solution of hot soda, which reveals any leaks that exist. These then should be soldered. Many anti-freeze substances attack dirt and sediment and if your radiator started to leak last winter after you added the anti-freeze, it was because you failed to clean the radiator and repair the leaks. The anti-freeze told you that leaks existed. You probably thought the anti-freeze was eating away the metal. Follow the maker's directions this winter and you will play safe.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL. NEW YORK—THURSDAY, JANUARY 16, 1919—CHICAGO No. 3

No British Post-War Models in Low-Price Field

From 6 to 9 Months Must Elapse Before the Makers Can Start Deliveries—Still on War Work

FOREIGN AUTOMOBILE PLANTS GREATLY EXPAND

But Manufacturers Still Adhere to Policy of Producing Few High-Priced Cars Instead of Many Low-Priced Ones—Believe Quantity Production Impossible

By David Beecroft
Directing Editor, Class Journal Co.

LONDON, ENGLAND, Jan. 15—*Special Cable*—The British automobile industry has very indefinite opinions concerning the future, and at this time has no definite program for new models.

It will be 6 months—with many factories, 9 months—before any deliveries of post-war models can be started.

A very few makers, not more than half a dozen, can be said to have post-war models ready. The remainder are putting pre-war models on the market at prices increased by 60 per cent.

Many automobile factories will have to continue for months on aviation engines and planes. Contracts for shell have been cancelled. One or two large manufacturers who have been producing aviation engines will have to continue till August on war work and cannot start to produce automobiles before that time.

There are no new Britsh post-war models in the low-price field.

Manufacturers appear more interested in $4000 and $5000 cars than they are in cheap ones.

Ford has no rival; and American automobiles selling at $1000 have few new British rivals.

Mr. Beecroft sailed for New York the day this article was cabled. He has been in Europe since November 9 as one of a party of American business paper representatives who have been the guests of the British government. The party traveled extensively in England, Scotland and France and was afforded unusual opportunity to investigate social environment, industrial pursuits and war activities. All the party returned to New York on January 2 except Mr. Beecroft, who remained to make a tour of the principal manufacturing centers of Italy

"COMMERCE, if it is to stay, must be a constructive force and never a destructive thing.

"We must serve the world if we are to be on safe foundations ourselves.

"The mere entering a foreign market by force of cut prices or of off-quality goods or by 'dumping' or by untruthful advertising, or by force of government aid or political power is in no true sense commerce, *nor will it last.*

"We must carry the flag as high in the commercial world as we have carried it before our armies.

"It means that we are going to play the game like gentlemen and make our methods such as shall survive because they render service. The ancient law has never been repealed that *'he who would be chief among you, let him be the servant of all'* and America having served with her dead and wounded sons in France must now serve the world by her factories and with her merchandise.

"That means that we must sell goods that others want and not unload those of which we would like to rid ourselves. That means we must forget there is behind the word 'foreigner' anything of implied contempt.

"That means that our visions and sympathy must be big enough for foreign trade; we must be large enough to adapt ourselves to it. If we are not, somebody else will be.

"It means that we must win upon our effectiveness, not upon our hustle, that we must carry our business far *because it is right* that it should go far on its own merit.

"It means a lot of forgetting and a lot of learning on the part of many of us." *—Wm. C. Redfield, Secretary of Commerce.*

The greatest British effort in this price-class field is Crossley, which has a post-war model to sell for $2500.

British makers still favor high-priced cars built in small quantities, rather than cheaper cars produced in greater quantities.

The Ford touring model now sells for $1000 here. This is an enormous increase and can be ascribed partly to increased cost of parts, which are purchased by the government on a cost-plus basis, and partly to higher transportation charges.

At the present time, the Ford Motor Co. is producing 3000 cars per day in its Manchester factory. These are produced by special arrangement, under which the government imports parts for the Ford company.

Want Import Duty Retained

London importers of American cars have not yet received permission to import American cars, although a united petition has been made to the government to let down the bars.

The opinion is that the government may continue total prohibition for two or three and perhaps for four months, but any action which is taken will likely be somewhat delayed because of the interference with other routine matters brought about by the Peace Conference.

In general, the opinion is strong that the majority of British automobile manufacturers will ask that the import duty be continued as at present. The opinion is strengthened by the fact that at the recent election four or five large automobile manufacturers were put into office, and it is known that they are all favorable to a combination of the present import duty.

But it is not the duty which worries British makers. Importers of *American cars do not fear the duty,* but they do fear a continuation of the total prohibition against imports as at present.

The restrictions against the importation of American commercial vehicles continue, but special petitions to the government are being heeded, and undoubtedly trucks will be permitted to be imported in limited quantities soon.

Importers of passenger automobiles are receiving permits to import sample machines which can be exhibited. However, they are not allowed to be sold.

Dealers who import French and Italian cars are making strong appeals to the government requesting permission again to take up the importation of these machines.

Over 46,000 British war trucks are to be repaired by the manufacturers and sold in Great Britain. This will extend over many months.

Truck Prices Not Abnormally High

British manufacturers of trucks have reached large production, due principally to the stimulus of war, and prices are not abnormally high as is the case with passenger cars.

In general, the British manufacturer does not believe that he can install such quantity production plans as are in use in the United States, and agrees that America will monopolize the low-price market.

The production lessons of the war, learned in turning out munitions, have not yet been incorporated into automobile manufacture. In fact, many makers

are quite undecided as to how to utilize the large factories—in many cases from three to five times as big as before the war—which have been built up.

These great plants are thoroughly modern. They are full of new machinery, which is mostly of American make. They have central heating plants, excellent lighting, large canteens, employees' recreation rooms, and Red Cross facilities.

Furthermore, these enlarged factories are all paid for out of profits made in war work. In addition, the companies have made large profits since the beginning of hostilities.

The growth in French and Italian factories is equally startling. Fiat, for example, has 50,000 employees; Renault has 25,000 and other French factories have grown threefold and fivefold. Here, too, makers all have excellent new, large factories, all paid for out of war profits, with a substantial profit in addition.

Renault and Fiat Post-War Models

Both Renault and Fiat have new post-war models ready for the market, and in both cases these have been designed for quantity production and low price.

Both companies are going out strong after world markets.

Hereafter, all European post-war models will have complete electric lighting and starting systems. Even old models are being fitted with such equipment.

The adoption of lighting and starting apparatus brings to light the great necessity for international standards on such parts as batteries, headlamps, and so forth. As it is now, France, Italy and England are all making batteries to different standards. This will work havoc with maintenance.

Olympia First Real Exposition

French manufacturers will show their first post-war models at the Lyons Sample Fair in March, but the revived Olympia show which is to be put on by British makers in November will in reality be Europe's first great exhibition of post-war cars.

Some of the new features that it is expected will be seen are detachable cylinder heads, valve-in-head engines and unit power plants. In general, the small engines will be block fours. But most of the new larger engines will be sixes. One or two new eight-cylinder models are expected. American body design, with the radiator the same height as the body lines is coming into vogue.

Dealers Survived War Well

British dealers have survived the war in good financial condition and are ready now to start re-selling. Many mechanics, drawn into the war, have now been demobilized and are anxious to enter the automoble business. It is expected that there may be a surplus of agencies.

Despite the fact that gasoline is now selling for $1 a gallon, the use of cars is increasing. Thousands of cars stored during the war are being brought out, cleaned up and started to running once more.

Manufacturers of ignition apparatus and other accessories whose plants were greatly enlarged during the war are all ready for a big peace production, and already the manufacture of straight-side tires has been started by the largest tire manufacturing company.

All automobile factories started to operate on a 47-hour week on January 1. Work begins at 8 a. m., with 45 minutes for lunch. The Ford company decreased its working hours from 48 to 40 per week and now assembles three more chassis per day under the shorter schedule. There have been many strikes due to the shorter hours because they upset the traditional methods of home life, women refusing in many cases to prepare late breakfasts.

Dismissing Hundreds of Women

Many of the large factories are dismissing hundreds of women employees because the labor unions insist that women gave higher production and more accurate work than men.

The manufacture of aviation engines and planes has slowed down considerably and large plane factories will be three or four months completing existing contracts. There are quantities of planes waiting for engines. However, several automobile makers have succeeded in getting airplane contracts reduced, thus permitting them to get back to car production sooner.

Progressive systems for the production of cars and trucks are used by only two companies—the Ford Motor Co. and the Associated Equipment Co., the latter being the maker of the London buses. This company has built 15,000 war trucks and is by far the largest truck maker in England.

Few Modern Assembling Methods

Other manufacturers are assembling in the old way, using hundreds of needless workers. All European factories are wofully lacking in racks and stands for materials passing through the factories. In consequence, floors are cluttered and finished parts too often are laid among the disorder. The use of electric industrial trucks is confined to a few factories and multiple spindle machinery is used in only four or five plants, and is not yet nearly as general as is the case in America.

The heads of British factories all complain that workers endeavor to do as little as possible and get as much pay as possible. At the same time, too many makers are following the same policy of selling automobiles at the highest prices and manufacturing as few as possible.

British dealers complain that British factories do not give quick service on spare parts and that service is still only vaguely understood. War has hampered such work, but there remains ground for much criticism.

During the war, British makers were greatly hampered by the government. The industry was suppressed more than was necessary. Many plants which were turned to shell production suffered great losses of skilled workers, and have now to rebuild their working forces.

British makers admit that going into war was easy as compared with the problems involved in getting back into peace production.

1919 Engineering Trends

Development Indicates Important Future Changes

Stagnation Brought About by War Has Created Unparalleled Opportunity for General Re-designing

Average Price Now on Level with the Pre-War Car and Not Likely to Go Down for Some Time

Few Mechanical Changes Because of Scarcity of New Models Brought Out Last Year

Importance of Simplifying Small Details of the Chassis Becoming Better Realized

Six-Cylinders and Overhead Valves Likely to Manifest Steadily Increasing Popularity

By A. Ludlow Clayden

IT has been the custom of AUTOMOTIVE INDUSTRIES each year to analyze the trend of automobile design and of engineering as shown in the passenger cars of the year. These analyses have hitherto always shown tendencies very clearly, and a study of the curves published one year can now be seen to have been almost invariably a true indication of what was to follow during the ensuing period.

For the successive years up to January, 1917, progress was regular and recordable, but at the end of that year it was obvious that passenger car design had been stagnated by the war. One could see the increased price due to rising material and labor markets, the lack of new models due to engineering activities being concentrated upon aircraft, tanks and multifarious other weapons.

None the less, there were changes in the tables and data published Jan. 3, 1918, because many new chassis were ready before the United States declared war.

Changes Due to Eliminations

This year such changes as appear are due mainly to eliminations. Every feature of the automobile analyzed in detail shows some change, but this is because many of those chassis included in the calculation of the averages last year have been taken off the market and have not yet been replaced by new designs. Some notable absentees will be observed by a careful study of the specification tables, and, of these, many are firms that will soon have new cars but whose experimental work is not far enough ahead to enable them to say with certainty what the specifications will be.

Of the cars remaining, many have been unchanged for nearly 2 years, so the trend curves and tabulations may be said to indicate negative development rather than positive trends. It is safe to say that in another 12 months' time a good half of the chassis now listed will be remodeled. There will be many entirely new cars—some new makes even. Price, now at a zenith, must fall again, or if the costs of material and labor remain at near their present level, then cheaper types of machines will be built—possibly smaller in size and less lavish in equipment.

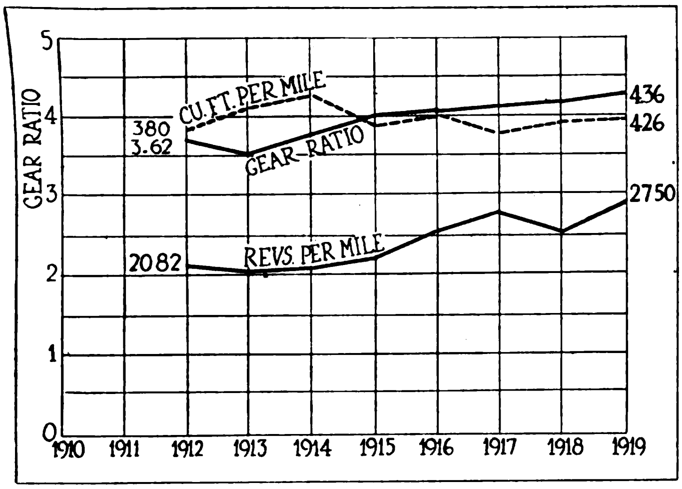
It was never so hard to predict engineering tendencies, nor was the immediate future ever so teeming with possibilities for new and good ideas. In 1915 the average engineering quality of the American passenger automobile improved enormously; it was the banner year for new cars, for higher efficiency, lighter weight and greater convenience for the owner. The year 1919 bids fair to equal if not surpass that of 1915.

Much That Is New Is Coming

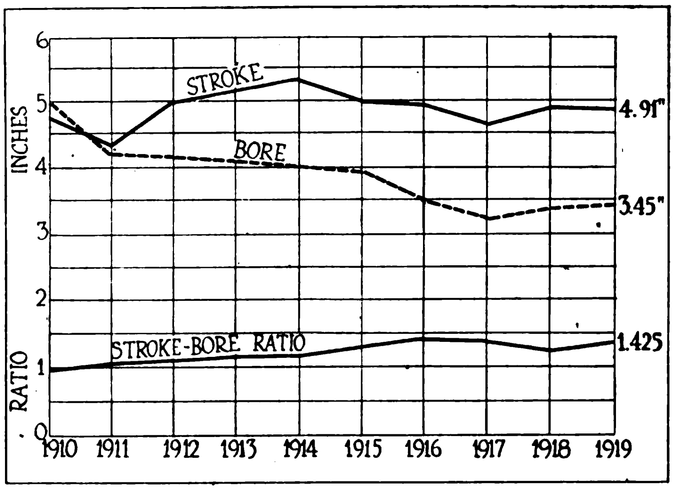
There are several reasons why much that is new should be anticipated. Firstly, owing to the aforementioned war stagnation, there is a majority of chassis which are due to change; it is time to market new models from the merchandising viewpoint.

(*Continued on page* 94)

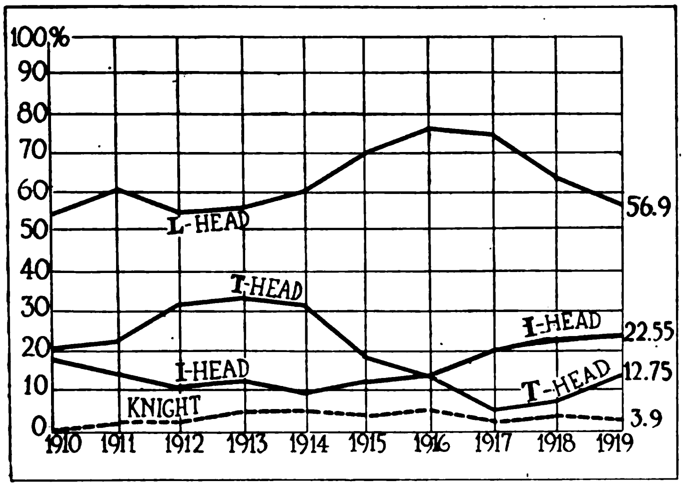
Automobile Engineering Tendencies



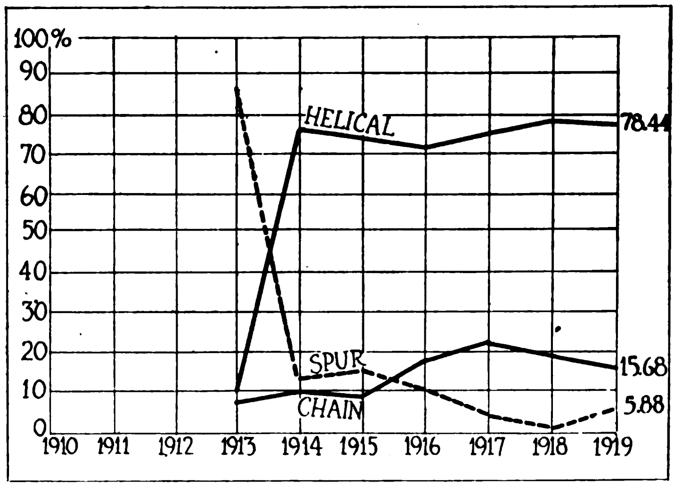
Compared with figures for the average car last year, the number of crankshaft revolutions per mile has increased from 2500 to 2750, and this, of course, has caused a corresponding increase in the number of cubic feet of mixture per mile required by the engine



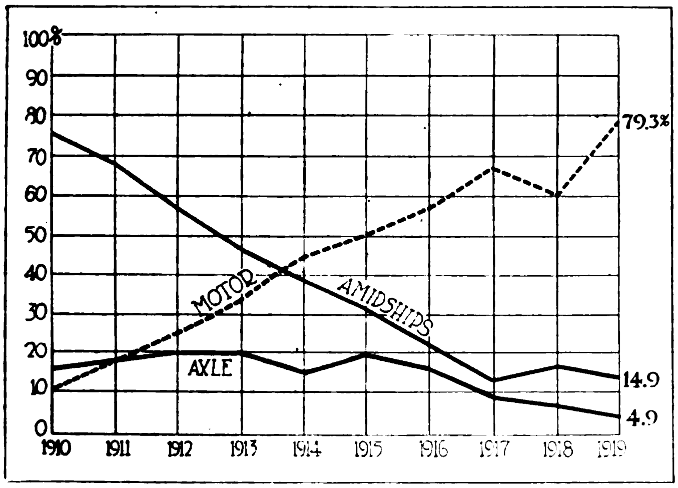
The bore of the average engine this year has decreased .03 in., whereas the stroke has increased .02 in. This accounts for a corresponding increase in the stroke-bore ratio, which amounts to 0.17. The average cylinder size of to-day is approximately 3½ by 5 in.



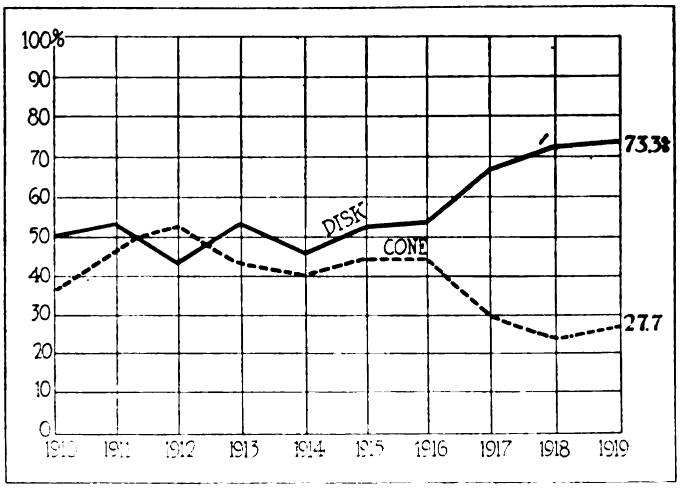
The valve-in-head engine still shows a slight increase, the figure last year being 22.2 per cent, though the gain is not as great as expected. The T-head engine shows quite an increase—from 6.8 per cent to 12.75 per cent—and the L-head has dropped from 63.5 per cent to 56.9 per cent .



In the drive of accessories, tendencies have not been so closely followed. Helical still leads, after its phenomenal gain in 1914, but both this and chain have dropped off slightly this year. Spur gear drive has increased slightly from 2 per cent to 5.88 per cent



The great gain in the location of the gearset in unit with the engine, which became apparent in 1914 and 1915 and dropped off in 1918, made a big gain again this year, jumping from 71 per cent to 79.3 per cent. The two other locations both show a slight decline in use



The percentages of disk and cone clutches in use show very little change since 1916, when a decided preference for the disk type first became a noticeable trend. This year, as was the case last year, they are both holding their own

1919 Passenger Automobiles Listed

MAKE AND MODEL	Wheelbase	No. of Cylinders	Bore and Stroke Inches	Piston Displacement Cubic Inches	Make of Engine	Cylinder Shape	Camshaft Drive	Water Circulation	LUBRICATION System	LUBRICATION Type of Pump	CARBURETION Make of Carbureter	CARBURETION Fuel Feed	IGNITION System	IGNITION Make	IGNITION Control	ELECTRIC SYS. Generator Make	ELECTRIC SYS. Voltage	CLUTCH Make	CLUTCH Type
Allen 41	112	4	3¾x5	221	Own	L	Helical	Ther.	Circ-Spl.	Piston	Stromberg	Vacuum	Single	Conn	Hand	Auto-Lite	6	Borg & Beck	Plate
American B	122	6	3⅛x5	230	Rutenber	T	Helical	Gear	Circ-Spl.	Eccentric	Zenith	Vacuum	Single	At Kent	Hand	Westinghouse	6	Borg & Beck	Plate
Anderson 400-G	120	6	3½x5¼	303	Continental	L	Helical	Cent.	Circ-Spl.	Piston	Zenith	Vacuum	Single		Hand	Westinghouse	6	Borg & Beck	Plate
Anderson 400-A-C-D-E	120	6	3¼x4½	224	Continental	L	Helical	Cent.	Circ-Spl.	Piston	Zenith	Vacuum	Single	Conn	Hand	Westinghouse	6	Borg & Beck	Plate
Apperson 8-18	130	8	3¼x5	332	Own	L	Helical	Ther.	Pressure	Gear	Johnson	Vacuum	Single	Remy	Hand	Bijur	6	Own	Plate
Auburn 6-39	120	6	3⅛x5	230	Rutenber		Helical	Cent.	Splash-Pres.		Rayfield	Vacuum	Single	Remy	Hand	Remy	6	Borg & Beck	Plate
Biddle H	121	4	3¾x5⅛	226	Buda	L	Helical	Ther.	Circ-Spl.	Gear	Zenith	Vacuum	Single	Fiseman	Hand	G & D	6	Warner	D sk
Briscoe B4-24	104	4	3 3/16x5⅛	164	Own	L	Helical	Ther.	Circ-Spl.	Piston	Dave-Buick	Gravity	Single	Conn	Hand	Auto-Lite	6	Own	Cone
Buick H	118–124	6	3⅜x4½	242	Own	I	Helical		Circ-Spl.		Marvel	Vacuum	Single	Delco		Delco	6	Own	Disk
Cadillac 57	125–132	8	3⅛x5⅛	314	Own	T	Chain	Cent.	Pressure	Gear	Own	Pressure	Single	Delco	H & A	Delco	6	Own	Disk
Case U	125	6	3½x5¼	308	Continental	L	Helical	Cent.	Splash-Pres.	Piston	Rayfield	Vacuum	Single	Westing.	Hand	Westinghouse	6	Borg & Beck	Plate
Chalmers 6-30	117	6	3¼x4½	224	Own	L	Chain	Ther.	Splash-Pres.	Gear	Stromberg	Vacuum	Single	Remy	Hand	Auto-Lite	6	Own	Disk
Chandler	123	6	3½x5	289	Own	L	Chain	Cent.	Circ-Spl.	Piston	Rayfield	Vacuum	Single	Bosch	Hand	Westinghouse	6	Borg & Beck	Plate
Chevrolet FA	108	4	3 11/16x5¼	224	Own	I	Helical	Cent.	Circ-Spl.	Gear	Zenith	Vacuum	Single		Hand	Auto-Lite	6	Own	Cone
Chevrolet 4-90	102	4	3 11/16x4	171	Own	I	Helical	Cent.	Circ-Spl.	Gear	Zenith	Gravity	Single		Hand	Auto-Lite	6	Own	Cone
Chevrolet D	120	8	3⅜x4	286	Own	I	Helical	Cent.	Circ-Spl.	Gear	Zenith	Vacuum	Single		Hand	Auto-Lite	6	Own	Cone
Cole 870	127	8	3½x4½	346	Northway	T	Helical	Cent.	Pressure	Gear	Stromberg	Vacuum	Dual	Delco	H & A	Delco	6	Northway	Cone
Columbia Cd & CF	115	6	3¼x4½	224	Continental	L	Helical	Cent.	Splash-Pres.	Piston	Stromberg	Vacuum	Single	At Kent	Hand	Ward-L	6	Borg & Beck	Plate
Comet C-51	125	6	3½x5	289	Continental	L	Helical		Circ-Spl.		Rayfield	Vacuum	Single	Delco	Hand	Dyneto	6	Borg & Beck	Plate
Crow-Elkhart K-36	115	4	3½x5	192	Gray	I	Spur	Ther.	Splash-Pres.	Gear	Zenith	Vacuum	Single		Hand	Dyneto	6	Borg & Beck	Plate
Cunningham V-3	132–142	8	3¾x5	442	Own	T	Helical	Cent.	Pressure	Gear	Stromberg	Vacuum	Single	Delco	Hand	Westinghouse	6	Brown-Lipe	Disk
Daniels B	127	8	3¼x5	332	Hersh-Sp.	L	Helical	Cent.	Pressure	Gear	Zenith	Vacuum	Single		Hand	Westinghouse	6	Brown-Lipe	Disk
Dixie L-35	112	4	3¼x5	166	Lycoming	L	Helical	Ther.	Circ-Spl.	Eccentric	Carter	Vacuum	Single	Conn	Hand	Dyneto	6	Borg & Beck	Plate
Dodge Brothers	114	4	3⅞x4½	212	Own	L	Helical	Cent.	Circ-Spl.	Eccentric	Stewart	Vacuum	Single		H & A	North East	12	Own	Disk
Dorris 6-80	132	6	4 x5	377	Own	I	Helical	Cent.	Pressure	Gear	Stromberg	Vacuum	Single		Hand	Westinghouse	6	Brown-Lipe	Disk
Dort 15	105½	4	3½x5	192	Lycoming	L	Helical	Ther.	Circ-Spl.	Piston	Carter	Gravity	Single	Conn	Hand	Westinghouse	6	Own	Cone
Elcar 4	116	4	3½x5	192	Lycoming	L	Helical	Ther.	Circ-Spl.	Eccentric	Carter	Vacuum	Single	At Kent	Hand	Dyneto	6	Mechanics	Disk
Elcar 6	116	6	3¼x4½	224	Continental	L	Helical	Cent.	Splash-Pres.	Eccentric	Stromberg	Vacuum	Single	At Kent	Hand	Dyneto	6	Borg & Beck	Plate
Elgin H	118	6	3⅛x4¼	196	Falls	F	Helical	Ther.	Splash-Pres.	Gear	Stromberg	Vacuum	Single	Wagner	Hand	Wagner	6	Borg & Beck	Plate
Essex A	108½	4	3⅜x5	179	Own	F	Helical	Ther.	Circ-Spl.	Piston	Own	Vacuum	Single	Delco	H & A	Delco	6	Own	Disk
Ford T	100	4	3¾x4	177	Own	L	Spur	Ther.	Splash-Grav		Holley-Kng.	Gravity	Single	Own	Hand			Own	Disk
Franklin	115	6	3¼x4	199	Own	I	Helical	Air	Splash-Pres.	Gear	Own	Vacuum	Single	At Kent	Atmtc.	Dyneto	12	Borg & Beck	Plate
Harroun A-1	106	4	3¼x5¼	174	Own	I	Helical	Ther.	Splash-Pres.	Piston	Stromberg	Vacuum	Single	At Kent	Hand	Remy	6	Own	Cone
Haynes 45	127	6	3½x5	289	Own	L	Helical	Cent.	Circ-Spl.	Piston	Rayfield	Vacuum	Single		Hand	Leece-N	6	Borg & Beck	Plate
Haynes 46		12	2¾x5	356	Own	I	Chain	Cent.	Pressure	Gear	Rayfield	Vacuum	Single		Atmtc.	Leece-N	6	Borg & Beck	Plate
Hollier 198	116	8	3 x4¼	240	Own		Spur	Ther.	Splash-Pres.	Piston	Stewart	Vacuum	Single	At Kent	Hand	Splitdorf	12	Own	Cone
Hollier 206	116	6	3¼x4½	224	Continental		Spur	Cent.	Splash-Pres.	Gear	Stewart	Vacuum	Single	Remy	Hand	Splitdorf	6	Own	Cone
Holmes	126	6	3½x4¼	245	Own	I	Helical	Air	Splash-Pres.	Gear	Newcomb	Vacuum	Single	Eiseman	Atmtc.	Dyneto	12	Brown-Lipe	Disk
Hudson M	125⅝	6	3½x5	289	Own	L	Helical	Cent.	Circ-Spl.	Piston	Own	Vacuum	Dual	Delco	Hand	Delco	6	Own	Disk
Hupmobile R	112	4	3¼x5½	183	Own	L	Chain	Ther.	Pressure	Gear	Stromberg	Vacuum	Single	At Kent	Hand	Westinghouse	6	Own	Disk
Jackson	118	8	3 x3½	198	Ferro	I	Helical	Ther.	Pressure	Gear	Zenith	Vacuum	Single	Remy	S-A	Auto-Lite	6	Borg & Beck	Plate
Jones 28	125	6	3½x5¼	303	Continental	L	Helical	Cent.	Splash-Pres.	Piston	Rayfield	Vacuum	Single		Hand	Westinghouse	6	Borg & Beck	Plate
Jordan	127	6	3½x5¼	303	Continental	L	Helical	Cent.	Splash-Pres.	Piston	Stromberg	Vacuum	Single		H & A	Bijur	6	Borg & Beck	Plate
King F	120	8	3 x5	283	Own		Chain	Ther.	Pressure	Gear	Ball	Vacuum	Single	At Kent	Hand	Bijur	6	Borg & Beck	Plate
Kissel	124	6	3 5/16x5½	284	Own	L	Helical	Cent.	Splash-Pres.	Gear	Stromberg	Vacuum	Single	Remy	Hand	Remy	6	T.W.Warner	Cone

ABBREVIATIONS

2-pt—*Two Point*
¾ Ell—*¾ Elliptic*
¾ Float—*¾ Floating*
¾ Plat—*¾ Platform*
Amid—*Amidships*
Atmtc—*Automatic*
B & P—*Ball and Plain*
B & R—*Ball and Roller*
B R & P—*Ball, Roller and Plain*
C & C—*Cup and Cone*
Cant—*Cantilever*
Cent—*Centrifugal*
Circ-Spl—*Circulating Splash*
Dual-D—*Dual Double*
D V—*Dual Valve*
Ell—*Elliptic*
F—1 *Valve in Head, 1 in Side*
Float—*Floating*
Fric—*Friction*
Gear—*Gear Pump*
H—*Horizontal*
H & A—*Hand and Automatic*
I—*I-Head*
Imp—*Impeller*
K—*Knight Type*
L—*L-Head*
Mag—*Magnetic*
Non-Spl—*Non-Circulating Splash*
Opt—*Optional*
Plan—*Planetary*
Plat—*Platform*

with Their Technical Specifications

TRANSMISSION — GEARSET — Make	GEARSET — Location	GEARSET — Forward Speeds	Final Drive	Torque Taken By	Make of Rear Axle	Rear Axle Type	Gear Ratio on Direct	RUNNING GEAR — TIRES — Front	TIRES — Rear	Wheels	Rear Springs	Make of Steering Gear	Make of Speedometer	Crankshaft Bearings and Number	BEARINGS — Gearset	BEARINGS — Rear Axle	BEARINGS — Front Wheel	MAKE AND MODEL
Own	Unit M.	3	Sp.B.	Springs	Adams	¾ Float.	4.45	32x3½	32x3½	Wood	S-E.	Ditweiler	Stewart	Plain 2	Ball	Roller	Roller	Allen 41
Grant-Lees	Unit M.	3	Sp.B.	Springs	Salisbury.	Semi-F.	4.42	32x4	32x4	Wood	S-E.	Gemmer	Van Sicklen	Plain 3	B&R	B&R	Ball	American B
Grant-Lees	Unit M.	3	Sp.B.	Springs	Columbia.	Float	3.53	33x4	33x4	Wire	S-E.	Jacox	Stewart	Plain 3				Anderson 400-G
Durston	Unit M.	3	Sp.B.	Springs	Columbia.	Float	4.58	33x4	33x4	Wood	S-E.	Jacox	Stewart	Plain 3	B&P		Ball	Anderson 400-A-C-D-E
Own	Amid	3	Sp.B.	Springs	Own	¾ Float.	4.25	34x4½	34x4½	Wire	¾-Ell.	Own	Van Sicklen	Plain 3	Roller	B&R	Roller	Apperson 8-18
Grant-Lees	Unit M.	3	Sp.B.	Springs	Columbia.	¾ Float.	*4.42	34x4	34x4	Wood	S-E.	Jacox	Stewart	Plain	Ball	B&R	Ball	Auburn 6-39
Warner	Unit M.	4	Sp.B.	Springs	American.	Float	4.41	32x4	32x4	Wire	S-E.	Gemmer	Stewart	Plain 3	B&R	Roller	Roller	Biddle H
Own	Unit X.	3	Bevel.	Tor-A.	Own	Semi-F.	4.23	30x3½	30x3½	Wood	Ell.	Own	Stewart	Plain 2	BR&P.	Roller	Ball	Briscoe B4-24
Own	Unit M.	3			Own	Float	4.07	33x4	33x4		Cant.		Stewart					Buick H
Own	Unit M.	3	Sp.B.	Springs	Timken	Float	4.44-5.07	35x5	35x5	Wood	Plat.	Own	Van Sicklen	Plain 3	B&R	Roller	Roller	Cadillac 57
Grant-Lees	Unit M.	3	Sp.B.	Springs	Columbia.	Float	4.45	35x4½	35x4½	Wood	S-E.	Jacox	Stewart	Plain 3	B&R	Roller	Roller	Case U
Own	Unit M.	3	Sp.B.	Springs	Timken	Semi-F.	4.75	32x4	32x4	Wood	S-E.	Own	Stewart	Plain 3	Roller	Roller	Roller	Chalmers 6-30
Own	Unit M.	3	Sp.B.	Tor-A.	Own	¾ Float.	4.40	34x4	34x4	Wood	S-E.	Opt.		Ball 3	Ball	Ball	Roller	Chandler
Own	Unit M.	3	Bevel.	Springs	Own	¾ Float.	4.25	32x3½	32x3½	Wood	Cant.	Warner		Plain 3	B&P	Roller	Ball	Chevrolet FA
Own	Unit M.	3	Bevel.	Springs	Own	¾ Float.	3.65	30x3½	30x3½	Wood	Cant.	Warner		Plain 3	B&P	Roller	Ball	Chevrolet 4-90
Own	Unit M.	3	Bevel.	Tor-A.	Own	¾ Float.	4.25	34x4	34x4	Wood	Cant.	Own	Stewart	Plain 3	R&P	Roller	Roller	Chevrolet D
Northway	Unit M.	3	Sp.B.	Springs	Columbia.	Float	4.45	33x5	33x5	Wood	S-E.	Gemmer	Stewart	Plain 3	Ball	B&R	Roller	Cole 870
Durston	Unit M.	3	Sp.B.	Springs	Timken	¾ Float.	4.75	32x4	32x4	Opt.	Cant.	Gemmer	Stewart	Plain 3	Ball	Roller	Roller	Columbia CD & CF
Muncie	Unit M.	3	Sp.B.	Rad-Rod.	Columbia.	Semi-F.	4.50	33x4	33x4	Wood	Cant.	C.A.S.	Stewart	Plain 3	Roller	Roller	Roller	Comet C-51
Covert	Unit M.	3	Bevel.	Springs	Peru	Float	4.00	32x3½	32x3½	Opt.	S-E.	Ditweiler		Plain 3	Ball	B&R	Roller	Crow-Elkhart K-36
Own	Unit M.	3	Sp.B.	Springs	Timken	Float	4.08	35x5	35x5	Opt.	¾-Ell.	Gemmer		Plain 3	B&R	Roller	Roller	Cunningham V-3
Brown-Lipe.	Unit M.	3	Sp.B.	Tor-A.	Timken	Float	4.08	34x4½	34x4½	Wood	S-E.	Gemmer	Stewart	Plain 3	Ball		Roller	Daniels B
Grant-Lees	Unit M.	3	Sp.B.	Tor-A.	Peru		4.75	32x3½	32x3½	Wood	¾-Ell.	C.A.S.	Van Sicklen	Plain 2	BR&P.	B&R	Ball	Dixie L-35
Own	Unit M.	3	Sp.B.	Springs	Own	Float	4.17	32x3½	32x3½	Opt.	¾-Ell.	Own	Johns-Man.	Plain 3	Ball	Roller	Roller	Dodge Brothers
Own	Unit M.	3	Sp.B.	Springs	Timken	¾-Float.	4.08	35x5	35x5	Wood	S-E.	Warner	Van Sicklen	Plain 7	Roller	Roller	Roller	Dorris 6-80
Mechanics	Unit M.	3	Bevel.	Springs	W-Weiss.	¾-Float.	4.07	30x3½	30x3½	Opt.	Cant.	Jacox	Stewart	Plain 2	Ball	R&P	Ball	Dort 15
Mechanics	Unit M.	3	Sp.B.	Springs	Salisbury.	Float	4.50	32x3½	32x3½	Wood	S-E.	Foster	Stewart	Plain 2	Ball	Roller	Roller	Elcar 4
Muncie	Unit M.	3	Sp.B.	Springs	Salisbury.	Float	4.50	33x4	33x4	Wood	S-E.	Foster	Stewart	Plain 3	Ball	Roller	Roller	Elcar 6
Mechanics	Unit M.	3	Sp.B.	Tor-A.	Adams	¾-Float.	5.00	33x4	33x4	Wood	Cant.	C.A.S.	Van Sicklen	Plain 3	Roller	Ball	Roller	Elgin H
Own	Unit M.	3	Sp.B.	Springs	Timken	Semi-F.	4.66	32x4	32x4	Wood	S-E.			Plain 3	Roller	Roller	Roller	Essex A
Own	Unit M.	2	Bevel.	Tor-T.	Own	Semi-F.	3.64	30x3	30x3½	Wood	Tr.S-E.	Own		Plain 3	Plain	Roller	Ball	Ford T
Own	Amid	3	Sp.B.	Springs	Own	Semi-F.	4.33	33x4½	33x4½	Wood	Ell.	Own	Stewart	Plain 7	Ball	Ball	Ball	Franklin
Mechanics	Unit M.	3	Bevel.	Springs	Adams	Float	4.00	30x3½	30x3½	Wood	Cant.	Gemmer	Stewart	Plain 3	Ball	Ball	Roller	Harroun A-1
Own	Unit M.	3	Sp.B.	Springs	Own	¾-Float.	4.42	34x4½	34x4½	Wood	S-E.	Jacox	Stewart	Plain 3	Ball	Ball	Ball	Haynes 45
Own		3	Sp.B.	Springs	Own	¾-Float.	4.07	34x4½	34x4½	Wire	S-E.	Jacox	Stewart	Plain 3	Ball	Ball	Ball	Haynes 46
Own	Unit M.	3	Bevel.	Springs	Own	Semi-F.	4.50	34x4	34x4	Wood	Cant.	Own		Plain 3	Ball	Ball	Ball	Hollier 198
Own	Unit M.	3	Sp.B.	Springs	Own	Semi-F.	4.50	32x4	32x4	Wood	Cant.	Gemmer		Plain 3	Ball	Ball	Ball	Hollier 206
Brown-Lipe.	Unit M.	3	Sp.B.	Springs	Timken	Semi-F.	4.50	34x4½	34x4½	Wood	Ell.	Gemmer	Van Sicklen	Plain 7	Roller	Roller	Roller	Holmes
Own	Unit M.	3	Sp.B.	Springs	Timken	¾-Float.	*4.90	35x4½	35x4½	Opt.	S-E.	Gemmer	Stewart	Plain 4	Roller	Roller	Roller	Hudson M
Own	Unit M.	3	Sp.B.	Springs	Own	¾-Float.	4.91	33x4	33x4	Wood	S-E.	Jacox	Van Sicklen	Plain 3	R&P	Roller	Ball	Hupmobile R
Covert	Unit M.	3	Sp.B.	Springs	Salisbury.	¾-Float.	5.27	37x4	37x4	Wood	Ell.	Foster	Stewart	Plain 3	Roller	Roller	Ball	Jackson
Brown-Lipe.	Unit M.	3	Sp.B.	Springs	Timken	Semi-F.	4.45	34x4	34x4	Opt.	S-E.	Warner	Stewart	Plain 3	Roller	Roller	Roller	Jones 28
Detroit	Unit M.	3	Sp.B.	Springs	Timken	¾-Float.	4.08	32x4	32x4	Opt.	S-E.	Gemmer	Van Sicklen	Plain 3	B&P	Roller	Roller	Jordan
Own	Unit M.	3	Sp.B.	Springs	Columbia.	Float	5.00	34x4	34x4	Opt.	Cant.	Jacox	Stewart	Plain 3	B&R	Roller	B&R	King F
T.W. Warner.	Unit M.	3	Sp.B.	Springs	Own	Float	4.58	32x4½	32x4½	Wire	¾-Ell.	Jacox	Stewart	Plain 3	B&P	Roller	Roller	Kissel

Rad-Rd—*Radius Rods*
Rev-C—*Reversed Cone*
Roll—*Roller*
S-A—*Semi-Automatic*
S-E—*Semi-Elliptic*
Semi-F—*Semi-Floating*
Sp.B—*Spiral Bevel*
Sp.G—*Spiral Gear*
Splash-Pres—*Splash Pressure*

Spur—*Spur Gears*
T—*T-Head*
Ther—*Thermo-Syphon*
Tor-A—*Torsion Arm*
Tor-R—*Torsion Rod*
Tor-T—*Torsion Tube*
Tr S-E—*Transverse Semi-Elliptic*
Trans—*Transverse*
Unit-M—*Unit with Motor*

Unit-T—*Unit with Torque Tube*
Unit-X—*Unit with Axle*
Vib-Dup—*Vibrating Duplex*
†—*Wire Extra*
*Also available—3.77:1, 4.08:1 and 4.45:1

EQUIPMENT

At Kent—*Atwater Kent*
G.B.&S.—*Golden, Belknap & Swartz*

G. & D.—*Gray & Davis*
Hersh-Sp—*Herschell-Spillman*
Johns-Man—*Johns-Manville*
Leece-N—*Leece-Neville*
Mass-Ph—*Massnick-Phipps*
Teet-Hart—*Teetor-Hartley*
W-Weiss—*Walker-Weiss*
Ward-L—*Ward Leonard*
West-M—*Weston-Mott*

1919 Passenger Automobiles Listed with

MAKE AND MODEL	Wheelbase	No. of Cylinders	Bore and Stroke Inches	Piston Displacement Cubic Inches	Make of Engine	Cylinder Shape	Camshaft Drive	Water Circulation	LUBRICATION System	LUBRICATION Type of Pump	CARBURETION Make of Carbureter	CARBURETION Fuel Feed	IGNITION System	IGNITION Make	IGNITION Control	ELECTRIC SYS. Generator Make	ELECTRIC SYS. Voltage	CLUTCH Make	CLUTCH Type
Kline 6-42-H	121	6	3¼x4½	224	Continental	L	Helical	Gear	Splash-Pres.	Piston	Rayfield	Vacuum	Single	Conn	Hand	Westinghouse	6	Borg & Beck	Plate
Lexington R-19	122	6	3¼x4½	224	Continental	L	Helical	Cent.	Circ-Sp	Piston	Rayfield	Vacuum	Single	Conn	Hand	Westinghouse	6	Borg & Beck	Plate
Liberty 10-B	115	6	3¼x4½	224	Continental	L	Helical	Ther.	Splash Pres	Piston	Stromberg	Vacuum	Dual	Delco	Hand	Delco	6	Borg & Beck	Plate
Locomobile 38-2	139	6	4¼x5	426	Own	T	Helical	Cent.	Splash-Pres	Gear	Ball	Pressure	Dual-D	Berling	Hand	Westinghouse	6	Own	Disk
Locomobile II-48	142	6	4½x5½	525	Own	T	Helical	Cent.	Splash-Pres.	Gear	Ball	Pressure	Dual-D	Berling	Hand	Westinghouse	6	Own	Disk
Maibohm B	116	6	3⅛x4¼	196	Falls	I	Helical	Ther.	Splash-Pres.	Piston	Stromberg	Vacuum	Single	At Kent.	Hand	Wagner	6	Borg & Beck	Plate
Marmon 34	136	6	3¾x5⅛	340	Own	I	Helical	Cent.	Pressure	Gear	Stromberg	Gravity	Single	Bosch	Hand	Bijur	6	Own	Cone
Maxwell 25	108½	4	3⅝x4½	186	Own	L	Helical	Ther.	Circ-Spl	Eccentric	Johnson	Vacuum	Single		Hand	Simms-Huff	12	Own	Cone
McFarlan	136	6	4½x6	573	Teetor-Hart	T	Helical	Cent.	Splash-Pres.	Piston	Stromberg	Vacuum	Double	Bosch	Hand	Westinghouse	6	Borg & Beck	Plate
Mercer 4	115-132	4	3¾x6¾	298	O n	L	Chain.	Cent.	Pressure	Gear	Ball	Vacuum	Single	Berling	Hand	Westinghouse	6	Own	Disk
Mitchell C-42	127	6	3½x5	289	Own	L	Helical	Cent.	Splash-Pres.	Piston	Rayfield	Vacuum	Single	Remy	Hand	Remy	6	Own	Cone
Mitchell D-40	120	6	3¼x5	249	Own	L	Helical.	Cent.	Splash-Pres.	Piston	Rayfield	Vacuum	Single	Remy	Hand	Remy	6	Own	Cone
Moline-Knight G	122	4	4 x6	302	Own	K	Chain	Ther.	Pressure	Gear	Schebler	Vacuum	Dual	Conn	Hand	Wagner	6	Own	Cone
Moline-Knight L	118	4	3¾x5	221	Own	K	Chain	Ther.	Pressure	Gear	Schebler	Vacuum	Dual	Conn	Hand	Wagner	6	Borg & Beck	Plate
Monitor M & O	117	6	3¼x4½	224	Continental	L	Helical	Gear	Splash-Pres.	Piston	Stromberg	Vacuum	Single		Hand	Dyneto	6	Borg & Beck	Plate
Moon 6-36-19	114	6	2⅞x4½	175	Continental		Helical.	Ther.	Splash-Pres	Piston	Tillotson	Gravity	Single	Delco	Atmtc.	Wagner	6	Detlaff	Plate
Moon 6-66-19	125	6	3½x5¼	303	Continental	L	Helical	Cent	Splash-Pr	Piston	Rayfield	Vacuum	Single	Delco	Atmtc.	Delco	6	Borg & Beck	Plate
Moore 30-C	106	4	3¾x4¼	188	G.B.& S		Chain	Ther.	Splash-Pres	Piston	K-D	Gravity	Single	Conn	Hand	Auto-Lite	6		Plate
Nash 681, 2, 3, 4, 5	121-127	6	3¼x5	249	Own	I	Helical.	Cent.	Circ-Spl	Gear	Marvel	Vacuum	Single	Delco	H & A.	Delco	6	Borg & Beck	Plate
National AF3	128	6	3½x5¼	308	Continental	L	Helical.	Cent.	Splash-Pres.	Piston	Rayfield	Vacuum	Single	Delco	H & A.	Westinghouse	6	Own	Cone
National AK	128	12	2⅞x4¾	370	Own	L	Helical.	Cent.	Pressure	Gear	Rayfield	Vacuum	Single	Delco	H & A.	Bijur	6	Own	Cone
Oakland 34-B	112	6	2 13/16x4¾	177	Own	I	Spur	Cent.	Pressure	Gear	Marvel	Vacuum	Single		Hand	Remy	6	Northway	Cone
Oldsmobile 37A	112	6	2 13/16x4¾	177	Northway	I	Helical.	Cent.	Pressure	Gear	Johnson	Vacuum	Single	Remy	Hand	Remy	6	Northway	Cone
Oldsmobile 45A	120	8	2⅞x4¾	247	Own	T	Helical.	Cent.	Pressure	Gear	Ball	Vacuum	Single	Delco	H & A.	Delco	6	Own	Cone
Olympian 45	112	4	3¼x4½	149	Own	I	Helical.	Ther.	Pressure	Gear	Stromberg	Vacuum	Single	Conn	Hand	Auto-Lite	6	Borg & Beck	Plate
Overland 90	106	4	3⅜x5	179	Own	L	Helical.	Ther.	Circ-Spl	Piston	Tillotson	Vacuum	Single	Conn	Hand	Auto-Lite	6	Own	Cone
Owen Magnetic W-42		6	4 x5½	415	Own	I	Spur	Cent.	Pressure	Gear	Zenith	Vacuum	Single	Bosch	Hand	Own	24		
Packard 3-25 3-35		12	3 x5	424	Own	T	Chain	Cent.	Pressure	Gear	Own	Pressure	Single	Delco	H & A.	Bijur	6	Own	Disk
Paige 6-55	127	6	3½x5¼	303	Continental	L	Helical.	Cent.	Splash-Pres.	Piston	Rayfield	Vacuum	Single	Remy	Hand	Remy	6	Borg & Beck	Plate
Paige 6-40	117	6	3⅛x5	230	Rutenber	L	Helical.	Cent.	Splash-Pres.	Piston	Stromberg	Gravity	Single	Remy	Hand	G & D	6	Borg & Beck	Plate
Paterson 6-48	120	6	3¼x4½	224	Continental	L	Helical.	Cent.	Splash-Pres	Piston	Stromberg	Vacuum	Dual	Delco	Hand	Delco	6	Borg & Beck	Disk
Peerless 56	125	8	3¼x5	332	Own	T	Helical.	Cent.	Pressure	Gear	Ball	Vacuum	Single	At Kent.	H & A.	Auto-Lite	6	Brown-Lipe	Disk
Pierce-Arrow 48B-5	142	6	4½x5½	525	Own	DV.	Helical	Cent.	Pressure	Gear	Own	Pressure.	Double	Bosch	Hand	Westinghouse	6	Own	Cone
Pilot 6-45	120	6	3⅛x5	230	Teetor-Hart	L	Helical.	Cent.	Splash-Pres	Piston	Tillotson	Vacuum	Dual	Delco	Hand	Delco	6	Borg & Beck	Plate
Premier 6-C	125½	6	3⅜x5½	295	Own	I	Helical.	Cent.	Splash-Pres.	Gear	Johnson	Vacuum	Single	Delco	Hand	Delco	6	Borg & Beck	Plate
Reo T & U	120	4	4⅛x4½	241	Own	F	Helical.	Cent.	Circ-Spl	Piston	Johnson	Vacuum	Single	Remy	Hand	Remy	6	Own	Disk
Revere	131	4	4⅜x6	361	Duesenberg	F	Helical.	Cent.	Splash-Pres.	Gear	Stromberg	Vacuum	Single	Bosch	Hand	North East	6	Brown-Lipe	Plate
Roamer 6-54	128	6	3½x5¼	303	Continental	L	Helical.	Cent.	Splash-Pres.	Piston	Stromberg	Vacuum	Single	Bosch	Hand	Bijur	6	Borg & Beck	Plate
Saxon Y-18	112	6	2⅞x4½	175	Continental	L	Helical.	Ther.	Circ-Spl	Piston	Stromberg	Vacuum	Single	Remy	Hand	Wagner	6	Own	Plate
Scripps-Booth 6-39	112	6	2 13/16x4¾	177	Northway	I	Helical.	Cent.	Pressure	Gear	Marvel	Vacuum	Single	Remy	Hand	Remy	6	Northway	Cone
Seneca H	108	4	3½x4½	173	LeRoi	L	Helical.	Ther.	Circ-Spl		Schebler	Vacuum	Single		Hand		6	Detroit	Plate
Singer 19	139	6	4 x5½	415	Hersh-Sp	T	Helical.	Cent.	Pressure	Gear	Rayfield	Vacuum	Single	Bosch	Hand	Westinghouse	6	Muncie	Disk
Standard G	127	8	3¼x5	332	Hersh-Sp	L	Helical.	Cent.	Pressure	Gear	Zenith	Vacuum	Single	Split	Hand	Westinghouse	6	Borg & Beck	Plate
Stearns SKL4	119	4	3¾x5	221	Own	K	Chain	Cent.	Splash-Pres.	Gear	Schebler	Vacuum	Single	Remy	Hand	Remy	12	Own	Disk
Stephens 74-76	118	6	3¼x4½	224	Own	I	Helical.	Ther.	Pressure	Gear	Stromberg	Vacuum	Single	Delco	Hand	Delco	6	Borg & Beck	Plate
Studebaker EG	126	6	3⅞x5	354	Own	L	Helical.	Cent.	Circ-Spl	Gear	Ball	Vacuum	Single	Remy	Hand	Wagner	6	Own	Cone
Studebaker EH	119	6	3½x5	289	Own	L	Helical.	Cent.	Circ-Spl	Gear	Ball	Vacuum	Single	Remy	Hand	Wagner	6	Own	Cone

ABBREVIATIONS

2-pt—*Two Point*
¾ Ell—*¾ Elliptic*
¾ Float—*¾ Floating*
¾ Plat—*¾ Platform*
Amid—*Amidships*
Atmtc—*Automatic*
B & P—*Ball and Plain*
B & R—*Ball and Roller*
B R & P—*Ball, Roller and Plain*
C & C—*Cup and Cone*
Cant—*Cantilever*
Cent—*Centrifugal*
Circ-Spl—*Circulating Splash*
Dual-D—*Dual Double*
D V—*Dual Valve*
Ell—*Elliptic*
F—1 *Valve in Head, 1 in Side*
Float—*Floating*
Fric—*Friction.*
Gear—*Gear Pump*
H—*Horizontal*
H & A—*Hand and Automatic*
I—*I-Head*
Imp—*Impeller*
K—*Knight Type*
L—*L-Head*
Mag—*Magnetic*
Non-Spl—*Non-Circulating Splash*
Opt—*Optional*
Plan—*Planetary*
Plat—*Platform*

Their Technical Specifications—Continued

TRANSMISSION							Gear Ratio on Direct	RUNNING GEAR				Make of Steering Gear	Make of Speedometer	Crankshaft Bearings and Number	BEARINGS			MAKE AND MODEL
GEARSET			Final Drive	Torque Taken By	Make of Rear Axle	Rear Axle Type		TIRES		Wheels	Rear Springs				Gearset	Rear Axle	Front Wheel	
Make	Location	Forward Speeds						Front	Rear									
Grant-Lees	Unit M.	3	Sp.B.	Springs	Hess	¾-Float.	4.50	33x4	33x4	Wood	¾-Ell	Wohlrab	Stewart	Plain 3	Ball	Ball	Roller	Kline 6-42-H
Warner	Unit M.	3	Sp.B.	Springs	Hess	Float	5.00	34x4	34x4	Wood	S-E	T.W.Warner	Stewart	Plain 3	Ball	Roller	Ball	Lexington R-19
Detroit	Unit M.	3	Sp.B.	Springs	Timken	Semi-F.	4.75	32x4	32x4	Wood	S-E	Jacox	Stewart	Plain 3	B&P	Roller	Roller	Liberty 10-B
Own	Amid	4	Sp.B.	Rad-Rod.	Own	Float	4.07	35x5	35x5	Wood	¾-Ell	Own	Stewart	Plain 7	Ball	Ball	Roller	Locomobile 38-2
Own	Amid	4	Sp.B.	Rad-Rod.	Own	Float		35x5	35x5	Wood	¾-Ell	Own	Stewart	Plain 7	Ball	Ball	Roller	Locomobile II-48
Mechanics	Unit M.	3	Bevel	Springs	Peru	Float	4.50	32x3½	32x3½	Wood	S-E	Jacox	Stewart	Plain 3	Ball	B&R	Ball	Maibohm B
Own	Unit-T.	3	Sp.B.	Tor-A.	Own	¾-Float.	3.69-4.00	32x4½	32x4½	Wire	Trans.	Gemmer	Van Sicklen	Plain 4	BR&P	B&R	Roller	Marmon 34
Own	Unit M.	3	Bevel.	Springs	Own	¾-Float.	3.58	30x3½	30x3	Wood	S-E	Own	Stewart	Plain 2	R&P	B&R	Ball	Maxwell 25
Brown-Lipe	Amid	3	Sp.B.	Springs	Timken	Float	3.50	35x5	35x5	Wood	S-E	Gemmer	Stewart	Plain 4	Roller	Roller	Roller	McFarlan
Own	Amid	4	Sp.B.	Springs	Own	Float	3.62	32x4½	32x4½	Opt.	S-E	Gemmer		Plain 3	Ball	B&R	Roller	Mercer 4
Own	Amid	3	Sp.B.	Springs	Own	Float	4.41	34x4	34x4	Wood	Cant.	Own		Plain 3	B&R	Roller	Roller	Mitchell C-42
Own	Amid	3	Sp.B.	Springs	Own	Float	4.41	32x4	32x4	Wood	Cant.	Own		Plain 3	B&R	Roller	Roller	Mitchell D-40
Warner	Amid	3	Sp.B.	Tor-A.	Timken	¾-Float.	4.12	35x4½	35x4½	Wood	Trans.	Jacox		Plain 3	Roller	Roller	Roller	Moline-Knight G
Warner	Amid	3	Sp.B.	Tor-A.	Timken	Semi-F.	4.96	34x4	34x4	Wood	Trans.	Jacox		Plain 3	Roller	Roller	Roller	Moline-Knight L
Grant-Lees	Unit M.	3	Sp.B.	Springs	Adams	Float	4.00	33x4	33x4	Wood	¾-Ell	C.A.S.	Stewart	Plain 3	Ball	B&R	Ball	Monitor M & O
Own	Unit M.	3	Sp.B.	Springs	Own	Float	4.75	32x3½	32x3½	Wood	S-E	Warner			Ball	Roller	Roller	Moon 6-36-19
Warner	Unit M.	3	Sp.B.	Springs	Timken	¾-Float.	4.60	35x4½	35x4½	Wood	S-E	Warner		Plain 3	Ball	Roller	Roller	Moon 6-66-19
Grant-Lees	Unit M.	3	Bevel.	Springs	Peru	Float	4.25	30x3½	30x3½	Wood	¾-Ell			Plain 3	Ball	B&R	Ball	Moore 30-C
Own	Unit M.	3	Sp.B.	Springs	Own	Semi-F.	4.50	33x4	33x4	Wood	S-E	Jacox	Stewart	Plain 3	Roller	Roller	Roller	Nash 681 2 3 4 5
Muncie	Unit M.	3	Sp.B.	Springs	Columbia.	Float	4.58	34x4½	34x4½	Wood	Cant.	T.W.Warner	Stewart	Plain 3	Ball	Roller	Roller	National AF3
Muncie	Unit M.	3	Sp.B.	Springs	Columbia.	Float	4.58	34x4½	34x4½	Wood	Cant.	T.W.Warner	Stewart	Plain 3	Ball	Roller.	Roller	National AK
T.W.Warner.	Unit M.	3	Bevel.	Springs	West-M.	¾-Float.	4.50	32x4	32x4	Wood	S-E	Jacox	Stewart	Plain 3	Ball	B&R	Ball	Oakland 34-B
Warner	Unit M.	3	Sp.B.	Springs	West-M.	Float	4.58	32x4	32x4	Wood	S-E	Northway	Stewart	Plain 3	B&P	B&R	Roller	Oldsmobile 37A
Northway	Unit M.	3	Sp.B.	Springs	West-M.	Float	4.61-4.91	34x4	34x4	Wood	¾-Ell	Jacox	Stewart	Plain 2	B&P	B&R	Roller	Oldsmobile 45A
Own	Unit M.	3	Sp.B.	Tor-A.	Peru	Float	4.64	32x3½	32x3½	Opt.	Trans.	T.W.Warner	Stewart	Plain 2	B&P	B&R	Ball	Olympian 45
Own	Unit-X.	3	Sp.B.	Tor-T.	Own	¾-Float.	3.93	31x4	31x4	Wood	Cant.	Own	Stewart	Plain 2	BR&P	Ball	Roller	Overland 90
Own			Sp.B.	Springs	American.	Float	4.00	35x5	35x5	Opt.	S-E	Own		Plain 3	Ball	Roller	Roller	Owen Magnetic W-42
Own	Unit M.	3	Sp.B.	Springs	Own	Semi-F.	4.36	35x5	35x5	Wood	S-E	Own	Waltham	Plain 3	Ball	Ball	Roller	Packard 3-25 3-35
Own	Unit M.	3	Sp.B.	Tor-T.	Salisbury.	¾-Float.	4.36	35x4½	35x4½	Wood	Cant.	Jacox		Plain 3	BR&P	B&R	Ball	Paige 6-55
Own	Unit M.	3	Sp.B.	Tor-T.	Salisbury.	¾-Float.	4.42	33x4	33x4	Wood	Cant.	Jacox		Plain 3	BR&P	B&R	Roller	Paige 6-40
Durston	Unit M.	3	Sp.B.	Springs	Hess	Float	4.50	33x4	33x4	Wood	S-E	Jacox		Plain 3	Ball	Roller	Roller	Paterson 6-48
Brown-Lipe	Unit M.	3	Sp.B.	Springs	Timken	Semi-F.	4.90	34x4½	34x4½	Wood	Plat	Gemmer	Stewart	Plain 3	Roller	Roller	Roller	Peerless 56
Own	Amid	4	Sp.B.	Springs	Own	Semi-F.		35x5	35x5	Wood	¾-Ell	Own	Stewart	Plain 7	Ball		Roller	Pierce-Arrow 48B-5
Muncie	Unit M.	3	Sp.B.	Tor-T.	Hess	Float	4.25	32x4	32x4	Wood	Cant.	C.A.S.	Van Sicklen	Plain 3	Ball	B&R	Roller	Pilot 6-45
Detroit	Unit M.	3	Sp.B.	Springs	Timken	Semi-F.	4.45	32x4½	32x4½	Wood	S-E	Warner	Stewart	Plain 3	Ball	Roller	Roller	Premier 6-C
Own	Amid	3	Sp.B.	Springs	Own	Semi-F.	4.30-4.60	34x4	34x4	Wood	S-E	Own	Stewart	Plain 3	Roller	Roller	Roller	Reo T & U
Brown-Lipe	Unit M.	4	Sp.B.	Tor-A.	American.	Float	3.50	32x4½	32x4½	Wire	S-E	Gemmer	Stewart	Plain 2	Ball	Roller	Roller	Revere
Grant-Lees	Unit M.	3	Sp.B.	Springs	Hess		3.77	32x4	32x4	Wire	S-E	Jacox	Stewart	Plain 3	Ball	Ball	Ball	Roamer 6-54
Own	Unit X.	3	Sp.B.	Tor-A.	Own	Semi-F.	5.00	32x3½	32x3½	Wood	Cant.	Warner	Stewart	Plain 3	Roller	Roller	Roller	Saxon Y-18
T.W.Warner.	Unit M.	3	Bevel.	Springs	West-M.	¼-Float.	4.50	32x4	32x4	Opt.	S-E	Jacox	Stewart	Plain 3	B&P	B&R	Ball	Scripps-Booth 6-39
Detroit	Unit M.	3	Sp.B.	Springs	Adams	Float	4.50	30x3½	30x3½	Wood	Cant.	Ditweiler	Stewart	Plain	Ball	Ball	Roller	Seneca H
Muncie	Unit M.	4	Sp.B.	Tor-A.	Timken	Float	3.70	35x5	35x5	Wire	Cant.	Gemmer	Stewart	Plain 3	Ball	Roller	Roller	Singer 19
Grant-Lees	Unit M.	3	Sp.B.	Springs	Timken	Semi-F.	4.90-4.45	34x4½	34x4½	Wood	S-E	Gemmer	Stewart	Plain 3	B&R	Roller	Roller	Standard G
Own	Unit M.	3	Sp.B.	Springs	Own	Semi-F.	4.50	34x4½	34x4½	Wood	Cant.	Own	Stewart	Plain 3	B&R	B&R	Roller	Stearns SKL4
Mechanics	Unit M.	3	Sp.B.	Springs	Opt.	Float	4.75	32x4	32x4	Opt.	S-E	Gemmer	Van Sicklen	Plain 3	Ball	B&R	Roller	Stephens 74-76
Own	Amid	3	Sp.B.	Springs	Own	Semi-F.	3.70	33x4½	33x4½	Wood	S-E	Gemmer		Plain 4	R&P	Roller	Roller	Studebaker EG
Own		3	Sp.B.	Springs	Own		4.00	32x4	32x4	Wood	S-E	Gemmer		Plain 4	R&P	Roller	Roller	Studebaker EH

Rad-Rd—*Radius Rods*
Rev-C—*Reversed Cone*
Roll—*Roller*
S-A—*Semi-Automatic*
S-E—*Semi-Elliptic*
Semi-F—*Semi-Floating*
Sp.B—*Spiral Bevel*
Sp.G—*Spiral Gear*
Splash-Pres—*Splash Pressure*

Spur—*Spur Gears*
T—*T-Head*
Ther—*Thermo-Syphon*
Tor-A—*Torsion Arm*
Tor-R—*Torsion Rod*
Tor-T—*Torsion Tube*
Tr S-E—*Transverse Semi-Elliptic*
Trans—*Transverse*
Unit-M—*Unit with Motor*

Unit-T—*Unit with Torque Tube*
Unit-X—*Unit with Axle*
Vib-Dup—*Vibrating Duplex*
†—*Wire Extra*
*Also available—3.77:1, 4.08:1 and 4.45:1

EQUIPMENT

At Kent—*Atwater Kent*
G.B.&S.—*Golden, Belknap & Swartz*

G. & D.—*Gray & Davis*
Hersh-Sp—*Herschell-Spillman*
Johns-Man—*Johns-Manville*
Leece-N—*Leece-Neville*
Mass-Ph—*Massnick-Phipps*
Teet-Hart—*Teetor-Hartley*
W-Weiss—*Walker-Weiss*
Ward-L—*Ward Leonard*
West-M—*Weston-Mott*

1919 Passenger Automobiles Listed with

MAKE AND MODEL	Wheel-base	No. of Cylinders	Bore and Stroke Inches	Piston Displacement Cubic Inches	Make of Engine	Cylinder Shape	Cam-shaft Drive	Water Circulation	LUBRICATION System	LUBRICATION Type of Pump	CARBURETION Make of Carbureter	CARBURETION Fuel Feed	IGNITION System	IGNITION Make	IGNITION Control	ELECTRIC SYS. Generator Make	ELECTRIC SYS. Voltage	CLUTCH Make	CLUTCH Type
Studebaker.........LH	112	4	3½x5	192	Own........	L...	Helical.	Cent..	Circ-Spl....	Gear.....	Schebler....	Vacuum.	Single...	Remy...	Hand..	Wagner.....	6	Own........	Cone..
Stutz................G	120-130	4	4⅜x6	215	Own........	DV.	Helical.	Cent..	Splash-Pres.	Gear.....	Stromberg..	Pressure.	Double..	....	Hand..	Remy.......	12	Own........	Cone..
Templar............445	118	4	3⅜x5½	197	Own........	I...	Chain..	Cent..	Pressure....	Gear.....	Zenith.....	Vacuum.	Single...	Remy...	H & A.	Remy.......	6	Borg & Beck.	Plate..
Tulsa................D	117½	4	3½x5	192	Lycoming...	L...	Helical.	Ther..	Circ-Spl....	Piston....	Zenith.....	Vacuum.	Single...	Delco...	Hand..	Dyneto......	6	Borg & Beck.	Plate..
Velie................38	114½	6	3¼x4½	274	Continental..	L...	Helical.	Cent..	Splash-Pres.	Piston....	Rayfield....	Vacuum.	Single...	Remy...	Atmtc..	Remy.......	6	Borg & Beck.	Plate..
Velie................39	124	6	3½x5¼	303	Continental..	L...	Helical.	Cent..	Splash-Pres.	Piston....	Rayfield....	Vacuum.	Single...	Remy...	Atmtc..	Remy.......	6	Borg & Beck.	Plate..
Westcott..........18-A	125	6	3½x5¼	303	Continental..	L...	Helical.	Cent..	Circ-Spl....	Piston....	Rayfield....	Vacuum.	Single...	Delco...	H & A.	Delco.......	6	Brown-Lipe..	Disk..
Willys-Knight......88-4	121	4	4⅛x4½	241	Own........	K...	Chain..	Ther..	Splash-Pres.	Piston....	Tillotson...	Vacuum.	Single...	Conn...	Hand..	Auto-Lite....	6	Own........	Cone..
Winton..............22	138	6	4½x5¼	501	Own........	L...	Chain..	Cent..	Pressure....	Piston....	Rayfield....	Vacuum.	Single...	Bosch...	Hand..	Bijur.......	6	....	Disk..
Winton...........22-A	128	6	3¾x5¼	348	Own........	L...	Chain..	Cent..	Pressure....	Piston....	Rayfield....	Vacuum.	Single...	Bosch...	Hand..	Bijur.......	6	....	Disk..

ABBREVIATIONS

2-pt—*Two Point*
¾ Ell—¾ *Elliptic*
¾ Float—¾ *Floating*
¾ Plat—¾ *Platform*
Amid—*Amidships*
Atmtc—*Automatic*
B & P—*Ball and Plain*
B & R—*Ball and Roller*
B R & P—*Ball, Roller and Plain*
C & C—*Cup and Cone*
Cant—*Cantilever*
Cent—*Centrifugal*
Circ-Spl—*Circulating Splash*
Dual-D—*Dual Double*
D V—*Dual Valve*
Ell—*Elliptic*
F—1 *Valve in Head, 1 in Side*
Float—*Floating*
Fric—*Friction*
Gear—*Gear Pump*
H—*Horizontal*
H & A—*Hand and Automatic*
I—*I-Head*
Imp—*Impeller*
K—*Knight Type*
L—*L-Head*
Mag—*Magnetic*
Non-Spl—*Non-Circulating Splash*
Opt—*Optional*
Plan—*Planetary*
Plat—*Platform*

1919 Steam-Driven

Name and Model	Wheelbase	Type of Boiler	Boiler Location	Type of Engine	Type of Valve Gear	Type of Valves	No. of Cylinders	Bore and Stroke	LUBRICATION Cylinders	LUBRICATION Engine	Engine Location	Final Drive	Fuel
Doble..........	136	Water Tube...	Under Hood...	Dbl. Acting....	Own........	Slide......	2	4x5	....	Splash......	Rear Axle...	Spur Gear...	Kerosene....
Stanley..........	130	Fire Tube.....	Under Hood...	Dbl. Acting....	....	Slide......	2	4x5	Force Feed..	Splash......	Rear Axle...	Spur Gear...	Kerosene....

1919 Engineering Trends

(*Continued from page* 88)

Secondly, many of our engineers have had their time wholly occupied by other things and they are returning to automobile work with an energy and a zest.

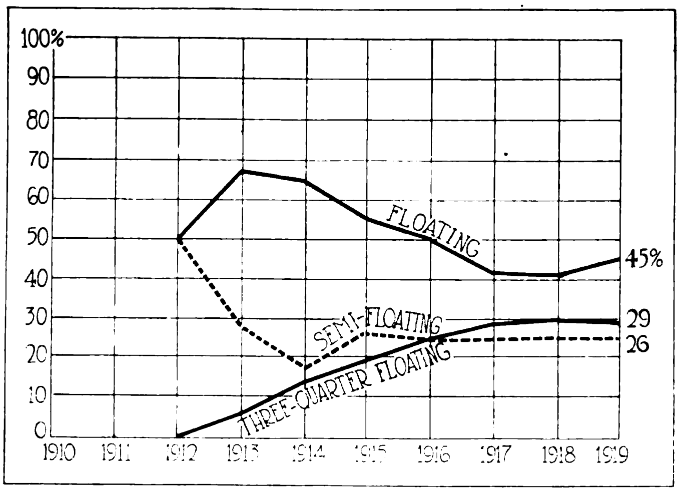
Thirdly, aviation engine manufacture, while it has produced little in the way of design which is applicable to automobiles, has without doubt shown many a manufacturer new methods for making things better.

Labor is accustomed to more accurate work, the possibilities for accuracy of many tools have been improved, the number of capable inspectors has been multiplied many times. These things mean that many an engineer will now dare to ask his shop for work of a more difficult nature than he would have been able to consider two years ago. Last, but by no means least, the machine shop set up for the old model has been ripped out of a large proportion of plants, and it is as easy to tool up for a new car as to retool for the old one.

At the exact and precise effects of all these things one can do no more than guess. The one certain thing is that they will be very perceptible.

There has never before been a similar opportunity for a general redesigning. Never before has a manufacturer of years' standing been able to contemplate putting into production a completely new machine at the same cost which he would have to face in continuing the old one. This opportunity becomes of increasing importance as the factory grows larger, so there is possibility that in 1919 we shall see some great changes in the product of the very largest plants; in other words, improvements may be looked for among the cheaper cars.

The average price of the 1919 American touring car is now $2,226. This is calculated from the prices existing



There has not been a great deal of change in the preference for the three types of rear axle. During the year gone by, the three-quarter floating type has declined very slightly, but the two other methods are practically where they were last year

Their Technical Specifications—Continued

Transmission: Gearset: Make	Transmission: Gearset: Location	Transmission: Gearset: Forward Speeds	Transmission: Final Drive	Transmission: Torque Taken By	Transmission: Make of Rear Axle	Transmission: Rear Axle Type	Gear Ratio on Direct	Running Gear: Tires: Front	Running Gear: Tires: Rear	Running Gear: Wheels	Running Gear: Rear Springs	Make of Steering Gear	Make of Speed-ometer	Crank-shaft Bearings and Number	Bearings: Gearset	Bearings: Rear Axle	Bearings: Front Wheel	MAKE AND MODEL
Own........	....	3	Sp.B..	Springs...	Own.....	....	4.08	32x3½	32x3½	Wood..	S-E.....	Gemmer.....	....	Plain 3...	R&P...	Roller..	Roller..	**Studebaker**..........**LH**
Own........	Unit X..	3	Sp.B..	Rad-Rod.	Own.....	¾-Float.	....	32x4½	32x4½	Wire....	S-E.....	Gemmer.....	Stewart.....	Plain 3...	Ball....	B&R...	Roller..	**Stutz**..............**G**
Own........	Unit M..	3	Sp.B..	Springs...	American.	Semi-F..	4.40	32x4	32x4	Wood...	S-E.....	Jacox.......	Stewart.....	Plain 3...	B&P...	B&R...	Roller..	**Templar**............**445**
Grant-Lees..	Unit M..	3	Sp.B..	Springs...	Salisbury.	Float...	4.50	33x4	33x4	Opt.....	S-E.....	C.A.S.......	Stewart.....	Plain 2...	B&P...	BR&P..	Ball....	**Tulsa**...............**D**
Durston.....	Unit M..	3	Sp.B..	Springs...	Timken..	Float...	4.75	32x4	32x4	Wood...	¾-Ell...	Gemmer.....	Van Sicklen..	Plain 3...	B&P...	Roller..	Roller..	**Velie**...............**38**
Warner.....	Unit M..	4	Sp.B..	Springs...	Timken..	Float...	4.45–4.08	33x4½	33x4½	Wood...	¾-Ell...	Gemmer.....	Van Sicklen..	Plain 3...	Ball....	Roller..	Roller..	**Velie**...............**39**
Opt.........	Unit M..	3	Sp.B..	Springs...	Timken..	¾-Float.	4.45	32x4½	32x4½	Wood...	Cant....	Gemmer.....	Stewart.....	Plain 3...	Roller..	Roller..	Roller..	**Westcott**...........**18–A**
Own........	Unit-X..	3	Sp.B..	Tor-T....	Own.....	Float...	4.30	34x4½	34x4½	Wood...	Cant....	Own........	Stewart.....	Plain 3...	BR&P..	Roller..	Roller..	**Willys-Knight**......**88–4**
....	Unit M..	4	Sp.B..	Springs...	....	Float...	4.08	35x5	35x5	Wood...	¾-Ell...	....	Stewart.....	Plain 4...	B&R...	Roller..	Roller..	**Winton**.............**22**
....	Unit M..	4	Sp.B..	Springs...	....	Float...	4.73	35x5	35x5	Wood...	¾-Ell...	....	Stewart.....	Plain 4...	B&R...	Roller..	Roller..	**Winton**...........**22–A**

Rad-Rd—*Radius Rods*
Rev-C—*Reversed Cone*
Roll—*Roller*
S-A—*Semi-Automatic*
S-E—*Semi-Elliptic*
Semi-F—*Semi-Floating*
Sp.B—*Spiral Bevel*
Sp.G—*Spiral Gear*
Splash-Pres—*Splash Pressure*

Spur—*Spur Gears*
T—*T-Head*
Ther—*Thermo-Syphon*
Tor-A—*Torsion Arm*
Tor-R—*Torsion Rod*
Tor-T—*Torsion Tube*
Tr S-E—*Transverse Semi-Elliptic*
Trans—*Transverse*
Unit-M—*Unit with Motor*

Unit-T—*Unit with Torque Tube*
Unit-X—*Unit with Axle*
Vib-Dup—*Vibrating Duplex*
†—*Wire Extra*
*Also available—3.77:1, 4.08:1 *and* 4.45:1

EQUIPMENT

At Kent—*Atwater Kent*
G.B.&S.—*Golden, Belknap & Swartz*

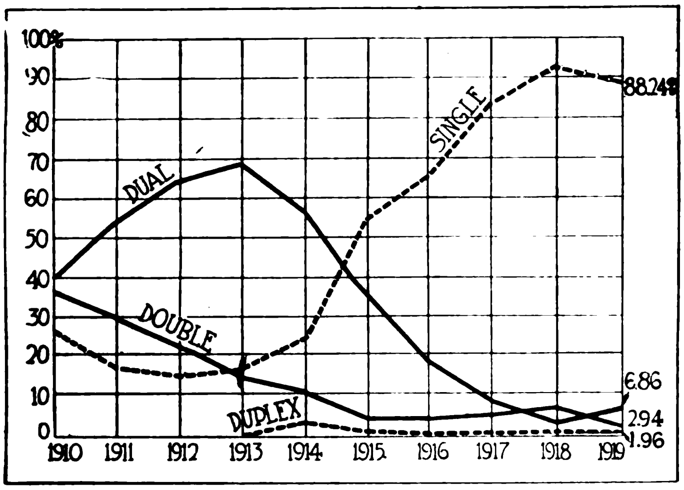
G. & D—*Gray & Davis*
Hersh-Sp—*Herschell-Spillman*
Johns-Man—*Johns-Manville*
Leece-N—*Leece-Neville*
Mass-Ph—*Massnick-Phipps*
Teet-Hart—*Teetor-Hartley*
W-Weiss—*Walker-Weiss*
Ward-L—*Ward-Leonard*
West-M—*Weston-Mott*

Passenger Automobiles

Control	Fuel Feed	Type of Burner	Feed Water Control	Rear Axle Ratio	Car Drives Through	Torque Taken By	Bearings: Rear Axle	Bearings: Front Wheel	Wheels	Wheels	Speed-ometer	Rear Springs	Name and Model
Throttle...	Gravity......	Atomizing.....	Pump.........	1.28-1	Springs.......	Engine Frame..	....	....	35x5	35x5	Waltham....	Semi-E......	**Doble**..........
Automatic..	Pressure....	Vaporizing....	Automatic ..	1.50-1	Springs.......	....	Timken...	Timken...	34x4	35x4½	Stewart.....	Elliptic......	**Stanley**.... ....

Jan. 15, 1919, for 99 different cars. There are 102 chassis listed in the specification tables this year, but a few of the manufacturers withheld prices.

It is interesting to look back along the curve of price fluctuation on the large folded supplement to this issue of AUTOMOTIVE INDUSTRIES, and to observe that a similar price prevailed just before the outbreak of war in August, 1914. In January, 1910, the average price was $2,214. In 1914 the $2200 mark was crossed during the tremendous fall in average price which occurred during that year, and now the curve is back again practically on a level with the $2,214 of January, 1910.



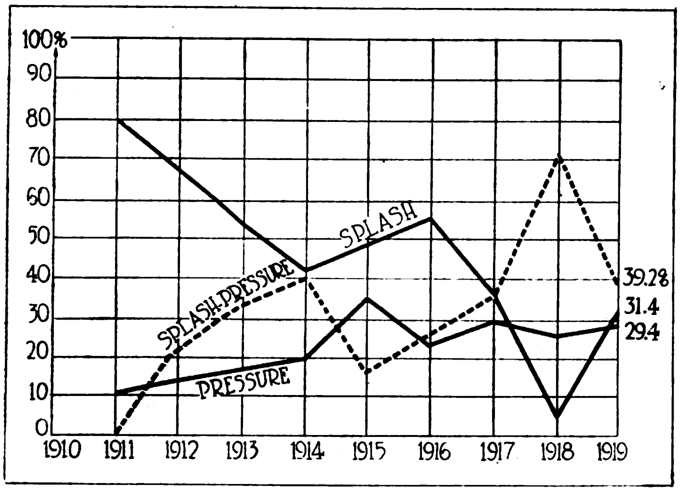
Ignition movements since 1914 have been generally consistent up to the last year when dual dropped below double. Now they have crossed again and are the same as at the end of 1917. Single ignition has dropped off very slightly

In complaining about the great increase in price caused by the war it is therefore wise to give a few moments' thought to the value now offered for $2,226 as compared with that obtainable 9 years ago for practically the same sum.

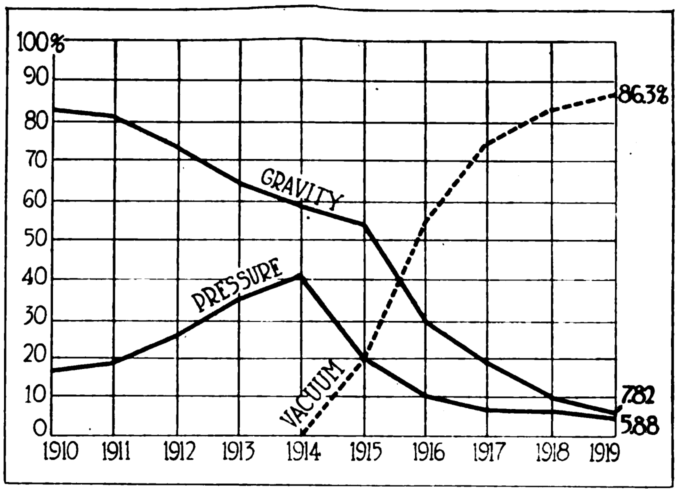
Yet again, when the cost of material and labor in 1910 is thought of and compared with to-day's figures, the amazing thing is not that prices have risen so much in the last 2 years, but that they have not gone far higher. Of course, the explanation lies in the immense improvement which has been made in manufacturing methods; it is this which enables the industry to give two or three times the value for money in automobile products.

Prices Will Not Drop

What will be the average price in January, 1920? It is a most interesting speculation. One thing is absolutely certain, and this is that it will not be very far below its present level. The industry learned its lesson, or should have done so in 1916, when prices were lowered too much owing to the false idea that the demand would not be sufficient to absorb the production. The market for high-priced cars ought to be very good indeed in America



In lubricating systems, splash has taken a decided upward trend during the last twelvemonth, gaining from 2 per cent to 31.4 per cent. Splash-pressure, on the other hand, has shown quite a drop, coming down from 71 per cent to just a little over 39 per cent



For five years now, the use of vacuum gasoline feed has shown a steady and consistent gain in favor and this year shows a further gain of from 83 per cent to 86.3 per cent. Both gravity and pressure systems show a slight decrease in popular favor

and that for cheap and moderate-priced vehicles is good throughout the world, for the whole world is calling for cars.

While there is no doubt that European competition in overseas markets will be keen, still for several years to come there is room for the absorption of all the automobiles that all the manufacturers can turn out of their shops. This means that there is no need for price cutting and it will be surprising if the average price existing a year hence will be more than two or three hundred dollars below the present average, perhaps not so much.

Few Mechanical Changes

Studying the trend curves relating to mechanical features, practically no change is to be seen, due to the lack of new designs. Many manufacturers who had new chassis ready to put into production have withheld them. Several new firms which were planning to break into the field during last year were compelled to withdraw. Thus there is no mechanical tendency deducible from the specifications which give much indication of what we may look for during 1919 in the way of engineering novelties.

It is, however, possible to forecast a little from what are known to be the ideas of some of the representative manufacturers. Here one may regard the past year as dead and can go back to 12 months ago, taking up the then clearly discernible tendencies and carry on from that point just as though 1918 had been removed from the calendar.

Doing this shows that the type of six-cylinder engine which was appearing on various new cars in 1917 is going to be a popular variety in 1919—that is to say, the medium size six of from 200 to 300 cu. in. displacement developing fairly high torque for its dimensions and having a brake mean effective pressure at the peak of its torque curve of around 100 lb.

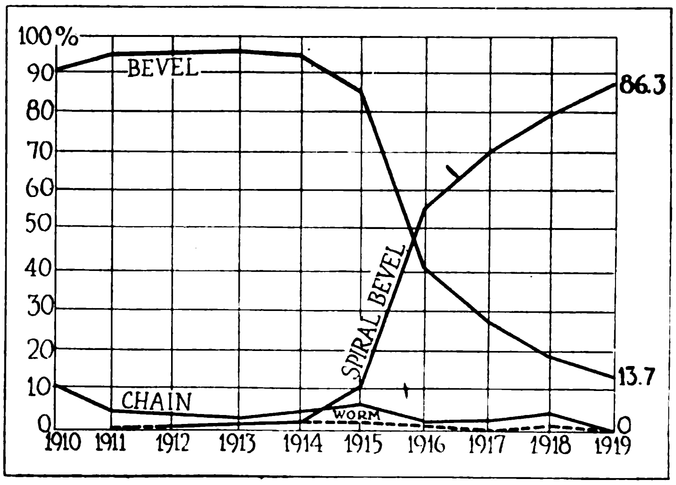
The overhead valve will be found on a large proportion of cars to be announced during the next six months partly because it is a better manufacturing job in these days of detachable cylinder heads and partly because the fuel conditions almost demand completely machined combustion chambers.

There seems little probability of many new eights or twelves. Some new fours there will be in all degrees of price, but the six will be the predominant type.

Four years ago an article published in *The Automobile* analyzed the cylinder situation and argued that if it were true that a cylinder of, say, 50 cu. in. displacement were the most desirable size, then there was room for all types of multicylinder motors according to the size and weight of car. Since that time development has rather tended to confirm the view that a cylinder of such a size is a good average, but meanwhile the size and weight of chassis have decreased, so that rather smaller motors are well able to take care of the job.

Furthermore, the eights and twelves introduced in 1915 were all new and all of a good high standard of engineering, while most of the sixes of that year were rather old and of a much lower standard. Since then the same engineering has been applied to the six, so that the difference in all-round performance between one number of cylinders and another is now more a matter of opinion than of actual fact among cars with a total piston displacement and weight of about the same value.

Again, the improvement in the design of sixes has permitted the use of lower gear ratios, so that while the piston displacement for all cars now averages only 267.4 cu. in. as compared with 307.38 cu. in. in January, 1915, the cubic feet of piston displacement per mile run on high gear has risen from 408 cu. ft. in 1915 to 426 cu. ft. in 1919. The revolutions per mile were 2300 in 1915 and are 2750 to-day.



Spiral bevel drive which first became prominent in 1915 and showed a big increase in 1916 has increased still more in popularity, rising from 79 per cent last year to 86.3 per cent this year. Both chain and worm drive have entirely disappeared

Comparison of Average American Car for Ten Years

General Averages	1919	1918	1917	1916	1915	1914	1913	1912	1911	1910
ENGINE STARTING										
Electric starter	99.4	99.4	99	98.8	94.5	87	37	2	0	0
Acetylene starter	0	0	0	0	0	1	14	0	0	0
Air	0	0	0	0	0	4	9	2	1	1
Optional	0	0	0	0	1.5	2	5	0	0	0
Mechanical	0	0	0	.0	.5	1	4	0	0	0
No starter stock	.6	0.6	1	1.2	2.5	5	31	98	99	99
FUEL FEED										
Gravity	7.8	9.7	18	31.8	57	58	65	75	81	82
Gravity pressure	....	....	1	2.4	.5	1	0	0	0	0
Pressure	5.9	6.8	7	12.0	22	41	35	25	19	18
Vacuum	86.3	83.5	74	53.8	20.5	0	0	0	0	0
GAS TANK LOCATION										
In cowl	....	....	....	No	7.2	13	....	....	....	....
At rear	....	....	....	1916	51.1	41	....	....	....	....
Under seat	....	....	....	figures avail.	21.2	46	....	....	....	....
TYPE OF CLUTCH										
Disk	73.3	73.8	68	53.4	51	48	52	44	51	49
Cone	27.7	25.64	30	45.6	44	41	45	52	47	39
Expanding band	0	0	0	0	.5	3	1	3	2	6
Contracting band clutch	0	0	0	0	4.5	5	2	1	1	3
None	0	0	1	0	....	3	....	....	....	....
Electric	0	0	1	1.0	....	....	....	....	....	....
LOCATION OF GEAR-SET										
Amidship	14.9	17.6	14	20.6	32.5	39	46	55	67	75
Unit with axle	4.9	7.37	9	15.3	18.2	15	20	20	17	15
Unit with motor	79.3	71.2	77	63.5	49.3	43	34	35	16	10
None	0	0	....	0	....	3	....	....	....	....
FINAL DRIVE										
Shaft and bevel	13.7	18.32	28	41.0	84.5	93	94	92	91	89
Chain	0	1.7	1.5	1.7	4.5	4	4	6	8	11
Shaft and worm	0	0.56	0.5	.5	1.5	1	1	1	0	0
Roller	0	0	0	0	0	1	1	1	1	0
Shaft spiral bevel	86.3	79.42	70	56.8	9.5	1	....	....	....	....
TYPE OF AXLE										
Floating	45	42.35	43.5	51.8	56.5	65	67	50	0	0
Semi-floating	26	26	25.5	23.6	23.0	17	26	49	0	0
Three-quarter	29	30.5	29.5	22.8	18.5	14	4	0	0	0
Seven-eighths	....	....	0	0	0	1	0	0	0	0
Dead	....	1.15	1.5	.6	2.0	3	3	1	0	0
TIMING GEAR DRIVE										
Spur gear	5.9	2.27	4	8.4	16.1	13	83	....	....	....
Helical or spiral	78.4	79	74	73.0	73.7	77	10	....	....	....
Silent chain	15.6	17.6	21	18.1	9.1	10	7	....	....	....
Worm	0	0	1	.5	1.1	0	0	0	0	0
Bevel	0	1.13	....	....	....	....	....	....	....	....

General Averages	1919	1918	1917	1916	1915	1914	1913	1912	1911	1910
Horsepower, S.A.E. rating	28	27.4	24.3	28.66	29.97	33.2	33.60	33.60	32.7	31.5
Bore	3.45	3.43	3.37	3.57	3.82	4.12	4.19	4.34	4.42	4.85
Stroke	4.91	4.94	4.66	4.97	5.10	5.28	5.15	4.97	4.46	4.68
Stroke bore ratio	1.42	1.25	1.38	1.39	1.33	1.28	1.23	1.09	1.01	1.03
Displacement	267.8	269	222.5	278.87	307.38	349	345	316.2	313.2	281.5
Wheelbase	120.6	120.7	113.25	119.56	122.19	121	122	121	114	112
Gear ratio	4.36	4.22	4.15-1	4.08-1	3.88-1	3.6-1	3.57-1	3.62-1	....	....
Tires	32x4	34x4	31x4	23x4½	34x4	35x4½	35x4½	35x4	34x4	34x4
Number cars	......	....	....	519	535	607	....	....	....	....
Number chassis	93	180	188	176	200	236	339	381	393	364
Number makes	85	125	131	108	119	133	156	193	270	239
Price	$2226	$1822	$1687	$1600	$2005	$2635	$2585	$2508	$2560	$2214
PERCENTAGE										
NUMBER OF CYLINDERS										
One cylinder	0	0	0	0	0	0	0	1	1	5
Two cylinders	0	0	0	0	.5	1	1	1	2	3
Four cylinders	29.5	34.61	37	39.2	51.0	54	62	78	80	82
Five cylinders	0	0	0	0	0	0	1	1	0	0
Six cylinders	55.8	51.76	47	45.8	47.5	45	36	19	17	10
Eight cylinders	11.7	10.22	12	12.6	1.0	0	0	0	0	0
Twelve cylinders	2.9	3.41	4	2.4	0	0	0	0	0	0
SHAPE OF CYLINDERS										
I cylinder type	22.5	22.2	20	13.7	16.5	30	31	30	22	20
L-head	56.9	63.5	73	73.3	70.0	59	56	55	60	56
T cylinder type	12.7	6.8	5	13.0	8.5	6	9	9	14	18
Knight type	3.9	4	2	3.6	3.0	3	3	2	1	0
Two cycle	0	0	0	0	1.0	1	1	4	3	6
Gasoline electric	1	0	0	1	0	0	0	0	0	0
H	0	2.3	....	....	....	....	....	....	....	....
F	3.9	1.2	....	....	....	....	....	....	....	....
COOLING										
Air cooled	1.9	0.6	1	.6	.5	2	4	5	6	7
Thermo syphon	31	32.4	38	38.2	27	19	17	19	28	23
Pump circulating	67.1	67.0	61	61.2	72.5	79	79	76	66	70
IGNITION SYSTEMS										
Single ignition	88.2	91.04	84	76.0	56	23	15	14	18	25
Dual ignition	6.8	2.14	9	19.2	36	59	68	63	53	40
Double	2.9	5.12	3	1.8	4.55	11	15	23	29	35
Duplex	1.9	.56	3	1.8	2.0	3	0	0	0	0
ENGINE LUBRICATION										
Splash oiling	31.4	57	35	52.7	46.5	42	53	68	81	0
Splash pressure	39.2	71.6	35	23.35	16	39	32	20	0	0
Pressure oiling	29.4	26.7	30	23.35	37.5	18	14	10	19	0

So far as can be judged, it is unlikely that the gear ratios will go any lower than they are on the representative modern machine, but it is more than probable that during 1919 still more of the adherents to comparatively high gearing will follow the trend, at the same time decreasing the dimensions of their engines. Thus while the average displacement per mile is not likely to increase, the average figure for revolutions per mile may show a rise next time it comes to be determined.

The cars for 1919 are going to be exceptionally interesting because between the fall of 1914 and the spring of 1917 so many new things were tried, and the war period has given the industry a breathing space in automobile development, permitting it to observe, study and digest the performance of this and that feature in the hands of the owner.

In the three years mentioned all sorts of new engines, all sorts of new spring suspensions, new and different types of ignition, a variety of new systems of frame design, and many new styles of bodies were produced and sold. Some of these ideas were good, some bad, some indifferent; now, during the coming year, we shall be able to see clearly what was really permanent.

Looking back, it is possible to see that many of the subjects discussed, say at the S. A. E. summer meeting in 1915, were not of much importance fundamentally, although they appeared to be so at the time, while some other developments which took place quietly have become general practice almost without discussion.

As an outstanding example, the cantilever spring may be mentioned. Its introduction was of importance not because of any special virtues inherent with the *design*, but because it caused engineers to think more about springs, and so led to a great and general improvement in the riding qualities of cars. On the other hand, the deep section, stiff frame, which is of almost as great importance in giving easy riding, has crept into use everywhere, and yet the reasons for it and the way to lay it out have hardly ever been even common topics of conversation among engineers.

Importance of Simplified Details

Another important thing, which has improved the reliability of cars and decreased the cost of their production, but yet has passed unnoticed, or almost so, at engineering gatherings, is the general simplification of detail. We have better brake layouts, better wiring, better spring shackles, fewer grease cups, simpler fan-belt adjustments, better accessibility, and a host of similar things, each too small to make a subject for argument but in their sum equally great as the better engineering in our engines.

While the work of the prominent engineers has improved in laying out the broad features of their cars, so has there been a great change in the work of the lesser lights whose duty it is to detail small parts.

The American public, in fact the automobile-using public of the world, owes much to the leading American automobile engineers, but their numerous assistants, whose names are not known outside their own factories, deserve as a body at least as much credit.

It is possible that 1919 will be a year of weight reduction, and if it is not then it is safe to predict that 1920

(*Continued on page* 157)

Motor Vehicle for Every 18 Persons

United States Has 5,945,442 Cars and Trucks in Use—Gain Over Last Year 20 Per Cent—Net Increase 1,004,176

Cars and Trucks in United States, Dec. 1, 1918

ALL DUPLICATE REGISTRATION DEDUCTED

New York	453,588
Ohio	417,400
Illinois	389,135
Pennsylvania	370,110
Iowa	327,500
California	288,173
Michigan	261,167
Texas	250,083
Indiana	227,160
Minnesota	201,127
Wisconsin	196,844
Kansas	186,109
Missouri	185,146
Massachusetts	176,564
Nebraska	175,370
New Jersey	129,011
Oklahoma	120,300
Washington	119,905
Georgia	99,160
Connecticut	84,902
South Dakota	84,003
Maryland	78,146
North Carolina	72,300
Virginia	72,228
North Dakota	70,531
Colorado	70,000
Oregon	66,607
Kentucky	65,884
Tennessee	61,500
South Carolina	55,400
Montana	50,125
Florida	47,059
Alabama	46,155
Maine	42,154
Arkansas	41,458
Dist. of Columbia	40,045
Mississippi	40,000
Louisiana	39,355
West Virginia	37,025
Idaho	31,925
Rhode Island	30,595
Utah	27,204
Arizona	22,671
Vermont	20,764
New Hampshire	20,458
New Mexico	16,893
Wyoming	16,150
Delaware	12,066
Nevada	7,987
Total	5,945,442

THE number of motor vehicles in use in the United States increased 20 per cent in the 11 months between Dec. 31, 1917, and Dec. 1, 1918, thus setting a new record for distribution of one vehicle for every 18 persons, and bringing the number of vehicles in use up to within 54,588 of the six million mark. There are now 5,945,442 cars and trucks in use, as compared with 4,941,276 in 1917. This represents a gain of 1,004,176. These are net figures with all duplicate, non-resident and re-registration deducted.

The gain is not so great, of course, as was the gain the previous year when we registered 1,396,324 more vehicles than during 1915, but this was to be expected, for the last 11 months has been a period remarkable in the history of the United States. The war extensively disrupted both manufacture and commerce. The production of motor vehicles fell off 42 per cent, from 1,938,778 last year to 1,124,606 up to Dec. 1 of this year. There have been Liberty loans and other disturbing factors, but that these have not had the bad effects so freely predicted for them is indicated by the increase in registration.

Steady Gain For 7 Years

For the seven years for which accurate data are available we have shown a steady gain in registration. The gain has fluctuated to a certain extent, and reached the peak in 1916 when the percentage of increase was greatest. Following are the figures:

Year	Gain	Gain %
1918	1,004,176	20
1917	1,139,324	39
1916	1,121,164	50
1915	669,218	38
1914	501,536	40
1913	243,521	24

During the first half of 1918, the net gain in registration was 525,665, this despite the fact that six states showed a loss of 33,324 for the period. During the last half of the year, these same states not only made up all this loss, but rolled up individual increases of from 10 to 48 per cent in addition.

Ohio leads all the states for the increase it shows for the year. Last year it was New York that held first place for showing the greatest increase. Then comes Iowa, which last year was third, and following is Illinois, which has not changed. Pennsylvania, which last year

Increase in Registration Dec. 31, 1917, to Dec. 1, 1918

Ohio	83,770
New York	49,341
Iowa	49,287
Illinois	48,843
Michigan	46,166
California	45,057
Pennsylvania	44,957
New Jersey	41,590
Missouri	39,004
Indiana	37,727
Texas	36,749
Wisconsin	32,313
Kansas	31,667
Georgia	28,664
Nebraska	27,269
Washington	26,083
Maryland	22,017
Massachusetts	21,520
Oklahoma	20,101
District of Columbia	18,847
South Carolina	18,578
Kentucky	18,484
Oregon	18,475
South Dakota	16,845
Virginia	16,567
North Carolina	16,350
Alabama	13,282
Tennessee	13,000
Arkansas	12,596
Connecticut	10,260
Minnesota	9,627
Mississippi	8,350
Montana	8,229
Florida	7,843
Louisiana	7,705
Idaho	7,609
North Dakota	7,538
Utah	5,978
West Virginia	5,719
Rhode Island	5,453
Wyoming	4,149
Maine	3,655
Colorado	3,150
New Mexico	2,817
Arizona	2,781
Delaware	2,411
New Hampshire	2,312
Vermont	2,214
Nevada	1,227
Total	1,004,176

Registration of Cars and Trucks for Seven Years

All Duplicate Registration Deducted

	Dec. 31, 1912	Dec. 31, 1913	Dec. 31, 1914	Dec. 31, 1915	Dec. 31, 1916	Dec. 31, 1917	Dec. 1, 1918
Alabama	3,385	5,435	8,425	13,798	22,354	32,873	46,155
Arizona	1,624	3,445	4,774	7,320	12,122	19,890	22,671
Arkansas	2,250	3,000	5,642	8,021	14,704	28,862	41,458
California	88,699	60,000	123,101	163,801	212,918	243,116	288,173
Colorado	8,950	13,000	17,951	26,611	44,180	66,850	70,000
Connecticut	17,950	23,263	26,218	38,950	56,048	74,642	84,902
Delaware	1,732	2,373	2,894	4,924	7,520	9,655	12,066
Dist. of Columbia..	11,902	15,625	8,000	10,200	13,118	21,198	40,045
Florida	6,749	8,372	11,366	13,123	14,220	39,216	47,059
Georgia	19,120	18,500	20,800	24,059	45,775	70,496	99,160
Idaho	2,500	2,173	3,272	7,093	12,996	24,316	31,925
Illinois	68,073	94,656	131,140	182,290	251,300	340,292	389,135
Indiana	54,334	44,738	65,500	96,915	139,138	189,433	227,160
Iowa	47,188	70,294	106,087	139,808	172,791	278,213	327,500
Kansas	22,000	34,366	50,467	74,956	114,364	154,442	186,109
Kentucky	5,147	7,210	11,746	19,500	31,500	47,400	65,884
Louisiana	7,000	7,200	3,500	10,880	20,014	31,650	39,355
Maine	7,743	10,570	14,300	18,600	28,951	38,499	42,154
Maryland	10,487	14,254	20,213	27,638	33,364	56,129	78,146
Massachusetts	51,229	60,826	76,832	89,133	136,790	155,044	176,564
Michigan	39,579	54,366	76,389	114,845	159,639	215,001	261,167
Minnesota	29,000	37,800	67,365	91,829	137,500	191,500	201,127
Mississippi	2,895	3,000	3,894	11,500	20,474	31,650	40,000
Missouri	24,379	38,140	50,998	76,462	107,865	146,142	185,146
Montana	2,000	5,686	10,706	14,520	24,585	41,896	50,125
Nebraska	33,861	47,274	50,000	59,140	101,201	148,101	175,370
Nevada	900	1,131	1,487	2,177	4,609	6,760	7,987
New Hampshire ...	5,764	7,420	8,738	10,819	14,338	18,146	20,458
New Jersey	35,439	39,288	58,820	67,556	75,108	87,421	129,011
New Mexico	911	1,721	3,090	4,947	8,028	14,086	16,893
New York	105,546	122,411	156,173	212,844	279,406	404,247	453,588
North Carolina	6,178	10,000	14,815	21,160	35,150	55,950	72,300
North Dakota	8,975	12,968	17,348	24,678	41,761	62,993	70,531
Ohio	63,066	86,054	121,265	179,767	252,179	333,630	417,400
Oklahoma	6,524	7,934	7,360	25,615	52,718	100,199	120,300
Oregon	10,165	13,957	16,347	23,758	30,917	48,132	66,607
Pennsylvania	59,357	76,178	107,141	150,729	230,648	325,153	370,110
Rhode Island	7,565	9,894	12,331	16,362	21,406	25,142	30,595
South Carolina	10,000	11,500	15,000	14,500	19,000	36,822	55,400
South Dakota	14,481	14,578	20,080	29,336	44,271	67,158	84,003
Tennessee	9,973	14,103	19,668	27,266	31,400	48,500	61,500
Texas	35,187	54,362	64,732	90,000	197,687	213,334	250,083
Utah	2,576	4,021	6,139	7,994	13,507	21,226	27,204
Vermont	4,183	5,430	7,613	11,499	14,251	18,550	20,764
Virginia	5,760	9,022	13,985	21,357	35,426	55,661	72,228
Washington	13,990	24,178	30,253	36,905	62,546	93,822	119,905
West Virginia	5,349	5,088	7,217	13,256	20,437	31,306	37,025
Wisconsin	24,578	34,646	53,180	81,371	117,603	164,531	196,844
Wyoming	3,300	1,584	2,428	3,976	7,125	12,001	16,150
	1,009,513	1,253,034	1,754,570	2,423,788	3,544,952	4,941,276	5,945,442

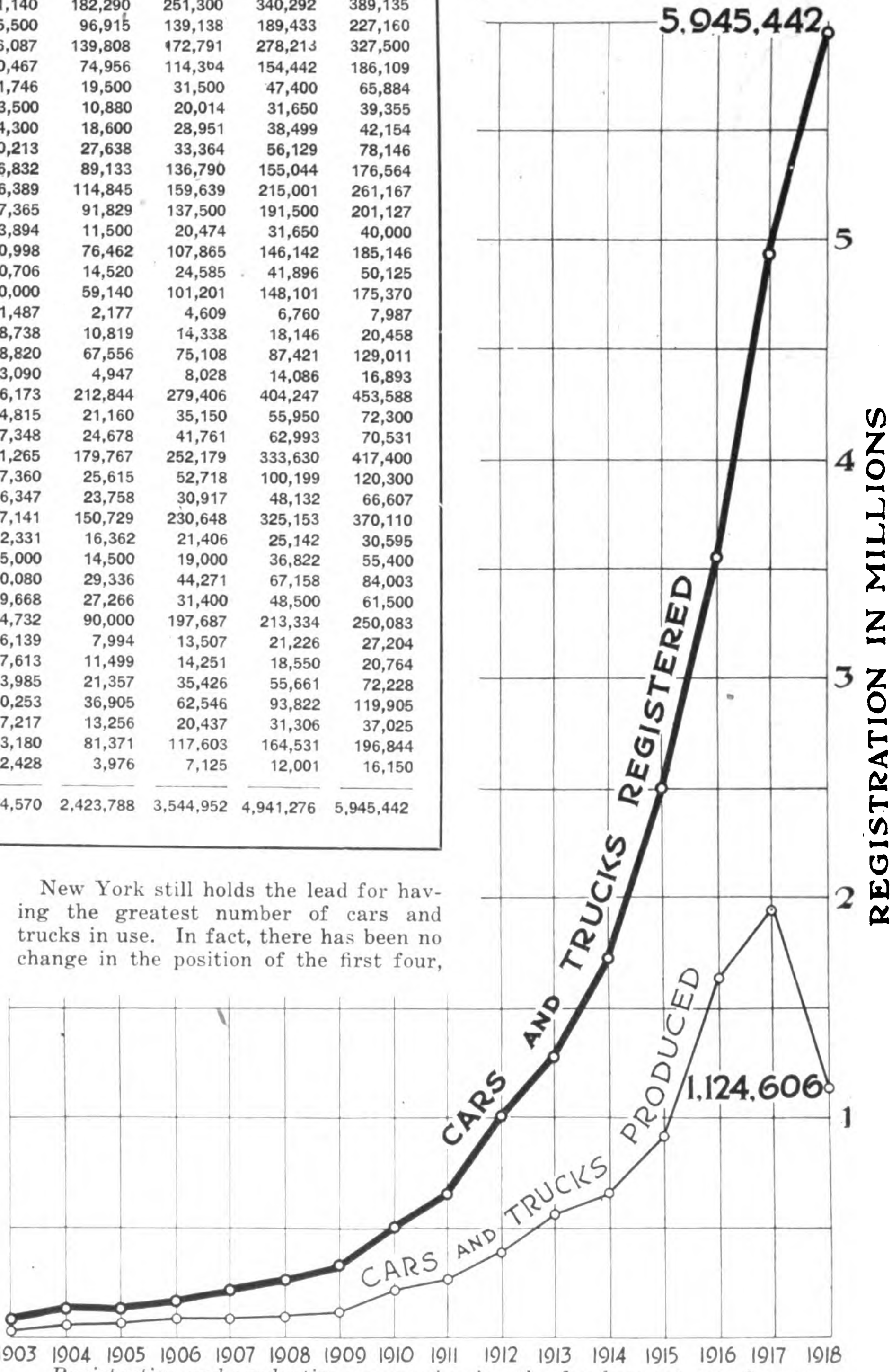
New York still holds the lead for having the greatest number of cars and trucks in use. In fact, there has been no change in the position of the first four, Ohio being second, Illinois third and Pennsylvania fourth. Iowa has moved up from seventh place to fifth and Michigan has moved up from ninth to seventh; California dropped back from fifth to sixth.

Gains are Scattered

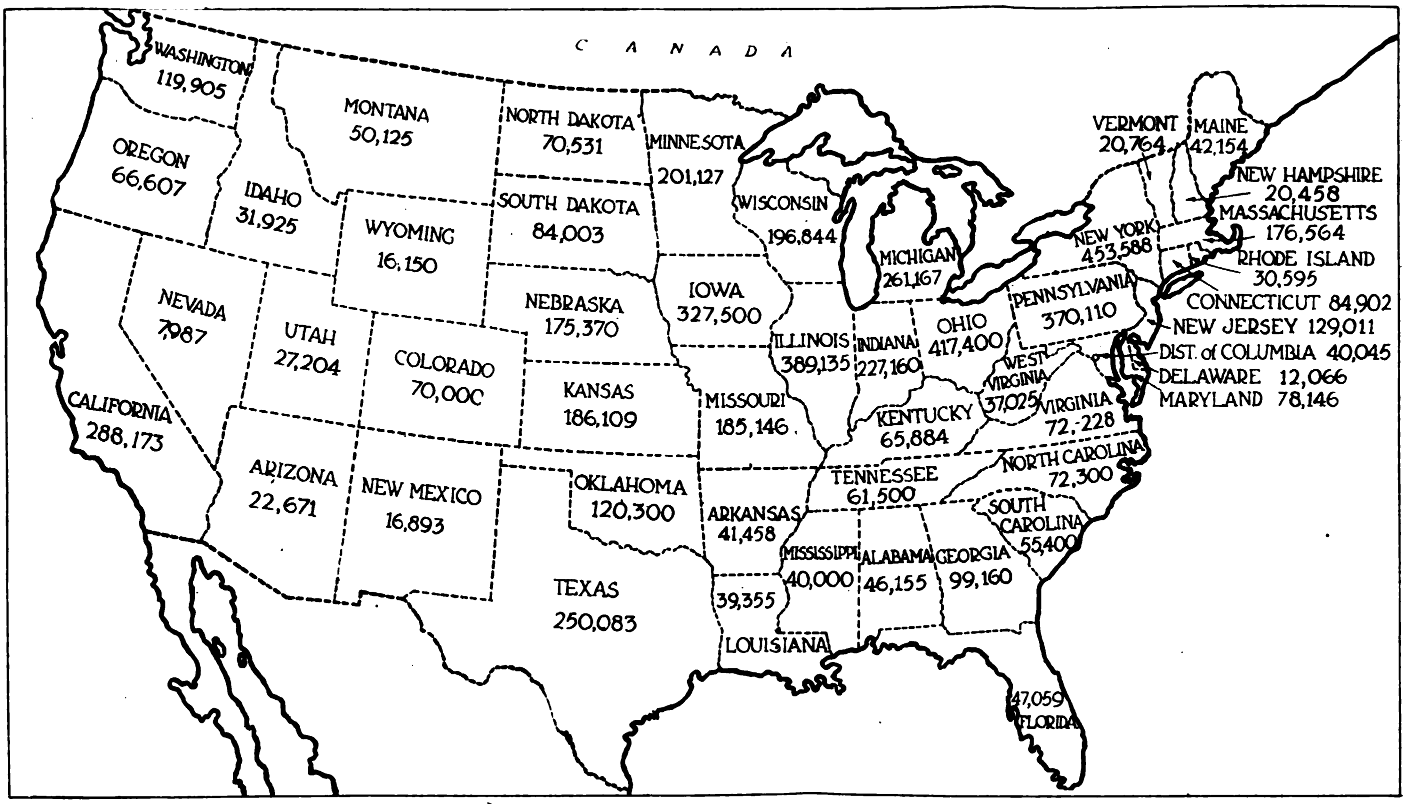
Among the states that have made the greatest gains, it is somewhat unusual that these are not grouped to the extent they were last year. For example, both Ohio and New York which head the list of gainers, are more manufacturing centers than they are agricultural. Iowa, which is third, is undoubtedly principally agricultural, but Illinois and Michigan, was the third greatest gainer, this year has dropped down to sixth place.

But though Ohio made the greatest gain, numerically, the District of Columbia was far ahead of all the states in percentage of gain. The fact that the District registered 89 per cent more cars this year than last will serve as some indication of the great influx into the National capital during the war. Last year there were 21,198 cars and trucks in the district, as against 40,045 this year.

In 1917 it was Florida that registered the greatest gain in percentage, the figure being 176 per cent. This year, however, the increase was but 20 per cent. South Carolina is in practically the same position this year as she was last. She registered a gain of 50 per cent this year and 89 per cent last. The District of Columbia and South Carolina were the only ones to show more than 50 per cent increase in registration.



Registration and production curves showing the development year by year ***from 1903 to the end of 1918***



Distribution of cars and trucks in the United States, all duplicates being deducted

Registrations of Cars, Trucks and Motorcycles, Dec. 1, 1918

State or Territory	Gross Vehicle Registration	New Vehicle Registration	Registration up to July 1, 1918	Gasoline Passenger Cars in Use	Gasoline Commercial Cars in Use	Electric Passenger Cars in Use	Electric Commercial Cars in Use	Motorcycles	Non-Resident Registrations**	Re-Registered***	Chauffeurs Registered	Tota Fees
Alabama	46,155	1,296	44,859	*40,639	*5,516			1,180			2,455	$456,619
Arizona	23,875	2,695	21,180	23,870		5		684		1,204	3,895	140,291
Arkansas	41,458	2,458	39,000									410,000
California	337,878	46,211	291,667	*317,737	*20,141			24,752	9,000	40,705	12,361	3,501,320
Colorado	80,000	8,400	71,600	75,000	*4,600	400		5,000	10,000		12,000	340,400
Connecticut	84,902	9,002	75,900	*69,851	*15,051			4,525			96,730	1,285,164
Delaware	12,955	1,826	11,129					707		889	15,905	232,195
Dist. of Col	47,514	10,545	36,969	42,082	4,780	652		2,457	7,469		23,552	190,401
Florida	‡47,059		42,846									
Georgia	99,160	9,679	89,481	92,000	7,000	150	10	964			4,867	293,473
Idaho	32,282	4,472	27,810					707		357	968	560,930
Illinois	389,135	26,393	362,742					10,825			45,360	2,592,382
Indiana	227,160	19,779	207,381					9,111			4,641	1,256,539
Iowa	327,500	2,500	325,000	*320,000	*7,500			2,150				
Kansas	189,952	4,952	185,000					4,171		3,843		979,620
Kentucky	65,884	8,341	57,543									402,250
Louisiana	39,760	2,160	37,600					399		405		
Maine	44,572	6,123	38,439	40,372	4,200					2,418		570,119
Maryland	78,146	17,134	61,012	69,574	6,747	1,213	612	5,347			18,487	909,499
Massachusetts	193,497	36,699	156,798	*160,486	*33,011			12,862	11	16,922	52,964	4,332,612
Michigan	261,547	24,566	236,981	*235,219	*26,328			7,805	380		24,809	2,797,806
Minnesota	203,727	15,018	188,709	*197,727	*6,000			5,127		2,600	4,400	1,037,535
Mississippi	40,000	2,500	37,500	*38,000	*2,000							
Missouri	187,646	22,856	164,790					3,968		2,500	21,500	1,393,528
Montana	51,050	4,185	46,865					852		925	1,470	350,913
Nebraska	175,370	15,870	159,500									
Nevada	8,160	535	7,625	*7,836	*324			115		173		33,045
New Hampshire	24,904	3,674	21,230					2,452	1,446	3,000	9,603	379,24
New Jersey	154,870	30,351	124,519	*139,269	*15,601			12,843		25,859	199,920	2,210,364
New Mexico	‡16,893		15,745									
New York	457,924	35,071	422,853	364,945	*92,979			28,550	4,336		145,750	4,648,192
North Carolina	72,300	10,354	61,946									422,710
North Dakota	71,687	2,863	68,824					1,657		1,156		457,538
Ohio	417,400	1,438	415,962			4,400		20,000				2,151,700
Oklahoma	120,300	28,600	91,700					1,610				1,130,714
Oregon	66,607	9,541	57,066	63,307	*3,200	100		4,275	None	None	3,089	
Pennsylvania	393,972	69,788	324,184	*362,827	*31,145			26,612		23,862	78,644	3,902,420
Rhode Island	‡30,595	4,196	26,399	*24,969	5,626			1,942			37,213	380,000
South Carolina	55,400	7,450	47,950					2,246				306,894
South Dakota	86,121	14,321	71,800					1,168		2,118		282,742
Tennessee	65,000	13,100	51,900					1,100		3,500		402,000
Texas	250,201	51,832	198,369					3,250	118		22,455	1,993,695
Utah	27,204	3,354	23,850	*22,135	*5,069			1,311			1,521	229,203
Vermont	22,550	2,785	19,765	20,671	1,870	8	1	734		1,786	3,748	398,691
Virginia	72,228	7,228	65,000					2,440			4,760	680,000
Washington	119,905	19,183	100,722	*103,219	*16,686			6,475				868,917
West Virginia	38,600	4,229	34,371					847		1,575	3,712	455,715
Wisconsin	196,844	14,144	182,700	*189,983	*6,861			7,246				2,045,451
Wyoming	16,150	2,000	14,150					288				76,925
Total	6,114,349	659,459	5,466,931	3,021,718	322,235	6,928	623	230,754	32,760	135,797	856,779	$47,489,760

NOTE—Steam cars and trucks are included with the gasoline vehicle figures, as segregation is not carried out by registration officials.
**Number of vehicles owned by citizens of other states. ***Number of vehicles re-registered owing to change of ownership, transfer, etc.
*Includes electrics. ‡Estimated.

Distribution of Manufacturers by States

State	Cars	Trucks	Motor-cycles	Tractors	Aircraft	Engines	Number of Names
Alabama	.....	.....	.....	.....	.....	.....	.....
Arizona	.....	.....	.....	.....	.....	.....	.....
Arkansas	.....	.....	.....	1	.....	.....	1
California	2	12	.....	7	2	.....	20
Colorado	1	.....	.....	.....	.....	.....	1
Connecticut	2	2	.....	.....	1	2	6
Delaware	.....	.....	.....	.....	.....	.....	.....
Dist. of Col.	.....	1	.....	.....	.....	.....	1
Florida	.....	.....	.....	.....	.....	.....	.....
Georgia	1	2	.....	.....	.....	.....	3
Idaho	.....	.....	.....	.....	.....	.....	.....
Illinois	21	39	2	23	2	3	78
Indiana	20	9	.....	8	.....	5	39
Iowa	.....	6	.....	10	.....	1	18
Kansas	1	2	.....	1	.....	.....	3
Kentucky	2	2	.....	1	.....	.....	4
Louisiana	1	1	.....	.....	1	.....	3
Maine	.....	.....	.....	1	.....	.....	1
Maryland	1	1	.....	.....	.....	.....	1
Massachusetts	4	11	3	2	2	.....	20
Michigan	34	48	.....	16	1	16	101
Minnesota	4	8	.....	24	.....	2	37
Mississippi	.....	.....	.....	.....	.....	.....	.....
Missouri	4	6	.....	7	1	.....	17
Montana	.....	.....	.....	.....	.....	.....	.....
Nebraska	1	3	.....	2	.....	.....	5
Nevada	.....	.....	.....	.....	.....	.....	.....
New Hampshire	.....	1	.....	.....	.....	.....	1
New Jersey	2	7	.....	1	4	1	16
New Mexico	.....	.....	.....	.....	.....	.....	.....
New York	15	31	2	6	12	7	75
North Carolina	2	.....	.....	.....	.....	.....	2
North Dakota	.....	.....	.....	1	.....	.....	1
Ohio	24	31	1	13	3	5	69
Oklahoma	3	3	.....	1	1	.....	6
Oregon	.....	.....	.....	.....	.....	.....	.....
Pennsylvania	6	26	1	4	.....	6	41
Rhode Island	.....	1	.....	.....	1	.....	.....
South Carolina	1	.....	.....	.....	.....	.....	1
South Dakota	.....	.....	.....	2	.....	.....	2
Tennessee	.....	.....	.....	.....	.....	.....	.....
Texas	2	2	.....	2	.....	.....	4
Utah	.....	.....	.....	.....	.....	.....	.....
Vermont	.....	.....	.....	.....	.....	.....	.....
Virginia	2	1	.....	1	1	.....	4
Washington	.....	5	.....	2	1	.....	8
W. Virginia	1	1	.....	.....	1	.....	2
Wisconsin	6	11	2	14	1	7	38
Wyoming	.....	.....	.....	.....	.....	.....	.....
Canada	12	8	.....	3	.....	.....	19
Total	175	281	11	153	35	55	649

The total under the heading "Number of Names" in the table at the right represents the number of individual establishments. This is not a total of the individual columns. For example, the dealer may or may not operate a garage, repairshop, supply department, etc. These two tables were compiled by the Automobile Trade Directory

Distribution of Wholesale and Retail Dealers by States

States	Jobbers	Exclusive Supply Houses	Dealers	Garages	Repairs	Companies with Supply Department	Number of Names
Alabama	2	25	183	118	81	52	289
Arizona	.....	14	122	114	57	44	217
Arkansas	1	17	239	163	69	54	344
California	19	164	1,448	1,452	937	481	2,637
Colorado	3	22	385	376	178	138	596
Connecticut	7	87	419	468	277	146	812
Delaware	.....	7	65	69	25	20	105
Dist. of Col.	2	21	56	48	27	9	127
Florida	2	34	249	252	146	101	453
Georgia	2	62	553	393	185	106	865
Idaho	1	11	173	148	65	71	240
Illinois	18	134	2,049	2,047	1,027	615	3,404
Indiana	10	65	963	821	360	271	1,510
Iowa	9	65	1,711	1,473	795	720	2,546
Kansas	8	35	964	498	412	333	1,526
Kentucky	3	21	314	244	83	74	438
Louisiana	3	20	178	102	56	34	256
Maine	3	18	346	312	135	123	566
Maryland	2	27	244	247	108	73	420
Massachusetts	15	141	772	955	419	234	1,620
Michigan	7	98	947	846	333	292	1,526
Minnesota	15	43	1,095	883	480	305	1,519
Mississippi	.....	12	132	107	43	40	197
Missouri	17	60	828	715	367	211	1,387
Montana	2	15	263	246	117	89	392
Nebraska	12	20	879	716	267	204	1,207
Nevada	.....	4	61	55	25	19	91
New Hampshire	.....	9	177	216	103	91	301
New Jersey	1	86	680	928	456	251	1,446
New Mexico	.....	6	105	95	41	45	160
New York	16	332	1,960	2,438	1,151	709	4,171
North Carolina	1	27	337	278	110	94	492
North Dakota	1	9	473	358	172	132	652
Ohio	27	146	1,677	2,402	624	476	2,606
Oklahoma	4	30	522	465	156	135	828
Oregon	3	26	238	232	116	72	398
Pennsylvania	14	216	1,885	1,830	812	641	3,185
Rhode Island	5	13	95	140	91	20	266
South Carolina	2	18	242	143	68	54	342
South Dakota	3	9	444	357	146	99	638
Tennessee	3	25	243	150	106	59	372
Texas	9	95	1,005	933	308	219	1,620
Utah	3	17	94	65	36	24	156
Vermont	.....	8	168	161	87	94	268
Virginia	2	48	305	216	100	68	461
Washington	6	51	417	352	175	92	656
W. Virginia	.....	16	268	162	66	59	347
Wisconsin	7	51	1,090	943	407	321	1,508
Wyoming	.....	8	82	73	38	25	123
Hawaii	.....	5	14	12	14	9	27
West Indies	.....	4	27	24	3	9	42
Canada	19	84	1,030	858	330	206	1,510
Mexico	2	2	10	11	3	2	18
Total	291	2583	29,22 6	27,710	12,791	8865	47,883

which come next, are only partly agricultural. And so it goes: California is a fruit-growing state; Pennsylvania is partly agricultural, partly mining and partly industrial; New Jersey is industrial; Missouri is farming and so is Indiana; Texas, Wisconsin and Kansas are agricultural.

On the whole, the greatest gain has been made among the agricultural states, which is a condition that has obtained for several years, and is particularly understandable this year because of the increased importance and purchasing power of the farmer.

Here, for example, are figures on a group of leading agricultural states which in each instance show gains:

State	1917	1918
No. Dak.	62,993	70,531
Neb.	148,100	175,370
Kansas	154,442	186,109
Minn.	191,500	201,127
Wis.	164,531	196,844
Iowa	278,213	327,500
Total	1,066,938	1,241,484

Registration and Population Dec. 1, 1918

State	Pop. Est. 1918	Cars and Trucks	Pop. per Car	State	Pop. Est. 1918	Cars and Trucks	Pop. per Car	State	Pop. Est. 1918	Cars and Trucks	Pop. per Car
Iowa	2,224,771	327,500	7	Nevada	114,742	7,987	14	New Jersey	3,080,371	129,011	24
Nebraska	1,296,877	175,370	7	Washington	1,660,578	119,905	14	Penna.	8,798,067	370,110	24
Dist. of Col.	374,584	40,045	9	Connecticut	1,286,268	84,902	15	New Mexico	437,015	16,893	26
So. Dakota	735,434	84,003	9	Illinois	6,317,734	389,135	17	Georgia	2,935,617	99,160	30
Kansas	1,874,195	186,109	10	Utah	453,648	27,204	17	So. Carolina	1,660,934	55,400	30
Montana	486,376	50,125	10	Delaware	216,914	12,066	18	Virginia	2,234,030	72,228	30
California	3,119,412	288,173	11	Maryland	1,384,539	78,146	18	No. Carolina	2,466,025	72,300	34
No. Dakota	791,437	70,531	11	Texas	4,601,279	250,083	18	Kentucky	2,408,547	65,884	36
Arizona	272,034	22,671	12	Vermont	366,192	20,764	18	Tennessee	2,321,253	61,500	38
Michigan	3,133,678	261,167	12	Maine	782,191	42,154	19	W. Virginia	1,439,165	37,025	39
Minnesota	2,345,287	201,127	12	Missouri	3,448,498	185,146	19	Arkansas	1,719,965	41,458	41
Wyoming	190,380	16,150	12	Florida	938,877	47,059	20	Louisiana	1,884,778	39,355	48
Indiana	2,854,167	227,160	13	Oklahoma	2,377,629	120,300	20	Mississippi	2,001,466	40,000	50
Ohio	5,273,814	417,400	13	Rhode Is.	637,415	30,595	21	Alabama	2,395,270	46,155	52
Oregon	888,243	66,607	13	New Hamp.	446,352	20,458	21				
Wisconsin	2,563,983	196,844	13	Mass.	3,832,790	176,564	22	Total	105,186,167	5,945,442	
Colorado	1,014,581	70,000	14	New York	10,646,689	453,588	23	Average for United States.			18
Idaho	461,766	31,925	14								

Vehicles Per Capita for Seven Years

State	1910 Census 1912	1910 Census 1913	1914	Est. 1916 Census 1915	Est. 1916 Census 1916	Est. 1917 Census 1917	Est. 1918 Census 1918
Alabama	631	393	254	168	104	72	52
Arizona	126	59	43	34	19	13	12
Arkansas	700	524	279	215	118	61	41
California	27	40	19	18	14	12	11
Colorado	89	61	44	36	22	15	14
Connecticut	62	48	42	32	22	17	15
Delaware	112	85	70	43	28	22	18
District of Columbia	28	21	41	35	28	17	9
Florida	112	90	73	67	63	23	20
Georgia	136	141	125	117	62	41	30
Idaho	130	150	100	59	33	18	14
Illinois	83	69	43	33	25	18	17
Indiana	50	60	41	29	20	15	13
Iowa	47	32	21	16	13	8	7
Kansas	77	49	33	24	16	12	10
Kentucky	445	318	195	121	76	51	36
Louisiana	237	230	473	167	108	57	48
Maine	96	70	52	41	27	20	19
Maryland	123	91	64	49	41	24	18
Massachusetts	66	55	44	41	27	24	22
Michigan	71	52	37	26	19	14	12
Minnesota	72	55	31	25	17	12	12
Mississippi	620	600	461	168	95	62	50
Missouri	135	86	65	44	32	23	19
Montana	188	67	35	31	19	11	10
Nebraska	35	25	24	21	13	9	7
Nevada	91	72	55	48	23	16	14
New Hampshire	75	58	49	41	31	24	21
New Jersey	72	65	43	43	39	34	24
New Mexico	359	190	106	82	50	30	26
New York	86	75	58	48	37	26	23
North Carolina	357	222	149	113	68	44	34
North Dakota	64	44	33	29	18	12	11
Ohio	75	55	39	28	20	16	13
Oklahoma	253	209	225	83	42	23	20
Oregon	66	48	41	35	27	18	13
Pennsylvania	129	101	65	56	37	27	24
Rhode Island	72	55	44	37	29	25	21
South Carolina	151	132	101	111	86	45	30
South Dakota	40	40	29	23	16	11	9
Tennessee	219	155	111	84	73	48	38
Texas	111	72	60	49	22	21	18
Utah	145	93	61	54	32	21	17
Vermont	85	66	47	32	26	20	18
Virginia	358	228	148	102	62	40	30
Washington	82	47	38	41	25	17	14
West Virginia	227	240	169	103	68	45	39
Wisconsin	95	67	44	31	21	15	13
Wyoming	63	92	60	45	45	15	12

Increase in Registration Dec. 31, 1917 to Dec. 1, 1918

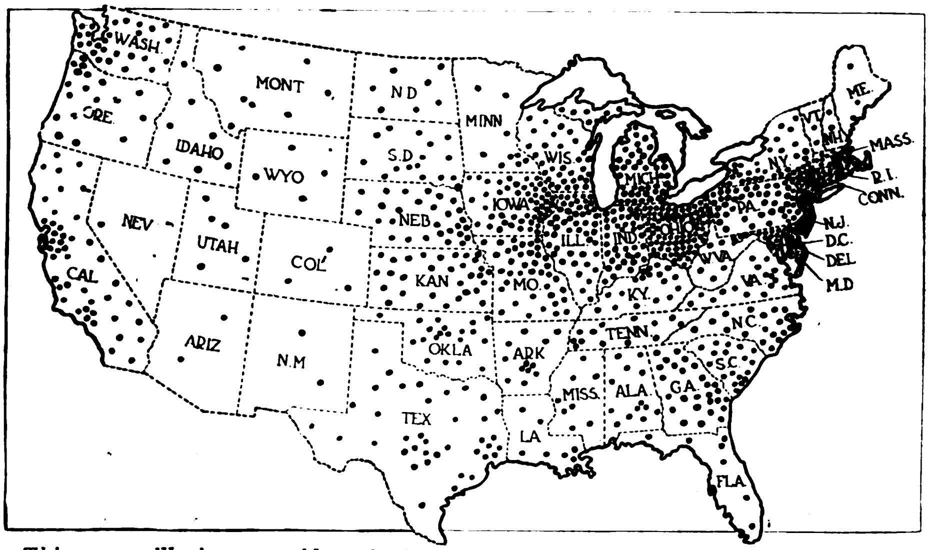
	Increase	Per Cent
District of Columbia	18,847	89
South Carolina	18,578	50
New Jersey	41,590	48
Arkansas	12,596	44
Georgia	28,664	41
Alabama	13,282	40
Maryland	22,017	39
Kentucky	18,484	39
Oregon	18,475	38
Wyoming	4,149	35
Idaho	7,609	31
Virginia	16,567	30
North Carolina	16,350	29
Washington	26,083	28
Utah	5,978	28
Missouri	39,004	27
Tennessee	13,000	27
Mississippi	8,350	26
Ohio	83,770	25
South Dakota	16,845	25
Delaware	2,411	25
Louisiana	7,705	24
Rhode Island	5,453	22
Michigan	46,166	21
Indiana	37,727	20
Kansas	31,667	20
Oklahoma	20,101	20
Wisconsin	32,313	20
New Mexico	2,817	20
Montana	8,229	20
Florida	7,843	20
California	45,057	18
Nevada	1,227	18
Nebraska	27,269	18
Iowa	49,287	18
West Virginia	5,719	18
Texas	36,749	17
Illinois	48,843	14
Pennsylvania	44,957	14
Massachusetts	21,520	14
Connecticut	10,260	14
Arizona	2,781	14
New York	49,341	13
New Hampshire	2,312	13
North Dakota	7,538	12
Vermont	2,214	12
Maine	3,655	10
Minnesota	9,627	5
Colorado	3,150	5
Total	1,004,176	
Average for United States..		20%

The New England states, which a year ago showed a very small increase compared with other centers, this year show a substantial gain. Here are the figures:

State	1917	1918
Maine	38,499	42,154
Vermont	18,146	20,458
Massachusetts	155,044	176,564
Rhode Island	25,142	30,595
Connecticut	74,642	84,902
Total	311,473	354,673

Iowa and Nebraska, as might be expected from the records of previous years, head the list insofar as per capita distribution of cars and trucks is concerned. In each of these states, the entire population can be carried in their vehicles. Each has one motor vehicle for every seven persons. Last year, Iowa had one for every 8 persons and Nebraska one for every 9 persons.

(*Continued on page* 198)



This map will give some idea of where the big gains in registration were made. Each dot represents 1000 vehicles gained over the previous year

Record of Performance of American Planes

This Table Serves to Illustrate the Numerous Types of Airplanes Built by the U. S. Government Since June, 1917—At One Period Nearly 60,000 Employees Were Engaged in the Work in Various Factories

Type	No. Seats	Engine	Altitude (Ft.)	Climb Time	Rate, Ft. per Min.	R.P.M.	Speed	R.P.M.	Service Ceiling at 100 Ft. per Min.	Weight Empty, Lb.	Military Load, Lb.	Fuel and Oil Load, Lb.	Total Load, Lb.	Endurance at 6500 Ft.	Gas Consumption, Lbs. per Hour	Oil Consumption, Lbs. per Hour	Theoretical Ceiling, Ft.
				M. S.													
Ordnance Engineering Scout.	1	80 Le Rhone	0	....	....	....	98	1180	13,500	835	282	..	1,117	....	..	..	....
			6,500	9	535	1140	94	1175	....	....	..	..	....	....	..	..	....
			10,000	17 30	315	1100	84	1175	....	....	..	..	....	....	..	..	....
			15,000	55	....	1100	70	1100	....	....	..	..	....	....	..	..	....
Bristol Scout	..	80 Le Rhone	0	11 45	400	1260	88.3	....	13,000	789	286	..	1,075	....	..	..	....
			6,500	23 26	240	1215	83	....	....	....	..	..	....	....	..	..	....
			10,000	....	....	....	75	....	....	....	..	..	....	....	..	..	....
Lepere	..	Liberty 12	0	....	....	1500	136	1800	20,800	....	..	..	....	....	..	..	22,000
			6,000	5 35	....	1540	132	1740	....	....	..	..	....	....	..	..	....
			10,000	10 35	....	1520	127	1680	....	....	..	..	....	....	..	..	....
			15,000	19 15	....	1500	118	1620	....	....	..	..	....	....	..	..	....
			20,000	41	....	1480	102	1550	....	....	..	..	....	....	..	..	....
S. E. 5 (British)	..	180 Hispano-Suiza	0	....	1170	....	123.0	2100	19,400	....	..	..	2,051	....	..	..	....
			6,500	6 50	810	1800	118.5	2080	....	....	..	..	....	....	..	..	....
			10,000	11 34	615	1800	115.5	2000	....	....	..	..	....	....	..	..	....
			15,000	21 20	340	1800	107.5	1965	....	....	..	..	....	....	..	..	....
			20,000	50 17	60	1780	85.0	1820	....	....	..	..	....	....	..	..	....
S. E. 5 (American)	..	180 Hispano-Suiza	0	....	....	....	121.6	2100	20,400	....	..	..	2,060	....	..	....	....
			6,500	8	750	1800	120.0	2140	....	....	..	..	....	....	..	..	....
			10,000	13	590	1800	117.0	2080	....	....	..	..	....	....	..	..	....
			15,000	22 10	350	1800	109.0	2000	....	....	..	..	....	....	..	..	....
			20,000	50 30	140	1790	92.5	1860	....	....	..	..	....	....	..	..	....
Standard E-1 or M-Defense	..	80 Le Rhone	0	....	....	....	99.8	1240	....	828	01	115	1,144	....	48	7.5	14,800
			6,000	10	....	1180	....	....	....	....	..	..	....	....	..	..	....
			6,500	....	....	....	94.0	1240	....	....	..	..	....	....	..	..	....
			10,000	22 20	....	1180	85.0	1220	....	....	..	..	....	....	..	..	....
V. S. B-1 (British Fighter)	..	300 Hispano-Suiza	0	....	....	114.5	1760	....	....	....	..	..	....	....	..	..	....
			6,500	5 35	1600	113.6	1700	....	....	1842	742	344	2,910	....	155	8	25,000
			10,000	10 45	1600	109.5	1660	....	....	....	..	..	....	....	..	..	....
			15,000	19 30	1600	101.0	1600	....	....	....	..	..	....	....	..	..	....
DeHaviland 4	..	Liberty 12	0	....	....	....	124.7	....	19,500	2391	1191	..	3,582	Full time, 2' 12"	..	..	....
			6,500	....	....	....	120.0	....	....	....	..	..	....		..	..	....
	..		10,000	14 5	....	....	117.0	....	....	....	..	..	....	Half throttle 3'3"	..	..	....
			15,000	....	....	..	113.0	....	....	....	..	..	....		..	..	....
Handley Page 0-400	..	2 Liberty 12's	0	....	....	....	97.0	....	14,000	....	..	..	11,270	....	..	..	....
			7,000	....	....	....	18.10	....	....	....	..	..	....	....	..	..	....
			10,000	....	....	....	29.0	....	....	....	..	..	....	....	..	..	....
V. E. 7	..	150 or 180 Hispano-Suiza	0	....	....	....	106	1730	17,500	1392	545	..	1,937	....	..	..	....
			6,500	8 50	635	1970	103	1700	....	....	..	..	....	....	..	..	....
			10,000	15 15	462	1480	97	1650	....	....	..	..	....	....	..	..	....
			15,000	29	220	1480	86	1600	....	....	..	..	....	....	..	..	....
DeHaviland 9	2	400 Liberty	0	....	....	....	116	....	17,000	....	..	..	....	4'00"	..	..	....
			10,000	9	....	....	109	....	....	....	..	..	....	....	..	..	....
Handley Page-V	to	4-375 h.p.	0	17	....	....	110	....	13,000	....	..	..	....	15'00"	..	..	....
	11	Eagle VIII Rolls-Royce	10,000	....	....	....	98	....	....	....	..	..	....	....	..	..	....
JN-4-D	..	Curtiss OX5 90 h.p.	0	....	....	....	75	....	....	1920	..	..	....	....	..	..	....
			10,000	....	....	....	....	....	....	....	..	..	....	....	..	..	....
JN-6-H	..	Hispano-Suiza 150 h.p.	0	....	....	....	105	....	....	2145	..	..	....	....	..	..	....
			10,000	....	....	....	....	....	....	....	..	..	....	....	..	..	....

OF the airplanes enumerated in the above table of performances, the following numbers have been actually produced and delivered into service either overseas or to flying fields in the U. S. In all, 517 De Haviland 4 machines have been completed at an estimated cost of $6,512 each, 2960 JN-4-D machines costing $4,646 each and 24 Bristols, costing $6,750 each.

Other JN planes, designated as type H, for training, gunnery and bombing purposes were shipped. Of these, 402 were training planes, 312 were for gunnery use and 100 were bombing planes. The cost of these is estimated at $4,750 each. Another type, known as SJ-4, not included in the table of performances, was produced in quantities at an estimated cost of $4,500 each. No less than 1600 of these were shipped.

Production commenced in June, 1917, with a total of 147 JN-4-D machines; from then on the rate increased rapidly and in January, 1918, a total production of 729 planes was reached. Production was maintained through the following months and during the summer a number of Penguin planes were built at a cost of $2,025 each.

Exports of Passenger Automobiles

(Figures are for Fiscal

	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	Totals by Countries
Europe:													
	8	4	22	25	36	100	134	314	4	....	....	....	647
Austria-Hungary	$16,611	$3,218	$36,978	$26,178	$27,911	$78,748	$91,781	$190,199	$2,310	....	....	....	$473,934
	....	....	....	2	1	13	16	20	18	6	1	....	77
Azores & Madeira Is.	....	....	....	$2,006	$1,265	$7,866	$10,549	$10,771	$10,119	$2,272	$700	....	$45,548
	35	14	14	58	133	122	94	244	12	....	....	....	726
Belgium	$58,859	$36,900	$46,340	$147,375	$241,269	$140,585	$85,679	$139,681	$15,191	....	....	....	$911,879
	....	....	....	2	9	28	17	43	....	....	....	....	59
Bulgaria	....	....	....	$1,890	$6,530	$19,716	$11,457	$21,679	....	....	....	....	$61,272
	40	10	50	46	52	51	81	263	219	806	1,216	2	2,835
Denmark	$30,464	$9,045	$29,967	$46,024	$10,021	$11,976	$77,149	$176,947	$156,296	$548,971	$932,768	$4,100	$2,093,728
	....	....	....	....	14	24	51	106	17	....	....	....	212
Finland	....	....	....	....	$12,049	$26,203	$53,568	$83,835	$9,163	....	....	....	$185,718
	111	191	201	246	310	574	818	1,427	451	2,087	1,397	1,169	8,952
France	$489,047	$669,405	$643,692	$771,869	$473,122	$469,721	$615,086	$919,060	$252,909	$1,428,325	$836,557	$1,518,858	$9,037,651
	66	68	45	100	99	288	845	1,411	16	....	....	....	2,938
Germany	$141,371	$171,293	$136,966	$265,218	$209,663	$226,227	$764,389	$1,040,787	$17,364	....	....	....	$2,973,278
	1	....	1	....	2	1	7	64	9	15	9	....	109
Gilbraltar	$2,500	....	$683	....	$9,530	$1,673	$6,576	$33,030	$6,077	$16,165	$11,518	....	$87,752
	....	....	....	....	5	14	5	25	36	124	78	4	291
Greece	....	....	....	....	$3,871	$9,355	$4,080	$28,256	$28,431	$118,398	$79,913	$6,580	$278,884
	....	....	....	....	....	....	2	5	3	....	11	15	36
Iceland and Faroe Is.	....	....	....	....	....	....	$1,016	$2,488	$2,128	....	$5,134	$11,396	$22,162
	93	73	62	93	136	211	331	342	114	382	186	129	2,152
Italy	$249,192	$243,744	$240,516	$333,193	$188,405	$193,037	$280,961	$241,466	$70,265	$217,240	$126,432	$78,228	$2,462,679
	....	....	....	....	....	1	....	1	....	....	....	....	2
Malta, Gozo & Cyprus Islands	....	....	....	....	....	$500	....	$422	....	....	....	....	$922
	19	19	21	33	20	103	111	141	96	439	485	....	1,487
Netherlands	$49,146	$43,699	$53,935	$76,957	$50,796	$78,363	$91,163	$117,131	$131,801	$399,017	$612,495	....	$1,707,533
	1	3	11	22	13	78	78	145	125	732	922	97	2,227
Norway	$330	$5,751	$8,079	$20,669	$13,808	$66,897	$66,689	$118,338	$89,357	$592,560	$944,002	$115,810	$2,042,290
	....	1	4	9	23	15	73	59	14	204	283	223	908
Portugal	....	$1,226	$3,041	$11,429	$23,966	$14,752	$58,931	$65,545	$18,255	$198,975	$271,421	$270,987	$938,528
	....	3	....	....	46	31	38	28	....	2	....	....	148
Roumania	....	$4,941	....	....	$31,806	$22,543	$30,337	$17,018	....	$3,000	....	....	$108,925
	32	32	71	97	147	261	580	926	907	1,268	780	492	5,593
Russia in Europe	$27,638	$37,243	$78,409	$107,310	$139,487	$254,047	$484,913	$898,458	$1,527,768	$3,142,616	$943,003	$1,136,400	$8,777,292
	....	....	....	....	1	4	2	4	2	3	....	....	16
Serbia, Montenegro & Albania	....	....	....	....	$652	$2,520	$1,160	$2,843	$2,950	$4,200	....	....	$14,325
	10	5	9	12	63	174	186	83	71	364	1,125	1,205	3,307
Spain	$10,640	$3,855	$9,061	$18,330	$54,599	$116,202	$127,621	$64,758	$59,555	$299,367	$1,195,887	$1,346,826	$3,306,701
	63	16	18	45	68	169	250	324	137	238	390	95	1,809
Sweden	$63,051	$20,409	$44,585	$55,118	$62,005	$127,729	$235,918	$253,588	$108,652	$180,869	$360,554	$111,377	$1,623,855
	1	1	5	....	8	12	22	79	2	6	9	3	148
Switzerland	$750	$608	$5,792	....	$5,104	$7,873	$24,965	$56,838	$1,244	$4,499	$9,248	$1,533	$118,454
	1	1	....	....	11	22	13	35	....	....	....	....	83
Turkey in Europe	$2,000	$807	....	....	$8,929	$13,886	$9,814	$21,052	....	....	....	....	$56,488
			590	1,258	2,222	5,660	3,783	6,992	8,321	9,810	1,268	742	40,646
England			$1,673,914	$2,391,984	$2,233,734	$4,403,361	$2,893,785	$5,615,487	$6,849,145	$6,933,806	$1,444,346	$1,712,672	$36,152,234
	739	757	3	12	13	22	6	25	143	158	4	150	536
Scotland	$1,414,056	$1,621,516	$6,240	$18,109	$22,638	$28,901	$8,104	$46,948	$82,708	$124,138	$2,991	$217,000	$557,777
			....	1	14	34	6	2	159	60	....	....	1,772
Ireland			....	$5,500	$16,850	$22,186	$5,538	$1,593	$157,091	$55,014	....	....	*$3,299,314
North America:													
	....	1	....	....	....	....	....	....	....	....	....	....	1
Bermuda	....	$1,800	....	....	....	....	....	....	....	....	....	....	$1,800
	3	....	....	....	1	....	1	4	1	....	12	8	30
British Honduras	$4,020	....	....	....	$2,500	....	$1,800	$3,929	$550	....	$5,774	$6,858	$25,431
	611	385	1,230	3,102	4,687	6,288	6,723	4,377	4,127	10,017	14,421	12,985	68,953
Canada	$969,385	$700,504	$1,457,129	$3,340,326	$5,047,927	$7,560,655	$8,229,324	$5,445,052	$3,723,125	$6,555,334	$11,143,740	$10,189,865	$64,362,366
Central American States:													
	....	2	5	2	12	13	13	30	9	60	37	199	372
Costa Rica	....	$1,336	$3,115	$1,823	$12,698	$12,603	$14,955	$17,877	$3,897	$28,325	$23,125	$85,070	$204,824
	4	6	11	16	28	19	10	26	10	24	35	34	223
Guatemala	$2,743	$11,550	$11,597	$22,094	$34,054	$38,109	$14,892	$36,763	$12,012	$23,552	$36,174	$46,657	$290,197
	....	....	2	....	....	3	4	4	31	34	42	16	136
Honduras	....	....	$492	....	....	$7,114	$8,100	$3,286	$20,422	$22,652	$24,564	$12,292	$98,922
	3	....	....	....	....	....	....	....	....	....	....	49	52
Nicaragua	$2,050	....	....	....	....	....	....	....	....	....	....	$32,031	$34,081
	2	7	2	13	21	20	39	58	110	228	355	129	985
Panama	$1,170	$4,926	$850	$13,289	$27,415	$14,271	$13,432	$51,906	$85,990	$170,964	$216,711	$93,320	$721,253
	....	1	2	3	5	6	11	10	16	68	75	54	251
Salvador	....	$1,700	$1,410	$5,565	$22,199	$10,658	$13,212	$13,323	$8,888	$54,598	$62,314	$68,297	$262,161
	....	....	....	....	....	....	....	....	....	....	....	....	....
Greenland	....	....	....	....	....	....	....	....	....	....	....	....	....
	465	244	200	245	350	273	235	155	70	383	2,807	2,578	8,005
Mexico	$681,086	$354,338	$282,462	$459,077	$614,160	$418,590	$423,123	$239,166	$66,830	$309,200	$1,642,011	$1,653,545	$7,143,597
	....	....	....	....	....	....	....	....	....	....	....	....	....
Miquelon, Langley & St. Pierre Islands	....	....	....	....	....	....	....	....	....	....	....	....	....
	3	2	6	15	10	14	9	5	17	21	48	27	17
Newfoundland & Labrador	$9,828	$6,500	$4,907	$18,285	$10,412	$13,812	$10,353	$2,761	$11,681	$15,632	$38,910	$34,676	$177,757
West Indies, British:													
					22	16	7	14	19	63	121	58	320
Barbados					$22,531	$11,310	$5,973	$12,320	$8,699	$30,688	$62,364	$33,198	$187,083
					58	53	62	66	80	273	335	236	1,163
Jamaica					$81,368	$52,650	$59,131	$61,475	$61,622	$205,239	$202,375	$149,673	$873,542
	35	28	42	102	7	31	43	47	59	128	204	161	680
Trinidad & Tobago	$56,059	$45,866	$77,164	$157,459	$7,325	$31,343	$39,902	$49,079	$40,281	$87,167	$112,014	$100,571	$467,682
					4	4	7	13	38	100	124	80	577
Other British					$5,900	$1,960	$6,716	$11,061	$18,463	$51,612	$80,879	$50,009	$563,148*
	67	105	74	120	157	202	223	297	1,359	3,698	3,529	2,846	12,677
Cuba	$129,226	$157,081	$140,160	$187,392	$208,960	$234,569	$242,686	$254,428	$745,695	$2,091,295	$2,545,071	$3,029,813	$9,966,376
	....	....	....	....	1	5	4	3	3	9	18	152	195
Danish (Virgin Is. of U. S.)	....	....	....	....	$723	$3,303	$2,131	$2,954	$1,375	$3,426	$9,114	$12,313	$35,339
	1	1	2	1	22	13	7	11	28	131	191	248	656
Dominican Republic	$1,650	$2,000	$2,820	$4,000	$18,591	$12,739	$5,382	$15,195	$14,609	$60,127	$96,173	$157,607	$390,893
	....	....	....	....	2	3	19	13	24	21	32	12	126
Dutch	....	....	....	....	$1,576	$1,647	$14,590	$9,605	$16,829	$10,945	$19,191	$7,435	$81,818
	....	....	1	....	....	....	5	65	54	101	293	248	767
French	....	....	$1,000	....	....	....	$3,877	$48,377	$34,906	$63,670	$154,990	$146,698	$453,518
	....	....	....	1	....	2	38	2	....	10	29	102	184
Haiti	....	....	....	$1,510	....	$910	$24,499	$1,485	....	$3,788	$13,780	$54,613	$100,585

*Includes England, Ireland and Scotland for 1907 and 1908.

For Years 1907 to 1918 Inclusive

Year ending June 30)

	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	Total by Countries
South America:													
Argentina	39 $58,070	70 $72,396	109 $81,614	268 $174,677	343 $423,193	727 $860,350	1,062 $1,181,735	940 $963,586	626 $294,129	4,399 $2,065,439	3,924 $2,336,001	3,525 $2,666,898	16,032 $11,178,088
Bolivia	2 $1,550	....	....	....	....	....	2 $1,493	4 $12,764	10 $5,462	26 $16,208	141 $100,151	152 $105,408	337 $243,036
Brazil	52 $57,037	55 $97,363	24 $26,892	64 $67,687	181 $225,083	554 $662,883	987 $1,035,247	299 $264,992	81 $52,939	272 $157,968	873 $523,383	1,575 $1,000,011	5,017 $4,151,485
Chile	44 $52,905	15 $20,045	2 $1,471	3 $1,824	16 $15,231	30 $39,873	78 $109,982	195 $160,194	120 $64,327	826 $530,211	2,587 $1,821,842	3,399 $3,576,511	7,315 $6,394,416
Colombia	....	1 $500	1 $1,976	12 $22,482	14 $13,579	42 $35,386	110 $113,334	79 $69,620	39 $34,956	91 $58,525	173 $118,937	164 $121,422	723 $590,717
Ecuador	....	4 $2,453	....	2 $2,168	4 $3,595	21 $20,578	74 $55,372	21 $21,229	20 $11,233	62 $44,396	137 $106,478	142 $130,036	487 $397,585
Falkland Is.	....	....	....	....	....	....	....	....	....	....	....	....	....
Guiana, British	....	1 $765	1 $823	4 $5,952	6 $4,700	20 $17,306	18 $114,313	16 $11,364	45 $24,311	73 $33,933	146 $65,989	180 $100,546	510 $280,002
Dutch	....	....	....	....	....	....	....	7 $3,948	9 $4,492	15 $7,181	23 $11,797	16 $17,775	70 $45,193
French	....	....	....	....	....	1 $580	1 $558	....	....	1 $1,000	1 $498	8 $3,632	12 $6,268
Paraguay	5 $2,394	1 $557	....	1 $1,200	....	....	....	....	5 $2,308	6 $2,256	40 $20,192	13 $5,025	71 $33,932
Peru	8 $6,428	8 $6,790	2 $4,403	4 $5,004	4 $2,950	13 $10,833	70 $55,646	36 $31,362	24 $20,658	59 $40,388	400 $295,558	784 $913,669	1,412 $1,393,689
Uruguay	1 $625	8 $13,142	4 $5,657	20 $23,666	96 $147,142	177 $235,097	209 $273,253	183 $167,269	45 $25,706	285 $150,540	1,165 $612,838	2,232 $1,177,463	4,425 $2,832,398
Venezuela	1 $1,000	....	....	....	....	26 $28,180	104 $109,499	126 $102,073	227 $143,086	518 $314,156	542 $327,507	160 $97,485	1,704 $1,122,986
Asia:													
Aden	....	....	....	....	1 $788	....	15 $7,998	28 $20,990	9 $6,706	16 $9,166	10 $7,968	8 $6,879	87 $60,495
China	16 $15,255	7 $7,471	4 $3,369	8 $13,785	42 $40,261	78 $98,730	89 $90,459	114 $143,619	122 $119,635	264 $191,932	509 $383,371	833 $818,659	2,086 $1,926,546
China, British	....	....	....	....	....	....	....	....	....	....	....	6 $3,000	6 $3,000
China, French	....	....	....	....	....	....	....	....	....	....	20 $9,325	2 $2,017	22 $11,342
China, Japanese	....	....	....	1 $5,100	....	1 $850	....	....	....	....	33 $17,796	10 $7,321	45 $31,067
Chosen (Korea)	....	....	....	1 $10,270	3 $3,308	....	7 $6,095	2 $1,795	2 $1,800	7 $4,780	5 $3,832	2 $1,300	29 $33,180
East Indies, British:													
British India	45 $26,067	11 $9,970	7 $5,320	26 $22,372	150 $130,421	253 $203,740	439 $355,573	437 $379,954	315 $274,680	2,289 $1,638,262	3,603 $2,644,085	73 $53,428	7,648 $5,743,872
Straits Settlements	9 $4,754	16 $12,625	14 $12,040	21 $20,955	36 $28,951	120 $86,668	387 $319,247	262 $216,659	77 $70,210	376 $239,715	855 $585,820	287 $202,221	2,460 $1,799,865
Other British	....	2 $1,375	....	4 $2,875	12 $8,540	25 $20,882	39 $31,245	82 $73,175	25 $20,208	239 $168,685	110 $80,033	11 $17,740	549 $424,758
Dutch	67 $36,629	117 $79,989	53 $40,836	33 $21,768	42 $34,252	120 $70,055	278 $198,378	290 $208,722	105 $87,306	1,064 $753,128	3,206 $2,642,330	1,272 $1,302,800	6,647 $5,476,193
French	....	....	....	....	....	....	....	....	....	8 $3,033	18 $17,967	18 $21,175	44 $42,175
Hongkong	9 $7,372	3 $2,308	1 $459	2 $3,788	1 $550	4 $2,740	7 $6,673	11 $13,043	2 $1,475	15 $10,858	38 $35,255	117 $91,22	210 $175,749
Japan	15 $19,242	7 $17,230	6 $4,996	12 $26,759	61 $58,933	118 $143,610	312 $364,507	96 $100,995	28 $29,210	153 $120,061	652 $481,748	2,139 $2,040,897	3,599 $3,408,188
Persia	....	....	....	....	....	....	....	....	....	....	....	2 $1,048	2 $1,048
Russia in Asia	2 $1,884	....	....	3 $1,760	....	....	1 $1,160	12 $14,998	551 $1,477,809	683 $529,385	1,072 $1,324,060	5 $8,425	2,329 $3,359,481
Siam	4 $1,569	5 $2,959	....	4 $6,407	6 $6,540	13 $8,933	56 $35,934	37 $26,219	13 $10,317	41 $32,082	31 $15,915	65 $60,220	275 $207,095
Turkey in Asia	....	....	3 $7,900	1 $1,200	1 $652	1 $650	1 $824	7 $5,662	1 $1,000	....	....	....	15 $17,888
Oceania, British:													
Australia	62 $57,731	87 $74,175	127 $81,426	437 $268,274	1,046 $874,112	2,597 $2,260,320	2,083 $1,896,990	3,099 $2,615,896	2,169 $1,768,479	5,335 $4,147,302	5,055 $3,792,571	4,307 $3,410,557	26,404 $21,217,833
New Zealand	69 $120,533	59 $72,647	60 $41,826	77 $55,236	413 $383,449	953 $946,736	958 $990,837	1,065 $974,708	938 $784,206	2,672 $2,055,843	3,554 $2,558,118	1,818 $1,453,311	12,636 $10,437,450
Other British	....	....	....	....	18 $24,414	75 $73,932	3 $2,396	9 $6,014	2 $2,081	28 $18,227	19 $11,062	30 $20,863	184 *$158,989
French	....	....	....	1 $900	....	3 $2,920	11 $14,005	46 $45,184	8 $7,482	92 $56,789	22 $12,330	12 $7,612	195 $147,222
German	....	....	....	....	....	....	1 $350	....	1 $5,000	7 $3,208	12 $5,847	12 $11,029	33 $25,43
Philippine Islands	2 $1,205	16 $14,897	24 $27,410	130 $175,626	309 $382,551	401 $557,368	517 $577,040	614 $697,175	407 $425,001	861 $859,450	1,019 $686,731	1,714 $1,373,204	6,014 $5,777,658
British Africa West	....	....	....	....	....	....	4 $2,688	32 $18,319	42 $20,899	63 $35,361	240 $144,838	202 $115,772	583 $337,877
South	2 $1,817	2 $1,147	26 $22,152	75 $61,185	135 $126,734	331 $306,606	1,279 $1,157,895	1,618 $1,437,883	695 $731,278	2,859 $2,040,977	3,423 $2,378,380	2,142 $1,706,136	12,587 $9,972,190
East	....	....	5 $4,402	11 $10,463	2 $2,511	22 $14,998	14 $12,802	49 $34,430	120 $75,188	237 $137,245	94 $55,681	112 $75,778	666 $423,498
Canary Islands	....	1 $1,426	2 $1,804	1 $850	....	3 $2,066	10 $6,426	15 $6,956	27 $12,015	51 $32,935	31 $24,525	15 $5,378	155 $94,381
Egypt	2 $887	1 $3,500	1 $1,300	1 $998	4 $10,097	5 $2,872	16 $10,156	22 $11,437	1 $695	25 $18,352	38 $22,113	21 $17,300	137 $99,709
French Africa	1 $950	....	4 $7,611	11 $18,188	21 $14,214	30 $20,164	10 $7,297	19 $17,273	....	2 $1,155	41 $13,315	121 $50,550	260 $150,717
German Africa	....	....	....	....	....	....	5 $3,175	19 $14,136	7 $4,865	20 $7,760	....	....	51 $29,936
Italian Africa	....	....	....	....	....	....	....	....	....	....	3 $1,200	....	3 $1,200
Liberia	....	....	....	....	....	....	1 $805	....	....	....	1 $975	12 $4,220	14 $6,000
Madagascar	....	....	....	....	....	....	....	....	....	7 $2,532	1 $808	2 $1,659	10 $4,999
Morocco	....	....	....	....	....	....	....	63 $29,497	25 $10,847	52 $20,574	87 $39,670	35 $17,718	262 $118,306
Portuguese Africa	1 $2,110	....	....	7 $5,302	3 $2,669	16 $13,096	20 $16,102	24 $21,563	6 $7,301	56 $38,510	7 $5,429	9 $9,673	149 $121,755
Totals	2,862 $4,890,886	2,477 $4,656,991	3,184 $5,387,021	6,926 $9,548,700	11,803 $12,965,049	21,757 $21,550,139	24,293 $24,275,793	28,306 $25,392,963	23,880 $21,113,953	56,234 $40,660,263	64,808 $48,612,632	52,312 $45,331,360	298,842 $264,385,750

*Includes Barbados, Jamaica, Trinidad and Tobago, Other British for 1907, 1908, 1909 and 1910.

Imports of Passenger Cars for 11 Years

American Purchases of Foreign Automobiles Have Steadily Declined as Domestic Production Increased

	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	Totals by Countries
Austria-Hungary	......	......	*1* 624	......	*4* $9,591	*14* $30,102	*4* $8,294	*1* $2,233	......	......	......	*24* $50,844
Belgium	*4* $8,537	*3* $7,080	*12* $29,087	*12* $26,180	*32* $59,941	*56* $144,693	*9* $19,582	......	......	......	......	*128* $295,100
France	*793* $1,775,589	*1,009* $1,838,653	*782* $1,467,646	*377* $797,931	*401* $964,635	*357* $814,392	*134* $304,716	*62* $131,936	*49* $115,643	*11* $29,497	......	*3,975* $8,240,638
Germany	*32* $124,747	*64* $193,580	*150* $368,219	*137* $297,153	*116* $250,313	*99* $261,168	*21* $45,680	*6* $13,606	......	......	......	*625* $1,554,466
Italy	*132* $331,363	*328* $561,620	*352* $587,052	*130* $239,079	*131* $200,530	*116* $205,931	*55* $79,464	*111* $122,446	*1* $1,023	*1* $1,100	*1* $1,280	*1,358* $2,330,888
Netherlands	......	......	*3* $6,652	*2* $2,573	......	*1* $500	*1* $1,136	*6* $11,245	*6* $8,880	*1* $1,600	......	*20* $32,586
Spain	......	*1* $1,471	......	......	......	......	......	*2* $6,592	*1* $2,637	......	......	*4* $10,700
Sweden	......	......	......	......	......	*1* $3,944	*1* $3,175	......	......	......	......	*2* $7,119
Switzerland	*2* $5,665	*17* $46,062	*28* $60,554	*55* $118,474	*14* $32,125	*2* $3,103	*1* $1,199	......	......	......	......	*119* $267,182
England	......	*78* $203,604	*101* $236,015	*128* $297,382	*187* $431,066	*78* $218,932	*40* $115,042	*73* $178,065	*36* $80,615	*57* $137,119	*13* $29,658	*856* $2,126,875
Scotland	*65** $199,377*	*22* $22,446	......	......	*1* $2,570	......	......	*1* $1,700	......	*1* $350	......	*25* $27,066
Ireland	......	......	......	......	......	......	......	......	*1* $803	......	......	*1* $803
Canada	*13* $40,720	*9* $21,475	*36* $69,737	*38* $98,019	*75* $171,366	*19* $32,815	*25* $29,940	*42* $35,143	*1,350* $579,168	*31* $18,114	*35* $21,240	*1,673* $1,117,737
Mexico	......	......	*3* $12,500	*2* $5,000	*1* $1,544	......	......	*11* $8,425	*28* $8,392	*3* $500	......	*48* $36,361
Newfoundland and Labrador	......	......	......	......	......	*2* $2,800	......	......	......	......	......	*2* $2,800
Cuba	*4* $14,316	*3* $9,400	*3* $8,575	*6* $16,302	......	*3* $11,000	*4* $4,100	*4* $11,000	*1* $3,500	......	*1* $400	*29* $78,593
Argentina	......	......	......	......	......	......	......	*1* $1,925	......	......	......	*1* $1,925
Japan	......	......	......	......	......	......	*1* $1,282	......	......	......	......	*1* $1,282
Australia	......	......	......	......	......	......	*1* $1,703	*2* $987	......	......	......	*3* $2,690
New Zealand	......	......	......	......	......	......	......	......	*1* $1,250	......	......	*1* $1,250
Philippine Islands	......	......	......	......	......	......	*3* $5,180	......	......	......	......	*3* $5,180
Russia	......	......	......	*1* $750	......	......	......	......	......	......	......	*1* $750
Panama	......	......	......	......	*1* $1,500	......	......	......	......	......	......	*1* $1,500
British West Indies	......	......	*1* $2,500	......	......	......	......	......	......	......	......	*1* $2,500
China	......	......	*1* $2,285	......	......	......	......	......	......	......	......	*1* $2,285
Totals	*1,045* $2,500,314	*1,624* $2,905,391	*1,473* $2,851,446	*888* $1,898,843	*963* $2,134,181	*748* $1,759,380	*300* $620,493	*322* $525,303	*1,474* $801,911	*105* $188,280	*50* $52,578	*8,992* $16,238,12[illegible]

*Included with totals for England.

Exports of Automotive Parts for 12 Years

From Slightly More Than Half a Million Dollars, Export of Parts Have Increased to $32,933,006 in 1918

Not Including Engines and Tires

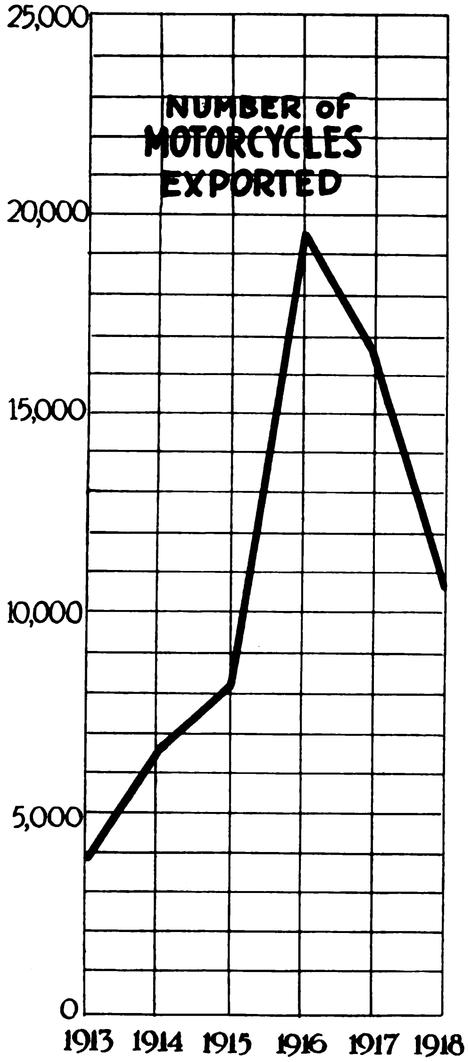
	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	Totals by Countries
Europe:													
Austria-Hungary	$717	$1,087	$669	$2,511	$1,412	$2,195	$4,572	$5,198	$1,045	....	....	....	$19,406
Azores and Madeira Is.	....	10	....	50	67	99	720	1,384	1,800	$1,532	$1,270	$198	7,120
Belgium	5,187	891	512	9,991	2,922	13,614	4,897	20,978	446	....	....	906	60,344
Bulgaria	....	....	....	....	171	823	40	390	....	....	....	....	1,424
Denmark	2,029	2,419	764	2,839	3,007	2,996	6,646	8,664	13,710	31,886	58,917	1,048	129,425
Finland	....	....	....	....	486	1,104	1,799	2,931	1,178	5,627	55	....	13,180
France	23,477	22,960	17,833	54,035	58,999	85,537	165,950	179,351	480,764	2,216,823	3,700,812	3,999,904	11,006,445
Germany	14,252	7,621	4,090	10,023	41,966	80,036	113,602	218,351	13,770	....	....	....	498,711
Gibraltar	....	....	....	57	....	100	....	514	229	617	525	61	2,103
Greece	....	....	427	....	100	454	379	807	2,010	24,724	12,604	4,675	46,180
Iceland and Faroe Is.	....	....	....	....	....	....	17	180	880	456	2,608	2,757	6,898
Italy	5,502	3,613	1,144	4,421	26,636	6,304	14,156	50,580	65,521	115,260	180,977	99,947	574,063
Malta, Gozo & Cyprus Is.	....	36	....	....	....	....	....	....	....	....	54	....	90
Netherlands	1,049	619	2,223	3,532	4,548	6,440	14,135	7,634	3,055	41,525	96,200	3,625	184,585

	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	Totals by Countries
Norway	$400	$622	$699	$2,684	$1,042	$934	$1,636	$1,893	$15,607	$59,769	$100,542	$18,855	$213,683
Portugal	....	....	205	394	1,618	865	920	2,357	3,239	45,356	66,929	20,274	142,157
Roumania ...	....	....	....	....	460	2,784	1,008	887	....	391	....	....	5,475
Russia in Europe	4,004	1,543	3,776	7,004	6,753	1,748	9,566	14,079	123,667	2,498,879	1,624,431	328,633	4,624,078
Serbia, Montenegro and Albania ...	....	....	....	....	....	113	....	....	....	4,932	....	....	5,045
Spain	3,620	129	260	2,854	2,267	3,755	3,192	6,266	7,347	32,748	95,720	154,850	313,003
Sweden	9,748	11,128	1,270	3,818	6,521	3,789	4,276	6,140	4,211	37,917	26,891	4,032	119,741
Switzerland..	178	782	1,409	1,894	....	....	457	1,069	400	1,150	565	54	7,958
Turkey in Eu.	....	....	56	....	35	964	116						
England ...			125,726	240,329	320,755	931,909	922,866	....	267	....	....	....	1,438
Scotland ...	*116,248	175,098	6,205	238	1,352	874	1,485	1,282,388	3,282,973	7,202,475	6,121,211	6,329,114	27,051,087
Ireland			6	54	350	523	451	23,269	29,403	52,414	22,146	955	138,341
No. America:								250	208	7,181	1,264	....	10,287
Bermuda	....	196	8	....	50	52	330	254	125	615	64	7	1,701
British Honduras	193	381	40	73	26	165	509	163	684	548	1,379	2,638	6,799
Canada	195,989	244,332	230,509	1,023,368	1,726,842	2,392,592	3,104,097	3,663,879	2,741,178	7,492,639	9.148,110	12,054,824	44,018,359
Cent. Amer. States:													
Costa Rica ..	255	159	346	2,376	1,376	1,820	4,516	6,208	5,041	10,162	7,498	23,613	62,870
Guatemala ..	24	1,858	1,188	2,124	4,970	2,062	1,851	1,613	732	2,367	9,852	9,111	37,752
Honduras ...	1,465	104	61	48	61	151	808	1,058	6,870	15,649	12,639	11,952	50,861
Nicaragua ...	160	....	60	38	30	86	741	47	609	666	964	2,264	5,665
Panama	274	1,278	2,182	3,180	4,927	4,689	11,738	16,988	25,861	34,180	56,657	72,180	234,129
Salvador	....	....	843	526	1,195	2,790	2,242	2,481	2,371	3,717	11,314	10,179	37,658
Mexico	181,553	47,279	104,984	81,248	35,506	47,479	46,743	41,508	30,819	42,258	125,823	431,440	1,166,640
Miquelon, Langley and St. Pierre Is.	....	....	....	....	....	....	....	300	....	25	5	65	395
Newfoundland & Labrador.	132	50	435	1,508	2,001	2,026	2,993	3,901	3,632	8,672	9,972	4,129	39,451
W. Indies: British—													
Barbados ..					3,866	3,209	5,055	4,177	4,216	6,383	14,452	15,089	56,447
Jamaica ...					11,008	28,569	25,355	24,693	32,337	53,867	54,854	65,429	317,601
Trinidad & Tobago ..	†2,310	3,804	6,295	14,085	1,817	4,847	9,119	13,003	12,865	21,526	44,060	55,794	163,331
Other Brit..					422	1,426	1,157	2,538	3,707	9,303	12,863	21,446	52,867
Cuba	18,095	39,169	27,385	49,088	31,323	31,594	35,928	48,217	101,429	411,731	906,710	1,028,276	2,728,945
Danish (Virgin Is. of U. S.)	....	....	39	....	....	558	1,640	1,206	865	975	1,876	2,844	10,003
Domin. Rep.	....	50	103	253	2,871	3,381	1,331	3,439	3,633	12,389	35,301	39,816	102,567
Dutch	....	17	....	....	242	281	1,767	2,754	4,598	3,288	6,052	4,707	23,689
French	50	128	164	101	20	97	198	8,099	7,428	9,546	24,672	53,518	104,016
Haiti	....	90	20	....	5	331	2,212	1.095	185	3,285	3,962	24,385	35,570
South Am.:													
Argentina ..	10,137	10,058	8,244	22,150	19,522	70,446	74,188	92,663	49,990	222,687	1,458,111	3,088,534	5,126,625
Bolivia	190	100	....	....	190	25	172	1,209	2,880	3,453	11,864	14,533	34,616
Brazil	8,665	8,690	8,527	7,802	15,769	35,680	108,859	84,602	28,633	59,935	134,326	233,414	724,902
Chile	3,527	2,988	1,348	663	484	2,656	4,711	22,405	14,721	72,939	248,043	806,015	1,180,500
Colombia ...	17	300	422	2,286	6,456	7,681	18,676	19,970	9,695	18,967	27,777	40,717	152,964
Ecuador	....	272	365	613	251	3,461	9,115	6,324	4,458	8,014	12,648	12,964	58,485
Guiana:													
British	....	128	852	1,303	2,012	3,181	3,809	4,583	5,116	6,809	23,597	35,081	86,471
Dutch	....	....	....	7	....	12	39	911	1,702	2,052	3,212	3,282	11,817
French	....	....	....	....	....	6	125	....	165	328	11	2,337	2,972
Paraguay ...	....	90	....	....	....	32	....	....	1,030	848	228	698	2,926
Peru	1,666	1,817	745	1,884	1,115	1,604	2,550	5,982	4,727	5,458	27,332	88,098	142,978
Uruguay	....	1,786	391	1,390	8,637	12,599	32,978	21,401	14,359	27,086	125,913	183,005	429,581
Venezuela ...	....	400	....	9	1,224	4,648	20,123	36,286	28,750	40.783	87,768	57,873	277,864
Asia:													
Aden	....	....	....	....	....	....	502	1,676	361	998	4,541	263	8,341
China	690	1,936	787	845	3,240	2,254	3,134	5,825	5,265	21,661	54,753	60,134	160,524
China:													
British	....	....	....	....	....	....	....	....	....	46	....	....	46
French	....	....	....	....	....	....	....	....	....	....	1,747	....	1,747
German	....	....	....	....	....	....	....	....	....	....	....	290	290
Japanese	....	....	....	....	....	....	....	....	....	....	....	382	382
Chosen	....	....	540	....	....	748	2,271	2,791	282	10,377	2,125	2,812	21,946
E. Indies: British—													
British Ind..	2,444	4,137	4,623	6,387	11,741	14,568	18,336	47,923	44,785	129,562	345,855	294,909	925,220
Straits Settlements ..	1,343	1,403	1,786	1,172	3,202	5,273	14,660	25,100	20,388	39,025	70,043	69,968	258,363
Other British	....	....	84	170	672	829	901	4,099	4,062	8,540	27,710	23,273	70,340
Dutch	1,758	5,168	5,135	4,577	2,627	3,452	11,453	15,368	15,232	34,638	193,225	192,430	485,063
French	....	....	....	....	....	....	....	....	274	....	....	1,998	2,272
Hongkong ..	123	296	252	290	119	2,711	92	626	1,088	2,180	2,885	7,702	18,364
Japan	5,021	586	498	3,375	4,997	39,681	51,619	35,637	26,028	30,446	116,130	319,038	633,056
Persia	....	....	....	....	....	....	....	....	174	....	....	1,090	1,264
Russia in As.	....	150	....	67	591	....	....	....	107,351	226,255	146,083	25,512	506,009
Siam	2,134	1,167	1,007	921	283	970	1,925	4,905	2,451	34,412	9,734	7,639	67,548
Turkey in As.	....	....	....	....	570	30	239	67	214	....	....	....	1,120
Oceania: British—													
Australia ...	3,826	7,148	14,227	21,533	53,940	102,427	166,176	202,363	199,154	389,690	753,309	1,052,986	2,966,779
New Zealand	25,625	1,752	1,392	5,150	16,306	26,095	37,438	53,644	48,111	176,618	285,654	309,658	987,443
Other British	....	....	....	....	311	971	479	1,060	665	1,991	4,751	4,674	14,902
French	....	....	....	....	200	495	3,032	7,560	5,730	5,640	4,383	6,272	33,312
German	....	....	....	....	....	....	220	396	....	66	936	7,138	8,756
Philip. Isl...	4,168	1,781	7,859	17,154	62,581	62,631	53,434	69,933	40,228	63,756	116,670	178,036	678,231
Africa:													
Belg. Congo..	....	....	....	....	....	....	....	....	....	34	....	....	34
British—													
West	....	....	....	....	....	56	465	5,743	6,537	20,311	64,938	49,077	147,127
South	3,000	802	4,088	14,655	15,486	29,123	62,304	157,246	100,240	286,401	422,200	811,323	1,906,868
East	....	....	....	2,478	981	851	1,444	3,203	3,929	11,371	9,599	23,290	57,141
Canary Is....	....	....	23	76	30	13	879	1,505	1,939	2,111	3,261	1,300	11,137
Egypt	110	380	10	277	169	99	295	130	1,494	4,751	2,623	716	11,054
French Afr...	....	....	....	....	339	327	78	200	2,660	2,458	2,316	7,163	15,536
German Afr..	....	....	....	....	....	....	....	999	522	21,098	....	....	22,619
Liberia	....	....	....	....	....	....	....	....	13	....	33	106	152
Madagascar .	....	....	....	....	....	....	....	....	....	....	4	175	179
Morocco	....	....	....	....	....	....	....	166	3,386	9,928	2,431	7,347	23,258
Portug. Afr..	....	74	38	47	115	910	1,222	1,585	3,431	7,064	5,339	1,160	20,985
Spanish Afr..	....	....	....	....	....	....	....	....	103	....	....	....	103
Totals...	$611,355	$620,856	$605,179	$1,641,520	$2,544,180	$4,107,155	$5,240,599	$6,624,232	$7,853,183	$22,536,485	$27,420,913	$32,933,006	$112,738,663

*Included in totals of exports to England.
†Included in totals of exports to Jamaica.

Motorcycle Exports

(Prior to 1913 Motorcycles were included with "Bicycles")



PRIOR to 1913 the U. S. Bureau of Foreign and Domestic Commerce evidently did not consider that the motorcycle possessed sufficient importance to justify an individual set of figures in its official records, and accordingly it included the motorcycle with the ordinary push-bicycle. Those figures which are available seem to indicate that of late years the motorcycle occupies a position of some importance in the foreign trade of the country, as from 1913 to 1918 our exports were valued at $12,616,559, a value representing that of no less than 63,267 motorcycles.

As is the case in certain other export tabulations in this issue of AUTOMOTIVE INDUSTRIES, war has shown a marked effect on the volume and value of our exports. Early in the struggle it was fully apparent that a motorcycle could travel under conditions impossible to an automobile, such as carrying reports and messages at speed over shell-shattered roads where the means of transport had frequently to be carried over obstructions or around or through shell-holes.

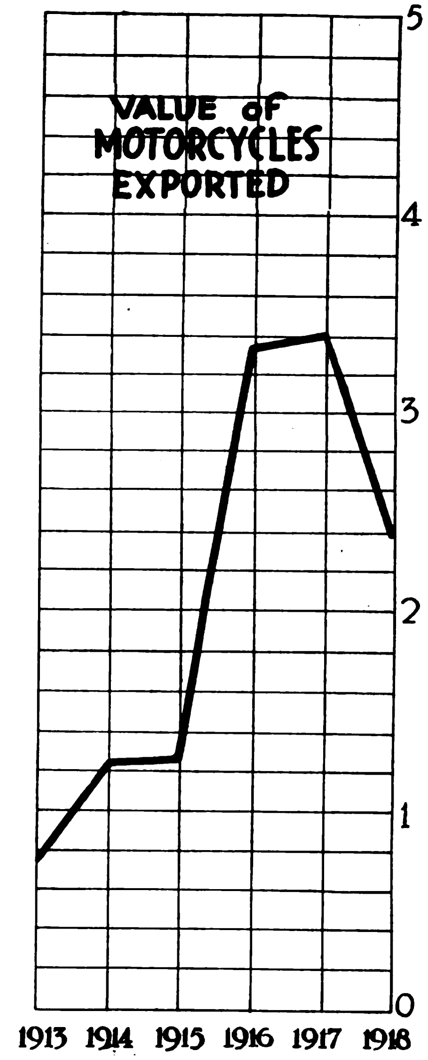
Hence it came about that although England, France and Italy had well-equipped motorcycle factories capable of

	1913	1914	1915	1916	1917	1918	
Europe:							
Austria-Hungary		*29* $5,875	*7* $1,535				*36* $7,410
Azores and Madeira Islands				*1* $228			*1* $228
Belgium	*25* $5,176	*65* $11,803	*1* $151				*91* $17,130
Bulgaria							
Denmark	*38* $6,269	*239* $43,325	*149* $24,163	*784* $128,186	*757* $135,787	*2* $650	*1,969* $338,380
Finland	*21* $4,479	*78* $13,798					*99* $18,277
France	*39* $8,043	*132* $29,663	*56* $11,573	*216* $36,121	*78* $14,562	*90* $20,946	*611* $120,908
Germany	*96* $17,525	*231* $48,201	*2* 597				*329* $66,323
Gibraltar	*2* $338				*3* $495		*5* $833
Greece		*15* $2,230		*4* $868	*1* $293	*1* $400	*21* $3,791
Iceland and Faroe Islands						*8* 2,000	*8* $2,000
Italy	*115* $23,298	*342* $70,054	*121* $24,190	*790* $147,223	*1,666* $349,667	*1,940* $464,661	*4,974* $1,079,098
Netherlands	*18* $4,570	*89* $17,885	*348* $67,962	*998* $190,512	*1,224* $237,008		*2,677* $517,937
Norway	*3* $805	*40* $8,009	*114* $20,656	*227* $41,943	*758* $162,126	*86* $21,414	*1,228* $254,953
Portugal	*16* $3,424	*89* $19,014	*91* $18,609	*197* $41,031	*241* $57,981	*222* $56,045	*856* $196,104
Roumania							
Russia in Europe	*85* $17,819	*408* $75,505	*649* $137,771	*2,103* $494,338	*14* $1,679		*3,259* $727,112
Spain	*40* $9,220	*76* $16,443	*122* $21,472	*206* $36,040	*703* $146,398	*426* $90,162	*1,573* $319,735
Sweden	*14* $3,162	*179* $34,106	*90* $18,556	*457* $88,325	*1,059* $245,062	*73* $13,071	*1,872* $402,282
Switzerland		*5* $1,229	*6* $1,327			*2* $393	*13* $2,949
Turkey in Europe	*1* $262						*1* $262
England	*1,036* $203,734	*1,604* $320,009	*3,324* $578,836	*3,797* $732,582	*287* $61,710	*28* $5,706	*10,076* $1,902,577
Scotland	*4* $828	*16* $3,284	*33* $8,393	*109* $21,900			$34,405
Ireland				*50* $10,738			*50* $10,738
North America:							
Bermuda				*1* $250			*1* $250
British Honduras						*1* $39	*1* $39
Canada	*1,335* $236,362	*1,065* $193,987	*832* $140,015	*927* $148,409	*1,064* $196,645	*1,041* $198,739	*6,264* $1,114,156
Central American States:							
Costa Rica	*6* $1,174			*2* $1,418	*3* $450		*11* $3,042
Guatemala	*3* $671	*5* $1,242	*2* $442	*4* $804	*31* $8,125	*28* $5,033	*73* $16,317
Honduras			*5* $1,159	*4* $330	*2* $400	*2* $575	*13* $2,464
Nicaragua				*1* $200	*2* $462	*1* $290	*4* $952
Panama	*27* $6,238	*32* $7,725	*59* $12,637	*76* $15,387	*61* $15,574	*62* $16,710	*317* $74,271
Salvador	*1* $200		*3* $919		*8* $1,638	*20* $4,458	*32* $7,215
Mexico	*48* $9,593	*26* $5,481	*8* $1,897	*51* $9,877	*102* $23,360	*59* $14,622	*294* $64,830
Newfoundland and Labrador	*3* $717	*8* $1,998	*7* $1,226	*12* $2,505	*5* $1,062	*3* $750	*38* $8,258
West Indies, British:							
Barbados		*6* $1,455	*11* $2,585	*5* $757	*11* $2,204	*14* $2,763	*47* $9,764
Jamaica	*2* $500	*7* $1,685	*8* $1,625	*18* $3,080	*32* $4,672	*30* $5,237	*97* $16,719
Trinidad and Tobago		*16* $4,086	*14* $2,833	*12* $2,506	*26* $5,318	*14* $2,452	*82* $17,195
Other British				*2* $480	*10* $1,949	*31* $4,167	*43* $6,596
Cuba	*43* $8,285	*80* $15,980	*75* $13,880	*66* $12,217	*73* $15,076	*165* $36,408	*502* $101,846
Danish (Virgin Is. of U. S.)	*1* $146	*4* $630					*5* $776
Dominican Republic	*14* $2,945	*2* $376		*12* $1,733	*10* $1,173	*10* $1,029	*48* $7,256
Dutch	*1* $166	*1* $150	*1* $196		*2* $368	*3* $904	*8* $1,784
French			*2* $484		*5* $900	*4* $636	*11* $2,020
Haiti	*1* $62				*4* $1,015	*14* $4,026	*19* $5,103

Covering Six Years

(Prior to 1913 Motorcycles were included with "Bicycles")

	1913	1914	1915	1916	1917	1918	
South America:							
Argentina	163 / $30,330	110 / $23,470	69 / $12,798	111 / $20,299	173 / $35,929	227 / $48,655	853 / $171,481
Bolivia	......	1 / $261	......	9 / $1,606	7 / $1,918	11 / $2,151	28 / $5,936
Brazil	57 / $12,090	61 / $10,935	43 / $7,743	78 / $9,966	88 / $16,051	94 / $23,387	421 / $80,172
Chile	39 / $8,134	37 / $7,967	2 / $570	14 / $2,406	34 / $6,389	88 / $18,041	214 / $43,507
Colombia	4 / $900	9 / $2,066	11 / $2,359	12 / $2,607	11 / $2,128	13 / $2,472	60 / $12,532
Ecuador	2 / $436	6 / $852	1 / $135	7 / $1,493	13 / $3,111	11 / $2,216	40 / $8,243
Guiana, British	2 / $338	8 / $1,523	7 / $1,356	8 / $1,383	30 / $5,047	55 / $8,828	110 / $18,475
Paraguay	......	......	......	1 / $196	......	......	1 / $196
Peru	......	3 / 632	3 / $847	8 / $1,576	25 / $4,546	5 / $1,103	44 / $8,704
Uruguay	15 / $2,921	10 / $2,409	......	21 / $4,743	49 / $9,207	26 / $5,892	121 / $25,172
Venezuela	18 / $3,466	23 / $4,725	4 / $912	4 / $456	22 / $4,746	2 / $573	73 / $14,878
Asia:							
Aden	......	......	2 / $246	14 / $2,431	6 / $787	......	22 / $3,464
China	18 / $4,542	20 / $4,786	25 / $6,790	11 / $2,562	92 / $16,943	......	166 / $35,623
China, British	......	......	......	......	......	77 / $13,822	77 / $13,822
China, Japanese	......	......	......	......	......	2 / $350	2 / $350
Chosen (Korea)	6 / $1,350	......	2 / $413	7 / $1,008	23 / $4,852	10 / $2,396	48 / $10,019
East Indies, British:							
British India	4 / $570	11 / $2,404	4 / $925	214 / $40,388	558 / $111,411	16 / $3,796	807 / $159,494
Straits Settlements	11 / $3,349	11 / $2,116	......	11 / $1,789	82 / $15,773	140 / $30,899	255 / $53,426
Other British	2 / $591	7 / $1,811	3 / $1,211	18 / $3,050	140 / $26,198	68 / $16,192	238 / $49,053
Dutch	3 / $642	20 / $4,916	54 / $11,871	185 / $34,753	1,079 / $229,167	251 / $50,126	1,592 / $331,475
Hongkong	......	1 / $325	2 / $690	23 / $4,353	37 / $7,531	18 / $3,070	81 / $15,969
Japan	137 / $25,833	21 / $4,548	14 / $3,597	19 / $3,191	122 / $25,716	384 / $78,324	697 / $141,209
Persia	......	......	......	......	......	2 / $730	2 / $730
Russia in Asia	......	1 / $115	......	18 / $3,738	21 / $5,380	......	40 / $9,233
Siam	......	3 / $648	6 / $1,375	6 / $1,189	21 / $3,626	17 / $3,311	53 / $10,149
Turkey in Asia	1 / $206	1 / $152	......	......	......	......	2 / $358
Oceania: British:							
Australia	24 / $4,706	786 / $132,998	709 / $137,269	2,394 / $475,157	2,998 / $634,011	1,678 / $380,786	8,589 / $1,764,927
New Zealand	136 / $22,664	29 / $6,029	333 / $49,072	1,576 / $282,049	1,108 / $236,432	731 / $157,432	3,913 / $753,678
Other British	......	......	11 / $1,560	10 / $2,120	5 / $1,330	1 / $267	27 / $5,277
French	6 / $1,157	......	......	......	2 / $628	4 / $1,186	12 / $2,971
German	......	......	......	......	1 / $298	1 / $96	2 / $394
Philippine Islands	257 / $42,052	134 / $25,690	135 / $29,383	247 / $51,276	142 / $30,743	163 / $35,725	1,078 / $214,869
Africa:							
Belgian Kongo	......	......	......	......	......	1 / $289	1 / $289
British Africa, West	......	2 / $418	2 / $396	72 / $15,689	29 / $3,575	86 / $12,336	191 / $32,414
South	40 / $6,784	187 / $33,659	555 / $101,210	1,144 / $204,302	1,364 / $252,478	1,874 / $449,846	5,164 / $1,048,279
East	......	1 / $251	6 / $834	69 / $12,210	32 / $5,033	155 / $34,358	263 / $52,686
Canary Islands	......	2 / $493	14 / $2,732	9 / $2,056	5 / $984	......	30 / $6,265
Egypt	......	4 / $739	2 / $438	20 / $3,559	39 / $7,251	......	65 / $11,987
French Africa	......	......	......	......	1 / $432	1 / $237	2 / $669
German Africa	......	1 / $201	1 / $473	......	......	......	2 / $674
Liberia	......	......	......	......	2 / $300	......	2 / $300
Madagascar	......	......	......	3 / $502	1 / $217	......	4 / $719
Morocco	......	......	1 / $283	......	1 / $355	1 / $360	3 / $998
Portuguese Africa	......	11 / $1,827	5 / $999	23 / $5,000	4 / $1,034	3 / $520	46 / $9,380
Spanish Africa	......	......	......	2 / $575	......	3 / $638	5 / $1,213
Totals: Number	3,983	6,410	8,166	19,500	16,609	10,599	63,267
Value	$749,072	$1,234,194	$1,494,176	$3,369,616	$3,401,716	$2,364,785	$12,616,559



producing large numbers of machines, we received hurry calls for all available supplies. Our prompt and effective response is shown by the figures given herewith.

Of course we have, apart from the temporary demand created by war, a world-wide trade in motorcycles. In this connection it is of interest to note that the smaller countries, far removed from the fighting zone, are consistently improving as motorcycle buyers. For instance, Siam, a country which but a few years ago was utterly dissociated in the public mind with things mechanical, seems to be adopting the motorcycle.

Perhaps the principal lesson to be learned from this tabulation of motorcycle exports is that the American machine is now thoroughly known in districts in which, before the war, few motorcycles of any kind were seen; that repeat orders from foreign governments and from distributers and dealers prove that it is appreciated as well as merely known, and that the conditions prevailing during the past few years have given the United States motorcycle manufacturer an opportunity to further cultivate his interests abroad.

Trucks Show Few Mechanical Changes

War Activities of Engineers Have Retarded Mechanical Development in Commercial Vehicle Design—Curtailment of Supplies of Raw Material Has Reduced Production Originally Planned

FEW changes involving either basic design or refinement in detail have been made in the gasoline trucks offered on the 1919 market as compared with those produced in 1918. No doubt the primary cause is that the abnormal conditions under which this branch of the automotive industry (in common with others) has been operated during the past year acted as a deterrent to development along lines other than those of accepted engineering practice. Another reason is that truck design under the severe demands of war-service has advanced so rapidly since 1914 that it has reached a point of relative excellence which leaves but little to be desired from a purely mechanical point of view.

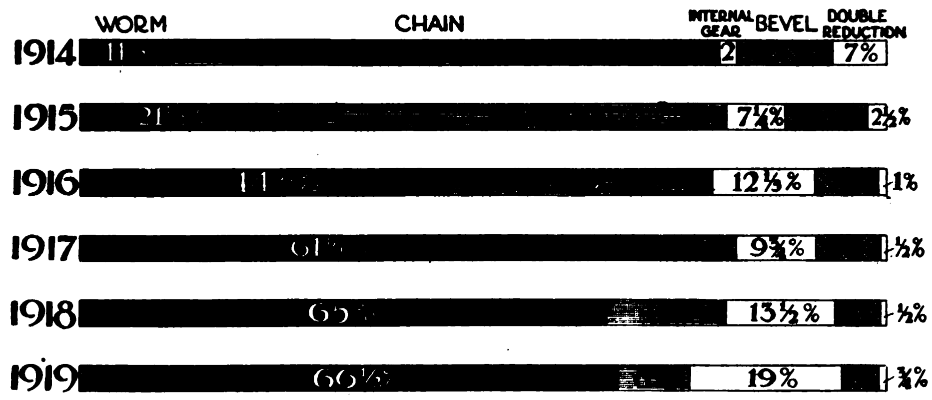
There is still much to be done in the development of the gasoline truck from a strictly utilitarian point of view, and doubtless engineering skill will lend its aid in this direction, supplementing the efforts of the sales organization to perfect a program planned to provide the maximum of earning capacity at a minimum of operating cost and a well-devised system of distribution, service and maintenance.

A Readjustment of Sizes

Obviously the load capacity of a truck is determined by the maker on the basis of demand. Trucks are built in capacities ranging from under half a ton to over 7 tons, and it is apparent that there is work suited both to the extremes as well as to the intermediates.

While the 1-ton truck still leads the field in respect of the number produced, the greatest gain in the number of models of any given size offered for 1919 is in the 1½-ton classification. Twenty-four more models of this size are listed than were offered in 1918. If the popularity of a size be judged by the number of models offered, the 2-ton truck leads the field for 1919 with 89 distinct offerings. It is followed closely by the 1½-ton size with 75 models, the 1-tonner with 68, the 3½-tonner with 62 and the 5 and 5½-tonners with 59.

Taking the six-year period from 1913 to 1919 the 3½-ton truck has shown the greatest gain, the 41 models now offered being over seven times the number marketed in 1913. The 2½-ton truck has also gained in favor during this period.



FINAL DRIVE BY MODELS OFFERED

The final drive averages shown above are calculated on the number of models offered in each particular year and as included in the specifications of those trucks published by the Class Journal Co. for that year. The averages must not be confused with those on the same subject based on the production of trucks. The latter averages are given below, so that the true situation in regard to types of final drive may be had both from the basis of number of models offered and of number of trucks produced. The above percentages indicate the decline in the chain drive for some form of inclosed drive

FINAL DRIVE BASED ON PRODUCTION

The above are averages calculated for the year 1918. *The* 1916 *production was* 98,000 *trucks;* 190,000 *in* 1917 *and* 250,000 *in* 1918. *Thus, while the percentage of bevel-driven trucks decreased* 2¼ *per cent in* 1918, *there were actually more bevel-driven trucks made in* 1918 *than in* 1917

Price Tendency Is Upward

Owing to the additional cost of material, labor, etc., there has been a general increase in truck prices. There have been no advances which were not fully justified by abnormal production conditions and there is no indication of any downward trend. In fact it is more than likely that some further advances may be announced in the spring, but it is impossible to prophesy with conditions as they are at present.

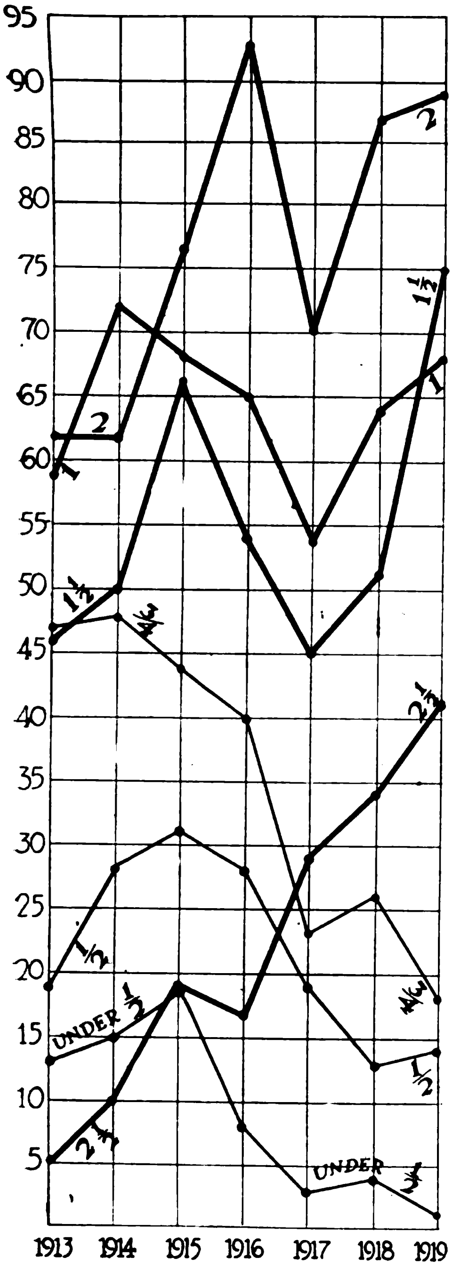
For the reason that prices have been advanced almost daily it is not easy to calculate the precise percentage representing the difference between 1918 and 1919 prices. A careful calculation made in November and based on actual current figures furnished by manufacturers showed that at that time the average increase in all models and sizes of trucks was 17.1 per cent. As a matter of fact individual prices advanced anywhere from 10 to 20 per cent and at the present time it may be safely assumed that the average advance is in the region of the latter figure.

It should not be forgotten that with wartime restrictions it was a matter of practical impossibiliy to increase production for commercial service (as distinct from Government work) and thus reduce overhead charges to a point which would permit of the truck being sold at the same price as before.

It is of interest to observe that the standard army truck has not yet affected to any appreciable extent the design of the regular commercial models. It is not likely that any modification embodied in army trucks will be adopted until present orders for standard commercial vehicles are filled. Then, should such a course be considered advisable, the various parts makers will be ready with the various jigs and tools formerly used in Government work and now available for other service.

1919 Mechanical Practice

As already pointed out there are practically no novelties or departures from generally accepted standard design, but



Truck Design for 1919

THERE are very few mechanical changes, standardization of parts may be considered as accomplished and developments may be expected now that the factories are reorganizing on a peace-time basis of operation.

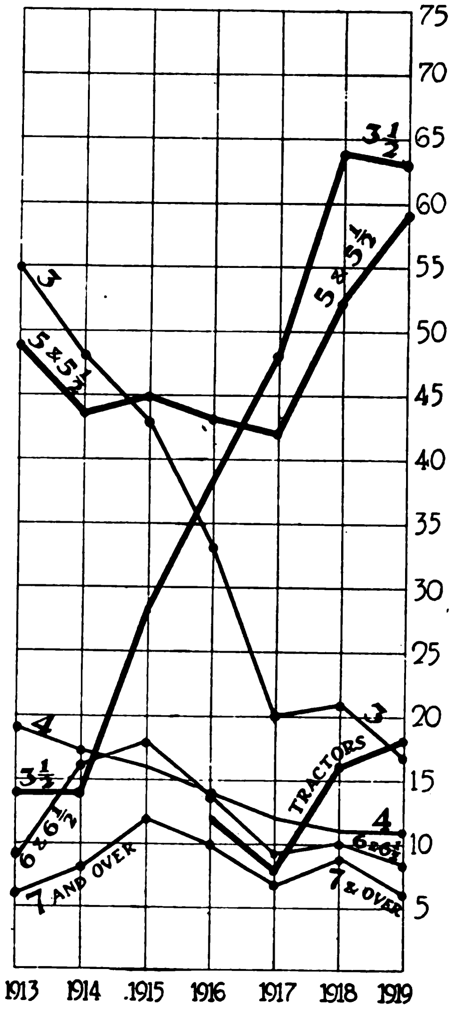
Three and one-half ton trucks show the greatest gain in number of models offered, although the one-tonner leads in actual number.

There has been little attempt made to solve the problem of using heavy fuel.

Amidship gearsets have increased in number, no doubt for the reason that they tend to prevent shaft-whipping.

Chain drive continues to give way to drives of one or other of the enclosed types.

Worm drive appears to be the favorite on trucks of ½, 1, 1½, 2, 2½, 3½ and 5 tons, as indicated by averages of all models. Hotchkiss type of drive continues to be popular.



These curves and the ones opposite are based on specifications compiled during the past 7 years by the Class Journal Co. and do not take into account the number of vehicles of a given model sold. The heavy lines indicate an increase in the number of models of a given size and the light lines a decrease

there are one or two exceptions of interest.

Perhaps one of the most important of these is the new type of double-reduction axle brought out by White. In this the second reduction is secured at the wheel instead of in the differential housing. This axle has several other unusual characteristics and has been under development and test for several years.

Size of Engines Increased

In engines the tendency is to increase size. For example, the average engine on the ¾-tonners has been increased from 3¼ x 5 to 3½ x 5, with a corresponding increase in horsepower from 16.92 to 19.61. The average engine of the 1-ton truck is now 3¾ x 5 as compared with 3½ x 5 in 1918.

In gearsets there is a tendency to adopt the use of four speeds in trucks for the 3 to the 5-ton sizes. Side chains are disappearing and are being replaced by one or other of the forms of enclosed drive. As evidence of this, chain-driven trucks are now but 8¾ per cent of the total production as against 15 per cent in 1918. On a production basis chain-driven trucks for 1918 were but 6 per cent of the total as compared with 9 per cent in 1917. Both worm and internal-gear driven trucks show increases, bevel drives are fewer and trucks with double-reduction drive have increased both on the basis of the number of models offered and on that of production.

Hotchkiss drive has held its position except in the case of 5-ton trucks, where radius rods are used on the majority of the models offered for propulsive purposes. Better brake lay-outs and the use of longer springs which are practically flat under load have overcome any earlier difficulties arising from the use of this type of drive.

Automatic control of engine temperature has not progressed to any great extent during the past year, although at the beginning of 1918 it was prophesied that the conventional cooling system would be discarded in favor of a system with automatic control. At the same time it is evident that some form of improved cooling will sooner or later be developed in order to insure greater engine efficiency throughout the climatic range from winter to summer.

Solid and Pneumatic Tires

Where solid tires are regular equipment, the pressed-on type is becoming practically universal. This has been brought about to some extent by the considerable increase in the number of tire presses available throughout the country. There appears to be little change in the ratio of the use of giant single tires on the rear wheels as compared with dual solids.

There has been a normal growth in the use of pneumatic tires for trucks of up to 2 and 3-ton capacities and it is indicated that the use of giant pneumatics for trucks of around 5-ton capacity will be extended.

Detailed Technical Specifications

Details of 489 Gasoline, 19 Electric and One Steam Motor Truck Chassis and Makes of Principal Truck Parts, Including Engines, Clutches, Gearsets,

Name and Model	Tons Capacity	Chassis Price	Wheelbase Inches	FRAME			TIRES			Wheels	ENGINE														
								Size in Ins.						COOLING			IGNITION			ELEC. SYSTEM			GOVERNOR		
															Radiator										
				Make	Material	Type	Kind	Front	Rear		Make	No. Cyl., Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	Water Circ.	Make	Core and Case	Type	Make	Spark Advance	Type	Make	Extra Cost, $	Type	Make	Drive
A. & B. 3T	3		144	own	rol-c.	s-flex.	s.	48x3½d	48x3½d	wd.	own.	4-5.17x4¾-42.8	2	g.p.	Bush.	fin-sht.	dual.	Bosch.	hand.	none	none	none	none	none	
A. & B. 5T	5		144	own	rol-c.	s-flex.	s.	48x3½d	48x5d	wd.	own.	4-5.17x4¾-42.8	2	g.p.	Bush.	fin-sht.	dual.	Bosch.	hand.	none	none		none	none	
Acason B	1½	$2,500	150				s.	36x3½	36x5		Wau.	4-3¾x5¼-22.5	2	cent.			sing.	Eismn	hand.	ltg*			cent.	Wau.	motor.
Acason H	2	2,850	150	Savg.	p-stl.	s-flex.	s.	36x4	36x7	wd.	Wau.	4-4¼x5½-29.0	2	cent.	G&O.	sq-t-cst.	sing.	Eismn	hand.	ltg.	Nlite.	75	cent.	Wau.	motor.
Acason L	3½	3,700	172	Savg.	p-stl.	s-flex.	s.	36x5	36x5d	wd.	Wau.	4-4¼x6¾-29.0	2	cent.	G&O.	sq-t-cst.	sing.	Eismn	hand.	ltg.	Nlite.	75	cent.	Wau.	motor.
Acason M	5	4,700	172	Savg.	p-stl.	s-flex.	s.	36x6	40x6d	c-s.	Wau.	4-4¾x6¾-36.1	2	cent.	G&O.	sq-t-cst.	sing.	Eismn	hand.	ltg.	Nlite.	75	cent.	Wau.	motor.
Acason Light Tractor	6	2,950	114				s.	36x4	36x7		Wau.	4-4¼x5½-29.0	2	cent.			sing.	Eismn	hand.	ltg*			cent.	Wau.	motor.
Acason Heavy Tractor	10	4,300	130				s.	36x5	36x5d		Wau.	4-4¾x6¾-36.1	2	cent.			sing.	Eismn	hand.	ltg*			cent.	Wau.	motor.
Acme B	1	1,950	130	Smth.	p-stl.	s-flex.	s.	34x3½	34x5	wd.	Con.	4-3¾x5-22.5	4	ther.	Long.	fin-sht.	sing.	Eismn	hand.	opt.	G&D.		cent.	Duplx.	
Acme A	2	2,750	148	Smth.	p-stl.	s-flex.	s.	36x4	36x7	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	G&O.	fin-cst.	sing.	Eismn	hand.	ltg.		85	cent.	Duplx.	gst.
Acme C	3½	3,650	168	Smth.	p-stl.	s-flex.	s.	36x5	40x5d	wd.	Con.	4-4½x5½-32.4	2	cent.	G&O.	fin-cst.	sing.	Eismn	hand.	ltg.		85	cent.	Duplx.	motor.
Acme E	5	4,750	180	Smith.	p-stl.	s-flex.	s.	36x6	40x6d	c-s.	Con.	4-4¾x6-36.1	2	cent.	G&O.	fin-cst.	sing.	Eismn	hand.	none	none		l-b.	Con.	motor.
Air-O-Flex 183	2		146	own	p-stl.	s-flex.	s.	36x4	36x7	wd.	Con.	4-4⅛x5¼-27.2	4	cent.		fin-cst.	sing.	A-K.	hand.	s,l&i2	Bijur.		cent.	Duplx.	motor.
All American AA	1	1,295	130	Dtrt.	p-stl.	s-flex.	p&s.	33x4	32x4	wd.	H-S.	4-3¼x5-16.9	4	ther.	Stan.	cel-cst.	sing.	Dixie.	fix.	none	none		none	none	none.
American E	2						s.	36x4	36x7		Buda	4-4¼x5½-29.0					sing.	Eismn	auto		West.		cent.	Pierce.	motor.
American E	3½						s*	36x5	36x10		Buda	4-4¼x5½-29.0					sing.	Eismn	auto		West.		cent.	Pierce.	motor.
American E	5						s*	36x6	40x12		Buda	4-4½x6-32.4					sing.	Eismn	auto		West.		cent.	Pierce.	motor.
Armleder HW	2		166	Smth.	p-stl.	s-flex.	s.	36x4	36x4d	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Long.	fin-c-st.	sing.	Bosch.	hand.	none	none		suc.	Pierce.	motor.
Armleder KW	3½		186	own	rol-i.	flex.	s.	36x5	36x5d	wd.	Con.	4-4½x5½-32.4	2	cent.	own.	fin-c-a.	sing.	Bosch.	hand.	none	none		suc.	Pierce.	motor.
Atlas 19	½	1,135	118	Prsh.	p-stl.		pnu.	32x4	32x4	wd.	Lyc.	4-3½x5-19.6	4	ther.	Jas.	sq-t-pst.	sing.	Remy.	hand.	sl&i	Remy				
Atterbury 7R	1½	2,575	140½	Savg.	p-stl.	flex.	s.	36x3½	36x5	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Long.	fin-c-a.	sing.	Eismn	fix.	none	none	none	cent.	Pierce.	motor.
Atterbury 7C	2	2,975	153½	Savg.	p-stl.	flex.	s.	36x4	36x4d	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Long.	fin-c-a.	sing.	Eismn	fix.	none	none	none	cent.	Pierce.	motor.
Atterbury 7D	3½	3,875	167½	Savg.	p-stl.	flex.	s.	36x5	40x5d	wd.	Con.	4-4½x5½-32.4	2	cent.	Long.	fin-c-a.	sing.	Eismn	hand.	none	none	none	cent.	Pierce.	motor.
Atterbury 8E	5	4,975	167½	Savg.	p-stl.	flex.	s.	36x5	40x6d	c-s.	Con.	4-4¾x6-36.1	2	cent.	own.	fin-c-a.	dual.	Eismn	hand.	ltg2.	Delco.	none	l-b.	Con.	motor.
Autocar XXI-F	2	2,050	97	own	p-stl.	s-flex.	opt.	34x4s	34x5s	wd.	own.	2-4¾x4½-18.1	1	cent.	own.	fin-sht	sing.	Bosc*.	fix.	none	none	none	none	none	none.
Autohorse 10	5	2,100		own	rol-c.	rigid.	s.	34x10		wd.	Con.	4-3¾x5-22.5	4	cent.	Eur.	zz-t-ps.	sing.	Koko.	hand.	none	none	none	cent.	opt.	
Available 1	1	2,250	132				s.	36x3½	36x5		Con.	4-3¾x5-22.5	4	ther.			sing.	Bosch.	fix.						
Available 2	2	2,950	144	own	rol-c.	s-flex.	s.	36x4	36x6	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Chgo	fin-p-stl.	sing.	Bosch.	fix.	none	none	none	cent.	Pierce.	motor.
Available 3	3½	4,200	150	own	rol-c.	s-flex.	s.	36x5	40x5d	wd.	Con.	4-4½x5½-32.4	2	cent.	Chgo	fin-p-stl.	sing.	Bosch.	fix.	none	none	none	cent.	Pierce.	motor.
Available 5	5	4,900	168				s.	36x6	40x6d		Con.	4-4½x5½-32.4	2	cent.			sing.	Bosch.	fix.				cent.	Pierce.	motor.
Beck A	1	1,350	124	P&B.	p-stl.		s.	34x3	34x4	wd.	Con.	4-3½x5-19.6	4	ther.	Idl.	cel-sht.			fix.				cent.	Pierce.	motor.
Beck B	1½	1,950	144	P&B.	p-stl.		s.	34x3½	34x5	wd.	Con.	4-3¾x5-22.5	4	ther.	Idl.	cel-sht.		Bosch.	fix.				cent.	Pierce.	motor.
Beck C	2	2,250	144	P&B.	p-stl.		s.	36x3½	36x6	wd.	Con.	4-4⅛x5¼-27.2	4	g-p.	Idl.	cel-cst.		Bosch.	fix.				cent.	Pierce.	motor.
Beech Creek 3A	3	3,850	132				s.	36x6	36x6		Wau.	4-4¼x5½-29.0	2	cent.			sing.	Eismn	hand.				cent.	Wau.	motor.
Bessemer G	1	1,450	124	Savg.	p-stl.	s-flex.	s.	34x3½	34x4	wd.	Con.	4-3½x5-19.6	4	ther.	Idl.	cel-sht.	sing.	Spltf.	hand.	none	none		none	none	none.
Bessemer H	1½	1,945	144	P&B.	p-stl.	s-flex.	s.	36x3½	36x5	wd.	Con.	4-3¾x5-22.5	4	ther.	Idl.	cel-cst.	sing.	Spltf.	hand.	opt.	opt.		none	none	none.
Bessemer J	2	2,490	158	P&B.	p-stl.	s-flex.	s.	36x4	36x4d	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Idl.	cel-cst.	sing.	Spltf.	hand.	opt.	opt.		cent.	Pierce.	motor.
Bessemer K	3½	3,450	175	P&B.	p-stl.	s-flex.	s.	36x5	36x5d	wd.	Con.	4-4½x5½-32.4	2	cent.	Idl.	cel-cst.	sing.	Spltf.	hand.	opt.	opt.		cent.	Pierce.	motor.
Bethlehem D	1½	1,965	136	Dtrt.	p-stl.	s-flex.	s.	34x3½	34x5	wd.	N.A.	4-3¾x4½-22.5	2	ther.	Fed.	cel-cst.	sing.	A-K.	hand.	sl&i2.	G&D*		suc.	Mnrch.	motor.
Bethlehem E	2½	2,365	144	Dtrt.	p-stl.	s-flex.	s.	34x4	34x6	wd.	N.A.	4-4 x4½-25.6	2	ther.	Fed.	cel-cst.	sing.	A-K.	hand.	sl&i2.	G&D*		suc.	Mnrch.	motor.
Bethlehem F	3½	2,365	162	Dtrt.	p-stl.	s-flex.	s.	34x4	34x5d	wd.	N.A.	4-4⅜x6-30.6	2	g-p.	Fed.	cel-cst.	sing.	A-K.	hand.	sl&i2.	G&D*		suc.	Mnrch.	motor.
Bourne VM	2	3,500	143				s.	36x4	36x8		Herc.	4-4 x5½-25.6	1	cent.			sing.	Eismn	fix.	s&l	Entz.		cent.	Simplx.	motor.
Bourne XM	3½	4,200	160	own			s.	36x5	36x10		Herc	4-4¼x5½-29.0	1	cent.			sing.	Eismn	fix.	s&l	Entz.		cent.	Simplx.	motor.
Brinton H	1	1,500	125	own			pnu.	33x4½	33x4½	wd.	Wis.	4-3¼x5-16.9	4	ther.		fin-sht.	sing.		fix.				none	none	
Brinton F	2½	3,000	140				s.	36x4	36x6	wd.	Con.	4-4⅛x5¼-27.2	4	cent.		fin-sht.	sing.	Bosch.	fix.			none	cent.	Pierce.	motor.
Briscoe 4-24	½	885	104	own	p-stl.	s-flex.	pnu.	31x4	31x4	wd.	own.	4-3 3/16x5⅛-16.2	4	ther.	S-W.	zz-t-sht.	sing.	Conn.	hand.	sl&i2.	Aut-L.	none	none	none	
Briscoe T-34	1		121	Prsh.	p-stl.	s-flex.	p&s.	33x4	34x4	wd.	own.	4-3⅜x5-18.2	4	ther.	Perf.	zz-t-cst.	sing.	Conn.	hand.	sl&i2.	Aut-L.	none	none	none	
Brockway J2	1½	2,450	140	Prsh.	p-stl.	s-flex.	s.	36x3½	36x5	wd.	Con.	4-3¾x5-22.5	4	ther.	Bush.	fin-cst.	sing.	Eismn	fix.	none	none	none	none	none	none.
Brockway K3	2	2,850	148	Prsh.	p-stl.	s-flex.	s.	36x4	36x7	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Bush.	fin-cst.	sing.	Eismn	hand.	none	none	none	none	none	none.
Brockway R	3½	3,750	164	Prsh.	p-stl.	s-flex.	s.	36x5	36x5d	wd.	Con.	4-4½x5½-32.4	2	cent.	Bush.	fin-cst.	sing.	Eismn	hand.	none	none	none	none	none	none.
Chase A	1	1,725	138				s.	36x3½	36x5		Wau.	4-3½x5¼-19.6	4				sing.	Bosch.	fix.				suc.	Mnrch.	motor.
Chase C	1½	2,025	149				s.	36x3½	36x6		Wau.	4-3½x5¼-19.6	4				sing.	Bosch.	fix.				suc.	Mnrch.	motor.
Chase B	2½	2,475	160				s.	36x4	36x4d		Buda	4-4⅛x5¼-27.2	4				sing.	Bosch.					suc.	Mnrch.	motor.
Chase X	3	2,800	160				s.	36x4	36x5d		Buda	4-4⅛x5¼-27.2	4				sing.	Bosch.	fix.				suc.	Mnrch.	motor.
Chase O	3½	3,000	175				s.	36x5	36x5d		Con*	4-4½x5½-32.4	2				sing.	Bosch.	hand.	s&l	Dneto.		suc.	Mnrch.	motor.
Chevrolet T	1		125	own	rol-c.	s-flex.	p&s.	31x4	32x4	wd.	own.	4-3 11/16x5¼-21.7	4	cent.	Har.	cel-pst.	sing.	Remy.	hand.	sl&i2.	Aut-L.		suc.	Mnrch.	motor.

ABBREVIATIONS—Types of Construction

*Other Options
amid—amidships
auto—automatic
bevl—bevel
c—center
c&l—center and left
c&s—cushion and solid
cent—centrifugal
c-s—cast steel
c-a—cast aluminum
cel-cst—cellular core, cast case
cel-pst—cellular core, pressed steel case
cel-sht—cellular core, sheet case
chn—chain
cylinders cast, 2 in pairs
cylinders cast, 4 in block
cylinders cast, 3 in threes
cylinders cast, 1 singly
d-d—dry disk
d-p—dry plate
d-rd—double reduction
d-s—driveshaft
elec—electric
ext-d-s—external driveshaft
ext-f-w—external front wheels
ext-g—external gear
ext-jst—external jackshaft
ext-r-w—external rear wheel
fab—fabric
fin—finned tube
fin-c-a—finned tube core, cast aluminum case
fin-cst—finned tube core, cast case
fin-pst—finned tube core, pressed steel case
fin-sht—finned tube core, sheet case
fix—fixed
flex—flexible
fric—friction
g.p.—gear pump
grav—gravity
gset—gearset
hyd—hydraulic
ind-c—individual clutch
int-d-s—internal driveshaft
int-f-w—internal front wheels
in-g—internal gear
in-g-4—internal gear drive on 4 wheels
int-r-w—internal rear wheel
jst—unit with jackshaft
l—left
l&c—left and center
leat—leather
l-b—loose ball
ltg—lighting
metl—metal
mtr—unit with motor
opt—optional
p—plate in oil
pist—piston pump
plan—planetary
pnu—pneumatic
pres—pressure
prog—progressive sliding gearset
p-t-c-a—plain tube core, cast aluminum case
p-t-cst—plain tube core, cast case
p-stl—pressed steel
p&s—pneumatic and solid
r—right
r-ax—unit with rear axle
rng-cst—ring core, cast case
rol-c—rolled channel
rol-i—rolled I-beam
r-rd—radius rods
selec—selective sliding gear
s-flex—semi-flexible
stg—starting
s&l—starting and lighting
s,l&i—starting, lighting and ignition
s,l&i2—starting, lighting and ignition, two-unit
sing—single
s—solid
s&c—solid and cushion
spgs—springs
sq-t-cst—square tube core, cast iron
sq-t-sht—square tube core, sheet case
stk—stock
sub-f—sub-frame
suc—suction
s-bev—spiral bevel
ther—thermo-syphon
tor-a—torque arm
t-t—torsion tube
unt-x—unit with axle
vacm—vacuum
wd—wood
w-d—multiple disk in oil
worm—top worm
w-p—wet plate
zz-t-cst—zig zag tube core, cast case
zz-t-pst—zig zag tube core, pressed steel case
zz-t-sht—zig zag tube core, sheet case

# of Gasoline Motor Trucks for 1919

As Produced by 219 American Manufacturers—Full Particulars on Types Rear Axles, Steering Gears, Governors and Also Electric and Fuel Systems

Engine: Speed: Motor in R.p.m.	Engine: Speed: Truck in M.p.h.	Engine: Fuel Sys.: Carburetor Make	Engine: Fuel Sys.: Fuel Feed	Transmission: Clutch: Type	Transmission: Clutch: Make	Transmission: Gearset: Type	Transmission: Gearset: Make	Transmission: Gearset: Placed	Transmission: Gearset: Speeds	Transmission: Final Drive: Type	Transmission: Final Drive: Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Brakes: Foot	Brakes: Hand	Control: Steering Gear: Placed	Control: Steering Gear: Make	Control: Levers	Universals: Type	Universals: Make	Name and Model
		Schblr.	grav.	none	none	elec.	none	amid.	2	in-g.	own.		r-rd.	r-rd.	Perf.	ext-r-w.	ext-f-w.	r.	Gem.	r.	metl.	Franck.	A. & B. 3T
		Schblr.	grav.	none.	none.	elec.	none.	amid.	2	in-g.	own.		r-rd.	r-rd.	Perf.	ext-r-w.	ext-f-w.	r.	Gem.	r.	metl.	Franck.	A. & B. 5T
1,500	18	Stmbg.	vacm.	d-p.	B-Beck.	selec.	Cover.	mtr.	3	worm	Timkn.	9.2	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.		Ross.		metl.	Spicer.	Acason B
1,200	15	Stmbg.	vacm.	d-d.	Muncie	selec.	Muncie	mtr.	4	worm	Timkn.	8.75	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.	r.	Ross.	c.	metl.	Blood.	Acason H
1,200	12	Stmbg.	vacm.	d-d.	Muncie	selec.	Muncie	mtr.	4	worm	Timkn.	10.33	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.	r.	Ross.	c.	metl.	Blood.	Acason L
1,000	10	Stmbg.	vacm.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	3	worm	Timkn.		spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.	r.	Ross.	c.	metl.	Blood.	Acason M
1,200	15	Stmbg.	vacm.	d-d.	Muncie	selec.	Muncie	mtr.	4	worm	Timkn.	9.25	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.		Ross.		metl.	Spicer.	Acason Light Tractor
1,000	10	Stmbg.	vacm.	d-p.	B-Beck.	selec.	Cotta.	mtr.	3	worm	Timkn.	10.33	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.		Ross.		metl.	Spicer.	Acason Heavy Tractor
1,700	22	Rayfld.	vacm.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	3	worm	Timkn.	7.75	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Blood.	Acme B
1,500	17½	Rayfld.	vacm.	d-p.	B-Beck.	ind-c.	Cotta.	mtr.	3	worm	Timkn.	8.50	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Blood.	Acme A
1,200	14	Rayfld.	vacm.	d-p.	B-Beck.	ind-c.	Cotta.	amid.	3	worm	Timkn	12	r-rd.	spgs.	Dtrt.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Blood.	Acme C
1,250	12½	Rayfld.	vacm.	d-p.	B-Beck.	ind-c.	Cotta.	amid.	3	worm	Timkn.	11.66	r-rd.	spgs.		int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Blood.	Acme E
1,800	30	Stmbg.	grav.	d-p.	Hoosier	selec.	B-Lipe.	amid.	4	in-g.	Russl.		r-rd.	r-rd.		ext-d-s.	ext-r-w.	l.	Lavn.	c.	metl.	Spicer.	Air-O-Flex 183
2,250	32.9	Zenith.	grav.	d-p.	B-Beck.	selec.	G-Lees.	mtr.	3	in-g.	Torbn.	6.5	spgs.	spgs.	Rowl.	ext-r-w.	int-r-w.	l.	Ross.	c.	metl.	Dtrt.	All American AA
		Schblr.			B-Lipe.	ind-c.	B-Lipe.			worm	Timkn.							r.	Ross.	r.	none.	none.	American E
		Schblr.			B-Lipe.	ind-c.	B-Lipe.			worm	Timkn.							r.	Ross.	r.	none.	none.	American E
		Schblr.			B-Lipe.	ind-c.	B-Lipe.			worm	Timkn.							r.	Ross.	r.	none.	none.	American E
1,100	16	Schblr.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Timkn.	8.75	r-rd.	spgs.	Mthr.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer*.	Armleder HW
1,100	14	Schblr.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Timkn.	8.75	r-rd.	spgs.	Mthr.	int-d-s.	int-r-w.	l.	Ross.	c.	metl.	Spicer*.	Armleder KW
1,800	30	Carter.	grav.	d-d.	B-Beck.	selec.	own.	mtr.	3	bevl.	Hess.		spgs.	spgs.	Rowl.	ext-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Arvac.	Atlas 19
1,200	15	Zenith.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm	Timkn.	8.5	spgs.	spgs.	S-P.	int-r-w.	int-r-w.	r.	Gem.	r.	metl.	Spicer.	Atterbury 7R
1,200	15	Zenith.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm	Timkn.	8.5	spgs.	spgs.	S-P.	int-r-w.	int-r-w.	r.	Gem.	r.	metl.	Spicer.	Atterbury 7C
1,125	13	Zenith.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm	Timkn.	10.33	spgs.	spgs.	S-P.	int-r-w.	int-r-w.	r.	Gem.	r.	metl.	Spicer.	Atterbury 7D
1,000	10.5	Zenith.	vacm.	d-p.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm	Timkn.	11.6	r-rd.	tor-a.	Perf.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Atterbury 8E
		Stmbg.	grav.	d-p.	own.	prog.	own.	amid.	3	d-rd.	own.		spgs.	spgs.		ext-r-w.	int-r-w.	r.	own.	r.	metl.		Autecar XXI-F
1,200	15	Stmbg.	grav.	d-p.	B-Beck.	selec.	Dtrt.	amid.	3	in-g.	own.	11.4	tor-a.	spgs.	Champ.	ext-dst.	int-f-w.	c.	own.	r.	metl.	own.	Autohorse 10
		Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Timkn.	7.0	r-rd.	spgs.	Tut.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Available 1
1,100	15	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	3	worm	Timkn.	7.75	r-rd.	spgs.	Tut.	int-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Spicer.	Available 2
1,100	13	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm	Timkn.	10.3	r-rd.	spgs.	Tut.	int-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Spicer.	Available 3
1,175	12	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Timkn.	11.7	r-rd.	spgs.	Tut.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Available 5
1,500		Stmbg.	grav.	d-d.	Fuller.	prog.	Fuller.	mtr.	3	in-g.	Clark.	3	spgs.		Hig.	int-r-w.	ext-r-w.	l.	Lavn.	c.	metl.	Blood.	Beck A
1,500		Stmbg.		d-d.	Fuller.	prog.	Fuller.	mtr.	3	in-g.	Clark.	6	spgs.			int-r-w.	ext-r-w.	l.	Lavn.	c.	metl.	Blood.	Beck B
1,200		Stmbg.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	in-g.	Clark.	9	spgs.	spgs.	Hig.	ext-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Blood.	Beck C
1,000	12	King.	vacm.	d-p.	B-Beck.	selec.	own.	amid.	6	bevl-4.	own.	8	r-rd.	spgs.		ext-d-s.	ext-r-w.		own.				Beech Creek 3A
1,550	22½	Zenith.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	in-g.	Torb.	7	spgs.	spgs.	Perf.	ext-r-w.	int-r-w.	l.	Ross.	c.	metl.	Arvac.	Bessemer G
1,340	18	Zenith.	grav.	d-p.	B-Beck.	prog.	B-Lipe.	amid.	3	in-g.	Torb.	8	spgs.	spgs.	Perf.	ext-r-w.	int-r-w.	l.	Ross.	c.	metl.	Arvac.	Bessemer H
1,000	13	Rayfld.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	in-g.	Torb.	8	spgs.	spgs.	Perf.	ext-r-w.	int-r-w.	l.	Ross.	c.	metl.	Arvac.	Bessemer J
1,200	12	Rayfld.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	in-g.	Torb.	10.25	r-rd.	spgs.	Perf.	int-r-w.	ext-d-s.	l.	Ross.	c.	metl.		Bessemer K
1,358	18	Schblr.	grav.	d-p.	B-Beck.	selec.	Dtrt.	mtr.	3	in-g.	Russl.	7.7	spgs.	spgs.	Shel.	ext-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Univ.	Bethlehem D
1,303	15	Schblr.	grav.	d-p.	B-Beck.	selec.	Dtrt.	mtr.	3	in-g.	Russl.	8.2	spgs.	spgs.	Shel.	ext-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Univ.	Bethlehem E
1,113	12	Schlbr.	grav.	d-p.	B-Beck.	selec.	Dtrt.	mtr.	3	in-g.	Russl.	9.4	spgs.	spgs.	Shel.	ext-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Univ.	Bethlehem F
1,280	15	Zenith.	grav.		Entz.		Entz.	mtr.		worm	Timkn.	8.5	r-rd.	spgs.	Mthr.	int-r-w.	int-r-w.		Ross.		metl.	Blood.	Bourne VM
1,100	12	Zenith.	grav.		Entz.		Entz.	mtr.		worm	Timkn.	10.3	r-rd.	spgs.	Mthr.	int-r-w.	int-r-w.		Ross.			Blood.	Bourne XM
			pres.	d-d.		selec.		mtr.	3	worm		6.2	spgs.	spgs.		int-r-w.	int-4-w.	l.		c.			Brinton H
			grav.	d-d.		selec.		mtr.	3	worm		7.75	spgs.	spgs.		int-r-w.	int-r-w.	l.		c.			Brinton F
		Buick.	grav.	cone.	own.	prog.	own.	r-ax.	3	bevl.	own.	4.23	tor-a.	tor-a.	Alloy.	ext-r-w.	int-r-w.	l.	own.	l&c.	metl.	own.	Briscoe 4-24
	25	Buick.	grav.	cone.	own.	prog.	own.	mtr.	3	in-g.	Russl.	8.2	spgs.	spgs.	Alloy.	ext-r-w.	int-r-w.	l.		l&c.	metl.	Univ.	Briscoe T-34
		Schblr.	grav.	cone.	Hart.	selec.	B-Lipe.	amid.	3	worm	Timkn.	8.5	spgs.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Brockway J2
		Schblr.	grav.	cone.	Hart.	selec.	B-Lipe.	amid.	3	worm	Timkn.	8.5	r-rd.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Brockway K3
		Schblr.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	3	worm	Timkn.	10.33	r-rd.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Brockway R
1,200	18	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Shel.	7.2	spgs.	spgs.	Perf.	int-r-w.	int-r-w.		Lavn.				Chase A
1,000	16	Stmbg.	grav.	d-p.	B-Beck.	selec.	Cotta.	mtr.	3	worm	Shel.	8.6	spgs.	spgs.	Perf.	ext-r-w.	int-r-w.		Lavn.				Chase C
1,000	14	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Shel.	8.66	spgs.	spgs.	Perf.	ext-r-w.	int-r-w.		Lavn.				Chase B
1,000	12	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Salsby.	9.25	spgs.	spgs.	Perf.	int-r-w.	int-r-w.		Lavn.				Chase X
1,000	12	Stmbg.	grav.	w-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm	Shel.	8.75	spgs.	tor-a.	Perf.	ext-r-w.	ext-r-w.		Lavn.				Chase O
1,000	25	Zenith.	grav.	cone.	own.	selec.	Warner	mtr.	3	worm	Ind.	4	spgs.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Warn.	r.	metl.	Arvac.	Chevrolet T

ABBREVIATIONS—Makers of Parts

*Other Options
A-K—Atwater-Kent
Al-Ch—Allis-Chalmers
Aut-L—Auto-Lite
B-Beck—Borg & Beck
B-Lipe—Brown-Lipe
Blng—Berling
Brem—Bremer
Can—Candler
Cant—Canton-Cleveland
CAS—C.A.S. Products Co.
Champ—Champion Spng
Chcgo—Chicago-Stndrd.
Chgo—Chicago Mfg. Co.
Con—Continental
Conn—Connecticut
Cover—Covert
Del—Delany
Ditw—Ditweiler
Dncto—Dyneto
Dtrt—Detroit Press. Stl.
Dtrt—Detroit Lubricat.
Dtrt—Detroit G. & M. Co.
Dtrt—Detroit Stl. Spng.
Duplx—Duplex
E&M—English & Mersick
Eismn—Eisemann
Emp—Empire
Ens—Ensign
Eur—Eureka
Fed—Fedders
Flech—Fletcher
Fost—Foster
Franck—Francke
G&D—Gray & Davis
G&O—G. & O. Mfg. Co.
GBS—Golden, Belknap & Swartz
G-Lees—Grant-Lees
Gem—Gemmer
H&N—H. & N. Carburetor Co.
Har—Harrison
Hart—Hartford
Hays—Hayes
Her—Hercules
Hig—Higgins
Hol—Holley
H-Shaw—Hele-Shaw
H-S—Herschell-Spillman
Hyd—Hydraulic
Idl—Ideal
Ind—Industrial Eqpt. Co.
Iron—Iron City
J-A—Jackson Radiator Wks.
Jacox—Jackson-Church-Wilcox
Jas—Jamestown Car Pts. Co.
Jhnson—Johnson
Kal—Kalamazoo
K-B—Kinsler-Bennett
Key-H—Keystone-Hindley
King—Kingston
Koko—Kokomo
Lau—Lauraine
Lavn—Lavine
LeR—LeRoi
Lgt—Light Foundry
Ligt—Liggett
L-N—Leece Neville
Lyc—Lycoming
Marvl—Marvel
Mast—Master
McC—McCord
McFar—McFarland
Mech—Mechanics
Merl—Merrill
Mil—Milwaukee
Mnrch—Monarch
Mod—Modine
Mthr—Mather
M&E—Merchant & Evans
Natl—National
N.A.—North American
N-E—North East
Nlite—Nicolite
Penn—Penn Spring Co.
P&B—Parish & Bingham
Per—Perfex
Perf—Perfection
Prsh—Parish
R-T—Rome-Turney
Rayfld—Rayfield
Rem—Remy
Rowl—Wm. Harvel Rowland
Rugles—Ruggles
Russl—Russel
Rut—Rutenber
Savg—Savage Arms
Salsby—Salisbury
Schblr—Schebler
Shel—Sheldon
Shkspr—Shakespeare
Smth—A. O. Smith
S-P—Spring-Perch
Spltf—Splitdorf
Stan—Standard Radiator Co.
Stand—Standard Steel Spring Co.
Stewrt—Stewart
Stlg—Sterling
Stmbg—Stromberg
Sundmn—Sunderman
S-W—Sparks-Withington
Therm—Thermoid
Timkn—Timken
Tltsn—Tillotson
Torbn—Torbensen
Tut—Tuthill
Univ—Universal Machine Co.
Wau—Waukesha
West—Westinghouse
Wis—Wisconsin
Wol—Wohlrab
W-W—Walker-Weiss

Detailed Technical Specifications of

Name and Model	Tons Capacity	Chassis Price	Wheelbase Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Size in Ins. Front	TIRES Size in Ins. Rear	Wheels	ENGINE Make	No. Cyl., Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	COOLING Water Circ.	COOLING Radiator Make	COOLING Radiator Core and Case	IGNITION Type	IGNITION Make	IGNITION Spark Advance	ELEC. SYSTEM Type	ELEC. SYSTEM Make	ELEC. SYSTEM Extra Cost, $	GOVERNOR Type	GOVERNOR Make	Drive
Clydesdale 65	2		163	P&B	p-stl	s-flex	s	36x4	36x4d	wd	Con	4-4⅛x5½-27.2	4	cent	own	p-t-c-a	sing	Bosch	hand				cent	own	motor
Clydesdale 90	3½		180	P&B	p-stl	s-flex	s	36x5	40x5d	wd	Con	4-4½x5½-32.4	2	cent	own	p-t-c-a	sing	Bosch	hand				cent	own	motor
Clydesdale 120B	5		204	P&B	p-stl	s-flex	s	36x5	40x6d	c-s	Con	4-4¾x6 -36.1	2	cent	own	p-t-c-a	sing	Bosch	hand				cent	own	motor
Collier 16	1½	$1,375	128	P&B	p-stl	s-flex	pnu	33x4½	33x4½	wd	Lyc	4-3½x5 -19.6	4	ther	Jas	zz-t-pst	sing	Conn	hand	sl&i2	Aut-L				none
Columbia E	2	2,350	144	own	rol-c	flex	s	36x4	36x6	wd	Con	4-4⅛x5¼-27.2	4	cent	Long	fin-cst	sing	Spltf	hand	ltg	Vesta	75	cent	Pierce	motor
Columbia T	6	2,350	112	own	rol-c	flex	s	36x4	36x6	wd	Con	4-4⅛x5¼-27.2	4	cent	Long	fin-cst	sing	Spltf	hand	ltg	Vesta	75	cent	Pierce	motor
Comet	1½	1,575	130				s	34x4	34x4		Lyc	4-3½x5 -19.6		ther				Delco		stg	Dneto				
Commerce E	1	1,500	126	Dtrt	p-stl	flex	s	34x3	34x4	wd	Con	4-3¾x5 -22.5	4	ther	Long	fin-cst	sing	Spltf	fix	s&l2	Bijur		cent	Pierce	d-s
Concord A	1½	2,450	140	P&B	p-stl	s-flex	s	36x3½	36x5	wd	Buda	4-3¾x5¼-22.5	4	cent	Bush	fin-cst	sing	Eismn	hand				suc	Mnrch	motor
Concord B	2½	2,850	150	P&B	p-stl	s-flex	s	36x4	36x4d	wd	Buda	4-4¼x5½-29.0	4	cent	Bush	fin-cst	sing	Eismn	hand				suc	Mnrch	motor
Corbitt E	1	2,000	130		p-stl	flex	opt	34x3½	34x4	wd	Con	4-3¾x5 -22.5	4	ther	Idl	cel-sht	sing	Eismn	hand	sl&i2	Disco	100	cent	Pierce	motor
Corbitt D	1½	2,400	138		p-stl	flex	opt	36x3½	36x5	wd	Con	4-3¾x5 -22.5	4	ther	Idl	cel-sht	sing	Eismn	hand	sl&i2	Disco	100	cent	Pierce	motor
Corbitt C	2	3,000	148		p-stl	flex	s	36x4	36x7	wd	Con	4-4⅛x5¼-27.2	4	cent	R-T	fin-cst	sing	Eismn	hand	none	none		cent	Pierce	motor
Corbitt B	2½	3,200	148		p-stl	flex	s	36x4	36x7	wd	Con	4-4⅛x5¼-27.2	4	cent	R-T	fin-cst	sing	Eismn	hand	none	none		cent	Pierce	motor
Corbitt A	3½	4,000	168		rol-c	rigid	s	36x5	36x5d	wd	Con	4-4½x5½-32.4	2	cent	R-T	fin-cst	sing	Eismn	hand	none	none		cent	Pierce	motor
Corbitt AA	5	4,500	168		rol-c	rigid	s	36x6	40x6d	c-s	Con	4-4½x6 -32.4	2	cent	R-T	fin-cst	sing	Eismn	hand	none	none		cent	Pierce	motor
Corliss A	¾	800*	100		p-stl	rigid	pnu	31x4	31x4	wd	Mil	4-3⅛x4½-15.6	4	ther		fin-sht	sing	Spltf	hand						
Couple-Gear HC	3½	6,000	144				s	36x4d	36x4d		Con	4-4¾x6 -36.1	1				dual	Eismn	fix	ltg					
Couple-Gear AC	5	6,600	144*				s	36x5d	36x5d		Wis	4-5¼x7 -44.1	1				dual	Eismn	fix	ltg			cent		f-whl
Crece 17	½	825	108		p-stl		p&s	32x4	32x4		Wis	4-3¼x5 -16.9	4				sing	Bosch	fix						
Dart E	1	2,100	130	Savg	p-stl	s-flex	s	34x3½	34x5	wd	Buda	4-3½x5¼-19.6	4	ther	Idl	cel-sht	sing	Eismn	hand	s&l	Bijur	200	none	none	
Dart CC4	2	2,950	150	Savg	p-stl	s-flex	s	36x4	36x7	wd	Buda	4-4¼x5½-29.0	4	cent	Idl	cel-cst	sing	Eismn	hand	s&l	Bijur	200	cent	Pierce	motor
Dart L	3½	4,000	160		rol-c	rigid	s	36x5	36x10	wd	Buda	4-4½x6 -32.4	4	cent	Per	cel-c-a	sing	Eismn	hand	s&l	Bijur	200	cent	Pierce	motor
D-E J	¾	1,050	108	Prsh	p-stl	s-flex	pnu	33x4	33x4	wd	L-R	4-3⅛x4½-15.6	4	ther	Bush	fin-sht	sing	Blng	hand	s&l	Al-Ch				
D-E A	1	1,775	128	Savg	p-stl	s-flex	s	34x3	34x4	wd	Con	4-3½x5 -19.6	4	ther	Bush	fin-cst	sing	Blng	fix				suc	Mnrch	motor
D-E B	1½	2,075	144	Savg	p-stl	s-flex	s	34x3½	34x5	wd	Con	4-3¾x5 -22.5	4	ther	Bush	fin-cst	sing	Blng	fix				suc	Mnrch	motor
D-E D	2	2,150	128	Savg	p-stl	s-flex	s	34x4	34x6	wd	Con	4-3¾x5 -22.5	4	ther	Bush	fin-cst	sing	Blng	fix				suc	Mnrch	motor
D-E C	2½	2,750	150	Savg	p-stl	s-flex	s	36x4	36x7	wd	Buda	4-4¼x5½-29.0	4	cent	Bush	fin-cst	sing	Blng	fix				suc	Mnrch	motor
D-E E	5	4,500	170	Savg	p-stl	rigid	s	36x5	40x6d	wd	Buda	4-4½x6 -32.4	4	cent	Bush	fin-cst	sing	Blng	fix				suc	Mnrch	motor
Defiance B	1½	1,795	135	Dtrt	p-stl	s-flex	s	34x3½	34x5	wd	Con	4-3¾x5 -22.5	4	ther	Perf	cel-cst	sing	Eismn	hand	ltg	Delco	150	suc	Mnrch	motor
DeKalb E-2	2	2,100	134	Prsh	p-stl	rigid	s	34x3½	36x5	wd	Con	4-4⅛x5¼-27.2	4	cent	J-A	cel-pst	sing	Eismn	hand	none	none	none	none	none	none
DeKalb E-2½	2½	2,600	136	Prsh	p-stl	rigid	s	36x4	36x6	wd	Con	4-4½x5½-32.4	4	cent	J-A	cel-pst	sing	Eismn	fix	none	none	none	none	none	none
Denby 12	1	1,650	124	Dtrt	p-stl	s-flex	s	34x3	34x4	wd	Con	4-3½x5 -19.6	4	ther	Long	fin-cst	sing	Eismn	fix	sl&i2	Bijur	150	suc	Mnrch	motor
Denby 13	2	2,350	144	Dtrt	p-stl	s-flex	s	36x3½	36x6	wd	Con	4-3¾x5 -22.5	4	ther	Long	fin-cst	sing	Eismn	fix	sl&i-2	Bijur	150	suc	Mnrch	motor
Denby 15	3	2,775	144	Dtrt	p-stl	s-flex	s	36x4	36x7	c-s	Con	4-3¾x5 -22.5	4	ther	Long	fin-cst	sing	Eismn	fix	sl&i-2	Bijur	150	suc	Mnrch	motor
Denby 210	5	4,900	170	Dtrt	p-stl	s-flex	s	36x6	40x12	c-s	Con	4-4½x5½-32.4	2	cent	Long	fin-cst	sing	Eismn	hand				cent	Duplx	motor
Diamond-T J5	1	2,125	132	Smth	p-stl	flex	s	36x3	36x4	wd	Con	4-3½x5 -19.6	4	ther	G&O	fin-cst	sing	Bosch	fix	none	none	none	cent	Pierce	motor
Diamond-T J4	1½	2,550	154	Smth	p-stl	flex	s	36x3½	36x5	wd	Con	4-3¾x5 -22.5	4	ther	G&O	fin-cst	sing	Bosch	fix	none	none	none	cent	Pierce	motor
Diamond-T J3	2	2,925	154	Smth	p-stl	flex	s	36x4	36x7*	wd	Con	4-4⅛x5¼-27.2	4	ther	G&O	fin-cst	sing		fix	none	none	none	cent	Pierce	motor
Diamond-T LB	3½	4,150	170	Smth	p-stl	flex	s	36x5	36x5d	wd	Con	4-4½x5½-32.4	4	ther	G&O	fin-cst	sing		hand	none	none	none	cent	Pierce	motor
Diamond-T R	5	4,950	170	Smth	p-stl	flex	s	36x6	40x6d	wd	Con	4-4½x5½-32.4	4	ther	G&O	fin-cst	sing		fix	none	none	none	cent	Pierce	motor
Doane 1919	6	5,650	178		rol-c*		s	36x6	40x6d	wd*	Wau	4-4¾x6¾-36.1	2	cent	own	cel-cst	sing	Bosch	auto	none	none	none	cent	Wau	motor
Dorris K4	2	2,985	162	own	p-stl	flex	s	36x4	36x7	wd	own	4-4¼x5½-29.0	4	cent	own	fin-cst	sing	Bosch	hand	s&l2	West	175	cent	own	motor
Douglas TA	1½	2,000	127	own	rol-c	rigid	s*	34x3½	34x5	wd	Buda	4-4⅛x5 -27.2	4	cent	Mayo	fin-cst	sing	Eismn	hand	ltg	Aut-L	none	cent	Pierce	motor
Duplex E	3½	4,000	130	P&B	p-stl	rigid	s	36x6	36x6	wd	Buda	4-4¼x5½-29.0	4	cent	Long	fin-cst	sing	Eismn	hand		opt		cent	Duplx	motor
Ellsworth 25A	¾	855*	108	P&B	p-stl	flex	pnu	30x3½	30x3½	wd	Lyc	4-3¼x5 -16.9	4	ther	Can	cel	sing		hand	sl&i-2	Dneto		none	none	none
Fageol	2	3,300	144				s	34x4	36x7		Wau	4-4 x5½-25.6	2				sing	Dixie	fix				cent	Wau	motor
Fargo P	2	2,200	144	own	rol-c	s-flex	s	36x4	36x6	wd	Con	4-3¾x5 -22.5	4	ther	own	fin-cst	sing	Bosch	hand	none	none	none	suc	Mnrch	motor
Federal S	1	1,900	132	Dtrt	p-stl	s-flex	opt	34x3	34x4	wd		4-3¾x5¼-22.5	4	cent	McC	fin-pst	sing	Eismn	fix	opt	opt		suc	Mnrch	motor
Federal T	1½	2,350	144	Dtrt	p-stl	s-flex	s	36x3½	36x5	wd	Con	4-4⅛x5¼-27.2	4	cent	McC	fin-pst	sing	Eismn	fix	opt	opt		suc	Mnrch	motor
Federal U	2	2,600	144	Dtrt	p-stl	s-flex	s	36x4	36x7	wd	Con	4-4⅛x5¼-27.2	4	cent	McC	fin-pst	sing	Eismn	fix	opt	opt		suc	Mnrch	motor
Federal W	3½	3,350	156		rol-c	s-flex	s	36x5	36x5d	c-s	Con	4-4½x5½-32.4	2	cent	McC	fin-pst	sing	Eismn	fix	opt	opt		suc	Mnrch	motor
Federal X	5	4,400	156		rol-c	s-flex	s	36x6	40x6d	c-s	Con	4-4½x5½-32.4	2	cent	McC	fin-pst	sing	Eismn	fix	opt	opt		suc	Mnrch	motor
Forschler	¾	1,535	120				s	32x2½	32x3		LeR	4-3⅛x4½-15.6	4				sing	Dixie	fix				suc	Mnrch	motor
Forschler	1	2,000	130				s*	34x3	34x4		Con	4-3½x5 -19.6	4				sing	Bosch	fix				suc	Mnrch	motor
Forschler	1½	2,375	138				s	34x3½	34x5		Con	4-3½x5 -19.6	4				sing	Bosch	fix				suc	Mnrch	motor
Forschler	2	2,750	140*				s*	34x4	34x6		Con	4-4⅛x5¼-27.2	4				sing	Bosch	fix				cent	Pierce	motor
Ford TT	1	550	124	P&B	p-stl	flex	p&s	30x3½	32x3½	wd	own	4-3¾x4 -22.5	4	ther	own	fin-sht	sing	own	hand	ltg					
F.W.D. B	3	4,600	124	Prsh	rol-c	s-flex	s	36x6	36x6	wd	Wis	4-4¾x5½-36.1	2	cent	Long	fin-cst	sing	Eismn	hand				cent	Pierce	motor
Fulton FX	1½	1,850	136	P&B	p-stl	flex	s	34x3	34x5	wd	H-S	4-3⅜x5 1/16-18.2	4	ther	G&O	zz-t-cst	sing	Simms	hand	opt	Bijur		cent	Pierce	gsct
Gabriel C	1	2,000	136	Prsh	p-stl	s-flex	pnu	35x5	35x5	wd	Buda	4-4¼x5½-29.0	4	cent	G&O	cel-cst	sing	Bosch	hand	s&l2	L-N	150	none	none	none
Gabriel E	2	3,250	156	Prsh	p-stl	s-flex	opt	36x4	36x7	wd	Buda	4-4¼x5½-29.0	4	cent	G&O	cel-cst	sing	Bosch	hand	s&l2	L-N	150	cent	Duplx	motor
Gabriel F	4	4,300	180	Prsh	p-stl	s-flex	s	36x5	40x6d	c-s	Buda	4-4½x6 -32.4	4	cent	G&O	cel-cst	sing	Bosch	hand	s&l2	L-N	150	cent	Duplx	motor
Garford 75-C	1	2,500	128	own	p-stl	s-flex	p&s	34x4½	36x4	wd	Buda	4-3¾x5¼-22.5	4	cent	own	fin-cst	sing	Spltf	hand	s&l	West	175	cent	Duplx	motor

ABBREVIATIONS—Types of Construction

*Other Options
amid—amidships
auto—automatic
bevl—bevel
c—center
c&l—center and left
c&s—cushion and solid
cent—centrifugal
c-s—cast steel
c-a—cast aluminum
cel-cst—cellular core, cast case
cel-pst—cellular core, pressed steel case
cel-sht—cellular core, sheet case
chn—chain
cylinders cast, 2 in pairs
cylinders cast, 4 in block
cylinders cast, 3 in threes
cylinders cast, 1 singly
d-d—dry disk
d-p—dry plate
d-rd—double reduction
d-s—driveshaft
elec—electric
ext-d-s—external driveshaft
ext-f-w—external front wheels
ext-g—external gear
ext-jst—external jackshaft
ext-r-w—external rear wheel
fab—fabric
fin—finned tube
fin-c-a—finned tube core, cast aluminum case
fin-cst—finned tube core, cast case
fin-pst—finned tube core, pressed steel case
fin-sht—finned tube core, sheet case
fix—fixed
flex—flexible
fric—friction
g.p.—gear pump
grav—gravity
gset—gearset
hyd—hydraulic
ind-c—individual clutch
int-d-s—internal driveshaft
int-f-w—internal front wheels
in-g—internal gear
in-g-4—internal gear drive on 4 wheels
int-r-w—internal rear wheel
jst—unit with jackshaft
l—left
l&c—left and center
leat—leather
l-b—loose ball
ltg—lighting
metl—metal
mtr—unit with motor
opt—optional
p—plate in oil
pist—piston pump
plan—planetary
pnu—pneumatic
pres—pressure
prog—progressive sliding gearset
p-t-c-a—plain tube core, cast aluminum case
p-t-cst—plain tube core, cast case
p-stl—pressed steel
p&s—pneumatic and solid
r—right
r-ax—unit with rear axle
rng-cst—ring core, cast case
rol-c—rolled channel
rol-i—rolled I-beam
r-rd—radius rods
selec—selective sliding gear
s-flex—semi-flexible
stg—starting
s&l—starting and lighting
s,l&i—starting, lighting and ignition
s l&i2—starting, lighting and ignition, two-unit
sing—single
s—solid
s&c—solid and cushion
spgs—springs
sq-t-cst—square tube core, cast iron
sq-t-sht—square tube core sheet case
stk—stock
sub-f—sub-frame
suc—suction
s-bev—spiral bevel
ther—thermo-syphon
tor-a—torque arm
t-t—torsion tube
unt-x—unit with axle
vacm—vacuum
wd—wood
w-d—multiple disk in oil
worm—top worm
w-p—wet plate
zz-t-cst—zig zag tube core, cast case
zz-t-pst—zig zag tube core, pressed steel case
zz-t-sht—zig-zag tube core, sheet case

Gasoline Motor Trucks for 1919—Continued

ENGINE — SPEED — Motor in R.p.m.	ENGINE — SPEED — Truck in M.p.h.	ENGINE — FUEL SYS. — Carbureter Make	ENGINE — FUEL SYS. — Fuel Feed	ENGINE — CLUTCH — Type	ENGINE — CLUTCH — Make	TRANSMISSION — GEARSET — Type	TRANSMISSION — GEARSET — Make	TRANSMISSION — GEARSET — Placed	TRANSMISSION — GEARSET — Speeds	TRANSMISSION — FINAL DRIVE — Type	TRANSMISSION — FINAL DRIVE — Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	BRAKES — Foot	BRAKES — Hand	CONTROL — STEERING GEAR — Placed	CONTROL — STEERING GEAR — Make	CONTROL — Levers	UNIVERSALS — Type	UNIVERSALS — Make	Name and Model
1,125	14	Zenith	grav	d-d	B-Lipe	selec	B-Lipe	amid	4	worm	Timkn	8.5	r-rd	spgs	Perf	int-r-w	int-r-w	r	Ross	r	metl	Spicer	**Clydesdale** 65
1,175	12	Zenith	grav	d-d	B-Lipe	selec	B-Lipe	amid	4	worm	Timkn	10.33	r-rd	spgs	Perf	int-r-w	int-r-w	r	Ross	r	metl	Spicer	**Clydesdale** 90
1,000	10	Zenith	vacm	d-d	B-Lipe	selec	B-Lipe	amid	4	worm	Timkn	11.66	r-rd	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Spicer	**Clydesdale** 120B
		Zenith		d-p	B-Beck	selec	G-Lees	mtr	3	worm	Chcgo	6	tor-a	tor-a	Stlg	ext-r-w	int-r-w	l	Ditw				**Collier** 16
1,200	15	Shkspr	grav	cone	Hart	selec	Covert	amid	3	in-g	Russl	9.4	spgs	spgs	Perf	ext-r-w	int-r-w	l	own	c	metl	Spicer	**Columbia** E
1,200	15	Shkspr	grav	cone	Hart	selec	Covert	amid	3	in-g	Russl	9.4	spgs	spgs	Perf	ext-r-w	int-r-w	l	own	c	metl	Spicer	**Columbia** T
2.000	20	Carter	grav	d-p	B-Beck	selec	Muncie	mtr	3	worm	Chcgo	7.75	spgs	tor-a		int-r-w	int-r-w	l	CAS	c	metl	Univ	**Comet**
2,200	20	Zenith	vacm	cone	Dtrt	selec	Dtrt	mtr	3	in-g	Torbn	7	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Jacx	c	metl	Spicer	**Commerce** E
1,170	18	Zenith	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	7.75	spgs	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Spicer	**Concord** A
1,266	16	Zenith	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	8.5	spgs	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Spicer	**Concord** B
1,080	18	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel	6.5	spgs	spgs	Shel	int-r-w	int-r-w	l	Lavn	c			**Corbitt** E
1,200	16	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel	7.5	spgs	spgs	Shel	ext-r-w	int-r-w	l	Ross	c			**Corbitt** D
1,075	14	Stmbg	vacm	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Shel	8.66	spgs	spgs	Shel	int-r-w	int-r-w	l	Ross	c			**Corbitt** C
1,290	14	Stmbg	vacm	d-d	B-Lipe	selec	B-Lipe	mtr	4	worm	Shel	8.66	spgs	spgs	Shel	int-r-w	int-r-w	l	Ross				**Corbitt** B
1,250	12	Stmbg		w-d	H-Shaw	ind-c	Cotta	amid	3	worm	Shel	8.75	spgs	spgs	Shel	int-r-w	int-r-w	l	Ross	c			**Corbitt** A
1,000	10	Stmbg	vacm	w-d	H-Shaw	ind-c	Cotta	amid	3	worm	Shel	8.75	r-rd	tor-a	Shel	int-r-w	int-r-w	l	Ross	c			**Corbitt** AA
		Schblr	grav	d-d				mtr	3	bevl		4.5	tor-t	tor-t		int-r-w	int-r-w						**Corliss** A
1,500	10	Stmbg	grav			elec			1	bevl-4	own	25	r-rd	r-rd	Tut	ext-4-w			own				**Couple-Gear** HC
1,500	10	Stmbg	grav			elec		amid	1	bevl-4	own	25	r-rd	r-rd	Tut	ext-4-w			own				**Couple-Gear** AC
1,000	17½	Zenith	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	bevl	Timkn	5.	spgs	spgs		ext-r-w	int		Lavn				**Croce** 17
		Zenith	vacm	d-d	Fuller	selec	Fuller	mtr	3	worm	Timkn	7	spgs	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Arvac	**Dart** E
1,100	12	Zenith	grav	d-d	Fuller	selec	Fuller	mtr	4	worm	Timkn	8.5	spgs	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Spicer	**Dart** CC4
1,100	14	Zenith	grav	d-d	Fuller	selec	Fuller	amid	4	worm	Timkn	10.75	spgs	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Spicer	**Dart** L
1,560	25	Schblr	grav	w-d	Dtrt	selec	Dtrt	mtr	3	worm	Shel	6.2	spgs	spgs	Iron	int-r-w	int-r-w	l	Gem	c	metl	Hart	**D-E** J
1,280	16	Zenith	grav	d-p	B-Beck	selec	Covert	mtr	3	worm	Hays	7.77	spgs	spgs	Iron	int-r-w	int-r-w	l	Ross	c	metl	Hart	**D-E** A
1,290	15	Zenith	grav	d-p	B-Beck	selec	Covert	mtr	3	worm	Hays	8.33	spgs	spgs	Iron	int-r-w	int-r-w	l	Ross	c	metl	Hart	**D-E** B
1,290	15	Zenith	grav	d-p	B-Beck	selec	Covert	mtr	3	worm	Hays	8.33	spgs	spgs	Iron	int-r-w	int-r-w	l	Ross	c	metl	Hart	**D-E** D
1,100	14	Zenith	grav	d-p	B-Beck	selec	Covert	mtr	3	worm	Hays	8.66	spgs	spgs	Iron	int-r-w	int-r-w	l	Ross	c	metl	Hart	**D-E** C
1,000	12	Zenith	grav	w-d	B-Lipe	selec	B-Lipe	amid	4	worm	Shel	8.7	spgs	spgs	Shel	int-r-w	int-r-w	l	Ross	c	metl	Hart	**D-E** E
960	14	Master	grav	cone	Fuller	selec	Covert	amid	3	worm	Timkn	8.5	r-rd	spgs	Kal	int-r-w	int-r-w	l	Ross	c	metl	K-B	**DeKalb** E-2
1,065	14	Master	grav	cone	Fuller	selec	Covert	amid	3	worm	Timkn	9.33	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Ross	c	metl	K-B	**DeKalb** E-2½
1,200	20	Stmbg	grav	d-p	B-Beck	selec	G-Lees	mtr	3	in-g	Torb	8	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Ditw	c	metl	Arvac	**Defiance** B
1,300	16	Stmbg	grav	d-d	Dtrt	selec	Dtrt	mtr	3	in-g	Russl	8.2	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Gem	c	metl	Univ	**Denby** 12
1,330	14	Stmbg	grav	d-d	Dtrt	selec	Dtrt	mtr	3	in-g	Russl	10.2	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Gem	c	metl	Univ	**Denby** 13
1,270	12½	Stmbg	grav	d-d	Dtrt	selec	Dtrt	mtr	3	in-g	Russl	10.9	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Gem	c	metl	Univ	**Denby** 15
1,050	10	Stmbg	grav	d-d	own	selec	Warner	amid	4	in-g	Clark	12.55	spgs	spgs	Dtrt	int-r-w	int-r-w	l	Ross	c	metl	Univ	**Denby** 210
1,100	18	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	7.75	spgs	spgs	Mthr	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Diamond-T** J5
1,100	16	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	7.75	spgs	spgs	Mthr	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Diamond-T** J4
1,050	15	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	7.75	spgs	spgs	Mthr	int-r-w	int-r-w	r	Gem	c	metl	Spicer	**Diamond-T** J3
1,050	12	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	4	worm	Timkn	10.33	spgs	spgs	Mthr	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Diamond-T** LB
1,050	10	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	4	worm	Timkn	11.66	spgs	spgs	Mthr	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Diamond-T** R
950	10	Master	grav	d-d	B-Lipe	selec		mtr	3	chn	own	10.5	r-rd	spgs		ext-d-s	int-r-w	r	Lavn	c	fab	own	**Doane** 1919
1,090	15	Stmbg	grav	d-d	Warner	selec	Warner	amid	4	worm	Timkn	7.75	spgs	spgs	Rowl	int-r-w	int-r-w	l	Ross	c	metl	Spicer	**Dorris** K4
1,150	15	Schblr	vacm	d-p	B-Beck	selec	G-Lees	mtr	3	in-g	Torbn	8	spgs	spgs	own	ext-r-w	int-r-w	l	Ross	c	metl	Arvac	**Douglas** TA
1,120	15	Schblr	vacm	d-d	B-Lipe	selec	B-Lipe	mtr	4	in-g-4	own	16.0	r-rd*	spgs	Tut	ext-d-s	ext-r-w	l	Lavn	c	metl	Blood	**Duplex** E
		Carter	grav	cone*	Mech	prog	Mech	mtr	3	bevl	Gemco		spgs	spgs	Shel	int-r-w	int-r-w	l	Fost	c		own	**Ellsworth** 25A
1,100	15	Zenith	grav	d-p	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	7.7	spgs	spgs		int-r-w	int-r-w		Ross				**Fageol**
1,250	15	Rayfld	grav	d-d	Fuller	selec	Fuller	mtr	3	in-g	Russl		spgs	spgs	Shel	ext-r-w	int-r-w	l	Jacx	c	metl	Spicer	**Fargo** P
1,150	18	Zenith	grav	d-p	B-Beck	selec	own	amid	3	worm	Timkn	7	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Federal** S
1,190	15	Zenith	grav	d-p	B-Beck	selec	Dtrt	amid	4	worm	Timkn	8.5	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Federal** T
1,125	13	Zenith	grav	d-p	B-Beck	selec	Dtrt	amid	4	worm	Timkn	9.25	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Federal** U
1,150	12	Zenith	grav	d-p	B-Beck	selec	Warner	amid	4	worm	Timkn	10.33	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Federal** W
1,150	10	Zenith	grav	d-p	B-Beck	selec	Warner	amid	4	worm	Timkn	13.66	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Federal** X
	18	Zenith	grav	d-d	Dtrt	selec		mtr	3	worm	Shel	6.50	spgs	spgs	Del	int-r-w	int-r-w		Ross				**Forschler**
1,200	16	Zenith	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel	7.7	spgs	spgs	Del	int-r-w	int-r-w		Ross				**Forschler**
1,200	14	Zenith	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel	8.6	spgs	spgs	Del	int-r-w	int-r-w		Ross				**Forschler**
1,200	12	Zenith	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel	8.8	spgs	spgs	Del	int-r-w	int-r-w		Ross				**Forschler**
1,373	18	own	grav	w-d	own	plan	own	mtr	2	worm	own		r-rd	t-t	Mthr*	ext-d-s	int-r-w	l	own	l	metl	own	**Ford** TT
1,350	15	Stmbg	grav	w-d	M & E	ind-c	Cotta	amid	3	bevl-4	own	8.9	spgs	tor-a	Tut	ext-d-s	ext-r-w	r	Ross	r	metl	Blood	**F.W.D** B
1,800	18	Carter	grav	d-p	B-Beck	selec	own	mtr	3	in-g	Russl	8.2	spgs	spgs	Perf	ext-r-w	int-r-w	l	Lavn	c	fab	Hart	**Fulton** FX
1,200	25	Rayfld	grav	d-p	B-Beck	selec	B-Lipe	amid	3	worm	Timkn		r-rd	tor-a	Merl	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Gabriel** C
1,100	18	Rayfld	grav	d-p	B-Beck	selec	B-Lipe	amid	4	worm	Timkn		r-rd	spgs	Merl	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Gabriel** E
1,000	12	Rayfld	grav	d-p	B-Beck	selec	B-Lipe	amid	4	worm	Timkn		r-rd	spgs	Merl	int-r-w	int-r-w	l	Gem	c	metl	Spicer	**Gabriel** F
1,303	18	Rayfld	grav	d-d	B-Lipe	selec	B-Lipe	amid	3	worm	Timkn	7.75	spgs	spgs	Perf	int-r-w	int-r-w	r	Ross	c	metl	Spicer	**Garford** 75-C

ABBREVIATIONS—Makers of Parts

*Other Options
A-K—Atwater-Kent
Al-Ch—Allis-Chalmers
Aut-L—Auto-Lite
B-Beck—Borg & Beck
B-Lipe—Brown-Lipe
Blng—Berling
Brem—Bremer
Can—Candler
Cant—Canton-Cleveland
CAS—C.A.S. Products Co.
Champ—Champion Spng
Chcgo—Chicago-Stndrd
Chgo—Chicago Mfg. Co.
Con—Continental
Conn—Connecticut
Cover—Covert
Del—Delany
Ditw—Ditweiler
Dneto—Dyneto
Dtrt—Detroit Press. Stl.
Dtrt—Detroit Lubricat.
Dtrt—Detroit G. & M. Co.
Dtrt—Detroit Stl. Spng.
Duplx—Duplex
E&M—English & Mersick
Eismn—Eisemann
Emp—Empire
Ens—Ensign
Eur—Eureka
Fed—Fedders
Flech—Fletcher
Fost—Foster
Franck—Francke
G&D—Gray & Davis
G&O—G. & O. Mfg. Co.
GBS—Golden, Belknap & Swartz
G-Lees—Grant-Lees
Gem—Gemmer
H&N—H. & N. Carburetor Co.
Har—Harrison
Hart—Hartford
Hays—Hayes
Her—Hercules
Hig—Higgins
Hol—Holley
H-Shaw—Hele-Shaw
H-S—Herschell-Spillman
Hyd—Hydraulic
Idl—Ideal
Ind—Industrial Equipment Co.
Iron—Iron City
J-A—Jackson Radiator Wks.
Jacox—Jackson-Church-Wilcox
Jas—Jamestown Car Pts. Co.
Jhnson—Johnson
Kal—Kalamazoo
K-B—Kinsler-Bennett
Key-H—Keystone-Hindley
King—Kingston
Koko—Kokomo
Lau—Lauraine
Lavn—Lavine
LeR—LeRoi
Lgt—Light Foundry
Ligt—Liggett
L-N—Leece Neville
Lyc—Lycoming
Marvl—Marvel
Mast—Master
McC—McCord
McFar—McFarland
Mech—Mechanics
Merl—Merrill
Mil—Milwaukee
Mnrch—Monarch
Mod—Modine
Mthr—Mather
M&E—Merchant & Evans
Natl—National
N.A.—North American
N-E—North East
Nlite—Nicolite
Penn—Penn Spring Co.
P&B—Parish & Bingham
Per—Perfex
Perf—Perfection
Prsh—Parish
R-T—Rome-Turney
Rayfld—Rayfield
Rem—Remy
Rowl—Wm. Harvel Rowland
Rugles—Ruggles
Russl—Russel
Rut—Rutenber
Savg—Savage Arms
Salsby—Salisbury
Schblr—Schebler
Shel—Sheldon
Shkspr—Shakespeare
Smth—A. O. Smith
S-P—Spring-Perch
递tf—Splitdorf
Stan—Standard Radiator Co.
Stand—Standard Steel Spring Co.
Stewrt—Stewart
Stlg—Sterling
Stmbg—Stromberg
Sundmn—Sunderman
S-W—Sparks-Withington
Therm—Thermoid
Timkn—Timken
Tltsn—Tillotson
Torbn—Torbenson
Tut—Tuthill
Univ—Universal Machine Co.
Wau—Waukesha
West—Westinghouse
Wis—Wisconsin
Wol—Wohlrab
W-W—Walker-Weiss

Detailed Technical Specifications of.

Name and Model	Tons Capacity	Chassis Price	Wheelbase Inches	Frame: Make	Frame: Material	Frame: Type	Tires: Kind	Tires: Size in Ins. Front	Tires: Size in Ins. Rear	Wheels	Engine: Make	Engine: No. Cyl. Bore and Stroke—N.A.C.C. Hp.	Engine: Cylinders Cast	Cooling: Water Circ.	Cooling: Radiator Make	Cooling: Radiator Core and Case	Ignition: Type	Ignition: Make	Ignition: Spark Advance	Elec. System: Type	Elec. System: Make	Elec. System: Extra Cost $	Governor: Type	Governor: Make	Governor: Drive
Garford 66-B	1½	3,000	144	own..	p-stl.	s-flex.	opt..	36x3½	36x5	wd..	Buda	4-3¾x5½-22.5	4	cent...	own..	fin-cst...	sing..	Spltf..	hand.	s&l...	West..	175	cent..	Duplx...	motor.
Garford 70-B	2	3,300	142	own..	p-stl.	s-flex.	opt..	36x4	36x7	wd..	Buda	4-4¼x5½-29.0	4	cent...	own..	fin-cst...	sing..	Spltf..	hand.	s&l...	West..	175	cent..	Duplx...	motor.
Garford 77-B	3½	4,300	128	own..	p-stl.	s-flex.	opt..	36x5	40x5d	wd..	Wis..	4-4¼x6 -29.0	4	cent...	own..	fin-cst...	dual..	Eismn	hand.	ltg....	West..	125	cent..	Duplx...	motor.
Garford 68	5	5,000	128	own..	p-stl.	s-flex.	s....	36x6	40x6d	c-s..	Wis..	4-4¾x5½-36.1	2	cent...	own..	fin-cst...	dual..	Eismn	hand.	ltg....	West..	125	cent..	Duplx...	motor.
Garford 69	6	5,300	128	own..	p-stl.	s-flex.	s....	36x6	40x7d	c-s..	Wis..	4-5⅒x5½-41.6	2	cent...	own..	fin-cst...	dual..	Eismn	hand.	ltg....	West..	125	cent..	Duplx...	motor.
Garford Tractor 70-B	4½	3,400	116	own..	p-stl.	s-flex.	s....	36x4	36x7	wd..	Buda	4-4¼x5½-29.0	4	cent...	own..	fin-cst...	sing..	Spltf..	hand.	ltg....	West..	125	cent..	Duplx...	motor.
Garford Tractor 77	7	4,400	105	own..	p-stl.	s-flex.	s....	36x5	40x5d	wd..	Wis..	4-4¾x5½-36.1	2	cent...	own..	fin-cst...	dual..	Eismn	hand.	ltg....	West..	125	cent..	Duplx...	motor.
Garford Tractor 68	10	5,100	102	own..	p-stl.	s-flex.	s....	36x6	40x6d	c-s..	Wis..	4-5⅒x5½-41.6	2	cent...	own..	fin-cst...	dual..	Eismn	hand.	ltg....	West..	125	cent..	Duplx...	motor.
Gary F	1		130	P&B..	p-stl.	flex..	s....	36x3½	36x4	wd..	Con..	4-3¾x5 -22.5	4	ther...		zz-ps...	sing..	Eismn	hand.	ltg....	Vesta		cent..	Pierce...	motor.
Gary G	1½		144	P&B..	p-stl.	flex..	s....	36x3½	36x5	wd..	Buda	4-4¼x5½-29.0	4	cent...	Chgo	fin-cst...	sing..	Eismn	hand.	ltg....	Vesta		cent..	Pierce...	motor.
Gary H	2		156	P&B..	p-stl.	flex..	s....	36x4	36x6	wd..	Buda	4-4¼x5½-29.0	4	cent...	Chgo	fin-cst...	sing..	Eismn	hand.	ltg....	Vesta		cent..	Simplex.	motor.
Gary HU	2½		162	P&B..	p-stl.	flex..	s....	36x4	36x7	wd..	Buda	4-4¼x5½-29.0	4	cent...	Chgo	fin-cst...	sing..	Eismn	hand.	ltg....	Vesta		cent..	Simplex.	motor.
Gary K	3½		162	own..	rol-c.	s-flex.	s....	36x5	36x5d	wd..	Buda	4-4½x6 -32.4	4	cent...	Chgo	fin-cst...	sing..	Eismn	hand.	ltg....	Vesta		cent..	Duplx...	motor.
Gem	½	675					pnu..	31x4	31x4		GBS.	4-3¾x4½-22.5	4				sing..	Conn..	hand.	s&l..	Dynt..				
Geneva 1	¾	650	96				s....	34x2	36x2½		Beav.	2-5¼x4¼-22.1	1				sing..	Simms	fix...						
Giant 15	1	1,850	138	Hyd..	p-stl.	s-flex.	opt..	34x3½	34x5	wd..	Con..	4-3½x5 -19.6	4	ther...	Idl...	cel-sht...	sing..	Eismn	hand.	lgt....	Dtrt.	50			
Giant 14	1½	2,400	138	Hyd..	p-stl.	s-flex.	s....	34x3½	34x5	wd..	Con..	4-3½x5 -19.6	4	ther...	Idl...	cel-sht...	sing..	Eismn	hand.	lgt....	Dtrt.	50			
Giant 16	2	2,850	144	Hyd..	p-stl.	s-flex.	pnu..	36x4	36x7	wd..	Con..	4-4⅛x5¼-27.2	4	cent...	own..	cel-c-a...	sing..	Eismn	hand.	lgt....	Dtrt.	60	none.		
Giant 17	3½	3,850	176	own..	p-stl.	s-flex.	s....	36x5	36x5d	wd..	Con..	4-4½x5½-32.4	2	cent...	own..	cel-c-a...	sing..	Eismn	hand.	lgt....	Dtrt.	60	cent..	Pierce...	motor.
Globe A	1	1,490	132				s....	34x3½	34x4		Con..	4-3½x5 -19.6	4				sing..	Eismn	fix...				cent..	Pierce...	motor.
Globe B	1½	1,850	144				s....	36x3½	36x5		Con..	4-3¾x5¼-22.5	4				sing..	Eismn	fix...				cent..	Pierce...	motor.
Globe C	2	2,190	154				s....	36x4	36x6		Con..	4-4⅛x5¼-27.2	4				sing..	Eismn	fix...				cent..	Pierce...	motor.
G. M. C. 16	¾	1,775		Dtrt..	p-stl.	s-flex.	pnu..	35x5	35x5	wd..	Con..	4-3¾x5 -22.5	4	cent...	McC.	fin-pst...	sing..	Eismn	hand.				suc..	Mnrch..	motor.
G. M. C. 21	1	2,125		Prsh..	p-stl.	s-flex.	opt..	34x3½	34x5	wd..	Con..	4-3¾x5 -22.5	4	cent...	McC.	fin-cst...	sing..	Eismn	hand.				suc..	Mnrch..	motor.
G. M. C. 31	1½	2,500		Prsh..	p-stl.	s-flex.	s....	36x3½	36x5	wd..	Con..	4-3¾x5 -22.5	4	cent...	McC.	fin-cst...	sing..	Eismn	hand.				suc..	Mnrch..	motor.
G. M. C. 41	2	2,800		Prsh..	p-stl.	s-flex.	s....	36x4	36x4d	wd..	Con..	4-4⅛x5¼-27.2	4	cent...	McC.	fin-cst...	sing..	Eismn	hand.				suc..	Mnrch..	motor.
G. M. C. 71	3½	3,950		own..	rol-c.	s-flex.	s....	36x5	40x5d	c-s..	Con..	4-4½x5½-32.4	2	cent...	McC.	fin-cst...	sing..	Eismn	hand.				suc..	Mnrch..	motor.
G. M. C. 101	5	4,550		own..	rol-c.	s-flex.	s....	36x6	40x6d	c-s..	Con..	4-4½x5½-32.4	2	cent...	McC.	fin-cst...	sing..	Eismn	hand.				suc..	Mnrch..	motor.
Gramm-Bernstein W	1½	2,450	130		p-stl.	s-flex.	s....	34x3½	36x5	wd..	Wau.	4-3¾x5¼-22.5	4	cent...	own..	fin-cst...	sing..	Eismn	hand.				l-b..	Wau....	motor.
Gramm-Bernstein W	2	2,750	146		p-stl.		s....	34x4	34x3½d	wd..	Wau.	4-3¾x5¼-22.5	4	cent...	own..	fin-cst...	sing..	Eismn	hand.				l-b..	Wau....	motor.
Gramm-Bernstein W	2½	3,350	156		p-stl.	s-flex.	s....	36x4	36x4d	wd..	Wau.	4-4¼x5¾-29.0	2	cent...	own..	fin-cst...	dual..	Eismn	hand.				cent..	Wau....	motor.
Gramm-Bernstein W	3½	4,000	158		p-stl.	s-flex.	s....	36x5	40x5d	wd..	Wau.	4-4½x5¾-32.4	2	cent...	own..	fin-cst...	dual..	Eismn	hand.				cent..	Wau....	motor.
Gramm-Bernstein W	5	5,000	168		p-stl.	s-flex.	s....	36x6	40x6d	c-s..	Wau.	4-4¾x6¾-36.1	2	cent...	own..	fin-cst...	dual..	Eismn	hand.				cent..	Wau....	motor.
Grant 12	¾	1,125*	115	P&B..	p-stl.	s-flex.	pnu..	32x4	32x4	wd..	Con..	4-3¼x5 -16.9	4	ther...	Fed..	cel-pst...	sing..	Spltf..	hand.	sl&i-2.	Bijur.	none	none.	none...	none
Grant 10	1½	1,885	124	Savg..	p-stl.	s-flex.	opt..	34x4½	34x5	wd..	Con..	4-3¾x5 -22.5	4	ther...	Fed..	cel-pst...	sing..	Spltf..	hand.	sl&i-2.	Remy.	none	cent..	Pierce...	d-s...
Grant 11	1½	1,935	140	Savg..	p-stl.	s-flex.	opt..	34x4½	34x5	wd..	Con..	4-3¾x5 -22.5	4	ther...	Fed..	cel-pst...	sing..	Spltf..	hand.	sl&i-2.	Remy.	none	cent..	Pierce...	d-s...
Grant 15	2	2,150	124	Savg..	p-stl.	s-flex.	opt..	34x4	34x6	wd..	Con..	4-3¾x5 -22.5	4	ther...	Fed..	cel-pst...	sing..	Spltf..	hand.	sl&i-2.	Remy.	none	cent..	Pierce...	d-s...
Grant 16	2	2,250	140	Savg..	p-stl.	s-flex.	opt..	34x4	34x6	wd..	Con..	4-3¾x5 -22.5	4	ther...	Fed..	cel-pst...	sing..	Spltf..	hand.	sl&i-2.	Remy.	none	cent..	Pierce...	d-s...
Hahn G	1	1,375	127	Prsh*.	p-stl.	s-flex.	opt..	34x3	34x4	wd..	Con..	4-3½x5 -19.6	4	ther...	Idl...	zz-t-sht..	sing..	Eismn	hand.						
Hahn C	1½	1,950	135	Prsh*.	p-stl.	s-flex.	opt..	36x3½	36x5	wd..	Con..	4-4⅛x5¼-27.2	4	cent...	Chgo	fin-cst...	sing..	Bosc*.	hand.				suc...	Pierce...	motor.
Hahn E	2½	2,500	145	Prsh*.	p-stl.	s-flex.	opt..	36x4	36x4d	wd..	Con..	4-4½x5½-32.4	2	cent...	Chgo	fin-cst...	sing..	Bosc*.	hand.				suc...	Pierce...	motor.
Hall	2	2,675	156				s....	36x4	36x4d	wd..	Con..	4-4⅛x5¼-27.2	4		Long.		sing..	Bosc*.	fix...				cent..	Duplx...	motor.
Hall	3½	3,500	144				s....	36x5	36x5d	wd..	Con..	4-4½x5½-32.4	2		Long.		sing..	Bosc*.	fix...				cent..	Duplx...	motor.
Hall	5	4,500	144				s....	36x5	40x6d	wd..	Con..	4-4½x5½-32.4	2		Long.		sing..	Bosc*.	fix...				cent..	Duplx...	motor.
Hall	7	4,500	144				s....	36x5	40x6d	wd..	Con..	4-4½x5½-32.4	2		Long.		sing..	Bosc*.	fix...				cent..	Duplx...	motor.
Harvey WFA	2½	3,000	150	own..	rol-c.	flex..	s....	36x4	36x7	wd..	Buda	4-4¼x5½-29.0	4	g.p....	own..	fin-cst...	sing..	Eismn	auto.				cent..	Duplx...	motor.
Harvey WHA	3½	3,900	160	own..	rol-c.	flex..	s....	36x5	36x5d	wd..	Buda	4-4¼x6 -29.0	4	g.p....	own..	fin-cst...	sing..	Eismn	auto.				cent..	Duplx...	motor.
Harvey WKA	5	5,000	160	own..	rol-c.	flex..	s....	36x6	40x6d	wd..	Buda	4-4½x6 -32.4	4	g.p....	own..	fin-cst...	sing..	Eismn	auto.				cent..	Duplx...	motor.
Harvey Tractor HT	10	4,000	125				s....	36x5	36x5d		Buda	4-4½x6 -32.4	4				sing..	Eismn	auto.	s&l...	West..		cent..	Duplx...	motor.
Hawkeye K	1½	1,900	148	own..	rol-c.	s-flex.	opt..	34x3½	34x5	wd..	Buda	4-3¾x5½-22.5	4	cent...	Idl...	cel-cst...	sing..	Eismn	hand.	ltg....	Vesta	75	cent..	Simplex.	motor.
Hawkeye L	2	2,500	148½	own..	rol-c.	s-flex.	opt..	34x4	34x6	wd..	Buda	4-3¾x5½-22.5	4	cent...	Idl...	cel-cst...	sing..	Eismn	hand.	ltg....	Vesta	75	cent..	Simplex.	motor.
Hendrickson	2	2,850	140				s....	36x4	36x4d*	wd..	Wau.	4-4¼x5¾-29.0	....	cent...		cst.....	sing..	Dixie..	hand.				cent..	Wau....	motor.
Hendrickson	3½	3,600	160				s....	36x5	36x5d	wd..	Wau.	4-4½x5¾-32.4	....	cent...		cst.....	sing..	Dixie..	hand.				cent..	Wau....	motor.
Higrade A17	¾	1,850	115				pnu..	35x5	35x5		Con..	4-3½x5 -19.6	4				sing..	Simms		s&l...	L-N...		cent..	Simplex.	motor.
Higrade A18	1	2,100	115				pnu..	35x5	35x5		Con..	4-3½x5 -19.6	4				sing..	Simms		s&l...	L-N...		cent..	Simplex.	motor.
Hoover 15-B	1	1,435	120	Dtrt..	p-stl.	s-flex.	pnu..	32x4	33x4½	wd..	Con..	4-3½x5 -19.6	4	ther...	Can..	cel-sht...	dual..	Spltf..	hand.	none..	none..	none			
Hupmobile	½	1,350	112	Dtrt..	p-stl.		pnu..	33x4	33x4	wd..	own..	4-3¼x5½-16.9	4	ther...	McC.	cel-pst...	sing..	A-K..	hand.		West..				
Hurlburt	2	3,500	148		p-stl.	rigid.	s....	36x4	36x4d	wd..	Buda	4-4¼x5½-29.0	4	cent...	own..	fin-cst...	dual..	Eismn	auto.	ltg...	Vesta	none	cent..	Duplx...	motor.
Hurlburt	3½	4,250	146		p-stl.	rigid.	s....	36x5	36x5d	wd..	Buda	4-4½x6 -32.4	4	cent...	own..	fin-cst...	dual..	Eismn	auto	ltg...	Vesta	none	cent..	Duplx...	motor.
Hurlburt	5	5,250	156		p-stl.	rigid.	s....	36x5	40x6d	wd..	Buda	4-4½x6 -32.4	4	cent...	own..	fin-cst...	dual.	Eismn	auto	ltg...	Vesta	none	cent..	Duplx...	motor.
I. H. C. H	¾	1,550	115	P&B..	p-stl.		s....	36x3	36x3½	wd..	own..	4-3½x5¼-19.6	4	cent...	Long.	fin-pst...	sing..	Bosch.	hand.	s&l*..	N-E..	125	cent..	own....	motor.
I. H. C. F	1	1,850	128	P&B..	p-stl.		s....	36x3½	36x4	wd..	own..	4-3½x5¼-19.6	4	cent...	Long.	fin-pst...	sing..	Bosch.	hand.	s&l*..	N-E..	125	cent..	own....	motor.
I. H. C. K	1½	2,200	129	P&B..	p-stl.		s....	36x3½	36x5	wd..	own..	4-3½x5¼-19.6	4	cent...	Long.	fin.....	sing..	Bosch.	hand.	s&l*..	N-E..	125	cent..	own....	motor.
I. H. C. G	2	2,600	138½	P&B..	p-stl.		s....	36x4	36x6	wd..	own..	4-4 x5 -25.6	4	ther...		cel-cst...	sing..	Spltf..	hand.	s&l*..	N-E..	135	cent..	own....	motor.
Independent F	1	1,485	128*				s*...	36x2*	36x4*		Con..	4-3½x5 -19.6	4				sing..	Eismn	fix...	s&l..	Jesco..		suc..	Mnrch..	motor.
Independent G	2	2,250	144				s....	36x3½	36x5		Con.	4-4⅛x5¼-27.2	4				sing..	Eismn	fix...	none..	none..	none	suc..	Mnrch..	motor.

ABBREVIATIONS—Types of Construction

*Other Options
amid—amidships
auto—automatic
bevl—bevel
c—center
c&l—center and left
c&s—cushion and solid
cent—centrifugal
c-s—cast steel
c-a—cast aluminum
cel-cst—cellular core, cast case
cel-pst—cellular core, pressed steel case
cel-sht—cellular core, sheet case
chn—chain
cylinders cast, 2 in pairs
cylinders cast, 4 in block
cylinders cast, 3 in threes
cylinders cast, 1 singly
d-d—dry disk
d-p—dry plate
d-rd—double reduction
d-s—driveshaft
elec—electric
ext-d-s—external driveshaft
ext-f-w—external front wheels
ext-g—external gear
ext-jst—external jackshaft
ext-r-w—external rear wheel
fab—fabric
fin—finned tube
fin-c-a—finned tube core, cast aluminum case
fin-cst—finned tube core, cast case
fin-pst—finned tube core, pressed steel case
fin-sht—finned tube core, sheet case
fix—fixed
flex—flexible
fric—friction
g.p.—gear pump
grav—gravity
gset—gearset
hyd—hydraulic
ind-c—individual clutch
int-d-s—internal driveshaft
int-f-w—internal front wheels
in-g—internal gear
in-g-4—internal gear drive on 4 wheels
int-r-w—internal rear wheel
jst—unit with jackshaft
l—left
l&c—left and center
leat—leather
l-b—loose ball
ltg—lighting
metl—metal
mtr—unit with motor
opt—optional
p—plate in oil
plst—piston pump
plan—planetary
pnu—pneumatic
pres—pressure
prog—progressive sliding gearset
p-t-c-a—plain tube core, cast aluminum case
p-t-cst—plain tube core, cast case
p-stl—pressed steel
p&s—pneumatic and solid
r—right
r-ax—unit with rear axle
rng-cst—ring core, cast case
rol-c—rolled channel
rol-i—rolled I-beam
r-rd—radius rods
selec—selective sliding gear
s-flex—semi-flexible
stg—starting
s&l—starting and lighting
s.l&i—starting, lighting and ignition
s l&i2—starting, lighting and ignition, two-unit
sing—single
s—solid
s&c—solid and cushion
spgs—springs
sq-t-cst—square tube core, cast iron
sq-t-sht—square tube core, sheet case
stk—stock
sub-f—sub-frame
suc—suction
s-bev—spiral bevel
ther—thermo-syphon
tor-a—torque arm
t-t—torsion tube
unt-x—unit with axle
vacm—vacuum
wd—wood
w-d—multiple disk in oil
worm—top worm
w-p—wet plate
zz-t-cst—zig zag tube core, cast case
zz-t-pst—zig zag tube core, pressed steel case
zz-t-sht—zig-zag tube core, sheet case

Gasoline Motor Trucks for 1919—Continued

Engine: Speed: Motor in R.p.m.	Engine: Speed: Truck in M.p.h.	Engine: Fuel Sys.: Carbureter Make	Engine: Fuel Sys.: Fuel Feed	Engine: Clutch: Type	Engine: Clutch: Make	Transmission: Gearset: Type	Transmission: Gearset: Make	Transmission: Gearset: Placed	Transmission: Gearset: Speeds	Transmission: Final Drive: Type	Transmission: Final Drive: Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Brakes: Foot	Brakes: Hand	Control: Steering Gear: Placed	Control: Steering Gear: Make	Control: Levers	Universals: Type	Universals: Make	Name and Model
1,269	16	Rayfld	grav	d-d	B-Lipe	selec	own	amid	4	worm	Timkn	8.5	spgs	spgs	Perf	int-r-w	int-r-w	r	Ross	c	metl	Spicer	Garford 66-B
1,035	15	Rayfld	grav	d-d	B-Lipe	selec	own	amid	4	worm	Timkn	7.75	spgs	spgs	Perf	int-r-w	int-r-w	r	Ross	c	metl	Spicer	Garford 70-B
1,041	12	Rayfld	grav	d-d	B-Lipe	selec	B-Lipe	amid	4	worm	Timkn	10.33	r-rd	spgs	Perf	int-r-w	ext-d-s	l	Ross	c	metl	Spicer	Garford 77-B
1,057	11	Rayfld	grav	d-d	B-Lipe	selec	own	amid	4	chn	own	11.44	r-rd	spgs	Perf	ext-d-s	int-r-w	r	Ross	c	metl	Spicer	Garford 68
1,057	10	Rayfld	grav	d-d	B-Lipe	selec	own	amid	4	chn	own	12.39	r-rd	spgs	Perf	ext-d-s	int-r-w	r	Ross	c	metl	Spicer	Garford 69
1,090	15	Rayfld	grav	d-d	B-Lipe	selec	own	amid	4	worm	Timkn	9.25	spgs	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Spicer	Garford Tractor 70-B
1,050	11	Rayfld	grav	d-d	B-Lipe	selec	own	amid	4	worm	Timkn	12	r-rd	spgs	Perf	int-r-w	ext-d-s	l	Ross	c	metl	Spicer	Garford Tractor 77
1,057	10	Rayfld	grav	d-d	B-Lipe	selec	own	amid	4	chn	own	11.44	r-rd	spgs	Perf	ext-d-s	int-r-w	r	Ross	c	metl	Spicer	Garford Tractor 68
1,275	15	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel		spgs	spgs	Tut	int-r-w	int-r-w	l	Lavn	c	metl	Blood	Gary F
1,275	15	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel		spgs	spgs	Tut	int-r-w	int-r-w	l	Lavn	c	metl	Hart	Gary G
1,275	15	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel		spgs	spgs	Tut	int-r-w	int-r-w	l	Lavn	c	metl	Hart	Gary H
1,275	15	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	4	worm	Shel		spgs	spgs	Tut	int-r-w	int-r-w	l	Lavn	c	metl	Hart	Gary HU
1,000	12	Stmbg	grav	d-d	Warner	selec	Warner	amid	4	worm	Shel		spgs	spgs	Tut	int-r-w	int-r-w	l	Lavn	c	metl	Blood	Gary K
		Carter	grav	d	B-Beck	selec	G-Lees	mtr	3	bevl	W-W	4.1	spgs	spgs		ext-r-w	int-r-w		Fost				Gem
1,200	18	Schblr	grav	d-p	Warner	plan		unt-j	2	chn	Shel	4	r-rd	r-rd	Shel	int-r-w	int-r-w					Spicer	Geneva 1
1,100	16	Schblr	grav	d-d	Warner	selec	Warner	mtr	3	worm	Timkn	7	spgs	spgs	Mthr	int-r-w	int-r-w	r	Jacox	c	metl	Spicer	Giant 15
1,100	13	Schblr	grav	d-d	Warner	selec	Warner	mtr	3	worm	Timkn	8.5	spgs	spgs	Mthr	int-r-w	int-r-w	r	Jacox	c	metl	Spicer	Giant 14
1,100	15	Schblr	grav	d-d	Warner	selec	Warner	mtr	3	worm	Timkn	23.2	spgs	spgs	Mthr	int-r-w	int-r-w	r	Jacox	c	metl	Spicer	Giant 16
1,100	12	Stmbg	grav	d-d	Warner	selec	Warner	amid	4	worm	Timkn	10.33	spgs	spgs	Dtrt	int-r-w	int-r-w	r	Ross	c	metl	Spicer	Giant 17
1,385	20	Master	vacm	d-p	B-Beck	selec	Cover	mtr	3	in-g	Clark	7	spgs	spgs	Shel	ext-r-w	int-r-w		Lavn		metl	Univ	Globe A
1,300	18	Master	vacm	d-p	B-Beck	selec	Cover	mtr	3	in-g	Shel	7.5	spgs	spgs	Shel	ext-r-w	int-r-w		Lavn		metl	Univ	Globe B
1,250	16	Master	vacm	d-p	B-Beck	selec	Cover	mtr	3	in-g	Clark	8	spgs	spgs	Shel	ext-r-w	int-r-w		Lavn		metl	Univ	Globe C
1,150	20	own	grav	d-d	own	selec	own	mtr	3	bevl	own	6	r-rd	spgs		ext-r-w	int-r-w	l	own	c	metl	Univ	G. M. C 16
1,600	18	Marvel	grav	d-d	own	selec	own	mtr	3	worm	Timkn	7.75	r-rd	spgs	Dtrt	int-r-w	int-r-w	l	Lavn	c	metl	Univ	G. M. C 21
1,600	15	Marvel	grav	d-d	own	selec	own	mtr	4	worm	Timkn	9.25	r-rd	spgs	Dtrt	int-r-w	int-r-w	l	Lavn	c	metl	Univ	G. M. C 31
1,600	14	Marvel	grav	d-d	own	selec	own	mtr	4	worm	Timkn	9.25	r-rd	spgs	Dtrt	int-r-w	int-r-w	l	Lavn	c	metl	Univ	G. M. C 41
1,500	12	Marvel	grav	d-d	own	selec	own	amid	4	worm	Timkn	12	r-rd	spgs	Dtrt	int-r-w	int-r-w	l	Lavn	c	metl	Univ	G. M. C 71
1,500	12	Marvel	grav	d-d	own	selec	Warner	amid	4	worm	Timkn	13.67	r-rd	spgs	Dtrt	int-r-w	int-r-w	l	Lavn	c	metl	Univ	G. M. C 101
1,200	17	Zenith	grav	d-d	own	ind-c	own	amid	3	worm	Shel	7.75	spgs	spgs		int-r-w	ext-r-w	l	Ross	c	metl	Arvac	Gramm-Bernstein W
1,200	14	Zenith	grav	d-d	own	ind-c	own	amid	3	worm	Shel	8.66	spgs	spgs		int-r-w	ext-r-w	l	Ross	c	metl	Arvac	Gramm-Bernstein W
1,150	16	Zenith	grav	d-d	own	ind-c	own	amid	3	worm	Shel	7.75	spgs	spgs		int-r-w	int-r-w	l	Ross	c	metl	Arvac	Gramm-Bernstein W
1,100	15	Zenith	grav	d-d	own	ind-c	own	amid	4	worm	Shel	8.75	spgs	spgs		int-r-w	int-r-w	l	Ross	c	fab	own	Gramm-Bernstein W
1,050	12½	Zenith	grav	cone	own	ind-c	own	amid	4	worm	Shel	10.25	spgs	spgs		int-r-w	int-r-w	l	Ross	c	fab	own	Gramm-Bernstein W
		Carter	vacm	d-p	B-Beck	selec	G-Lees	mtr	3	in-g	Torbn	5.33	t-t	spgs	Cooper	ext-r-w	int-r-w	l	Ditw	c	metl	Arvac	Grant 12
1,400	20	Carter	vacm	d-p	B-Beck	selec	G-Lees	mtr	3	in-g	Torbn	7	t-t	spgs	Cooper	ext-r-w	int-r-w	l	Jacox	c	metl	Arvac	Grant 10
1,400	20	Carter	vacm	d-p	B-Beck	selec	G-Lees	mtr	3	in-g	Torbn	7	t-t	spgs	Cooper	ext-r-w	int-r-w	l	Jacox	c	metl	Arvac	Grant 11
1,400	14	Carter	vacm	d-p	B-Beck	selec	G-Lees	mtr	3	in-g	Torbn	7	t-t	spgs	Cooper	ext-r-w	int-r-w	l	Jacox	c	metl	Arvac	Grant 15
1,400	14	Carter	vacm	d-p	B-Beck	selec	G-Lees	mtr	3	in-g	Torbn	7	t-t	spgs	Cooper	ext-r-w	int-r-w	l	Jacox	c	metl	Arvac	Grant 16
1,500	22	Stmbg	grav	d-d*	Dtrt*	selec	Dtrt*	mtr	3	in-g	Torbn		spgs	spgs	Del	ext-r-w	int-r-w	l	Lavn	c	metl	Spicer	Hahn G
1,500	27	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn		r-rd	spgs	Del	int-r-w	int-r-w	l	Lavn	c	metl	Spicer	Hahn C
1,500	38	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn		r-rd	spgs	Del	int-r-w	int-r-w	l	Ross	c	metl	Spicer	Hahn E
1,500	18	Zenith	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	10.33	spgs	spgs	Perf*			l	Gem	c		K-B	Hall
1,500	15	Zenith	grav	d-d	B-Lipe	selec	B-Lipe	amid	3	worm	Timkn	10.33	spgs	spgs	Perf*			l	Gem	c		K-B	Hall
1,200	12	Zenith	grav	d-d	B-Lipe	selec	B-Lipe	amid	3	worm	Timkn	13.66	spgs	spgs	Perf*			l	Gem	c		K-B	Hall
1,200	12	Zenith	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	chn	Timkn	14.5	r-rd	r-rd	Perf*			l	Gem	c		K-B	Hall
1,000	16	Stmbg	grav	d-p	B-Beck	selec	B-Lipe	amid	4	worm	Shel		spgs	spgs	Shel	int-r-w	int-r-w	l	Ross	c	metl	Spicer	Harvey WFA
1,000	13	Stmbg	grav	d-p	B-Beck	selec	B-Lipe	amid	4	worm	Shel		spgs	spgs	Shel	int-r-w	int-r-w	l	Ross	c	metl	Spicer	Harvey WHA
1,000	12	Stmbg	grav	d-p	B-Beck	selec	B-Lipe	amid	4	worm	Shel		spgs	spgs	Shel	int-r-w	int-r-w	l	Ross	c	metl	Spicer	Harvey WKA
1,000	11	Stmbg	grav	d-p	B-Beck	selec	B-Lipe	amid	4	worm	Shel	8.75	spgs	spgs	Shel	int-r-w	int-r-w		Ross				Harvey Tractor HT
1,035	16	Zenith	grav	d-d	Fuller	selec	Fuller	mtr	3	in-g	Clark	7	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Gem	c	metl	Univ	Hawkeye K
1,100	14	Zenith	grav	d-d	Fuller	selec	Fuller	mtr	4	in-g	Clark	9	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Gem	c	metl	M&E	Hawkeye L
1,000	15	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Timkn	7.75	r-rd	tor-a	Tut	ext-r-w	ext-r-w	l	Ross	c	metl		Hendrickson
1,100	14	Stmbg	grav	d-p	B-Beck	ind-c	Cotta	mtr	3	worm	Timkn	10.3	r-rd	spgs	Tut	int-r-w	int-r-w	l	Ross	c	metl		Hendrickson
	20	Zenith	grav	p	Fuller	ind-c	Fuller	mtr	3	worm	Shel	4.56	spgs	spgs		ext-r-w	int-r-w		Lavn				Higrade A17
	20	Zenith	grav	p	Fuller	ind-c	Fuller	mtr	3	worm	Shel	4.56	spgs	spgs		ext-r-w	int-r-w		Lavn				Higrade A18
		Schblr	vacm	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel	6.5	spgs	spgs	Shel	int-r-w	int-r-w	l	Lavn	c	metl	Acme	Hoover 15-B
2,200	55	Stmbg	vacm	d-d	own	selec	own	mtr	3	s-bev	own	4.91	spgs	spgs	Mthr	ext-r-w	int-r-w	l	Jacox	c	metl	Dtrt	Hupmobile
1,000	16	Flech	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	own	8.66	r-rd	tor-a		int-r-w	int-r-w	l		c	metl	Spicer	Hurlburt
1,000	13	Flech	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	own		r-rd	tor-a		int-r-w	int-r-w	l		c	metl	Spicer	Hurlburt
1,000	12	Flech	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	own		r-rd	tor-a		int-r-w	int-r-w	l		c	metl	Spicer	Hurlburt
1,275	18	Hol	grav	d-d	own	selec	own	amid	3	in-g	own	7	spgs	spgs	Stand	int-r-w	int-r-w	l	Lavn	c	metl	own	I. H. C H
1,275	17	Hol	grav	d-d	own	selec	own	amid	3	in-g	own	8	spgs	spgs	Stand	int-r-w	int-r-w	l	Lavn	c	metl	own	I. H. C F
1,275	15	Hol	grav	d-d	own	selec	own	amid	3	in-g	own	9	spgs	spgs	Stand	int-r-w	int-r-w	l	Ross	c	metl	own	I. H. C K
1,175	14	Ens	vacm	d-d	own	selec	own	amid	3	in-g	own	9	spgs	spgs	Stand	int-r-w	int-r-w	l	Ross	c	metl	own	I. H. C G
1,350	..	Marvel	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Chgco		spgs	spgs		int-r-w	int-r-w		Lavn				Independent F
		Marvel	grav	d-d		selec		mtr	3	worm			spgs	spgs		int-r-w	int-r-w						Independent G

ABBREVIATIONS—Makers of Parts

*Other Options
A-K—Atwater-Kent
Al-Ch—Allis-Chalmers
Aut-L—Auto-Lite
B-Beck—Borg & Beck
B-Lipe—Brown-Lipe
Bing—Berling
Brem—Bremer
Can—Candler
Cant—Canton-Cleveland
CAS—C.A.S. Products Co.
Champ—Champion Spag.
Chcgo—Chicago-Stndrd.
Chgo—Chicago Mfg. Co.
Con—Continental
Conn—Connecticut
Cover—Covert
Del—Delany
Ditw—Ditweiler
Dneto—Dyneto
Dtrt—Detroit Press. Stl.
Dtrt—Detroit Lubricat.
Dtrt—Detroit G. & M. Co.
Dtrt—Detroit Stl. Spag.
Duplx—Duplex
E&M—English & Mersick
Eismn—Eisemann
Emp—Empire
Ens—Ensign
Eur—Eureka
Fed—Fedders
Flech—Fletcher
Fost—Foster
Franck—Francke
G&D—Gray & Davis
G&O—G. & O. Mfg. Co.
GBS—Golden, Belknap & Swarts
G-Lees—Grant-Lees
Gem—Gemmer
H&N—H. & N. Carburetor Co.
Har—Harrison
Hart—Hartford
Hays—Hayes
Her—Hercules
Hig—Higgins
Hol—Holley
H-Shaw—Hele-Shaw
H-S—Herschell-Spillman
Hyd—Hydraulic
Idl—Ideal
Ind—Industrial Eqpt. Co.
Iron—Iron City
J-A—Jackson Radiator Wks.
Jacox—Jackson-Church-Wilcox
Jas—Jamestown Car Pts. Co.
Jhnson—Johnson
Kal—Kalamazoo
K-B—Kinsler-Bennett
Key-H—Keystone-Hindley
King—Kingston
Koko—Kokomo
Lau—Lauraine
Lavn—Lavine
LeR—LeRoi
Lgt—Light Foundry
Ligt—Liggett
L-N—Leece Neville
Lyc—Lycoming
Marvl—Marvel
Mast—Master
McC—McCord
McFar—McFarland
Mech—Mechanics
Merl—Merrill
Mnrch—Monarch
Mil—Milwaukee
Mod—Modine
Mthr—Mather
M&E—Merchant & Evans
Natl—National
N.A.—North American
N-E—North East
Nlite—Nicolite
Penn—Penn Spring Co.
P&B—Parish & Bingham
Per—Perfex
Perf—Perfection
Prsh—Parish
R-T—Rome-Turney
Rayfld—Rayfield
Rem—Remy
Rowl—Wm. Harvel Rowland
Rugles—Ruggles
Russl—Russel
Rut—Rutenber
Savg—Savage Arms
Salsby—Salisbury
Schblr—Schebler
Shel—Sheldon
Shkspr—Shakespeare
Smth—A. O. Smith
S-P—Spring-Perch
Spltf—Splitdorf
Stan—Standard Radiator Co.
Stand—Standard Steel Spring Co.
Stewrt—Stewart
Stlg—Sterling
Stmbg—Stromberg
Sundmn—Sunderman
S-W—Sparks-Withington
Therm—Thermoid
Timkn—Timken
Tltsn—Tillotson
Torbn—Torbenson
Tut—Tuthill
Univ—Universal Machine Co.
Wau—Waukesha
West—Westinghouse
Wis—Wisconsin
Wol—Wohlrab
W-W—Walker-Weiss

Detailed Technical Specifications of

Name and Model	Tons Capacity	Chassis Price	Wheelbase Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Size in Ins. Front	TIRES Size in Ins. Rear	Wheels	ENGINE Make	No. Cyl. Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	COOLING Water Circ.	COOLING Radiator Make	COOLING Radiator Core and Case	IGNITION Type	IGNITION Make	IGNITION Spark Advance	ELEC. SYSTEM Type	ELEC. SYSTEM Make	ELEC. SYSTEM Extra Cost $	GOVERNOR Type	GOVERNOR Make	Drive
Indiana.....T	1	$2,150	135	own...	rol-c.	s-flex.	s*...	34x3½	34x4	wd..	Wau.	4-3¾x5½-22.5	4	cent...	.....	fin-cst...	sing..	Eismn	hand.	s&l-2..	West..	175	cent..	Wau....	motor.
Indiana.....Q	1½	2,600	144	own...	rol-c.	s-flex.	opt..	36x3½	36x5	wd..	Rut..	4-4⅛x5½-27.2	2	cent...	Long.	fin-cst...	sing..	Eismn	hand.	s&l-2..	West..	175	cent..	Pierce...	motor.
Indiana.....D	2	2,800	150	own...	rol-c.	s-flex.	opt..	36x4	36x7	wd..	Rut..	4-4⅛x5½-27.2	2	cent...	Long.	fin-cst...	sing..	Eismn	hand.	s&l-2..	West..	175	cent..	Pierce...	motor.
Indiana.....R	3½	3,450	156	own...	rol-c.	s-flex.	opt..	36x5	36x5d	c-s..	Rut..	4-4⅜x5½-30.6	2	cent...	Long.	fin-cst...	sing..	Eismn	hand.	s&l-2..	West..	175	cent..	Pierce...	motor.
Indiana.....L	5	4,600	167	own...	rol-c.	s-flex.	opt..	36x5	40x6d	wd..	Wau.	4-4¾x6¾-36.1	2	cent...	Long.	fin-cst...	dual..	Eismn	hand.	s&l-2..	West..	175	cent..	Wau....	motor.
Jumbo.....A	2	2,500	144	Dtrt..	p-stl.	rigid.	s....	36x4	36x6	wd..	Buda	4-4¼x5½-29.0	4	cent...	G&O.	cel-cst...	sing..	Eismn	hand.	opt...	opt...	....	cent..	Duplx...	motor.
Kearns.....	½	850	107	......	.....	.....	pnu..	30x3½	30x3½	....	Lyc..	4-3¼x5 -16.9	4	....	.....	....	sing..	Conn..	hand.	s&l...	Dneto.	....	none.	none....	none..
Kearns.....	1½	1,800	136	......	.....	.....	s....	34x3½	34x5	....	H-S..	4-3¼x5 -16.9	4	....	.....	....	sing..	Blng..	hand.	none..	none..	none	none.	none....	none..
Kelly-Springfield...K-31	1½	2,750	144	own...	p-stl.	flex..	s....	36x3½	36x6	wd*.	own..	4-3¾x5¼-22.5	4	cent...	Fed..	cel-cst...	sing..	Eismn	fix...	s&l-2.	opt...	250	l-b...	own....	motor.
Kelly-Springfield...K-32	1½	2,750	144	own...	p-stl.	flex..	s....	36x3½	36x6	wd*.	own..	4-3¾x5¼-22.5	4	cent...	Fed..	cel-cst...	sing..	Eismn	fix...	s&l-2.	opt...	250	l-b...	own....	motor.
Kelly-Springfield...K-35	2½	3,250	144	own...	p-stl.	flex..	s....	36x4	36x4d	wd*.	own..	4-3¾x5¼-22.5	4	cent...	Fed..	cel-cst...	sing..	Eismn	fix...	s&l-2.	opt...	250	l-b...	own....	motor.
Kelly-Springfield...K-36	2½	3,250	144	own...	p-stl.	flex..	s....	36x4	36x4d	wd*.	own..	4-3¾x5¼-22.5	4	cent...	Fed..	cel-cst...	sing..	Eismn	fix...	s&l-2.	opt...	250	l-b...	own....	motor.
Kelly-Springfield...K-40	3½	4,250	150	own...	p-stl.	flex..	s....	36x5	40x5d	wd*.	own..	4-4½x6½-32.4	2	cent...	Fed..	cel-cst...	sing..	Eismn	auto.	s&l-2.	opt...	250	l-b...	own....	motor.
Kelly-Springfield...K-45	4	4,400	150	own...	p-stl.	flex..	s....	36x5	40x6d	wd*.	own..	4-4½x6½-32.4	2	cent...	Fed..	cel-cst...	sing..	Eismn	auto.	s&l-2.	opt...	250	l-b...	own....	motor.
Kelly-Springfield...K-50	5	4,900	150	own...	p-stl.	flex..	s....	36x6	40x6d	wd*.	own..	4-4½x6½-32.4	2	cent...	Fed..	cel-cst...	sing..	Eismn	auto.	s&l-2.	opt...	250	l-b...	own....	motor.
Kelly-Springfield...K-60	6	5,200	150	own...	p-stl.	flex..	s....	36x6	40x7d	wd*.	own..	4-4½x6½-32.4	2	cent...	Fed..	cel-cst...	sing..	Eismn	auto.	s&l-2.	opt...	250	l-b...	own....	motor.
Kissel.....Utility	1½	2,073	152	Smith.	p-stl.	s-flex.	s....	34x3½	34x5	wd..	own..	4-3⅞x5½-24.2	4	cent...	Fed..	sq-t-sht..	sing..	Eismn	hand.	s&l...	......	150	cent..	Pierce...	motor.
Kissel.....Freighter	2	2,832	168	Smith.	p-stl.	rigid.	s....	34x4	36x7	wd..	own..	4-4¼x5½-29.0	4	cent...	Mayo	sq-t-sht..	sing..	Eismn	hand.	s&l...	......	150	cent..	Pierce...	motor.
Kissel.....Heavy Duty	3½	3,905	168	Smith.	p-stl.	rigid.	s....	36x5	36x5d	wd..	own..	4-4¼x5½-29.0	4	cent...	Mayo	sq-t-sht..	sing..	Eismn	hand.	s&l...	......	150	cent..	Pierce...	motor.
Kissel.....Dreadnaught	5	4,785	180	Smith.	p-stl.	rigid.	s....	36x6	36x6d	wd..	own..	4-4¼x5½-29.0	4	cent...	Mayo	sq-t-sht..	sing..	Eismn	hand.	s&l...	......	150	cent..	Pierce...	motor.
Kleiber.....AA	1	2,400	130	own...	rol-c.	s-flex.	s....	34x3½	34x5	wd..	Con..	4-3¾x5¼-22.5	4	cent...	Per..	cel-sht...	dual..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Kleiber.....A	1½	2,650	140	own...	rol-c.	s-flex.	s....	36x3½	36x6	wd..	Con..	4-4⅛x5¼-27.2	4	cent...	Per..	cel-sht...	dual..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Kleiber.....BB	2	2,950	140	own...	rol-c.	s-flex.	s....	36x4	36x3½d	wd..	Con..	4-4¼x5¼-29.0	4	cent...	Per..	cel-sht...	dual..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Kleiber.....B	2½	3,500	150	own...	rol-c.	s-flex.	s....	36x4	36x4d	wd..	Con..	4-4½x5½-32.4	2	cent...	Per..	cel-sht...	dual..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Kleiber.....C	3½	4,100	158	own...	rol-c.	s-flex.	s....	36x5	36x5d	wd*	Con..	4-4½x5½-32.4	2	cent...	R-T..	fin-pst...	dual..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Kleiber.....D	5	5,100	170	own...	rol-c.	s-flex.	s....	36x6	40x6d	c-s..	Con..	4-5¼x5¾-44.2	2	cent...	R-T..	fin-cst...	dual..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Knox.....35	5-10	5,500	108½	......	rol-c.	rigid.	s....	36x4	38x6d	c-s..	own..	4-5 x5½-40.0	2	cent...	Fed..	cel-sht...	sing..	Eismn	hand.	sl&i-2.	Bijur..	....	none.	none....	none..
Knox.....36	10	6,000	108½	......	rol-c.	rigid.	s....	36x5	38x6d*	c-s..	own..	4-5 x5½-40.0	2	cent...	Fed..	cel-sht...	sing..	Eismn	hand.	sl&i-2.	Bijur..	....	none.	none....	none..
Koehler.....K	1¼	1,450	129	own...	rol-c.	s-flex.	s....	34x3	34x4	wd..	own..	4-3½x5 -19.6	4	ther....	own..	fin-cst...	sing..	Eismn	fix...	none..	none..	none	suc..	Mnrch..	motor.
Koehler.....L	2½	1,985	152	own...	rol-c.	s-flex.	s....	34x4	34x6	wd..	own..	4-3½x5 -19.6	4	ther....	own..	fin-cst...	sing..	Eismn	fix...	none..	none..	none	suc..	Mnrch..	motor.
Koehler Tractor.....KT	3	1,750	106	own...	rol-c.	s-flex.	s....	34x3	34x5	wd..	own..	4-3½x5 -19.6	4	ther....	own..	fin-cst...	sing..	Eismn	fix...	none..	none..	none	suc..	Mnrch..	motor.
Koehler Tractor.....LT	5	2,165	....	own...	rol-c.	s-flex.	s....	34x4	34x6	wd..	own..	4-3½x5 -19.6	4	ther....	own..	fin-cst...	sing..	Eismn	fix...	none..	none..	none	suc..	Mnrch..	motor.
LaFrance (Ward).....3A	3	3,925	154	own..	p-stl.	flex..	s....	36x4	36x4d	wd..	Con..	4-4⅛x5¼-27.2	4	cent...	.....	fin-c-a..	sing..	Conn..	hand.	s&l-2.	Dneto.	none	cent..	Simplex.	motor.
LaFrance (Ward).....2-A	2	3,500	154	own..	p-stl.	flex..	s....	36x4	36x7	wd..	Con..	4-4⅛x5¼-27.2	4	cent...	Bush.	fin-c-a...	sing..	Conn..	hand.	s&l-2.	Dneto	none	cent..	Simplex.	motor.
Lane.....G	1½	2,250	135	......	.....	.....	s....	34x3½	34x5	....	Con..	4-3¾x5 -22.5	4	....	.....	....	sing..	Eismn	hand.	......	......	....	cent..	Pierce...	motor.
Lane.....H	2½	2,850	150	......	.....	.....	s....	34x4	36x6	....	Con..	6-3½x5¼-29.4	6	....	.....	....	sing..	Eismn	hand.	......	......	....	cent..	Pierce...	motor.
Lane.....K	3½	3,700	160	......	.....	.....	s....	36x5	36x5d	....	Con..	6-3¾x5¼-33.7	6	....	.....	....	sing..	Eismn	hand.	......	......	....	cent..	Pierce...	motor.
Lange.....B	2	2,950	136	own...	rol-c.	rigid.	s....	36x4	36x6	wd..	Con..	4-4⅛x5¼-27.2	4	ther....	.....	sq-t-sht..	sing..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Lapeer Tractor.....3	3	1,900	90	......	.....	.....	s....	34x3½	34x5	....	Wau.	4-3½x5¼-19.6	4	....	.....	....	sing..	Dixie..	fix...	......	......	....	cent..	Wau....	motor.
Lapeer Tractor.....5	5	2,500	90	......	.....	.....	s....	34x3½	34x3½d	....	Wau.	4-4⅛x5¼-27.2	4	....	.....	....	sing..	Dixie..	fix...	......	......	....	cent..	Wau....	motor.
Larrabee.....M	1	1,950	130	Dtrt..	p-stl.	s-flex.	s....	34x3½	34x5	wd..	Con..	4-3¾x5 -22.5	4	ther....	Bush.	fin-cst...	sing..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Larrabee.....C-D	2½	3,000	154	Savg..	p-stl.	s-flex.	s....	36x4	36x7	wd..	Con..	4-4⅛x5¼-27.2	4	cent...	Bush.	fin-cst...	sing..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Larrabee.....A	3½	3,950	172	Savg..	p-stl.	s-flex.	s....	36x5	36x5d	wd..	Con..	4-4½x5½-32.4	2	cent...	Bush.	fin-cst...	sing..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Larrabee.....T	5	4,750	176	Savg..	p-stl.	s-flex.	s....	36x5	40x6d	c-s..	Con..	4-4½x5½-32.4	2	cent...	Bush.	fin-cst...	sing..	Bosch.	hand.	......	......	....	cent..	Pierce...	motor.
Lippard-Stewart.....C	¾	1,900	125	P&B..	p-stl.	s-flex.	pnu..	35x4½	35x4½	wd..	Con..	4-3¾x5¼-22.5	4	cent...	Fed..	cel-sht...	sing..	Eismn	fix...	s&l...	Dneto.	175	cent..	Pierce...	motor.
Lippard-Stewart.....H	1	2,250	145	P&B..	p-stl.	flex..	s....	36x3	36x5	wd..	Con..	4-3¾x5¼-22.5	4	cent...	Fed..	cel-c-a...	sing..	Eismn	fix...	s&l...	Dneto.	175	cent..	Pierce...	motor.
Lippard-Stewart.....F	1½	2,750	158	P&B..	p-stl.	flex..	s....	36x3½	36x3d	wd..	Con..	4-4⅛x5¼-27.2	4	cent...	Fed..	cel-c-a...	sing..	Eismn	fix...	s&l...	Dneto.	175	cent..	Pierce...	motor.
Lippard-Stewart.....G	2	3,050	158	P&B..	p-stl.	flex..	s....	36x4	36x4d	wd..	Con..	4-4⅛x5¼-27.2	4	cent...	Fed..	cel-c-a...	sing..	Eismn	fix...	s&l...	Dneto.	175	cent..	Pierce...	motor.
Lombard.....5	.....	.....	.....	......	rol-c.	s-flex.	.....	.....	.....	....	.....	6-5¾x7 -79.3	2	cent...	.....	fin-sht...	......	......	hand.	......	......	....	.....	....	......
Loyal.....	½	865	110	......	p-stl.	flex..	pnu..	32x4	32x4	....	H-S..	4-3½x5 -19.6	2	ther....	.....	....	sing..	A-K..	auto.	s&l...	......	none	none.	....	......
Loyal Special.....	¾	1,025	120	......	p-stl.	flex..	pnu..	32x4	32x4	....	H-S..	4-3½x5 -19.6	2	ther....	.....	....	sing..	A-K..	auto.	s&l...	......	none	none.	....	......
Maccar.....L	1½	2,750	150	Prsh..	p-stl.	rigid.	opt..	36x4	36x5	wd..	Con.	4-4⅛x5¼-27.2	4	cent...	own..	fin-cst...	sing..	Bosch.	hand.	none..	none..	none	cent..	Pierce...	motor.
Maccar.....H	2½	3,300	162	Prsh..	p-stl.	rigid.	s....	36x4	36x4d	wd..	Con..	4-4½x5½-32.4	2	cent...	own..	fin-cst...	sing..	Bosch.	hand.	none..	none..	none	cent..	Pierce...	motor.
Maccar.....M	3½	4,100	174	Prsh..	p-stl.	rigid.	s....	36x5	36x5d	wd..	Con..	4-4½x5½-32.4	2	cent...	own..	fin-cst...	sing..	Bosch.	hand.	none..	none..	none	cent..	Pierce...	motor.
Maccar.....U	5½	5,000	174	Prsh..	p-stl.	rigid.	s....	36x5	40x6d	wd..	Wis..	4-5⅒x5½-45 6	2	cent...	own.	fin-cst...	sing..	Bosch.	hand.	none..	none..	none	cent..	Pierce...	motor.
Mack.....AB	1	2,400	144*	......	p-stl.	s-flex.	s....	36x4	36x3½d	wd..	own..	4-4 x5 -25.6	2	cent...	own..	cel-sht...	sing..	Spltf..	hand.	opt...	opt...	....	cent..	own....	motor.
Mack.....AB	1	2,400	144*	......	p-stl.	s-flex.	s....	36x4	36x3½d	wd..	own..	4-4 x5 -25.6	2	cent...	own..	cel-sht..	sing..	Spltf..	hand.	opt...	opt...	....	cent..	own....	motor.
Mack.....AB	1½	2,800	162*	......	p-stl.	s-flex.	s....	36x4	36x3½d	wd..	own..	4-4 x5 -25.6	2	cent...	own..	cel-sht...	sing..	Spltf..	hand.	opt...	opt...	....	cent..	own....	motor.
Mack.....AB	1½	2,800	162*	......	p-stl.	s-flex.	s....	36x4	36x3½d	wd..	own..	4-4 x5 -25.6	2	cent...	own..	cel-sht...	sing..	Spltf..	hand.	opt...	opt...	....	cent..	own....	motor.
Mack.....AB	2	3,000	162*	......	p-stl.	s-flex.	s....	36x4	36x4d	wd..	own..	4-4 x5 -25.6	2	cent...	own..	cel-sht...	sing..	Spltf..	hand.	opt...	opt...	....	cent..	own....	motor.

ABBREVIATIONS—Types of Construction

*Other Options
amid—amidships
auto—automatic
bevl—bevel
c—center
c&l—center and left
c&s—cushion and solid
cent—centrifugal
c-s—cast steel
c-a—cast aluminum
cel-cst—cellular core, cast case
cel-pst—cellular core, pressed steel case
cel-sht—cellular core, sheet case
chn—chain
cylinders cast, 2 in pairs
cylinders cast, 4 in block
cylinders cast, 3 in threes
cylinders cast, 1 singly
d-d—dry disk
d-p—dry plate
d-rd—double reduction
d-s—driveshaft
elec—electric
ext-d-s—external driveshaft
ext-f-w—external front wheels
ext-g—external gear
ext-jst—external jackshaft
ext-r-w—external rear wheel
fab—fabric
fin—finned tube
fin-c-a—finned tube core, cast aluminum case
fin-cst—finned tube core, cast case
fin-pst—finned tube core, pressed steel case
fin-sht—finned tube core, sheet case
fix—fixed
flex—flexible
fric—friction
g.p.—gear pump
grav—gravity
gset—gearset
hyd—hydraulic
ind-c—individual clutch
int-d-s—internal driveshaft
int-f-w—internal front wheels
in-g—internal gear
in-g-4—internal gear drive on 4 wheels
int-r-w—internal rear wheel
jst—unit with jackshaft
l—left
l&c—left and center
leat—leather
l-b—loose ball
ltg—lighting
metl—metal
mtr—unit with motor
opt—optional
p—plate in oil
pist—piston pump
plan—planetary
pnu—pneumatic
pres—pressure
prog—progressive sliding gearset
p-t-c-a—plain tube core, cast aluminum case
p-t-cst—plain tube core, cast case
p-stl—pressed steel
p&s—pneumatic and solid
r—right
r-ax—unit with rear axle
rng-cst—ring core, cast case
rol-c—rolled channel
rol-i—rolled I-beam
r-rd—radius rods
selec—selective sliding gear
s-flex—semi-flexible
stg—starting
s&l—starting and lighting
s,l&i—starting, lighting and ignition
s l&i2—starting, lighting and ignition, two-unit
sing—single
s—solid
s&c—solid and cushion
spgs—springs
sq-t-cst—square tube core, cast iron
sq-t-sht—square tube core, sheet case
stk—stock
sub-f—sub-frame
suc—suction
s-bev—spiral bevel
ther—thermo-syphon
tor-a—torque arm
t-t—torsion tube
unt-x—unit with axle
vacm—vacuum
wd—wood
w-d—multiple disk in oil
worm—top worm
w-p—wet plate
zz-t-cst—zig zag tube core, cast case
zz-t-pst—zig zag tube core, pressed steel case
zz-t-sht—zig-zag tube core, sheet case

Gasoline Motor Trucks for 1919—Continued

ENGINE				TRANSMISSION												BRAKES		CONTROL			UNIVERSALS		
SPEED		FUEL SYS.		CLUTCH		GEARSET				FINAL DRIVE								STEERING GEAR					
Motor in R.p.m.	Truck in M.p.h.	Carburetor, Make	Fuel Feed	Type	Make	Type	Make	Placed	Speeds	Type	Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs, Make	Foot	Hand	Placed	Make	Levers	Type	Make	Name and Mode
1,250	20	Stmbg.	grav.	d-p.		selec.		amid.	3	worm	own.	6.5	r-rd.	spgs.		int-r-w.	int-r-w.	l.		c.	metl.		Indiana T
1,160	19	Stmbg.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm	Shel.	6.5	r-rd.	spgs.	Dtrt.	int-r-w.	int-r-w.	l.	Wol.	c.	fab.	Acme.	Indiana Q
1,160	16	Stmbg.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm	Shel.	7.75	r-rd.	spgs.	Dtrt.	int-r-w.	int-r-w.	l.	Wol.	c.	metl.	Acme.	Indiana D
1,160	12	Stmbg.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm	Shel.	10.25	r-rd.	spgs.	Dtrt*	int-r-w.	int-r-w.	l.	Wol.	c.	metl.	Spicer.	Indiana R
800	11	Stmbg.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm	Shel.	8.75	r-rd.	spgs.	Dtrt*	int-r-w.	int-r-w.	l.	Wol.	c.	metl.	Spicer.	Indiana L
1,150	14	Zenith.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	in-g.	Clark.	8	spgs.	spgs.	Dtrt.	ext-r-w.	int-r-w.	l	Jacox.	c.	metl.	Arvac.	Jumbo A
		Carter.	grav.	d-d.	Mech.	selec.	Mech.	mtr.		bevl.	Peru.								Lavn.				Kearns
				d-p.	B-Beck.		G-Lees.				Hayes.												Kearns
1,400	17.3	Zenith.	grav.	cone.	own.	selec.	Cover.	amid.	3	chn.	own.	8.66	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	own.	Kelly-Springfield K-31
1,400	17.3	Zenith.	grav.	cone.	own.	selec.	Cover.	amid.	3	worm	own.	8.66	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Kelly-Springfield K-32
1,400	14.1	Zenith.	grav.	cone.	own.	selec.	Cover.	amid.	3	chn.	own.	10.64	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	own.	Kelly-Springfield K-35
1,400	14.5	Zenith.	grav.	cone.	own.	selec.	Cover.	amid.	3	worm	own.	10.33	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Kelly-Springfield K-36
1,400	15.7	Rayfld.	grav.	cone.	own.	selec.	Cover.	amid.	3	chn.	own.	10.48	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	own.	Kelly-Springfield K-40
1,400	15.5	Rayfld.	grav.	cone.	own.	selec.	Cover.	amid.	3	chn.	own.	10.71	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	own.	Kelly-Springfield K-45
1,400	13.6	Rayfld.	grav.	cone.	own.	selec.	Cover.	amid.	3	chn.	own.	12.24	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	own.	Kelly-Springfield K-50
1,400	13.4	Rayfld.	grav.	cone.	own.	selec.	Cover.	amid.	3	chn.	own.	12.39	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	own.	Kelly-Springfield K-60
1,100	17	Stmbg.	vacm.	d-d.	Warner	selec.	Warner	mtr.	3	worm	Shel.	6.5	spgs.	spgs.	Mthr.	int-r-w.	int-r-w.	l.	Jacox.	c.	metl.	Spicer.	Kissel Utility
1,190	15	Stmbg.	vacm.	d-d.	Warner	selec.	Warner	amid.	4	worm	Timkn.	8.5	spgs.	spgs.	Mthr.	int-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Spicer.	Kissel Freighter
1,315	12	Stmbg.	vacm.	d-d.	Warner	selec.	Warner	amid.	4	worm	Shel.	11.75	spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Kissel Heavy Duty
1,335	11	Stmbg.	vacm.	d-d.	Warner	selec.	Warner	amid.	4	worm	Shel.	13.1	spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Kissel Dreadnaught
1,200	20	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Timkn.	7	spgs.	spgs.	Betts.	ext-r-w.	int-r-w.	r.	Ross.	c.	metl.	Spicer.	Kleiber AA
1,200	15	Stmbg.	grav.	w-d.	H-Shaw	selec.	B-Lipe.	amid.	3	worm	Shel.	7.75	spgs.	spgs.	Betts.	ext-r-w.	int-r-w.	r.	Ross.	c.	metl.	Spicer.	Kleiber A
1,200	15	Stmbg.	grav.	w-d.	H-Shaw	selec.	B-Lipe.	amid.	3	worm	Timkn.	7.75	spgs.	spgs.	Betts.	int-r-w.	int-r-w.	r.	Ross.	c.	metl.	Spicer.	Kleiber BB
1,200	13	Stmbg.	grav.	w-d.	H-Shaw	selec.	B-Lipe.	amid.	4	worm	Shel.	9	spgs.	spgs.	Betts.	int-r-w.	int-r-w.	r.	Ross.	c.	fab.	Spicer.	Kleiber B
1,200	11	Stmbg.	grav.	w-d.	H-Shaw	selec.	B-Lipe.	amid.	4	worm	Timkn.	10.5	spgs.	spgs.	Betts.	int-r-w.	int-r-w.	r.	Ross.	c.	metl.	Spicer.	Kleiber C
1,000	9.5	Stmbg.	grav.	w-d.	H-Shaw	selec.	B-Lipe.	amid.	4	worm	Timkn.	11.66	spgs.	spgs.	Betts.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Kleiber D
		Zenith.	vacm.	d-p.	own.	selec.	own.	jst.	3	chn.	Timkn.	9.6	r-rd.		Penn.	ext-j-s.	int-r-w.	l.	Ross.	c.	metl.	own	Knox 35
		Zenith.	vacm.	d-p.	own.	selec.	own.	jst.	3	chn.	Timkn.	12	r-rd.		Penn.	ext-j-s.	int-r-w.	l.	Ross.	c.	metl.	own	Knox 36
1,000	20	Stmbg.	grav.	d-d.	Mech.	selec.	Mech.	mtr.	3	in-g.	Torbn.	7	spgs.	spgs.		ext-r-w.	int-r-w.	l.	own.	c.	metl.	K-B.	Koehler K
1,000	18	Stmbg.	grav.	d-d.	Mech.	selec.	Mech.	mtr.	3	in-g.	Torbn.	9	spgs.	spgs.		ext-r-w.	int-r-w.	l.	own.	c.	metl.	K-B.	Koehler L
1,000	16	Stmbg.	grav.	d-d.	Mech.	selec.	Mech.	mtr.	3	in-g.	Torbn.	8	spgs.	spgs.		ext-r-w.	int-r-w.	l.	own.	c.	metl.	K-B.	Koehler Tractor KT
1,000	14	Stmbg.	grav.	d-d.	Mech.	selec.	Mech.	mtr.	3	in-g.	Torbn.	10	spgs.	spgs.		ext-r-w.	int-r-w.	l.	own.	c.	metl.	K-B.	Koehler Tractor LT
1,250	16	Zenith.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm		8.5	r-rd.	spgs.	Stand.	int-r-w.	int-r-w.	r.	Ross.	c.	metl*	Hart.	LaFrance (Ward) 3-A
1,250	16	Zenith.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm	Timkn.	8.5	r-rd.	spgs.	Stand.	int-r-w.	int-r-w.	r.	Ross.	c.	metl*	Hart.	LaFrance (Ward) 2-A
1,200	18	Stmbg.	vacm.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm		7.2	spgs.	spgs.	Kal.	int-r-w.	int-r-w.		Ross.			Acme.	Lane G
1,100	18	Stmbg.	vacm.	d-p.	B-Beck.	selec.	Cover.	amid.	3	worm	Timkn.	7.7	spgs.	spgs.	Kal.	int-r-w.	int-r-w.		Ross.			Acme.	Lane H
1,100	13	Stmbg.	vacm.	d-p.	B-Beck.	selec.	Cover.	amid.	3	worm	Shel.	8.7	spgs.	spgs.	Kal.	int-r-w.	int-r-w.		Ross.			Acme.	Lane K
1,250	15	Stmbg.	grav.	w-d.	H-Shaw	ind-c.	own.	amid.	3	chn.	own.	9	r-rd.		Stand.	ext-r-w.	int-r-w.	l.	Gem.	c.	metl.	M-E.	Lange B
1,000	12	Stewrt.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	in-g.	Torbn.	10	spgs	spgs.		ext-r-w.	int-r-w.		Ross.				Lapeer Tractor 3
1,000	8	Stewrt.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	in-g.	Torbn.	13	spgs.	spgs.		ext-r-w.	int-r-w.		Ross.				Lapeer Tractor 5
1,200	15	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm	Shel.	8.75	spgs.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Univ.	Larrabee M
1,200	18	Schblr.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm	Shel.	6.5	spgs.	spgs.	Merl.	ext-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Univ.	Larrabee C-D
1,000	12	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm	Shel.		spgs.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Univ.	Larrabee A
1,000	10	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm	Shel.		spgs.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	M-E.	Larrabee T
1,200	25	Zenith.	grav.	cone.	Hart.	selec.	B-Lipe.	amid.	3	s-bev.	Timkn.	5.08	spgs.	spgs.	Mthr.	ext-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Lippard-Stewart C
1,125	17	Zenith.	grav.	cone.	Hart.	selec.	B-Lipe.	amid.	3	worm	Timkn.	7	spgs.	spgs.	Mthr.	ext-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Lippard-Stewart H
1,100	15	Zenith.	grav.	cone.	Hart.	selec.	B-Lipe.	amid.	3	worm	Timkn.	7.75	spgs.	spgs.	Mthr.	ext-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Lippard-Stewart F
1,225	14	Zenith.	grav	cone.	Hart.	selec.	B-Lipe.	amid.	3	worm	Timkn.	9.25	spgs.	spgs	Mthr.	ext-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Lippard-Stewart G
1,400	6	Stmbg.	pres.	w-d.		ind-c.		amid.	3	worm								l.		c.			Lombard 5
	25	Stmbg.	grav.	d-p.	B-Beck.	selec.	Cover.	mtr.	3	in-g.	Torbn.		spgs.	spgs.		int-r-w.	ext-r-w.			c.			Loyal
	25	Stmbg.	grav.	d-p.	B-Beck.	selec.	Cover.	mtr.	3	in-g.	Torbn.		spgs.	spgs.		int-r-w.	ext-r-w.			c.			Loyal Special
1,000	17	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Timkn.	7	r-rd.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	l&c.	metl.	Spicer.	Maccar L
1,000	15	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Timkn.	7.75	r-rd.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	l&c.	metl.	Spicer.	Maccar H
1,000	15	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm	Timkn.	8.75	r-rd.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	l&c.	metl.	Spicer.	Maccar M
1,000	12	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm	Timkn.	10.25	r-rd.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	l&c.	metl.	Spicer.	Maccar U
1,275		Stmbg*	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm	Timkn.	7.75	spgs.	spgs.	Mthr.	ext-d-s.	int-r-w.	l.	Gem.	c.			Mack AB
1,275		opt.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	chn.	own.	6.29	r-rd.	tor-a	Mthr.	int-r-w.	int-d-s.	l.	Gem.	c.			Mack AB
1,275		Stmbg*	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm	Timkn.	8.5	spgs.	spgs.	Mthr.	int-r-w.	int-r-w.	l.	Gem.	c.			Mack AB
1,275		Stmbg*	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	chn.	Timkn.	6.99	r-rd.		Mthr.	ext-d-s.	int-r-w.	l.	Gem.	c.			Mack AB
1,275		Stmbg*	grav.	d-d	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm	Timkn	8.5	spgs.	spgs.	Mthr.	int-r-w.	int-r-w	l.	Gem.	c.			Mack AB

ABBREVIATIONS—Makers of Parts

*Other Options
A-K—Atwater-Kent
Al-Ch—Allis-Chalmers
Aut-L—Auto-Lite
B-Beck—Borg & Beck
B-Lipe—Brown-Lipe
Blng—Berling
Brem—Bremer
Can—Candler
Cant—Canton-Cleveland
CAS—C.A.S. Products Co.
Champ—Champion Spag.
Chego—Chicago-Stndrd
Chgo—Chicago Mfg. Co.
Con—Continental
Conn—Connecticut
Cover—Covert
Del—Delany
Ditw—Ditweiler
Dneto—Dyneto
Dtrt—Detroit Press. Stl.
Dtrt—Detroit Lubricat.
Dtrt—Detroit G. & M. Co.
Dtrt—Detroit Stl. Spng.
Duplx—Duplex
E&M—English & Mersick
Eismn—Eisemann
Emp—Empire
Ens—Ensign
Eur—Eureka
Fed—Fedders
Flech—Fletcher
Fost—Foster
Franck—Francke
G&D—Gray & Davis
G&O—G. & O. Mfg. Co.
GBS—Golden, Belknap & Swartz
G-Lees—Grant-Lees
Gem—Gemmer
H&N—H. & N. Carburetor Co.
Har—Harrison
Hart—Hartford
Hays—Hayes
Her—Hercules
Hig—Higgins
Hol—Holley
H-Shaw—Hele-Shaw
H-S—Herschell-Spillman
Hyd—Hydraulic
Idl—Ideal
Ind—Industrial Equipment Co.
Iron—Iron City
J-A—Jackson Radiator Wks.
Jacox—Jackson-Church-Wilcox
Jas—Jamestown Car Pts. Co.
Jhnson—Johnson
Kal—Kalamazoo
K-B—Kinsler-Bennett
Key-H—Keystone-Hindley
King—Kingston
Koko—Kokomo
Lau—Lauraine
Lavn—Lavine
LeR—LeRoi
Lgt—Light Foundry
Ligt—Liggett
L-N—Leece Neville
Lyc—Lycoming
Marvl—Marvel
Mast—Master
McC—McCord
McFar—McFarland
Mech—Mechanics
Merl—Merrill
Mil—Milwaukee
Mnrch—Monarch
Mod—Modine
Mthr—Mather
M&E—Merchant & Evans
Natl—National
N.A.—North American
N-E—North East
Nlite—Nicolite
Penn—Penn Spring Co.
P&B—Parish & Bingham
Per—Perfex
Perf—Perfection
Prsh—Parish
R-T—Rome-Turney
Rayfld—Rayfield
Rem—Remy
Rowl—Wm. Harvel Rowland
Rugles—Ruggles
Rusel—Russel
Rut—Rutenber
Savg—Savage Arms
Salsby—Salisbury
Schblr—Schebler
Shel—Sheldon
Shkspr—Shakespeare
Smth—A. O. Smith
S-P—Spring-Perch
Spltf—Splitdorf
Stan—Standard Radiator Co.
Stand—Standard Steel Spring Co.
Stewrt—Stewart
Stlg—Sterling
Stmbg—Stromberg
Sundmn—Sunderman
S-W—Sparks-Withington
Therm—Thermoid
Timkn—Timken
Titan—Tillotson
Torbn—Torbenson
Tut—Tuthill
Univ—Universal Machine Co.
Wau—Waukesha
West—Westinghouse
Wis—Wisconsin
Wol—Wohlage
W-W—Walker-Weiss

Detailed Technical Specifications of

Name and Model	Tons Capacity	Chassis Price	Wheelbase Inches	Frame: Make	Frame: Material	Frame: Type	Tires: Kind	Tires: Size in Ins. Front	Tires: Size in Ins. Rear	Wheels	Engine: Make	No. Cyl., Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	Cooling: Water Circ.	Cooling: Radiator Make	Cooling: Radiator Core and Case	Ignition: Type	Ignition: Make	Ignition: Spark Advance	Elec. System: Type	Elec. System: Make	Elec. System: Extra Cost, $	Governor: Type	Governor: Make	Governor: Drive
Mack AB	2	3,000	162*		p-stl.	s-flex.	s.	36x4	36x4d	wd.	own.	4-4 x5 -25.6	2	cent.	own.	cel-sht.	sing.	Spltf.	hand.	opt.	opt.		cent.	own.	motor.
Mack AC	3½	4,600	180*		p-stl.	s-flex.	s.	36x5	40x5d	wd.	own.	4-5 x6 -40.0	2	cent.	own.	rng-cst.		Spltf.	hand.	opt.	opt.		cent.	own.	motor.
Mack AC	5½	5,250	180*		p-stl.	s-flex.	s.	36x6	40x6d	wd.	own.	4-5 x6 -40.0	2	cent.	own.	rng-cst.		Spltf.	hand.	opt.	opt.		cent.	own.	motor.
Mack Tractor AC	7	4,600	119		p-stl.	s-flex.	s.	36x5	40x5d	wd.	own.	4-5 x6 -40.0	2	cent.	own.	rng-cst.		Spltf.	hand.	opt.	opt.		cent.	own.	motor.
Mack AC	7½	5,500	180*		p-stl.	s-flex.	s.	36x7	40x7d	wd.	own.	4-5 x6 -40.0	2	cent.	own.	rng-cst.		Spltf.	hand.	opt.	opt.		cent.	own.	motor.
Mack Tractor AC	11	5,250	119		p-stl.	s-flex.	s.	36x6	40x6d	wd.	own.	4-5 x6 -40.0	2	cent.	own.	rng-cst.		Spltf.	hand.	opt.	opt.		cent.	own.	motor.
Mack Tractor AC	15	5,500	119		p-stl.	s-flex.	s.	36x7	40x7d	wd.	own.	4-5 x6 -40.0	2	cent.	own.	rng-cst.		Spltf.	hand.	opt.	opt.		cent.	own.	motor.
Manly 30	1½	2,050	144				s.	36x4	36x5		Wau.	4-3¾x5¼-22.5	4				sing.	Eismn	fix.				cent.	Wau.	motor.
Manly 40	2	2,350	156				s.	36x4	36x6		Wau.	4-3¾x5¼-22.5	4				sing.	Eismn	fix.				cent.	Wau.	motor.
Manly 50	2½	2,800	156				s.	36x4	40x7		Wau.	4-4 x5½-25.6	2				sing.	Eismn	fix.				cent.	Wau.	motor.
Master M	2	2,390	144	P&B.	p-stl.	s-flex.	s.	34x4	36x7	wd.	Buda	4-4¼x5½-29.0	4	cent.	own.	cel-cst.	sing.	Eismn	auto.		West.	150	suc.	McCanna	motor.
Master O	2	2,490	170	P&B.	p-stl.	s-flex.	s.	34x4	36x7	wd.	Buda	4-4¼x5½-29.0	4	cent.	own.	cel-cst.	sing.	Eismn	auto.	opt.	opt.	150	suc.	McCanna	motor.
Master W	2	2,590	144	P&B.	p-stl.	s-flex.	s.	34x4	36x7	wd.	Buda	4-4¼x5½-29.0	4	cent.	own.	cel-cst.	sing.	Eismn	auto.	sl&i.	West.	150	suc.	McCanna	motor.
Master WL	2	2,690	170	P&B.	p-stl.	s-flex.	s.	34x4	36x7	wd.	Buda	4-4¼x5½-29	4	cent.	own.	cel-cst.	sing.	Eismn	auto.	sl&i.	West.	150	suc.	McCanna	motor.
Master A	3½	3,890	158	P&B.	p-stl.	s-flex.	s.	36x5	40x5d	wd.	Buda	4-4½x6 -32.4	4	cent.	own.	cel-cst.	sing.	Eismn	auto.	l&i.	West.	150	cent.	Pierce.	d-s.
Maxfer	1	1,195	130	P&B.			p&s.	36x4	34x4			4-3½x5 -19.6	4				sing.	Delco.		s&l.	Delco.				
Maxwell	1	1,025	124	Hyd.	p-stl.	s-flex.	s.	32x3	32x4	wd.	own.	4-3⅝x4½-21.0	4	ther.	own.	fin-pst.	sing.	A-K.	hand.	ltg.	Aut-L.	none	suc.	own.	motor.
Menominee Hurryton	1	1,890	130	own.	rol-c.	s-flex.	s.	34x3½	34x5	wd.	Con.	4-3¾x5 -22.5	4	ther.	G&O.	cel-sht.	sing.	Eismn	hand.	ltg.			cent.	Pierce.	motor.
Menominee H	1½	2,475	130	own.	rol-c.	s-flex.	s.	36x3½	36x5	wd.	Con.	4-3¾x5¼-22.5	4	cent.	G&O.	cel-sht.	sing.	Eismn	hand.	ltg.			cent.	Pierce.	motor.
Menominee D	2	2,950	144	own.	rol-c.	s-flex.	s.	36x4	36x4d	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	G&O.	fin-cst.	sing.	Eismn	hand.				cent.	Pierce.	motor.
Menominee G	3½	3,880	160	own.	rol-c.	s-flex.	s.	36x5	36x5d	wd.	Con.	4-4½x5½-32.4	2	cent.	G&O.	fin-cst.	sing.	Eismn	hand.				cent.	Pierce.	motor.
Menominee J	5	4,950	160	own.	rol-c.	s-flex.	s.	36x6	40x6d	wd.	Con.	4-4½x5½-32.4	2	cent.	G&O.	fin-cst.	sing.	Eismn	hand.				cent.	Pierce.	motor.
Modern 30		1,800	132				s.	34x3½	34x5		Con.	4-3¾x5 -22.5	4						fix.					opt.	
Moreland 17-N	1	2,175	126	Smith.	p-stl.	s-flex.	s.	34x3½	34x4	wd.	Con.	4-3¾x5 -22.5	4	ther.	own.	cel-sht.	sing.	Dixie.	hand.						
Moreland 17-B	1½	2,930	150	Smith.	p-stl.	s-flex.	s.	36x3½	36x5	c-s.	Con.	4-4⅛x5¼-27.2	4	cent.	own.	cel-sht.	dual.	Dixie.	hand.						
Moreland 17-C	2½	3,500	168	own.	p-stl.	s-flex.	s.	36x4	36x7	c-s.	Con.	4-4½x5½-32.4	2	cent.	McF.	cel-sht.	dual.	Dixie.	hand.						
Moreland 17-G	4	4,500	186	own.	p-stl.	s-flex.	s.	36x5	40x5d	c-s.	Wau.	4-4¾x6¾-36.1	2	cent.	McF.	cel-sht.	dual.	Dixie.	hand.				cent.	Pierce.	motor.
Moreland 17-J	5	5,000	168	own.	p-stl.	s-flex.	s.	36x6	40x6d	c-s.	Wau.	4-4¾x6¾-36.1	2	cent.	own.	cel-sht.	dual.	Dixie.	hand.				cent.	Wau.	motor.
Muskegon 20	2	2,325	144	P&B.	p-stl.	flex.	s.	36x4	36x6	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Mayo	cel-cst.	sing.	Eismn	2-pt.	none.	none.	none	cent.	Pierce.	d-s.
Myers 50	1	1,495	130	P&B.	p-stl.	s-flex.	s*.	34x4	34x4	wd.	Lyc.	4-3½x5 -19.6	4	ther.	Stan.	cel-cst.	sing.	Swiss.	hand.	sl&i-2.	Dynt.	none	cent.	Pierce.	gset.
Myers 55	1	1,460	130	P&B.	p-stl.	s-flex.	s*.	34x3½	34x4	wd.	Lyc.	4-3½x5 -19.6	4	ther.	Stan.	cel-cst.	sing.	Delco.	hand.				cent.	Pierce.	gset.
Myers 70	1½	1,750	130	P&B.	p-stl.	s-flex.	s.	34x3½	34x5	wd.	Lyc.	4-3½x5 -19.6	4	ther.	Stan.	cel-cst.	sing.	Delco.	hand.	sl&i-2.	Dynt.	none	cent.	Pierce.	gset.
Myers 75	1½	1,700	130	P&B.	p-stl.	s-flex.	s.	34x3½	34x5	wd.	Lyc.	4-3½x5 -19.6	4	ther.	Stan.	cel-cst.	sing.	Swiss.	hand.				cent.	Pierce.	gset.
Nash 2018	1	1,650	130	Smith.	p-stl.	s-flex.	s.	34x3	34x4	wd.	own.	4-3¾x5¼-22.5	4	cent.	Long.	fin-cst.	sing.	Conn.	hand.	sl&i-2.	Aut-L.	none	cent.	Duplex.	motor.
Nash 4017	2	3,250	124	Smith.	p-stl.	s-flex.	s.	36x5	36x5	c-s.	Buda	4-4¼x5½-29.0	4	cent.	McC.	fin-cst.	sing.	Eismn	hand.	s&l-2.	Bijur.		cent.	Duplex.	motor.
Nash 3018	2	2,175	144	Smith.	p-stl.	s-flex.	s*.	34x4	36x5	wd.	own.	4-3¾x5¼-22.5	4	cent.	Long.	fin-cst.	sing.	Conn.	hand.	sl&i-2.	Aut-L.	none	cent.	Duplex.	motor.
Nelson & LeMoon F1	1	2,000	opt.	own.	rol-c.	s-flex.	s.	36x3	36x4	wd.	Con.	4-3¾x5¼-22.5	4	cent.	Chgo	fin-cst.	sing.	Eismn	fix.	s&l.	West.	175	suc.	Mnrch.	motor.
Nelson & LeMoon F2	2	2,775	opt.	own.	rol-c.	s-flex.	s.	36x4	36x7	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Chgo	fin-cst.	dual.	Eismn	hand.	s&l.	West.	175	suc.	Mnrch.	motor.
Nelson & LeMoon F3½	3½	3,750	opt.	own.	rol-c.	s-flex.	s.	36x5	36x5d	wd.	Con.	4-4½x5½-32.4	2	cent.	Chgo	fin-cst.	dual.	Eismn	hand.	s&l.	West.	175	suc.	Mnrch.	motor.
Nelson & LeMoon F5	5	4,750	opt.	own.	rol-c.	s-flex.	s.	36x6	40x6d	wd.	Buda	4-4½x6 -32.4	4	cent.	Chgo	fin-cst.	dual.	Eismn	hand.	s&l.	West.	175	suc.	Mnrch.	motor.
Netco D	2	2,500	144	Prsh.	p-stl.	rigid.	s.	36x4	36x6	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	R-T.	fin-cst.	sing.	Eismn	fix.	none.	none.				
Niles B	1	1,500	124				pnu.	35x5	35x5		Con.	4-3½x5 -19.6	4				sing.	Eismn	hand.				cent.	Pierce.	motor.
Niles E	2	2,400	140				s.	36x4	36x7		Con.	4-4⅛x5¼-27.2	4				sing.	Eismn	hand.				cent.	Pierce.	motor.
Noble NW2	2½	2,675	148	Dtrt.	p-stl.	s-flex.	s.	36x4	36x7	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Long.	fin-cst.	sing.	Eismn	hand.	ltg.	Remy.	45	cent.	Pierce.	motor.
Noble NW4	4	3,750	168	own.	rol-c.	s-flex.	s.	36x5	36x5d	p-st.	Con.	4-4½x5½-32.4	2	cent.	Long.	fin-cst.	sing.	Eismn	hand.	ltg.	Remy.	50	cent.	Pierce.	motor.
Norwalk 2000	1	1,495	130	P&B.	p-stl.	flex.	pnu*.	34x4	34x4	wd.	Lyc.	4-3½x5 -19.6	4	ther.	Stan.	cel-pst.	sing.	Delco.	hand.	sl&i-2.	Dynt.	none	none.	none.	
Norwalk 3000	1½	1,750	130	P&B.	p-stl.	flex.	opt.	34x4	34x5	wd.	Lyc.	4-3½x5 -19.6	4	ther.	Stan.	cel-pst.	sing.	Delco.	hand.	sl&i-2.	Dynt.	none	none.	none.	
O.K. 3T	1½	2,250	150	P&B.	p-stl.	s-flex.	s.	36x4	36x5	wd.	Buda	4-4⅛x5¼-27.2	4	cent.		fin-cst.	sing.	Eismn	fix.	none.	none.	none	cent.	Pierce.	motor.
O.K. 1T	3	2,985	158	Savg.	p-stl.	s-flex.	s.	36x4	36x7	wd.	Buda	4-4¼x5½-29.0	4	cent.	Chgo	fin-cst.	sing.	Eismn	fix.	none.	none.	none	cent.	Pierce.	motor.
Old Hickory M	¾	995	112	own.	rol-c.	s-flex.	pnu.	33x4	33x4	wd.	Lyc.	4-3¼x5 -16.9	4	ther.	Can.	cel-pst.	sing.	Conn.	hand.	sl&i.	Dynt.	none			
Old Reliable WA	1½	2,350	150	Savg.	p-stl.	s-flex.	s.	34x3½	36x6	wd.	Wis.	4-4 x5 -25.6	4	cent.	Chgo	fin-cst.	sing.	Bosch.	hand.	ltg.	opt.	50	suc.	Mnrch.	motor.
Old Reliable WB	2½	3,250	160	own.	rol-c.	s-flex.	s.	34x4	36x4d	wd.	Wis.	4-4¼x6 -29.0	4	cent.	Chgo	fin-cst.	sing.	Bosch.	hand.	ltg.	opt.	50	suc.	Mnrch.	motor.
Old Reliable WC	3½	4,000	160	own.	rol-c.	rigid.	s.	34x5	36x5d	wd.	Wis.	4-4¼x6 -29.0	4	cent.	Chgo	cel-sht.	sing.	Bosch.	hand.	ltg.	opt.	50	suc.	Mnrch.	motor.
Old Reliable WD	5	5,000	166	own.	rol-c.	rigid.	s.	36x5	40x6d	wd.	Wau*	4-4¾x6¾-36.1	2	cent.	Chgo	fin-cst.	sing.	Bosch.	hand.	ltg.	opt.	50	suc.	Mnrch.	motor.
Old Reliable CO	5	5,000	126	own.	rol-c.	rigid.	s.	36x6	36x6d	wd.	Wis.	4-4¾x5¾-36.1	2	cent.	Chgo	fin-cst.	sing.	Bosch.	hand.	none.	none.	none	cent.	Duplex.	motor.
Old Reliable CP	7	6,000	136	own.	rol-c.	rigid.	s.	36x6	40x7d	wd*	Wau.	4-4¾x6¾-36.1	2	cent.	Chgo	fin-cst.	sing.	Bosch.	hand.	none.	none.	none	cent.	Wau.	motor.
Oneida A	1	2,290	130	Smith.	p-stl.	s-flex.	s*.	36x3½	36x5	wd.	Con.	4-3¾x5¼-22.5	4	cent.	Long.	fin-cst.	sing.	Bosch.	hand.	ltg.	West.		cent.	Pierce.	motor.
Oneida B	1½	2,650	130	Smith.	p-stl.	s-flex.	s*.	36x3½	36x6	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Long.	fin-cst.	sing.	Bosch.	hand.	ltg.	West.		cent.	Pierce.	motor.
Oneida C	2	3,000	144	Smith.	p-stl.	s-flex.	s*.	36x4	36x7	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Long.	fin-cst.	sing.	Bosch.	hand.	ltg.	West.		cent.	Pierce.	motor.
Oneida D	3½	3,700	160	Smith.	p-stl.	s-flex.	s*.	36x5	36x5d	wd.	Con.	4-4½x5½-32.4	2	cent.	Long.	fin-cst.	sing.	Bosch.	hand.	ltg.	West.		cent.	Pierce.	motor.
Oneida E	5	4,750	170	Smith.	p-stl.	flex.	s.	36x6	40x12	c-s.	Con.	4-5¼x5¾-44.2	2	cent.	Long.	fin-cst.	sing.	Bosch.	hand.	ltg.	West.		cent.	Pierce.	motor.
Overland Panel	⅖	835	104				pnu.	31x4	31x4		own.	4-3⅜x5 -18.2	4	ther.				Conn.	hand.	s&l.	Aut-L.				
Overland Express	⅗	1,015	106				pnu.	33x4½	33x4½		own.	4-4⅛x4½-27.2	4	ther.				Conn.	hand.	s&l.	Aut-L.				
Packard E	1	2,650	126	own.	rol-c.	flex.	s*.	34x3½	34x6	wd.	own.	4-4 x5½-25.6	4	cent.	own.	cel-sht.	sing.	Spltf.	hand.	sl&i-2.	Bijur.	180	cent.	own.	motor.
Packard E	1½	3,000	126	own.	rol-c.	flex.	s*.	34x3½	34x3½d	wd.	own.	4-4 x5½-25.6	4	cent.	own.	cel-sht.	sing.	Spltf.	hand.	sl&i-2.	Bijur.	180	cent.	own.	motor.

ABBREVIATIONS—Types of Construction

*Other Options
amid—amidships
auto—automatic
bevl—bevel
c—center
c&l—center and left
c&s—cushion and solid
cent—centrifugal
c-s—cast steel
c-a—cast aluminum
cel-cst—cellular core, cast case
cel-pst—cellular core, pressed steel case
cel-sht—cellular core, sheet case
chn—chain
cylinders cast, 2 in pairs
cylinders cast, 4 in block
cylinders cast, 3 in threes
cylinders cast, 1 singly
d-d—dry disk
d-p—dry plate
d-rd—double reduction
d-s—driveshaft
elec—electric
ext-d-s—external driveshaft
ext-f-w—external front wheels
ext-g—external gear
ext-jst—external jackshaft
ext-r-w—external rear wheel
fab—fabric
fin—finned tube
fin-c-a—finned tube core, cast aluminum case
fin-cst—finned tube core, cast case
fin-pst—finned tube core, pressed steel case
fin-sht—finned tube core, sheet case
fix—fixed
flex—flexible
fric—friction
g.p.—gear pump
grav—gravity
gset—gearset
hyd—hydraulic
ind-c—individual clutch
int-d-s—internal driveshaft
int-f-w—internal front wheels
in-g—internal gear
in-g-4—internal gear drive on 4 wheels
int-r-w—internal rear wheel
jst—unit with jackshaft
l—left
l&c—left and center
leat—leather
l-b—loose ball
ltg—lighting
metl—metal
mtr—unit with motor
opt—optional
p—plate in oil
pist—piston pump
plan—planetary
pnu—pneumatic
pres—pressure
prog—progressive sliding gearset
p-t-c-a—plain tube core, cast aluminum case
p-t-cst—plain tube core, cast case
p-stl—pressed steel
p&s—pneumatic and solid
r—right
r-ax—unit with rear axle
rng-cst—ring core, cast case
rol-c—rolled channel
rol-i—rolled I-beam
r-rd—radius rods
selec—selective sliding gear
s-flex—semi-flexible
stg—starting
s&l—starting and lighting
s.l&i—starting, lighting and ignition
s l&i2—starting, lighting and ignition, two-unit
sing—single
s—solid
s&c—solid and cushion
sprs—springs
sq-t-cst—square tube core, cast iron
sq-t-sht—square tube core, sheet case
stk—stock
sub-f—sub-frame
suc—suction
s-bev—spiral bevel
ther—thermo-syphon
tor-a—torque arm
t-t—torsion tube
unt-x—unit with axle
vacm—vacuum
wd—wood
w-d—multiple disk in oil
worm—top worm
w-p—wet plate
zz-t-cst—zig zag tube core, cast case
zz-t-pst—zig zag tube core, pressed steel case
zz-t-sht—zig-zag tube core, sheet case

Gasoline Motor Trucks for 1919—Continued

ENGINE						TRANSMISSION										BRAKES		CONTROL			UNIVERSALS		
SPEED		FUEL SYS.		CLUTCH		GEARSET				FINAL DRIVE								STEERING GEAR					
Motor in R.p.m.	Truck in M.p.h.	Carbureter Make	Fuel Feed	Type	Make	Type	Make	Placed	Speeds	Type	Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Foot	Hand	Placed	Make	Levers	Type	Make	Name and Model
1,275		Stmbg*	grav	d-d	B-Lipe	selec	B-Lipe	mtr	4	chn	own	6.99	r-rd		Mthr	ext-d-s	int-r-w	l	Gem	c			Mack AB
1,000		Stmbg*	grav	d-p	own	selec	own	amid	3	chn	own	7.45	r-rd		Mthr	ext-j-s	int-r-w	l	Gem	c			Mack AC
1,000		Stmbg*	grav	d-p	own	selec	own	amid	3	chn	own	8.4	r-rd		Mthr	ext-j-s	int-r-w	l	Gem	c			Mack AC
1,000		Stmbg*	grav	d-p	own	selec	own	amid	3	chn	own	10.77	r-rd		Mthr	ext-j-s	int-r-w	l	Gem	c			Mack Tractor AC
1,000		Stmbg*	grav	d-p	own	selec	own	amid	3	chn	own	11.58	r-rd		Mthr	ext-j-s	int-r-w	l	Gem	c			Mack AC
1,000		Stmbg*	grav	d-p	own	selec	own	amid	3	chn	own	11.5	r-rd		Mthr	ext-j-s	int-r-w	l	Gem	c			Mack Tractor AC
1,000		Stmbg*	grav	d-p	own	selec	own	amid	3	chn	own	14.1	r-rd		Mthr	ext-j-s	int-r-w	l	Gem	c			Mack Tractor AC
1,120	16	Zenith	vacm	d-d		selec		mtr	3	worm		7.5	r-rd	r-rd		ext-r-w	int-r-w					own	Manly 30
1,150	15	Zenith	vacm			selec		mtr	3	worm		8.25	r-rd	r-rd		ext-r-w	int-r-w					own	Manly 40
1,035	14	Zenith	vacm	d-d		selec		mtr	4	worm		8.66	r-rd	r-rd		int-r-w	int-r-w					own	Manly 50
1,100	16	Master	grav	d-p	Fuller	selec	Fuller	mtr	3	in-g	Torbn	8	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Wol	c	metl	Arvac	Master M
1,100	16	Master	grav	d-d	Fuller	selec	Fuller	mtr	3	in-g	Torbn	8	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Wol	c	metl	Arvac	Master O
1,100	16	Master	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Timkn	8.33	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Wol	c	metl	Arvac	Master W
1,100	16	Master	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Timkn	8.33	spgs	spgs	Dtrt	ext-r-w	int-r-w	l	Wol	c	metl	Arvac	Master WL
1,000	12	Master	grav	d-p	B-Lipe	selec	B-Lipe	amid	4	worm	Timkn	10.33	spgs	spgs	Dtrt	int-r-w	int-r-w	l	Lavn	c	metl	Spicer	Master A
				cone		selec		mtr	3	worm			spgs	spgs		ext-r-w	int-r-w						Maxfer
1,400	18	Jhnson	grav	cone	own	selec	own	mtr	3	worm	own	7.25	spgs	spgs	Shel	int-r-w	int-r-w	l	own	c	metl	own	Maxwell
		Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Timkn	7	spgs	spgs	Tut	int-r-w	int-r-w	l	Gem	c	fab	own	Menominee Hurryton
			grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Timkn	9.25	r-rd	spgs	Tut	int-r-w	int-r-w	l	Gem	c	metl	Acme	Menominee H
			grav	d-d	Fuller	selec	Fuller	mtr	3	worm	Timkn	9.25	r-rd	spgs	Tut	int-r-w	int-r-w	l	Gem	c	metl	Spicer	Menominee D
		Stmbg	grav	d-d	Fuller	selec	Fuller	amid	4	worm	Timkn	10.33	r-rd	spgs	Tut	int-r-w	int-r-w	l	Gem	c	metl*	own*	Menominee G
			grav	d-d	B-Lipe	selec	B-Lipe	amid	4	worm	Timkn	13.66	r-rd	spgs	Tut	int-r-w	int-r-w	l	Gem	c	metl	Blood	Menominee J
		Zenith		d-d	Fuller	selec	Fuller	mtr	3	worm	Timkn		r-rd	spgs		ext-r-w	ext-r-w		Ross				Modern 30
1,140	18	Miller	grav	d-d	own	selec	own	mtr	3	worm	Timkn	6	spgs	spgs		int-r-w	int-r-w	l	Ross	c	fab	Therm	Moreland 17-N
1,140	16	Miller	grav	d-d	own	selec	own	amid	4	worm	Timkn	7	r-rd	spgs		int-r-w	int-r-w	l	Ross	c	fab	Therm	Moreland 17-B
1,090	15½	Miller	grav	d-p	own	selec	own	amid	4	worm	Timkn	6.8	r-rd	spgs	own	int-r-w	int-r-w	l	Ross	c	fab	own	Moreland 17-C
950	13	Miller	grav	d-p	own	selec	own	amid	4	worm	Timkn	7.8	r-rd	spgs	own	int-r-w	int-r-w	l	Ross	c	fab	own	Moreland 17-G
950	10	Miller	grav	d-d	own	selec	own	amid	4	worm	Timkn	8.8	r-rd	spgs	own	int-r-w	int-r-w	l	Ross	c	fab	own	Moreland 17-J
1,190	16	Stewrt	vacm	d-d	Fuller	selec	Fuller	mtr	3	in-g	Torbn	8	spgs	spgs	Perf	ext-r-w	int-r-w	l	Lavn	c	metl	Hart	Muskegon 20
1,250	20	Carter	vacm	d-d	Mech	selec	Mech	mtr	3	worm	Emp	7	spgs	spgs	Cant	int-r-w	ext-r-w	l	C.A.S.	c	metl	Univ	Myers 50
1,250	20	Carter	vacm	d-d	Mech	selec	Mech	mtr	3	worm	Emp	7	spgs	spgs	Cant	int-r-w	ext-r-w	l	C.A.S.	c	metl	Univ	Myers 55
1,250	18	Carter	vacm	d-p	B-Beck	selec	G-Lees	mtr	3	worm	Emp	7.75	spgs	spgs	Cant	int-r-w	ext-r-w	l	C.A.S.	c	metl	Univ	Myers 70
1,250	18	Carter	vacm	d-d	B-Beck	selec	G-Lees	mtr	3	worm	Emp	7.75	spgs	spgs	Cant	int-r-w	ext-r-w	l	C.A.S.	c	metl	Univ	Myers 75
1,351	20	Stmbg	grav	d-p	B-Beck	selec	Dtrt	mtr	3	in-g	Clark	6.8	spgs	spgs	Std	ext-r-w	ext-d-s	l	Jacox	c	metl	own	Nash 2018
1,191	15	Stmbg	grav	d-p	B-Beck	ind-c	own	amid	4	in-g-4	own	8.5	spgs	spgs	Mthr	int-r-w	ext-d-s	l	Lavn	c	metl	Spicer	Nash 4017
1,281	16	Stmbg	grav	d-p	B-Beck	selec	Dtrt	mtr	3	in-g	Clark	9	spgs	spgs	Std	ext-r-w	ext-d-s	l	Jacox	c	metl	own	Nash 3018
1,200	16	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	6.75	spgs	spgs	Tut	int-r-w	int-r-w	r	Lavn	c	fab	own	Nelson & LeMoon F1
1,200	15	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	7.75	spgs	spgs	Tut	int-r-w	int-r-w	r	Lavn	c	fab	own	Nelson & LeMoon F2
1,100	12	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	4	worm	Timkn		spgs	spgs	Tut	int-r-w	int-r-w	r	Lavn	c	fab	own	Nelson & LeMoon F3½
1,100	10	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	4	worm	Timkn		spgs	spgs	Tut	int-r-w	int-r-w	r	Lavn	c	fab	own	Nelson & LeMoon F5
1,800		Zenith	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	8.5	spgs	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Hart	Netco D
1,573	25	Stmbg	grav	d-d	Cover	selec	Cover	mtr	3	worm	Timkn	6.5	spgs	spgs		int-r-w	int-r-w		Gem				Niles B
1,173	15	Stmbg	grav	d-p	B-Beck	selec	Cover	amid	3	worm	Timkn	8.5	r-rd	spgs		int-r-w	int-r-w		Gem				Niles E
1,300	16	Stmbg	vacm	d-p	B-Beck	selec	Fuller	mtr	4	worm	Shel	8.75	spgs	spgs	Kal	int-r-w	int-r-w	l	Ross	c	metl	Blood	Noble NW2
1,148	12	Stmbg	vacm	d-p	B-Beck	selec	Fuller	amid	4	worm	Shel	10.25	r-rd	spgs	Kal	int-r-w	int-r-w	l	Ross	c	metl	Acme	Noble NW4
2,600	28	Carter	vacm	d-p	B-Beck	selec	G-Lees	mtr	3	worm	Emp	7.2	spgs	spgs	Perf	int-r-w	ext-r-w	l	C.A.S.	c	metl	Univ	Norwalk
2,600	25	Carter	vacm	d-p	B-Beck	selec	G-Lees	mtr	3	worm	Emp	7.5	spgs	spgs	Perf	int-r-w	ext-r-w	l	C.A.S.	c	metl	Univ	Norwalk
.200	15	Zenith	vacm	d-d	Muncie	selec	Muncie	mtr	3	worm	Chgo		spgs	spgs	Tut	int-d-s	int-r-w	l	Ross	c	metl	Hart	O.K. 3T
.200	12	Zenith	vacm	d-d	Fuller	selec	Fuller	mtr	4	worm	Hays		spgs	spgs	Tut	int-r-w	int-r-w	l	Ross	c	metl	Hart	O.K. 1T
.800	20	Carter	grav	cone	Lyc	selec	G-Lees	mtr	3	bevl	Salsby	6	tor-t	tor-t	Tut	ext-r-w	int-r-w	l	C.A.S.	c	fab	own*	Old Hickory M
.250	15	Rayfld	vacm	w-d	own	selec	B-Lipe	amid	4	worm	Shel	8.75	spgs	spgs	Shel	int-r-w	int-r-w	r	Ross	c	metl	Spicer	Old Reliable WA
.150	12	Stmbg	vacm	w-d	own*	selec	B-Lipe	amid	4	worm	Shel	8.75	spgs	spgs	Shel	int-r-w	int-r-w	r	Ross	c	metl	Spicer	Old Reliable WB
.250	15	Rayfld	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Shel	8.75	spgs	spgs	Shel	int-r-w	int-r-w	r	Ross	c	metl	Spicer	Old Reliable WC
.250	15	Rayfld	vacm	d-d	Fuller	selec	Fuller	amid	4	worm	Shel	8.75	spgs	spgs	Shel	int-r-w	int-r-w	r	Ross	c	metl	Spicer	Old Reliable WD
950	12	Stmbg	grav	w-d	own	selec	Savg	jst	3	chn*	Shel	8.93	r-rd	r-rd	Shel	ext-d-s	int-r-w	r	Ross	r	metl	Hart*	Old Reliable CO
1,090	12	Stmbg	grav	w-d	own*	selec	Savg	jst	4	chn*	Shel	10.88	r-rd	r-rd	Shel	ext-d-s	int-r-w	r	Ross	r	metl	Hart*	Old Reliable CP
1,300	16	Stmbg	grav	w-d	H-Shaw	id-c	Cotta	amid	3	worm	Timkn	8.75	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Ross	c	metl	Spicer	Oneida A
1,300	15	Stmbg	grav	w-d	H-Shaw	id-c	Cotta	amid	3	worm	Tikmn	9.25	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Ross	c	metl	Spicer	Oneida B
1,200	14	Stmbg	grav	w-d	H-Shaw	id-c	Cotta	amid	3	worm	Timkn	9.25	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Ross	c	metl	Spicer	Oneida C
1,150	12	Stmbg	grav	w-d	H-Shaw	id-c	Cotta	amid	3	worm	Timkn	10.5	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Ross	c	metl	Spicer	Oneida D
1,100	11	Stmbg	grav	w-d	H-Shaw	id-c	Cotta	amid	3	worm	Timkn	11.66	r-rd	spgs	Mthr	int-r-w	int-r-w	l	Ross	c	metl	Spicer	Oneida E
		Titsn	vacm	cone	own	selec	own	r-ax	3	bevl	own	4.3	t-t	t-t		ext-r-w	int-r-w		own				Overland Panel
		Titsn	grav	cone	own	selec	own	r-ax	3	s-bev	own	4.4	t-t	t-t		ext-r-w	int-r-w		own				Overland Express
1,000	16	own	pres	d-d	own	selec	own	amid	4	worm	own	6.25	tor-a	tor-a	S-P	ext-d-s	int-r-w	l	own	l&c	metl*	Spicer	Packard 1-E
1,000	16	own	pres	d-d	own	selec	own	amid	4	worm	own	6.25	tor-a	tor-a	S-P	ext-d-s	int-r-w	l	own	l&c	metl*	Spicer	Packard E

ABBREVIATIONS—Makers of Parts

*Other Options
A-K—Atwater-Kent
Al-Ch—Allis-Chalmers
Aut-L—Auto-Lite
B-Beck—Borg & Beck
B-Lipe—Brown-Lipe
Bling—Berling
Brem—Bremer
Can—Candler
Cant—Canton-Cleveland
CAS—C.A.S. Products Co.
Champ—Champion Spng.
Chgo—Chicago-Stndrd
Chgo—Chicago Mfg. Co.
Con—Continental
Conn—Connecticut
Cover—Covert
Del—Delany
Ditw—Ditweiler
Dneto—Dyneto
Dtrt—Detroit Press. Stl.
Dtrt—Detroit Lubricat.
Dtrt—Detroit G. & M. Co.
Dtrt—Detroit Stl. Spng.
Duplx—Duplex
E&M—English & Mersick
Eismn—Eisemann
Emp—Empire
Ens—Ensign
Eur—Eureka
Fed—Fedders
Flech—Fletcher
Fost—Foster
Franck—Francke
G&D—Gray & Davis
G&O—G. & O. Mfg. Co.
GBS—Golden, Belknap & Swartz
G-Lees—Grant-Lees
Gem—Gemmer
H&N—H. & N. Carburetor Co.
Har—Harrison
Hart—Hartford
Hays—Hayes
Her—Hercules
Hig—Higgins
Hol—Holley
H-Shaw—Hele-Shaw
H-S—Herschell-Spillman
Hyd—Hydraulic
Idl—Ideal
Ind—Industrial Equipment Co.
Iron—Iron City
J-A—Jackson Radiator Wks.
Jacox—Jackson-Church-Wilcox
Jas—Jamestown Car Pts. Co.
Jhnson—Johnson
Kal—Kalamazoo
K-B—Kinsler-Bennett
Key-H—Keystone-Hindley
King—Kingston
Koko—Kokomo
Lau—Lauraine
Lavn—Lavine
LeR—LeRoi
Lgt—Light Foundry
Ligt—Liggett
L-N—Leece Neville
Lyc—Lycoming
Marvl—Marvel
Mast—Master
McC—McCord
McFar—McFarland
Mech—Mechanics
Merl—Merrill
Mil—Milwaukee
Mnrch—Monarch
Mod—Modine
Mthr—Mather
M&E—Merchant & Evans
Natl—National
N.A.—North American
N-E—North East
Nlite—Nicolite
Penn—Penn Spring Co.
P&B—Parish & Bingham
Per—Perfex
Perf—Perfection
Prsh—Parish
R-T—Rome-Turney
Rayfld—Rayfield
Rem—Remy
Rowl—Wm. Harvel Rowland
Rugles—Ruggles
Russl—Russel
Rut—Rutenber
Savg—Savage Arms
Salsby—Salisbury
Schblr—Schebler
Shel—Sheldon
Shkspr—Shakespeare
Smth—A. O. Smith
S-P—Spring-Perch
Spltf—Splitdorf
Stan—Standard Radiator Co.
Stand—Standard Steel Spring Co.
Stewrt—Stewart
Stlg—Sterling
Stmbg—Stromberg
Sundmn—Sunderman
S-W—Sparks-Withington
Therm—Thermoid
Timkn—Timken
Titsn—Tillotson
Torbn—Torbenson
Tut—Tuthill
Univ—Universal Machine Co.
Wau—Waukesha
West—Westinghouse
Wis—Wisconsin
Wol—Wohlrab
W-W—Walker-Weiss

Detailed Technical Specifications of

Name and Model	Tons Capacity	Chassis Price	Wheelbase Inches	FRAME			TIRES			Wheels	ENGINE			COOLING			IGNITION			ELEC. SYSTEM			GOVERNOR		
				Make	Material	Type	Kind	Size in Ins. Front	Size in Ins. Rear		Make	No. Cyl. Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	Water Circ.	Radiator Make	Radiator Core and Case	Type	Make	Spark Advance	Type	Make	Extra Cost $	Type	Make	Drive
Packard E	2	3,400	144	own	rol-c	flex	s*	34x4	34x4d	wd	own	4-4 x5½-25.6	4	cent	own	cel-sht	sing	Spltf	hand	sl&i-2	Bijur	180	cent	own	motor
Packard E	3	4,100	156	own	rol-c	flex	s*	36x5	36x5d	wd	own	4-4½x5½-32.4	4	cent	own	cel-sht	sing	Spltf	hand	sl&i-2	Bijur	180	cent	own	motor
Packard E	4	4,450	156	own	rol-c	flex	s*	35x5	40x5d	wd	own	4-4½x5½-32.4	4	cent	own	cel-sht	sing	Spltf	hand	sl&i-2	Bijur	180	cent	own	motor
Packard E	5	5,150	156	own	rol-c	flex	s*	36x6	40x6d	wd	own	4-5 x5½-40.0	4	cent	own	cel-sht	sing	Spltf	hand	sl&i-2	Bijur	180	cent	own	motor
Packard E	6	5,400	156	own	rol-c	flex	s*	36x6	40x7d	wd	own	4-5 x5½-40.0	4	cent	own	cel-sht	sing	Spltf	hand	sl&i-2	Bijur	180	cent	own	motor
Palmer	1	1,695	132	P&B	p-stl		s*	34x3½	34x4	wd	Con	4-3¾x5 -22.5	4	cent	Fed	cel-cst	dual	Bosch	fix				cent	Pierce	motor
Palmer	2	2,595	144	P&B	p-stl		s	36x3½	36x4d*	wd	Con	4-4⅛x5¼-27.2	4	cent	Fed	cel-cst	dual	Bosch	fix				cent	Pierce	motor
Panhard A	1	1,195	130				p&s	32x3½	32x3½		Gray	4-3½x5 -19.6	4	ther			sing	Aut-L	hand	ltg	Aut-L				
Panhard B	1½	1,395	130				s	32x3½	32x4		Gray	4-3½x5 -19.6	4	ther			sing	Aut-L	hand	ltg	Aut-L				
Parker	2	3,150	150	own	p-stl	s-flex	s*	34x4	36x3½d	wd	Con	6-3½x5¼-29.4	4	cent	own	sq-t-cst	sing	Bosch	hand	s&l-2	West	none	cent	Pierce	motor
Parker	3	3,700	160	own	p-stl	s-flex	s	34x4	36x5d	wd	Con	6-3½x5¼-29.4	4	cent	own	sq-t-cst	sing	Bosch	hand	s&l-2	West	none	cent	Pierce	motor
Parker	4	4,250	160	own	p-stl	s-flex	s	36x5	40x5d	wd	Con	6-3¾x5¼-33.7	2	cent	own	sq-t-cst	sing	Bosch	hand	s&l-2	West	none	cent	Pierce	motor
Parker	5	5,000	168	own	p-stl		s	36x5	40x6d	wd	Con	6-3¾x5¼-33.7	2	cent	own	sq-t-cst	sing	Bosch	hand	s&l-2	West	none	cent	Pierce	motor
Peerless TC	3	4,125	151	own	rol-c	s-flex	s	36x4	40x4d	wd	own	4-4½x6½-32.4	2	gear	own	fin-c-a	dual	Remy	hand	none	none	none	cent	own	motor
Peerless TC	4	4,150	151	own	rol-c	s-flex	s	36x5	40x5d	wd	own	4-4½x6½-32.4	2	gear	own	fin-c-a	dual	Remy	hand	none	none	none	l-b	own	motor
Peerless TC	5	4,700	151	own	rol-c	s-flex	s	36x6	40x6d	wd	own	4-4½x6½-32.4	2	gear	own	fin-c-a	dual	Remy	hand	none	none	none	l-b	own	motor
Pierce-Arrow X-4	2	3,750	150	Prsh	p-stl	flex	s*	36x4	36x4d	wd	own	4-4 x5½-25.6	2	cent	own	fin-c-a	dual	Eismn	hand	sl&i-2	West		cent	own	motor
Pierce-Arrow R-9	5	5,500	168	Prsh	p-stl	flex	s*	36x6	40x6d	wd	own	4-4⅞x6 -38.2	2	cent	own	fin-c-a	dual	Eismn	hand	sl&i-2	West		cent	own	motor
Power	2		150	own	rol-c	s-flex	pnu	36x4	36x4d	wd	Con	4-4⅛x5¼-27.2	4	cent	Can	sq-t-cst	sing	Simms	hand				cent	Pierce	motor
Rainier R-5	½	1,250	115	P&B	p-stl	s-flex	pnu	33x4	33x4	wd	Lgt	4-3¼x4½-16.9	4	ther	Har	cel-pst	sing	Simms	fix		Bijur	125	none	none	none
Rainier R-2	¾	1,350	125	P&B	p-stl	s-flex	pnu	34x4	34x4	wd	Lgt	4-3¼x4½-16.9	4	ther	Har	cel-pst	sing	Simms	fix		Bijur	125	none	Mnrch	motor
Rainier R-4	1¼	1,595	125	P&B	p-stl	s-flex	p&s	34x3	34x4	wd	Lgt	4-3¼x4½-16.9	4	ther	Har	cel-pst	sing	Simms	fix		Bijur	125	suct	Mnrch	motor
Rainier R-6	1½	1,890	133	Prsh	p-stl	s-flex	s&c	32x4	34x4	wd	Con	4-3½x5⅛-19.6	4	ther	Har	cel-pst	sing	Sims*	fix	none	none	none	suct	Mnrch	motor
Rennoc-Leslie M	2½	2,895	144	own	rol-c	s-flex	s	36x5	36x7	wd	Buda	4-4⅛x5½-27.2	4	cent	Chgo	fin-cst	dual	Spltf	hand	ltg	West	none	cent	Pierce	motor
Rennoc-Leslie Tractor B	8	2,895	116	own	rol-c	s-flex	s	36x5	36x7	wd	Buda	4-4⅛x5½-27.2	4	cent	Chgo	fin-cst	dual	Spltf	hand	ltg	West	none	cent	Pierce	motor
Reo F	¾	1,250	128	own	p-stl	rigid	pnu	34x4½	34x4½	wd	own	4-4⅛x4½-27.2	2	cent	own	fin-pst	sing	Remy	hand	sl&i-2	Remy	none	none	none	none
Republic Despatch	¾	1,095	110		p-stl	s-flex	opt	32x3	32x3½	wd	own	4-3¼x5 -16.9	4	ther	own	cel-cst	sing	Remy	hand	ltg	Remy		suc	Rugles	motor
Republic 9 Special	¾	1,295	128		p-stl	s-flex	opt	32x3	32x4	wd	own	4-3½x5 -19.6	4	ther	own	cel-cst	sing	Eismn	fix	none	none	none	suc	Rugles	motor
Republic 10	1	1,485	124		p-stl	s-flex	s	34x3	34x4	wd	Con	4-3½x5 -19.6	4	ther	own	cel-cst	sing	Eismn	fix	none	none	none	suc	Rugles	motor
Republic 11X	1½	1,775	144		p-stl	s-flex	s	34x3½	34x5	wd	Con	4-3¾x5 -22.5	4	ther	own	cel-cst	sing	Eismn	fix	none	none	none	suc	Rugles	motor
Republic 12X-12A	2	2,150	144		p-stl	s-flex	s	34x4	34x6	wd	Buda	4-4⅛x5½-27.2	4	cent	own	cel-cst	sing	Bosch	fix	none	none	none	suc	Rugles	motor
Republic TX	3½	3,450	165		p-stl	s-flex	s	36x5	36x5d	c-s	Buda	4-4¼x5½-29.0	4	cent	own	cel-cst	sing	Bosch	hand	none	none	none	suc	Rugles	motor
Riker B	3		150	Prsh	p-stl	s-flex	s	36x5	36x5d	wd	own	4-4¼x6 -29.0	2	cent	own	fin-c-a	dual	Blng*	hand	s&l-2	West		l-b	own	motor
Riker BB	4		150	Prsh	p-stl	s-flex	s	36x5	36x6d	wd	own	4-4¼x6 -29.0	2	cent	own	fin-c-a	dual	Blng*	hand	s&l-2	West		l-b	own	motor
Rowe CDW	2	3,000		own	rol-c	rigid	s	34x4	36x7	wd	Wis	4-4 x5 -25.6	4	cent	Fed	sht		Bosch		none	none	none	cent	Duplex	motor
Rowe CDW	2½	3,250		own	rol-c	rigid	s	34x4	36x4d	wd	Wis	4-4 x5 -25.6	4	cent	Fed	sht		Bosch		none	none	none	cent	Duplex	motor
Rowe DEW	3	3,800		own	rol-c	rigid	s	36x5	36x5d	wd		4-4 x6 -25.6	4	cent	Fed	sht		Bosch		none	none	none	cent	Duplex	motor
Rowe FW	5	4,900		own	rol-c	rigid	s	36x6	40x6d	wd	Wis	4-4¾x5½-36.1	2	cent	Fed	sht		Bosch					cent	Duplex	motor
Royal	1	2,400	128	own	rol-c	rigid	s	34x4	34x5	wd	Wis	4-3¼x5 -16.9	4	cent	Kells	fin-cst	sing	Bosch	fix	sl&i	opt		suc	Mnrch	motor
Royal	1½	2,800	128½	own	rol-c	rigid	s	34x4	34x5	wd	Wis	4-3¾x5 -22.5	4	cent	Kells	fin-cst	sing	Bosch	fix	sl&i	opt		suc	Mnrch	motor
Royal	2	3,200	132	own	rol-c	rigid	s	36x4½	36x6	wd	Wis	4-4 x6 -25.6	4	cent	Kells	fin-cst	sing	Bosch	fix	sl&i	opt		suc	Mnrch	motor
Royal	2½	3,500	132½	own	rol-c	rigid	s	36x4½	36x6	wd	Wis	4-4¼x6 -29.0	4	cent	Kells	fin-cst	sing	Bosch	fix	sl&i	opt		suc	Mnrch	motor
Royal	3½	4,200	158	own	rol-c	rigid	s	36x5	38x5d	wd	Wis	4-4½x6 -32.4	4	cent	Kells	fin-cst	sing	Bosch	fix	sl&i	opt		suc	Mnrch	motor
Royal	5	5,000	168	own	rol-c	rigid	s	36x6	40x6d	wd	Wis	4-4¾x5½-36.1	2	cent	Kells	fin-cst	sing	Bosch	fix	s&l	opt		suc	Mnrch	motor
Royal	6	5,400	168	own	rol-c	rigid	s	36x6	40x6d	wd	Wis	4-5⅛x6 -42.2	2	cent	Kells	fin-cst	sing	Bosch	fix	sl&i	opt		suc	Mnrch	motor
Royal	7	6,500	168	own	rol-c	rigid	s	36x7	40x7d	wd	Wis	4-5¼x7 -44.2	2	cent	Kells	fin-cst	sing	Bosch	fix	s&l	opt		suc	Mnrch	motor
Rush D	½	895	105				pnu	31x4	31x4		Lyc	4-3¼x5 -16.9	4	ther			sing	Conn	hand	s&l	Spltf				
Sandow G	1		120	Savg	p-stl	flex	s	34x3½	34x5	wd	Con	4-3½x5 -19.6	4	ther	Brm	fin-cst	sing	Eismn							
Sandow CG	1¼		134	Savg	p-stl	s-flex	s	34x3½	34x5	wd	Con	4-3½x5 -19.6	4	ther	Brm	fin-cst	sing	Eismn	hand						
Sandow H	1½		138	Savg	p-stl	s-flex	s	34x4	34x6	wd	Con	4-3½x5 -19.6	4	ther	Brm	fin-cst	sing	Eismn	hand						
Sandow J	2		165	Savg	p-stl	s-flex	s	36x4	36x7	wd	Con	4-4⅛x5¼-27.2	4	cent	Chgo	fin-cst	sing	Bosch	hand						
Sandow	3½		175			s-flex	s	36x5	36x5d	wd	Con	4-4½x5½-32.4	2	cent	Chgo	fin-cst	sing	Bosch	hand				suc		motor
Sandow	5		163	Savg	p-stl	s-flex	s	36x6	40x6d	wd	Wau	4-4¾x6¾-36.1	4	cent	Chgo	fin-cst	sing	Bosch	hand				suc	Mnrch	motor
Sanford .25	2½	3,000	156	Prsh	p-stl	rigid	s	36x4	36x4d	wd	Con	4-4⅛x5¼-27.2	4	cent	McC	fin-cst	sing	Bosch	hand	none	none	none	cent	Pierce	motor
Sanford .35	3½	3,975	174	Prsh	p-stl	rigid	s	36x5	36x5d	wd	Con	4-4½x5½-32.4	2	cent	McC	fin-cst	sing	Bosch	hand	none	none	none	cent	Pierce	motor
Sanford .50	5	4,750	174	Prsh	p-stl	rigid	s	36x5	36x6d	wd	Con	4-4½x5½-32.4	2	cent	McC	fin-cst	sing	Bosch	hand	none	none	none	cent	Pierce	motor
Schacht	2	3,150	144	own	rol-c	flex	s	36x4	36x7	wd	Buda	4-4¼x5½-29.0	4	cent	own	p-t-cst	sing	Bosch	hand	none	none	none	cent	Duplex	motor
Schacht	2½	3,500	156	own	rol-c	flex	s	36x4	36x4d	wd	Buda	4-4¼x5½-29.0	4	cent	own	p-t-cst	sing	Bosch	hand	none	none	none	cent	Duplex	motor
Schacht	3½	3,950	168	own	rol-c	flex	s	36x5	36x5d	wd	Buda	4-4¼x5½-29.0	4	cent	own	p-t-cst	sing	Bosch	hand	none	none	none	cent	Duplex	motor
Schacht	5	4,950	168	own	rol-c	flex	s	36x5	40x6d	wd	Buda	4-4¼x5½-29.0	2	cent	own	p-t-cst	sing	Bosch	hand	none	none	none	cent	Duplex	motor
Schleicher	3	3,675	150*				s	34x4½	34x3½d		Con	4-4¼x5½-29.0	2					Bosch	hand					opt	
Schleicner	5	4,725	150*				s	34.5	34x4d		Con	4-5 x6 -40-0	2					Bosch	hand						
Selden TXR	1		137½	P&B	p-stl	s-flex	s	34x3½	34x5	wd	Con	4-3½x5 -19.6	4	ther	Bush	fin-sht	sing	Bosch	fix	s&l	N-E		cent	Pierce	motor
Selden TWL	1		140¾	P&B	p-stl	s-flex	s	34x3	34x4	wd	Con	4-3½x5 -19.6	4	ther	Bush	fin-sht	sing	Bosch	fix	s&l	N-E		cent	Pierce	motor
Selden TXL	1		140	P&B	p-stl	s-flex	s	34x3½	34x5	wd	Con	4-3½x5 -19.6	4	ther	Bush	fin-sht	sing	Bosch	fix	s&l	N-E		cent	Pierce	motor
Selden JCB&JCBL	2		150	P&B	p-stl	s-flex	s	36x4	36x7	wd	Con	4-4⅛x5¼-27.2	4	cent	Bush	fin-cst	sing	Bosch	fix	s&l	N-E		cent	Pierce	motor

ABBREVIATIONS—Types of Construction

*Other Options
amid—amidships
auto—automatic
bevl—bevel
c—center
c&l—center and left
c&s—cushion and solid
cent—centrifugal
c-s—cast steel
c-a—cast aluminum
cel-cst—cellular core, cast case
cel-pst—cellular core, pressed steel case
cel-sht—cellular core, sheet case
chn—chain
cylinders cast, 2 in pairs
cylinders cast, 4 in block
cylinders cast, 3 in threes
cylinders cast, 1 singly
d-d—dry disk
d-p—dry plate
d-rd—double reduction
d-s—driveshaft
elec—electric
ext-d-s—external driveshaft
ext-f-w—external front wheels
ext-g—external gear
ext-jst—external jackshaft
ext-r-w—external rear wheel
fab—fabric
fin—finned tube
fin-c-a—finned tube core, cast aluminum case
fin-cst—finned tube core, cast case
fin-pst—finned tube core, pressed steel case
fin-sht—finned tube core, sheet case
fix—fixed
flex—flexible
fric—friction
g.p.—gear pump
grav—gravity
gset—gearset
hyd—hydraulic
ind-c—individual clutch
int-d-s—internal driveshaft
int-f-w—internal front wheels
in-g—internal gear
in-g-4—internal gear drive on 4 wheels
int-r-w—internal rear wheel
jst—unit with jackshaft
l—left
l&c—left and center
leat—leather
l-b—loose ball
ltg—lighting
metl—metal
mtr—unit with motor
opt—optional
p—plate in oil
pist—piston pump
plan—planetary
pnu—pneumatic
pres—pressure
prog—progressive sliding gearset
p-t-c-a—plain tube core, cast aluminum case
p-t-cst—plain tube core, cast case
p-stl—pressed steel
p&s—pneumatic and solid
r—right
r-ax—unit with rear axle
rng-cst—ring core, cast case
rol-c—rolled channel
rol-i—rolled I-beam
r-rd—radius rods
selec—selective sliding gear
s-flex—semi-flexible
stg—starting
s&l—starting and lighting
s,l&i—starting, lighting and ignition
s l&i2—starting, lighting and ignition, two-unit
sing—single
s—solid
s&c—solid and cushion
spgs—springs
sq-t-cst—square tube core, cast iron
sq-t-sht—square tube core, sheet case
stk—stock
sub-f—sub-frame
suc—suction
s-bev—spiral bevel
ther—thermeo-syphon
tor-a—torque arm
t-t—torsion tube
unt-x—unit with axle
vacm—vacuum
wd—wood
w-d—multiple disk in oil
worm—top worm
w-p—wet plate
zz-t-cst—zig zag tube core, cast case
zz-t-pst—zig zag tube core, pressed steel case
zz-t-sht—zig-zag tube core, sheet case

Gasoline Motor Trucks for 1919—Continued

ENGINE: Speed: Motor in R.p.m.	ENGINE: Speed: Truck in M.p.h.	ENGINE: Fuel Sys.: Carbureter Make	ENGINE: Fuel Sys.: Fuel Feed	ENGINE: Clutch: Type	ENGINE: Clutch: Make	TRANSMISSION: Gearset: Type	TRANSMISSION: Gearset: Make	TRANSMISSION: Gearset: Placed	TRANSMISSION: Gearset: Speeds	TRANSMISSION: Final Drive: Type	TRANSMISSION: Final Drive: Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	BRAKES: Foot	BRAKES: Hand	CONTROL: Steering Gear: Placed	CONTROL: Steering Gear: Make	CONTROL: Levers	UNIVERSALS: Type	UNIVERSALS: Make	Name and Model
1,000	14	own	pres	d-d	own	selec	own	amid	4	worm	own	7.25	tor-a	tor-a	S-P	ext-d-s	int-r-w	l	own	l&c	metl*	Spicer	Packard E
1,000	12	own	pres	d-d	own	selec	own	amid	4	worm	own	9	tor-a	tor-a	S-P	ext-d-s	int-r-w	l	own	l&c	metl*	Spicer	Packard E
1,000	12	own	pres	d-d	own	selec	own	amid	4	worm	own	10	tor-a	tor-a	S-P	ext-d-s	int-r-w	l	own	l&c	metl*	Spicer	Packard E
1,000	11	own	pres	d-d	own	selec	own	amid	4	worm	own	10.66	tor-a	tor-a	S-P	ext-d-s	int-r-w	l	own	l&c	metl*	Spicer	Packard E
1,000	11	own	pres	d-d	own	selec	own	amid	4	worm	own	10.66	tor-a	tor-a	S-P	ext-d-s	int-r-w	l	own	l&c	metl*	Spicer	Packard E
		Stmbg	grav	m-d	Fuller	prog	Fuller			in-g	Torbn		r-rd	t-t	Champ	int-r-w			Ross		metl	Blood	Palmer
1,000	15	Stmbg	grav	m-d	Fuller	prog	Fuller			worm	Timkn		r-rd	t-t	Champ	int-r-w			Ross		metl	Blood	Palmer
1,600	28	Schblr	vacm	d-d	Fuller	selec	Fuller	mtr	3	in-g	Torbn	6.5	t-t	spgs	Kal	ext-r-w	int-r-w		Lavn			Arvac	Panhard A
1,600	22	Schblr	vacm	d-d	Fuller	selec	Fuller	mtr	3	in-g	Torbn	8	t-t	spgs	Kal	ext-r-w	int-r-w		Lavn			Arvac	Panhard B
1,100	16	Stmbg	grav	d-d	B-Lipe	selec	own	mtr	3	worm	own	9.66	r-rd		Tut	int-d-s	int-r-w	l	Ross	l&c	metl	Spicer*	Parker
1,100	14	Stmbg	grav	d-d	B-Lipe	selec	own	mtr	3	worm	own	10.66	r-rd		Tut	int-d-s	int-r-w	l	Ross	l&c	metl	Spicer*	Parker
1,100	13	Stmbg	grav	d-d	B-Lipe	selec	own	mtr	3	worm	own	11.33	r-rd		Tut	int-d-s	int-r-w	l	Ross	l&c	metl	Spicer*	Parker
1,100	12	Stmbg	grav	d-d	B-Lipe	selec	own	mtr	3	worm	own	12.66	r-rd		Tut	int-d-s	int-r-w	l	Ross	l&c	metl	Spicer*	Parker
925	12.5	Stmbg	grav	cone	own	selec	own	amid	4	chn	own	8.7	r-rd	spgs	own	ext-j-s	int-r-w	r	own	r	metl	own	Peerless TC
925	12.5	Stmbg	grav	cone	own	selec	own	amid	4	chn	own	8.7	r-rd	spgs	own	ext-j-s	int-r-w	r	own	r	metl	own	Peerless TC
925	11	Stmbg	grav	cone	own	selec	own	amid	4	chn	own	10.4	r-rd	spgs	own	ext-j-s	int-r-w	r	own	r	metl	own	Peerless TC
1,300	16	own	grav	cone	own	selec	own	amid	4	worm	own	8.25	r-rd	tor-a	S-P	ext-d-s	int-r-w	r	own	r	metl	own	Pierce-Arrow X-4
950	14	own	grav	cone	own	selec	own	amid	3	worm	own	7.8	r-rd	tor-a	S-P	ext-d-s	int-r-w	r	own	r	metl	own	Pierce-Arrow R-9
1,200	15	King	grav	d-d	Fuller	selec	Fuller	mtr	4	worm	Timkn		spgs	spgs	Dtrt	int-r-w	int-r-w	l	Ross	r&c	metl	Univ	Power
2,000	36	Zenith	grav*	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	5.8	spgs	spgs	Perf	int-r-w	int-r-w	l	Lavn	c	metl	Hart	Rainier R-5
2,000	23	Zenith	grav*	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	7.25	spgs	spgs	Perf	int-r-w	int-r-w	l	Lavn	c	metl	Hart	Rainier R-2
2,000	20	Zenith	grav*	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Hays*	8.5	spgs	spgs	Perf	ext-r-w	int-r-w	l	Lavn	c	metl	Hart	Rainier R-4
1,800	17	Zenith	grav*	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Chgo	8.5	spgs	spgs	Perf	ext-r-w	int-r-w	l	Lavn	c	metl	Hart	Rainier R-6
1,200	15	Stmbg	grav	d-d	Warner	selec	Warner	amid	4	worm	Hays	8.75	spgs	spgs	Rowl	int-r-w	int-r-w	l	Lavn	c	metl	Hart	Rennoc-Leslie M
1,000	12	Stmbg	grav	d-d	Warner	selec	Warner	amid	4	worm	Hays	8.75	spgs	spgs	Rowl	int-r-w	int-r-w	l	Lavn	c	metl	Hart	Renhoc-Leslie Tractor B
		Jhnson	grav	d-d	own	selec	own	amid	3	s-bev	own	4.3	spgs	tor-a	Penn	int-r-w		l	own	l&c	metl*	own	Reo F
1,400	25	Stmbg	grav	d-d	own	selec	own	mtr	3	in-g	Torbn	5.38	spgs	spgs		ext-r-w	ext-d-s	l	Jacox	c	metl	Univ	Republic Despatch
1,400	25	Stmbg	grav	d-d	own	selec	own	mtr	3	in-g	Torbn	6.65	spgs	spgs		ext-r-w	ext-d-s	l	Jacox	c	metl	Univ	Republic 9 Special
1,200	18	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	3	in-g	Torbn	7.15	spgs	spgs		ext-r-w	ext-r-w	l	Jacox	c	metl	Arvac	Republic 10
1,200	15	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	3	in-g	Torbn	8	spgs	spgs		ext-r-w	int-r-w	l	Jacox	c	metl	Arvac	Republic 11X
1,000	12	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	3	in-g	Torbn	8	spgs	spgs		ext-r-w	int-r-w	l	Jacox	c	metl	Arvac	Republic 12X-12A
1,000	10	Stmbg	grav	d-d	Fuller	selec	Fuller	mtr	4	in-g	Torbn	10.26	spgs	spgs		ext-r-w	int-r-w	l	Jacox	c	metl	K-B	Republic TX
1,350	14	own	grav	cone	own	selec	own	amid	4	worm	own	10	r-rd	tor-a	S-P*	ext-d-s	int-r-w	r	Ross	r	metl	own	Riker B
1,350	14	own	grav	cone	own	selec	own	amid	4	worm	own	10	r-rd	tor-a	S-P*	ext-d-s	int-r-w	r	Ross	r	metl	own	Riker BB
		Zenith	grav	w-d	B-Lipe	selec	B-Lipe	mtr	4	worm	Timkn		r-rd	spgs	Shel	r-w	r-w	l	Ross	c	metl	Arvac	Rowe :CDW
		Zenith	grav	w-d	B-Lipe	selec	B-Lipe	mtr	4	worm	Shel		r-rd	spgs	Shel	r-w	r-w	l	Ross	c	metl	Arvac	Rowe CDW
		Zenith	grav	w-d	B-Lipe	selec	B-Lipe	mtr	4	worm	Shel		r-rd	spgs	Shel	r-w	r-w	l	Ross	c	metl	M&E	Rowe DEW
		Zenith	grav	w-d	B-Lipe	selec	B-Lipe	amid	4	worm	Shel		r-rd	spgs	Shel	r-w	r-w	l	Ross	c	metl	M&E	Rowe FW
1,600	18	Stmbg	grav	d-p	B-Beck	ind-c	own	amid	3	worm	Timkn*		spgs	spgs	Merl	int-r-w	int-r-w	r	Ross	r	metl	own	Royal
1,600	18	Stmbg	grav	d-p	B-Beck	ind-c	own	amid	3	worm	Timkn*		spgs	spgs	Merl	int-r-w	int-r-w	r	Ross	r	metl	own	Royal
1,600	18	Stmbg	grav	d-p	B-Beck	ind-c	own	amid	3	worm	Timkn*		r-rd	spgs	Merl	int-r-w	int-r-w	r	Ross	r	metl	own	Royal
1,600	18	Stmbg	grav	d-p	B-Beck	ind-c	own	amid	3	worm	Timkn*		r-rd	spgs	Merl	int-r-w	int-r-w	r	Ross	r	metl	own	Royal
1,600	18	Stmbg	grav	d-p	B-Beck	ind-c	own	amid	3	worm	Timkn*		r-rd	spgs	Merl	int-r-w	int-r-w	r	Ross	r	metl	own	Royal
1,000	15	Stmbg	grav	w-d	H-Shaw	ind-c	own	amid	3	worm	Timkn*		r-rd	spgs	Merl	int-r-w	int-r-w	r	Ross	r	metl	own	Royal
1,000	15	Stmbg	grav	w-d	H-Shw*	ind-c	own	amid	3	worm	Timkn*		r-rd	spgs	Merl	int-r-w	int-r-w	r	Ross	r	metl	own	Royal
900	12	Stmbg	grav	w-d	H-Shaw	ind-c	own	amid	3	worm	Timkn*		r-rd	spgs	Merl	int-r-w	int-r-w	r	Ross	r	metl	own	Royal
1,600	29	Carter	grav	d-p	B-Beck	selec		mtr	3	bevl	own	.5	spgs	tor-a		ext-r-w	int-r-w		Lavn				Rush D
1,050	20	Stmbg	vacm	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel	6.5	spgs	spgs	Dtrt	int-r-w	int-r-w	l	Ross	c	metl	K-B	Sandow G
1,050	18	Stmbg	vacm	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel	7.8	spgs	spgs	Dtrt	int-r-w	int-r-w	l	Ross	c	metl	K-B*	Sandow CG
1,100	15	Stmbg	vacm	d-d	Fuller	selec	Fuller	mtr	3	worm	Shel	8.75	spgs	spgs	Dtrt	int-r-w	int-r-w	l	Ross	c	metl	Univ*	Sandow H
1,000	15	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	8.5	spgs	spgs	Dtrt	int-r-w	int-r-w	r	Ross	c	metl	Univ*	Sandow J
1,000		Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	8.66	r-rd	spgs	Dtrt	int-r-w	int-r-w	r	Ross	c	metl	Univ	Sandow
950	10	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	amid	4	worm	Timkn	10.5	r-rd	spgs	Dtrt	int-r-w	int-r-w	r	Ross	c	metl	K-B*	Sandow
1,250	15	Stmbg	grav	d-p	B-Beck	selec	Dtrt	amid	4	worm	Shel	8.75	spgs	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Spicer*	Sanford 25
1,100	13	Stmbg	grav	d-p	B-Beck	selec	Warner	amid	4	worm	Shel		spgs	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Spicer*	Sanford 35
1,100	13	Stmbg	grav	d-p	B-Beck	selec	Warner	amid	4	worm	Shel		spgs	spgs	Perf	int-r-w	int-r-w	l	Ross	c	metl	Spicer*	Sanford 50
900	16	Schblr	grav	cone	Hart	selec	own	amid	3	worm	own	8.66	r-rd	tor-a	Natl	ext-d-s	int-r-w	l	own	c	metl	Hart	Schacht
900	14	Schblr	grav	cone	Hart	selec	own	amid	3	worm	own	9.66	r-rd	tor-a	Natl	ext-d-s	int-r-w	l	own	c	metl	Hart	Schacht
900	12	Schblr	grav	cone	Hart	selec	own	amid	3	worm	own	10.3	r-rd	tor-a	Natl	ext-d-s	int-r-w	l	own	c	metl	Hart	Schacht
900	10	Schblr	grav	cone	Hart	selec	own	amid	3	worm	own	14	r-rd	tor-a	Natl	ext-d-s	int-r-w	l	own	c	metl	Hart	Schacht
1,200	25	Stmbg	grav				own			chn	own		r-rd			ext-r-w	ext-sht						Schleicher
1,200	20	Stmbg	grav	cone		selec	own	amid	4	chn	own		r-rd			ext-r-w	ext-sht						Schleicher
1,200	17	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	in-g	Russl	7.4	spgs	spgs	Perf	ext-r-w	int-r-w	r	Lavn	c	metl	Spicer	Selden TXR
1,135	17	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	worm	Timkn	6.75	spgs	spgs	Perf	int-r-w	int-r-w	r	Lavn	c	metl	Spicer	Selden TWL
1,200	17	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	3	in-g	Russl	7.4	spgs	spgs	Perf	ext-r-w	int-r-w	r	Lavn	c	metl	Spicer	Selden TXL
1,295	20	Stmbg	grav	d-d	B-Lipe	selec	B-Lipe	mtr	4	in-g	Russl	9.45	spgs	spgs	Perf	ext-r-w	int-r-w	r	Jacox	c	metl	Spicer	Selden JCB&JCBL

ABBREVIATIONS—Makers of Parts

*Other Options
A-K—Atwater-Kent
Al-Ch—Allis-Chalmers
Aut-L—Auto-Lite
B-Beck—Borg & Beck
B-Lipe—Brown-Lipe
Bling—Berling
Brem—Bremer
Can—Candler
Cant—Canton-Cleveland
CAS—C.A.S. Products Co.
Champ—Champion Spng.
Chego—Chicago-Stndrd
Chgo—Chicago Mfg. Co.
Con—Continental
Conn—Connecticut
Cover—Covert
Del—Delany
Ditw—Ditweiler
Dneto—Dyneto
Dtrt—Detroit Press. Stl.
Dtrt—Detroit Lubricat.
Dtrt—Detroit G. & M. Co.
Dtrt—Detroit Stl. Spng.
Duplx—Duplex
E&M—English & Mersick
Eismn—Eisemann
Emp—Empire
Ens—Ensign
Eur—Eureka
Fed—Fedders
Flech—Fletcher
Fost—Foster
Franck—Francke
G&D—Gray & Davis
G&O—G. & O. Mfg. Co.
GBS—Golden, Belknap & Swartz
G-Lees—Grant-Lees
Gem—Gemmer
H&N—H. & N. Carburetor Co.
Har—Harrison
Hart—Hartford
Hays—Hayes
Her—Hercules
Hig—Higgins
Hol—Holley
H-Shaw—Hele-Shaw
H-S—Herschell-Spillman
Hyd—Hydraulic
Idl—Ideal
Ind—Industrial Equipment Co.
Iron—Iron City
J-A—Jackson Radiator Wks.
Jacox—Jackson-Church-Wilcox
Jas—Jamestown Car Pts. Co.
Jhnson—Johnson
Kal—Kalamazoo
K-B—Kinsler-Bennett
Key-H—Keystone-Hindley
King—Kingston
Koko—Kokomo
Lau—Lauraine
Lavn—Lavine
LeR—LeRoi
Lgt—Light Foundry
Ligt—Liggett
L-N—Leece Neville
Lyc—Lycoming
Marvl—Marvel
Mast—Master
McC—McCord
McFar—McFarland
Mech—Mechanics
Merl—Merrill
Mil—Milwaukee
Mnrch—Monarch
Mod—Modine
Mthr—Mather
M&E—Merchant & Evans
Natl—National
N.A.—North American
Nlite—Nicolite
Penn—Penn Spring Co.
P&B—Parish & Bingham
Per—Perfex
Perf—Perfection
Prsh—Parish
R-T—Rome-Turney
Rayfld—Rayfield
Rem—Remy
Rowl—Wm. Harvel Rowland
Ruggles—Ruggles
Russl—Russel
Rut—Rutenber
Savg—Savage Arms
Salsby—Salisbury
Schblr—Schebler
Shel—Sheldon
Shkspr—Shakespeare
Smth—A. O. Smith
Spltf—Splitdorf
Stan—Standard Radiator Co.
Stand—Standard Steel Spring Co.
Stewrt—Stewart
Stlg—Sterling
Stmbg—Stromberg
Sundmn—Sunderman
S-W—Sparks-Withington
Therm—Thermoid
Timkn—Timken
Titan—Tillotson
Torbn—Torbenson
Tut—Tuthill
Univ—Universal Machine Co.
Wau—Waukesha
West—Westinghouse
Wis—Wisconsin
Wol—Wohlrab

Detailed Technical Specifications of

Name and Model	Tons Capacity	Chassis Price	Wheelbase Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Size in Ins. Front	TIRES Size in Ins. Rear	Wheels	ENGINE Make	No. Cyl., Bore and Stroke N.A.C.C. Hp.	Cylinders Cast	COOLING Water Circ.	COOLING Radiator Make	COOLING Radiator Core and Case	IGNITION Type	IGNITION Make	IGNITION Spark Advance	ELEC. SYSTEM Type	ELEC. SYSTEM Make	ELEC. SYSTEM Extra Cost $	GOVERNOR Type	GOVERNOR Make	GOVERNOR Drive
Selden JWB&JWBL	2	......	150	P&B	p-stl	s-flex	s	36x4	36x7	wd	Con	4-4⅛x5¼-27.2	4	cent	Bush	fin-cst	sing	Bosch	fix	s&l	N-E	....	cent	Pierce	motor
Selden NL	3½	......	164	P&B	p-stl	s-flex	s	36x5	36x5d	wd	Con	4-4½x5½-32.4	2	cent	Bush	fin-cst	sing	Eismn	hand	s&l	N-E	....	cent	Pierce	motor
Selden DL	5	......	170	P&B	p-stl	s-flex	s	36x6	40x12	c-s	Con	4-4½x5½-32.4	2	cent	Bush	fin-cst	sing	Eismn	hand	s&l	N-E	....	cent	Pierce	motor
Seneca J	½	......	108	Savg	p-stl	s-flex	pnu	30x3½	30x3½	wd	LeR	4-3⅛x4½-15.6	4	ther	Fed	cel-pst	sing	Remy	hand	sl&i	Al-Ch	....	none	none	none
Service 320	1	$2,100	137	own	p-stl	flex	s	34x3½	34x5	wd	Buda	4-3½x5⅛-19.6	4	ther	Long	fin-cst	sing	Eismn	hand	opt	West	120	none	none	none
Service 340	2	3,000	160	own	p-stl	flex	s	36x4	36x7	wd	Buda	4-4¼x5½-29.0	4	cent	Long	fin-cst	sing	Eismn	hand	opt	West	140	cent	Duplx	motor
Service 370	3½	3,900	171	own	p-stl	flex	s	36x5	36x5d	wd	Buda	4-4¼x5½-29.0	4	cent	Long	fin-cst	sing	Eismn	hand	s&l-2	West*	140	cent	Duplx	motor
Service 375	3½	4,200	171	own	p-stl	flex	s	36x5	36x5d	wd	Buda	4-4½x6 -32.4	4	cent	Long	fin-cst	sing	Eismn	auto	s&l-2	West*	140	cent	Duplx	motor
Service 400	5	5,000	171½	own	p-stl	flex	s	36x6	40x6d	c-s	Buda	4-4½x6 -32.4	4	cent	Long	fin-cst	sing	Eismn	auto	s&l-2	West*	140	cent	Duplx	motor
Shaw M-3	2	2,700	153	Smith	p-stl	rigid	s	36x4	36x6	wd	Con	4-4⅛x5¼-27.2	4	cent	Long	fin-cst	sing	Bosch	auto	none	none	none	cent	Pierce	motor
Signal F	1	2,400	144	Prsh	p-stl	s-flex	s	34x3½	36x5	wd	Con	4-4⅛x5¼-27.2	4	cent	Mod	fin-cst	sing	Eismn	fix	none	none	none	cent	Pierce	motor
Signal H	1½	2,700	144	Prsh	p-stl	s-flex	s	34x4	36x6	wd	Con	4-4⅛x5¼-27.2	4	cent	Mod	fin-cst	sing	Eismn	fix	none	none	none	cent	Pierce	motor
Signal J	2	3,100	150	Prsh	p-stl	s-flex	s	34x4	36x8	wd	Con	4-4⅛x5¼-27.2	4	cent	Mod	fin-cst	sing	Eismn	fix	none	none	none	cent	Pierce	motor
Signal M	3½	4,100	168	Prsh	p-stl	s-flex	s	36x5	40x5d	wd	Con	4-4½x5½-32.4	2	cent	Mod	fin-cst	sing	Eismn	fix	none	none	none	cent	Pierce	motor
Signal R	5	5,100	180	Prsh	p-stl	s-flex	s	36x6	40x6d	wd	Con	4-4¾x6 -36.1	2	cent	Mod	fin-cst	sing	Eismn	fix	none	none	none	cent	......	motor
Standard 76	2	2,800	140	own	rol-c	s-flex	s	36x4	36x6	wd	Con	4-4⅛x5¼-27.2	4	cent	Long	fin-cst	sing	Eismn	fix	none	none	none	cent	Pierce	motor
Standard 66	3½	3,675	160	own	rol-c	s-flex	s	36x5	36x5d	wd	Con	4-4½x5½-32.4	2	cent	.....	fin-cst	sing	Eismn	auto	none	none	none	cent	Pierce	motor
Standard 86	5	4,650	160	own	rol-c	s-flex	s	36x6	40x6d	wd	Con	4-4½x5½-32.4	2	cent	.....	fin-cst	sing	Eismn	auto	none	none	none	cent	Pierce	motor
Steele C	2	2,500	115	own	rol-c	s-flex	s	38x5	40x4d	c-s	Con	4-4⅛x5¼-27.2	4	cent	Bush	cel-sht	sing	Eismn	auto	......	......	....	cent	own	motor
Steele B	3	3,000	127	own	rol-c	s-flex	s	38x6	40x6d	c-s	own	4-5 x5 -40.0	2	cent	Whit	cel-sht	sing	Eismn	auto	......	......	....	cent	own	motor
Steele BA	4	3,500	127	own	rol-c	s-flex	s	38x6	40x5d	c-s	own	4-5 x5 -40.0	2	cent	Whit	cel-sht	sing	Eismn	auto	......	......	....	cent	own	motor
Steele A	5	4,000	127	own	rol-c	s-flex	s	38x7	40x6d	c-s	own	4-5 x5 -40.0	2	cent	Whit	cel-sht	sing	Eismn	auto	......	......	....	cent	own	motor
Sterling	2½	3,300	156	Smith	p-stl	flex	s	36x4	36x4d	wd*	own	4-4¼x5¾-29.0	2	cent	own	cel-cst	sing	Eismn	hand	ltg	......	....	cent	Wau	motor
Sterling	3½	4,325	162	Smith	p-stl	flex	s	36x5	40x5d	wd*	own	4-4¼x6¾-29.0	2	cent	own	cel-cst	dual	Eismn	hand	ltg	......	....	cent	Wau	motor
Sterling	5	5,100	168	Smith	p-stl	flex	s	36x6	40x6d	wd*	own	4-4¾x6¾-36.1	2	cent	own	cel-cst	dual	Eismn	hand	ltg	......	....	cent	Wau	motor
Sterling	7	5,600	168	Smith	p-stl	flex	s	36x6	40x7d	c-s	own	4-4¾x6¾-36.1	2	cent	own	cel-cst	dual	Eismn	hand	ltg	......	....	cent	Wau	motor
Stewart 6	¾	950	110	Prsh	p-stl	s-flex	pnu	32x4	32x4	wd	LeR	4-3⅛x4½-15.6	4	ther	Fed	fin-cst	sing	Blng	fix	......	......	....	......	......	......
Stewart 8	1	1,575	130	Hyd	p-stl	s-flex	s*	34x3½	34x4	wd	Con	4-3½x5 -19.6	4	ther	Bush	fin-cst	sing	Blng	fix	......	......	....	......	......	......
Stewart 9	1½	1,975	140	Hyd	p-stl	s-flex	s	34x3½	34x5	wd	Con	4-3¾x5 -22.5	4	ther	Bush	fin-cst	sing	Blng	fix	......	......	....	......	......	......
Stewart 7	2	2,575	156	Hyd	p-stl	s-flex	s	34x4	34x4d	wd	Con	4-4⅛x5¼-27.2	4	cent	Bush	fin-cst	sing	Blng	fix	......	......	....	cent	Pierce	motor
Studebaker SF	½	......	112	own	p-stl	s-flex	pnu	35x4½	35x4½	wd	own	4-3⅞x5 -24.2	4	cent	McC	cel-pst	sing	Remy	hand	sl&i-2	Wag	none	......	......	......
Studebaker 7	1	......	125	own	p-stl	s-flex	pnu	35x5	35x5	wd	own	4-3⅞x5 -24.2	4	cent	McC	cel-pst	sing	Remy	hand	sl&i-2	Wag	none	cent	Pierce	motor
Sullivan F	1½	2,350	129	own	rol-c	s-flex	s	36x3	36x5	wd	Buda	4-3¾x4½-22.5	4	ther	Bush	fin-sht	sing	Bosch	fix	......	......	....	......	......	......
Sullivan E	2	2,850	150	P&B	pst	s-flex	s	36x4	36x6	wd	Buda	4-3¾x4½-22.5	4	cent	Bush	fin-sht	sing	Bosch	fix	......	......	....	......	......	......
Superior A	1	1,600	124	Savg*	p-stl	rigid	p&s*	34x3½	34x4	wd	own	4-3½x5 -19.6	4	ther	Idl	zz-t-sht	sing	Eismn	hand	none	none	none	suc	Mnrch	motor
Superior C	2	2,200	144	Savg*	p-stl	rigid	s	36x4	36x6	wd	own	4-3¾x5 -22.5	4	cent	Idl	zz-t-sht	sing	Eismn	hand	none	none	none	suc	Mnrch	motor
Tiffin A	¾	1,100	110	P&B	p-stl	flex	pnu	35x4½	35x4½	wd	Con	4-3½x5 -19.6	4	ther	Bush	fin-sht	sing	Bosch	hand	none	none	none	none	none	none
Tiffin GW	1½	2,075	135	P&B	p-stl	flex	s	36x3½	36x5	wd	Con	4-3¾x5¼-22.5	4	cent	Bush	fin-sht	sing	Bosch	hand	none	none	none	cent	Pierce	motor
Tiffin MW	2½	2,750	148	P&B	p-stl	s-flex	s	36x4	36x3½d	wd	Con	4-4⅛x5¼-27.2	4	cent	Bush	fin-sht	sing	Bosch	hand	none	none	none	cent	Pierce	motor
Tiffin PW	3½	3,600	160	own	rol-c	s-flex	s	36x5	36x5d	wd	Con	4-4½x5½-32.4	2	cent	own	fin-cst	sing	Bosch	hand	sl&i-2	West	150	cent	Pierce	motor
Tiffin RW	5	4,650	168	own	rol-i	rigid	s	36x6	40x6d	c-s	Con	6-3¾x5¼-33.7	3	cent	Bush	fin-sht	sing	Bosch	hand	sl&i-2	West	160	none	none	none
Tiffin SW	6	4,850	168	own	rol-i	rigid	s	36x6	40x12	c-s	Con	6-3¾x5¼-33.7	3	cent	Bush	fin-sht	sing	Bosch	hand	sl&i-2	West	160	none	none	none
Titan Transport	3½	4,300	162	P&B	p-stl	s-flex	s	36x5	40x5d	wd	Buda	4-4½x6 -32.4	4	cent	Per	zz-t-cst	sing	Bosch	hand	ltg	Bosch	....	cent	Duplx	motor
Titan Heavy Duty	6	5,150	156	P&B	p-stl	s-flex	s	36x6	40x6d	c-s	Buda	4-4½x6 -32.4	4	cent	Per	zz-t-cst	dual	Bosch	hand	ltg	Bosch	....	cent	Duplx	motor
Tower F	2	2,750	146	Dtrt	p-stl	flex	s	36x4	36x7	wd	Con	4-4⅛x5¼-27.2	4	cent	own	zz-t-cht	sing	Bosch	hand	none	none	none	cent	Pierce	d-s
Traffic	2	1,395	133	......	rol-c	s-flex	s	34x3½	34x5	wd	Gray	4-3½x5 -19.6	4	ther	Eur	cel-sht	sing	Koko	hand	none	none	none	none	none	none
Transport Tractor N	5	2,750	80	......	......	......	s	34x3½	34x4d	....	......	4-3¾x5 -22.5	4	ther	.....	......	sing	Bosch	fix	......	......	....	suc	Mnrch	motor
Triangle A	1½	2,185	144	......	rol-c	s-flex	s	34x3½	34x6	wd	Wau	4-3¾x5¼-22.5	4	cent	Per	zz-t-pst	sing	Eismn	fix	none	none	none	cent	Wau	motor
Union B	2½	2,375	152	Smith	p-stl	s-flex	s	36x4	36x7	wd*	Wis	4-4 x6 -25.6	4	cent	own	fin-c-a	sing	Eismn	hand	none	none	none	cent	Duplx	duplex
U. S. E	2½	2,800	144	own	rol-c	flex	s	34x4	36x4d	wd	Con	4-4⅛x5¼-27.2	4	cent	Long	fin	sing	Eismn	hand	......	......	....	cent	Pierce	motor
U. S. H	2½	3,250	144	own	rol-c	flex	s	34x4	36x4d	wd	Con	4-4⅛x5¼-27.2	4	cent	Long	fin-cst	sing	Eismn	hand	......	......	....	cent	Pierce	motor
U. S. D	3½	3,500	162	own	rol-c	flex	s	36x5	36x5d	wd	Con	4-4½x5½-32.4	2	cent	Long	fin-cst	sing	Eismn	hand	......	......	....	cent	Pierce	motor
U. S. J	3½	3,950	162	own	rol-c	flex	s	36x5	40x5d	wd	Con	4-4½x5½-32.4	2	cent	Long	fin-cst	sing	Eismn	hand	......	......	....	cent	......	motor
U. S. K	5	4,850	168	own	rol-c	flex	s	36x5	40x6d	c-s	Wau	4-4¾x6¾-36.1	2	cent	Long	fin-cst	sing	Eismn	hand	......	......	....	cent	Wau	motor
United AX	1½	......	133	own	p-stl	flex	s	36x3½	36x6	wd	Buda	4-3¾x5¼-22.5	4	cent	G&O	fin-cst	sing	Eismn	hand	opt	opt	....	cent	Simpl	motor
United BX	2½	......	148	own	p-stl	flex	s	36x4	36x7	wd	Buda	4-4¼x5½-29.0	4	cent	G&O	fin-cst	sing	Eismn	hand	......	......	....	cent	Simpl	motor
United CX	3½	......	160	own	p-stl	flex	s	36x5	36x5d	wd	Buda	4-4½x6 -32.4	4	cent	G&O	fin-cst	sing	Eismn	hand	......	......	....	cent	Simpl	motor
United VX	5	......	160	own	p-stl	flex	s	36x5	40x6d	c-s	Buda	4-4½x6 -32.4	4	cent	G&O	fin-cst	sing	Eismn	hand	......	......	....	cent	Simpl	motor
Universal G	1½	......	133	......	p-stl	rigid	......	34x3½	34x5	wd	Buda	4-3¾x5¼-22.5	4	pist	Long	fin-cst	sing	Eismn	hand	ltg	......	....	suc	Mnrch	motor
Universal D	2	......	132	......	p-stl	......	s	36x5	36x4d	wd	own	4-4¼x5½-29.0	4	cent	Long	fin-cst	sing	Eismn	hand	ltg	......	none	suc*	Mnrch*	motor
Universal L	3½	......	156	......	rol-c	......	s	36x5	36x5d	wd	Buda	4-4¼x5½-29.0	4	cent	Long	fin-cst	sing	Eismn	hand	ltg	......	none	suc*	Mnrch*	motor
Velie 25B	2	2,950	150*	......	......	......	s	36x4	36x7	....	Con	4-4⅛x5¼-27.2	4	......	.....	......	sing	Bosch	hand	......	......	....	cent	Pierce	motor

ABBREVIATIONS—Types of Construction

*Other Options
amid—amidships
auto—automatic
bevl—bevel
c—center
c&l—center and left
c&s—cushion and solid
cent—centrifugal
c-s—cast steel
c-a—cast aluminum
cel-cst—cellular core, cast case
cel-pst—cellular core, pressed steel case
cel-sht—cellular core, sheet case
chn—chain
cylinders cast, 2 in pairs
cylinders cast, 4 in block
cylinders cast, 3 in threes
cylinders cast, 1 singly
d-d—dry disk
d-p—dry plate
d-rd—double reduction
d-s—driveshaft
elec—electric
ext-d-s—external driveshaft
ext-f-w—external front wheels
ext-g—external gear
ext-jst—external jackshaft
ext-r-w—external rear wheel
fab—fabric
fin—finned tube
fin-c-a—finned tube core, cast aluminum case
fin-cst—finned tube core, cast case
fin-pst—finned tube core, pressed steel case
fin-sht—finned tube core, sheet case
fix—fixed
flex—flexible
fric—friction
g.p.—gear pump
grav—gravity
gset—gearset
hyd—hydraulic
ind-c—individual clutch
int-d-s—internal driveshaft
int-f-w—internal front wheels
in-g—internal gear
in-g-4—internal gear drive on 4 wheels
int-r-w—internal rear wheel
jst—unit with jackshaft
l—left
l&c—left and center
leat—leather
l-b—loose ball
ltg—lighting
metl—metal
mtr—unit with motor
opt—optional
p—plate in oil
pist—piston pump
plan—planetary
pnu—pneumatic
pres—pressure
prog—progressive sliding gearset
p-t-c-a—plain tube core, cast aluminum case
p-t-cst—plain tube core, cast case
p-stl—pressed steel
p&s—pneumatic and solid
r—right
r-ax—unit with rear axle
rng-cst—ring core, cast case
rol-c—rolled channel
rol-i—rolled I-beam
r-rd—radius rods
selec—selective sliding gear
s-flex—semi-flexible
stg—starting
s&l—starting and lighting
s,l&i—starting, lighting and ignition
s l&i2—starting, lighting and ignition, two-unit
sing—single
s—solid
s&c—solid and cushion
spgs—springs
sq-t-cst—square tube core, cast iron
sq-t-sht—square tube core, sheet case
stk—stock
sub-f—sub-frame
suc—suction
s-bev—spiral bevel
ther—thermo-syphon
tor-a—torque arm
t-t—torsion tube
unt-x—unit with axle
vacm—vacuum
wd—wood
w-d—multiple disk in oil
worm—top worm
w-p—wet plate
zz-t-cst—zig zag tube core, cast case
zz-t-pst—zig zag tube core, pressed steel case
zz-t-sht—zig-zag tube core, sheet case

Gasoline Motor Trucks for 1919—Continued

ENGINE						TRANSMISSION										BRAKES		CONTROL			UNIVERSALS		
SPEED		FUEL SYS.		CLUTCH		GEARSET				FINAL DRIVE								STEERING GEAR					
Motor in R.p.m.	Truck in M.p.h.	Carbureter Make	Fuel Feed	Type	Make	Type	Make	Placed	Speeds	Type	Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs Make	Foot	Hand	Placed	Make	Levers	Type	Make	Name and Model
1,295	20	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn.	9.25	spgs.	spgs.	Perf.	int-r-w.	int-r-w.	r.	Jacox.	c.	metl.	Spicer.	Selden....JWB&JWBL
1,295	11	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn.	10.33	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	r.	Ross.	c.	metl.	Spicer.	Selden....NL
1,295	11	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	13.66	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	r.	Ross.	c.	metl.	Spicer.	Selden....DL
2,200		Schblr.	vacm.	d-d.	Dtrt.	selec.	Dtrt.	mtr.	3	bevel.	Adams.	4.25	spgs.	tor-a.	Cant.	int-r-w.	ext-r-w.	l.	Ditw.	c.	metl.	Univ.	Seneca....J
1,400	16	Stmbg.	vacm.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn.	7.75	spgs.	spgs.		int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Arvac.	Service....320
1,100	15	Stmbg.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	3	worm.	Timkn.	7.75	spgs.	spgs.		int-r-w	int-r-w.	l.	Ross.	c.	metl*.	own*.	Service....340
1,100	13	Stmbg.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	8.75	spgs.	spgs.		int-r-w	int-r-w.	l.	Ross.	c.	metl*.	own*.	Service....370
1,000	13	Stmbg.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	7.8	spgs.	spgs.		int-r-w.	int-r-w.	l.	Ross.	c.	metl*.	own*.	Service....375
1,000	11½	Stmbg.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	10.25	r-rd.	spgs.		int-r-w.	int-r-w.	l.	Ross.	c.	metl*.	own*.	Service....400
1,275	16	Zenith.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn.	8.5	spgs.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Shaw....M-3
1,085	15	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	7.75	r-rd.	spgs.	Perf*.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Signal....F
1,300	15	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	9.25	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Signal....H
1,300	15	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	9.25	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Signal....J
1,300	15	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	12	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Signal....M
1,200	12	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	11.66	r-rd.	spgs.	Perf.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Signal....R
1,500	15	Schblr.	grav.	d-p.	B-Beck.	prog.	Covert.	amid.	3	worm.	Timkn.	11.62	r-rd.	tor-a.	Tut.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Standard....70
1,200	12	Schblr.	vacm.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	10.33	r-rd.	tor-a.	Tut.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Standard....65
1,000	10	Schblr.	vacm.	d-p.	B-Beck.	prog.	B-Lipe.	amid.	4	worm.	Timkn.	11.66	r-rd.	tor-a.	Tut.	int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Standard....85
1,100	14	Stmbg.	grav.	w-d.	H-Shaw	ind-c.	Cotta.	jst.	3	chn.	own.		r-rd.				int-r-w.	r.	Gem.	r.	metl.	own.	Steele....C
900	12	Stmbg.	grav.	w-d.	H-Shaw	ind-c.	Cotta.	jst.	3	chn.	own.		r-rd.		Del.	ext-jst.	int-r-w.	r.	Ross.	r.	metl.	own.	Steele....B
900	9	Stmbg.	grav.	w-d.	H-Shaw	ind-c.	Cotta.	jst.	3	chn.	own.		r-rd.		Del.	ext-jst.	int-r-w.	r.	Ross.	r.	metl.	own.	Steele....BA
900	9	Stmbg.	grav.	w-d.	H-Shaw	ind-c.	Cotta.	jst.	3	chn.	own.		r-rd.		Del.	ext-jst.	int-r-w.	r.	Ross.	r.	metl.	own.	Steele....A
1,040	16	Zenith.	grav.	w-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.	7.7	spgs.	spgs.	Shel.	int-r-w.	int-r-w	l.	Ross.	c.	metl.	Spicer.	Sterling....
1,000	13	Rayfld	vacm.	w-d.	H-Shaw	ind-c.	own.	amid.	3	worm.	Timkn.	8.75	r-rd.	spgs.	Mthr.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Sterling....
950	13	Rayfld	vacm.	w-d.	H-Shaw	ind-c.	own.	amid.	3	worm.	Timkn.	8.8	r-rd.	spgs.	Mthr.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Sterling....
900	12	Rayfld	vacm.	w-d.	H-Shaw	ind-c.	own.	jst.	3	chn.	own.	10.65	r-rd.		Mthr.	ext-jst.	int-r-w.	l.	Ross.	c.	metl.	Univ.	Sterling....
1,400	22	Zenith.	grav.	d-p.	Mech.	selec.	Mech.	mtr.	3	in-g.	Clark.	5.8	spgs.	spgs.	Dtrt.	ext-r-w.	ext-r-w.	l.	C.A.S.	c.	fab.		Stewart....6
1,200	20	Zenith.	grav.	d-p.	B-Beck.	selec.	Fuller.	mtr.	3	in-g.	Clark.	5.8	spgs.	spgs.	Dtrt.	ext-r-w.	ext-d-s.	l.	Gem.	c.	metl.	Hart.	Stewart....8
1,250	18	Zenith.	grav.	d-p.	Fuller.	selec.	Fuller.	mtr.	3	in-g.	Clark.	7	spgs.	spgs.	Dtrt.	ext-r-w.	ext-d-s.	l.	Gem.	c.	metl.	Hart.	Stewart....7
1,100	14	Zenith.	grav.	d-p.	Fuller.	selec.	Fuller.	mtr.	3*	in-g.	Clark.	8.15	spgs.	spgs.	Dtrt.	ext-r-w.	ext-d-s.	l.	Ross.	c.	metl.	Hart.	Stewart....9
		Schblr.	vacm.	cone.	own.	selec.	own.	r-ax.	3	bevl.	own.	4.6	r-rd.	tor-a.	own.	int-r-w.	ext-r-w.	l.	Gem*.	c.	metl.	own.	Studebaker....SF
960	20	Schblr.	vacm.	cone.	own.	selec.	own.	r-ax.	3	bevl.	own.	5.	r-rd.	tor-a.	own.	int-r-w.	ext-r-w.	l.	Gem.	c.	metl.	own.	Studebaker....7
		Stmbg.	grav.	cone.	Hart.	selec.	Covert.	amid.	3	worm.	Timkn.	8.5	spgs.	spgs.	Merl.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Hart.	Sullivan....F
		Stmbg.	vacm.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn.	7.75	spgs.	spgs.	Shel.	int.	int.	l.	Ross.	c.	metl.	Blood.	Sullivan....E
1,200	16	Stmbg.	vacm.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	in-g.	Torb.	7	spgs.	spgs.	Tut.	ext-r-w.	int-r-w.	l.	C.A.S.	c.	metl.	Arvac.	Superior....A
1,300	15	Stmbg.	vacm.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	in-g.	Torb.	9	spgs.	spgs.	Tut.	ext-d-s.	int-r-w.	l.	Ross.	c.	metl.	Arvac.	Superior....C
		Schblr.	grav.	cone.	Detrt.	selec.	Detrt.	mtr.	3	in-g.	Russl.	6.8	spgs.	spgs.	Kal.	int-r-w.	ext-r-w.	l.	Lavn.	c.	metl.	Acme.	Tiffin....A
1,000	12.5	Schblr.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	8.6	spgs.	spgs.	Kal.	ext-r-w.	int-r-w.	l.	Ross.	c.	metl.	Acme.	Tiffin....GW
1,000	13	Schblr.	grav.	cone.	Hart.	selec.	Covert.	amid.	3	worm.	Timkn.	9.12	r-rd.	spgs.	Kal.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Acme.	Tiffin....MW
1,000	9	Schblr.	grav.	d-p.	B-Beck.	selec.	Covert.	amid.	3	worm.	Shel.	11.7	r-rd.	spgs.	Kal.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Acme.	Tiffin....PW
1,000	10	Schblr.	grav.	d-p.	B-Beck.	selec.	Covert.	amid.	3	worm.	Shel.	11.7	r-rd.	spgs.	Kal.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Acme.	Tiffin....RW
1,000	9	Schblr.	grav.	d-p.	B-Beck.	selec.	Covert.	amid.	3	worm.	Shel.	13	r-rd.	spgs.	Kal.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Acme.	Tiffin....SW
1,000	16	Stmbg.	grav.	d-p.	B-Beck.	ind-c.	Cotta.	amid.	3	in-g.	Clark.	8	r-rd.	spgs.	Shel.	ext-r-w.	int-r-w.	l.	Lavn.	c.	metl.		Titan....Transport
1,000	12	Stmbg.	grav.	d-p.	B-Beck.	ind-c.	Cotta.	amid.	3	in-g.	Clark.	11	r-rd.	spgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	c.	metl.		Titan....Heavy Duty
	15	Stmbg.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Timkn.	8.5	r-rd.	tor-a.	Dtrt.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Tower....F
1,500	15	Carter.	grav.	d-p.	B-Beck.	selec.	Cover.	mtr.	3	in-g.	Russl.	8.2	spgs.	spgs.	Dtrt.	ext-r-w.	int-r-w.	l.	Ditw.	c.	metl.	Arvac.	Traffic....
	12	Zenith.	grav.	d-d.		selec.		mtr.	4	worm.			spgs.	spgs.		int-r-w.	int-r-w.						Transport Tractor....N
1,350	18	Stmbg.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	in-g.	Clark.	6.8	spgs.	spgs.	Dtrt.	ext-d-s.	ext-r-w.	l.	Gem.	c.	metl.	Univ.	Triangle....A
1,100		Schblr.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	4	in-g.	Russl.	7.8	spgs.	spgs.	Mthr.	ext-r-w.	int-r-w.	r.	Ross.	c.	metl.	Univ.	Union....B
1,160		Stmbg.	grav.	cone.	Hart.	ind-c.	Cotta.	amid.	3	chn.	own.	8.16	r-rd.		Tut.	ext.	int-r-w.	l.	Lavn.	c.	metl.	Hart.	U. S....E
1,160		Stmbg.	grav.	cone.	Hart.	selec.	B-Lipe.	amid.	4	worm.	Shel.	7.75	spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Hart.	U. S....H
1,090		Stmbg.	grav.	cone.	Hart.	selec.	B-Lipe.	amid.	4	chn.	own.	8.01	r-rd.		Tut.	ext.	int.	l.	Lavn.	c.	metl.	Hart.	U. S....D
1,090		Stmbg.	grav.	cone.	Hart.	selec.	B-Lipe.	amid.	4	worm.	Shel.	10.25	spgs.	spgs.	Shel.	int.	int.	l.	Lavn.	c.	metl.	Blood*.	U. S....J
950		Stmbg.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.75	r-rd.	spgs.	Shel.	int.	int.	r.	Lavn.	c.	metl.	Blood*.	U. S....K
1,078	15	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.	7.7	spgs.	spgs.		int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Blood.	United....AX
1,007	14	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	7.75	r-rd.	spgs.		int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Blood.	United....BX
1,055	13	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.7	r-rd.	spgs.		int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Blood.	United....CX
1,033	12	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	10.25	r-rd.	spgs.		int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Blood.	United....VX
1,160	15	Zenith.	grav.	d-p.	own.	selec.	own.	mtr.	3	worm.	own.		r-rd.	tor-a.	Kal.	int-r-w.	int-r-w.	l.	Lavn.	c.			Universal....G
1,100	12	Zenith.	grav.	d-d.	own.	selec.	own.	amid.	3	chn.	own.		r-rd.		Kal.	int-r-w.	int-r-w.	r.	Lavn.	r.			Universal....D
1,000	12	Zenith.	grav.	d-d.	own.	selec.	own.	amid.	3	chn.	own.		r-rd.		Kal.	int-r-w.	int-d-s	r.	Lavn.	r.			Universal....L
1,008	18	Stmbg.	vacm.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	worm.	Timkn.	7.7	spgs.	spgs.	Mthr.	int-r-w.	int-r-w.		Gem.			Spicer.	Velie....25A

ABBREVIATIONS—Makers of Parts

*Other Options
A-K—Atwater-Kent
Al-Ch—Allis-Chalmers
Aut-L—Auto-Lite
B-Beck—Borg & Beck
B-Lipe—Brown-Lipe
Blng—Berling
Brem—Bremer
Can—Candler
Cant—Canton-Cleveland
CAS—C.A.S. Products Co.
Champ—Champion Spag.
Chgo—Chicago-Stndrd.
Chgo—Chicago Mfg. Co.
Con—Continental
Conn—Connecticut
Cover—Covert
Del—Delany
Ditw—Ditweiler
Dneto—Dyneto
Dtrt—Detroit Press. Stl.
Dtrt—Detroit Lubricat.
Dtrt—Detroit G. & M. Co.
Dtrt—Detroit Stl. Spng.
Duplx—Duplex
E&M—English & Mersick
Eismn—Eisemann
Emp—Empire
Ens—Ensign
Eur—Eureka
Fed—Fedders
Flech—Fletcher
Fost—Foster
Franck—Francke
G&D—Gray & Davis
G&O—G. & O. Mfg. Co.
GBS—Golden, Belknap & Swartz
G-Lees—Grant-Lees
Gem—Gemmer
H&N—H. & N. Carburetor Co.
Har—Harrison
Hart—Hartford
Hays—Hayes
Her—Hercules
Hig—Higgins
Hol—Holley
H-Shaw—Hele-Shaw
H-S—Herschell-Spillman
Hyd—Hydraulic
Idl—Ideal
Ind—Industrial Equipment Co.
Iron—Iron City
J-A—Jackson Radiator Wks.
Jacox—Jackson-Church-Wilcox
Jas—Jamestown Car Pts. Co.
Jhnson—Johnson
Kal—Kalamazoo
K-B—Kinsler-Bennett
Key-H—Keystone-Hindley
King—Kingston
Koko—Kokomo
Lau—Lauraine
Lavn—Lavine
LeR—LeRoi
Lgt—Light Foundry
Ligt—Liggett
L-N—Leece Neville
Lyc—Lycoming
Marvl—Marvel
Mast—Master
McC—McCord
McFar—McFarland
Mech—Mechanics
Merl—Merrill
Mil—Milwaukee
Mnrch—Monarch
Mod—Modine
Mthr—Mather
M&E—Merchant & Evans
Natl—National
N.A.—North American
N-E—North East
Nlite—Nicolite
Penn—Penn Spring Co.
P&B—Parish & Bingham
Per—Perfex
Perf—Perfection
Prsh—Parish
R-T—Rome-Turney
Rayfld—Rayfield
Rem—Remy
Rowl—Wm. Harvel Rowland
Rugles—Ruggles
Russl—Russel
Rut—Rutenber
Savg—Savage Arms
Salsby—Salisbury
Schblr—Schebler
Shel—Sheldon
Shkspr—Shakespeare
Smth—A. O. Smith
S-P—Spring-Perch
Spltf—Splitdorf
Stan—Standard Radiator Co.
Stand—Standard Steel Spring Co.
Stewrt—Stewart
Stlg—Sterling
Stmbg—Stromberg
Sundmn—Sunderman
S-W—Sparks-Withington
Therm—Thermoid
Timkn—Timken
Tilsn—Tillotson
Torbn—Torbensen
Tut—Tuthill
Univ—Universal Machine Co.
Wau—Waukesha
West—Westinghouse
Wis—Wisconsin
Wol—Wohlrab
W-W—Walker-Weiss

Detailed Technical Specifications of

Name and Model	Tons Capacity	Chassis Price	Wheelbase, Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Size in Ins. Front	TIRES Size in Ins. Rear	Wheels	ENGINE Make	No. Cyl., Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	COOLING Water Circ.	COOLING Radiator Make	COOLING Radiator Core and Case	IGNITION Type	IGNITION Make	IGNITION Spark Advance	ELEC. SYSTEM Type	ELEC. SYSTEM Make	ELEC. SYSTEM Extra Cost, $	GOVERNOR Type	GOVERNOR Make	GOVERNOR Drive
Velie 26B	3½	$3,900	172*				s	36x5	36x5d		Con.	4-4½x5½-32.4	2				sing.	Bosch	hand.				cent.	Pierce	motor.
Vim 21	½	945	108	Prsh.	p-stl.	s-flex.	pnu.	31x4	31x4	wd.	own.	4-3 x4½-14.4	4	ther.	McC.	cel-pst.	sing.	Spltf.	hand.	ltg.	West.				
Vim 25	1	2,195	120		p-stl.	s-flex.	opt.	34x3½	34x4	wd.	Con.	4-3¾x5 -22.5	4	cent.		fin-cst.	sing.	Spltf.	hand.				cent.	Duplx.	motor.
Vim 22	2	3,465	142		p-stl.	s-flex.	s	36x4	36x6	wd.	Her.	4-3¾x5⅛-22.5	4	cent.	McC.	fin-cst.	sing.	Spltf.	hand.				cent.	Duplx.	motor.
Vim 23	3	4,345	175		p-stl.	s-flex.	s	36x4	36x4d	wd.	Her.	4-4¼x5½-29.0	4	cent.	McC.	fin-cst.	sing.	Spltf.	hand.				cent.	Duplx.	motor.
Walter MO	3		108		rol-c.		s	40x4d	40x4d	c-s.	own.	4-4⅜x6 -30.6	4	cent.		cel-sht.	sing.		hand.	none.	none.	none	cent.	own.	motor.
Walter F	5	5,700	140	own.	p-stl.	flex.	s	40x7	40x10	c-s.	own.	4-4½x6½-32.4	2	cent.	own.	fin-c-a.	sing.	Eismn	hand.	sl&i-2.	West.	none	cent.	own.	motor.
Watson 5-ton Tractor	5	4,050	80	own.	rol-c.		s	34x4	36x5d	wd.	Con.	4-4½x5½-32.4	2	cent.	Fed.	cel-sht.	dual.	Bosch.	hand.	none.	none.	none	cent.	Pierce.	motor.
Weir-Smith	3½		153	own.	rol-c.	rigid.	s	37x7	37x7	wd.	Con.	4-4½x5½-32.4	4	cent.	Long.		dual.	Dixie.							
White GBBE	¾	2,300	133		p-stl.		pnu.	34x4½	34x4½	wd.	own.	4-3¾x5⅛-22.5	4	cent.		cel-sht.	sing.	Eismn	hand.	s&l	opt		none.	none.	none.
White TBC	1½	3,300	145		p-stl.		p&s.	36x4	36x4d	wd.	own.	4-3¾x5⅛-22.5	4	cent.		cel-sht.	sing.	Eismn	hand.	s&l	opt				
White TJ	3	4,100	174	own.			s	36x5	40x5d	c-s.	own.	4-3¾x5¾-22.5	4	cent.			sing.								
White TG	5	5,000	174	own.			s	36x6	40x6d	c-s.	own.	4-4¼x5¾-29.0	4	cent.			sing.								
White-Hickory H	1½	2,400	144	Smith.	p-stl.	s-flex.	s	36x3½	36x5	wd.	Con.	4-3¾x5 -22.5	4	cent.	Chgo	cel-pst.	sing.	Eismn	fix.	none.	none.	none	cent.	Pierce.	motor.
Wichita A	1	1,850	144	own.	p-stl.	flex.	s	36x3	36x4	wd.	own.	4-3½x5 -19.6	4	ther.	Per.	cel-cst.	sing.	Bosc*.	hand.	ltg.	Bosch.	125	none.	none.	none.
Wichita K	1	2,000	144	own.	p-stl.	flex.	s	36x3	36x4	wd.	own.	4-3½x5 -19.6	4	ther.	Per.	cel-cst.	sing.	Bosc*.	hand.	ltg.	Bosch.	125	none.	none.	none.
Wichita L	1½	2,350	144	own.	p-stl.	flex.	s	36x3½	36x5	wd.	own.	4-3½x5 -19.6	4	ther.	Per.	cel-cst.	sing.	Bosc*.	hand.	ltg.	Bosch.	125	none.	none.	none.
Wichita B	2	2,500	144	own.	p-stl.	flex.	s	36x3½	36x6	wd.	own.	4-3½x5 -19.6	4	ther.	Per.	cel-cst.	sing.	Bosc*.	hand.	ltg.	Bosch.	125	none.	none.	none.
Wichita R	2½	2,950	144	own.	p-stl.	flex.	s	36x4	36x7	wd.	Wau.	4-3¾x5¼-22.5	4	cent.	Per.	cel-cst.	sing.	Bosc*.	hand.	ltg.	Bosch.	125	l-b.	Wau.	motor.
Wichita O	3½	3,750	165	own.	p-stl.	flex.	s	36x5	36x5d	c-s.	Wau.	4-4½x5¾-32.4	2	cent.	E&M	cel-sht.	sing.	Bosc*.	hand.	ltg.	Bosch.	125	cent.	Wau.	motor.
Wichita Q	5	4,600	165	own.	p-stl.	flex.	s	36x6	36x6d	c-s.	Wau.	4-4½x5¾-32.4	2	cent.	E&M	cel-sht.	sing.	Bosc*.	hand.	ltg.	Bosch.	125	cent.	Wau.	motor.
Wilcox A	1	2,100	128	Smith.	p-stl.	s-flex.	p&s.	35x5	35x5	wd.	Con.	4-3¾x5 -22.5	4	ther.	Long.	fin-cst.	sing.	Bosch.	hand.	none.	none.	none	cent.	Pierce.	motor.
Wilcox X	1½	2,775	144	Smith.	p-stl.	s-flex.	s	36x4	36x5	c-s.	own.	4-4¼x5 -29.0	2	cent.	Long.	fin-c-a.	sing.	Bosch.	hand.	none.	none.	none	cent.	Pierce.	motor.
Wilcox C	2½	3,250	150	Smith.	p-stl.	s-flex.	s	36x4	36x3½d	wd*.	own.	4-4¼x5 -29.0	2	cent.	Long.	fin-c-a.	sing.	Bosch.	hand.	none.	none.	none	cent.	Pierce.	motor.
Wilcox D	3½	3,950	154	Smith.	p-stl.	s-flex.	s	36x5	36x5d	wd*	own.	4-4¼x5 -29.0	2	cent.	Long.	fin-c-a.		Bosch.	hand.				cent.	Pierce.	motor.
Wilcox W	5	5,100	162	Smith.	p-stl.	s-flex.	s	36x5	40x12	c-s.	Wau.	4-4¾x6¾-36.1	2	cent.	Long.	fin-c-a.		Bosch.	hand.	none.	none.	none	cent.	Wau.	motor.
Wilson	1	1,750	124	own.	p-stl.	s-flex.	p&s*.	35x5	35x5	wd.	own.	4-3½x5 -19.6	4	ther.	own.	cel-sht.	sing.	Eismn	hand.	opt.	opt.	opt.	cent.	Pierce.	motor.
Wilson	2	2,800	144	own.	rol-c.	s-flex.	s	36x4	36x4d	wd.	own.	4-4⅛x5¼-27.2	4	cent.	own.	fin-cst.	sing.	Eismn	fix.	opt.	opt.	opt.	cent.	Pierce.	motor.
Wilson	3½	3,800	160	own.	rol-c.	s-flex.	s	36x5	36x5d	wd.	own.	4-4½x5½-32.4	2	cent.	own.	fin-cst.	dual.	Eismn	hand.	opt.	opt.	opt.	cent.	Pierce.	motor.
Winther 38	1½	2,250	132	own.	rol-c.	s-flex.	s	34x3½	34x6	c-s.	Wis.	4-3¾x5 -22.5	4	cent.	Brm.	fin-cst.	sing.	Eismn	hand.	s&l	Bijur*.	200	cent.	Simplex.	motor.
Winther 48	2	3,200	150	own.	rol-c.	s-flex.	s	36x4	36x4d	c-s.	Wis.	4-4 x6 -25.6	4	cent.	Brm.	fin-cst.	sing.	Eismn	hand.	s&l	Bijur*.	200	cent.	Simplex.	motor.
Winther 68	3	3,900	150	own.	rol-c.	s-flex.	s	36x5	36x5d	c-s.	Wis.	4-4 x6 -25.6	4	cent.	Brm.	fin-cst.	sing.	Eismn	hand.	s&l	Bijur*.	200	cent.	Simplex.	motor.
Winther 88	4	4,300	156	own.	rol-c.	s-flex.	s	36x5	40x5d	c-s.	Wis.	4-4¼x6 -29.0	4	cent.	Brm.	fin-cst.	sing.	Eismn	hand.	s&l	Bijur*.	200	cent.	Simplex.	motor.
Winther 108	5	5,000	162	own.	rol-c.	s-flex.	s	36x6	40x6d	c-s.	Wis.	4-4¾x5½-36.1	2	cent.	Brm.	fin-cst.	sing.	Eismn	hand.	s&l	Bijur*.	200	cent.	Simplex.	motor.
Winther 128	6	5,250	162	own.	rol-c.	s-flex.	s	36x6	40x12	c-s.	Wis.	4-5⅛x6 -42.2	2	cent.	Brm.	fin-cst.	sing.	Eismn	hand.	s&l	Bijur*.	200	cent.	Simplex.	motor.
Winther 148	7	5,500	162	own.	rol-c.	s-flex.	s	36x6	40x7d	c-s.	Wis.	4-5⅛x6 -42.2	2	cent.	Brm.	fin-cst.	sing.	Eismn	hand.	ltg.	Bijur*.	200	cent.	Simplex.	motor.
Wisconsin B	1½	1,750	136	Smith.	p-stl.	s-flex.	s	34x3½	34x4	wd.	Wau.	4-3½x5¼-19.6	4	cent.	Chgo	cel-sht.	sing.	Eismn	hand.	none.	none.	none	cent.	Wau.	motor.
Wisconsin C	2½	2,850	156	Smith.	p-stl.	s-flex.	s	36x4	36x6	wd.	Wau.	4-4 x5¾-25.6	2	cent.	Chgo	cel-sht.	sing.	Eismn	hand.	none.	none.	none	cent.	Wau.	motor.
Witt-Will WD-16	1	2,000	120		p-stl.	s-flex.	s*	36x3*	36x4*	wd.	Con.	4-3¾x5¼-22.5	4	cent.	Natl.	sq-t-sht.	sing.	Eismn	auto.				cent.	Pierce.	motor.
Witt-Will WD-18	2½	2,950	144		p-stl.	s-flex.	s*	36x3½*	36x3½d*	wd.	Con.	4-4⅛x5¼-27.2	4	cent.	Natl.	cel-sht.	sing.	Eismn	auto.				cent.	Pierce.	motor.
Wolverine C	1½	2,250	140	P&B.	p-stl.	s-flex.	s	34x3½	34x5	wd.	Con.	4-3¾x5 -22.5	4	ther.	Long.	fin-cst.	sing.	Spltf.	hand.	s&l-2.	G&D.	none	suc.	Mnrch.	motor.

Received Too Late to Classify

Name and Model	Tons Capacity	Chassis Price	Wheelbase, Inches	FRAME Make	FRAME Material	FRAME Type	TIRES Kind	TIRES Front	TIRES Rear	Wheels	ENGINE Make	No. Cyl., Bore and Stroke—N.A.C.C. Hp.	Cylinders Cast	Water Circ.	Radiator Make	Core and Case	IGNITION Type	IGNITION Make	Spark Advance	ELEC. Type	ELEC. Make	Extra Cost, $	GOVERNOR Type	GOVERNOR Make	Drive
Kimball 2A	1½				p-stl.	flex.	s	36x3½	36x5	c-s.	Wis.	4-4 x5 -25.6	4	cent.	Flexo	cel-pst.	sing.	Eismn	hand.				cent.	Simplex.	motor.
Kimball 4A	2		154		p-stl.	flex.	s	36x4	36x6	c-s.	Wis.	4-4 x6 -25.6	4	cent.	Flexo	cel-pst.	sing.	Eismn	hand.				cent.	Simplex.	motor.
Kimball 6A	2½		154*		p-stl.	flex.	s	36x4	36x7*	c-s.	Wis.	4-4¼x6 -29.0	4	cent.	Flexo	cel-pst.	sing.	Eismn	hand.				cent.	Simplex.	motor.
Kimball 8A	4		164		p-stl.	flex.	s	36x5	40x5d	c-s.	Wis.	4-4¾x5½-36.1	2	cent.	Flexo	cel-pst.	sing.	Eismn	hand.				cent.	Simplex.	motor.
Kimball 10A	5		164		p-stl.	flex.	s	36x6	40x6d	c-s.	Wis.	4-5.1x5½-41.6	2	cent.	Flexo	cel-pst.	sing.	Eismn	hand.				cent.	Simplex.	motor.
Mack Tractor AB	5		120		p-stl.	s-flex.	s	36x4	36x4d	wd.	own.	4-4 x5 -25.6	2	cent.	own.	cel-sht.	sing.	Spltf.	hand.	opt.	opt.		cent.	own.	motor.
Patriot	1½	2,150	135		p-stl.		s	34x3½	34x5	wd.	Con.	4-3¾x5 -22.5		ther.		fin-cst.	sing.						cent.	Pierce.	motor.
Patriot	2½	3,150	156		p-stl.		s	34x4	34x7	wd.	Con.	4-4⅛x5¼-27.2		cent.		fin-cst.	sing.						cent.	Pierce.	motor.
Texan	1½	1,375					p&s.	34x4	34x4	wd.	Lyc.									s,l&i.	Dneto.	none			

Steam Vehicles

Name and Model	Capacity in Pounds	Price of Chassis	Wheelbase in Inches	FRAME Material	FRAME Construction	TIRES Kind	TIRES Size in Inches Front	TIRES Size in Inches Rear	Wheels	BOILER Location	BOILER Type	BOILER Heating Surface in Sq. In.	BOILER Horsepower	BURNER Type	BURNER Regulation	PRESSURE Normal in Lbs.	PRESSURE Maximum in Lbs.	WATER Water Capacity in Gal.	CONDENSER Type	CONDENSER Circulation
Steam	10,000	$5,500	157	p-stl.		solid	36x5	36x10	wood	under hood	Wat-tube	21,600	40	atomiz.	auto.	700	6000	25	fin-cst.	ther.

ABBREVIATIONS—Types of Construction

*Other Options
amid—amidships
auto—automatic
bevl—bevel
c—center
c&l—center and left
c&s—cushion and solid
cent—centrifugal
c-s—cast steel
c-a—cast aluminum
cel-cst—cellular core, cast case
cel-pst—cellular core, pressed steel case
cel-sht—cellular core, sheet case
chn—chain
cylinders cast, 2 in pairs
cylinders cast, 4 in block
cylinders cast, 3 in threes
cylinders cast, 1 singly
d-d—dry disk
d-p—dry plate
d-rd—double reduction
d-s—driveshaft
elec—electric
ext-d-s—external driveshaft
ext-f-w—external front wheels
ext-g—external gear
ext-jst—external jackshaft
ext-r-w—external rear wheel
fab—fabric
fin—finned tube
fin-c-a—finned tube core, cast aluminum case
fin-cst—finned tube core, cast case
fin-pst—finned tube core, pressed steel case
fin-sht—finned tube core, sheet case
fix—fixed
flex—flexible
fric—friction
g.p.—gear pump
grav—gravity
gset—gearset
hyd—hydraulic
ind-c—individual clutch
int-d-s—internal driveshaft
int-f-w—internal front wheels
in-g—internal gear
in-g-4—internal gear drive on 4 wheels
int-r-w—internal rear wheel
jst—unit with jackshaft
l—left
l&c—left and center
leat—leather
l-b—loose ball
ltg—lighting
metl—metal
mtr—unit with motor
opt—optional
p—plate in oil
plst—piston pump
plan—planetary
pnu—pneumatic
pres—pressure
prog—progressive sliding gearset
p-t-c-a—plain tube core, cast aluminum case
p-t-cst—plain tube core, cast case
p-stl—pressed steel
p&s—pneumatic and solid
r—right
r-ax—unit with rear axle
rng-cst—ring core, cast case
rol-c—rolled channel
rol-i—rolled I-beam
r-rd—radius rods
selec—selective sliding gear
s-flex—semi-flexible
stg—starting
s&l—starting and lighting
s.l&i—starting, lighting and ignition
s l&i2—starting, lighting and ignition, two-unit
sing—single
s—solid
s&c—solid and cushion
spgs—springs
sq-t-cst—square tube core, cast iron
sq-t-sht—square tube core, sheet case
stk—stock
sub-f—sub-frame
suc—suction
s-bev—spiral bevel
ther—thermo-syphon
tor-a—torque arm
t-t—torsion tube
unt-x—unit with axle
vacm—vacuum
wd—wood
w-d—multiple disk in oil
worm—top worm
w-p—wet plate
zz-t-cst—zig zag tube core, cast case
zz-t-pst—zig zag tube core, pressed steel case
zz-t-sht—zig-zag tube core, sheet case

Gasoline Motor Trucks for 1919—Continued

Engine: Speed: Motor in R.p.m.	Truck in M.p.h.	Fuel Sys.: Carbureter, Make	Fuel Feed	Clutch: Type	Clutch: Make	Transmission: Gearset: Type	Gearset: Make	Gearset: Placed	Speeds	Final Drive: Type	Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs, Make	Brakes: Foot	Hand	Control: Steering Gear: Placed	Make	Levers	Universals: Type	Make	Name and Model
1,215	14	Stmbg.	vacm.	d-d	B-Lipe.	selec.	B-Lipe.	amid.	4	worm	Timkn.	10.3	r-rd.	spgs.	Mthr.	int-r-w.	int-r-w.	r.	Gem.	c.	metl.	Spicer.	Velie 26A
	35	Zenith.	grav.	cone.	own	selec.	own.	mtr.	3	bevl.		5.25	spgs.	spgs.		ext-r-w.	int-r-w.	l.	Jacox.	c.	metl.	Spicer.	Vim 21
1,600	30	Zenith.	grav.	d-d		selec.		mtr.	3	worm.	Shel.	6.5	spgs.	spgs.		int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Vim 25
1,100	16	Zenith.	grav.	d-d		selec.	B-Lipe.	mtr.	4	worm.	Shel.	7.75	spgs.	spgs.		int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Vim 22
1,000	14	Zenith.	grav.	d-d		selec.	B-Lipe.	amid.	4	worm.	Shel.	7.75	spgs.	spgs.		int-r-w.	int-r-w.	l.	Gem.	c.	metl.	Spicer.	Vim 23
1,000	12.5	Zenith.	grav.	cone.	own.	selec.	own.	amid.	4	ext-g.	own.	9.5	spgs.	spgs.		ext-d-s.	ext-d-s.	l.	own.	c.	leat.	own.	Walter MO
1,000	15	H&N.	grav.	d-d.	Warner	selec.	own.	mtr.	4	in-g.	own.	8	spgs.	spgs.	Merl.	ext-f-w.	ext-f-w.	l.	own.	c.	metl.	own.	Walter F
1,100	11	Zenith.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	worm.	Timkn.	10.3	r-rd.	spgs	Shel.	int-r-w.	int-r-w.	r.	Gem.	c.	metl.	Spicer.	Watson 5-ton Tractor
	14	Zenith.	grav.	d-d.	Fuller.	selec.	own.		8	worm.	Timkn.				Tut.	d-s.	r-w.	r.	Ross.	c.	metl.	own.	Weir-Smith
		own.	grav.	w-p.	own.	selec.	own.	amid.	4	bevl.	own.		r-rd.	spgs.		int-r-w.	ext-r-w.	l.	own.	c&l.			White GBBE
		own.	grav.	w-p.	own.	selec.	own.	amid.	4	d-rd.	own.		r-rd.	spgs.		int-r-w.	ext-r-w.	l.	own.	c&l.			White TBC
		own.	vacm.	w-p.		selec.	own.	mtr.	4	d-rd.	own.		r-rd.	spgs.		ext-d-s.	int-r-w.	l.		c.			White
		own.	vacm.	w-p.		selec.	own.	mtr.	4	d-rd.	own.		r-rd.	spgs.		ext-d-s.	int-r-w.	l.		c.			White
1,200	18	Stmbg.	vacm.	d-d.	Fuller.	prog.	Fuller.	mtr.	3	worm.	Timkn.		spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Arvac.	White-Hickory H
1,050	15	Stmbg.	grav.	cone.	own.	prog.	Cover.	amid.	3	chn.	Shel.	7.32	r-rd.	sub-f.	Dtrt.	int-r-w.	int-r-w.	r.	Ross.	l.	fab.	own.	Wichita A
1,210	15	Stmbg.	grav.	cone.	own.	prog.	Cover.	amid.	3	worm.	Shel.	7.8	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.	r.	Ross.	l.	fab.	own.	Wichita K
1,330	15	Stmbg.	grav.	cone.	own.	prog.	Cover.	amid.	3	worm.	Shel.	10.66	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.	r.	Ross.	l.	fab.	own.	Wichita L
1,060	15	Stmbg.	grav.	cone.	own.	prog.	Cover.	amid.	3	chn.	Shel.	8.24	r-rd.	sub-f.	Dtrt.	int-r-w.	int-r-w.	r.	Ross.	l.	fab.	own.	Wichita B
1,250	13	Stmbg.	grav.	cone.	own.	prog.	B-Lipe.	amid.	4	worm.	Shel.	10.33	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.	r.	Ross.	l.	fab.	own.	Wichita R
1,200	11	Stmbg.	grav.	cone.	own.	prog.	B-Lipe.	amid.	4	worm.	Shel.	11.75	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.	r.	Ross.	l.	fab.	own.	Wichita O
1,020	9	Stmbg.	grav.	cone.	own.	prog.	B-Lipe.	amid.	4	worm.	Shel.	13	spgs.	spgs.	Dtrt.	int-r-w.	int-r-w.	r.	Ross.	l.	fab.	own.	Wichita Q
1,200	18	Stmbg.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Shel.	6.5	spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	own.	c.	metl.	Spicer.	Wilcox S
1,100	14	Stmbg.	grav.	cone.	own.	selec.	own.	amid.	4	worm.	Shel.	8.75	spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	own.	c.	fab.	own.	Wilcox X
1,100	14	Stmbg.	grav.	cone.	own.	selec.	own.	amid.	4	worm.	Shel.	8.75	spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	own.	c.	fab.	own.	Wilcox Q
1,100	10	Stmbg.	grav.	cone.	own.	selec.	own.	amid.	3	worm.	Shel.	11.7	spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	own.	c.	metl.	own.	Wilcox P
1,000	13.6	Stmbg.	grav.	cone.	own.	selec.	own.	amid.	4	worm.	Shel.	8.75	spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	own.	c.	metl.	Spicer.	Wilcox W
1,150	25	Stmbg.	grav.	d-d.	own.	selec.	own.	mtr.	3	worm		6	spgs.	spgs.	own.	ext-r-w.	int-r-w.	l.	own.	c.	metl.	own.	Wilson
1,150	15	Stmbg.	grav.	cone.	own.	selec.	own.	amid.	3	worm		8.75	spgs.	spgs.	own.	int-r-w.	int-r-w.	l.	own.	c.	metl.	own.	Wilson
1,150	14	Marvl*.	grav.	d-d.	own.	selec.	own.	amid.	4	worm		8.75	spgs.	spgs.	own.	int-r-w.	int-r-w.	l.	own.	c.	metl.	own.	Wilson
1,200	20	Mast.	grav.	d-p.	B-Beck.	selec.	B-Lipe.	mtr.	3	in-g.	Clark.	7	spgs.	spgs.	Mthr.	ext-r-w.	ext-d-s.	l.	Ross.	c.	metl.	own.	Winther 38
1,200	18	Mast.	vacm.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	in-g.	Clark.	7	spgs.	spgs.	Mthr.	ext-r-w.	int-r-w.	r.	Ross.	l.	metl.	Blood.	Winther 48
1,100	14	Mast.	vacm.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	in-g.	Clark.	9	spgs.	spgs.	Mthr.	ext-r-w.	int-r-w.	r.	Ross.	l.	metl.	Blood.	Winther 68
1,000	12	Mast.	vacm.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	in-g.	Clark.	11	spgs.	spgs.	Mthr.	int-r-w.	int-r-w.	r.	Ross.	l.	metl.	Blood.	Winther 88
1,000	11	Mast.	vacm.	d-p.	B-Beck.	selec.	B-Lipe.	mtr.	4	in-g.	Clark.	11	spgs.	spgs.	Mthr.	int-r-w.	int-r-w.	r.	Ross.	l.	metl.	Blood.	Winther 108
950	10	Mast.	vacm.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	in-g.	Clark.	11	spgs.	spgs.	Mthr.	int-r-w.	int-r-w.	r.	Ross.	l.	metl.	Blood.	Winther 128
900	10	Mast.	vacm.	d-p.	B-Beck.	selec.	B-Lipe.	amid.	4	in-g.	Clark.	11	spgs.	spgs.	Mthr.	int-r-w.	int-r-w.	r.	Ross.	l.	metl.	Blood.	Winther 148
1,000	16	Mast.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	6.5	spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Blood.	Wisconsin B
1,000	15	Mast.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	worm.	Shel.	7.7	spgs.	spgs.	Shel.	int-r-w.	int-r-w.	l.	Lavn.	c.	metl.	Blood.	Wisconsin C
		Zenith.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn.	3.	spgs.	spgs.		int-r-w.	int-r-w.	l.	Ross.	c.	metl.	Spicer.	Witt-Will D-16
1,000	14	Zenith.	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	3	worm.	Timkn.	7.7	spgs.	spgs.	Shel.	int-r-w.	int.	l.	Ross.	c.	metl.	Spicer.	Witt-Will WD-18
1,350	15	Flech.	grav.	d-d.	Fuller.	selec.	Fuller.	mtr.	3	in-g.	Russl.	7.7	spgs.	spgs.	Tut.	ext-r-w.	int-r-w.	l.	Gem.	c.	metl.	Univ.	Wolverine C

Received Too Late to Classify

Motor in R.p.m.	Truck in M.p.h.	Carbureter, Make	Fuel Feed	Clutch: Type	Clutch: Make	Gearset: Type	Gearset: Make	Gearset: Placed	Speeds	Final Drive: Type	Axle Make	Total Gear Reduction	Propulsion Taken By	Torque Taken By	Springs, Make	Brakes: Foot	Hand	Steering Gear: Placed	Make	Levers	Universals: Type	Make	Name and Model
1,200	18	Mast.	vacm.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	6.5	spgs.	spgs.		int-r-w.	int-r-w.	l.	Lavn.	c.			Kimball 2A
1,100	15	Mast.	vacm.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	7.7	spgs.	spgs.		int-r-w.	int-r-w.	l.	Lavn.	c.			Kimball 6A
1,200	17	Mast.	vacm.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	7.7	spgs.	spgs.		int-r-w.	int-r-w.	l.	Lavn.	c.			Kimball 4A
1,200	14	Mast.	vacm.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.7	spgs.	spgs.		int-r-w.	int-r-w.	l.	Lavn.	c.			Kimball 8A
1,200	10	Mast.	vacm.	d-d.	B-Lipe.	selec.	B-Lipe.	amid.	4	worm.	Shel.	8.7	spgs.	spgs.		int-r-w.	int-r-w.	l.	Lavn.	c.			Kimball 10A
1,275		Stmbg*	grav.	d-d.	B-Lipe.	selec.	B-Lipe.	mtr.	4	chn.		10.5	r-rd.	tor-a.	Mthr.	ext-d-s.	int-r-w.	l.	Gem.	c.			Mack Tractor AB
1,250	18	Stmbg.	vacm.	d-d.		selec.		amid.	3	in-g.			spgs.	spgs.				l.		c.			Patriot
1,250	16	Stmbg.	vacm.	d-d.		selec.		amid.	4	worm			spgs.	spgs.				l.		c.			Patriot
							Munc*.			worm	Chego.												Texan

Steam Vehicles

System: Feed Pump Type	Feed Control	Engine: Location	No. of Cylinders	Cylinders Cast	Valve Location	Valve Action	Valve Stroke	Reverses By	Transmission: Final Drive	Gear-Ratio	Axle Type	Propulsion Taken By	Torque Taken By	Control: Throttle	Hook-up	Reverse	Steering Wheel Location	Brake Lever Location	Name and Model
pump	ther.		4	block	cyl-ends	Stokesbary	variable.	lever	int-g.	4.50-1		springs	springs	lever	lever	lever	left	center	Steam

ABBREVIATIONS—Makers of Parts

*Other Options
A-K—Atwater-Kent
Al-Ch—Allis-Chalmers
Aut-L—Auto-Lite
B-Beck—Borg & Beck
B-Lipe—Brown-Lipe
Blng—Berling
Brem—Bremer
Can—Candler
Cant—Canton-Cleveland
CAS—C.A.S. Products Co.
Champ—Champion Spng.
Chcgo—Chicago-Stndrd
Chgo—Chicago Mfg. Co.
Con—Continental
Conn—Connecticut
Cover—Covert
Del—Delany
Ditw—Ditweiler
Dneto—Dyneto
Dtrt—Detroit Press. Stl.
Dtrt—Detroit Lubricat.
Dtrt—Detroit G. & M. Co.
Dtrt—Detroit Stl. Spng.
Duplx—Duplex
E&M—English & Mersick
Eismn—Eisemann
Emp—Empire
Ens—Ensign
Eur—Eureka
Fed—Fedders
Flech—Fletcher
Fost—Foster
Franck—Francke
G&D—Gray & Davis
G&O—G. & O. Mfg. Co.
GBS—Golden, Belknap & Swarts
G-Lees—Grant-Lees
Gem—Gemmer
H&N—H. & N. Carburetor Co.
Har—Harrison
Hart—Hartford
Hays—Hayes
Her—Hercules
Hig—Higgins
Hol—Holley
H-Shaw—Hele-Shaw
H-S—Herschell-Spillman
Hyd—Hydraulic
Idl—Ideal
Ind—Industrial Equipment Co.
Iron—Iron City
J-A—Jackson Radiator Wks
Jacox—Jackson-Church-Wilcox
Jas—Jamestown Car Pts. Co.
Jhnson—Johnson
Kal—Kalamazoo
K-B—Kinsler-Bennett
Key-H—Keystone-Hindley
King—Kingston
Koko—Kokomo
Lau—Lauraine
Lavn—Lavine
LeR—LeRoi
Lgt—Light Foundry
Ligt—Liggett
L-N—Leece-Neville
Lyc—Lycoming
Marvl—Marvel
Mast—Master
McC—McCord
McFar—McFarland
Mech—Mechanics
Merl—Merrill
Mil—Milwaukee
Mnrch—Monarch
Mod—Modine
Mthr—Mather
M&E—Merchant & Evans
Natl—National
N.A.—North American
N-E—North East
Nlite—Nicolite
Penn—Penn Spring Co.
P&B—Parish & Bingham
Per—Perfex
Perf—Perfection
Prsh—Parish
R-T—Rome-Turney
Rayfld—Rayfield
Rem—Remy
Rowl—Wm. Harvel Rowland
Rugles—Ruggles
Russl—Russel
Rut—Rutenber
Savg—Savage Arms
Salsby—Salisbury
Schblr—Schebler
Shel—Sheldon
Shkspr—Shakespeare
Smth—A. O. Smith
S-P—Spring-Perch
Spltf—Splitdorf
Stan—Standard Radiator Co.
Stand—Standard Steel Spring Co.
Stewrt—Stewart
Stlg—Sterling
Stmbg—Stromberg
Sundmn—Sunderman
S-W—Sparks-Withington
Therm—Thermoid
Timkn—Timken
Titsn—Tillotson
Torbn—Torbenson
Tut—Tuthill
Univ—Universal Machine Co.
Wau—Waukesha
West—Westinghouse
Wis—Wisconsin
Wol—Wohlrab
W-W—Walker-Weiss

Truck Production for 1918 Is 250,000

A Gain of 32 Per Cent Over 1917—Indications That 1919 Will Be Record Year—Great Highway Developments Indicated—The Truck's Future and Load Capacity Trend

DESPITE abnormal manufacturing and selling conditions which affected every industry in the country to a greater or lesser degree during the past year, and which were particularly detrimental to the development of the automotive industry (except in its capacity for handling successfully the enormous tasks set it by the Government), 1918 will go down in history as a record breaker on gasoline truck production.

It is true that the restrictions placed upon the activities of the truck builder in all directions other than the filling of the country's military requirements resulted in failure to reach the estimated output of 310,000 trucks for the year, but, nevertheless, all former annual production figures were eclipsed in 1918.

Excluding attachments designed to convert passenger cars into trucks (so-called), 250,000 trucks of all kinds were built during the past year, as compared with a total of 190,000 in 1917. Thus it is that although the scheduled goal was not reached by 60,000, the 1917 figure was exceeded by precisely a similar figure, a gain of 32 per cent.

Unwarranted Restrictions

It is a curious commentary on the frame of mind of our wartime legislators that although the War Industries Board went on record early in 1918 with the statement that it considered trucks "to be an important means of transportation, the use of which was not to be curtailed," this branch of the industry suffered continually from adverse priority orders curtailing the supply of essential material and thereby experienced much delay and loss. The Highways Transport Committee and other Government departments repeatedly expressed their opinion that the widest possible use of trucks should be encouraged by every possible means, but nevertheless the officially dictated handicap continued to be imposed for an appreciable time. Yet 1918 was a record truck year.

It is not possible to prophesy with any degree of accuracy the truck production for 1919, but it is safe to place the minimum around 290,000. It is true that all official restrictions have been removed, but the reorganizing of factories on a peace basis, the inevitable redistribution of labor and the possibility of having to meet overseas necessities for steel and other metals to be used for reconstruction work in devastated districts have caused a temporary feeling of uncertainty as to when normal production can be resumed throughout the country. Under favorable circumstances it is quite conceivable that this minimum production figure will be substantially exceeded before the year closes.

The one hundred per cent plus service rendered by the truck in war has done much to enable the potential commercial user to visualize through a wider angle lens the vast possibilities the truck affords in peace, and there is no question that the demand waits but to be filled as soon as our truck factories have passed through the reconstruction period and are operating on a normal production schedule.

Where the 1918 Trucks Are Operating

Of the 250,000 trucks built in 1918, present figures indicate that 137,000 have gone into commercial service in the U. S., as compared with the domestic consumption of 153,000 during 1917. Thus, assuming the 1918 demand was the same as that of 1917, there was an apparent shortage of 16,000 trucks. In other words, there should be an excess demand for 16,000 trucks over and above whatever may prove the normal demand in 1919.

Of the balance of our 1918 production, approximately 12,000 trucks were exported, irrespective of the 102,000 delivered to the Government for military service either overseas or at home. Of the 1918 production, assuming that all trucks on order were completed by December 31, 1918, approximately 41 per cent went into military work.

The Status of the Military Truck

A matter of vital importance to both the truck maker and the truck user is how the problem of the existing military trucks will be solved. The manufacturer naturally views the situation from the angle of how the sale of such trucks is likely to affect his business, and the user thinks he sees the possibility of securing serviceable used trucks at a cut-rate price.

Common sense and a slight knowledge of conditions overseas indicate that a belief that all trucks now with the American Expeditionary Forces will remain there until worn out is fully justified. Approximately 47,000 trucks were shipped abroad for military service, and it is fairly evident that all of these will be needed to maintain our army of occupation. Afterwards it seems highly probable that any of the trucks yet capable of giving adequate service will be absorbed by the industrial army of rehabilitation which must follow on the heels of our fighting forces. Therefore the problem, so far as these overseas trucks are concerned, may be considered as solved.

It is with regard to the forty-odd thousand Government trucks which are in this country that the position demands a measure of consideration, ignoring any balance of uncompleted orders which have not been cancelled. Assuming that the Government turns over 20,000, or perhaps 25,000, trucks to the Post Office Department, there still remains a large number to be disposed of.

It is too soon to speculate on the manner in which the problem of distributing this truck surplus can be solved without reacting to the detriment of trade. It is possible that nothing can be done until the peace treaty is actually signed, as this undoubtedly will have considerable bearing on the ultimate disposition of the vehicles. For example, the size of our overseas army of occupation and the possible necessity for maintaining a relatively large force on police duty abroad may in itself give the answer. It is understood that several of the allied governments are anxious to purchase any trucks not needed by our War Department, and this, again, may clear up the situation to the satisfaction of those most concerned.

The suggestion has been made that any remaining surplus of Government trucks should be employed in the reclamation of Western waste lands and in the construction of a national system of highways, instead of being placed on the market at cut prices.

The subject is one of real importance to the trade, and for this reason it is expected that full consideration will be given it by all parties in the course of our various schemes for the return of business generally to a peace footing with a minimum of hardship imposed on any branch of the nation's industry.

1919—A Year of Road Development

Railroad congestion and inability to handle the abnormal freight movement demanded by wartime conditions gave the truck the chance to prove itself. It has done so to the full. Given reasonably good highways, the railroad short and middle-distance hauls are things of the past. Trucks, when operated with a reasonable degree of intelligence, have shown

they can do the work with greater efficiency, much greater speed and at lower cost.

Trucks have invaded the cotton fields of the South and the lumber camps of the North; they have shown what they can do in the grain-raising districts of the Middle West, and they have proved their worth to the farmer who must reach the market town with his perishable products in a minimum of time. The Post Office has demonstrated that its fleet of trucks is earning four times its cost, and is planning to operate 2000 more on 600 new routes in the immediate future.

Admittedly the truck has shown conclusively what it can do—it remains to provide a highway system which will furnish the opportunity for unlimited truck-mileage irrespective of weather conditions. The wear and tear on highways has been greater than ever during the past year, but owing to the impossibility of obtaining materials less than one-half of the money available for construction and maintenance was expended. Thus, our roads are now, speaking generally, in a pretty bad state.

Federal Highways Commission Is Probability

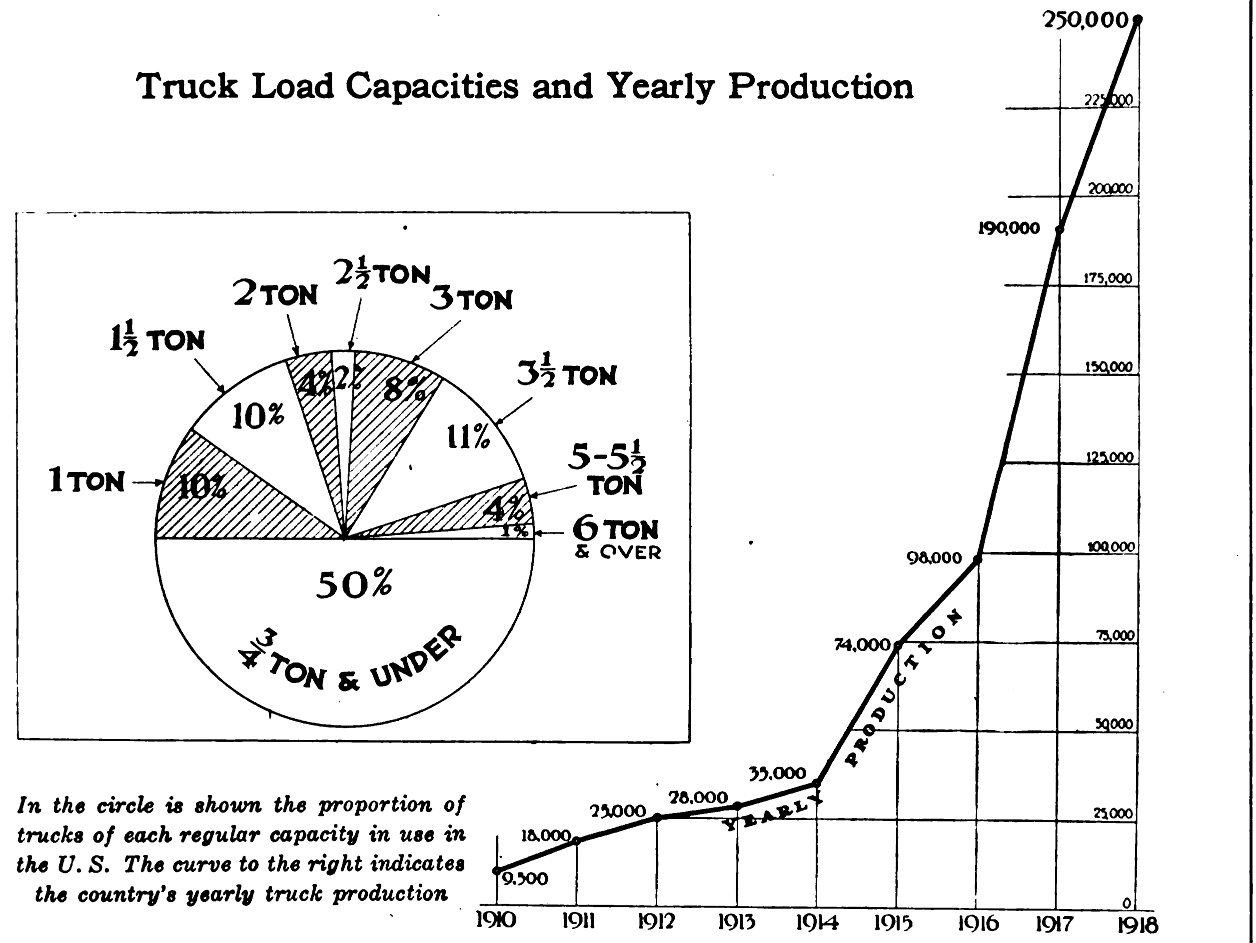
To remedy the existing state of things and to add considerably to the country's road mileage, it is probable that 1919 will see the creation of a Federal Highway Commission and a system of national highways, laid out, built and maintained by the Government as through trunk lines for commercial as well as military purposes. Good roads will enable the truck user to reach points which are now commercially inaccessible—good roads mean more, and yet more, trucks.

Since the truck has proved its position as an essential to the successful conduct of war overseas and has, in addition, been tried out under extreme conditions in time of national commercial stress at home—where it has fulfilled its mission with all credit—there can be no question as to its assured future. The only possible doubt is as to whether *any* limit can be set on its all round usefulness in doing its part in keeping the wheels of industry turning, or whether its future is, to all practical intents and purposes, limitless. There is no doubt but that in the almost immediate past we have had but little conception as to the value and efficiency of the truck. We know better now, but it is a question if we still realize the vast possibilities it holds in the development of highway transport.

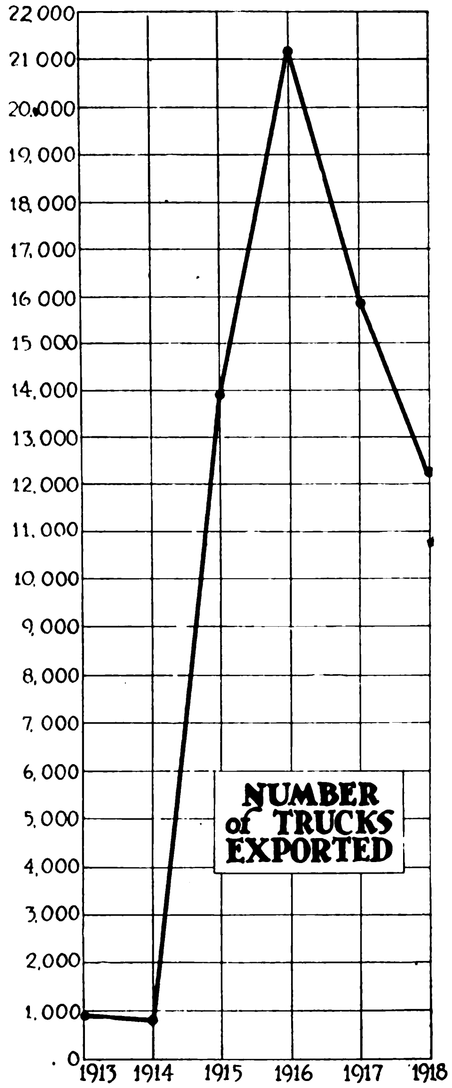
In this connection it is of interest to note the changes that are taking place in the matter of truck load capacities. These are referred to in detail elsewhere in this issue of AUTOMOTIVE INDUSTRIES. A recent compilation of the capacities of all the trucks in use in the country indicates that 50 per cent are of ¾-tons and under, 1 and 1½-ton trucks are each 10 per cent of the total, 4 per cent are 2-tonners, 2 per cent are of 2-ton capacity, 3-tonners represent 4 per cent, 3½-tonners are 11 per cent, 5 and 5½-tonners are 4 per cent and the remaining 1 per cent covers 6-ton trucks and over.

A summing up of the future of the truck needs but few words. Services already rendered show beyond the shadow of a doubt that the truck is not only capable of furnishing adequate service, but that it is an essential to transportation. Relatively, it is only in its infancy as a means of countrywide transport, and the day is not far distant when our truck trains will run on schedule both as connecting links between railroad systems and as independent carriers of high-speed, heavy-duty and low-cost type.

Truck Load Capacities and Yearly Production



In the circle is shown the proportion of trucks of each regular capacity in use in the U. S. The curve to the right indicates the country's yearly truck production



Nearly 22 Per Cent of Trucks

Exports Have Dropped During the Past Two Cultivation on

A CASUAL glance at the charts giving numbers and value of our exports of commercial vehicles for the past six years is amply sufficient to show that the truck manufacturers of the United States touched the peak of overseas trade at the period when the world-war and its demands on the manufacturing resources of England, France and Italy had caused the mobilization of every factory and machine shop in those countries on a munition-making basis.

It is true that a number of these factories continued to build trucks, but as the entire production was absorbed by the several governments for strictly military duties, the commercial needs of the various communities were ignored. As the railroads were fully occupied in war work, transportation in these countries would have been at a standstill were it

TRUCKS PRODUCED AND EXPORTED

Year	Number Produced	Number Exported	Percentage Exported
1913....	28,000	993	3.54
1914....	35,000	784	2.24
1915....	74,000	13,996	18.91
1916....	98,000	21,265	21.90
1917....	190,000	15,997	8.92
1918....	250,000	12,200	4.88

Note—The figures in italics show the number of trucks.

EXPORTS OF COMMERCIAL VEHICLES FOR SIX YEARS

Prior to 1913, commercial vehicle statistics were included under the general heading Automobiles

	1913	1914	1915	1916	1917	1918	Totals by Countries
Europe:							
Austria-Hungary	*2* $3,595	*3* $7,455	....	....	....	....	*5* $11,050
Azores and Madeira Islands	....	....	....	....	....	....	....
Belgium	....	....	*100* $365,000	....	....	....	*100* $365,000
Bulgaria	*2* $1,528	....	....	....	....	....	*2* $1,528
Denmark	*3* $2,120	....	*44* $25,033	*41* $36,413	*58* $81,414	*2* $3,800	*148* $189,786
Finland	....	....	....	....	....	....	....
France	*6* $10,709	*2* $5,070	*4,990* $13,523,843	*5,681* $17,709,579	*4,264* $13,854,903	*2,754* $10,001,636	*17,697* $55,105,740
Germany	*4* $4,029	*24* $18,462	*4* $2,800	....	....	....	*32* $25,291
Gibraltar	....	....	....	....	....	27 $58,325	*27* $58,325
Greece	*1* $1,176	*1* $1,800	*142* $426,570	*45* $98,815	*3* $2,000	*14* $32,000	*206* $561,361
Iceland and Faroe Islands	....	....	....	....	....	*1* $2,245	*1* $2,245
Italy	....	*1* $1,229	*1* $8,000	*5* $14,655	*65* $159,775	*52* $28,055	*124* $211,714
Netherlands	*2* $4,489	*1* $1,452	*9* $19,069	*50* $93,797	*36* $55,805	....	*98* $174,112
Norway	*2* $2,200	*2* $3,852	*3* $4,689	*81* $121,480	*162* $266,741	*40* $133,227	*290* $532,189
Portugal	*1* $1,400	*8* $12,075	*5* $10,291	*295* $1,117,681	*21* $45,087	*12* $36,914	*342* $1,223,448
Roumania	*12* $12,000	....	....	....	....	....	*12* 12,000
Russia in Europe	*13* $34,163	*2* $5,322	*2,251* $7,666,883	*3,909* $12,544,258	*1,733* $5,428,979	*406* $1,562,303	*8,314* $27,241,908
Serbia, Montenegro & Albania	....	....	*10* $6,300	*20* $65,000	....	....	*30* $71,300
Spain	*1* $1,400	....	*1* $1,800	*30* $57,277	*29* $55,808	*46* $97,910	*107* $214,195
Sweden	....	*1* $900	*10* $17,600	*19* $29,050	*6* $10,879	*7* $10,360	*43* $68,789
Turkey in Europe	....	*1* $2,000	*2* $8,009	....	....	....	*3* $10,009
England	*184* $119,468	*203* $189,099	*5,306* $14,042,325	*8,268* $18,723,403	*6,525* $17,061,105	*4,805* $13,438,981	*25,291* $63,574,381
Scotland	....	....	*4* $11,250	*224* $271,745	....	*447* $1,203,328	*675* $1,386,323
Ireland	....	....	*1* $7,033	*8* $39,776	....	....	*9* $46,809
North America:							
British Honduras	....	....	....	....	....	*2* $3,700	*2* $3,700
Canada	*489* $1,004,237	*247* $474,724	*306* $705,213	*387* $724,817	*636* $945,047	*1,108* $1,381,542	*3,173* $5,235,580
Central American States:							
Costa Rica	*2* $3,643	*8* $10,571	*2* $4,165	....	*1* $900	*5* $10,245	*18* $29,524
Guatemala	....	....	....	*2* $4,916	*4* $4,323	*3* $5,512	*9* $14,651
Honduras	*1* $3,000	....	*6* $12,500	*6* $14,540	*4* $4,094	*6* $3,373	*23* $37,507
Nicaragua	....	....	....	*1* $2,500	....	*1* $2,509	*1* $2,509
Panama	....	*5* $7,243	*6* $12,010	*32* $55,171	*75* $97,970	*47* $47,859	*165* $220,253
Salvador	....	....	....	*1* $1,300	*1* $868	*4* $14,811	*6* $16,979
Mexico	*35* $83,363	*12* $17,509	*8* $14,492	*51* $100,500	*218* $198,151	*365* $525,664	*689* $939,679
Newfoundland and Labrador	*4* $8,845	*1* $1,221	*1* $750	*1* $1,692	*1* $2,675	*2* $7,250	*10* $22,433
West Indies, British:							
Barbados	....	....	....	....	*1* $1,506	*2* $3,400	*3* $4,906
Jamaica	*4* $9,234	*3* $9,250	*3* $7,292	*9* $18,524	*6* $8,285	*10* $6,775	*35* $59,360
Trinidad and Tobago	....	*1* $2,000	....	*2* $1,974	*2* $5,722	*14* $18,361	*19* $28,057
Other British	....	....	....	*6* $11,327	*1* $500	*28* $89,914	*35* $101,741
Cuba	*14* $23,639	*19* $33,500	*21* $34,607	*117* $176,647	*397* $722,519	*554* $1,130,982	*1,122* $2,121,894
Danish (Virgin Is. of U.S.)	*1* $4,250	....	....	....	....	*2* $2,845	*3* $7,095
Dominican Republic	*1* $1,858	*1* $1,800	*2* $3,372	*4* $5,173	*22* $23,640	*21* $13,323	*51* $49,166
Dutch	....	*1* $595	*1* $1,463	....	*2* $2,095	....	*4* $4,153
French	....	....	*2* $3,975	*1* $2,310	*7* $13,305	*26* $49,626	*36* $69,216

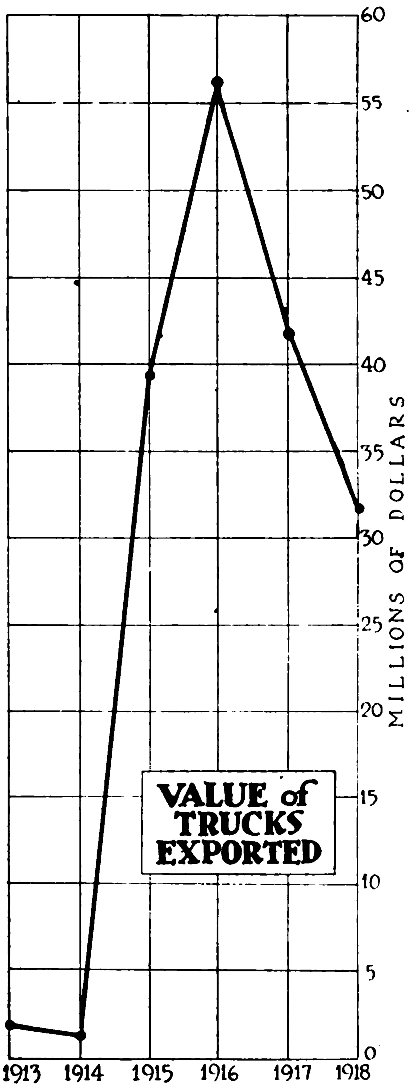
Produced in 1916 Sold Abroad

Years—The Field Is Still There and Needs Intensive Lines

EXPORTS OF COMMERCIAL VEHICLES FOR SIX YEARS

Prior to 1913, commercial vehicle statistics were included under the general heading Automobiles

	1913	1914	1915	1916	1917	1918	Totals by Countries
Haiti	*3* $5,553	....	....	....	*2* $1,324	*11* $10,578	*16* $17,155
South America:							
Argentina	*35* $78,000	*48* $65,225	*3* $2,910	*45* $33,063	*141* $146,255	*51* $50,124	*323* $375,577
Bolivia	....	....	....	....	*20* $48,590	*14* $24,958	*34* $73,548
Brazil	*36* $75,073	*13* $20,449	*3* $2,861	*11* $19,635	*14* $8,300	*24* $31,133	*101* $157,451
Chile	....	*2* $10,743	....	*17* $46,566	*69* $160,696	*220* $282,638	*308* $500,643
Colombia	*3* $6,112	....	*1* $1,237	*4* $1,236	*2* $4,998	*3* $7,100	*13* $20,683
Ecuador	*1* $2,017	....	....	*2* $3,378	*1* $2,050	*3* $6,876	*7* $14,321
Guiana, British	....	....	*1* $900	....	*1* $1,529	*7* $5,100	*9* $7,529
Dutch	....	....	....	*1* $1,037	....	....	*1* $1,037
Peru	....	*3* $5,301	*2* $3,484	*5* $5,830	*25* $48,776	*73* $155,834	*108* $218,225
Uruguay	*7* $19,280	*1* $865	....	*2* $5,818	*4* $10,437	*16* $15,809	*30* $52,209
Venezuela	*23* $34,291	*12* $28,228	*3* $7,164	*6* $13,029	*14* $28,502	*16* $12,410	*74* $123,624
Asia:							
China	....	*7* $12,700	....	*39* $9,799	*9* $14,287	*23* $26,236	*78* $63,022
China, French	....	....	*1* $2,451	....	....	....	*1* $2,451
Chosen (Korea)	*1* $3,500	....	....	*3* $5,027	....	*2* $1,629	*6* $10,156
East Indies, British:							
British India	....	*7* $12,091	*7* $8,680	*135* $208,067	*126* $205,023	*11* $20,275	*286* $454,136
Straits Settlements	*2* $5,588	*7* $14,381	....	*17* $25,169	*57* $61,881	*70* $113,554	*153* $220,573
Other British	....	....	*1* $3,300	*20* $27,841	*26* $38,970	*3* $7,138	*50* $77,249
Dutch	*2* $4,840	*7* $14,232	*11* $9,567	*58* $82,586	*108* $137,609	*68* $162,749	*254* $411,583
French	....	....	....	....	....	*2* $3,500	*2* $3,500
Hongkong	....	....	*1* $4,780	*3* $6,304	....	*8* $5,371	*12* $12,455
Japan	*21* $32,770	*1* $900	*1* $3,382	*15* $14,528	*70* $59,198	*279* $317,787	*387* $428,565
Persia	....	....	....	....	....	*4* $2,712	*4* $2,712
Russia in Asia	....	....	*596* $1,903,221	*1,170* $3,546,435	*515* $1,662,144	....	*2,281* $7,111,800
Siam	....	....	....	*9* $7,036	*8* $6,700	*6* $4,535	*23* $18,271
Turkey in Asia	....	*1* $1,354	*5* $26,282	....	*2* $1,143	....	*8* $28,779
Oceania, British:							
Australia	*17* $23,027	*32* $37,378	*57* $84,142	*201* $295,538	*194* $237,159	*109* $163,405	*610* $840,649
New Zealand	*1* $1,201	*39* $61,599	*20* $31,575	*93* $149,848	*75* $119,833	*74* $145,764	*302* $509,820
Other British	....	....	....	*2* $2,612	*1* $1,688	*2* $2,404	*5* $6,702
French	*2* $3,400	*4* $7,625	....	*1* $860	*2* $2,750	*5* $6,480	*14* $21,115
German	....	....	....	*1* $1,530	*3* $2,377	*4* $5,518	*8* $9,425
Philippine Islands	*43* $91,809	*38* $64,805	*27* $62,132	*58* $88,286	*53* $57,457	*163* $215,106	*382* $579,613
British Africa:							
West	....	*1* $1,260	....	*7* $13,173	*115* $124,574	*27* $20,136	*150* $159,143
South	*11* $9,476	*12* $11,539	*15* $40,280	*36* $54,519	*34* $82,957	*70* $107,085	*178* $305,856
East	....	....	....	....	....	*1* $787	*1* $787
Canary Islands	....	*1* $1,203	....	....	*1* $575	....	*2* $1,778
Egypt	....	....	....	....	*4* $9,624	....	*4* $9,624
French Africa	*1* $858	....	....	....	....	*18* $12,963	*19* $13,821
Morocco	....	....	....	*7* $9,675	....	....	*7* $9,675
Portuguese Africa	....	*1* $2,604	....	*1* $2,803	*1* $2,500	....	*3* $7,907
GRAND TOTAL: Number	*993*	*784*	*13,996*	*21,265*	*15,977*	*12,200*	*65,215*
Value	$1,737,141	$1,181,611	$39,140,682	$56,805,548	$42,343,502	$31,874,450	$173,082,915



not for the trucks imported from the U. S. A.

In the case of Russia, a country without truck factories and with an incomplete railroad organization, the commercial vehicles purchased from us were essential to keep commerce moving even in a sub-normal way. Canada's American-built trucks were also sorely needed to replace the overworked railroads. In Latin American republics we have done well in the absence of European competition.

Now that we have passed the relatively artificial export peak created by war-time conditions, as shown by the falling off in our truck exports, there remains the question of maintaining our sales to foreign customers in the face of the intensive competition we shall have to face from a reconstructed Europe. There is no doubt whatever but that this can be accomplished and that the close of 1919 will see a decided improvement in our truck exports over that of 1918.

Although a steady increase may be expected in the domestic demand for trucks, it may be that production is now practically at a point where the export field must be developed to its full.

Note—The figures in italics show the number of trucks.

Austro-Daimler 200-Hp. Aircraft Engine

Part III

Metallurgical Test Data—Mechanical Test Data—General Data —Analysis of Weights

THE chemical compositions and the relative material strengths of the principal parts of the engine are given in the following chemical analysis and mechanical test reports:

(1) *Chemical Analysis*

Per Cent:	C.	Si.	Mn.	S.	P.	Cr.	Ni.
Crankshaft	.14	.27	.43	.030	.006	1.34	3.45
Cylinder	.47	.19	.67	.037	.046	Nil.	Nil.
Connecting rod	.40	.16	.73	.043	.023	.36	1.50
Camshaft (case-hardened)	...	.21	.43	.035	.012	.57	3.15
Inlet valve	.46	.24	.42	.023	.022	.47	2.28
Exhaust valve	.44	.24	.41	.025	.022	.47	2.36
Valve rocker	.46	.09	.63	.051	.028	.42	1.57
Piston pin (case-hardened)	...	.12	.49	.028	.011	1.5	3.70

(2) *Chemical Analysis*

	Crankcase Per Cent	Piston Per Cent
Copper	2.79	7.67
Zinc	6.61	1.33
Tin	Nil.	2.21
Silicon	0.76	0.52
Iron	2.06	1.32
Manganese	0.02	Trace
Nickel	...	Nil.
Magnesium	...	0.29
Aluminum (by difference)	87.76	86.66

(3) *Bearings*

Per Cent	Journal Bearings	Big-End Bearings	Camshaft Bearings	Valve Rocker Bearings
Copper	6.70	5.10	87.51	96.29
Zinc	...	...	0.28	Trace
Tin	81.13	81.42	11.34	2.52
Lead	0.71	1.64	0.17	0.28
Antimony	12.00	12.00	...	...
Manganese	...	...	Nil.	0.21
Nickel	...	...	0.35	0.07
Iron	...	...	0.17	0.13
Phosphorus	...	...	0.05	...

(4) *Mechanical Tests*

	Mark	No.	Area sq. in.	Y.S. T sq. in.	M.S. T sq. in.	Elong: p.c. of	Red: Area	Impact ft. lbs.
Journal	A.	1.	.002	66.7	75.1	13.35	57.4	
Journal	B.	2.	...	...	...	...	...	30.5
Pin	C.	3,	.005	62.7	72.5	15.55	59.8	
Pin	D.	4.	...	...	...	...	...	33.5
Web, longitude.	E.	5.	.005	71.6	75.8	10.0	35.0	
Web, transverse.	H.	8.						(1) 5.0
Web	F.	6.	...	...	...	...	...	7.5
Web, transverse.	G.	7.	.005	72.9	74.5	7.78	25.1	
								(2) 7.0

General Data

Make of engine and rated hp	Austro-Daimler 200-hp.
No. of cylinders	Six
Type number	8597
Bore	135.0 mm. (5.31 in.)
Stroke	175.0 mm. (6.89 in.)
Stroke/bore ratio	1.29:1
Area of one piston	143.1 sq. cm. (22.2 sq. in.)
Total piston area of engine	858.6 sq. cm. (133.1 sq. in.)
Swept volume of one cylinder	2504.9 cu. cm. (152.8 cu. in.)
Total swept volume of engine	15029.7 cu. cm. (916.8 cu. in.)
Clearance volume of one cylinder	623.1 cu. cm. (38.0 cu. in.)
Compression ratio	5.02:1
Normal b.hp. and speed	200 b.hp. at 1400 r.p.m.
Maximum ditto	222 b.hp. at 1600 r.p.m.
Normal b.m.e.p.	123.3 lb. per sq. in at 1400 r.p.m.
Maximum ditto	123.5 lb. per sq. in. at 1300 r.p.m.
Piston speed	1607 ft. per min.
Mechanical efficiency (calculated)	89.7 per cent
Indicated mean pressure (calculated)	137.5 lb. sq. in.
Fuel consumption per b.hp. hour	0.555 pint = 0.499 lb.
Brake thermal efficiency	27.4 per cent
Indicated thermal efficiency	30.6 per cent
Air standard efficiency	47.5 per cent
Relative efficiency	64.4 per cent
Cu. in. of swept volume per b.hp.	4.58 cu. in.
Sq. in. of piston area per b.hp.	0.665 sq. in.
Hp. per cu. ft. of stroke volume	377.3 b.hp.
Hp. per sq. ft. of piston area	216.6 b.hp.
Direction of rotation of crankshaft	Anti-clockwise
Direction of rotation of airscrew	Ditto
Type of gear reduction to airscrew	None
Ratio crankshaft speed/propeller speed	1:1
Type of valve gear	Overhead camshaft
Type of starting gear	Compression release

CARBURETERS

Number and type of carbureters	One dual Austro-Daimler
Diameter of choke tube	24.0 mm. (0.945 in.)
Bore of main jets	35.0 c.c. through per min.
Bore of pilot jets	5.8 c.c. through per min.
Fuel consumption per hour	111.0 pints = 100.0 lb.
Fuel consumption per b.hp. hour	0.555 pint = 0.499 lb.

GAS VELOCITIES, VALVE AREA, ETC.

Diameters

Induction pipe	59.0 mm. (2.32 in.)
Inlet and exhaust effective valve ports (each)	44.0 mm. (1.73 mm.)
Inlet and exhaust cylinder ports (each)	42.0 mm. (1.65 in.)

CROSS SECTIONAL AREAS

Induction pipe	27.33 sq. cm. (4.22 sq. in.)
Inlet valve (πdh) } each	13.69 sq. cm. (2.12 sq. in.)
Exhaust valve (πdh) } each	14.05 sq. cm. (2.18 sq. in.)
Exhaust branch pipes	38.25 sq. cm. (5.92 sq. in.)

MEAN GAS VELOCITIES

(1400 r.p.m.)

Induction pipe	141.0 ft. per sec.
Inlet valves	140.0 ft. per sec.
Exhaust valves	136.0 ft. per sec.
Exhaust branch pipe	100.5 ft. per sec.

INLET VALVES

Number per cylinder	Two
Largest diameter	48.0 mm. (1.89 in.)

(*Continued on page* 134)

Record of Performances of British Airplanes

Type	Tractor or Pusher	No. of Seats	Engine	Normal B.H.P. and R.P.M. at G. L.	Lifting Surface	Speed in M.P.H. and R.P.M. @ 10,000 Ft.: At 6500	At 10,000	At 15,000	Time in Mins. and Rate of Climb in Ft. per Minute and R.P.M. @ 10,000 Ft.: 6500′ Time	6500′ Rate	10,000′ Time	10,000′ Rate and R.P.M.	15,000′ Time	15,000′ Rate	Service Ceiling, Ft.	Loading: Lbs. per Sq. Ft.	Lbs. per H.P.	Comparative Performance See Note At 10,000′: Speed	Climb	Weight, Lbs.: Gross =	Empty +	Fuel and Oil +	Mily. Load +	Crew	Dimensions: Span ′ ″	Length ′ ″	Height ′ ″
De Haviland 9[1].....	T	2	200 B.H.P. Siddeley	240@1400	438	....	....	102	9.7	550	17.1	405 1350	34.2	200	17,500	7.6	14.0	.....	...	3351	2234	572	185	360	42 6	30 6	10 0
De Haviland 9[2].....	T	2	200 B.H.P. Siddeley	240@1400	438	....	111.5 1505	101	10.1	520	17.9	380 1350	36.4	180	17,000	7.6	13.9	.....	...	3342	2225	572	185	360	42 6	30 6	10 0
De Haviland 9[3].....	T	2	200 B.H.P. Siddeley	240@1400	438	....	....	97.5	11.1	460	20.3	315 1350	46.7	110	15,000	8.1	14.9	105.4	366	3564	2225	572	407	360	42 6	30 6	10 0
De Haviland 9[4].....	T	2	200 B.H.P. Siddeley	240@1400	438	....	107 1475	.....	11.7	430	21.7	290 1350	....	....	14,500	8.1	14.9	.....	...	3564	2225	572	407	360	42 6	30 6	10 0
S. E. 5.............	T	1	Viper Hispano.	202@1800	249	....	....	117.5	6.7	810	11.6	610 1720	22.6	330	19,000	8.0	9.8	.....	...	1980	......	....	100	180	28 0	21 4	9 5
Bristol Fighter......	T	2	200 Hispano S.	210@2000	405	....	105 1995	97.5	8.7	620	15.1	475 1810	28.8	270	19,000	6.5	12.5	98.6	355	2630	1733	345	192	360	39 3	24 9	9 6
Blackburn Kangaroo.	T	3	Twin Falcon Mk. 2	2x253@2000	868	98	86 1885/1895	.....	18.2	250	38.2	115 1805/1805	....	....	10,500	9.2	15.8	93.4	292	8017	5284	1730	463	540	74 10	42 6	16 0
Sopwith Hippo......	T	2	225 Clerget	....	....	....	115 1345	93	7.4	655	13.4	470 1230	28.6	195	17,000	...	....	.....	...	2590	......	....	363	360	.....	....	...
De Haviland 9.....	T	2	260 Fiat	260@1400	438	....	....	109	9.2	550	16.6	405 1420	32.7	240	20,000	8.2	13.9	.....	...	3600	......	....	185	360	42 6	30 6	10 0
Sopwith Dolphin[5]...	T	1	200 Hispano S.	210@2000	258	....	127.5 1970	119	6.1	900	10.5	705 1725	19.5	425	21,000	7.4	9.1	97.8	296	1911	......	....	101	180	32 6	22 6	8 0
Sopwith Dolphin[6]...	T	1	200 Hispano S.	210@2000	258	....	121.5 1915	114	7.1	775	12.1	590 1725	23.0	335	20,000	7.6	9.3	.....	...	1959	......	....	136	180	32 6	22 6	8 0
Sopwith Camel......	T	1	150 Mono Gnome	154@1225	231	....	....	.....	5.6	960	9.6	755 1175	17.9	470	22,000	6.2	9.4	.....	...	1441	930	230	101	180	28 2	18 6	8 6
De Haviland 4.....	T	2	Rolls Eagle 8	360@1800	438	....	130 1840	124	6.5	840	11.3	660 1575	20.9	400	21,000	8.2	9.9	.....	...	3576	2509	522	185	360	42 6	29 8	11 1
S. E. 5......	T	1	Viper Hispano	202@1800	249	....	....	120	6.3	870	10.8	665 1780	20.8	370	19,500	8.0	9.8	.....	...	1988	......	....	....	180	28 0	21 4	9 5
Sopwith Dolphin....	T	1	200 Hispano S.	210@2000	258	....	128 1945	119.5	6.4	855	11.0	675 1690	20.2	420	21,000	7.8	9.6	.....	...	2003	......	....	101	180	32 6	22 6	8 0
Sopwith Dolphin....	T	1	200 Hispano S.	210@2000	258	....	....	116.5	6.2	885	10.6	685 1825	19.9	405	21,000	7.7	9.5	.....	...	1990	......	....	101	180	32 6	22 6	8 0
Sopwith Hippo......	T	2	220 Clerget	....	360	....	115.5 1345	101	7.4	655	13.4	470 1230	28.6	195	17,000	7.2	....	.....	...	2590	1481	386	363	360	38 10	24 6	8 0
B. A. T............	T	1	100 Mono Gnome	105@1250	230	....	100 1205	.....	9.1	550	16.8	360 1075	43.0	85	14,500	5.5	12.0	86.6	140	1260	866	164	50	180	24 8	20 8	7 5
Sopwith Snipe.......	T	1	200 B. R. 2.	228@1300	274	....	....	107	4.9	1040	8.8	760 1190	17.6	400	19,000	7.1	8.6	.....	...	1950	......	....	321	180	.....	....	...
De Haviland 9.....	T	2	260 Fiat	260@1400	438	....	117.5 1625	107.5	9.0	580	16.0	430 1445	32.3	215	17,500	8.2	13.9	.....	...	3600	2460	595	185	360	42 6	30 6	10 0
Sopwith Rhino......	T	2	200 B.H.P. Siddeley	240@1400	(612)	....	103 1490	.....	12.5	380	24.8	210 1375	....	....	12,000	5.9	15.0	.....	...	3590	2185	507	538	360	41 0	30 3	10 10
Sopwith Rhino......	T	2	200 B.H.P. Siddeley	240@1400	(612)	....	103 1455	.....	13.5	350	26.8	185 1375	....	....	12,000	5.9	15.0	.....	...	3590	2185	507	538	360	.....	....	...
Sopwith Rhino	T	2	200 B.H.P. Siddeley	240@1400	(612)	....	....	.....	10.0	500	18.6	325 1380	....	....	14,500	5.0	12.8	.....	...	(3061)	(2185)	465	51	360	.....	....	...
De Haviland 9.....	T	2	200 B.H.P. Siddeley	240@1400	438	....	114 1570	.....	9.5	540	17.3	385 1395	36.7	165	16,500	...	....	.....	...	......	......	....	185	360	42 6	30 6	10 0
De Haviland 9.....	T	2	200 B.H.P. Siddeley	240@1400	438	....	108.5 1420	.....	11.0	465	20.2	305 1360	49.5	85	14,500	...	....	.....	...	......	......	....	185	360	42 6	30 6	10 0
Sopwith Dolphin[8]...	T	1	200 Hispano S.	210@2000	258	..	119.5 2040	.....	5.5	910	10.3	685 1840	...	...	19,000	7.6	9.4	.....	...	1970	......	....	101	180	32 6	22 6	8 0
Sopwith Dolphin[9]...	T	1	200 Hispano S.	210@2000	258	....	111.5 1990	.....	6.5	800	11.7	600 1825	...	...	18,500	7.8	9.6	.....	...	2008	......	....	139	180	32 6	22 6	8 0
Sopwith Dolphin[10]...	T	1	200 Hispano S.	210@2000	258	....	111.5 1990	.....	6.5	800	11.7	600 1825	....	....	18,500	7.8	9.7	.....	...	2018	......	....	149	180	32 6	22 6	8 0
Sopwith Snipe......	T	1	200 B. R. 2.	228@1300	274	...	....	110	4.9	1040	8.8	760 1190	17.6	400	19,500	7.2	8.6	87.9	180	1964	1212	251	321	180	30 0	18 7	9 0
Sopwith Snipe......	T	1	200 B. R. 2.	228@1300	274		....	114	4.4	1225	7.4	1000 1195	13.3	710	....	...	....	.....	...	......	......	....	70	180	30 0	18 7	9 0
Bristol Fighter......	T	2	200 B.H.P. Siddeley	240@1400	405		104 1505	99	7.7	710	13.5	550 1360	25.2	320	20,000	6.9	11.7	.....	...	2810	1918	347	185	360	39 6	26 0	9 5
De Haviland 9......	T	2	200 B.H.P. Siddeley	240@1400	438	....	110 1525	101	10.4	500	18.7	360 1365	38.8	160	16,500	7.6	13.8	.....	...	3316	2201	570	185	360	42 6	30 6	10

NOTE:

Loading, Lbs. per H. P.—Gross Weight ÷ Actual H. P. developed at normal revs. (A suffix *R* shows that *Rated H.P.* has been used in absence of *Actual H.P.*)

Lifting Surface—Surface of Wings and Flaps only.

Military Load—Weight of Guns, Bombs, Ammunition, and Reconnaissance Load.

Air Endurance—At 10,000′ Alt. at full throttle, including climb.

Service Ceiling—Height at which rate of climb is 100 ft./min.

Weight Empty—Includes Cooling Water for water-cooled engines.

[1]With reconn. load, and gap covered with triplex.

[2]With reconn. load, but with gap open.

[3]With 14-20 lb. bombs and gap covered with fabric.

[4]With 14-20 lb. bombs, but with gap open.

[5]Without cabane and Lewis gun. [6]With cabane and Lewis gun.

[7]Two superimposed two-bladed D. G. B. 2610.

[8]With 2 Vickers guns only.

[9]With 2 Vickers guns and Lewis gun on top plane.

[10]With 2 Vickers guns and Lewis gun on cabane.

Comparative performance reduced to correspond with loadings of 14 lbs. per H.P. and 7 lbs. per sq. ft.

Austro-Daimler 200-Hp. Aircraft Engine

(*Continued from page* 132)

Effective valve port diameter	44.0 mm. (1.73 in.)
Width of seating	2.5 mm. (0.09 in.)
Angle of seating	45 deg.
Lift of valve	9.9 mm. (0.39 in.)
Diameter of stem	10.0 mm. (0.39 in.)
Length of valve guide	68.0 mm. (2.67 in.)
Overall length of valve	135.0 mm. (5.315 in.)
Number of springs per valve	One
Free length of spring	60.0 mm. (2.36 in.)
Length of spring in position (no lift)	46.0 mm. (1.81 in)
Mean diameter of coils	34.0 mm. (1.34 in.)
Diameter of wire	4.0 mm. (0.157 in.)
Ratio length of spring/lift of valve	4.61:1
Weight of valve complete with spring	0.50 lb.
Weight of spring bare	0.16 lb.
Inlet valve opens	10 deg. early
Inlet valve closes	30 deg. late
Period of induction	220 deg.
Inlet valve tappet clearance	0.25 mm. (0.01 in.)

Exhaust Valves

Number per cylinder	Two
Largest diameter	48.0 mm. (1.89 in.)
Effective valve port diameter	44.0 mm. = 1.73 in.
Width of seat	2.5 mm. (0.09 in.)
Angle of seat	45 deg.
Lift of valve	10.16 mm. (0.40 in.)
Diameter of stem	10.0 mm. (0.39 in.)
Length of valve guide	68.0 mm. (2.67 in.)
Overall length of valve	135.0 mm. (5.315 in.)
Number of springs per valve	One
Free length of spring	60.0 mm. (2.36 in.)
Length of spring in position (no lift)	46.0 mm. (1.81 in.)
Mean diameter of coils	34.0 mm. (1.34 in.)
Diameter of wire	4.0 mm. (0.157 in.)
Ratio length of spring/lift of valve	4.6:1
Weight of valve complete with spring	0.5 lb.
Weight of spring bare	0.16 lb.
Exhaust valve opens	45 deg. early
Exhaust valve closes	7 deg. late
Period of exhaust	232 deg.
Exhaust valve tappet clearance	0.304 mm. (0.012 in.)

Inertia Forces, Bearing Loads, Etc.

Weight of piston complete with rings and piston pin	4.18 lb.
Weight per sq.in. of piston area	0.188 lb.
Weight of connecting rod complete	4.84 lb.
Weight of reciprocating part of connecting rod	1.66 lb.
Total reciprocating weight per cylinder	5.84 lb.
Weight per sq. in. of piston area	0.263 lb.
Length of connecting rod (centers)	315.0 mm. (12.40 in.)
Ratio connecting rod/crank throw	3.6:1
Inertia lb./sq. in. piston area top center	63.8 lb./sq. in.
Inertia lb./sq. in. piston area bottom center	36.2 lb./sq. in.
Inertia lb./sq. in. piston area mean	25.0 lb./sq. in.
Weight of rotating mass of connecting rod	3.18 lb.
Total centrifugal pressure	610 lb.
Centrifugal pressure lb./sq. in. piston area	27.5 lb./sq. in.
Mean average fluid pressure including compression	47.0 lb./sq. in.
Mean average loading on crank pin bearing, total from all sources in terms of lb./sq. in. piston area	91.0 lb./sq. in.
Diameter of crank pin	56.0 mm. (2.20 in.)
Rubbing velocity	13.42 ft. per sec.
Effective projected area of big-end bearing	32.4 sq. cm. (5.02 sq. in.)
Ratio piston area/projected area of big-end bearing	4.42:1
Mean average loading on big-end bearing	402 lb./sq. in.
Load factor on big-end bearing	5400 lb./ft. sec.

Cylinders

Overall height of bare cylinder from top of base chamber	365.0 mm. (14.370 in.)
Depth of spigot at base of cylinder	15.0 mm. (0.590 in.)
Diameter of cylinder over water jacket	160.0 mm. (6.29 in.)
Thickness of flange at base of cylinder	11.0 mm. (0.433 in.)
Number of holding-down bolts per cylinder	Eight
Diameter of holding-down studs	4 of 14.0 mm., 4 of 19.0 mm.
Thickness of water jacket	1.0 mm. (0.039 in.)
Mean thickness of combustion chamber wall	5.0 mm. (0.197 in.)
Thickness of cylinder barrel (top)	4.0 mm. (0.177 in.)
Thickness of cylinder barrel (center)	3.0 mm. (0.138 in.)
Thickness of cylinder barrel (bottom)	4.0 mm. (0.157 in.)
Diameter of water connections between cylinders	36.0 mm. (1.42 in.)

Piston

Type of piston	Aluminum; internal ribs
Diameter at top	134.0 mm. (5.275 in.)
Diameter at bottom	134.58 mm. (5.297 in.)
Length	110.5 mm. (4.35 in.)
Ratio, piston length cylinder bore	0.82:1
Number of rings per cylinder	Three
Position of rings	Above piston pin
Width of rings	7.0 mm. (0.275 in.)
Gap of rings in cylinder	0.48 mm. (0.019 in.)

Connecting Rod

Length between centers	315.0 mm. (12.40 in.)
Ratio connecting rod/crank throw	3.6:1
Little-end bearing, type	Plain phosphor bronze
Little-end bearing, diameter	28.0 mm. (1.10 in.)
Little-end bearing, length	67.0 mm. (2.64 in.)
Little-end bearing, projected area	18.70 sq. cm. (2.90 sq. in.)
Ratio piston area/projected area little-end bearing	7.66:1
Big-end bearing, type	Bronze shell, lined white metal
Big-end bearing, diameter	56.0 mm. (2.20 in.)
Big-end bearing, length (actual)	67.0 mm. (2.63 in.)
Big-end bearing, length (effective)	58.0 mm. (2.28 in.)
Big-end bearing, projected area	28.4 sq. cm. (5.02 sq. in.)
Ratio piston area/projected area big-end bearing	4.42:1
Number of big-end bolts	Four
Full diameter of bolts	10.0 mm. (0.39 in.)
Total cross sectional area bottom of threads	2.04 sq. cm. (0.316 sq. in.)
Pitch of threads	1.5 metric
Maximum load due to inertia at 1400 r.p.m.	1390 lb.
Maximum load due to inertia at 1600 r.p.m.	1815 lb.
Load due to centrifugal force at 1400 r.p.m.	370 lb.

Load due to centrifugal force at 1600 r.p.m.	485 lb.
Total load on bolts at 1400 r.p.m.	1760 lb.
Total load on bolts at 1600 r.p.m.	2300 lb.
Stress per sq. in. at 1400 r.p.m.	5570 lb./sq. in.
Stress per sq. in. at 1600 r.p.m.	7280 lb./sq. in.

Crankshaft

Number and type of main bearings	Seven, bronze cage, lined white metal
Cylinder centers	166.0 mm. (6.53 in.)
Crankpins	
Outside diameter	56.0 mm. (2.20 in.)
Inside diameter	30.0 mm. (1.18 in.)
Length	68.0 mm. (2.67 in.)
Journals	
Outside diameter	58.0 mm. (2.28 in.)
Inside diameter (front two)	21.0 mm. (0.82 in.)
Inside diameter (others)	30 mm. (1.18 in.)
Length, propeller end	56.0 mm. (2.20 in.)
Length, rear end	43.5 mm. (1.71 in.)
Length, center	50.0 mm. (1.97 in.)
Length, intermediate	50.0 mm. (1.97 in.)

Crank Webs

Width	74.0 mm. (2.91 in.)
Thickness (front two)	24.5 mm. (0.96 in.)
Thickness (others)	24.0 mm. (0.94 in.)
Radius at ends of journals and crankpins	4.5 mm. (0.17 in.)
Weight of complete shaft	96.5 lb.

Working Clearances

Piston clearance top (total)	1.00 mm. (0.039 in.)
Piston clearance bottom (total)	0.42 mm. (0.016 in.)
Side clearance of connecting rod in piston (total)	2.50 mm. (0.098 in.)
Side clearance of connecting rod on crankpin (total)	1.00 mm. (0.039 in.)
End clearance of crankshaft in main bearings	2.00 mm. (0.079 in.)

Lubrication System

Number and type of oil pumps	One plunger
Oil consumption per hour	8.75 U. S. pints
Oil consumption per b.hp. hour	0.044 U. S. pint = 0.039 lb.
Oil pressure	50 deg. C.
Oil temperature	5 lb. per sq. in.
Specific gravity of oil	0.899
Ratio pump speed/crankshaft speed	1:15

Ignition

Number and type of magnetos	Two Bosch Z.H.6
Firing sequence of engine	Propeller 1-5-3-6-2-4
Ignition timing (fully advanced)	20 deg. E to 40 deg. E, variable
Number of plugs per cylinder	Two
Type of plugs	Bosch 3-point
Ratio magneto speed/crankshaft speed	1.5:1

Cooling System

Number and type of water pumps	One centrifugal
Diameter of inlet pipe	36.0 mm. (1.42 in.)
Diameter of outlet pipe	36.0 mm. (1.42 in.)
Diameter of rotor	112.0 mm. (4.40 in.)
Number and type of radiators	One honeycomb
Ratio water pump speed/engine speed	1.894:1
Water temperature inlet	54.5 deg. C.
Water temperature outlet	60.0 deg. C.

Air Pump

Type of air pump	Cam-operated plunger
Bore	38.0 mm. (1.496 in.)

Weights

Weight of complete engine, dry, with propeller boss and exhaust manifold	728.5 lb.
Weight per b.hp. ditto	3.64 lb.
Weight of fuel per hour	100.00 lb.
Weight of oil per hour	7.86 lb.
Total weight of fuel and oil per hour	107.86 lb.
Gross weight of engine in running order, less fuel and oil (cooling system) at 0.65 lb. per b.hp.	858.50 lb.
Weight per b.hp. ditto	4.29 lb.
Gross weight of engine in running order, with fuel and oil for six hours' running (tankage at 10 per cent weight of fuel and oil)	1570.4 lb.
Weight per b.hp.	7.85 lb.

Overall Dimension

Height	1150 mm.
Length	1724 mm.
Width	568 mm.

GENERAL ANALYSIS OF WEIGHTS

Description of part	No. per Set	Average unit weight in lb.	Weight of complete set in lb.	Percentage of total weight
Cylinders, bare	6	18.43	110.62	15.30
Detachable inlet valve pockets	6	1.06	6.37	0.87
Pistons, complete with rings	6	3.52	21.12	2.90
Piston pins	6	0.66	4.00	0.54
Connecting rods	6	4.84	29.04	3.98
Crankshaft	1	96.50	96.50	13.24
Inlet valves	12	0.34	4.12	0.56
Exhaust valves	12	0.34	4.12	0.56
Inlet exhaust valve springs	24	0.16	3.88	5.53
Valve collars and locking cones	24	0.09	2.19	0.30
Valve rockers (with bearings)	12	1.25	15.00	2.06
Camshaft	1	10.25	10.25	1.40
Camshaft casing complete	1	34.50	34.50	4.74
Half compression gear	1	2.69	2.69	0.36
Vertical camshaft driving spindle (complete)	1	6.81	6.81	0.93
Vertical spindle housing	1	1.62	1.62	0.22
Camshaft bevel sprocket	1	3.15	3.15	0.43
Crankcase, top half	1	107.00	107.00	14.68
Crankcase, bottom half	1	73.50	73.50	10.09
Bearing caps	7	2.27	15.93	2.19
Main holding-down bolts	14	0.75	10.50	1.44
Thrust race complete	1	5.28	5.28	0.72
Propeller hub	1	11.31	11.31	1.55
Carbureters	1	24.06	24.06	3.30
Induction pipes	2	4.25	8.50	1.16
Exhaust pipes	6	2.33	14.00	1.92
Oil pump	1	11.81	11.81	1.62
Oil leads with relief valve	1	4.56	4.56	0.62
Magnetos	2	14.37	28.75	3.94
High tension leads with casing	1	4.75	4.75	0.65
Magneto and throttle controls	1	2.12	2.12	0.29
Water pump	1	7.62	7.62	1.04
Water pipes	1	6.56	6.56	0.90
Air pump	1	1.62	1.62	0.22
Rev. counter drive	1	0.75	0.75	0.10
Gun gear with case	1	5.81	5.81	0.80
Miscellaneous parts	1	28.09	28.09	3.85
Total			728.50	100.00

French Airplanes in Service at the Front

(April, 1918)

Airplanes		Engines		Speed on the Level in M.P.H.				Duration of Climb				Theoretical Ceiling, Ft.	Hours of Flying Under Full Power at Ground Level	Armament		Total Load, Lb.	Division of Load					Weight Empty, Lb.	Total Weight in Flying Order, Lb.	Load per H.P., Lb.	Span, Ft.	Length, Ft.	Height, Ft.	Total Surface, Sq. Ft.	Load per Sq. Ft., Lb.
Make	Type	Make and Type	Maxmim Power Permitted	At 6500 Ft.	At 9800 Ft.	At 13,100 Ft.	At 16,400 Ft.	To 6500 Ft. M. S.	To 9800 Ft. M. S.	To 13,100 Ft. M. S.	To 16,400 Ft. M. S.		H. M.	Machine Guns with Mountings	Bomb Carriers Provided for Dropping:		Fuel and Oil, Lb.	Crew, Lb.	Armament, Lb.	Miscellaneous, Lb.	Bombs, Lb.								
Army Planes																													
A. R. (484 sq. ft.), radiator in the wing.	A.R.L. 1A2	Renault 8Gdy	200 1600	92 1620	87 1590	81 1550	.....	11	20	33 10	...	16,400	2 30	Vick. front Turr. rear	4–264	936	308	352	165	110	.....	1815	2750	13.75	39.4	28.74	9.85	484.5	5.72
A. R. (484 sq. ft.)	A.R.L. 2A2	Renault 8Gc	190 1600	82 1580	79 1530	73.5 1490	.....	14 45	28 20	...	...	......	2 45	Vick. front Turr. rear	4–264	936	308	352	165	110	.....	......	......	......	39.4	30.55	9.85	484.5	.....
Breguet (560 sq. ft.) with ailerons.	Bre. 14A2	Renault 12Fcx	300 1600	109.5 1580	107 1560	104.5 1540	100 1510	6 50	11 35	18 30	29 30	......	2 45	Vick. front Turr. rear	4–264	1157	475	352	198	132	.....	2222	3380	11.45	47.12	29.58	10.82	560	6.15
Breguet (528 sq. ft.)	Bre. 14A2	Renault 12Fcy	310 1600	114 1000	108 1550	107.5 1520	102.5 1500	7 40	12 10	17 35	25 40	......	2 45	Vick. front Turr. rear	4–264	1157	475	352	198	132	.....	2222	3380	10.90	46.00	29.22	10.82	528	6.38
Breguet Fiat	Bre. 14A2	Fiat A12	285 1600	110 1580	107.5 1570	103 1520	94 1470	15	15 50	23 50	37 50	20,300	3	Vick. front Turr. rear	4–264	1157	475	352	198	132	.....	2288	3447	12.10	46.00	.....	.....	528	6.54
Caudron G6	Cau. 6A2	Rhone 9Jb	130 2x 1280	94 1310	91 1285	84.5 1205	.....	7 35	13 40	24 55	...	15,400	1 45	Supp. front Turr. rear	4–264	1100	383	352	169	196	.....	2074	3170	12.20	55.7	28.22	9.68	427	7.42
Sopwith	Sop. 1A2	Clerget 9Bc or	145 1300	104 1310	100 1285	93.5 1230	.....	12 45	23 40	41 20	...	......	2 15	Vick. front Turr. rear	4–264	880	264	352	169	94.5	.....	1157	2040	15.07	33.6	25.60	10.16	344.5	5.93
Sopwith	Sop. 1A2	Rhone 9Jby	135 1350	 1300	97 1270	.....	....	10 40	17 40	..	...	......	2 15	Vick. front Turr. rear	4–264	880	264	352	169	94.5	.....	1157	2040	15.07	33.6	25.60	10.16	344.5	5.93
Salmson*	Sal. 2A2 and Sal. 2bisA2	Salmson 9Z	270 1600	116 1620	112.5 1590	109 1560	104 1520	7 15	11 40	17 20	27 30	20,300	2 45	Vick. front Turr. rear	4–264	1120	440	352	198	132	.....	1676	2800	10.34	38.5	27.90	9.52	398	6.95
Spad 2-seater	Spa. 11A2	Hispano 8Bc	235 2150	112.5 2125	110.5 2095	105 2050	....	7 35	12 30	17 30	......	20,800	2 15	Vick. front Turr. rear	4–264	825	264	352	150	59	.....	1485	2310	11.00	36.8	25.45	8.54	323	7.16
Spad 2-seater*	Spa. 16A2	Lorraine 8Bb	250 1650	115 1650	.....	.....	....	7	11 50	18 15	31	......	1 45	Vick. front Turr. rear	4–264	825	264	352	150	59	.....	1526	2350	9.46	36.8	25.45	8.54	323	7.28
Caudron R11*	Cau. 11A3	Hispano 8Bda	215 2x 2150	114.5 2230	111.5 2115	108.5 2185	102.5 2080	8 10	14 30	22 30	39	19,350	3	Turr. front Turr. rear Emerg. gun	6–264	1684	792	528	231	132	.....	3124	4760	11.00	58.9	36.80	9.18	583	8.18
Letord	Let. 1A3	Hispano 8A2	175 2x 1700	92 1690	88.5 1655	84 1 00	.....	12	21 30	36	...	17,000	3	Turr. front Turr. rear Emerg. gun	6–264	1415	524	528	207	156	.....	2758	4178	11.88	59.00	36.80	12.14	661	6.34
Letord	Let. 2A3	Hispano 8Bda	215 2x 2150	98 2125	96 2075	92 2035	.....	9 30	16	27	...	17,700	3	Turr. front Turr. rear Emerg. gun	6–264	1685	792	528	220	143	.....	3562	5200	11.88	59.00	36.80	12.14	661	7.46
Letord	Let. 5A3	Lorraine 8Ba	250 2x 1650	97.5 1670	94.5 1630	88 1590	.....	10	18	31	...	16,050	3	Turr. front Turr. rear Emerg. gun	....	1730	835	528	220	143	.....	3650	5380	10.78	59.02	36.70	12.14	680	7.87
Bombing Planes																													
Breguet*	Bre. 14B2	Renault 12Fcx	300 1600	110 1560	106.5 1530	103 1500	.....	9 15	16 30	26	47	19,000	2 45	Vick. front Turr. rear	32–253	1610	475	352	150	110	520	2280	3880	13	46	29.2	10.8	560	6.95
Caproni	Cap. Bn3	3 Isotta F	180 3x 1500	84 1530	81 1500	78 1460	.....	23 50	39 10	60	...	......	......	Turr. front Turr. above	8–440 4–264 2 G.P.	3300	1880	352	123	66	880	5420	8730	16.2	73.5	36.1	13	990	8.84
Sopwith	Sop. 1B1	Clerget 9Bb	135 1250	.....	.....	.....	.....	...	...	...	...	......	4 15	Supp. above	18–264 or 6–340 or 12–264	1100	470	176	99	22	332	1320	2200	16.3	33.7	25.6	10.2	345	6.34
Voisin L.A.P.	Voi. 8Bn2	Peugeot 8Aa	220 2050	75 2050	73 2040	66 2030	.....	17 20	32 20	66	...	14,100	4	2 Supp. lat.	2–340 10–264 4–340	1210	462	352	110	66	220	2900	4100	18.7	61.6	36.1	11.5	680	6.14
Voisin	Voi. 10Bn2	Renault 12Fcx	300 1600	78 1520	76 1500	71.5 1480	.....	14 30	26 50	50	...	......	2 40	2 Supp. lat.	10–264 4–340	1210	462	352	110	66	220	2900	4100	18.7	61.6	36.1	11.5	680	6.14
Chasers																													
Morane	MoS A1C1	Gnome (stock)	160 1400	129 1385	126 1360	121 1330	.....	4 55	8 05	12 20	...	23,000	1 45	Vick. front	....	500	220	176	88	17.6	.....	924	1425	.....	27.9	18.55	7.90	145	10.2
Nieuport (160 sq. ft.).	Nie. 24.27 C.	Rhone 9Jb	130 1280	106 1280	104.5 1260	103 1240	.....	5 40	9 25	14 40	21 30	22,700	1 15	Vick. front	....	423	147½	176	88	11	.....	782	1200	9.25	26.9	21	7.90	160	7.47
Nieuport, ½ dihedral.	Nie. 28C	Gnome 9N	160 1400	123 1390	121.5 1380	119 1350	115 1310	5 30	9	14	21 15	22,300	1 45	Vick. front	....	500	220	176	88	17.6	.....	880	1380	.....	26.3	20.5	7.55	172	8.10

Spad (195 sq. ft.)	Spa. 7C1	Hispano 8Aa	175	119.5	111.5	108	.....	6 40	11 30	19 30	...	18,000	2 10	Vick. front	....	451	176	176	88	11	.....	1100	1550	9.04	25.7	20	7.20	195	8.08
Spad (195 sq.ft.)	Spa. 7C1	Hispano 8Ab	1700 205	1720 132	1680 126	1640 124.5	116	4 40	8 10	12 40	..	21,400	1 30	Vick. front		451	176	176	88	11	.....	1100	1550	9.04	25.7	20	7.20	195	8.08
Spad* (2-machine gun)	Spa. 13C1	Hispano 8Ba	1800 220	1870 130	1830 128	1780 125	1710 118	5 17	8 45	13 5	20	22,300	2	Vick. front	....	556	242	176	132	11	.....	1255	1815	8.25	26.3	20.35	7.55	215	8.42
Spad* (2-machine gun)	Spa. 13C1	Hispano 8BEc	2150 235	2180 135	2170 134	2130 130.5	2050 123	4 40	8	12 20	18 35	22,300	1 40	Vick. front	....	556	242	176	132	11	.....	1255	1815	8.25	26.3	20.35	7.55	215	8.42
Spad Cannon*	Spa. 12Ca1	Hispano 8C	2150 220	2080	2060	2020	1950	...	...	...	...	......	......	Vick. front 1½" Cannon	....	.....	.....	176	191	28.6	.....	.....	.....	.....	.....	.....	.....	.....	.....
Breguet Cannon	Bre. 5Ca2	Renault 12Fb	2150 265	84	78.5	.....	.....	15 30	...	...	...	14,100	.....	1½" Cannon Supp. above	....	1190	462	352	220	44	110	3087	4260	16.05	57.8	32.5	12.8	632	6.74
Voisin Cannon	Voi. 8Ca2	Peugeot 8Aa	1400 220	1350 75	1350 73	66	.....	17 20	32 20	66	...	14,100	2 45	Supp. above	....	2110	313	352	414	22	110	2890	4100	18.7	61.6	36.1	11.5	680	6.14
			2050	2050	2010	2030																							

*These types are the only extensively used and supplied to the squadrons. The other types are still figuring in some squadrons but are no more supplied.

French Airplanes Under Test

Airplanes		Engines		Speed on the Level in M.P.H.				Duration of Climb				Theoretical Ceiling, Ft.	Hours of Flying Under Full Power at Ground Level	Armament		Total Load, Lb.	Division of Load					Weight Empty, Lb.	Total Weight in Flying Order, Lb.	Load per H.P., Lb.	Span, Ft.	Length, Ft.	Height, Ft.	Total Surface, Sq. Ft.	Load per Sq. Ft., Lb.
Make	Type	Make and Type	Maximum Power Permitted	At 6500 Ft.	At 9800 Ft.	At 13,100 Ft.	At 16,400 Ft.	To 6500 Ft.	To 9800 Ft.	To 13,100 Ft.	To 16,400 Ft.			Machine Guns with Mountings	Bomb Carriers Provided for Dropping:		Fuel and Oil, Lb.	Crew, Lb.	Armament, Lb.	Miscellaneous, Lb.	Bombs, Lb.								
Army Planes																													
Breguet	Bre. 14A2	Fiat A12	275	110.6	173	103.3	97	M. S. 9 25	M. S. 15 50	M. S. 23 50	M. S. 37 50	20,350	H. M. 3	Vick. front Turr. rear	14–44	1158	476	352	198	132	.....	.....	.....	.....	46	29.2	10.8	560	.....
Breguet	Bre. 14A2	Lorraine 12D	1500 370	1580 122	1570 118.7	1520 115	1470 107.6	5 20	8 50	13	19 20	23,000	..	....	....	1158	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Breguet	Bre. 14A2	Renault 12K	1650 400	1750 126.4	1730 123	1700 119.5	1650 113.2	6 09	10 19	15 40	22 28	23,000	3 40	Vick. front Turr. rear	....	1442	684	352	220	187	.....	2,640	4,090	10.13	46	29.2	10.8	528	7.57
Salmson Armored	Sal. 4Ab2	Salmson 9Zm	1600 260	1595 89.4	1575 85	1560	1540	20 14	43 27	...	...	12,140	2	Vick. front Turr. rear M. gun below	....	1155	320	352	308	176	.....	3,100	4,260	16.40	50	28.9	9.7	533	8.04
			1650	1690	1660																								
Bombing Planes																													
Voisin Triplane/ab	Voi. 28Bn4	4 Hispano 8Be	215	79.6	...	.....	.....	27	...	...	...	11,500	2 50	1.85 in. gun	As desired	4400	1320	880	330	220	1650	11,000	15,400	17.95	118.5	78	18.9	2150	7.1
Caudron C22	Cau. 22Bn2	2 Rhone 9Jb	2150 130	2150 98.3	88	*	.....	11	21	*	...	11,150	3 30	M. gun rear	6–264 3–342	1980	550	352	88	66	837	2,070	4,050	15.65	54	27.2	8.25	536	7.57
Caudron C23	.....	2 CH 9Z	1280 260	1290	1250	.....	.....	...	...	...	...	..	..	......	....	.....	.....	.....	.....	.....	1540	.....	.....	.....	.....	.....	.....	.....	.....
*Speed with 1540 lb.	Climb	with 1980 lb.	2x 1650																										
Chasers																													
Gourdou	C1	Hispano 8Ab	200	147.5	.....	.....	.....	4 58	8 15	12 42	...	20,500	1 30	2 Vick front	†	430	160	176	172	17.6	†	1,320	1,750	8.8	29.5	21.6	7.54	179	9.82
Nieuport	Nie. 28C1	Rhone 9R	1800 170	1980 125	123.8	121.3	117	4 30	7 40	12	...	20,700	2 15	1 Vick. front	....	511	228	176	88	17.6	.....	880	1,390	7.38	26.3	20.2	7.54	172	8.08
Nieuport Monocoque	.....	Rhone 9R	1400 170	1410 123	1400 121.3	1380 118.2	1360 114	4 20	7 20	11 40	17 25	22,000	2 15	1 Vick. front	....	516	234	176	88	17.6	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hanriot	H.D. 1C1	Rhone 9Jb	1400 130	1440	1430	1415	1385	5 31	9 17	14 08	20 50	23,600	..	....		452	.....	.....	.....	.....	.....	898	1,360	10.4	27.6	19.5	8.10	192	7.06
Morane Parasol	MoS A1C1	Rhone 9R	1280 170	133.7	131.8	128	119.5	4 30	7 45	11 40	16 30	23,000	2 10	1 Vick. front	....	511	234	176	88	17.6	.....	916	1,440	8.5	27.9	18.5	7.86	145	9.92
Rep	C1	Salmson 9Z	1400 260	1405 133.7	1390 131.8	1365 128.7	1310 122	5 30	9 23	14 39	23 28	19,700	2	2 Vick. front	....	683	313	176	176	17.6	.....	1,450	2,130	7.7	27.6	20.8	8.24	221	9.52
Vickers	Vic. 16C1	Lorraine 8Bd	1550 275	1705	1700 133.7	1670 129	1610 121.4	4 49	7 58	11 38	16 18	23,800	2 10	2 Vick. front	....	738	368	176	176	17.6	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hanriot-Dupont	H.D. 3C2	Salmson 9Za	1700 260	128.7	1750 126.3	1730 122	1700 116.5	6 39	11 04	17 09	25 34	22,000	2	Vick. front Turr. rear	....	940	275	352	302	11	.....	1,564	2,505	9.9	30.1	22.8	9.84	269	9.10
Vickers	C2	Lorraine 8Bd	1550 285	1640	1620	1590	1560	6 15	10 40	16 20	26 50	20,350	2 15	Vick. front Turr. rear	....	967	386	352	198	11	.....	1,695	2,640	9.25	35.45	26.2	8.70	356	7.47
Sea	Sea. 4C2	Lorraine 12D	1700 390	.....	.....	.....	.....	6 22	10 29	15 06	22 41	23,000	2	Vick. front Turr. rear	....	1210	507	352	297	55	.....	2,180	3,390	8.7	39.4	27.9	9.84	404	8.40
			1650																										

† The total load of the Gourdou plane has been reduced to take account of the lightening provided by the manufacturer from 512 to 428 lb.

Officially Recognized Perform and Sea

With a Few Conspicuous Examples of Achievements Authentic, Have Not Been

THE airplane records which are tabulated on these two pages and the one following are those that have been compiled by the Aero Club of America. But while they are the recognized records of airplane performance and cover flights which have been officially observed and recorded both in the United States and in foreign countries, they do not by any means represent some of the more recent achievements of foreign and American pilots.

Obviously, the war has precluded the possibility of publishing specific information regarding the accomplishments of military aviators and machines. Nevertheless, authentic reports from outside sources reveal that many of the records on these pages are, in fact, records no more. When the final data are collected, checked and officially promulgated in the form of records, it likely will be found that at least half of the figures given herewith have been superseded.

In the meantime, a brief review of some of the more conspicuous performances will serve to show how extensive may be the changes in the records. For example, the American altitude record for seaplanes is given as 875 ft. in a plane carrying six persons. As a matter of fact, this record is beaten nearly every day by regular navy fliers who commonly attain altitudes of more than 3000 ft., carrying as many as 11 persons.

In the matter of distance and passenger carrying, it probably will be a long time before the recent record of the navy seaplane NC1 is approached, yet it is not officially chronicled. This plane flew from Hampton Roads to Rockaway Beach, N. Y., carrying 51 passengers.

Another record about which nothing has become public was a flight of three navy seaplanes completely across the continent. Three stock machines were assembled, and almost without preparation flown from the Atlantic to the Pacific by regular navy pilots.

The altitude record, too, has been broken since these figures were compiled. Whereas Capt. Schroeder in September reached an altitude of 28,500 ft., a British pilot on Jan. 2 drove an American plane carrying himself and an observer to an altitude of 30,500 ft. in 55 min. 15 sec.

Speed records, as well, have been bet-

World's Records

SPEED

Time for a Given Distance

Kilometer	Miles	Aviator	Pass.	Place	Date	Machine	Motor	Time
5	3.11	Vedrines	0	Clearing, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	0: 1:43.38
·10	6.21	Vedrines	0	Clearing, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	0: 3:27.87
15	9.32	Vedrines.	0	Clearing, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	0: 5:11.58
20	12.42	Vedrines	0	Clearing, Ill	Sept. 9, 1912	Deperdussin	Gnome-140	0: 6:55.95
30	18.64	Vedrines	0	Clearing, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	0:10:32.51
40	24.85	Vedrines	0	Clearing, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	0:14:03.59
50	31.06	Vedrines	0	Clearing, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	0:17:34.88
100	62.13	Vedrines	0	Clearing, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	0:35:16.65
150	93.20	Vedrines	0	Clearing, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	0:53:04.73
200	124.27	Vedrines	0	Clearing, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	1:10:56.65
250	155.34	Johnstone	0	Mineola, N. Y.	July 27, 1911	Moisant	Gnome-50	3:32:56.80
10	6.21	Grahame-White	1	Nassau Blvd., N. Y.	Sept. 30, 1911	Nieuport	Gnome-70	0: 6:13.40
20	12.42	Grahame-White	1	Nassau Blvd., N. Y.	Sept. 30, 1911	Nieuport	Gnome-70	0:12:26.60
30	18.64	Grahame-White	1	Nassau Blvd., N. Y.	Sept. 30, 1911	Nieuport	Gnome-70	0:18:42.00
40	24.85	Grahame-White	1	Nassau Blvd., N. Y.	Sept. 30, 1911	Nieuport	Gnome-70	0:24:49.80
50	31.06	Grahame-White	1	Nassau Blvd., N. Y.	Sept. 30, 1911	Nieuport	Gnome-70	0:31:01.60
5	3.10	Sopwith	2	Chicago, Ill.	Aug. 15, 1911	Wright	Wright-30	0: 6:56.40

Distance for a Given Time

40	24.85	Vedrines	0	Chicago, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	0:15:00.00
80	49.70	Vedrines	0	Chicago, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	0:30:00.00
166.6	103.50	Vedrines	0	Chicago, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	1:00:00.00
141.9	88.20	Johnstone	0	Mineola, N. Y.	July 27, 1911	Moisant	Gnome-50	2:00:00.00
214.6	133.20	Johnstone	0	Mineola, N. Y.	July 27, 1911	Moisant	Gnome-50	3:00:00.00
283.6	176.20	Johnstone	0	Mincola, N. Y.	July 27, 1911	Moisant	Gnome-50	4:00:00.00
24.14	15.00	Grahame-White	1	Squantum, Mass.	Sept. 4, 1911	Nieuport	Gnome-70	0:15:00.00
36.24	30.00	Grahame-White	1	Nassau Blvd., N. Y.	Sept. 30, 1911	Nieuport	Gnome-70	0:30:00.00

Maximum Speed Irrespective of Length of Flight

								Speed per Hour Kilo	Miles
....	....	Vedrines	0	Chicago, Ill.	Sept. 9, 1912	Deperdussin	Gnome-140	174.1	108.1
....	....	Grahame-White	1	Squantum, Mass.	Sept. 4, 1911	Nieuport	Gnome-70	101.7	63.2
....	....	Sopwith	2	Chicago, Ill.	Aug. 15, 1911	Wright	Wright-30	56.2	34.9

DISTANCE

....	....	W. C. Robinson	0	Des Moines, Iowa, to Kentland, Ind.	Oct. 17, 1914	Parasol type	Robinson	535.0	332.0

DISTANCE—Closed Circuit

....	....	T. C. Macaulay	5	Newport News, Va., to Pt. Lookout and return.	May 4, 1916	Curtiss	Curtiss	173.7	154.0

DURATION

								Time
....	....	Lt. B. Q. Jones	0	San Diego	Jan. 15, 1915	....	......	8:53:00
....	....	Lt. T. F. Dodd	1	San Diego to Burbank, Cal.	Feb. 14, 1914	Burgess	Renault-70	4:43:00
....	....	Lt. B. Q. Jones	2	San Diego	Mar. 12, 1915	....	......	7:05:00

ALTITUDE

								Feet
....	....	Capt. R. W. Schroeder	0	Fairfield, Ohio	Sept. 18, 1918	Bristol	Hispano-Suiza 300	28,900
....	....	V. Carlstrom	1	Newport News	April 30, 1916	Curtiss	Curtiss-OX	16,225
....	....	V. Carlstrom	2	Newport News	April 10, 1916	Curtiss	Curtiss-OX	11,180
....	....	R. V. Morris	3	Buffalo	Aug. 10, 1915	....	......	8,105

ance Records of Airplanes planes

of Military Aviators and Machines, Which, Though Promulgated As Records

World's Records

CLIMBING

Kilometer	Miles	Aviator	Pass.	Place	Date	Machine	Motor	Ft.	Time
....	....	R. Simon	0	Chicago, Ill.	Aug. 19, 1911	Bleriot	Gnome-50	1640	3:35:00
....	....	Sopwith	0	Chicago, Ill.	Aug. 19, 1911	Sopwith	Gnome-70	1640	3:35:00
....	....	Grahame-White	1	Nassau Blvd., N. Y.	Sept. 30, 1911	Nieuport	Gnome-70	3280	9:00:00

ALIGHTING

Kilometer	Miles	Aviator	Pass.	Place	Date	Machine	Motor	Distance from Mark
....	....	Sopwith	0	Nassau Blvd., N. Y.	July 22, 1911	Wright	E.M.V. 60	1 ft. 5½ in.

WEIGHT CARRYING

Kilometer	Miles	Aviator	Pass.	Place	Date	Machine	Motor	Weight, Lb.
....	....	P. O. Parmelee	0	Chicago, Ill.	Aug. 19, 1911	Wright	Wright-30	458

CROSS COUNTRY

Kilometer	Miles	Aviator	Pass.	Place	Date	Machine	Motor	Distance Miles
....	....	Stinson	0	Chicago to Binghamton	May 23, 1918	Curtiss	Curtiss	601.7
....	....	V. Carlstrom	1	Newport News to Sheepshead Bay	May 23, 1918	Curtiss	Curtiss-OX	283.0

DURATION

Kilometer	Miles	Aviator	Pass.	Place	Date	Machine	Motor	Time
....	....	Stinson	0	Chicago to Binghamton	May 23, 1918	Curtiss	Curtiss	10:10:00
....	....	Lt. T. F. Dodd	1	San Diego to Burbank, Cal.	Feb. 14, 1914	Burgess	Gnome-70	4:43:00

HYDROAIRPLANE

Distance

Kilometer	Miles	Aviator	Pass.	Place	Date	Machine	Motor	Miles
....	....	L. B. Sperry	1	Brooklyn, N. Y., to Ossining, N. Y., and return.	Jan. 20, 1915	Curtiss	......	60
....	....	A. G. Sutro	2	San Francisco	Sept. 28, 1913	Sutro	......	33.5
....	....	T. C. Macaulay	4	Newport News to Baltimore.	May 6, 1916	....	......	178.3

DURATION

Kilometer	Miles	Aviator	Pass.	Place	Date	Machine	Motor	Time
....	...	L. V. Sperry	1	Brooklyn to Ossining and return.	Jan. 20, 1915	Curtiss	......	1:25:00
...	....	T. C. Macaulay	4	Newport News to Baltimore.	May 16, 1916	....	......	3:01:00
....	....	A. G. Sutro	2	San Francisco	Sept. 28, 1913	Sutro	......	1:15:35

ALTITUDE

Kilometer	Miles	Aviator	Pass.	Place	Date	Machine	Motor	Feet
....	....	Lt. R. C. Saufley	0	Pensacola	Mar. 29, 1916	Curtiss	......	16,010
....	....	Caleb Bragg	1	Pt. Washington	Sept. 19, 1917	Wright-Martin FBA	......	13,950
....	....	Caleb Bragg	2	Pt. Washington	Aug. 25, 1917	Wright-Martin FBA	......	12,900
....	....	Floyd Smith	3	North Island, Cal.	Feb. 15, 1916	Martin	......	9,603
....	....	T. C. Macaulay	5	Newport News	May 4, 1916	Curtiss	......	775
....	....	T. C. Macaulay	6	Newport News	April 30, 1916	Curtiss	......	875

tered time and again. There was a conspicuous example of this only last week when Major-General Kenly flew from Washington to New York to attend the dinner of the Manufacturers' Aircraft Association. He came over in a De Haviland, covering the 270 miles between the Capital and Mineola in 99 minutes, which figures out at an average of 163 m.p.h. Still more recently, Lieut. Springer flew a Martin bomber, the first to be turned out, from Dayton to Cleveland, carrying a passenger, at the rate of 172 m.p.h. And it was considered quite an accomplishment when S. F. Kettering flew more than a month ago from Dayton to New York in a De Haviland equipped with a Liberty engine in 4 hr. 10 min., averaging 140 m.p.h.

Cross country records have long since gone by the boards. Take the case of the four army airplanes which only last week reached Mineola after having flown all the way from San Diego. They were in the air 55 hours, all told, during the 34 days required for the journey.

And in the middle of December, came news from England that for the first time the flight between England and India had been accomplished. Major A. S. MacLaren made the flight with one passenger in a Handley-Page machine equipped with four Rolls-Royce Eagle engines, covering the distance in five legs.

It is believed by many that a large portion of long distance records of the future will be held by seaplanes or flying boats, this for the reason that as long as they are over water they are sure of a landing place and thus are enabled to venture further than land machines.

Two long flights in navy seaplanes have recently been completed, one from the Naval Air Station at Pensacola and the other from Norfolk, Va. Lieut. T. C. Rodman, U. S. Marine Corps, on Dec. 30 flew 900 miles from the Pensacola station, carrying eleven passengers. The same day Lieutenant-Commander Bollinger, U. S. N., covered a distance of 651 miles from the Norfolk station without stop, carrying five passengers.

These, of course, are only random examples, and may not represent the ultimate that has been attained in any of these fields. Doubtless some of even these astonishing performances have been beaten and the results withheld for military or other reasons.

(*Continued on following page*)

Recognized World Records of Airplane Performance

(See article on pages 138 and 139)

GREATEST SPEED

Closed Circuit Without Alighting

Hours	Aviator	Pass.	Country	Date	M.P.H. in Flight of 3.11 Miles
.....	M. Prevost	0	France	Sept. 29, 1913	126.7
.....	G. Legagneux	1	France	July 20, 1912	85.00
.....	E. Nieuport	2	France	July 20, 1912	63.9
.....	P. Mendelli	3	Austria	Aug. 16, 1912	66.00
.....	Garaix	4	France	June 10, 1914	69.00
.....	Garaix	5	France	June 10, 1914	67.25
.....	Garaix	6	France	April 22, 1914	66.70

DISTANCE

Closed Circuit Without Alighting

					Miles
.....	A. Senguin	0	France	Oct. 13, 1913	616.00
.....	E. Reneaux	1	France	June 9, 1914	310.50
.....	H. Bier	2	Austria	Oct. 1, 1911	69.50
.....	Mendelli	3	Austria	Aug. 16, 1912	68.30
.....	Champel	4	France	April 15, 1913	155.20
.....	Garaix	5	France	June 10, 1914	93.10
.....	Garaix	6	France	April 22, 1914	68.30

DISTANCE

In a Straight Line Without Alighting

					Miles
.....	Deroye	0	Italy	July 17, 1913	506.80
.....	Garaix	6	France	April 22, 1914	63.80

TIME

Closed Circuit Without Alighting

					Miles
¼	M. Prevost	0	France	Sept. 29, 1913	31.06
½	M. Prevost	0	France	Sept. 29, 1913	62.13
1	M. Prevost	0	France	Sept. 29, 1913	124.36
2	J. Vedrines	0	France	Jan. 9, 1913	153.30
3	M. Tabuteau	0	France	Jan. 24, 1912	192.50
4	Gilbert	0	France	Dec. 30, 1912	249.60
5	Gilbert	0	France	Dec. 30, 1912	316.70
6	Bournique	0	France	Dec. 31, 1910	304.20
7	M. Tabuteau	0	France	Dec. 30, 1910	324.70
8	Fourny	0	France	Sept. 11, 1912	357.20
9	Fourny	0	France	Sept. 11, 1912	410.40
10	Fourny	0	France	Sept. 11, 1912	462.60
11	Fourny	0	France	Sept. 11, 1912	509.20
12	Fourny	0	France	Sept. 11, 1912	561.30
13	Fourny	0	France	Sept. 11, 1912	608.50
¼	Glegagneux	1	France	July 5, 1912	19.20
½	Glegagneux	1	France	July 5, 1912	41.30
1	Glegagneux	1	France	July 5, 1912	82.80
2	Erenaux	1	France	June 9, 1914	131.40
3	Erenaux	1	France	June 9, 1914	186.10
4	Erenaux	1	France	June 9, 1914	262.00
1	Mendelli	3	Austria	Aug. 16, 1912	65.80
¼	Garaix	4	France	June 10, 1914	16.40
½	Garaix	4	France	June 10, 1914	32.90
1	Garaix	4	France	June 10, 1914	66.40
2	Champel	4	France	April 15, 1913	101.80
3	Champel	4	France	April 15, 1913	153.30
¼	Garaix	6	France	April 22, 1914	12.40
½	Garaix	6	France	April 22, 1914	31.00
1	Garaix	6	France	April 22, 1914	64.50

DURATION

Closed Circuit Without Alighting

					H.	M.	Sec.
.....	W. Landman	0	Germany	June 26-7, 1914	21	48	45.0
.....	Gaubert	1	France	Aug. 30, 1913	6	42	49.6
.....	Lt. B. Q. Jones	2	United States	....	7	5	00.0
.....	Garaix	3	France	July 2, 1914	4	3	39.8
.....	Champel	4	France	April 15, 1913	3	1	17.0
.....	Garaix	5	France	June 10, 1914	1	24	11.2
.....	Garaix	6	France	April 22, 1914	1	2	25.6
.....	L. Noel	7	Great Britain	April 22, 1913	0	17	25.4
.....	Frants	8	France	Mar. 2, 1913	0	11	28.4
.....	L. Noel	9	Great Britain	Oct. 2, 1913	0	19	47.0

ALTITUDE

					Feet
.....	Capt. N. W. Schroeder	0	United States	Sept. 18, 1918	28,900
.....	H. Bier	1	Austria	June 27, 1914	20,237
.....	H. Bier	2	Austria	June 28, 1914	17,843
.....	E. V. Losse	3	Austria	June 27, 1914	15 715
.....	Garaix	4	France	Feb. 25, 1914	10,004
.....	Garaix	5	France	Feb. 4, 1914	7,314
.....	Garaix	6	France	Jan. 31, 1914	5,740
.....	Garaix	7	France	Mar. 17, 1914	5,248
.....	Garaix	8	France	Mar. 28, 1914	5,018
.....	Garaix	9	France	Mar. 30, 1914	5,215
.....	Sykorsky	15	Russia	April 25, 1914	984

SPEED

Closed Circuit Without Alighting

Aviator Only

Kilometers	Miles	Aviator	Country	Date	H.	M.	Sec.
5	3.11	J. Vedrines	United States	Sept. 9, 1912	0	1	43.4
10	6.21	M. Prevost	France	Sept. 29, 1913	0	2	56.6
20	12.42	M. Prevost	France	Sept. 29, 1913	0	5	54.2
30	18.64	M. Prevost	France	Sept. 29, 1913	0	8	52.2
40	24.85	M. Prevost	France	Sept. 29, 1913	0	11	50.2
50	31.06	M. Prevost	France	Sept. 29, 1913	0	14	48.2
100	62.13	M. Prevost	France	Sept. 29, 1913	0	29	40.0
150	93.20	M. Prevost	France	Sept. 29, 1913	0	44	38.0
200	124.26	M. Prevost	France	Sept. 20, 1913	0	59	45.6
250	155.34	J. Vedrines	France	Jan. 9, 1913	2	1	58.6
300	186.39	Gobioni	Italy	Mar. 28, 1912	2	49	00.0
350	217.45	Gilbert	France	Dec. 30, 1912	3	26	16.0
400	248.12	Gilbert	France	Dec. 30, 1812	3	55	27.6
450	279.58	Gilbert	France	Dec. 30, 1912	4	24	44.8
500	310.60	Gilbert	France	Dec. 30, 1912	4	54	6.2
600	372.43	Gilbert	France	Dec. 30, 1912	5	52	38.0
700	434.70	Fourny	France	Sept. 11, 1912	9	31	1.0
800	496.83	Fourny	France	Sept. 11, 1912	10	44	45.8
900	548.96	Fourny	France	Sept. 11, 1912	11	59	9.6
1000	621.09	Fourny	France	Sept. 11, 1912	13	1	12.0

Aviator and One Passenger

5	3.11	H. Bier	Austria	Oct. 1, 1912	0	2	58.0
10	6.21	G. Legagneux	France	July 20, 1912	0	4	24.8
20	12.42	G. Legagneux	France	July 20, 1912	1	8	51.0
30	18.64	G. Legagneux	France	July 20, 1912	0	13	18.6
40	24.85	G. Legagneux	France	July 20, 1912	0	17	44.8
50	31.06	G. Legagneux	France	July 20, 1912	0	23	13.0
100	62.13	G. Legagneux	France	July 20, 1912	0	34	36.6
150	93.20	G. Legagneux	France	July 20, 1912	1	7	10.0
200	124.26	E. Renaux	France	June 9, 1914	1	53	40.0
250	155.34	E. Renaux	France	June 9, 1914	2	21	56.0
300	186.39	E. Renaux	France	June 9, 1914	2	50	28.0
350	217.45	E. Renaux	France	June 9, 1914	3	18	44.2
400	248.12	E. Renaux	France	June 9, 1914	3	47	17.0
450	279.58	E. Renaux	France	June 9, 1914	4	15	29.4
500	310.60	E. Renaux	France	June 9, 1914	4	43	16.0

Aviator and Two Passengers

5	3.11	C. Nieuport	Austria	June 30, 1912	0	2	52.0
10	6.21	C. Nieuport	Austria	June 30, 1912	0	5	45.0
20	12.42	E. Nieuport	France	Mar. 9, 1911	0	11	59.6
30	18.64	E. Nieuport	France	Mar. 9, 1911	0	17	52.6
40	24.85	E. Nieuport	France	Mar. 9, 1911	0	22	44.4
50	31.06	E. Nieuport	France	Mar. 9, 1911	0	29	37.4
100	62.13	E. Nieuport	France	Mar. 9, 1911	0	59	8.0

Aviator and Three Passengers

5	3.11	P. Mendelli	Austria	Aug. 16, 1912	0	3	48.0
10	6.21	G. Busson	France	Mar. 10, 1911	0	6	16.0
20	12.42	P. Mendelli	Austria	Mar. 16, 1912	0	12	3.0
30	18.64	P. Mendelli	Austria	Aug. 16, 1912	0	17	37.0
40	24.85	P. Mendelli	Austria	Aug. 16, 1912	0	23	11.0
50	31.06	P. Mendelli	Austria	Aug. 16, 1912	0	29	47.0
100	62.13	P. Mendelli	Austria	Aug. 16, 1912	0	56	33.0

Aviator and Four Passengers

5	3.11	G. Busson	France	Mar. 10, 1911	0	3	34.0
10	6.21	Garaix	France	June 10, 1914	0	5	27.4
20	12.42	Garaix	France	June 10, 1914	0	11	0.2
30	18.64	Garaix	France	June 10, 1914	0	16	32.6
40	24.85	Garaix	France	June 10, 1914	0	22	1.8
50	31.06	Garaix	France	June 10, 1914	0	27	32.8
100	62.13	Garaix	France	June 10, 1914	0	55	12.8
150	93.20	Champel	France	April 15, 1913	1	49	11.8
200	124.26	Champel	France	April 15, 1913	2	25	2.2
250	155.34	Champel	France	April 15, 1913	3	1	17.0

Aviator and Five Passengers

10	6.21	Garaix	France	June 10, 1914	0	5	32.4
20	12.42	Garaix	France	June 10, 1914	0	11	5.4
30	18.64	Garaix	France	June 10, 1914	0	16	39.4
40	24.85	Garaix	France	June 10, 1914	0	22	14.0
50	31.06	Garaix	France	June 10, 1914	0	27	47.4
100	62.13	Garaix	France	June 10, 1914	0	56	20.2
150	93.20	Garaix	France	June 10, 1914	1	24	11.2

Aviator and Six Passengers

10	6.21	Garaix	France	April 22, 1914	0	5	35.0
20	12.42	Garaix	France	April 22, 1914	0	11	12.2
30	18.64	Garaix	France	April 22, 1914	0	16	48.8
40	24.85	Garaix	France	April 22, 1914	0	22	28.2
50	31.06	Garaix	France	April 22, 1914	0	28	5.4
100	62.13	Garaix	France	April 22, 1914	0	56	44.0

Comparative Chart of Airplanes in the Italian Service.

Airplanes		Engines		Speeds		Duration of Climb									Components of Total Load					Weights							
Name	Type	Type	Normal H.P.	Ground Level, Speed, M.P.H.	6500 Ft. (2000 M.), Speed, M.P.H.	To 3280 Ft. (1000 M)	To 6500 Ft. (2000 M.)	To 10,000 Ft. (3000 M.)	To 13,000 Ft. (4000 M.)	Ceiling, Calc.	Air Endurance at G. L. at Max. R.P.M.	Crew	Armament, Guns and Mountings	Total Load	Petrol and Oil	Crew	Armt. & Ammun.	Misc.	Bombs	Empty	In Flying Trim	Per H.P.	Span, Ft.	Length, Ft.	Height, Ft.	Total Surface, Sq. Ft.	Load per Sq. Ft.
						m. s.	m. s.	m. s.	m. s.		h.m.																
MACHINES ATTACHED TO ARMY CORPS:																											
Aviatik	....	Salmson	143	71.5	....	8	18	40	....	....	3 30	2	1 M.G.	726	308	330	66	22	....	1540	2266	15.9	39.4	25.6	10.2	430	5.27
Caudron[1]	G.3.	Le Rhone	88	68.0	....	7	16	32	55	19,000	4 0	2	....	627	275	330	...	22	....	979	1606	18.3	43.4	23.3	8.4	290	5.54
Caudron[1]	G.4.	2 Le Rhone	176	83.0	....	5	11	20	36	26,000	4 30	2	1 M.G.	1100	616	330	66	88	....	1870	2970	16.8	55.4	24.0	8.54	430	6.97
Farman	14.	Fiat A.10	110	67.0	....	10	24	45	75	15,000	4 0	2	1 M.G.	638	242	330	66	..	....	1408	2046	18.6	53.2	31.2	10.5	602	3.38
Farman Colombo With Ova Booms	....	Colombo with Ova Booms	120	74.5	....	7	16	26	50	....	4 0	2	1 M.G.	638	242	330	66	..	....	1408	2046	17.05	53.2	31.2	10.5	602	3.38
Voisin	....	Salmson	143	65.0	....	10	23	45	....	....	3 30	2	1 M.G.	792	374	330	66	22	....	1760	2552	17.8	48.4	31.2	9.7	580	4.4
Voisin	....	I.F. v.4.8.	190	71.5	....	8	18	35	....	19,500	4 0	2	1 M.G.	770	374	330	66	..	....	1980	2750	14.5	48.4	31.2	9.7	580	4.75
RECONNAISSANCE M/CS.																											
Pomilio[2]	C.1.	Fiat A.12 Type D	270	114	110.5	5 27	12 36	22 1	37	....	3 0	2	2 M.G.	880	440	330	110	..	....	2589.4	3469.4	12.9	36.4	30.8	9.85	495	7.05
Savoia Pomilio	2.	Fiat A.12	270	84.0	....	6 30	18 0	28 0	46 0	....	4 0	2	1 M.G.	990	495	330	55	..	110	2750	3740	13.9	55.0	35.2	11.7	720	5.21
Savoia Pomilio (Light Structure)	....	Fiat A.12	270	91.5	91.0	4 50	12 0	21 30	36 0	....	4 0	2	1 M.G.	990	495	330	55	..	110	2310	3300	12.2	48.3	35.2	11.7	645	5.13
Savoia Pomilio (Twin Engines)	....	2 I.F.v.4.B.	380	91.5	....	5 45	13 0	23 30	42 30	....	4 0	3	2 M.G.	1540	759	495	176	..	110	3520	5060	13.3	65.0	35.2	11.7	840	6.05
S.A.M.L. with large wings[2]	....	Fiat A.12	270	100	....	5 44	12 18	21 6	36 24	....	3 30	2	1 M.G.	924	440	330	66	..	88	2156	3080	11.4	45.3	27.9	9.7	484	6.37
S.A.M.L. with reduced wings[2]	....	Fiat A.12	270	104.0	....	5 41	12 6	21 37	30 45	....	3 30	2	1 M.G	825	440	330	55	..	....	2112	2937	10.9	41.0	27.9	9.7	420	7.04
*S.I.A. (Reconnaissance)	7.B.	Fiat A.12	270	118	117.5	2 45	7 30	11 45	18 45	....	4 0	2	2 M.G.	1100	495	330	110	33	132	2120.8	3220.8	11.9	43.8	30.4	9.85	516	6.25
*S.I.A. (Reconnaissance)	7.B.	Fiat A.12	270	....	....	....	....	....	....	21,000	....	2	....	770	....	....	....	..	....	2120.8	2890.8	10.7	43.8	30.4	9.85	516	5.6
*S.I.A. (Reconnaissance)	7.B.	Fiat A.12	270	....	....	....	....	....	....	25,000	....	1	....	550	....	....	....	..	....	2120.8	2670.8	9.9	43.8	30.4	9.85	516	5.2
BOMBERS:																											
*Caproni Biplane[3]	....	3 Fiat A.12	810	90.6	....	6 30	14 35	25	40	15,000	4 0	3	2 M.G.	3300	1452	495	110	55	1188	6600	9900	12.2	77.0	41.2	13.85	1420	7.0
*Caproni Triplane[4]	....	3 I.F.v5.	810	77.6	73.6	19 41	51 25	....	....	9,400	7 0	5	4 M.G.	6600	2310	825	220	55	3190	8025.6	14625.6	18.1	101.9	49.3	21.4	2690	5.45
Caproni[5]	....	3 Fiat A.10	330	73.5	....	12 0	28 0	50 0	....	....	6 0	3	2 M.G.	2200	1100	495	110	55	440	4268	6468	19.6	73.4	35.8	12.6	1053	6.15
Caproni[6]	....	2 Fiat 1 I.F. A.10. v.4.B	410	81.0	....	10 0	22 0	40 0	65 0	....	5 30	3	2 M.G.	2200	1100	495	110	55	440	4378	6578	16.1	73.4	35.8	12.6	1053	6.25
Caproni[7]	....	3 I.F. v.4.B.	570	86.0	....	5 30	12 10	21 0	30 0	....	4 0	3	2 M.G.	2200	1100	495	110	55	440	5060	7260	12.8	73.4	35.8	12.6	1053	6.9
*S.I.A. 9b	9.B.	Fiat A.14	700	134.0	130.2	4 30	10 0	18 0	26 45	1,650,000	3 0	2	2 M.G.	2442	770	330	110	11	1221	3938	6380	9.13	50.9	33.2	13.1	710	9.1
*S.P. 4	4	2 S.P.A.	460	93.2	91.4	3 0	8 15	14 0	....	....	4 0	3	2 M.G.	2200	792	495	110	22	781	3740	5940	12.9	65.0	35.2	11.66	839	7.1
*S.I.A.7.b. (Bomber)	7.B.	Fiat A.12	270	116.0	114.1	4 0	9 30	18 0	36 45	....	4 0	2	2 M.G.	1760	572	330	110	22	726	2090	3850	14.3	43.8	30.4	9.85	516	7.46
FIGHTERS																											
*Hanriot-Dupont	....	Le Rhone	110	113.0	109.1	2 10	5 10	8 30	13 10	....	2 30	1	1 M.G.	396	176	165	55	..	....	869	1265	11.5	27.9	19.7	8.36	193.5	6.56
Nieuport One Seater	....	Le Rhone	88	95.0	....	5 0	11 8	18 37	27 40	22,000	2 30	1	1 M.G.	352	154	165	33	..	....	792	1144	13.0	24.45	18.3	8.9	140	8.2
Nieuport One Seater	....	Le Rhone	110	102	100	3 15	6 30	11 30	....	....	2 30	1	1 M.G.	396	187	165	44	..	....	858	1254	11.4	26.95	18.4	7.7	161	7.8
Spad One Seater Flat Winged	....	H.S.	140	123.5	120.5	2 00	5 50	9 50	....	....	2 00	1	1 M.G	451	231	165	55	..	....	1100	1551	11.0	25.8	20.0	7.2	192	8.1
*S.V.A. (Fighter)	....	S.P.A.	230	143.5	....	1 40	4 30	8 10	13 0	....	2 30	1	2 M.G.	506	231	165	110	..	....	1496	2002	8.7	30.05	26.8	9.2	263.0	7.62
*S.V.A. (Escort)	....	S.P.A.	230	143.0	....	2 30	7 30	12 0	18 0	....	5 0	1	2 M.G.	759	462	165	110	22	....	1533.4	2292.4	10.0	30.05	26.8	9.2	263.0	8.7
*S.V.A. (Escort)	....	S.P.A.	230	143.7	....	2 10	5 30	10 15	15 15	....	....	1	....	495	....	....	....	..	....	1533.4	2292.4	10.0	30.5	26.8	9.2	263.0	8.7
HYDROPLANES																											
Lohner	1	I.F. v.4.B.	190	65.0	....	13 0	13 0	....	....	....	6 0	2	1 M.G.	1302.4	572	330	114.4	..	286	2530	3832.4	20.2	53.2	34.2	11.5	570	6.7
Lohner	2 (L.C.)	I.F.	190	87.0	....	8 0	19 0	38 0	....	....	4 0	1	1 M.G.	990	440	330	66	22	132	2090	3080	16.3	53.2	34.8	10.4	516	6.0
Lohner[2]	3	I.F.	190	89.0	....	6 58	16 17	29 11	57 30	....	4 0	2	1 M.G.	990	440	330	66	22	132	1804	2794	14.75	52.4	33.6	10.5	495	5.65
F.B.A.	....	Gnome-Mono	102	68.5	....	7 30	17 0	40 0	....	....	4 0	1	1 M.G.	693	308	165	66	..	154	1265	1958	19.15	45.0	28.9	10.0	329	6.0
F.B.A.	....	H.S.	140	86.0	....	8 30	24 0	40 0	....	15,000	4 0	2	1 M.G.	946	407	330	66	33	110	1782	2728	19.5	47.6	33.2	10.9	448	6.15
F.B.A.	....	I.F. v.4.B.	190	90.0	....	8 0	19 0	38 0	53 0	....	4 0	2	1 M.G.	1045	440	330	66	33	176	2035	3080	16.2	47.6	33.2	11.1	448	6.86
Macchi One Seat Fighter	....	I.F. v.4.B.	190	108.5	....	3 45	8 45	14 0	22 0	....	3 0	1	1 M.G.	572	275	165	55	33	44	1507	2079	10.9	39.4	27.2	9.85	301	6.9
*Sopwith	....	Le Rhone	110	96.4	....	5 0	12 0	25 0	....	....	3 0	1	1 M.G.	440	220	165	55	..	....	1056	1496	13.6	25.6	23.0	9.85	236.2	6.35

*Experimental machines. [1]Artillery destroyers. [2]Average of acceptance tests in August. [3]Six machine guns can be fitted. [4]Nine machine guns can be fitted. [5]The load of bombs can be increased by reducing the air endurance, which in practice will not exceed 5 hours. [6]Generally the air endurance is reduced, in order to increase the load of bombs. [7]The 16,500 ft. was attained with a load of 1,760 lbs. in 38 mins.

Developments in the Galician Oil Industry

INDUSTRY in general depends in so many ways upon the supply of mineral oil that every new development in the oil fields of Europe has an important bearing on the reconstruction of the industries of these countries. War requirements of lubricating oil for railway use made a greatly increased output from the wells of Galicia necessary. The effects of the increased demand continue, and in view of the possibly distant resumption of imports from the United States further efforts are being made to widen the available oil fields. A number of fresh borings have been started, and preparations are being made for others. Government help is afforded the prospectors by lending machinery and horses and by supplying them with wood and coal with a view to hastening the progress of the boring. The Galician wells yield an oil richer in the heavy constituents needed for a lubricating oil than those of the Boryslaw and Tustanovic districts, says the *Oesterreichische Chemiker- und Techniker-Zeitung*.

Tungsten Contact Points

IN a recent article in Electrotechnische Zeitschrift by H. v. Fleischbein, the author explains the general difficulties in making relay contacts, and the troubles met with even when using platinum, through dirt, burning or welding together of the contacts. A series of experiments has resulted in the construction of contacts of tungsten that are superior to contacts of platinum.

The main difficulty in using tungsten lies in the fixing of the tungsten to the supporting spring. This has been successfully overcome by a process of electric spot welding. Care has to be taken that the material of the spring does not overheat and allow the tungsten contact to be pushed through it. As tungsten is a poor conductor of electricity, the heating at the contacts is greater than with platinum, and on this account it is advisable to make the contacts as short as possible. Under certain circumstances artificial cooling must be resorted to.

Engines Used by Royal Naval Air Service

(WAR AND SCHOOL USE)

Engine	Used in Aeroplane	Seaplane	Remarks
90 H.P. Anzani	Caudron (School)	....	Early type radial engine used for school purposes.
150 H.P. A. R. 1	Bristol Mono.	A.D. Navy plane	Latest design Rotary engine. Only two in use at present.
120 H.P. Austro Daimler (Beardmore)	....	W. & T. F. Boat	Chiefly used by R. F. C.
135 H.P. Canton Unne	Henry Farman	Short S.830	Water-cooled stationary radial, no further engines being ordered.
200 H.P. Canton Unne	....	Short S.166	Water-cooled stationary radial, no further engines being ordered.
80 H.P. Clerget	Sopwith 9901 (Pup)	....	Seven-cyl. It is understood that the manufacture of this engine is being stopped in favor of the 80 Rhone.
110 H.P. Clerget	Sopwith 9400 S	Sopwith Baby	
110 H.P. Clerget	Sopwith 9400 L	....	
110 H.P. Clerget	Sopwith 9700	....	9-cyl. Rotary; to be superseded by 130 H.P. Clerget.
110 H.P. Clerget	Sopwith Triplane	....	
110 H.P. Clerget	Nieuport 2-Seater	....	
130 H.P. Clerget	Sopwith F1	Hamble Baby	
130 H.P. Clerget	Nieuport 2-Seater	....	
130 H.P. Clerget	Nieuport Single	....	
130 H.P. Clerget	A. W. Quad	....	9-cyl. Rotary, used largely by both services.
130 H.P. Clerget	Nieuport Triplane	....	
130 H.P. Clerget	....	Sopwith Imp Baby	
130 H.P. Clerget	....	White Type 4	
90 H.P. Curtiss	B.E. 2.C.	....	8-cyl. V water cooled; school use.
90 H.P. Curtiss	J.N. 3.	....	
90 H.P. Curtiss	J.N. 4.	....	
160 H.P. Curtiss	Curtiss R.2.	....	8-cyl. V water cooled; being developed to give greater power and reliability, in America.
80 H.P. Gnome	Avro Scout		
80 H.P. Gnome	Avro 179 type	....	7-cyl. Rotary chiefly used for school purposes.
80 H.P. Gnome	Bristol Scout	....	
100 H.P. Gnome Mono	Bristol Scout	Sopwith Baby	
100 H.P. Gnome Mono	Avro Scout	Sopwith Schndr.	9-cyl. Rotary, not likely to be used for war purposes in future.
100 H.P. Gnome Mono	....	F.B.A.F. Boat	
100 H.P. Gnome Mono	....	P.V. 2.	
150 H.P. Hispano	Spad	Maurice Farman	8-cyl. V water cooled; a modern type based on latest principles.
200 H.P. Hispano	....	A.D.F. Boat	Similar engine to above but fitted with reduction gear to propeller.
90 H.P. R.A.F.	B.E.2.C.	....	8-cyl. V air cooled, school purposes only
70-75 H.P. Renault	B.E.2.C.	....	8-cyl. V air cooled, school purposes only.
70-80 H.P. Renault	M. Farman, long	....	8-cyl. V air cooled, school purposes only.
70-80 H.P. Renault	M. Farman, short	....	
150 H.P. Renault	Farman F.40	....	8-cyl. V water cooled, comparatively few of these engines in service.
240 H.P. Renault	....	Short 184	12-cyl. V water cooled, being used for two-seater seaplanes.
60 H.P. Rhone	G.W. 1600 type	....	7-cyl. Rotary, school purposes only, being superseded by 80 H.P. Rhone.
80 H.P. Rhone	Sopwith 9901	....	9-cyl. Rotary, school purposes and single seater fighters.
80 H.P. Rhone	Nieuport 1 seater	....	
75 H.P. Rolls-Royce	B.E.2.E.	....	6-cyl. vertical, water cooled, school purposes and small airships.
190 H.P. Rolls-Royce	De Havilland 4	A.D.F. Boat	12-cyl. V water cooled; now being developed to give 260 H.P.
190 H.P. Rolls-Royce	Fairey Fighter	Blackburn Twin	Two 190 H.P. engines in Fairey fighter and Blackburn Twin.
190 H.P. Rolls-Royce	....	Fairey type 3	
250 H.P. Rolls-Royce	De Havilland 4	Large America	12-cyl. V water cooled; now being developed to 360 H.P. Two 250 H.P. engines in large America Three 250 H.P. engines in Porte Boat. Two 250 H.P. engines in Handley Page.
250 H.P. Rolls-Royce	Handley Page	Porte Boat	
250 H.P. Rolls-Royce	....	Fairey Campania	
250 H.P. Rolls-Royce	....	Wight Convert	
150 H.P. Sunbeam	....	Avro Tractor Short S.8.27	8-cyl. V water cooled. Now out of date.
200 H.P. Sunbeam	A.W. Biplane	....	12-cyl. V water cooled; now being developed to give increased H.P.
200 H.P. Sunbeam	Parnall Night Flyer	....	
200 H.P. Sunbeam	Sunbeam type 7	....	
225 H.P. Sunbeam	....	Short 184 Short 184 single bomber	12-cyl. V water cooled; out of date.
240 H.P. Sunbeam	....	Short 184 Short 184 single bomber	12-cyl. V water cooled; will be superseded by later Sunbeam
320 H.P. Sunbeam	H.P. Triplane	Short 320 H.P.	12-cyl. V water cooled; used in large 2-seater seaplane.
		Cruiser Seaplane	Two 320 H.P. engines in cruiser seaplanes.

The above table contains the first published list of all engines used by the British Navy in airplanes and seaplanes and seems to be arranged on a chronological basis. This is indicated by the fact that the Austro-Daimler engine, which had been adopted in England previous to the war, appears high up in the list. In the early part of the war the British Navy seems to have pinned its faith mainly to rotary types of engines, while later the V type engine came to the front

British Airplanes

Principal Types of Engines and Air Service and

Airplanes in Use in Royal Naval Air Service

(*NOT* INCLUDING EXPERIMENTAL TYPES)

Machine	Engine	Duty
Avro.	80 Gnome.	Both 2-seater and single-seater, used exclusively for school (training) work.
B.E. 2.	75/80 H.P. Renault.	Two-seater tractor, used as a training machine, also as a night flyer for home defense against Zepps. A few also still used for reconnaissance patrol in the Eastern Mediterranean.
-c, d, & c.	90 H.P. R.A.F.	
Bristol Scout.	80 & 100 H.P. Gnome.	Originally used as fast single-seater fighter. Now becoming out of date, and only used for advanced training purposes.
Caudron.	100 Anzani & 80 Gnome.	Two-seater tractor. Used only as school machine.
Curtiss J.N. 3 & J.N. 4.	90 H.P. Curtiss.	Two-seater tractor. Supplied from America as a "reconnaissance machine." Only used for training purposes in this country.
Curtiss R.2.	160 Curtiss being replaced in this country by 200 Sunbeam.	Two-seater tractor. Has a good performance and carries a useful load of bombs. On completion of alteration of engine may be used on active service for bombing raids.
De Havilland 4	190 & 250 H.P. Rolls-Royce.	An army type machine now being built for R. N. A. S. Large two-seater tractor, used for fighting and reconnaissance patrols. Of very good performance.
Farman F.40.	150 Renault.	A large two-seater "pusher." Supplied from France, and used in this country for gunnery, training, etc.
Graham White.	60 H.P. LeRhone & 80 H.P. Gnome.	An elementary school training machine (being replaced by Maurice Farmans).
Handley Page.	2-250 H.P. Rolls-Royce.	A very large three-seater bombing machine. Used for bombing raids.
Henri Farman.	135 H.P. Canton Unne.	A large "pusher" machine chiefly used in the Mediterranean for bombing and fighter patrols. Now becoming obsolete.
Maurice Farman.	75 & 80 H.P. Renault.	The standard machine used in the R. N. A. S. for elementary training.
Nieuport.	80 LeRhone, 110 & 130 Clerget.	Both single- and two-seater. The earlier types of 80 H.P. engines are now obsolescent. Used as a fast fighter and "chaiser."
Sopwith (a) "1½ Strutter."	110 & 130 Clerget.	Both single-seater and two-seater. Single-seater used as a bomber, the two-seater as a "fighter reconnaissance machine." One of the best machines in 1916. Now obsolescent.
(b) "Pup."	80 H.P. LeRhone.	Single-seater fighter. Very fast and with excellent climb. Used very considerably during 1916 in France, this machine is now outclassed by the latest Sopwith, Nieuport & Spad fighters, and is becoming obsolete. Will be used for higher training. Also for ship use, flying off the deck.
(c) "F1" or "Camel."	130 Clerget.	The latest Sopwith single-seater fighter Only just produced, and not yet available in quantities.
(d) Triplane.	130 Clerget.	A single-seater fighter of great speed and climbing powers. The last machine produced by Sopwith before the "Camel."
"3pad."	150 & 200 H.P. Hispano-Suiza.	A French machine. A single-seater fighter. Only lately produced and not yet available in quantities. 200 H.P. machine has a better performance in the way of speed and climb than any machine yet produced.
Short.	250 Rolls-Royce & 240 Sunbeam.	A large two-seater land bomber. Carries a great weight of bombs, but has poor speed and climb and is therefore vulnerable, and is becoming obsolete. A few still used in France.

and Seaplanes

Planes in Use in the Royal Naval in the Army

Seaplanes in Use in Royal Naval Air Service

(*NOT* INCLUDING EXPERIMENTAL MACHINES)

Machine	Engine	Duty
Large "America" Flying Boat.	2-250 H.P. Rolls-Royce or 2-320 H.P. Sunbeam.	A large three-seater boat for reconnaissance and patrol work from coast stations.
Small "America" Flying Boat.	2-125 H.P. Anzani.	A small edition of above. Now obsolescent, and only used for training.
A.D. Flying Boat.	200 H.P. Hispano-Suiza.	A medium flying boat designed in Air Department, hence the name. The first has only just been completed, and the machine will not be available in quantities for four months. For fleet reconnaissance work from seaplane carriers.
Blackburn Twin.	2-100 Rolls-Royce.	A large twin-engined 2-float seaplane. The first has just completed trials, and a further twenty ordered but will not be available for some months. For reconnaissance and coast patrol with bombs. Or would carry a torpedo.
"Baby" Seaplane.	110 & 130 H.P. Clerget.	A small single-seater seaplane for fighting and attack of Zepps. There are various types, all differing only in detail, e.g., Sopwith "Baby," Hamble "Baby," Blackburn "Baby."
Fairey "Campania."	250 H.P. Rolls-Royce.	A 2-float seaplane designed for use in seaplane carriers. Carries eight hours' fuel, and to be used for fleet reconnaissance. First machine just completed trials and will not be available in quantities for some months.
M. Farman.	150 H.P. Hispano-Suiza.	After standard Maurice Farman practice, but with floats. 50 on order, but none yet delivered. For training and for coast patrol, etc.
"Porte Boat."	3-250 H.P. Rolls-Royce.	The largest type flying boat. Designed by Wing Commander Porte. Has not proved so handy as the "Large America" type and no more are being ordered after the ten now on order are completed.
Short.	150 H.P. Sunbeam. 125 H.P. Canton Unne.	Two of the earlier pattern Short seaplanes. Now only used for training.
	225 H.P. & 240 H.P. Sunbeam.	The standard 2-float seaplane at present in use in R. N. A. S. Used for reconnaissance and submarine patrol from coast stations.
	240 H.P. Renault.	Also from seaplane carriers. Also for higher training.
	320 H.P. Sunbeam.	The latest short seaplane, designed as a torpedo carrier. Also used for patrol work. Only two or three machines delivered at present. Will not be available in quantities for some months.
"Wight" (J. S. White of Cowes).	250 H.P. Rolls-Royce.	Originally designed as a land-bombing machine. Sixteen out of the twenty are being converted into seaplanes. The first so converted has given a very good performance, and a further fifty will be ordered. Will not be available in quantities for some months. Used similarly to the 225 & 240 Short.
White & Thompson and "F. B. A." Boats.	100 H.P. Gnome and 120 H.P. Austro-Daimler.	A small flying boat, now only used for training purposes. The F. B. A. was originally a French machine, but is built in this country by the White & Thompson Co.

The above table gives a list of the seaplanes in use by the British Navy with their engines and a brief general description of each type. The table is arranged alphabetically according to the names of the planes. It will be seen that the horsepower of seaplanes so far built ranges from 110 to 750, but it is stated that the large 750 hp. Porte seaplane has been discarded, it having proved less manoeuverable than the 500 hp. American plane

British Army Airplane Engines With Their Respective Machines

Engine	Machine	Category	Remarks
	ROTARY		
80 Clerget	Avro	T	7-cylinder.
	Bristol Scout	F	
110/130 Clerget	Bristol Monoplane	..	9-cylinder.
	Nieuport 2-Seater	C.R.	
	Sopwith 1½ Strutter	F.R.	
	Sopwith Camel	F	
	Sopwith Triplane	F	
	Vickers Scout F.B. 19	F	
80 Gnome	Avro	T	7-cylinder.
	Bristol Scout	T	
	G.W. Biplane	T	
	H. Farman	T	
80 Le Rhone	Avro	T	9-cylinder.
	Bristol Scout	F	
	Sopwith Scout	F	
	Morane Parasol	C.R.	
110 LeRhone	De Haviland 5	F	9-cylinder.
	Morane Parasol	C.R.	
	Nieuport Scout	F	
	Vickers F.B. 12	F	
	Vickers F.B. 19	F	
	Nieuport 2-Seater	C.R.	
100 Mono	Avro	T	9-cylinder.
	De Haviland 2	F	
	F.E. 8	F	
	Vickers F.B. 9	T	
	RADIAL		
140 Salmson (C. Unne)	H. Farman (All Steel)	C.R.	10-cylinder Stationary W. C.
	STATIONARY WATER COOLED		
160 H.P. Beardmore	A.W. Reconnaissance	C.R.	6-cylinder Vertical.
	F.E. 2B	F.R.	
	Martinsyde	B	
120 H.P. Beardmore	F.E. 2B	T	6-cylinder Vertical
	Martinsyde	B	
200 B.H.P.	De Haviland 4	F.R.	6-cylinder Vertical.
90 Curtiss	Curtiss J.N.3 & J.N.4	T	8-cylinder V Type.
	De Haviland 6	T	
	Maurice Farman	T	
150/200 Hispano Suiza	F.E. 9	F.R.	8-cylinder V type: a modern type based on latest principles. 200 H.P. fitted with reduction gear to propeller.
	S.E. 5	F	
	S.P.A.D.	F	
190 Rolls Royce	Bristol Fighter	F.R.	12-cylinder V type: now being developed to give 260 H.P.
250/300 Rolls Royce	F.E. 2D	F.R.	12-cylinder V type: now being developed to give 360 H.P.
	De Haviland 4	F.R.	
200 R.A.F. 3a	De Haviland 4	B	12-cylinder V Type.
220/240 Renault	Not in use in army	..	12-cylinder V Type.
	STATIONARY AIR COOLED		
70/75 Renault	M. Farman		
	B.E. 2	T	8-cylinder V Type.
80 Renault	Caudron	T	8-cylinder V Type.
	De Haviland 1	T	
	M. Farman	T	
	De Haviland 6	T	
90 R.A.F. 1a	A.W.B.E.	C.R.	8-cylinder V Type.
	B.E. 2	C.R.	
	De Haviland 6	T	
140 R.A.F. 4a	B.E. 12 & 12a	B	12-cylinder V Type.
	R.E. 7	T	
	R.E. 8	C.R.	

C.R.—Corps Reconnaissance. F.R.—Fighter Reconnaissance. B.—Bomber. F—Fighter. T—Training.

French Experimental Engines

ORDERED IN QUANTITY

Make of Engine	Nominal H.P.	Type	No. of Cyls.	Bore, Mm.	Stroke, Mm.	Normal H.P.	Normal R.P.M.	Prop. R.P.M.	Compression Ratio	M.E.P. at Normal R.P.M.	Piston Speed at Normal R.P.M.	Weight, Dry	Max. B.H.P.	Max. R.P.M.
Clerget 9B	130	Rotary	9	120	160	130	1250	1250	....	83	1312	377	.....	.....
Hispano 38	180	W.C.90° Vee	8	120	130	208	1800	1800	5.3	127.9	1536	442	245	2170
Hispano 35 & 44	220	W.C.90° Vee	8	120	130	222	2000	1500	5.3	122.4	1706	495	235	2220
LeRhone	120	Rotary	9	112	170	133	1250	1250	....	91.6	1394	337	.....	.....
Lorraine	220	W.C. 90° V.	8	120	170	245	1500	1500	5.2	138.6	1672	533	279	1700
Lorraine	275	W.C. 90° V.	8	120	175	276	1650	1650	5.2	135.3	1897	545	300	1800
Mono	150	Rotary	9	115	170	165	1350	1350	5.45	103.7	1505	280	171	1480
Renault	190	W.C. 50° Vee	8	125	150	190	1550	1550	5	107.2	1519	486	196	1600
Renault	300	W.C. 50° Vee	12	125	150	300	1550	1550	5	113.6	1519	793	310	1600
Salmson 29	250	W.C. Radial	9	125	170	230	1500	1500	5.4	107.8	1672	473	260	1650

The above table of French experimental aircraft engines shows that the French are now going in quite strongly for the V type, though continuing their work on rotary and radial types

Exports of Airplanes and Parts for Seven Years

Parts

(Figures not given separately prior to 1913)

	1913	1914	1915	1916	1917	1918	Totals by Countries
Europe:							
Denmark	....	....	....	....	$29,236	....	$29,236
France	$3,910	$9,876	....	$18,421	132,432	$1,118,409	1,283,048
Germany	140	5,225	....	....	....	....	5,365
Greece	....	....	....	556	....	....	556
Italy	....	....	$42,640	33,538	15,792	86,748	178,718
Netherlands	....	....	89	....	3,071	....	3,160
Norway	....	....	12,215	5,500	20,912	....	38,627
Portugal	....	....	....	....	4	....	4
Russia in Europe	....	52	3,500	69,095	38,000	12,600	123,247
Spain	....	....	....	70,000	....	....	70,000
Sweden	....	....	....	2,300	13,870	....	16,170
United Kingdom:							
England	....	3,513	400,043	4,361,700	1,615,913	4,362,543	10,743,712
Scotland	....	....	....	750	47,418	....	48,168
Ireland	....	....	....	14,580	....	....	14,580
North America:							
Bermuda	....	....	....	....	66	....	66
British Honduras	....	....	....	....	....	8	8
Canada	348	390	9,273	227,053	902,628	3,231,252	4,370,944
Central American States:							
Costa Rica	108	....	....	....	....	....	108
Guatemala	....	600	1,516	130	....	....	2,246
Honduras	....	....	....	....	108	....	108
Nicaragua	....	....	53	....	....	13	66
Panama	....	1,001	....	3	76	7,986	9,066
Salvador	....	1,850	80	....	....	....	1,930
Mexico	3,710	1,662	6,545	6,986	242	580	19,725
West Indies:							
British	....	....	....	59	80	1,767	1,906
Cuba	2,312	167	63	1,892	384	6,515	11,333
Danish	99	....	190	....	....	310	599
Dominican Republic	....	422	37	....	36	272	767
French	14	....	....	....	44	200	258
South America:							
Argentina	....	....	....	64	....	25	89
Brazil	5,193	3,543	....	3,072	1,990	15,300	29,098
Chile	....	....	....	459	....	89	548
Colombia	....	....	....	....	126	....	126
Guiana—Dutch	....	50	....	....	....	....	50
Venezuela	....	....	230	983	125	594	1,932
Asia:							
China	....	....	....	....	13,141	....	13,141
East Indies:							
British India	....	....	....	....	40	1,333	1,373
Dutch	....	....	....	325	54,913	....	55,238
Hongkong	....	8,000	....	....	....	....	8,000
Japan	....	255	....	8,150	5,400	22,003	35,808
Russia in Asia	....	....	104,450	....	237,742	....	342,192
Siam	....	....	572	....	114	1,381	2,067
Oceania:							
Australia	....	....	....	150	....	....	150
New Zealand	....	....	....	17,844	....	3,049	20,893
Philippine Islands	9,968	514	1,931	....	....	....	12,413
Africa:							
British—South	....	5	....	....	....	....	5
Totals	$25,802	$37,225	$583,427	$4,843,610	$3,133,903	$8,877,977	$17,501,944

Airplanes

(Figures not given separately prior to 1912)

	1912	1913	1914	1915	1916	1917	1918	Totals by Countries
Europe:								
France	*3* $8,100	*5* $12,100	*2* $8,000	......	......	......	......	*10* $23,200
Germany	*1* $5,400	*2* $9,000	*4* $16,375	......	......	......	......	*7* $30,775
Italy	......	......	......	*3* $17,000	......	......	......	*3* $17,000
Netherlands	......	......	......	......	......	......	*6* $76,226	*6* $76,226
Russia in Europe	*2* $10,000	*3* $18,500	*6* $65,574	......	......	......	......	*11* $94,074
Spain	......	......	......	......	*4* $27,980	......	......	*4* $37,980
Sweden	......	......	......	......	......	......	*3* $44,239	*3* $44,239
United Kingdom:								
England	......	*1* $3,000	*5* $26,575	*61* $324,512	*240* $1,964,094	*12* $170,954	*4* $27,775	*323* $2,516,912
North America:								
Canada	*12* $39,060	*11* $22,300	*6* $18,700	*20* $88,215	*16* $95,046	*102* $616,068	*2* $6,500	*169* $885,889
Central American States:								
Guatemala	......	......	*1* $2,900	......	......	......	......	*1* $2,900
Panama	*2* $7,500	*1* $3,000	......	......	......	......	......	*3* $10,500
Mexico	......	......	*3* $26,000	*6* $42,500	......	......	......	*9* $68,500
West Indies:								
Jamaica	*1* $2,500	......	......	......	*1* $875	......	......	*2* $3,375
Cuba	*2* $7,000	......	......	*1* $5,000	......	......	......	*3* $12,000
Dominican Republic	......	......	*1* $2,500	......	......	......	......	*1* $2,500
South America:								
Argentina	......	......	......	......	*1* $5,000	......	......	*1* $5,000
Brazil	*3* $7,500	*1* $5,500	......	......	*3* $20,000	......	*2* $34,500	*9* $67,500
Colombia	......	......	......	*1* $500	......	......	......	*1* $500
Ecuador	......	......	*1* $800	......	......	......	......	*1* $800
Venezuela	......	*2* $3,500	......	......	......	......	......	*2* $3,500
Asia:								
China	......	*1* $1,000	......	......	......	......	......	*1* $1,000
East Indies, Dutch	......	......	......	......	*2* $27,000	*12* $145,000	......	*14* $172,000
Hongkong	......	......	*1* $4,000	*2* $4,000	......	......	......	*3* $8,000
Japan	*1* $6,500	*2* $3,850	*3* $10,500	*1* $3,000	*2* $8,400	*7* $52,520	*3* $16,880	*19* $101,650
Russia in Asia	......	......	......	*57* $473,292	......	......	......	*57* $473,292
Turkey in Asia	......	......	*1* $7,000	......	......	......	......	*1* $7,000
Oceania:								
Australia	*1* $5,054	......	......	......	......	*2* $17,000	......	*3* $22,054
Philippine Islands	*1* $7,191	......	......	......	......	......	......	*1* $7,191
Totals	*29* $105,805	*29* $81,750	*34* $188,924	*152* $958,019	*269* $2,158,395	*135* $1,001,542	*20* $206,120	*668* $4,700,555

ALTHOUGH the airplane branch of the automotive industry is relatively in its infancy, our exports of parts and complete planes have already touched substantial figures, with the promise of further increases as the development of commercial airplane service proceeds. In the case of parts, our exports valued at $25,802 in 1913 have increased to a value of $8,877,977 in 1918. The widely extended field of our foreign sales both of airplanes and parts augurs well for the future, as it is evident that in the earlier years many planes and their parts were purchased for experimental purposes. In many of the countries, notably the Republics of Latin America, national movements are being made to develop postal and general commercial service. The figures in italics denote the number of airplanes shipped.

Future Production Plans Will Require Special Machinery

Tractor, Truck and Car Fields Soon to Be on Largest Production Scale

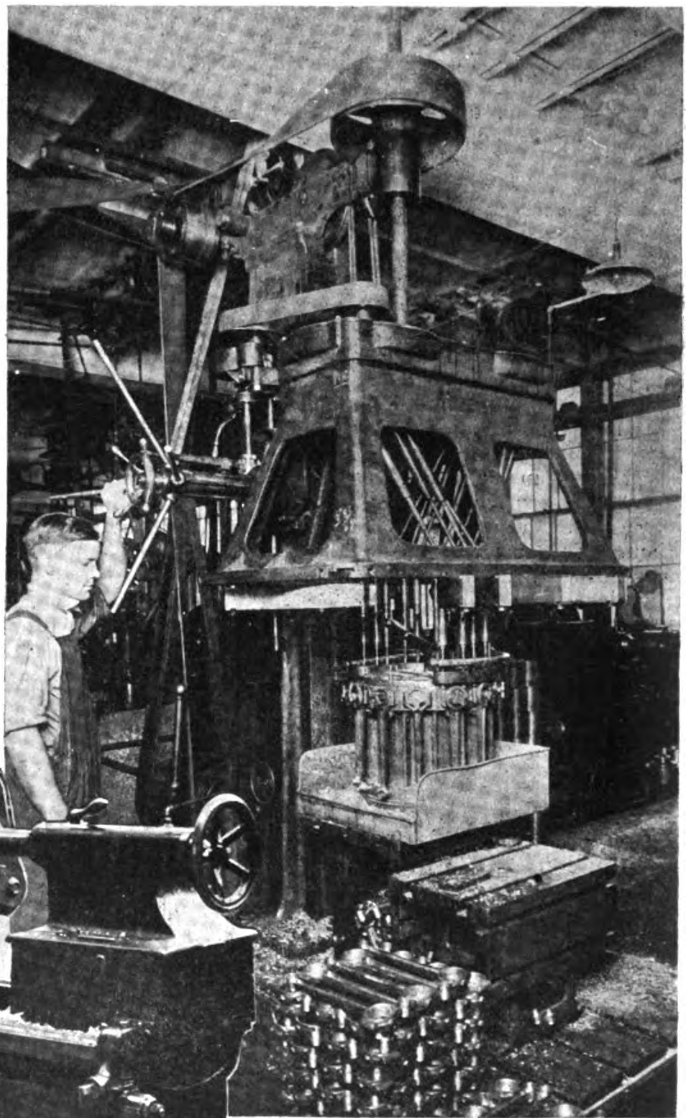
Special Jigs, Tools, Gauges Also Necessary to Fit Into Efficient Production Scheme

By J. Edward Schipper

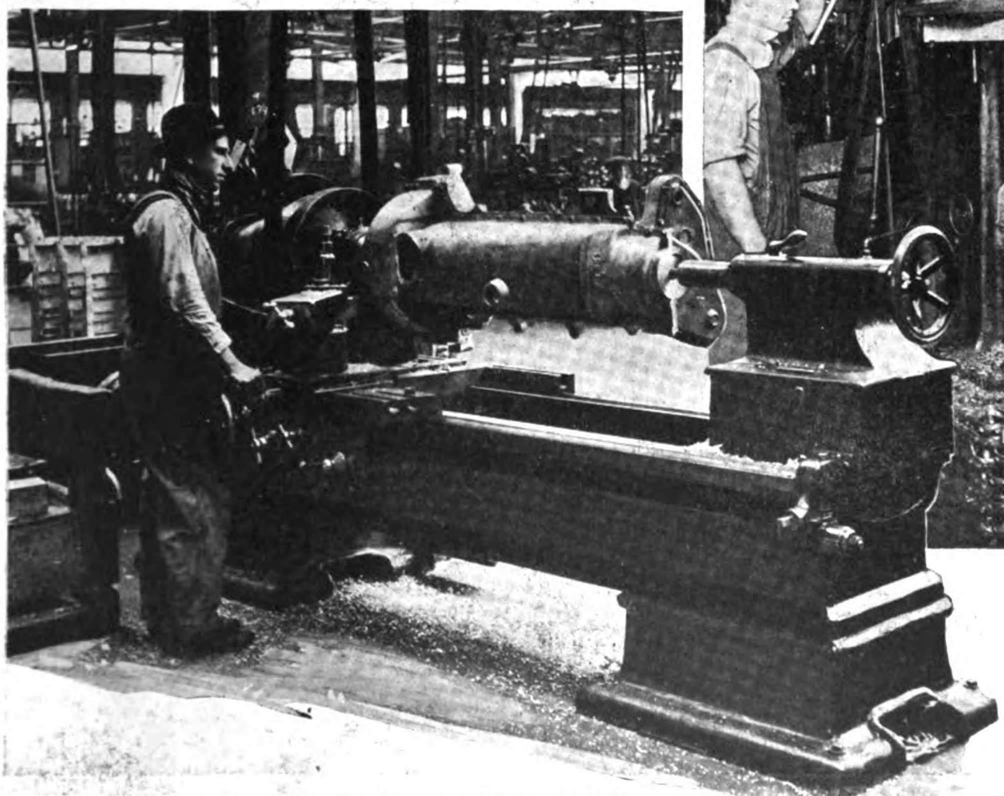
AUTOMOTIVE manufacture is still to enter its most active period. In the past all the big production companies have been in the automobile field. Ford, Overland, Buick, Dodge and other great concerns have carried the art of automobile manufacture to such efficiency that the overhead per car has been reduced to a degree where prices have dropped far below what would have appeared possible a decade ago.

With quantity production in the automobile field as a stepping stone, the era of great production and low prices is going to spread into the other branches of the automotive industry. It is certain that we are only on the eve of a great tractor move which will rival, if not surpass, the productive efforts of the automobile factories. A production of 300 farm tractors per day is now considered large. Yet this production will not begin to be a factor in some of the factories that are sure to spring up within the next 5 years.

Behind all this development in the manufacturing field there lies another development just as significant and without which the manufacturing development could not go on. This is the introduction of more special machinery particularly adapted to the wants of the automotive field. More and more the need for machinery built to fit a situation, or to form a link in the



Machining connecting-rods. On a machine of this kind several rods can be drilled at once by means of the rotating jig



Special high-center lathe used for machining bell housings

chain of manufacturing units designed for quantity production, has made itself felt.

Not so long ago we looked with unusual interest on a drill press or multiple-spindle drill which would drill thirty-two holes at a time, each one perfectly centered and in the same time formerly required to drill a single hole.

Not long after the development of the multiple-spindle drill, we became accustomed to the railway drill where a row of the multiple-spindle drilling machines built along a railway took care of all the milling and reaming and tapping on a piece of work which passed along below them on a track, carried by a swinging jig which brought the work into position and guided the tools.

With giant strides the machine-making industry, guided by the requirements and by the ingenuity of the production men, has overcome difficulties and progressed in quantity manufacture, until to-day we stand at a point where we can see that a concern which enters a field of competitive price must be well fortified by a highly efficient production scheme. This means special machinery, worked out to a degree even beyond what we have to-day in the great automobile factories.

It is necessary that the factory which goes into a low-priced field practically eliminate the work of the human hand and replace it by the work of human brains, and machinery. This does not mean a decrease in the necessity for labor, because it is a fact that those concerns which have gone furthest in the use of special production machinery and methods, have also gone furthest with the ideas of profit-sharing and welfare, and are, furthermore, the largest employers of labor.

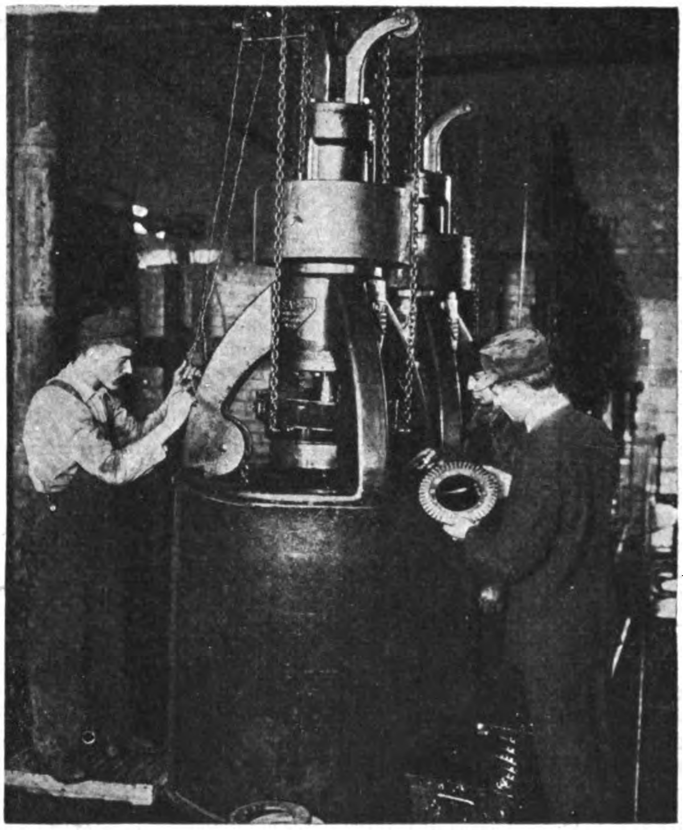
The supremacy of America in the manufacturing field depends on the efficiency of her manufacturing methods. America's labor is paid more than the labor of other countries, and the only way to offset this in the markets of the world is by such efficient production that the labor cost per unit and the overhead cost per unit are cut to a minimum. Machines that will do the same work or better work and will do it much more rapidly and accurately are going to be in demand in the automotive industry as never before.

It is beyond the powers of anyone to predict exactly what the tractor industry is going to be. Beyond the tractor industry, we can see on the horizon the airplane industry looming up in an embryonic stage but carrying behind it the thought that never has an improvement in transportation been discarded. Some day air transportation will come into its own.

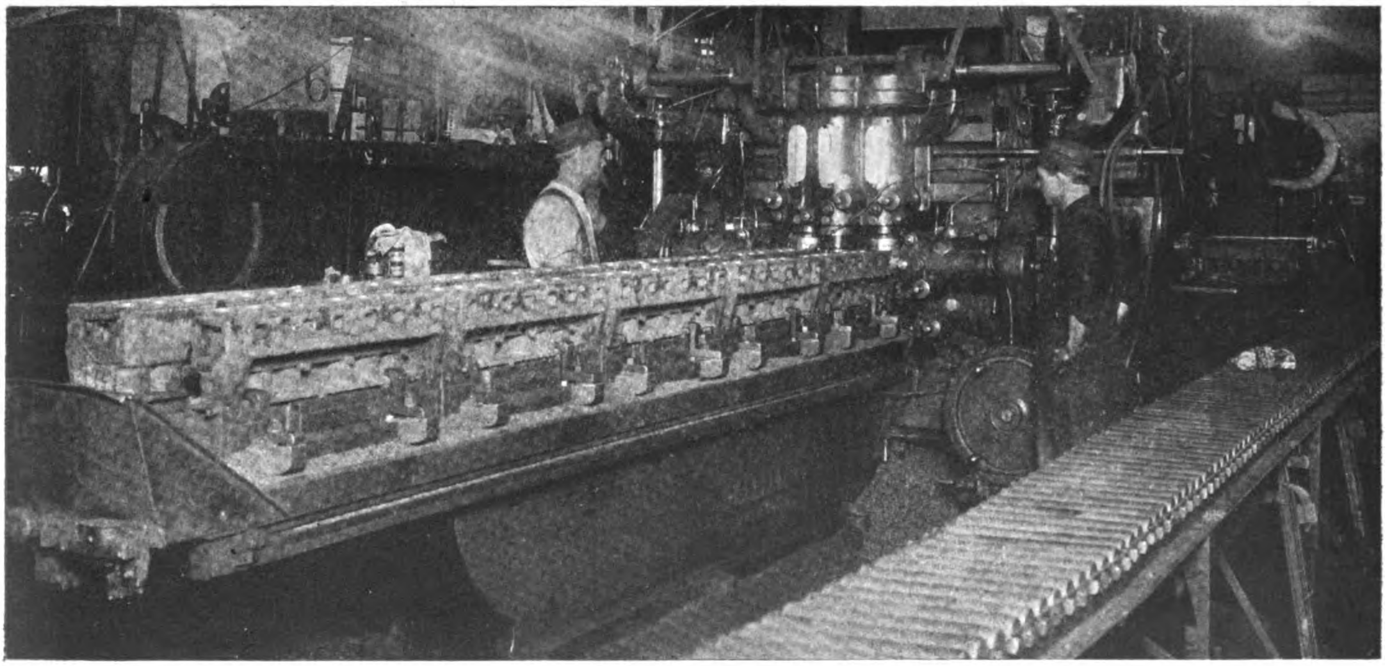
The internal combustion engine and the transmission parts with which it must be associated in the production of automobiles, trucks, tractors, airplanes, farm lighting equipment, and all the various other helps for humanity which have been rendered possible by the self-contained powerplant, lend themselves particularly well to the big production idea. In order to bring these essentials within the reach of every human being they must be low in price, and in order that they be low in price they must be produced in quantities.

Carrying this still further, production in quantity means that we must have special machines adapted for the particular work and fitting into the factory system as a part of its design.

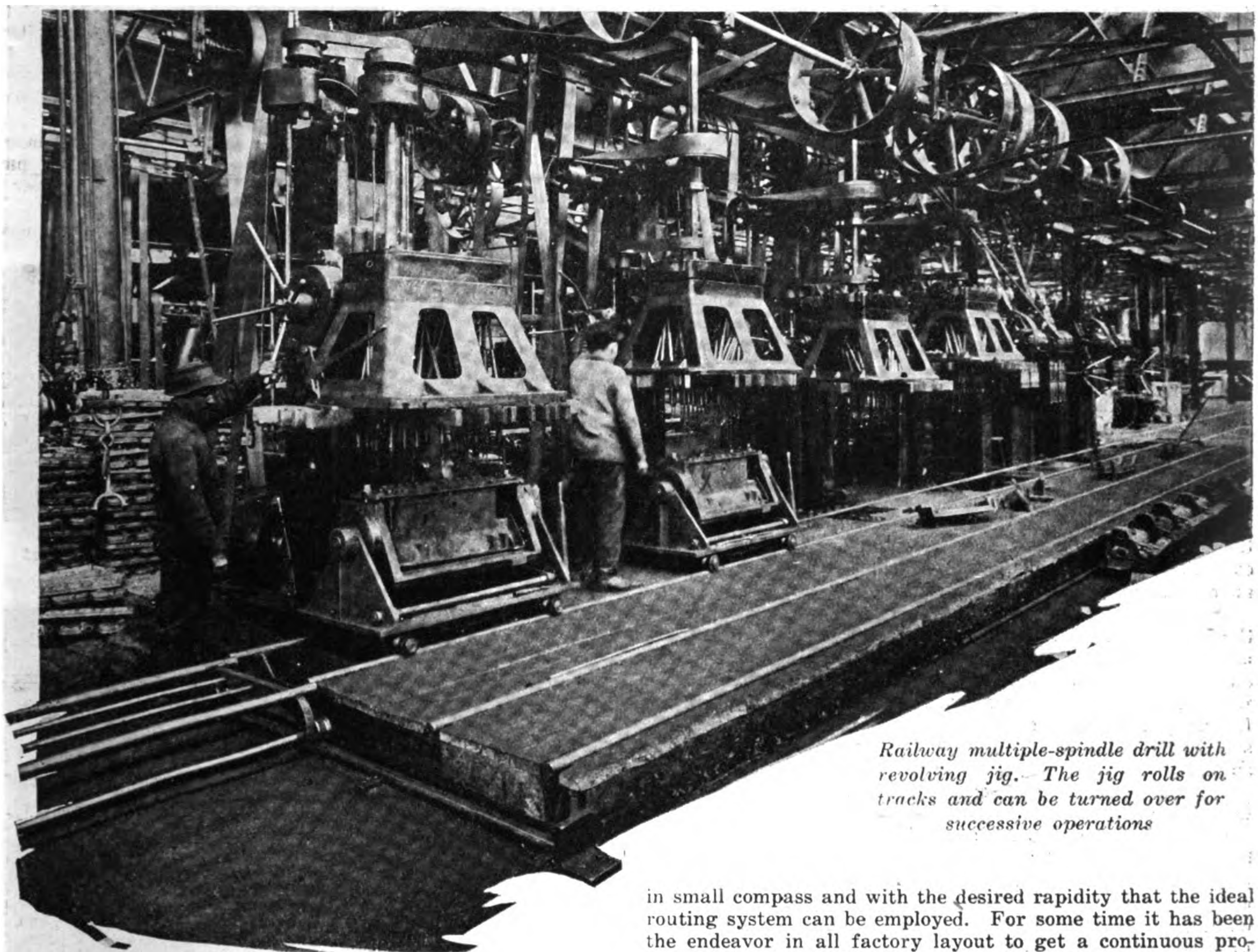
It is only by the use of machinery which handles its work



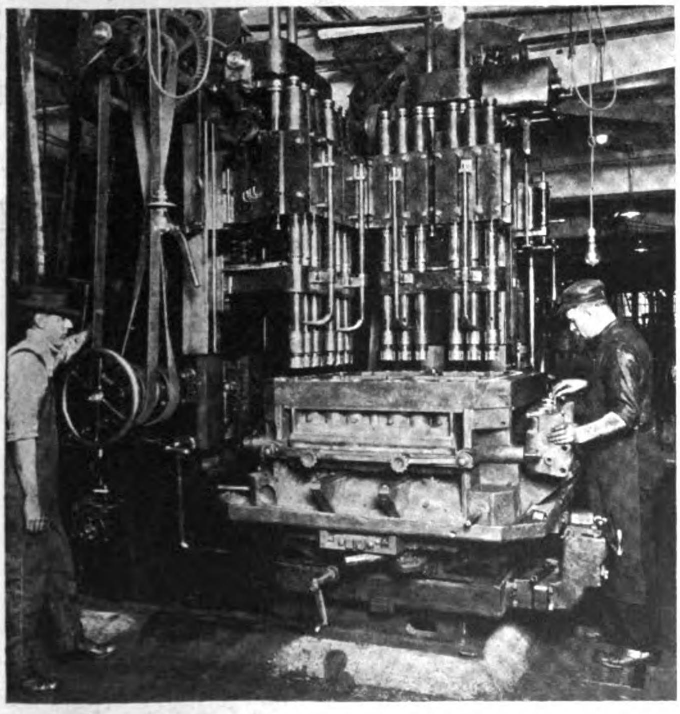
Gear hardening machine used by Dodge Brothers which automatically controls the oil treatment



An example of a machine with a long table. This faces the blocks for the Packard cylinders and handles ten blocks at a time



Railway multiple-spindle drill with revolving jig. The jig rolls on tracks and can be turned over for successive operations



A multiple boring machine in which the work proceeds continuously over to the rotating table. One block is set up while the operations are going on on the others

in small compass and with the desired rapidity that the ideal routing system can be employed. For some time it has been the endeavor in all factory layout to get a continuous progression of the work, so that at no time does it double back on itself or recross its path. Very often the limitations of machinery have compelled deviations from ideal routing, and one of the purposes of special machinery is to allow manufacture to conform to the ideal progression method.

It is of particular interest that the machinery for automotive apparatus must have the same fundamental characteristics. It makes little difference if the cylinders which must be bored are intended for automobiles, trucks, or tractors. The same fundamental cylinder boring tool is used for each. In the same way the connecting-rod end with its reaming and other manufacturing steps is handled identically regardless of whether these connecting-rods are used for farm lighting equipment or for mail trucks.

The methods of aligning the work and handling it in the most expeditious manner are the same. Crankcases produce about the same set of problems whether they are intended for one type of engine or another. They all have main bearings which must be aligned and camshaft bearings which must be treated in the same manner. And so it is throughout the entire engine parts field.

What must be done for a part of one type of engine must be done for a corresponding part of another type, so that the special machinery field in engine manufacture, although it must be to specialized design as far as installation dimensions are concerned, must also be of more or less standard nature, fundamentally.

It is not in manufacture alone that the special machine has come into its own. Testing machinery which carries the art of inspection down to its final limit is just as important. For instance, it is impossible to test a spring manually. A machine must be designed to do the work. Dodge Brothers have a machine that tests springs and does nothing else. For 24 hr. a day this machine rocks the car spring back and forth, hour after hour, day after day, constantly exerting on

it a pressure far greater than it would be subjected to under an automobile body.

The overload pressure is applied on this spring at the extreme rate of 155 vibrations per minute, until the spring has absorbed more shock than it would be called upon to survive in long years of actual service. With a conservative number of miles per year as a basis, it has been shown that some of the springs subjected to this test would last 60 years.

There are other machines of types which are quite different from those used for manufacturing or testing. For instance, there is a machine used by the Continental Motor Corp. which sand-blasts small parts. This is a table sand-blast in which connecting-rods, and all sorts of small engine parts can be piled and after a single revolution of the table they come out with a sand-blasted finish which would have taken an operator in a sand-blast cage hours of individual handling to have finished.

Still another field is that of gear hardening. In several automobile factories a hardening press is employed which is an excellent example of the adaptation of a special machine. This machine is in the form of a large tank in which a supply of oil is kept at a constant level and temperature. The rear axle driving gear goes into this tank, while held rigidly between two presses which act as an effective safe-guard against the natural tendency of the hot gear to warp when it comes in contact with the liquid. The oil solution of course brings the gear to the proper degree of hardness.

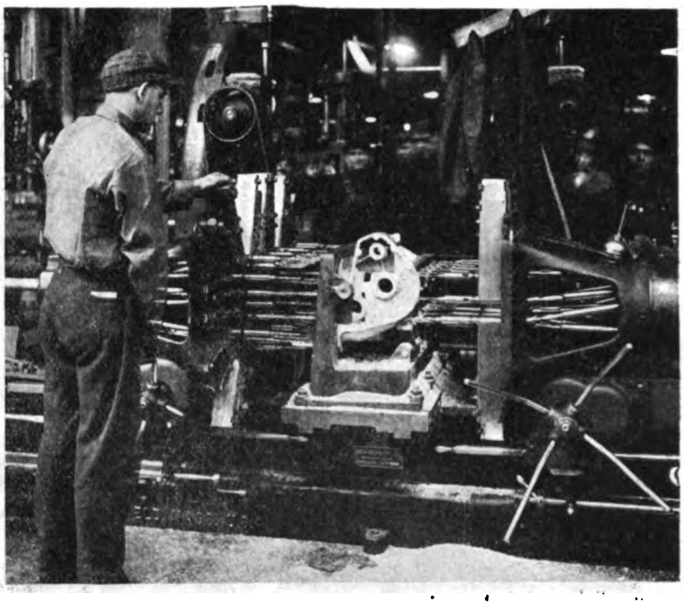
These are only a few specific examples of what is typical of the entire field. Even in the matter of jigs and fixtures, there is a tremendous industry that could exist on the needs of the automotive industry alone. In the larger establishments these jigs and fixtures are generally designed and worked out in the factory itself to fit the peculiar needs of the product and the scheme of manufacture. But they are in reality a part of the special machinery. By the use of the proper jig, the full benefit of the machine is reached, and the amount of manual work is cut to the limit.

Nowhere is the need for specially designed fixtures so well brought out as in testing or inspection apparatus. Fixed gages for the determination of accuracy can be made up to not only give a much closer check on the work, but also to make that checking much more rapid. This was exemplified to a marked degree in the manufacturing work of the Liberty engine. In no products except perhaps precision instruments have the limits been held so close and fixed in so many directions as they were in the Liberty engine. The use of a large number of especially designed gages was responsible in no small degree for the rapid manufacture of these engines in spite of the great accuracy required. Special machinery, special jigs and special fixtures, supplemented by the especially designed gages, leave no room for the human element which is the foe to interchangeability in manufactured products.

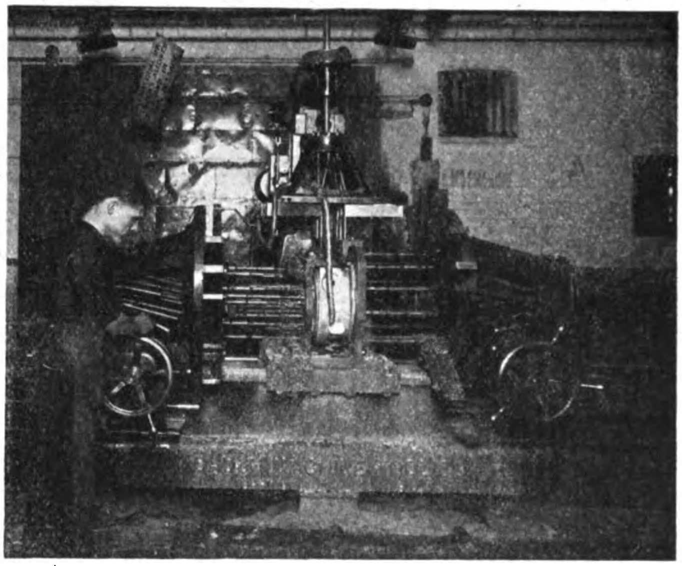
Industry is at the present time entering into a period of readjustment during which the problems of future manufacture are being closely studied. There are a number of concerns which are just about to enter quantity manufacture on products they have never touched before. This is due largely to experience gained in the war.

For example, take the Atwater-Kent company of Philadelphia. During the war the government asked this concern, owing to its experience in making small parts accurately, to enter the manufacture of prism binoculars for the army. This concern had never touched lens grinding, nor the manufacture of the small parts necessary for optical instruments, yet by the aid of new methods and modern machinery, it was soon turning out binoculars superior to those of German manufacture. Now that the war is over, this concern will not abandon the optical department, but will go ahead on a large commercial scale with this branch of manufacture.

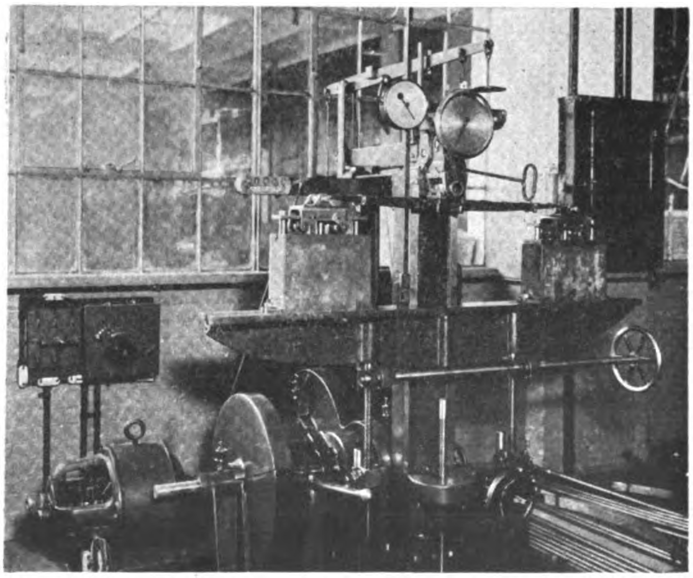
This is only one example picked from scores and illustrates how this new era upon which we are entering is going to make felt a demand for new equipment, new machinery, and new factory methods. Not in every case, however, are concerns going on with the work which was given them by the war department. They are going to swing back in most cases to their own line on an enlarged scale.



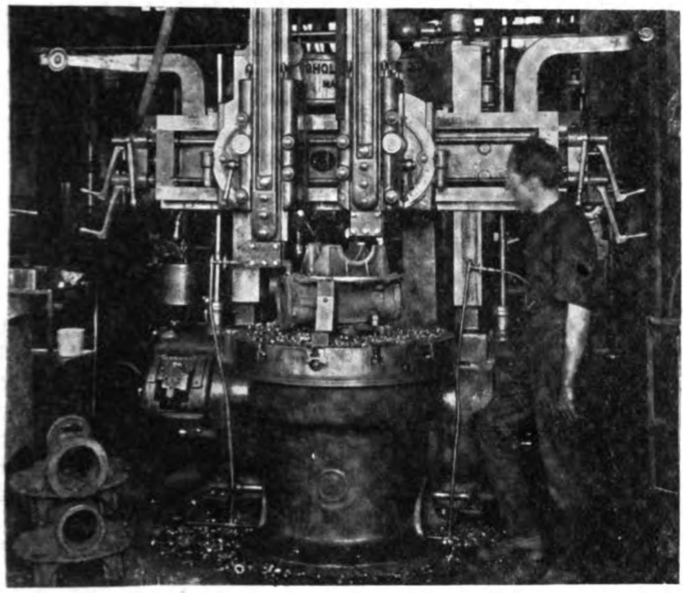
Drilling both sides of a Continental engine crankcase at the same time by means of a special drill and jig



An example of multiple-spindle drill which drills from three sides at the same time



Spring testing machine used by Dodge Brothers



The cutting operations can be handled rapidly on the largest of castings with this late type of machine

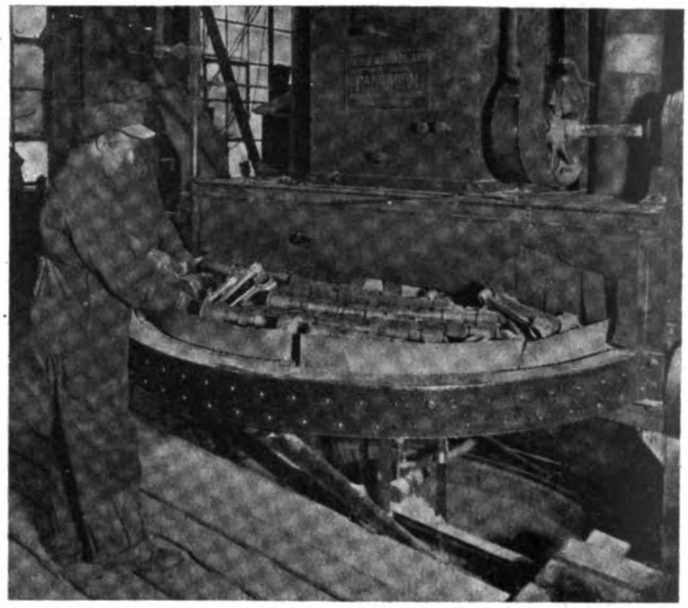
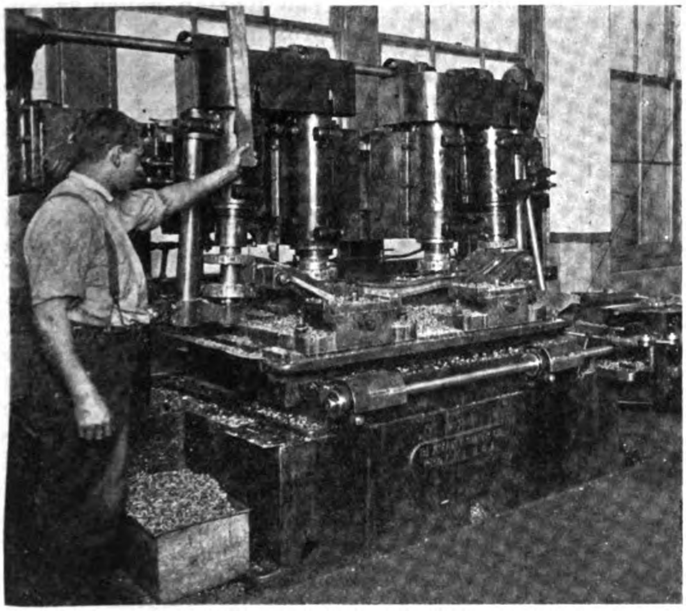
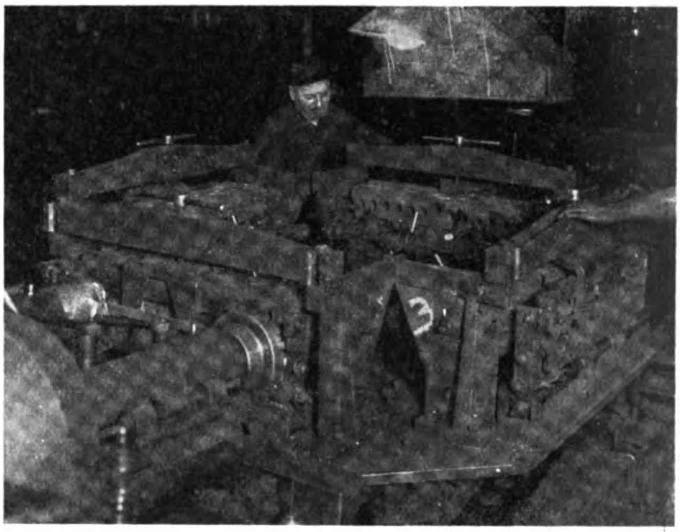


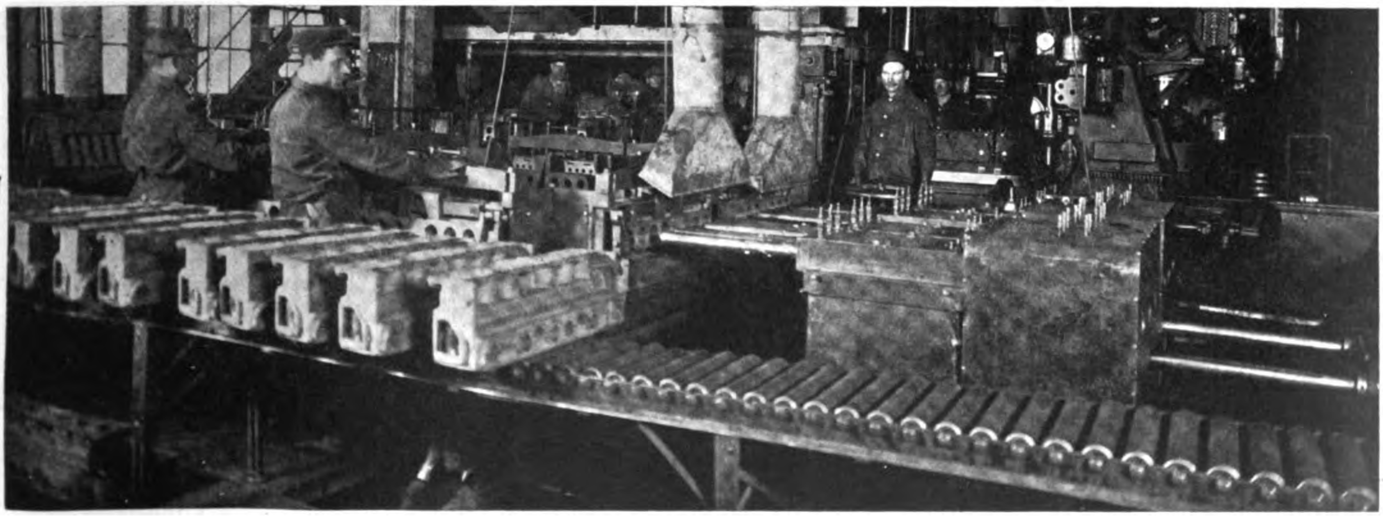
Table sand-blast machine which automatically puts sand-blast finish on a large number of small parts



This machine is facing off at one time all the necessary surfaces, six of them, on a Packard front axle



Cylinder block milling machine which handles four cylinder blocks on a single table



A good example of how special machinery fits into the progressive system. The gravity conveyor brings these cylinder blocks to the boring machine and they are then sent on their way for further operation

Metric Conversion Tables

A Series of Tables of Equivalents Arranged for Quick and Easy Reference

THE fundamental unit of the metric system is the METER—the unit of length. From this the units of capacity (LITER) and of weight (GRAM) were derived. All other units are the decimal subdivisions or multiples of these. These three units are simply related, *e. g.*, for all practical purposes one CUBIC DECIMETER equals one LITER and one LITER of water weighs one KILOGRAM. The metric tables are formed by combining the words "METER," "GRAM," and "LITER" with the six numerical prefixes, as in the tables herewith.

All lengths, areas, and cubic measures in the following tables are derived from the international meter, the legal equivalent being 1 meter = 39.37 inches (law of July 28, 1866). In 1893 the United States Office of Standard Weights and Measures was authorized to derive the yard from the meter, using for the purpose the relation legalized in 1866, 1 yard equals $\frac{3600}{3937}$ meter. The customary weights are likewise referred to the kilogram (Executive order approved April 5, 1893). This action fixed the values, inasmuch as the reference standards are as perfect and unalterable as it is possible for human skill to make them.

Fundamental Equivalents

PREFIXES	MEANING			UNITS
milli-	= *one thousandth*	$\frac{1}{1000}$	.001	
centi-	= *one hundredth*	$\frac{1}{100}$	.01	"meter" *for length.*
deci-	= *one tenth*	$\frac{1}{10}$	.1	
Unit	= *one*		1	"gram" *for weight or mass.*
deka-	= *ten*	$\frac{10}{1}$	10	
hecto-	= *one hundred*	$\frac{100}{1}$	100	"liter" *for capacity.*
kilo-	= *one thousand*	$\frac{1000}{1}$	1000	

All capacities are based on the practical equivalent 1 cubic decimeter equals 1 liter. The decimeter is equal to 3.937 inches in accordance with the legal equivalent of the meter given previously. The gallon referred to in the tables is the United States gallon of 231 cubic inches. The bushel is the United States bushel of 2,150.42 cubic inches. These units must not be confused with the British units of the same name, which differ from those used in the United States. The British gallon is approximately 20 per cent larger, and the British bushel 3 per cent larger, than the corresponding units used in this country.

The customary weights derived from the international kilogram are based on the value 1 avoirdupois pound = 453.5924277 grams. This value is carried out farther than that given in the law, but is in accord with the latter as far as it is there given. The value of the troy pound is based upon the relation just mentioned and also the equivalent $\frac{5760}{7000}$ avoirdupois pound equals 1 troy pound.

In view of the increasing use of metric measures and weights, and the extension of international standards, these tables will be useful for constant reference.

Fahrenheit-Centigrade Thermometer Scales Compared

F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
212	100	185	85.0	158	70.0	131	55.0	104	40.0	77	25.0	50	10.0	23	−5.0	−3	−19.4	−30	−34.4
211	99.4	184	84.4	157	69.4	130	54.4	103	39.4	76	24.4	49	9.4	22	−5.6	−4	−20.0	−31	−35.0
210	98.9	183	83.9	156	68.9	129	53.9	102	38.9	75	23.9	48	8.9	21	−6.1	−5	−20.6	−32	−35.6
209	98.3	182	83.3	155	68.3	128	53.3	101	38.3	74	23.3	47	8.3	20	−6.7	−6	−21.1	−33	−36.1
208	97.8	181	82.8	154	67.8	127	52.8	100	37.8	73	22.8	46	7.8	19	−7.2	−7	−21.7	−34	−36.7
207	97.2	180	82.2	153	67.2	126	52.2	99	37.2	72	22.2	45	7.2	18	−7.8	−8	−22.2	−35	−37.2
206	96.7	179	81.7	152	66.7	125	51.7	98	36.7	71	21.7	44	6.7	17	−8.3	−9	−22.8	−36	−37.8
205	96.1	178	81.1	151	66.1	124	51.1	97	36.1	70	21.1	43	6.1	16	−8.9	−10	−23.3	−37	−38.3
204	95.6	177	80.6	150	65.6	123	50.6	96	35.6	69	20.6	42	5.6	15	−9.4	−11	−23.9	−38	−38.9
203	95.0	176	80.0	149	65.0	122	50.0	95	35.0	68	20.0	41	5.0	14	−10.0	−12	−24.4	−39	−39.4
202	94.4	175	79.4	148	64.4	121	49.4	94	34.4	67	19.4	40	4.4	13	−10.6	−13	−25.0	−40	−40.0
201	93.9	174	78.9	147	63.9	120	48.9	93	33.9	66	18.9	39	3.9	12	−11.1	−14	−25.6	−41	−40.6
200	93.3	173	78.3	146	63.3	119	48.3	92	33.3	65	18.3	38	3.3	11	−11.7	−15	−26.1	−42	−41.1
199	92.8	172	77.8	145	62.8	118	47.8	91	32.8	64	17.8	37	2.8	10	−12.2	−16	−26.7	−43	−41.7
198	92.2	171	77.2	144	62.2	117	47.2	90	32.2	63	17.2	36	2.2	9	−12.8	−17	−27.2	−44	−42.2
197	91.7	170	76.7	143	61.7	116	46.7	89	31.7	62	16.7	35	1.7	8	−13.3	−18	−27.8	−45	−42.8
196	91.1	169	76.1	142	61.1	115	46.1	88	31.1	61	16.1	34	1.1	7	−13.9	−19	−28.3	−46	−43.3
195	90.6	168	75.6	141	60.6	114	45.6	87	30.6	60	15.6	33	0.6	6	−14.4	−20	−28.9	−47	−43.9
194	90.0	167	75.0	140	60.0	113	45.0	86	30.0	59	15.0	32	0.0	5	−15.0	−21	−29.4	−48	−44.4
193	89.4	166	74.4	139	59.4	112	44.4	85	29.4	58	14.4	31	−0.6	4	−15.6	−22	−30.0	−49	−45.0
192	88.9	165	73.9	138	58.9	111	43.9	84	28.9	57	13.9	30	−1.1	3	−16.1	−23	−30.6	−50	−45.6
191	88.3	164	73.3	137	58.3	110	43.3	83	28.3	56	13.3	29	−1.7	2	−16.7	−24	−31.1	−51	−46.1
190	87.8	163	72.8	136	57.8	109	42.8	82	27.8	55	12.8	28	−2.2	1	−17.2	−25	−31.7	−52	−46.7
189	87.2	162	72.2	135	57.2	108	42.2	81	27.2	54	12.2	27	−2.8	0	−17.8	−26	−32.2	−53	−47.2
188	86.7	161	71.7	134	56.7	107	41.7	80	26.7	53	11.7	26	−3.3	−1	−18.3	−27	−32.8	−54	−47.8
187	86.1	160	71.1	133	56.1	106	41.1	79	26.1	52	11.1	25	−3.9	−2	−18.9	−28	−33.3	−55	−48.3
186	85.6	159	70.6	132	55.6	105	40.6	78	25.6	51	10.6	24	−4.4	..	....	−29	−33.9	..	....

Comparison of Customary and Metric Units from 1 to 10

LENGTHS

Inches	Millimeters	Inches	Centimeters	Feet	Meters	U. S. Yards	Meters	U. S. Miles	Kilometers
0.03937	1	0.3937	1	1	0.304801	1	0.914402	0.62137	1
0.07874	2	0.7874	2	2	0.609601	1.093611	1	1	1.60935
0.11811	3	1	2.54001	3	0.914402	2	1.828804	1.24274	2
0.15748	4	1.1811	3	3.28083	1	2.187222	2	1.86411	3
0.19685	5	1.5748	4	4	1.219202	3	2.743205	2	3.21869
0.23622	6	1.9685	5	5	1.524003	3.280833	3	2.48548	4
0.27559	7	2	5.08001	6	1.828804	4	3.657607	3	4.82804
0.31496	8	2.3622	6	6.56167	2	4.374444	4	3.10685	5
0.35433	9	2.7559	7	7	2.133604	5	4.572009	3.72822	6
1	25.4001	3	7.62002	8	2.438405	5.468056	5	4	6.43739
2	50.8001	3.1496	8	9	2.743205	6	5.486411	4.34959	7
3	76.2002	3.5433	9	9.84250	3	6.561667	6	4.97096	8
4	101.6002	4	10.16002	13.12333	4	7	6.400813	5	8.04674
5	127.0003	5	12.70003	16.40417	5	7.655278	7	5.59233	9
6	152.4003	6	15.24003	19.68500	6	8	7.315215	6	9.65608
7	177.8004	7	17.78004	22.96583	7	8.748889	8	7	11.26543
8	203.2004	8	20.32004	26.24667	8	9	8.229616	8	12.87478
9	228.6005	9	22.86005	29.52750	9	9.842500	9	9	14.48412

AREAS

Square Inches	Square Millimeters	Square Inches	Square Centimeters	Square Feet	Square Meters	Square Yards	Square Meters	Square Miles	Square Kilometers	Acres	Hectars
0.00155	1	0.1550	1	1	0.09290	1	0.8361	0.3861	1	1	0.4047
0.00310	2	0.3100	2	2	0.18581	1.1960	1	0.7722	2	2	0.8094
0.00465	3	0.4650	3	3	0.27871	2	1.6723	1	2.5900	2.471	1
0.00620	4	0.6200	4	4	0.37161	2.3920	2	1.1583	3	3	1.2141
0.00775	5	0.7750	5	5	0.46452	3	2.5084	1.5444	4	4	1.6187
0.00930	6	0.9300	6	6	0.55742	3.5880	3	1.9305	5	4.942	2
0.01085	7	1	6.452	7	0.65032	4	3.3445	2	5.1800	5	2.0234
0.01240	8	1.0850	7	8	0.74323	4.7839	4	2.3166	6	6	2.4281
0.01395	9	1.2400	8	9	0.83613	5	4.1807	2.7027	7	7	2.8328
1	645.16	1.3950	9	10.764	1	5.9799	5	3	7.7700	7.413	3
2	1,290.33	2	12.903	21.528	2	6	5.0168	3.0888	8	8	3.2375
3	1,935.49	3	19.355	32.292	3	7	5.8529	3.4749	9	9	3.6422
4	2,580.65	4	25.807	43.055	4	7.1759	6	4	10.3600	9.884	4
5	3,225.81	5	32.258	53.819	5	8	6.6890	5	12.9500	12.355	5
6	3,870.98	6	38.710	64.583	6	8.3719	7	6	15.5400	14.826	6
7	4,516.14	7	45.161	75.347	7	9	7.5252	7	18.1300	17.297	7
8	5,161.30	8	51.613	86.111	8	9.5679	8	8	20.7200	19.768	8
9	5,806.46	9	58.065	96.875	9	10.7639	9	9	23.3100	22.239	9

VOLUMES

Cubic Inches	Cubic Millimeters	Cubic Inches	Cubic Centimeters	Cubic Feet	Cubic Meters	Cubic Yards	Cubic Meters
0.000061	1	0.0610	1	1	0.02832	1	0.7645
0.000122	2	0.1220	2	2	0.05663	1.3079	1
0.000183	3	0.1831	3	3	0.08495	2	1.5291
0.000244	4	0.2441	4	4	0.11327	2.6159	2
0.000305	5	0.3051	5	5	0.14159	3	2.2937
0.000366	6	0.3661	6	6	0.16990	3.9238	3
0.000427	7	0.4272	7	7	0.19822	4	3.0582
0.000488	8	0.4882	8	8	0.22654	5	3.8228
0.000549	9	0.5492	9	9	0.25485	5.2318	4
1	16,387.2	1	16.3872	35.314	1	6	4.5874
2	32,774.3	2	32.7743	70.629	2	6.5397	5
3	49,161.5	3	49.1615	105.943	3	7	5.3519
4	65,548.6	4	65.5486	141.258	4	7.8477	6
5	81,935.8	5	81.9358	176.572	5	8	6.1165
6	98,323.0	6	98.3230	211.887	6	9	6.8810
7	114,710.1	7	114.7101	247.201	7	9.1556	7
8	131,097.3	8	131.0973	282.516	8	10.4635	8
9	147,484.5	9	147.4845	317.830	9	11.7715	9

(Continued on following page)

CAPACITIES

U. S. Liquid Ounces	Milliliters (cc.)	U. S. Liquid Quarts	Liters	U. S. Liquid Gallons	Liters	U. S. Dry Quarts	Liters	U. S. Bushels	Hecto-liters
0.03381 =	1	1 =	0.94636	0.26417 =	1	0.9081 =	1	1 =	0.35239
0.06763 =	2	1.05668 =	1	0.52834 =	2	1 =	1.1012	2 =	0.70479
0.10144 =	3	2 =	1.89272	0.79251 =	3	1.8162 =	2	2.83774 =	1
0.13526 =	4	2.11336 =	2	1 =	3.78543	2 =	2.2025	3 =	1.05718
0.16907 =	5	3 =	2.83908	1.05668 =	4	2.7242 =	3	4 =	1.40957
0.20288 =	6	3.17005 =	3	1.32085 =	5	3 =	3.3037	5 =	1.76196
0.23670 =	7	4 =	3.78543	1.58502 =	6	3.6323 =	4	5.67548 =	2
0.27051 =	8	4.22673 =	4	1.84919 =	7	4 =	4.4049	6 =	2.11436
0.30432 =	9	5 =	4.73179	2 =	7.57087	4.5404 =	5	7 =	2.46675
1 =	29.574	5.28341 =	5	2.11336 =	8	5 =	5.5061	8 =	2.81914
2 =	59.147	6 =	5.67815	2.37753 =	9	5.4485 =	6	8.51323 =	3
3 =	88.721	6.34009 =	6	3 =	11.35630	6 =	6.6074	9 =	3.17154
4 =	118.295	7 =	6.62451	4 =	15.14174	6.3565 =	7	11.35097 =	4
5 =	147.869	7.39677 =	7	5 =	18.92717	7 =	7.7086	14.18871 =	5
6 =	177.442	8 =	7.57088	6 =	22.71261	7.2646 =	8	17.02645 =	6
7 =	207.016	8.45345 =	8	7 =	26.49804	8 =	8.8098	19.86420 =	7
8 =	236.590	9 =	8.51723	8 =	30.28348	8.1727 =	9	22.70194 =	8
9 =	266.163	9.51014 =	9	9 =	34.06891	9 =	9.9110	25.53968 =	9

MASSES

Avoirdupois Ounces	Grams	Troy Ounces	Grams	Avoirdupois Pounds	Kilograms
0.03527 =	1	0.03215 =	1	1 =	0.45359
0.07055 =	2	0.06430 =	2	2 =	0.90718
0.10582 =	3	0.09645 =	3	2.20462 =	1
0.14110 =	4	0.12860 =	4	3 =	1.36078
0.17637 =	5	0.16075 =	5	4 =	1.81437
0.21164 =	6	0.19290 =	6	4.40924 =	2
0.24692 =	7	0.22506 =	7	5 =	2.26796
0.28219 =	8	0.25721 =	8	6 =	2.72155
0.31747 =	9	0.28936 =	9	6.61387 =	3
1 =	28.3495	1 =	31.10348	7 =	3.17515
2 =	56.6991	2 =	62.20696	8 =	3.62874
3 =	85.0486	3 =	93.31044	8.81849 =	4
4 =	113.3981	4 =	124.41392	9 =	4.08233
5 =	141.7476	5 =	155.51740	11.02311 =	5
6 =	170.0972	6 =	186.62088	13.22773 =	6
7 =	198.4467	7 =	217.72437	15.43236 =	7
8 =	226.7962	8 =	248.82785	17.63698 =	8
9 =	255.1457	9 =	279.93133	19.84160 =	9

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES

From 1 to 10 Units

Long Tons	Short Tons	Metric Tons	Kilograms	Avoirdupois Pounds	Troy Pounds
.89287	1	.90718	907.18	2,000.00	2,430.56
1	1.12000	1.01605	1,016.05	2,240.00	2,722.22
1.78571	2	1.81437	1,814.37	4,000.00	4,861.11
2	2.24000	2.03209	2,032.09	4,480.00	5,444.44
2.67857	3	2.72155	2,721.55	6,000.00	7,291.67
3	3.36000	3.04814	3,048.14	6,720.00	8,166.67
3.57143	4	3.62874	3,628.74	8,000.00	9,722.22
4	4.48000	4.06419	4,064.19	8,960.00	10,888.89
4.46429	5	4.53592	4,535.92	10,000.00	12,152.78
5	5.60000	5.08024	5,080.24	11,200.00	13,611.11
5.35714	6	5.44311	5,443.11	12,000.00	14,583.33
6	6.72000	6.09628	6,096.28	13,440.00	16,333.33
6.25000	7	6.35029	6,350.29	14,000.00	17,013.89
7	7.84000	7.11232	7,112.32	15,680.00	19,055.56
7.14286	8	7.25748	7,257.48	16,000.00	19,444.44
8	8.96000	8.12838	8,128.38	17,920.00	21,777.78
8.03571	9	8.16466	8,164.66	18,000.00	21,875.00
9	10.08000	9.14442	9,144.42	20,160.00	24,500.00

CUBIC INCH-CUBIC CENTIMETER CONVERSION TABLE

Cu. In.	Cu. Cm.	Cu. In.	Cu. Cm.	Cu. In.	Cu. Cm.	Cu. In.	Cu. Cm.	Cu. In.	Cu. Cm.
10 —	164	210 —	3441	410 —	6718	610 —	9995	810 —	13272
20 —	327	220 —	3605	420 —	6882	620 —	10159	820 —	13436
30 —	492	230 —	3769	430 —	7046	630 —	10323	830 —	13600
40 —	655	240 —	3933	440 —	7210	640 —	10487	840 —	13764
50 —	819	250 —	4097	450 —	7374	650 —	10651	850 —	13928
60 —	983	260 —	4260	460 —	7537	660 —	10815	860 —	14092
70 —	1147	270 —	4424	470 —	7701	670 —	10978	870 —	14256
80 —	1311	280 —	4588	480 —	7865	680 —	11142	880 —	14420
90 —	1475	290 —	4752	490 —	8029	690 —	11306	890 —	14583
100 —	1638	300 —	4916	500 —	8193	700 —	11470	900 —	14747
110 —	1802	310 —	5079	510 —	8357	710 —	11634	910 —	14911
120 —	1966	320 —	5243	520 —	8521	720 —	11798	920 —	15075
130 —	2130	330 —	5407	530 —	8684	730 —	11962	930 —	15239
140 —	2294	340 —	5571	540 —	8848	740 —	12126	940 —	15403
150 —	2458	350 —	5735	550 —	9012	750 —	12289	950 —	15567
160 —	2622	360 —	5899	560 —	9176	760 —	12453	960 —	15730
170 —	2786	370 —	6063	570 —	9340	770 —	12617	970 —	15894
180 —	2950	380 —	6226	580 —	9504	780 —	12781	980 —	16058
190 —	3114	390 —	6390	590 —	9668	790 —	12945	990 —	16222
200 —	3277	400 —	6554	600 —	9831	800 —	13109	1000 —	16386

Lengths—Inches and Millimeters—Equivalents of Decimal and Common Fractions of an Inch in Millimeters

FROM 1/64 TO 1 INCH

½'s	¼'s	8ths	16ths	32nds	64ths	Millimeters	Decimals of an Inch	Inch	½'s	¼'s	8ths	16ths	32nds	64ths	Millimeters	Decimals of an Inch
					1	= .397	.015625							33	=13.097	.515625
				1	2	= .794	.03125						17	34	=13.494	.53125
					3	= 1.191	.046875							35	=13.891	.546875
			1	2	4	= 1.588	.0625					9	18	36	=14.288	.5625
					5	= 1.984	.078125							37	=14.684	.578125
				3	6	= 2.381	.09375						19	38	=15.081	.59375
					7	= 2.778	.109375							39	=15.478	.609375
		1	2	4	8	= 3.175	.1250				5	10	20	40	=15.875	.625
					9	= 3.572	.140625							41	=16.272	.640625
				5	10	= 3.969	.15625						21	42	=16.669	.65625
					11	= 4.366	.171875							43	=17.066	.671875
			3	6	12	= 4.763	.1875					11	22	44	=17.463	.6875
					13	= 5.159	.203125							45	=17.859	.703125
				7	14	= 5.556	.21875						23	46	=18.256	.71875
					15	= 5.953	.234375							47	=18.653	.734375
	1	2	4	8	16	= 6.350	.2500			3	6	12	24	48	=19.050	.75
					17	= 6.747	.265625							49	=19.447	.765625
				9	18	= 7.144	.28125						25	50	=19.844	.78125
					19	= 7.541	.296875							51	=20.241	.796875
			5	10	20	= 7.938	.3125					13	26	52	=20.638	.8125
					21	= 8.334	.328125							53	=21.034	.828125
				11	22	= 8.731	.34375						27	54	=21.431	.84375
					23	= 9.128	.359375							55	=21.828	.859375
		3	6	12	24	= 9.525	.3750				7	14	28	56	=22.225	.875
					25	= 9.922	.390625							57	=22.622	.890625
				13	26	=10.319	.40625						29	58	=23.019	.90625
					27	=10.716	.421875							59	=23.416	.921875
			7	14	28	=11.113	.4375					15	30	60	=23.813	.9375
					29	=11.509	.453125							61	=24.209	.953125
				15	30	=11.906	.46875						31	62	=24.606	.96875
					31	=12.303	.484375							63	=25.003	.984375
1	2	4	8	16	32	=12.700	.5	1	2	4	8	16	32	64	=25.400	.1000

Lengths—Hundredths of an Inch to Millimeters

FROM 1 TO 100 HUNDREDTHS

Hundredths of an Inch	0	1	2	3	4	5	6	7	8	9
	0	.254	.508	.762	1.016	1.270	1.524	1.778	2.032	2.286
10	2.540	2.794	3.048	3.302	3.556	3.810	4.064	4.318	4.572	4.826
20	5.080	5.334	5.588	5.842	6.096	6.350	6.604	6.858	7.112	7.366
30	7.620	7.874	8.128	8.382	8.636	8.899	9.144	9.398	9.652	9.906
40	10.160	10.414	10.668	10.922	11.176	11.430	11.684	11.938	12.192	12.446
50	12.700	12.954	13.208	13.462	13.716	13.970	14.224	14.478	14.732	14.986
60	15.240	15.494	15.748	16.002	16.256	16 510	16.764	17.018	17.272	17.526
70	17.780	18.034	18.288	18.542	18.796	19.050	19.304	19.558	19.812	20.066
80	20.320	20.574	20.828	21.082	21.336	21.590	21.844	22.098	22.352	22.606
90	22.860	23.114	23.368	23.622	23.876	24.130	24.384	24.638	24.892	25.146

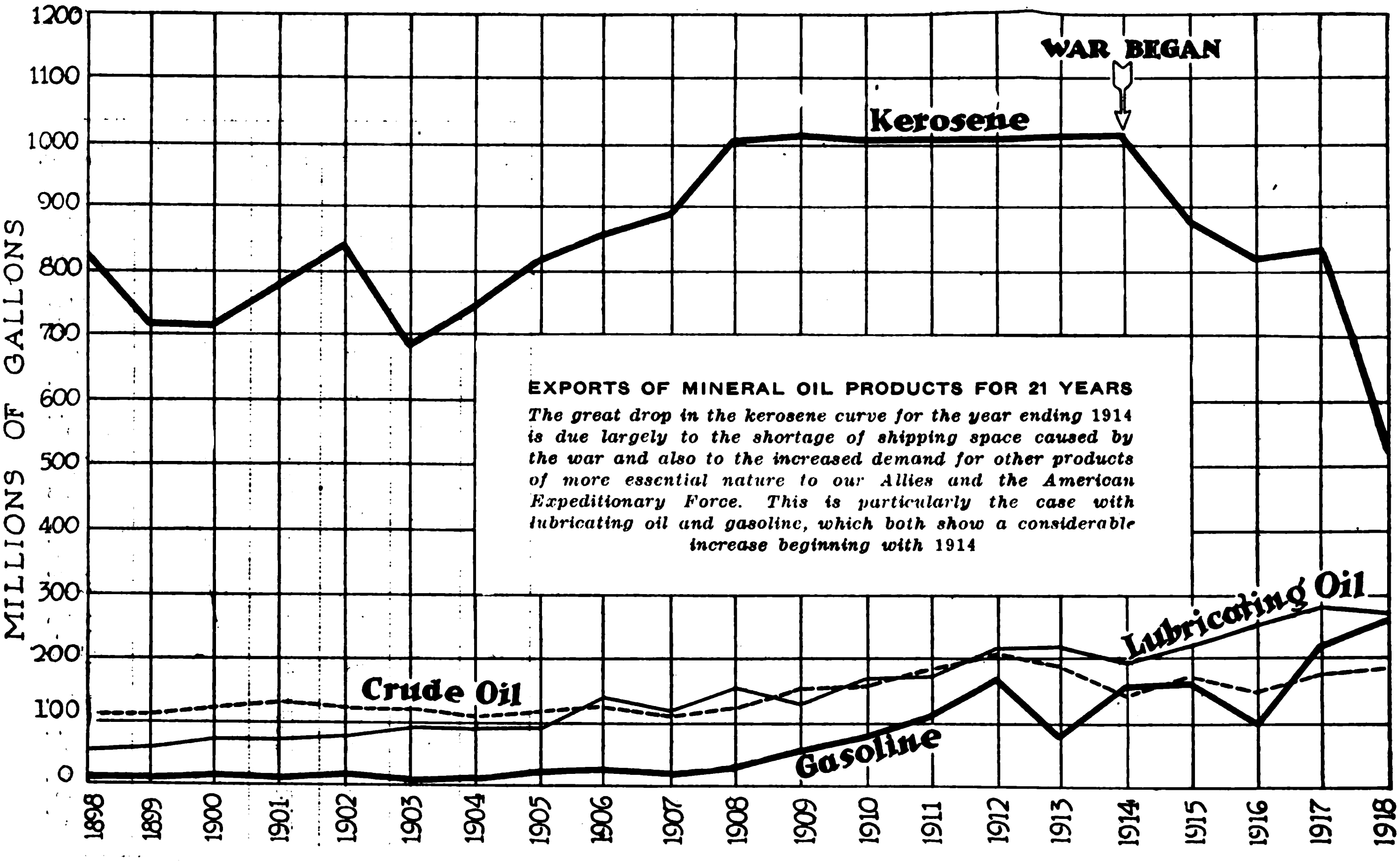
Lengths—Millimeters to Decimals of an Inch

FROM 1 TO 100 UNITS

Millimeters	0	1	2	3	4	5	6	7	8	9
	0	.03937	.07874	.11811	.15748	.19685	.23622	.27559	.31496	.35433
10	.39370	.43307	.47244	.51181	.55118	.59055	.62992	.66929	.70866	.74803
20	.78740	.82677	.86614	.90551	.94488	.98425	1.02362	1.06299	1.10236	1.14173
30	1.18110	1.22047	1.25984	1.29921	1.33858	1.37795	1.41732	1.45669	1.49606	1.53543
40	1.57480	1.61417	1.65354	1.69291	1.73228	1.77165	1.81102	1.85039	1.88976	1.92913
50	1.96850	2.00787	2.04724	2.08661	2.12598	2.16535	2.20472	2.24409	2.28346	2.32283
60	2.36220	2.40157	2.44094	2.48031	2.51968	2.55905	2.59842	2.63779	2.67716	2.71653
70	2.75590	2.79527	2.83464	2.87401	2.91338	2.95275	2.99212	3.03149	3.07086	3.11023
80	3.14960	3.18897	3.22834	3.26771	3.30708	3.34645	3.38582	3.42519	3.46456	3.50393
90	3.54330	3.58267	3.62204	3.66141	3.70078	3.74015	3.77952	3.81889	3.85826	3.89763

1 ft. lb. (work) =0.1383 kg-m.
1 lb.-ft. (torque) =0.1383 m-kg.
1 h.p. = 1.0138 chevaux vapeur (metric horsepower).
1 B.T.U. =0.252 calories.
1 ft. p. s. =0.30479 m.p.s.
1 ft. p.m. =0.00508 m.p.s.
1 m.p.hr. = 1.609 km.p.h.
1 lb. p. sq. in. =0.0703 kg. p. sq.cm.
1 lb. p. gal. =0.1198 kg. p. liter.
1 B.T.U. p. lb. =0.5556 cal. p. kg.

1 B.T.U. p. gal. =0.06658 cal. p. liter.
1 lb. p. h.p.-hr. =447.4 gr. p. cheval-heure.
1 gal. p. h.p.-hr. =3.733 liters p. cheval-heure.
1 mile p. gal. =0.425 km. p. liter.
Diametral pitch (gears) =25.4 ÷ module.
Threads per inch (screws) =25.4 ÷ metric pitch.
Fahrenheit deg. = (Centigrade deg. ×1.8) +32.
1 mile per hour per second (acceleration) = 1.6 km. p. h. p. s.
1 ft. p. s. p. s. (acceleration) =0.3048 m. p. s. p. s.



Production of Crude at New High Level

Exports of All Mineral Oil Products Except Kerosene Show Steady Increase for 21 Years

THE production of crude oil is always dependent upon the relation between the decline in the territory already yielding and the opening of new wells, new sands or new oil fields. Eastern oil properties have been declining for some years, while the demand has grown very rapidly in the same period. Other territories have been opened up in the Mid-Continent region—Louisiana and California principally—which have taken up the slack and added the necessary increase so that the production shows a steady and increasing rise as the demand came upon the industry. In the main, prospectors and producers have been able to keep up the discovery of new sands and fields at a sufficient pace to meet the demand of the automotive and other industries.

Twice of late years the production declined or remained stationary for almost a year; once, before the Mid-Continent field was more than experimental territory and after the drop in Texas and Indiana production had become severe (1907), and once again when the Cushing field in the Mid-Continent area declined in a few months from 300,000 bbl. daily to 100,000 bbl. daily (1912).

Prices are governed almost entirely by the relation of supply to market, and these times will find a corresponding

Mineral Oil Exports for 21 Years

Year	Crude Oil		Gasoline		Kerosene		Lubricating Oil	
	Quantity, Gals.	Value	Quantity, Gals.	Value	Quantity, Gals.	Value	Quantity, Gals.	Value
1898	113,297,397	$4,343,262	16,252,929	$1,080,797	824,426,581	$42,922,682	60,299,365	$7,239,454
1899	113,088,060	5,202,892	16,252,785	1,170,294	722,279,480	41,087,031	67,424,393	7,943,193
1900	133,023,656	7,364,162	21,985,093	2,016,802	721,025,237	55,978,937	74,583,969	9,744,367
1901	138,448,430	6,686,929	17,834,254	1,865,608	781,207,105	51,477,267	71,457,605	10,006,937
1902	133,536,800	6,084,818	23,498,479	1,677,738	842,829,070	53,390,345	76,035,611	10,274,743
1903	134,892,170	6,329,899	13,139,228	1,225,661	699,810,892	47,079,842	93,314,566	12,052,016
1904	114,576,920	6,572,923	16,910,121	1,802,207	741,567,086	57,902,503	88,810,130	12,048,842
1905	123,059,010	6,359,435	30,816,655	2,575,851	822,881,953	56,169,606	97,357,196	13,142,860
1906	139,688,615	7,016,131	32,756,694	2,613,677	864,361,210	54,181,617	146,110,702	17,974,721
1907	128,175,737	6,626,896	26,357,054	2,735,598	894,529,432	56,249,891	136,140,226	17,179,562
1908	135,223,575	6,465,114	36,242,370	4,003,827	1,041,725,901	70,809,415	159,763,900	20,370,613
1909	169,855,309	6,907,525	63,831,267	5,805,482	1,080,542,456	71,329,901	144,254,271	18,307,342
1910	168,903,985	5,277,181	77,650,923	6,302,418	1,005,027,536	62,477,527	170,430,277	20,891,473
1911	185,190,761	5,417,513	111,998,260	9,479,394	1,022,311,042	57,476,494	173,642,495	22,061,190
1912	208,110,365	6,831,367	171,040,150	15,437,736	1,044,049,848	59,845,823	202,125,197	25,970,271
1913	195,642,935	7,570,767	81,698,917	10,831,490	1,048,894,297	66,189,265	213,671,499	29,574,410
1914	146,477,342	6,812,672	151,611,537	21,699,475	1,157,283,310	74,500,162	196,884,696	27,852,959
1915	152,514,129	4,911,634	156,860,666	17,603,317	886,316,740	53,607,032	214,429,099	28,499,786
1916	163,732,589	5,754,084	100,148,554	16,297,561	823,143,138	52,283,057	250,395,439	37,452,084
1917	177,748,832	7,309,990	226,154,560	46,932,967	833,969,012	54,642,377	271,032,751	48,665,984
1918	183,072,778	9,107,519	260,300,337	61,447,382	528,805,501	47,488,425	269,667,145	66,146,827

rise in prices followed by a considerable drop, due to the temporary effect upon the total production. There is no immediate probability of a large increase in production above demands in this country, as increase in prospecting will depend upon a decrease in the material and equipment necessary and the discovery of considerable areas of new sand or new fields of importance.

Mexico, which has the largest probable supply of oil under ground on proved territory, is not likely to attract the prospector or investor until conditions stabilize.

Lowering in prices is likely to come only from the reduced demands of European countries in peace requirements and the opening up of the European fields to full production, particularly the Russian. There is therefore no immediate prospect of such abundance of oil as would lead to any considerable price change in the immediate future.

The United States has produced 60 per cent of the total crude petroleum output from 1857 to 1917 and produced 67 per cent of the total output for the year of 1917. Russia was second in production, turning out 26 per cent during the years 1857-1917 and 13 per cent in the year 1917, showing a reduction in the 1917 production as compared with that production maintained previously—a decline probably due to the unsettled Russian conditions. Mexico, which is hailed as the bonanza of oil centers, stands third on the list, having produced only 3.18 per cent of all the crude petroleum from 1857 to 1917, although its production increased satisfactorily in 1917. This output was 11 per cent of the world output that year.

The total production of the world for 1857 to 1917 was 293,309,824,332 gal., or 6,983,457,246 bbl. of 42 gal. each. The production for 1917 was 21,027,345,612 gal., or 500,651,086 bbl. of 42 gal. each. During the 1857-1917 period the output of the United States was 178,611,048,126 gal. of crude petroleum, or 4,252,644,003 bbl. of 42 gal. each. Russia during the same period produced 75,968,486,714 gal., or 1,832,583,017 bbl. Rumania, which in 1857 was the only nation producing crude petroleum, shows a figure of 142,992,465 bbl. produced during the 1857-1917 period. But the Rumanian production to-day stands ninth in rank owing to the discoveries and developments of petroleum in the United States, Russia, Mexico, Dutch East Indies, India, Galicia, Japan and Formosa.

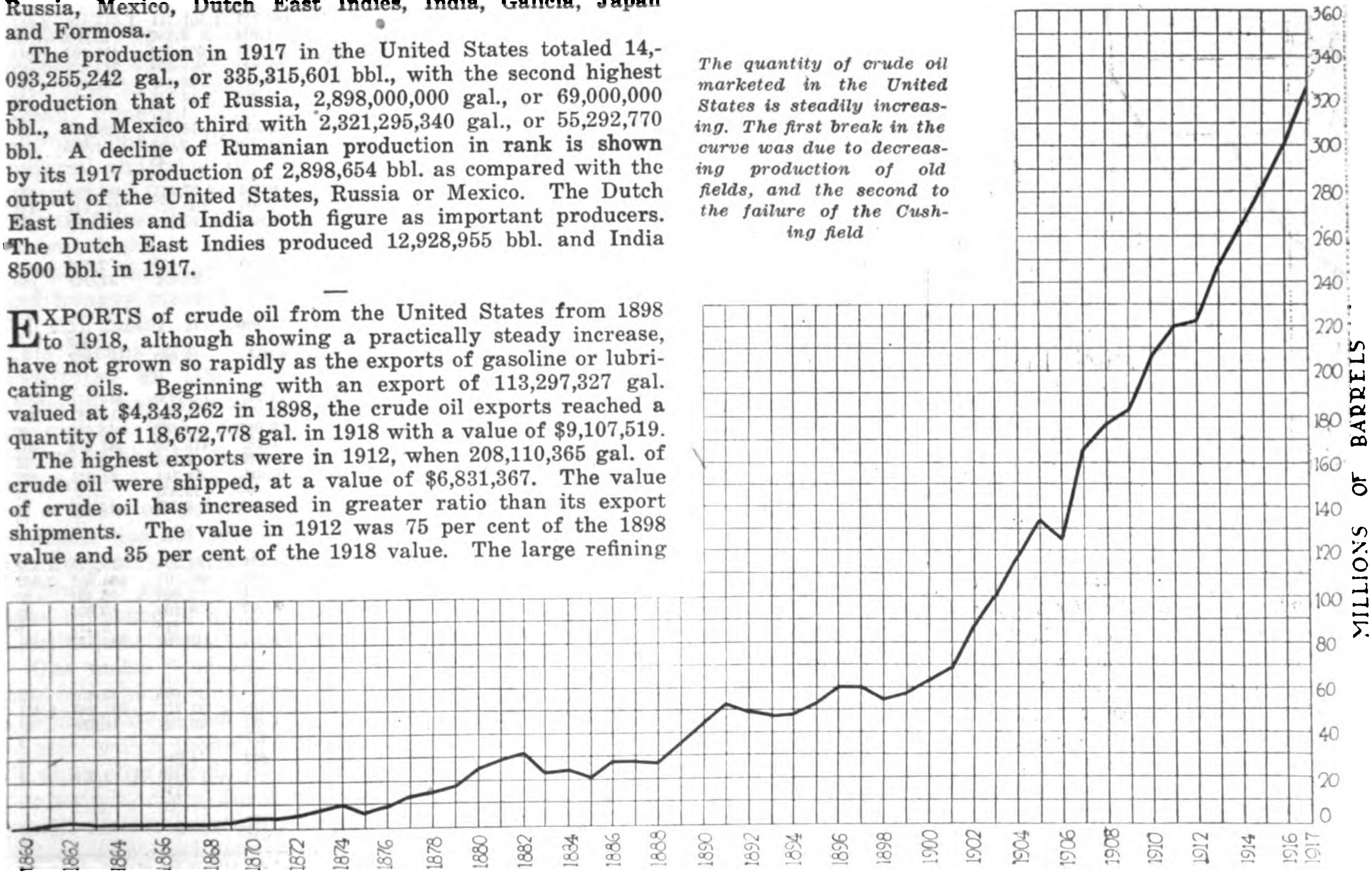
The production in 1917 in the United States totaled 14,093,255,242 gal., or 335,315,601 bbl., with the second highest production that of Russia, 2,898,000,000 gal., or 69,000,000 bbl., and Mexico third with 2,321,295,340 gal., or 55,292,770 bbl. A decline of Rumanian production in rank is shown by its 1917 production of 2,898,654 bbl. as compared with the output of the United States, Russia or Mexico. The Dutch East Indies and India both figure as important producers. The Dutch East Indies produced 12,928,955 bbl. and India 8500 bbl. in 1917.

EXPORTS of crude oil from the United States from 1898 to 1918, although showing a practically steady increase, have not grown so rapidly as the exports of gasoline or lubricating oils. Beginning with an export of 113,297,327 gal. valued at $4,343,262 in 1898, the crude oil exports reached a quantity of 118,672,778 gal. in 1918 with a value of $9,107,519.

The highest exports were in 1912, when 208,110,365 gal. of crude oil were shipped, at a value of $6,831,367. The value of crude oil has increased in greater ratio than its export shipments. The value in 1912 was 75 per cent of the 1898 value and 35 per cent of the 1918 value. The large refining activities carried on in the United States and the desire for refined oil productions rather than for crude oil have hitherto been the chief reasons for the comparatively smaller exports of crude oil.

Gasoline exports in the last 20 years grew from 16,252,927 gal., valued at $1,080,797 to 260,300,337 gal. valued at $61,447,382. The growth of gasoline exports has been a steady one with few declines, those being comparatively small. The greatest decline was in 1916 as compared with 1915. The 1915 exports totaled 156,000,000 gal. as compared with 100,000,000 gal. in 1916. The reason for this was that in the first year of the war the Allies ordered from us more gasoline than they consumed and a stock of this was carried over into 1916. At the same time the submarine warfare showed its effects in 1916. Exports of 1917 and 1918, 226,000,000 and 260,000,000 gal. respectively, will undoubtedly drop to some extent within the next year, as these were almost entirely for war consumption. Prior to the war the exports for the entire world totaled 81,698,917 gal. with a value of $10,831,490. The effect of the automobile on gasoline consumption is readily apparent in the export figures, which jumped from 16,000,000 gal. in 1898 to 77,000,000 gal. in 1910. The value of gasoline for export was 15 cents per gal. in 1898 and 23 cents per gal. in 1918. The 1917 value of 25½ cents per gal. for export was undoubtedly the highest price paid in the history of gasoline, which has been as low for export as 6½ cents a gal.

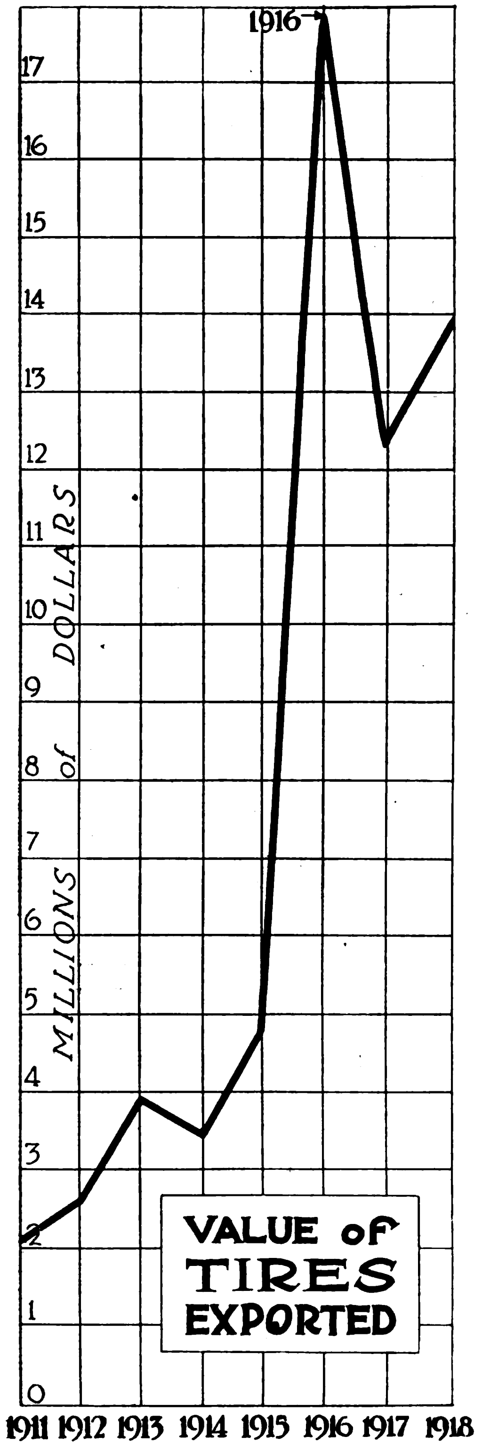
Illuminating oil exports, which include kerosene, have seldom varied between the figures of 800,000,000 gal. and 1,000,000,000 gal. during the past 20 years, this being due to a declining use of oil for illuminating purposes in many of the districts. The exports in 1898 of 824,426,581 gal. are approximately equal to the exports of 1915-1916 or 1917 and far in excess of the exports of 1918, which reached 528,805,501 gal. Prior to the beginning of the European war the exports had reached a high figure of 1,157,283,310 gal., the largest quantity exported in any single year. The value of illuminating oil for export has increased from 5 cents per gal. in 1898, when it was more expensive than gasoline, to 9 cents per gal. in 1918, the highest price paid for illuminating oil for export.



The quantity of crude oil marketed in the United States is steadily increasing. The first break in the curve was due to decreasing production of old fields, and the second to the failure of the Cushing field

Exports of Pneumatic Tires for Eight Years

(Prior to 1911 Tires were included in "All other manufactures of rubber")



There are two reasons why our exports of pneumatic tires should have dropped in 1917-1918. One is that the gasoline shortage abroad became more acute and the other that restrictions on the importation of crude rubber caused a reduction in production

	1911	1912	1913	1914	1915	1916	1917	1918	Totals by Countries
Austria-Hungary	$329	$375	$299	$1,009					$2,012
Azores and Madeira Is.				138	$178	$373		$72	761
Belgium	821	51,620	401,900	15,730					470,071
Bulgaria			500	170	150				820
Denmark	98	288	16,611	11,414	12,288	16,089	$6,917		63,705
Finland			1,545	4,585					6,130
France	185,473	316,629	20,205	5,448	8,723	80,423	425,132	661,648	1,703,681
Germany	29,979	1,160	401,196	132,181	6,090				5,706,606
Gibraltar								129	129
Greece				271	2,680	698	34,654	2,000	40,303
Iceland and Faroe Is.							61		61
Italy	537	2,387	1,150	915	11,740	333,437	101,362	55,913	507,441
Malta, Gozo & Cyprus Is.									
Netherlands		405	424	2,286	1,907	36,548	26,326	215	68,111
Norway	1,295	79	456	5,649	7,394	10,001	11,937	525	37,336
Portugal	693	271	282	157	1,434	25,990	9,055	15,488	53,370
Roumania		174	146	211		576			1,107
Russia in Europe	655		729	1,168	6,480	1,125,733	143,916	94,264	1,372,945
Serbia, Montenegro and Albania									
Spain	3,547		567	1,595	2,408	32,984	77,753	12,233	131,087
Sweden	8,335	7,545	5,301	77,537	26,707	35,850	6,347		167,622
Turkey in Europe					1,927				1,927
England	1,104,416	1,177,579	1,125,718	1,503,440	2,655,009	9,175,248	2,569,901		19,629,472
Scotland				336	245	116,858	66,753	618,071	184,192
Ireland		167				1,376			1,543
North America:									
Bermuda			401	267	139	1,440	14	409	2,670
British Honduras	15	612	163	727	64	36	590	3,469	5,676
Canada	405,778	696,433	1,324,459	961,937	772,574	1,176,836	1,485,939	1,766,518	8,590,474
Central American States:									
Costa Rica	951	1,863	2,793	6,877	2,381	6,098	11,918	4,018	36,899
Guatemala	1,343	2,178	2,224	5,547	3,406	6,299	24,545	7,039	53,581
Honduras		402	299	1,392	3,229	7,932	19,657	19,603	52,513
Nicaragua		130	429	180	419	157	294	1,042	2,651
Panama	5,379	4,073	19,466	18,362	24,549	73,854	74,047	137,609	357,339
Salvador	525	346	1,705	2,094	2,617	11,673	22,530	22,319	63,799
Mexico	144,893	148,480	203,883	111,948	106,083	236,811	257,413	777,984	1,987,495
Newfoundland & Labrador	955	1,144	693	1,668	4,034	5,108	8,243	11,317	33,162
West Indies, British:									
Barbados	1,227	1,599	4,588	4,351	4,136	6,019	15,666	19,391	56,997
Jamaica	11,614	19,285	30,004	55,361	36,887	40,354	109,048	109,097	109,948
Trinidad & Tobago	639	4,316	16,364	17,023	22,672	30,510	45,654	107,353	242,601
Other British	477	510	1,869	2,472	3,327	8,337	21,525	25,991	61,503
Cuba	27,072	21,714	12,322	55,236	192,355	547,410	1,019,915	1,336,233	3,212,257
Danish (Virgin Is. of U. S.)		190	540	1,739	577	1,099	2,753	6,939	13,837
Dominican Republic	321	2,934	2,305	2,903	3,092	18,233	37,441	61,631	123,873
Dutch	30	173	767	746	3,038	4,437	7,383	9,031	25,511
French		134	115	1,015	1,527	1,293	19,333	33,471	53,977
Haiti			765	2,336	526	998	2,287	13,021	20,003
South America:									
Argentina	3,541	10,196	8,153	21,920	34,076	488,339	1,301,344	1,649,810	3,517,419
Bolivia			106	1,526	3,413	4,954	9,187	20,513	39,699
Brazil	10,112	24,952	47,537	11,839	77,425	295,479	695,876	455,103	1,619,322
Chile	262	354	2,844	10,636	21,353	58,809	261,693	725,876	1,031,737
Colombia	2,564	5,268	16,211	18,925	15,239	28,617	39,298	51,618	180,770
Ecuador	392	615	8,459	3,313	8,620	9,225	13,645	46,305	90,574
Falkland Is.							1,817		1,817
Guiana, British	624	1,804	2,726	3,420	3,884	5,512	10,171	29,437	57,578
Dutch			63	544	308	1,339	2,588	1,918	6,760
French						14	45		59
Paraguay					16		35		51
Peru	557	745	1,273	4,838	5,253	9,663	27,934	107,236	157,499
Uruguay	586	849	1,990	17,987	11,836	76,608	100,427	221,634	431,937
Venezuela	130	1,835	10,703	20,439	32,635	71,849	128,966	116,612	383,169
Asia:									
Aden		30		55	264	1,585	440	2,536	4,910
China	590	850	622	28,326	18,971	41,298	36,932	53,039	180,648
China (leased territory), British									
French						999			999
Japanese		181	152					547	880
Chosen (Korea)			240	2,578	2,189	4,330	3,909	927	14,173
East Indies, British:									
British India	874	676	882	3,555	15,441	119,242	145,820	416,411	702,901
Straits Settlements	283	1,312	1,133	7,174	8,595	63,572	142,271	214,887	439,227
Other British	160	407	337	30	1,883	19,012	6,692	52,466	80,987
Dutch	916	6,170	860	2,677	7,688	201,287	415,742	347,912	983,252
Hongkong	997	4,568	677	1,057	879	4,189	3,252	6,412	22,031
Japan	15,319	13,531	29,975	18,629	12,741	20,045	34,243	83,235	227,718
Russia in Asia						100	12,432		12,532
Siam	207		1,334	92	742	2,236	8,547	16,179	29,337
Turkey in Asia		159			4,037				4,19[illegible]
Oceana, British:									
Australia	3,292	24,081	58,068	94,321	245,240	1,551,154	783,209	819,755	3,579,120
New Zealand	7,078	11,847	26,270	35,695	201,379	944,008	689,705	946,801	2,862,786
Other British		300	37	432	164	574	5,008	16,124	22,639
French	36	665	956	7,278	5,262	8,990	8,102	10,801	42,090
German		105		396		41	518	5,211	6,271
Philippine Is.	90,759	73,763	100,476	141,205	250,832	391,634	345,702	863,727	2,258,098
Africa:									
Belgian Kongo						17			17
British Africa, West		48	89		1,149	27,301	10,967	33,470	73,024
South	8,310	7,049	17,057	27,090	32,833	291,318	391,211	693,035	1,467,922
East		55	536	642	4,833	9,732	20,162	21,846	57,806
Canary Is.		91	270			1,777			2,138
Egypt				208	63	532	1,316		2,119
French Africa							420	2,399	2,819
Italian Africa							174		
Liberia							92		266
Madagascar						197			197
Portuguese Africa	71	108			946	3,601			4,726
Totals	$2,085,107	$2,657,809	$3,943,220	$3,505,267	$4,963,270	$17,936,227	$12,330,201	$13,977,671	$61,398,772

1919 Engineering Trends

(*Continued from page* 97)

will be such. Development of the aluminum cylinder engine was unquestionably halted by the rise in price and scarcity of that metal, but during the war facilities for aluminum production have increased greatly, so there is every reason to expect a large drop in price.

Also the alloy steel situation is due to improve rapidly, and those factories which have been doing aviation engine work are now accustomed to handling delicate steels, so they will not be so afraid of employing them. There is a very substantial difference in the weights of a frame made of carbon steel and one of nickel chrome, for example; and axles can be lightened considerably by using high-grade materials.

Weight is likely to receive consideration because it is a factor of importance in the performing ability of a car. There is quite an effect on the accelerative ability if a few hundred pounds is cut away. Of course, the user gains most from light weight in the saving of tires and fuel, but the average buyer is more likely to be influenced by a good demonstration than by any forecast of running cost which the dealer may make.

Better Material and Workmanship Forecast

Another experience of the past four years is likely to encourage the use of good materials and a rather higher grade of workmanship, and this is a growing realization of the fact that a few dollars added to manufacturing cost may easily save several times that sum on the service department account. Some of the manufacturers of low and medium-priced cars who cut prices heavily in 1915, and trimmed the factory cost to match, have discovered that their economies were more apparent than real.

Every one knows that it is cheaper to make a good job in the first instance than to do a poor one and have to patch it up at a later date; but the point it is desired to make is that many manufacturers now know how far it is safe to cut manufacturing cost, because they have already gone the limit, and even a bit beyond it.

Conditions in 1917, under the shadow of war, with material and labor both scarce and dear, and with every prospect of further rises, made it very difficult for any manufacturer of any article not a prime war necessity to branch out in any direction.

To-day the conditions are reversed. There is a huge and hungry market, materials are falling fast, and will fall still faster, while labor cannot at least go any higher. This means that an engineer will not be afraid in specifying an alloy steel or aluminum part that the material may become too expensive or too scarce. He knows that if he can afford to use it now he will still better be able to do so in six months' time. Nothing is pleasanter than to plan a chassis and estimate its cost on a basis of prices which must *fall*. The automobile engineer has not been able to do this for so long that he has forgotten the feeling. Fall in material prices is not a thing to gamble on, however. It would be unwise to take a chance of a fall of any definite amount, but it is infinitely helpful to be protected against a rise.

One metal it is sincerely to be hoped will come into use once more, and that is copper and its alloys. On the moderate-priced car of the day there are many parts of steel which should not be made of that material. Brass or aluminum should be used always for all small fittings, for switch covers, for door handles, and for all the parts which receive constantly the friction of handling.

Iron and steel cannot be plated so that they will not rust, except at a high cost, and even then there is a limit to the durability of the plate. Brass or aluminum lasts forever, keeps its appearance and its efficiency; for the rusting of a switch cover, for example, not only mars the look of the whole car but eventually interferes with the working of the switch. Brass fittings were forced off the medium-priced car in 1915, and let it not be forgotten how infinitely better for their purpose they were than the gimcrack affairs too often employed to-day.

Among the large engineering problems to be faced, by far the most important remains the fuel question. It has been with us for 5 years, and it becomes worse rather than better. This, too, is a thing in which aviation engine work has been entirely unhelpful, because aviation engines have had good low-gravity gasoline provided for them; they could not have shown anything like the same results with the commercial fuel.

It is an easily demonstrable fact that a car which performs well on ordinary gasoline will outdo itself easily if filled up with the best aviation gas. Now, just as the crux of kerosene vaporizer design is that the most heat is required when there is least exhaust heat available, and vice versa, so does this hold true for gasoline carburation.

The hot-spot manifold, if it will operate successfully at low speeds and low throttle positions, cannot fail to give too much heat at full speed and full throttle. The wide-open position is so seldom used by the average driver that this does not matter much up to a point, but if fuel gets poorer it will begin to cause trouble.

It may be recalled that in the Nash car, introduced in the fall of 1917, an attempt was made partially to counteract the natural perversity of the case by using as part of the fuel heating system an exhaust jacket which was shut off as the throttle opened. This seems to be a step in the right direction.

There was a patent granted to R. W. A. Brewer some time ago covering the idea of heating a portion of the intake by bringing the exhaust manifold against it, but with the interposition of a block of copper or other good conductor between the two. Then by making the copper adjustable the area of contact could be varied. This is another way of approaching the same end, and no doubt there are still others.

Control of Cooling System

Closely interconnected is the control of cooling systems. The thermostat control of water circulation and the air shutter over the radiator appeared just about the time when it was very difficult to introduce anything new. One or the other of these systems, or some combination giving the same effect, is destined to become as universal as electric starting, for it is just as necessary, and 1919 will surely see the development take place.

It is distinctly interesting to observe that in the few foreign "after war" models which have been described in the British automobile journals no special precautions seem to have been taken to care for heavy fuel. The European engineer seems fondly to expect gasoline of a pre-war grade. That he will get it is exceedingly unlikely, so here is another feature in which American engineering is going to show the way.

Mentioning European automobiles in this connection leads to another fact which is not without interest to the American engineer, and this is that a big proportion of new European cars are sixes. While the high grade four seems likely to remain the pre-eminent type abroad for a while, there are so many sixes that no doubt can exist but that European engineers are going to try out the small six on their public, and there is little question that this is due to the success in Europe of the medium-priced American sixes imported in 1916 and 1915.

S. A. E. Standardization Work in 1918

Numerous New Standards Put on Record, Mainly Relating to Aeronautical, Motorcycle and Marine Work—Activities to Be Pushed the Coming Year

DURING the year 1918 more new standards were added to the S. A. E. lists than in any previous year. The majority of these were aircraft standards, but marine, motorcycle and tractor standards were also included in considerable number. Much of the work that led to the adoption of these standards was done during 1917, but action on it by the Standards Committee was taken only at the winter meeting of 1918. Most of the activities of the Standards Committee and its numerous divisions during the past year and a half have been influenced by war conditions. For instance, all of the work carried on in connection with aircraft and motorcycle engineering was done in response to a direct request from a Government department. In addition to the regular standards the Standards Committee also has worked out various recommended practices, especially in connection with aircraft work.

The ball bearing standards, although in force now for quite a number of years, were revised during 1918. A practically complete series of thrust bearing standards also has been on the Data Sheets of the Society for some time, but in 1918 standard tolerances for such bearings were adopted.

The Engine Division drew up a design for hand starting cranks which was accepted by the Society in the course of the year and is now a recognized standard.

Magneto dimensions had been standardized previously for 4 and 6-cylinder engines, but certain dimensions applying only to 8 and 12-cylinder engines were added in 1918, as were complete dimensions for motorcycle magnetos. There are now three sets of standard magneto dimensions, viz., for 4 and 6-cylinder magnetos, 8 and 12-cylinder magnetos and motorcycle magnetos.

Standard Bracket Mounting for Generators

A standard bracket mounting for electric generators was adopted in August, 1918, and supplements the previously standardized flange mounting. The ignition distributer mounting adopted in 1917 was revised and extended in 1918. The same applies to the standard flange mounting for starting motors. Several detail standards have also been evolved by the Electrical Equipment Division and incorporated among the regular standards of the Society during the year. These include cables and cable terminals for starting motors, starting motor pinion details and starting switch location.

Clamps and fittings for rubber hose as used in aeronautic work were adopted. The connections of thermostats have also been standardized, it being specified that these must conform either to the S. A. E. carbureter flange standard or the S. A. E. clamps and fittings standard for rubber hose.

The first aeronautic standards were put through in very much of a hurry, and it is little wonder that several had to be revised within a year, especially when the intense development in aircraft engineering is considered. This applies to loops and ferrules for round tinned steel wire, loops for single-strand non-flexible steel cable, plain hexagon head bolts, ball hexagon head bolts, castle hexagon nuts and ball hexagon nuts. A standard for plain hexagon nuts was adopted in 1918. All of these airplane parts are for use in wing and body construction only and not for use on aircraft engines.

A considerable amount of standardization work is now in progress and is awaiting action at the coming annual meeting of the Society.

The Electrical Equipment Division has decided to recommend the adoption of two types of cable terminals for ignition distributors, generators, meters and switches. One of these is the spade type, which can be used either straight or with the wire connections set at an angle of 90 deg. to the spade, for use in connection with binding posts having Nos. 8, 10 and 14 machine screw threads. The other type is a flat terminal with the wire coming in at the side, which fits the same sizes of screws. All terminals are to be 1/32 in. thick, to insure proper strength. Another recommendation to be made by the same division is in regard to a sleeve type of starting motor mountings. This mounting is to be used only in connection with an outboard screw shift pinion drive. In the design submitted, a cylindrical portion of the gearshift housing slides into a bored hole in the bell housing. The gear housing is locked in position in the bell housing by means of a set screw with a tapered point. Some attention has also been given to the subject of rating of storage batteries for farm lighting outfits. It is the consensus of opinion that this rating should be based upon an intermittent discharge test.

The engine division has recommended two sizes of rear supporting arms, one to be used with the No. 1 S. A. E. flywheel bell housing, and the other with Nos. 2, 3, 4 and 5. Standardization of the front swivel support is now under consideration. Another standard to be recommended concerns flexible disc magneto couplings. These are to have an outside diameter of disc of 2¾ in. and an inside diameter of 1 in., a diameter of bolt circle of 2 in., a thickness of disc of ¼ in. and four ¼-in. bolts equally spaced.

A sub-division of the Marine Division has evolved standards for swing port lights in five sizes, with air openings of 10, 12, 14, 16 and 18 in. diameter respectively.

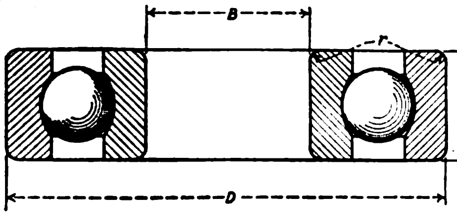
The Miscellaneous Division has under consideration the subject of carbureter hot-air intake sizes, and it is hoped that a report may be made on it at the time of the annual meeting. The division is also revising the aeronautical spark plug shell standard, in order to bring it into harmony with a desired international standard.

The Springs Division, as usual, has been quite active again, and has recommended a number of new spring points, a test for parallelism of spring eye center lines, and revisions of various spring standards.

One of the new divisions of the committee, that of Stationary and Farm Engines, has made some recommendations regarding voltage and capacity ratings of farm lighting outfits. At the present time small generators are generally built to be operated at 1800 r.p.m., while engines of the capacity for farm lighting purposes only run at about 1000 r.p.m. The division considers that it would be of great advantage to purchasers and to the trade as well, if both engines and generators were designed to run at the same speed, so that the generators could be driven directly; and they have recommended that 32 volts be the standard voltage for farm lighting outfits, and recommended various speeds for engines and generators of different output. Flanges for cast iron carbureters and oval and round pipe flanges are other subjects that have received consideration.

The Tire and Rim Division of the committee has been very busy and has taken action on a considerable number of subjects. A table of solid tire sizes has been worked out, to conform to the present table of Class A Pneumatic tire sizes. This includes 15 sizes, ranging from 32 x 3½ to 40 x 14. Other subjects on which action has been taken by this division include base bands for solid tires, industrial truck tires, base bands for industrial truck wheels, allowable tolerances for felloe bands, wood-felloe dimensions for pneumatic tire rims, pneumatic tires for motorcycles, wood spokes for passenger car wheels, valve hole sizes for automobile rims, and solid tire sections and contours.

ANNULAR BALL BEARINGS



HEAVY SERIES—DIMENSIONS

Bearing No.	B Mm.	B Inches	D Mm.	D Inches	W Of Individual Rings Mm.	W Of Individual Rings Inches	r Corner Radius Mm.	r Corner Radius Inches
403	17	0.66929	62	2.44095	17	0.66929	1	0.04
404	20	0.78740	72	2.83465	19	0.74803	2	0.08
405	25	0.98425	80	3.14962	21	0.82677	2	0.08
406	30	1.18110	90	3.54332	23	0.90551	2	0.08
407	35	1.37795	100	3.93702	25	0.98425	2	0.08
408	40	1.57481	110	4.33072	27	1.06299	2	0.08
409	45	1.77166	120	4.72443	29	1.14173	2	0.08
410	50	1.96851	130	5.11813	31	1.22047	2	0.08
411	55	2.16536	140	5.51183	33	1.29921	3	0.12
412	60	2.36221	150	5.90554	35	1.37795	3	0.12
413	65	2.55906	160	6.29924	37	1.45669	3	0.12
414	70	2.75591	180	7.08664	42	1.65355	3	0.12
415	75	2.95277	190	7.48035	45	1.77166	3	0.12
416	80	3.14962	200	7.87405	48	1.88977	3	0.12
417	85	3.34647	210	8.26775	52	2.04725	3	0.12
418	90	3.54332	225	8.85830	54	2.12599	3	0.12
419	95	3.74017	250	9.84256	55	2.16536	3	0.12
420	100	3.93702	265	10.43311	60	2.36221	3	0.12

MEDIUM SERIES—DIMENSIONS

Bearing No.	B Mm.	B Inches	D Mm.	D Inches	W Of Individual Rings Mm.	W Of Individual Rings Inches	r Corner Radius Mm.	r Corner Radius Inches
300	10	0.39370	35	1.37795	11	0.43307	1	0.04
301	12	0.47244	37	1.45669	12	0.47244	1	0.04
302	15	0.59055	42	1.65355	13	0.51181	1	0.04
303	17	0.66929	47	1.85040	14	0.55118	1	0.04
304	20	0.78740	52	2.04725	15	0.59055	1	0.04
305	25	0.98425	62	2.44095	17	0.66929	1	0.04
306	30	1.18110	72	2.83465	19	0.74803	2	0.08
307	35	1.37795	80	3.14962	21	0.82677	2	0.08
308	40	1.57481	90	3.54332	23	0.90551	2	0.08
309	45	1.77166	100	3.93702	25	0.98425	2	0.08
310	50	1.96851	110	4.33072	27	1.06299	2	0.08
311	55	2.16536	120	4.72443	29	1.14173	2	0.08
312	60	2.36221	130	5.11813	31	1.22047	2	0.08
313	65	2.55906	140	5.51183	33	1.29921	3	0.12
314	70	2.75591	150	5.90554	35	1.37795	3	0.12
315	75	2.95277	160	6.29924	37	1.45669	3	0.12
316	80	3.14962	170	6.69294	39	1.53544	3	0.12
317	85	3.34647	180	7.08664	41	1.61418	3	0.12
318	90	3.54332	190	7.48035	43	1.69292	3	0.12
319	95	3.74017	200	7.87405	45	1.77166	3	0.12
320	100	3.93702	215	8.46460	47	1.85040	3	0.12
321	105	4.13387	225	8.85830	49	1.92914	3	0.12
322	110	4.33072	240	9.44886	50	1.96851	3	0.12

LIGHT SERIES—DIMENSIONS

Bearing No.	B Mm.	B Inches	D Mm.	D Inches	W Of Individual Rings Mm.	W Of Individual Rings Inches	r Corner Radius Mm.	r Corner Radius Inches
200	10	0.39370	30	1.18110	9	0.35433	1	0.04
201	12	0.47244	32	1.25984	10	0.39370	1	0.04
202	15	0.59055	35	1.37795	11	0.43307	1	0.04
203	17	0.66929	40	1.57481	12	0.47244	1	0.04
204	20	0.78740	47	1.85040	14	0.55118	1	0.04
205	25	0.98425	52	2.04725	15	0.59055	1	0.04
206	30	1.18110	62	2.44095	16	0.62992	1	0.04
207	35	1.37795	72	2.83465	17	0.66929	1	0.04
208	40	1.57481	80	3.14962	18	0.70866	2	0.08
209	45	1.77166	85	3.34647	19	0.74803	2	0.08
210	50	1.96851	90	3.54332	20	0.78740	2	0.08
211	55	2.16536	100	3.93702	21	0.82677	2	0.08
212	60	2.36221	110	4.33072	22	0.86614	2	0.08
213	65	2.55906	120	4.72443	23	0.90551	2	0.08
214	70	2.75591	125	4.92128	24	0.94488	2	0.08
215	75	2.95277	130	5.11818	25	0.98425	2	0.08
216	80	3.14962	140	5.51183	26	1.02362	3	0.12
217	85	3.34647	150	5.90554	28	1.10236	3	0.12
218	90	3.54332	160	6.29924	30	1.18110	3	0.12
219	95	3.74017	170	6.69294	32	1.25984	3	0.12
220	100	3.93702	180	7.08664	34	1.33858	3	0.12
221	105	4.13387	190	7.48035	36	1.41732	3	0.12
222	110	4.33072	200	7.87405	38	1.49607	3	0.12

INCH TOLERANCES FOR MILLIMETER SIZES

Bore Tolerance in Inches

Bore Mm.	Bore Inches	Bearing Number Light Series	Bearing Number Medium Series	Bearing Number Heavy Series	Tolerance Plus	Tolerance Minus
10 to	0.39370 to	200 to	300 to	403 to	0.0002	0.0004
55 inc.	2.16536 inc.	211 inc.	311 inc.	411 inc.		
60 to	2.36221 to	212 to	312 to	412 to	0.0002	0.0005
80 inc.	3.14962 inc.	216 inc.	316 inc.	416 inc.		
85 to	3.34647 to	217 to	317 to	417 to	0.0002	0.0006
110 inc.	4.33072 inc.	222 inc.	322 inc.	420 inc.		

Outside Diameter Tolerance in Inches

Outside Dia. Mm.	Outside Dia. Inches	Bearing Number Light Series	Bearing Number Medium Series	Bearing Number Heavy Series	Tolerance Plus	Tolerance Minus
30 to	1.18110 to	200 to	300 to	....	0.0000	0.0005
47 inc.	1.85040 inc.	204 inc.	303 inc.	....		
52 to	2.04725 to	205 to	304 to	403 to	0.0000	0.0008
140 inc.	5.51183 inc.	216 inc.	313 inc.	411 inc.		
150 to	5.90554 to	217 to	314 to	412 to	0.0000	0.0012
265 inc.	10.43311 inc.	222 inc.	322 inc.	420 inc.		

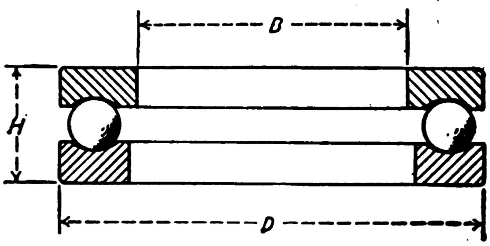
Width Tolerance in Inches

Width tolerance in inches for individual race rings for all sizes of bearings to be plus 0.0000 and minus 0.0050 in.

Eccentricity Tolerance in Inches

Bore Mm.	Bore Inches	Bearing Number Light Series	Bearing Number Medium Series	Bearing Number Heavy Series	Tolerances Inner Race	Tolerances Outer Race
10 to	0.39370 to	200 to	300 to	403 to	0.0006	0.0012
20 inc.	0.78740 inc.	204 inc.	304 inc.	404 inc.		
25 to	0.98425 to	205 to	305 to	405 to	0.0008	0.0012
40 inc.	1.57481 inc.	208 inc.	308 inc.	408 inc.		
45 to	1.77166 to	209 to	309 to	409 to	0.0010	0.0016
75 inc.	2.95277 inc.	215 inc.	315 inc.	415 inc.		
80 to	3.14962 to	216 to	316 to	416 to	0.0012	0.0018
110 inc.	4.33072 inc.	222 inc.	322 inc.	420 inc.		

THRUST BALL BEARING TOLERANCES



SINGLE-DIRECTION, FLAT FACE TYPE INCH TOLERANCES FOR MILLIMETER SIZES

Bore Diameter

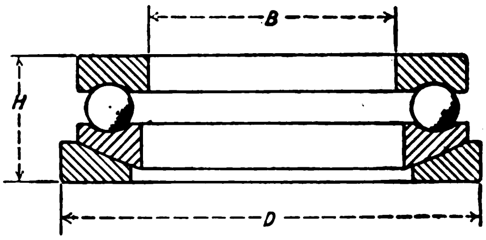
Bore (B) Mm.	Bore (B) Inch	Tolerances, Inch Plus	Tolerances, Inch Minus
0 to 35	0.0000 to 1.3779	0.0008	0.0000
36 to 60	1.4173 to 2.3622	0.0010	0.0000
61 to 110	2.4016 to 4.3307	0.0012	0.0000

Outside Diameter

Diameter (D) Mm.	Diameter (D) Inch	Tolerances, Inch Plus	Tolerances, Inch Minus
0 to 150	0.0000 to 5.9055	0.0000	0.0020
151 to 200	5.9449 to 7.8740	0.0000	0.0030

Total Thickness

Thickness (H) Mm.	Thickness (H) Inch	Tolerances, Inch Plus	Tolerances, Inch Minus
0 to 35	0.0000 to 1.3779	0.0020	0.0020
36 to 100	1.4173 to 3.9370	0.0030	0.0030



SINGLE DIRECTION SELF-ALIGNING TYPE

Bore Diameter

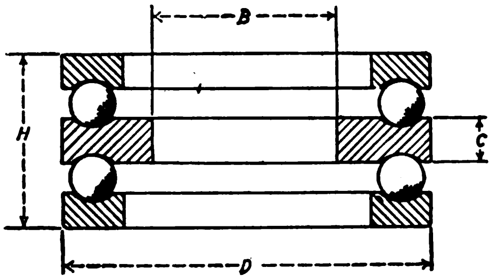
Bore (B) Mm.	Bore (B) Inch	Tolerances, Inch Plus	Tolerances, Inch Minus
0 to 35	0.0000 to 1.3779	0.0008	0.0000
36 to 60	1.4173 to 2.3622	0.0010	0.0000
61 to 110	2.4016 to 4.3307	0.0012	0.0000

Outside Diameter

Diameter (D) Mm.	Diameter (D) Inch	Tolerances, Inch Plus	Tolerances, Inch Minus
0 to 150	0.0000 to 5.9055	0.0000	0.0020
151 to 200	5.9449 to 7.8740	0.0000	0.0030

Total Thickness

Thickness (H) Mm.	Thickness (H) Inch	Tolerances, Inch Plus	Tolerances, Inch Minus
0 to 40	0.0000 to 1.5748	0.0030	0.0030
41 to 100	1.6142 to 3.9370	0.0040	0.0040



TWO-DIRECTION, FLAT-FACE TYPE

Bore Diameter

Bore (B) Mm.	Inch	Tolerances, Inch Plus	Minus
0 to 35	0.0000 to 1.3779	0.0008	0.0000
36 to 60	1.4173 to 2.3622	0.0010	0.0000
61 to 110	2.4016 to 4.3307	0.0012	0.0000

Outside Diameter

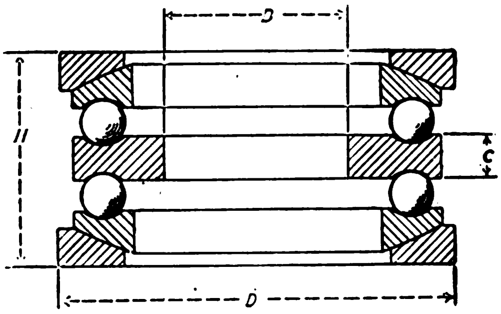
Diameter (D) Mm.	Inch	Tolerances, Inch Plus	Minus
0 to 150	0.0000 to 5.9055	0.0000	0.0020
151 to 200	5.9449 to 7.8740	0.0000	0.0030

Total Thickness

Thickness (H) Mm.	Inch	Tolerances, Inch Plus	Minus
0 to 75	0.0000 to 2.9528	0.0040	0.0040
76 to 150	2.9921 to 5.9055	0.0060	0.0060

Thickness of Center Plate

Thickness (C) Mm.	Inch	Tolerances, Inch Plus	Minus
0 to 10	0.0000 to 0.3937	0.0015	0.0015
11 to 20	0.4331 to 0.7874	0.0020	0.0020
21 to 35	0.8268 to 1.3779	0.0025	0.0025



DOUBLE DIRECTION SELF-ALIGNING TYPE

Bore Diameter

Bore (B) Mm.	Inch	Tolerances, Inch Plus	Minus
0 to 35	0.0000 to 1.3779	0.0008	0.0000
36 to 60	1.4173 to 2.3622	0.0010	0.0000
61 to 110	2.4016 to 4.3307	0.0012	0.0000

Outside Diameter

Diameter (D) Mm.	Inch	Tolerances, Inch Plus	Minus
0 to 150	0.0000 to 5.9055	0.0000	0.0020
151 to 200	5.9449 to 7.8740	0.0000	0.0030

Total Thickness

Thickness (H) Mm.	Inch	Tolerances, Inch Plus	Minus
0 to 85	0.0000 to 3.3465	0.0060	0.0060
86 to 200	3.3858 to 7.8740	0.0080	0.0080

Thickness of Center Plate

Thickness (C) Mm.	Inch	Tolerances, Inch Plus	Minus
0 to 10	0.0000 to 0.3937	0.0015	0.0015
11 to 20	0.4331 to 0.7874	0.0020	0.0020
21 to 35	0.8268 to 1.3779	0.0025	0.0025

BALL BEARINGS

Temperature for Measurements

These tolerances are applicable only when the bearings and measuring appliances have been brought to a uniform temperature, as for instance 68 deg. Fahr. In case of question as to measurements, gages officially checked by the United States Bureau of Standards shall be considered as final. These tolerances are understood as referring to the dimensions of ball bearings, and not to the dimensions of measuring instruments. When it is desired to measure bearings by the use of maximum and minimum gages, the dimensions of the maximum gage shall be 0.0001 in. over the maximum bearing dimension, and the dimension of the minimum gage shall be 0.0001 in. under the minimum bearing dimension.

The above paragraph specifying the temperature at which tolerances are applicable to bearings and measuring appliances applies both to annular (radial) ball bearing tolerances and thrust bearing tolerances.

Definition of Eccentricity.

The eccentricity of the inner race is that lack of running truth noticed upon the stationary outer race when rotating the inner race and balls upon true centers.

The eccentricity of the outer race is that lack of running truth shown upon a suitable indicator during the rotation of the outer race and balls upon the inner race fixed upon a stationary arbor.

MAGNETO DIMENSIONS

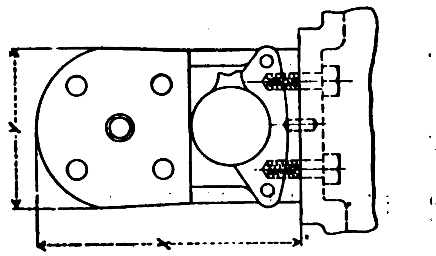
Airplane, Automobile, Marine, Motorcycle, Tractor

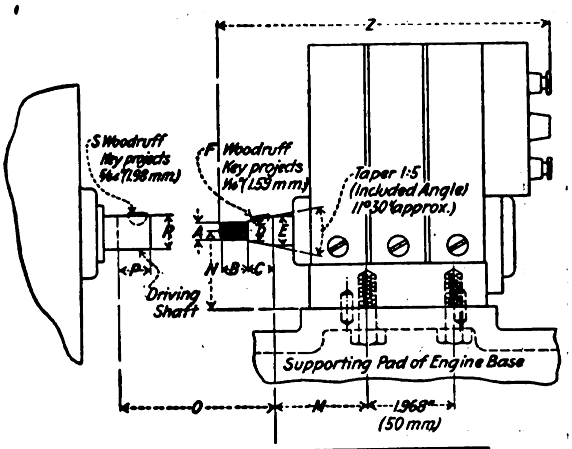
		4 and 6 Cyl.		8 and 12 Cyl.		Motorcycle	
		Inch	Mm.	Inch	Mm.	Inch	Mm.
A U. S. S. Threads		3/8"-16 thds.	9.53-1.58	3/8"-16 thds.	9.53-1.58	5/16"-18 thds.	7.94-1.41
B		.5905	15	.5905	15	.4170	10.59
C		.590	14.98	.590	14.98	.3543	9
D		.472	12	.472	12	.4409	11.20
E		.590	14.98	.590	14.98	.5118	13
F Woodruff Key (Dia. X thickness)		No. 3 1/2x1/8	No. 3 12.7x3.18	No. 3 1/2x1/8	No. 3 12.7x3.18	Special 5/16x3/32	Special 7.94x2.38
H		No std.	....	1.693	43	No std.	....
I		No std.	....	2.519	63.98	No std.	....
M		2.086	52.98	2.086	52.98	1.553	39.45
N		1.771	44 98	1.968	50	1.771	44.98
*‡O		2.375	60.32	2.375	60.32	No std.	....
*‡P		.75	19.05	.75	19.05	No std.	....
*†‡R (limits)		.750 .749	19 05 19 02	.750 .749	19.05 19.02	No std.	....
Coupling Bore (limits)		.7505 .7495	19.06 19.04	.7505 .7495	19.06 19.04	No std.	....
‡S Woodruff Key (Dia. X thickness)		No. 8 3/4x5/32	No. 8 19.05x3.97	No. 8 3/4x5/32	No. 8 19.05x3.97	No std.	....
Magneto Space Max.	X	8.000	203.20	9.000	228.60	6.000	152.40
	Y	5.000	127.00	5.000	127.00	3.750	95.25
	Z	10.000	254.00	10.000	254.00	6.375	161.93
Width at Brushes	W	No std.	....	No std.	....	4.000	101.60
Adv. Lever Rad.		2.125	53.97	No std.	....	1 968	50
Timing Lever Holes	Tapped S.A.E.	1/4"-28 thds.	6.35-.9 Mm. p'ch	No std.	....	No std.	....
	Plain	.25	6.35	No std.	....	.2185	5.55
Dowels (Airplane Only)	Diam.	5/16 +.002 -.002	7 94 +.05 - 00	5/16 +.002 -.000	7.94 +.05 -.00	No std.	....
	Depth	5/16	7 94	5/16	7.94	No std.	....

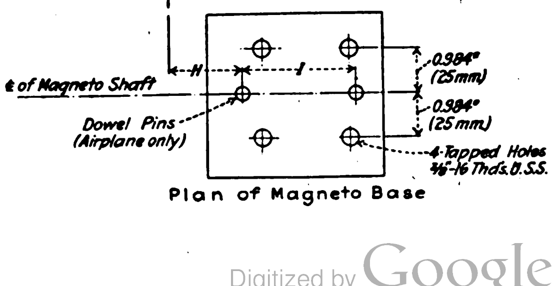
*Provides for Impulse Couplings for tractors. Conforms to National Gas Engine Association standard.

†Recommended material for drive-shaft is selected cold-rolled stock.

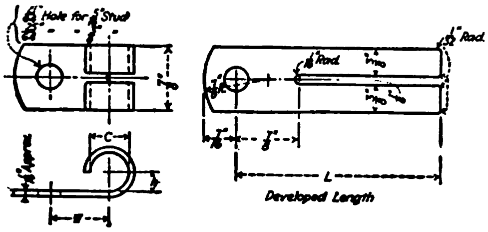
‡Not for use in airplanes.







Plan of Magneto Base



CABLE TERMINALS FOR STARTING MOTORS.

Terminal No.	C	h	W	L
1	17/32	17/64	13/16	2 3/16
0	13/32	19/64	27/32	2 5/16
00	21/32	21/64	⅞	2 ½

Dimensions in inches.

Materials

The materials recommended for cable terminals for starting motors are: Tinned copper, tinned brass, or zinc-coated steel.

CABLES FOR STARTING MOTORS

*Cable Size	Max. Cable Length, Ft.
SB-1	5
SB-0	7
SB-00	9

The three sizes of cables for starting motors given above are considered sufficient to cover all usual 6-volt requirements. The cable lengths specified are based on an allowable drop of 0.3 volt at 500 amperes.

*"SB" indicates Single Braid.

STARTING MOTOR PINION

Flywheel starting motors shall be equipped with an 8-10 pitch, 11-tooth, 20-deg. pressure angle pinion. The pitch line clearance between pinion and flywheel shall be 0.015 inch.

STARTING SWITCH LOCATION

Starting switches shall be located on the chassis so as to facilitate electrical assembly and testing on chassis.

IGNITION DISTRIBUTOR MOUNTING

The ignition distributor mounting dimensions shown are suitable for use when the distributor is mounted on either the generator or the engine.

BRACKET MOUNTING FOR GENERATORS

This specification is complete in regard to mounting dimensions of the generator. Bracket dimensions and the dimensions and location of the pad on the crankcase are now being determined.

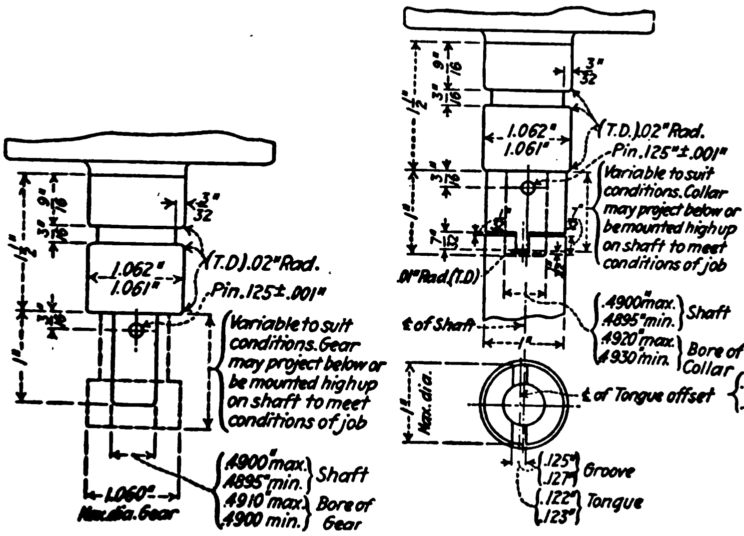
GENERATOR SHAFT-END FOR COUPLING DRIVE

The shaft-end illustrated under Bracket Mounting for Generators is considered of ample capacity for all sizes of generators, except in special instances where small generators, naturally not suited to this Standard, may be fitted with the standard magneto shaft-end in accordance with present practice.

FLANGE MOUNTINGS FOR STARTING MOTORS

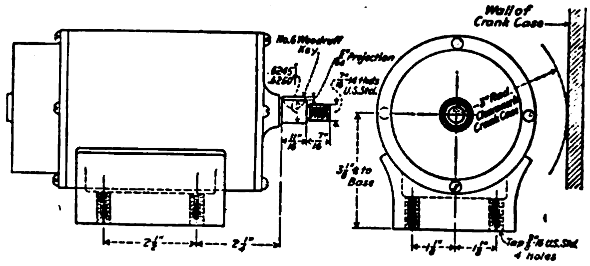
Size No.	A	B	C	D	E
1	2⅝	2⅛	13/32	9/16	3.496 to 3.499
2	2 11/16	2⅞	13/32	9/16	3.621 to 3.624
3	2 13/16	3⅛	15/32	19/32	3.621 to 3.624

These standard flanges may be used for either right-hand or left-hand mounting of motors.



Type A *Type B*

Ignition distributor mounting



Bracket mounting for generators

SPARK CONTROL—MOTORCYCLE

Spark control on military motorcycles shall be of the handle bar grip type placed on the left side and arranged to advance the spark by turning top of the grip toward the center.

THROTTLE CONTROL—MOTORCYCLE

Throttle control on military motorcycles shall be of the handle bar grip type, placed on the right side and operate to open the throttle by twisting the top of the grip toward the center.

KICK STARTERS—MOTORCYCLE

Kick starters on military motorcycles shall be of the folding pedal type and operate by pushing down and back.

Starters cannot be confined to a definite side until further standardization takes place on engines.

CLUTCH PEDAL—MOTORCYCLE

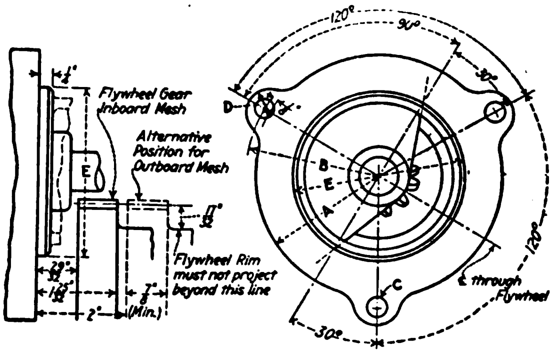
Clutch pedal on military motorcycles shall be placed on the left side and operate to release the clutch by pushing forward and down, clutching by reverse action.

BRAKE PEDAL—MOTORCYCLE

Brake pedal on military motorcycles shall be placed on the right side and operate to apply the brake by pushing down.

OIL AND GREASE CUPS—MOTORCYCLE.

Oil and grease cups on military motorcycles shall have an attaching diameter of 5/16 inch, 32 threads.



Flange mounting for starting motors

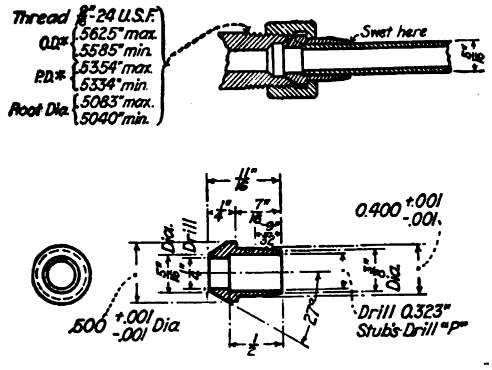
CLAMPS AND FITTINGS FOR RUBBER HOSE

Inside Hose Diameter	Outside Diameter of Hose and Extended Inside Diameter of Clamps: Single-ply	Two-ply	Three-ply	Four-ply	Length of Fitting for Lap of Hose
3/16	7/16	½	9/16	⅝	1
¼	½	9/16	⅝	11/16	1
5/16	9/16	⅝	11/16	¾	1
⅜	⅝	11/16	¾	13/16	1
½	¾	13/16	⅞	15/16	1
¾	1	1 1/16	1⅛	1 3/16	1
1	1¼	1 5/16	1⅜	1 7/16	1¼
1¼	1½	1 9/16	1⅝	1 11/16	1¼
1½	1¾	1 13/16	1⅞	1 15/16	1¼
1¾	2	2 1/16	2⅛	2 3/16	1¼
2	2¼	2 5/16	2⅜	2 7/16	1¼
2¼	2½	2 9/16	2⅝	2 11/16	1¼
2½	2¾	2 13/16	2⅞	2 15/16	1½
3	3¼	3 5/16	3⅜	3 7/16	1½

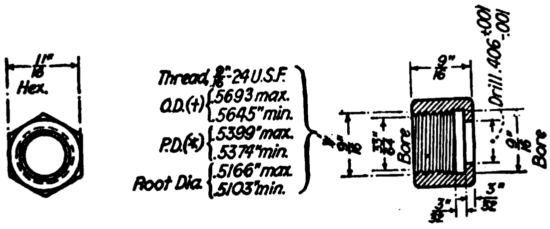
Limits on inside diameter of hose ± 1/64. Limits on thickness of hose (not measured at lap) ± 1/64. All dimensions in inches.

CLAMPS AND FITTINGS FOR RUBBER HOSE—AERONAUTIC

In order to comply with present practice and utilize existing hose connections, the list of sizes shown above are recommended for aeronautic practice.



Brass



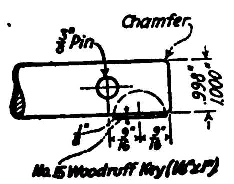
Steel—copper and white nickel plate

*Actual size.
†Minimum diameter for respective pitch diameters. Outside diameter tolerances of commercial taps are slightly greater.

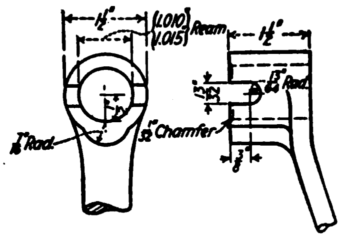
MOTORCYCLE FUEL AND LUBRICATION PIPE FITTINGS

Fuel and lubrication pipes on military motorcycles shall be 5/16 in. outside diameter and the fittings shall be of the soldered type with 9/16 in. nut, 24 threads, United States Form.

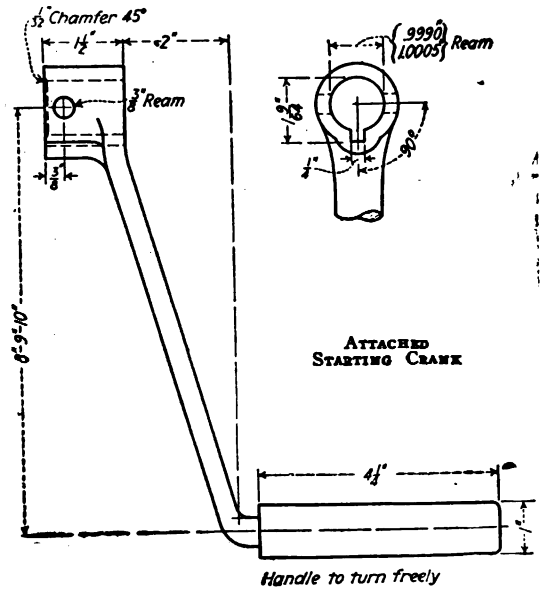
Outside diameter tolerances of commercial taps are slightly greater.



SHAFT END

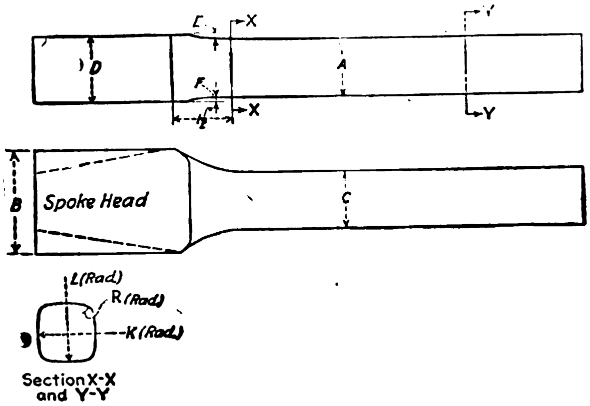


REMOVABLE CRANK



ATTACHED STARTING CRANK

Hand-starting crank, attached



WOOD SPOKE DIMENSIONS, COMMERCIAL VEHICLE WHEELS

Spoke Symbol Numbers	Nominal Spoke Size, Thickness Between Flanges (D)	Size of Finished Barrel			E	F	K	L	R	Max. Flange Diameter		
		A	B	C						12 Spokes	14 Spokes	16 Spokes
1425	1½	1½	2⅝	1½	⅛	⅛	3½	3½	5/16	9½	11	12½
1625	1¾	1¾	2⅝	1¾	⅛	⅛	2 9/16	2 9/16	5/16	10	11½	13¼
2026	2	2	2¾	2	⅛	⅛	5⅝	5⅝	⅜	10	11½	13¼
2230	2¼	2¼	3	2¼	5/32	5/32	3 11/16	3 11/16	⅜	10⅜	12½	14¼
2430	2½	2½	3	2½	5/32	5/32	3 9/16	3 9/16	⅜	10⅜	12½	14½
2632	2¾	2¾	3¼	2½	5/32	5/32	3½	10⅝	⅜	11⅜	13½	15½
3032	3	3	3¼	2½	5/32	5/32	3½	10⅝	⅜	11⅜	13½	15½
3432	3½	3½	3¼	2½	5/32	5/32	7½	10¼	7/16	11⅜	13½	15½
4032	4	4	3¼	3	5/32	5/32	7⅝	12⅝	⅜	11⅜	13½	15½
4432	4½	4½	3¼	3	5/32	5/32	7⅝	12⅝	⅜	11⅜	13½	15½
5032	5	5	3¼	3	5/32	5/32	10½	17 5/16	½	11⅜	13½	15½

Wood Spokes for Commercial Vehicle Wheels

The first two figures of the symbol number indicate the finished size of barrel (thickness between flanges); and the second two figures indicate the dry width of head. The first figure of each pair indicates whole inches, and the second indicates eights of an inch; thus 1425 indicates 1½-in. barrel and 2⅝-in. head.

Radial allowance above flange diameters

⅛ in., up to and including 9-in. flanges
3/16 in., from 9 in. to 11½-in. flanges, inclusive
¼ in., above 11½-in. flanges

TACHOMETER DRIVE

Instrument End—The upper or instrument end of the shaft has a squared socket, made integral with a shoulder which forms a thrust bearing.

Engine End—The lower or engine end is finished with a cylindrical end with a single integral key.

Casing—The casing is to be of flexible metallic tubing, covered with whipcord braid and impregnated to prevent oil leakage; similar to sample, or covered with other material which will be equally flexible, oil tight and free from stretching and of no greater weight than the whipcord braid covering casing. The outside diameter of casing to be over braid to be approximately 7/16 in.; the inside diameter of casing to be approximately ¼ in. The ends of the casing are finished alike, as shown in detailed sketches. The screw-threaded sockets covering the whipcord braid are screwed in place and set with shellac or other suitable material to form an oil-tight and permanent connection.

Shaft End—The shaft end at the engine is drilled and slotted to fit the tachometer shaft end, allowing for end-play of at least 1 in. More play than this may be required where the drive shaft is more than 6 ft. in length, the amount to be determined experimentally.

Drive Shaft—Drive shaft to be of helical wire wound construction, with core wires.

Spindle—The tachometer spindle is finished square to fit the square socket on the drive shaft.

Drive Shaft—Drive shaft will rotate at one-half crank shaft speed.

End Nuts—Size and contour of exterior circumference of end nuts optional, but 15/16 octagon recommended.

TRACTOR SPECIFICATION

CONDENSED

S. A. E. Recommended Practice

1. Firm name ....
   Address
2. Tractor trade name and model........................
3. Drawbar horsepower, S. A. E. tractor rating..................
   Old trade rating..........................
4. Belt horsepower, S. A. E. tractor rating.....................
   Old trade rating..........................
5. Engine: Make.......................Bore........Stroke........
   No. cylinders.........Cycle.........Normal R.P.M.........
   Lubricating system, type..............................
   Ignition ....Carbureter..............
   Fuel system ....
   Cooling system ....
   Belt pulley dia...........Face...........R.P.M..........
6. Transmission, type or make..............................
   No. speeds forward ....
   Speed M.P.H. at normal engine speed—
   1st ....2d ....3d ....
   Indicate by check (X) speed normally used for plowing.
7. Wheels: No.................Arrangement ....
   Driving, No................ Dia............Face...........
   Non-driving, No............ Dia............Face...........
   If track laying type, No. of tracks........................
   Length ....Face.......................
8. Frame construction ....
9. Wheel base ....Tread.................
10. Width overall.....................Length overall............
11. Turning radius ½ diameter largest track circle...............
12. Weight of tractor less fuel, oil, water and lugs..............
13. Shipping weight, including standard equipment and stays.......
    Dimensions to be given in inches.

TRACTOR SPECIFICATION

COMPLETE

1. Firm name ....
   Address
   Trade name ....Model....................
2. Horsepower rating:
   (a) Drawbar (old trade) ....S. A. E...............
   (b) Belt (old trade) ....S. A. E...............
3. Engine
   Make ....
   Model ....
4. Number of cylinders...........................Cycle..........
5. Engine. Type (mark X)

   (Cyl. how cast)

   Vertical ....Valve-in-head ....Individual ....
   Horizontal ....L-head ....Pairs ....
   Opposed ....T-head ....In block ....
   Removable head.........Removable cylinder sleeve...........
6. Bore........................in. Stroke ....in.
7. Compression.........lb. gage pressure.
8. Normal R.P.M............
9. Valves. Make.........................Type ....
   Diameter, inlet valve, clear....in.; inlet valve, lift....in.
   Diameter, exhaust valve, clear..in.; exhaust valve, lift..in.
   Valves. Material ....
10. Valve spring pressure at closed position.
    Intake...............lb. Exhaust ....lb.
11. Piston weight with rings...........................lb............oz.
    Piston material ....
12. Piston clearance (for diameters).
    First land..............in. Third land.................in.
    Second land ....in. Skirt ....in.
13. Piston rings. Number...............Width..................in.
    Make or type...
    *Expansion pressure..........................oz.
14. Piston rings. Diameter.................Wall thickness...........
15. Oscillating bearing. Length..............................
16. Piston-pin bearing. Type (mark X for a, b, or c).
    (a) Bearnig in piston bosses..........................
    (b) Bearing in connecting-rod end....................
    (c) Bearing in both...................................
    Method of holding piston pin...........................
17. Governor: Make.......................Type...... { Open .... / Enclosed .... }
18. Connecting-rod. Length (c to c)..............................in.
    Bearing cap bolts: No....................Dia..................in.
    Connecting-rod bearing: { Type........................Make........ / Diameter.........in. Length.....in. / Material........................ }
    Weight of connecting-rod complete with all bolts, nuts, bearings and piston-pin in place..............lb...........oz.
19. Crankshaft: Kind of steel.........Heat-treatment..............
20. Main crankshaft bearings. Number......... Type.........

Dimensions of Each Bearing.

	Diameter	Length	Material
Front	....	in..............	in..............
Second	....	in..............	in..............
Middle	....	in..............	in..............
Fourth	....	in..............	in..............
Rear	....	in..............	in..............

(Rear is flywheel end)

21. Flywheel. Diameter....................in. Weight...............lb.
22. Method of attaching (mark X):
    Flange ....Taper............Straight..............
23. Cams (mark X):
    Integral ....Separate..................
24. Camshaft bearings. Number................

	Diameter	Length	Material
Front	....	in..............	in..............
Second	....	in..............	in..............
Middle	....	in..............	in..............
Fourth	....	in..............	in..............
Rear	....	in..............	in..............

*Give pressure in ounces, as applied on the diameter 90-deg. distant from the diameter through the saw cut, which will just bring the ends of the ring together.

25. Timing gears (mark X for a or b):
    (a) Spur........................(b) Helical ....
    Crankshaft gear material..................................
    Camshaft gear material ....
26. Engine weight, complete with carbureter and ignition equipment..............lb.
27. Lubrication system (mark X except in g):
    (a) Circulating............ (f) Drilled crankshaft ....
    (b) Non-circulating........... (g) Mechanical lubricator ....
    (c) Pressure feed .... Make ....
    (d) Gravity feed .... (h) Rink type ....
    (e) Splash ....
28. Lubricating camshaft (mark X):
    Independent lead.........Pressure..........Splash..........
29. Piston lubrication (mark X):
    Splash ....Pressure ....
30. Lubricating oil capacity...gal.
31. Oil-pump type (mark X):
    Plunger ....Gear ....Individual...............
32. Oil-pump location ....
33. Ignition system. Make...................................
    Type (mark X):
    Magneto ........H.T......L.T.......Direct. of Rot..........
    Impulse coupling............Make ....
    Battery ....Make......Type......Volts......Amp. hrs.....
34. Starting device ....Make ....Volts........
35. Spark-plugs. Make..........Size ....Type { Extension.... / Standard..... }
36. Carbureter. Make..............Model..............Size..........
37. Exhaust—heat used for (mark X):
    Air...............................Fuel............................
    Mixture in carbureter.........Mixture in manifold..........
38. Hot-water jacket on (mark X):
    Carbureter ....Manifold.....................
39. Water injected with fuel—Yes................No..................
40. Fuel supply. Type (mark X):
    (a) Gravity...
    (b) Pump ....
    (c) Vacuum tank ....
41. Fuel tanks. Number..................
    Capacity, gal............gasoline.
    Capacity, gal............kerosene.
42. Air cleaner. Make.......................Size..................
    (mark X) (a) Dry.......................... (b) Water..........
43. Radiator. Make...
    Core: { Height ....in. / Width ....in. / Thickness ....in. / Sectional ....in. }
44. Cooling system. Capacity........gal.; cooling fluid..............
45. Cooling system. Circulation:
    Thermosyphon ....
    Type ....
    Pump: Delivery, gal. per minute at normal R.P.M.........
46. Cooling system. Air circulation:
    Exhaust ....Make ....
    Fan .... { Diameter..........in. / Normal engine speed........R.P.M. / Type of drive .... }
47. Belt pulley. Make.......................R.P.M...............
    Material ....
    Diameter ....Face......................
48. Belt-pulley drive. Type (mark X):
    Gear ....Direct..........................
    Equipped with independent clutch.......
    Brake ....
49. Belt-pulley bearings. Make.................................
    Type (mark X):

	Bore	O. D.	Width
Roller	....	....	....
Ball	....	....	....
Plain	....	....	....

50. Transmission. Make............Type, open.......Enclosed........
51. Clutch. Type:
    Transmission ....Make........Size...in.
    Belt ....Make........Size...in. Ply.......
52. Reductions (pairs of gears) engine to drive wheel, No..........

Reduction	Type of Gearing	Pitch	Face	Material	Finish	Heat Treatment
1st	......	......	......	......	......	......
2nd	......	......	......	......	......	......
3rd	......	......	......	......	......	......
Final reduction	......	......	......	......	......	......
Reverse	......	......	......	......	......	......

Shaft Bearings

	Type	Bore	Outside Diameter	Width	Material
1st shaft..	......	......	......	......	......
2nd shaft ..	......	......	......	......	......
3rd shaft..	......	......	......	......	......
4th shaft ..	......	......	......	......	......
Reverse ..	......	......	......	......	......

53. Differential. Open..............Enclosed........Make.........
54. Differential gearing. Type (mark X):
    Bevel ....
    Spiral ....
    Spur ....
    Material ....
    Interlocking ....
    Finish ....
55. Differential main bearings. Make..............................
    Type (mark X):

	Bore	O. D.	Width
Roller	....	....	....
Ball	....	....	....
Plain	....	....	....

    Thrust bearing. Make...................Type..................
56. Locking differential. Yes...................No..................
57. Final drive. Type (mark X):
    Through axle .... } { Gear.......................
    Through spokes .... } { Chain......................
    Through rim .... }

58. Traction speeds at normal engine R.P.M.:
(Also mark by X speed normally used for plowing.)
Speed M.P.H.
1st (..)....................
2nd (..)....................
3rd (..)....................
4th (..)....................
Reverse....................
59. Driving wheels. Number..................
Cast solid ....
Section of spoke..........sq. in. Shape of section..........
Built-up or cast in..
Dia............in. Face..........in.
Note—If tracklaying type, No. of tracks....................
Length............in. Face............in.
60. Drive-wheel axle. Type and mounting (*mark* X):
Stationary .... Spring ....
Live .... Rigid ....
Dia. ....in. Material ....
Bearings, Make ....
Type (*mark* X):

	Bore	O. D.	Width
Roller	....	....	....
Ball	....	....	....
Plain	....	....	....

61. Non-drive wheels. Number............
Cast solid ....
Section of spokes........sq. in. Shape of section..........
Built-up or cast in..
Dia............in. Face............in.
62. Guide wheels. Number.......Dia......in..........Face......in.
Position ....Mounting .... { Spring............ { Rigid............
Spindle dia......................Material ....
Spindle bearings. Make............
Type (*mark* X):

	Bore	O. D.	Width
Roller	....	....	....
Ball	....	....	....
Plain	....	....	....

63. Steering arrangement { Knuckle type .... { Swinging axle..........................
Reversible ....Irreversible ....
64. Static weight on wheels (without water, fuel or oil):
On non-drive ....lb. On drive wheels............lb.
............lb. ....lb.
65. Frame. Type (*mark* X):
Pressed ....Make......................
Structural ....Material...................
Cast ....
66. Side members shape and size..............................
67. Wheelbase c to c of front and rear wheels..........ft........in.
Gage ....ft........in.
(a) Total width over all..........................ft........in.
(b) Total width over rims........................ft........in.
Length over all..
68. Turning radius (one-half diameter greatest track circle)........
69. Drawbar height. High................Low..................
(S. A. E. Standard, 17 in.)
70. Drawbar swivelled. Yes....................No..................
71. Extension rims. Width.....................................in.
72. Lugs. Type ....Size.................
73. Clearance at lowest point..................................in.
74. Total weight of tractor (less fuel, oil, water and lugs)........lb.
75. Domestic shipping weight including standard equipment and blocking.............lb.
76. Boxing for export. Number of boxes..........................
For cubical contents and weight of each box:

Box No.	Contents, Cu. Ft.	Weight, Lb.
1..................	....	....
2..................	....	....
3..................	....	....
4..................	....	....
5, etc..............	....	....

TRACTOR DRAWBAR RATING

The drawbar rating shall be 80 per cent of the horsepower that the tractor is guaranteed to develop at the drawbar continuously for two hours, the tractor being in good condition and properly operated at rated engine speed. The tests should be taken on ground sufficiently firm to give the traction wheels a good footing, a firm sod being preferable.

HEIGHT OF TRACTOR DRAWBAR

The standard height of drawbar shall be 17 in. for both plowing and other work.

PLOWING SPEED

The standard tractor speed for plowing shall be 2½ m.p.h. for tractors of 15 drawbar hp. and under.

MAGNETO DIMENSIONS

Magnetos for tractors shall be made to S. A. E. Standard dimensions as shown in S. A. E. Handbook, Vol. I, pages 36 and 36xa.

The magneto drive shaft on the engine shall be 0.750 in. diameter, the magneto coupling to be attached to this shaft by a key and pin.

TRACTOR BELT POWER RATING

The belt horsepower rating shall be 80 per cent of the horsepower the engine is guaranteed to deliver at the belt pulley continuously for two hours, the engine being in good condition and properly operated at rated speed.

TRACTOR BELT SPEED

A belt speed of 2600 ft. per min. at the crown of the pulley shall be used for all tractors, this being a speed which will meet the widest range of conditions.

TRACTOR BELT AND PULLEY WIDTHS

Belt pulleys for tractors shall be as large as possible, and the widths vary according to the horsepower delivered, as shown in the following table:

Horsepower	Pulley Widths, In.	Max. Belt Widths, In.
Under 20	6½	6
20 to 30 inc..........	7½	7
Above 30.............	To be determined	

It is intended that the maximum belt widths shall be ½ in. less than pulley widths

S. A. E. STEELS FOR TRACTORS

S. A. E. Steel No. 1020 is recommended for all ordinary hot and cold-rolled shafting, gear blanks and shapes; also for cold-rolled bars for general use.

S. A. E. Steel No. 1045 is recommended for all hot and cold-rolled special shafting where a hard surface is needed.

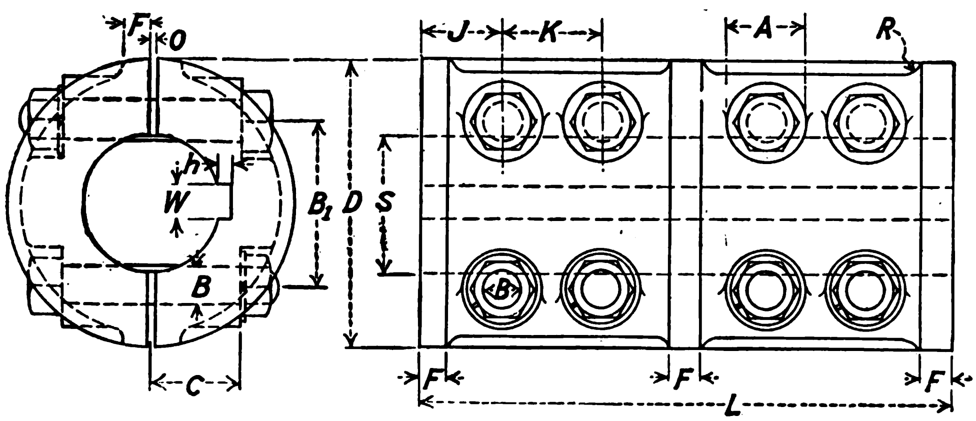
TRACTOR SCREWS AND BOLTS

In tractor engines, S. A. E. Standard screws for tapped holes shall be used, except in soft material such as cast-iron, brass, bronze or aluminum, where U. S. Standard screws shall be used.

In general tractor construction bolts and screws of the U. S. or S. A. E. Standard pitches, with square or hexagon heads, shall be used. They shall be limited to ⅛-in. steps above ½-in. diameter, and 1/16-in. steps below ½-in. down to and including ¼-in. diameter.

TRACTOR CARBURETER FLANGES

All oversize carbureters shall be equipped with the next size larger S. A E. Standard flange than the flange standardized for the nominal carbureter opening. (For example, on a 1⅝-in. oversize carbureter, the flange shall be the same as for the 1½-in. nominal.)



Marine shaft coupling
(See table on page 165)

Dimensions for Marine Drive Shaft Couplings

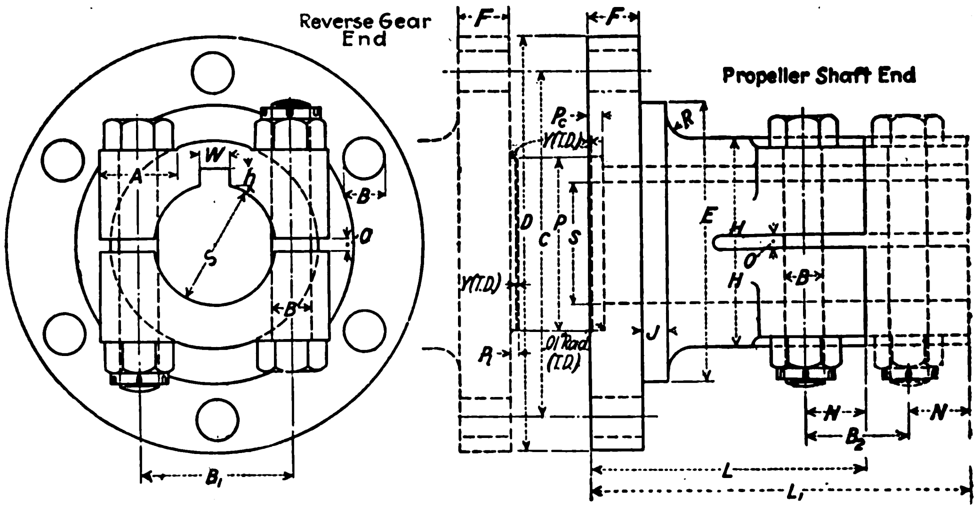
Size No. (See Note)	S	Key-way W	Key-way h	Clamp L	Clamp D	Clamp F	Clamp A	Clamp C	Clamp R	Clamp O	Bolts, S. A. E. No.	Bolts, S. A. E. *B	Bolts, S. A. E. †Thds. S.A.E.	Bolts, S. A. E. B1	Bolts, S. A. E. J	Bolts, S. A. E. K
PS- 8	1	1/4	1/8	5	2 3/4	1/4	7/8	3/4	1/8	1/8	8	3/8	24	1 11/32	13/16	1
PS- 9	1 1/8	1/4	1/8	5	2 3/4	1/4	7/8	3/4	1/8	1/8	8	7/16	20	1 13/32	13/16	1
PS-10	1 1/4	5/16	5/32	6	3	5/16	15/16	13/16	5/32	1/8	8	7/16	20	1 9/16	15/16	1 5/16
PS-11	1 3/8	3/8	3/16	6	3	5/16	15/16	7/8	5/32	1/8	8	7/16	20	1 11/16	15/16	1 5/16
PS-12	1 1/2	3/8	3/16	6	3 3/8	5/16	1 1/16	7/8	5/32	1/8	8	1/2	20	1 7/8	15/16	1 1/8
PS-13	1 5/8	7/16	7/32	7	3 1/2	7/16	1 3/16	1	7/32	1/8	8	1/2	20	2	1 1/8	1 1/8
PS-14	1 3/4	7/16	7/32	7	4	7/16	1 5/16	1 1/16	7/32	1/8	8	9/16	18	2 3/16	1 1/8	1 1/8
PS-15	1 7/8	1/2	1/4	8	4	7/16	1 5/16	1 1/8	7/32	1/8	8	5/8	18	2 3/8	1 3/16	1 3/8
PS-16	2	1/2	1/4	8	4 3/8	7/16	1 5/16	1 5/16	7/32	1/8	8	5/8	18	2 1/2	1 5/16	1 5/8
PS-18	2 1/4	5/8	5/16	9	5 1/4	9/16	1 1/2	1 5/16	9/32	1/8	8	3/4	16	2 13/16	1 7/16	1 7/8
PS-20	2 1/2	5/8	5/16	10	5 1/2	5/8	1 1/2	1 7/16	5/16	1/8	8	3/4	16	3 1/16	1 9/16	2 1/8
PS-22	2 3/4	3/4	3/8	11	6	11/16	1 3/4	1 9/16	3/8	1/8	8	7/8	14	3 3/8	1 5/8	2 5/16
PS-24	3	3/4	3/8	12	6 1/2	3/4	1 3/4	1 11/16	3/8	3/16	8	7/8	14	3 5/8	1 13/16	2 1/2
PS-26	3 1/4	7/8	7/16	12 1/2	6 3/4	13/16	1 3/4	2 1/8	7/16	3/16	8	7/8	14	3 7/8	2 1/16	2 9/16
PS-28	3 1/2	7/8	7/16	14	7	7/8	2	2 3/8	7/16	5/16	8	1	14	4 1/8	2 1/4	3 11/16
PS-32	4	1	1/2	18	8 1/4	7/8	2	2 7/8	1/2	1/4	12	1	14	4 3/4	2 3/8	2 3/8

SHAFT COUPLING

Dimensions in inches.
NOTE.—In column "Size No." P indicates Propeller Shaft, S indicates Steel, and the figures number of eighths of an inch in shaft diameters.
*Figures in column indicate bolt diameters. Use clearance drill of same nominal size for holes B.
†All threads to be S. A. E. pitch, U. S. Form.

REVERSE COUPLING—CAST IRON

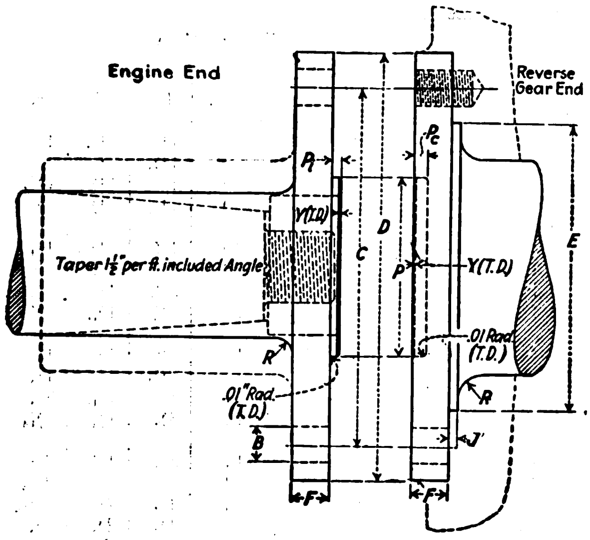
(T. D.) indicates Tooling Dimension. Dimensions in inches.
NOTE.—In column "Size No." R indicates Reverse Gear, P indicates Propeller Shaft, C indicates Cast Iron, and the figures number of eighths of an inch in shaft diameters.
*Pilot tolerance, + 0.000, — 0.001 in. Pilot recess tolerance, + 0.001, — 0.000 in. per inch diameter.
†Figures in column indicate bolt diameters. Use clearance drill of same nominal size for holes B in flange.
‡All threads to be S. A. E. pitch, U. S. Form.



Marine reverse gear cast-iron coupling (See table below)

Dimensions of Marine Reverse Gear Couplings

Size No. (See Note)	S	Keyway W	Keyway h	Flange D	Flange E	Flange F	Flange J	Pilot *P	Pilot P1	Pilot Pe	Pilot Y	Hub H	Hub L	Hub L1	Hub N	Hub B1	Hub B2	Hub R	Hub O	Hub A	Bolts, S. A. E. No.	Bolts, S. A. E. †B	Bolts, S. A. E. ‡Thds. per In.	Bolts, S. A. E. C
RPC- 6	3/4	3/16	3/32	4	2 13/32	1/2	1/8	1 3/8	1/16	1/8	1/64	2	2	....	5/8	1 1/16	....	1/8	1/8	3/8	4	3/8	24	3
RPC- 7	7/8	3/16	3/32	4	2 13/32	1/2	1/8	1 3/8	1/16	1/8	1/64	2	2	....	5/8	1 3/16	....	1/8	1/8	3/8	4	3/8	24	3
RPC- 8	1	1/4	1/8	4	2 13/32	1/2	1/8	1 3/8	1/16	1/8	1/64	2	2	....	5/8	1 9/32	....	1/8	1/8	3/8	4	3/8	24	3
RPC- 9	1 1/8	1/4	1/8	5	3 13/32	5/8	3/16	2	1/8	3/16	1/32	2 1/2	2 1/2	....	3/4	1 13/32	....	3/16	3/32	3/8	6	7/16	20	4
RPC-10	1 1/4	5/16	5/32	5	3 13/32	5/8	3/16	2	1/8	3/16	1/32	2 1/2	2 1/2	....	3/4	1 9/16	....	3/16	3/32	3/8	6	7/16	20	4
RPC-11	1 3/8	3/8	3/16	5	3 13/32	5/8	3/16	2	1/8	3/16	1/32	2 1/2	2 1/2	....	3/4	1 11/16	....	3/16	3/32	3/8	6	7/16	20	4
RPC-12	1 1/2	3/8	3/16	6	4 3/16	5/8	5/8	2 1/2	1/8	3/16	1/32	3	....	4	7/8	1 15/16	1 1/2	3/8	5/16	1 1/8	6	9/16	18	5
RPC-13	1 5/8	7/16	7/32	6	4 3/16	5/8	5/8	2 1/2	1/8	3/16	1/32	3	....	4	7/8	2 1/16	1 1/2	3/8	5/16	1 1/8	6	9/16	18	5
RPC-14	1 3/4	7/16	7/32	6	4 3/16	5/8	5/8	2 1/2	1/8	3/16	1/32	3	....	4	7/8	2 3/16	1 1/2	3/8	5/16	1 1/8	6	9/16	18	5
RPC-15	1 7/8	1/2	1/4	7	4 1/2	1 3/16	7/16	3	3/16	1/4	1/32	4	....	5	1	2 3/8	2	7/16	5/16	1 1/4	6	5/8	18	5 1/2
RPC-16	2	1/2	1/4	7	4 1/2	1 3/16	7/16	3	3/16	1/4	1/32	4	....	5	1	2 1/2	2	7/16	5/16	1 1/4	6	5/8	18	5 1/2
RPC-18	2 1/4	5/8	5/16	8	5 3/8	1 1/8	1/2	3 3/4	1/4	5/16	3/64	4 3/4	....	6	1 1/8	2 13/16	2 1/2	1/2	1/4	1 1/2	6	3/4	16	6 1/2
RPC-20	2 1/2	5/8	5/16	8	5 3/4	1 1/8	1/2	3 3/4	1/4	5/16	3/64	4 3/4	....	6	1 1/8	3 1/16	2 1/2	1/2	1/4	1 1/2	6	3/4	16	6 1/2
RPC-22	2 3/4	3/4	3/8	9	6 3/16	1 3/8	5/8	4 3/4	1/4	5/16	3/64	5 3/4	....	7	1 1/4	3 3/4	3	5/8	5/16	1 3/4	6	7/8	14	7 3/4
RPC-24	3	3/4	3/8	9	6 3/16	1 3/8	5/8	4 3/4	1/4	5/16	3/64	5 3/4	....	7	1 1/4	3 3/4	3	5/8	5/16	1 3/4	6	7/8	14	7 3/4



Engine coupling—steel

MARINE PROPELLER SHAFT COUPLINGS

ENGINE COUPLING—STEEL

The engine end when integral with the engine shaft is shown in full lines on the drawing. When separate, the shaft taper and dimensions are the same as for Reverse Couplings of the corresponding size.

The reverse gear end, as shown by full lines, shall have drilled bolt holes. When the flange is designed integral with the reverse gear, as shown by dotted lines, the bolt holes shall be drilled and tapped for S. A. E. standard cap screws.

These couplings are designed to be made of steel and are intended for high power engines.

NOTES RELATING TO TABLE BELOW

(T. D.) indicates Tooling Dimensions. Dimensions in inches.

NOTE.—In column "Size No." E indicates Engine, R indicates Reverse Gear, and the figures number of eighths of an inch in shaft diameters.

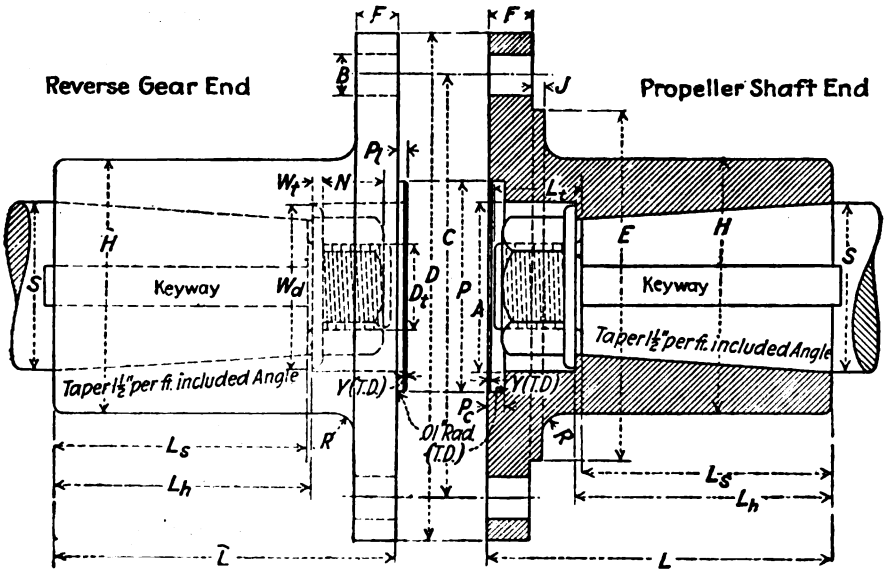
*Pilot tolerance + 0.000, — 0.001 in. per inch of diameter. Pilot recess tolerance, + 0.001, — 0.000 in. per inch of diameter.

†Figures in Column B indicate bolt diameters. Use clearance drill of same nominal size for holes B in flange.

‡All threads to be S. A. E. pitch, U. S. form. See S. A. E. Handbook, Vol. I, sheet 4.

Dimensions for Marine Engine Couplings

Size No. (See Note)	Equiv. Shaft Diam.	Flange					Pilot				Bolts, S. A. E.			
		D	E	F	J	R	*P	P_1	Pc	Y	No.	†B	‡Thds. per In.	C
ER- 8	1	4	2 13/32	3/8	1/8	3/16	1 5/8	1/16	1/8	1/64	4	3/8	24	3
ER- 9	1 1/8													
ER-10	1 1/4	5	3 11/32	7/16	3/16	3/16	2	1/8	3/16	1/32	6	7/16	20	4
ER-11	1 3/8													
ER-12	1 1/2													
ER-13	1 5/8													
ER-14	1 3/4	6	4 1/16	1/2	1/4	1/4	2 1/2	1/8	3/16	1/32	6	9/16	18	5
ER-15	1 7/8													
ER-16	2													
ER-18	2 1/4	7	4 1/2	5/8	5/16	5/16	3	3/16	1/4	1/32	6	5/8	18	5 1/2
ER-20	2 1/2													
ER-22	2 3/4	8	5 3/8	3/4	3/8	3/8	3 3/4	1/4	5/16	3/64	6	3/4	16	6 1/2
ER-24	3													
ER-26	3 1/4	9	6 1/16	7/8	3/8	7/16	4 3/8	1/4	5/16	3/64	6	7/8	14	7 3/8
ER-28	3 1/2													
ER-32	4	10	6 1/2	1	1/2	1/2	5	5/16	3/8	3/64	6	1	14	8



REVERSE COUPLING—STEEL

(See table on page 167)

(T. D.) indicates Tooling Dimension. Dimensions in inches.

NOTE.—In column "Size No." R indicates Reverse Gear, P indicates Propeller Shaft, S indicates Steel, and the figures number of eighths of an inch in shaft diameters.

*Nuts for Size Nos. RPS-26 and RPS-28 use 2¾-in. hex. stock. Nuts for Size No. RPS-32 use 3-in. hex. stock.

†All threads to be S. A. E. pitch, U. S. Form. See S. A. E. Handbook, Vol. I, page 4.

‡Pilot tolerance, + 0.000, — 0.001 in. per inch of diameter. Pilot recess tolerance, + 0.001, — 0.000 in. per inch of diameter.

§Figures in column indicate bolt diameters. Use clearance drill of same nominal size for holes B in flange.

Notes Regarding Materials

When propeller mounts are for use in salt water, bronze or other non-corrosive metal is recommended for all parts of the hub, shaft and fairwater assembly.

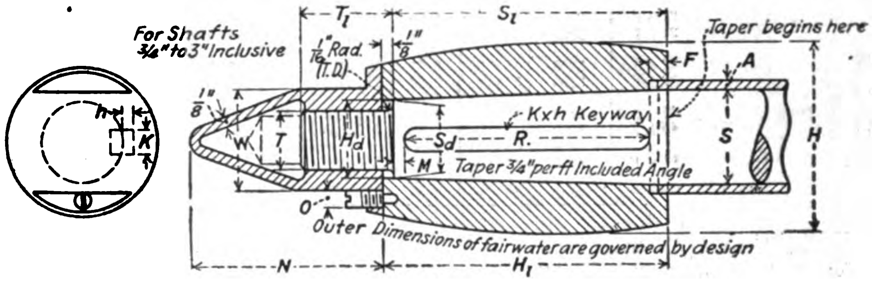
When bronze is used, a tensile strength of 60,000 lb. per sq. in. and an elongation of 28 per cent in 2 inches is recommended. The chemical composition of a bronze conformnig to these physical properties is as follows: Copper, 62 per cent; tin, 1 per cent; spelter, 37 per cent.

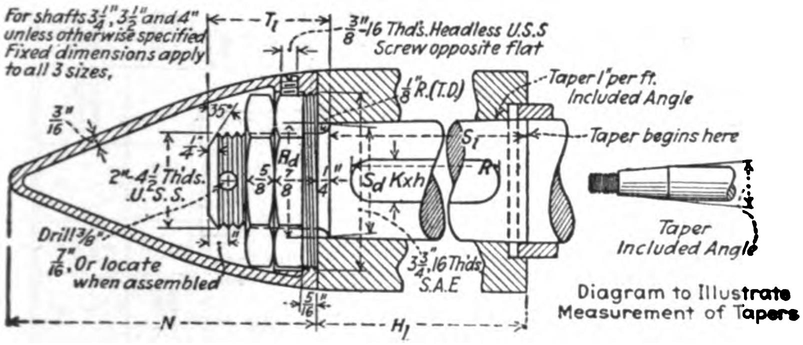
A bronze having similar physical characteristics is commonly known as "Tobin bronze."

Dimensions for Marine Reverse Gear Couplings of Steel

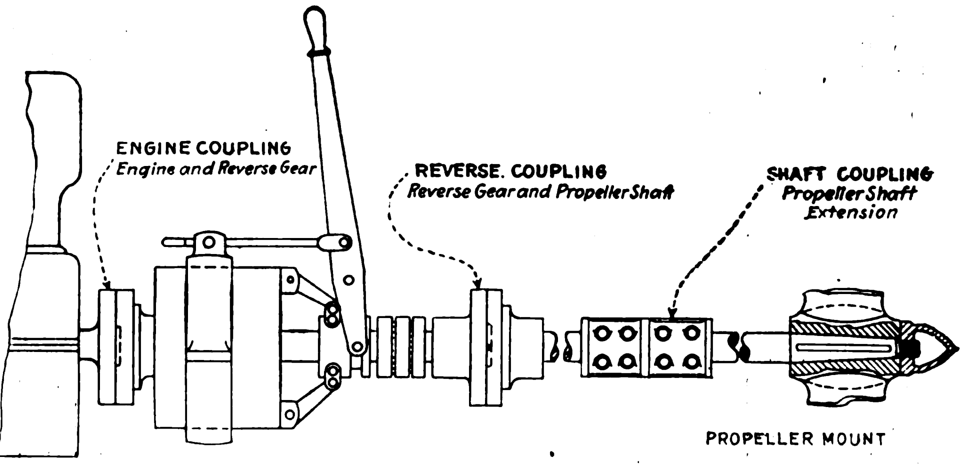
Size No. (See Note)	Shaft and *Nut						Keyway		Washer		Flange					Pilot				Hub				Bolts, S. A. E.		
	S	Ls	Dt	N	†Thds. S.A.E.	Lt	Width	Height	Wd	Wt	D	E	F	J	A	‡P	P₁	Pₑ	Y	H	L	Lₕ	R	No.	§B	C
RPS- 8	1	1 13/16	9/16	7/16	18	5/8	1/4	1/8	1 5/16	1/8	4	2 13/32	5/8	1/16	1 3/8	1 1/8	1/16	1/8	1/64	1 3/8	2 1/2	1 3/8	3/16	4	3/8	3
RPS- 9	1 1/8	1 13/16	9/16	7/16	18	5/8	1/4	1/8	1 5/16	1/8	4	2 13/32	5/8	1/16	1 3/8	1 1/8	1/16	1/8	1/64	1 3/8	2 1/2	1 3/8	3/16	4	3/8	3
RPS-10	1 1/4	2 1/16	3/4	9/16	16	3/4	5/16	5/32	1 7/16	1/8	5	3 11/32	7/16	3/32	1 3/4	2	1/8	3/16	1/32	2 3/8	3	2 1/4	7/32	6	7/16	4
RPS-11	1 3/8	2 1/16	3/4	9/16	16	3/4	3/8	3/16	1 7/16	1/8	5	3 11/32	7/16	3/32	1 3/4	2	1/8	3/16	1/32	2 3/8	3	2 1/4	7/32	6	7/16	4
RPS-12	1 1/2	2 1/16	3/4	9/16	16	3/4	3/8	3/16	1 7/16	1/8	5	3 11/32	7/16	3/32	1 3/4	2	1/8	3/16	1/32	2 3/8	3	2 1/4	7/32	6	7/16	4
RPS-13	1 5/8	2 1/16	3/4	9/16	16	3/4	3/8	3/16	1 7/16	1/8	5	3 11/32	7/16	3/32	1 3/4	2	1/8	3/16	1/32	2 3/8	3	2 1/4	7/32	6	7/16	4
RPS-14	1 3/4	2 11/16	1	3/4	14	1	7/16	7/32	1 11/16	1/8	6	4 1/16	1/2	1/8	2 3/16	2 1/2	1/8	3/16	1/32	3	4	3	1/4	6	9/16	5
RPS-15	1 7/8	2 11/16	1	3/4	14	1	1/2	1/4	1 11/16	1/8	6	4 1/16	1/2	1/8	2 3/16	2 1/2	1/8	3/16	1/32	3	4	3	1/4	6	9/16	5
RPS-16	2	2 11/16	1	3/4	14	1	1/2	1/4	1 11/16	3/16	6	4 1/16	1/2	1/8	2 3/16	2 1/2	1/8	3/16	1/32	3	4	3	1/4	6	9/16	5
RPS-18	2 1/4	3 11/16	1 1/8	13/16	12	1 1/8	5/8	5/16	2 7/16	3/16	7	4 1/2	5/8	1/8	2 1/2	3	3/16	1/4	1/32	3 3/4	5	3 3/8	5/16	6	5/8	5 1/2
RPS-20	2 1/2	3 15/16	1 1/4	13/16	12	1 1/4	5/8	5/16	2 7/16	3/16	7	4 1/2	5/8	1/8	2 1/2	3	3/16	1/4	1/32	3 3/4	5	3 3/8	5/16	6	5/8	5 1/2
RPS-22	2 3/4	4 1/8	1 3/8	7/8	12	1 1/4	3/4	3/8	2 11/16	1/4	8	5 3/8	3/4	1/8	3	3 3/8	1/4	5/16	3/64	4 3/8	5 1/2	4 1/4	3/8	6	3/4	6 1/2
RPS-24	3	4 5/8	1 3/8	7/8	12	1 1/4	3/4	3/8	2 11/16	1/4	8	5 3/8	3/4	1/8	3	3 3/8	1/4	5/16	3/64	4 3/8	6	4 3/4	3/8	6	3/4	6 1/2
RPS-26	3 1/4	5 3/16	1 1/2	7/8	12	1 3/8	7/8	7/16	3 3/16	1/4	9	6 1/16	7/8	3/16	3 3/4	4 3/8	1/4	5/16	3/64	5	7	5 3/8	7/16	6	7/8	7 3/8
RPS-28	3 1/2	5 7/16	1 5/8	7/8	12	1 5/8	7/8	7/16	3 7/16	1/4	9	6 1/16	7/8	3/16	3 3/4	4 5/8	1/4	5/16	3/64	5	7	5 5/8	7/16	6	7/8	7 5/8
RPS-32	4	6 1/4	2	1 5/16	12	1 1/2	1	1/2	3 15/16	5/16	10	6 1/2	1	5/16	4 1/4	5	5/16	3/8	3/64	6	8	6 1/2	1/2	6	1	8

Shaft and Hub Taper Fits





The small end of the shaft and hub tapers (Sd and Hd in the drawings and table) are the governing dimensions which insure proper assembly of varying hub lengths on the shaft, and clearance between the end of the shaft taper and the bottom of the shaft nut.



MOTORBOAT TRANSMISSION ASSEMBLY

Drawing indicates the order in which the recommended couplings and propeller mount are assembled.

NOTES ON AERONAUTIC TURNBUCKLE DIMENSIONS

FACTORS CONTROLLING INTERCHANGEABILITY

The Recommended Practice for Turnbuckle Dimensions is not intended to limit design, but rather to aid manufacturers in designing, and so eliminate all differences that would otherwise interfere with interchangeability. The dimensions of the slot and the pin diameter in the fork end, and size of hole in the eye end, are the most important factors influencing interchangeability.

THREAD FITS, PROTECTIVE COATING AND INSPECTION METHOD

The fit of the threads in the barrel, the protective coating and method of inspection are to be specified by the purchaser. As a matter of information, the present practice for threads requires that they must have a snug, true fit, allowing barrel or shank to be turned by hand, and showing no perceptible slackness in fit or end-shake with three threads exposed.

TURNBUCKLE STRENGTHS

The turnbuckle strengths in the tables are for 19-strand steel wire cable (see S. A. E. Handbook, Vol. I, pages 45pc and 45pd). Breaking strength of spliced cable is about 10 per cent less than undisturbed cable. Yielding point of solid wire loops is about 20 per cent less than specified wire strength.

MEASUREMENT OF TAKE-UPS

Take-ups are measured with the threads of the turnbuckle ends flush with the ends of the barrel.

The amount of take up for each turnbuckle end is measured from the end of the barrel to a point on the radius f/2, on the detail drawings, which would strike the barrel threads. In some cases the take-up is limited to the distance from the inner end of the Eye, Fork or Clevis End to the near side of the spanner hole.

The total take-up is equal to twice that of the end having the least take-up.

Aeronautic Turnbuckle Dimensions

GENERAL ASSEMBLY

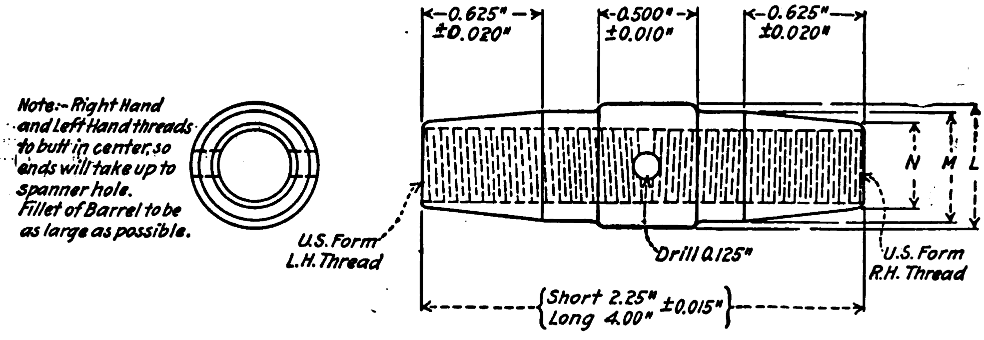
S. A. E. Symbols (See Key)	Strength, Lb.	Cable Diameter	Approx. Take-up See Note 1	A See Note 2	c See Note 3	D	E Threads, U. S. Form	f	G See Note 4	H	J	V Thimble Radius
Tolerances	....	....	....	+.010 −.000	+.006 −.000	+.010 −.000	+.0000 −.0040	+.010 −.005	+.010 −.000	+.010 −.005	+.005 −.005	....
16 S F	1600	.109 (7/64)	1.04	.219 (7/32)	.133	.188 (3/16)	.1900 (No. 10)–32	.313 (5/16)	.150	.469 (15/32)	.188 (3/16)	.175
16 L F	1600	.109 (7/64)	2.79	.219 (7/32)	.133	.188 (3/16)	.1900 (No. 10)–32	.313 (5/16)	.150	.469 (15/32)	.188 (3/16)	.175
21 S F	2100	.125 (1/8)	1.00	.219 (7/32)	.155	.188 (3/16)	.2160 (No. 12)–28	.313 (5/16)	.150	.500 (1/2)	.188 (3/16)	.175
21 L F	2100	.125 (1/8)	2.75	.219 (7/32)	.155	.188 (3/16)	.2160 (No. 12)–28	.313 (5/16)	.150	.500 (1/2)	.188 (3/16)	.175
32 S F	3200	.156 (5/32)	0.61	.281 (9/32)	.189	.250 (1/4)	*.2500 (1/4)–28	.438 (7/16)	†.203 (13/64)	.625 (5/8)	.219 (7/32)	.200
32 L F	3200	.156 (5/32)	2.36	.281 (9/32)	.189	.250 (1/4)	*.2500 (1/4)–28	.438 (7/16)	†.203 (13/64)	.625 (5/8)	.219 (7/32)	.200
46 S F	4600	.188 (3/16)	0.64	.313 (5/16)	.243	.250 (1/4)	*.3125 (5/16)–24	.438 (7/16)	†.203 (13/64)	.625 (5/8)	.281 (9/32)	.250
46 L F	4000	.188 (3/16)	2.39	.313 (5/16)	.243	.250 (1/4)	*.3125 (5/16)–24	.438 (7/16)	†.203 (13/64)	.625 (5/8)	.281 (9/32)	.250
61 L F	6100	.219 (7/32)	2.08	.344 (11/32)	.256	.375 (3/8)	*.3750 (3/8)–24	.563 (9/16)	†.203 (13/64)	.750 (3/4)	.281 (9/32)	.300
80 L F	8000	.250 (1/4)	2.00	.375 (3/8)	.308	.375 (3/8)	*.3750 (3/8)–24	.563 (9/16)	†.266 (17/64)	.781 (25/32)	.328 (21/64)	.350

KEY TO SYMBOLS.—The numbers indicate the turnbuckle strength in hundred pounds. The following letter, "Short" or "Long." The last letter indicates whether Fork (*F*) or Clevis (*C*) End is used in combination with Eye End. When the turnbuckle make-up calls for ends to be alike, one end shall have right hand, and the other end left hand, thread.

*Tolerance is + 0.0000 in., — 0.0060 in. †Tolerance is + 0.015 in., — 0.0000 in. Dimensions in inches.

NOTES.—1. Total take-ups for Eye End and Fork End assembly.
2. Will take 0.0180 in. serving. Use same size thimble as cable size.
3. Allows approximately 0.0150 in. on diameter below root diameter of thread.
4. Four clip thicknesses, 1/10, 1/8, 3/16, 1/4 in.

For further Notes on Aeronautic Turnbuckle Dimensions, see S. A. E. Handbook, Vol. I, page 45uj.



TURNBUCKLE BARREL

S. A. E. Symbols (See Key)	Strength, Lb.	Naval Brass Bureau of Aircraft Production Specification No. 11030, or Equivalent, Ultimate Strength 67,000 Lb. per Sq. In. — E Threads, U. S. Form	L	M	N
Tolerances	......	+.0000 −.0040	+.005 −.005	+.005 −.005	+.005 −.005
16 S F	1600	.1900 (No. 10)–32	.375 (3/8)	.281 (9/32)	.250 (1/4)
16 L F	1600	.1900 (No. 10)–32	.375 (3/8)	.281 (9/32)	.250 (1/4)
21 S F	2100	.2160 (No. 12)–28	.375 (3/8)	.328 (21/64)	.281 (9/32)
21 L F	2100	.2160 (No. 12)–28	.375 (3/8)	.328 (21/64)	.281 (9/32)
32 S F	3200	*.2500 (1/4)–28	.438 (7/16)	.391 (25/64)	.328 (21/64)
32 L F	3200	*.2500 (1/4)–28	.438 (7/16)	.391 (25/64)	.328 (21/64)
46 S F	4600	*.3125 (5/16)–24	.500 (1/2)	.438 (7/16)	.406 (13/32)
46 L F	4600	*.3125 (5/16)–24	.500 (1/2)	.438 (7/16)	.406 (13/32)
61 L F	6100	*.3750 (3/8)–24	.625 (5/8)	.594 (19/32)	.469 (15/32)
80 L F	8000	*.3750 (3/8)–24	.625 (5/8)	.594 (19/32)	.469 (15/32)

BARREL

KEY TO SYMBOLS. — The numbers indicate the turnbuckle strength in hundred pounds. The following letter "Short" or "Long." The last letter indicates whether Fork (*F*) or Clevis (*C*) End is used in combination with Eye End. When the turnbuckle make-up calls for both ends to be alike, one end shall have right hand, and the other left hand, thread.

*Tolerance is + 0.0000 in., — 0.0060 in. Dimensions in inches.

TURNBUCKLE EYE END

S. A. E. Symbols (See Key)	Strength, Lb.	Approx. Take-up	A See Note 1	B See Note 2	e See Note 3	E Threads, U. S. Form	f	I	J	R See Note 4	S	V Thimble Radius	Y See Note 5	Z
Tolerances	...	......	+.010 −.000	+.005 −.005	+.006 −.000	+.0000 −.0040	+.010 −.005	...	+.005 −.005	......	+.007 −.007	....	+.010 −.000	+.030 −.010
16 S F	1600	0.80	.219 (7/32)	.28	.133	.1900 (No. 10)-32	.313 (5/16)	.03	.188 (3/16)	.326	.500 (1/2)	.175	.505	1.125 (1 1/8)
16 L F	1600	1.67	.219 (7/32)	.28	.133	.1900 (No. 10)-32	.313 (5/16)	.03	.188 (3/16)	.326	.500 (1/2)	.175	.505	2.000
21 S F	2100	0.59	.219 (7/32)	.28	.155	.2160 (No. 12)-28	.313 (5/16)	.03	.188 (3/16)	.328	.500 (1/2)	.175	.557	1.125 (1 1/8)
21 L F	2100	1.47	.219 (7/32)	.28	.155	.2160 (No. 12)-28	.313 (5/16)	.03	.188 (3/16)	.328	.500 (1/2)	.175	.557	2.000
32 S F	3200	0.69	.281 (9/32)	.353	.189	*.2500 (1/4)-28	.438 (7/16)	.04	.219 (7/32)	.402	.625 (5/8)	.200	.625 (5/8)	1.125 (1 1/8)
32 L F	3200	1.56	.281 (9/32)	.353	.189	*.2500 (1/4)-28	.438 (7/16)	.04	.219 (7/32)	.402	.625 (5/8)	.200	.625 (5/8)	2.000
46 S F	4600	0.68	.313 (5/16)	.384	.243	*.3125 (5/16)-24	.438 (7/16)	.04	.281 (9/32)	.465	.688 (11/16)	.250	.750 (3/4)	1.125 (1 1/8)
46 L F	4600	1.56	.313 (5/16)	.384	.243	*.3125 (5/16)-24	.438 (7/16)	.04	.281 (9/32)	.465	.688 (11/16)	.250	.750 (3/4)	2.000
61 L F	6100	1.55	.344 (11/32)	.435	.256	*.3750 (3/8)-24	.563 (9/16)	.06	.281 (9/32)	.503	.750 (3/4)	.300	.875 (7/8)	2.000
80 L F	8000	1.37	.375 (3/8)	.498	.306	*.3750 (3/8)-24	.563 (9/16)	.06	.328 (21/64)	.619	.875 (7/8)	.350	.875 (7/8)	2.000

KEY TO SYMBOLS.—The numbers indicate the turnbuckle strength in hundred pounds. The following letter, "Short" or "Long." The last letter indicates whether Fork (F) or Clevis (C) End is used in combination with Eye End. When the turnbuckle make-up calls for ends to be alike, one end shall have right hand, and the other left hand, thread.

*Tolerance is +0.0000 in., −0.0060 in. Ultimate strength, 125,000 lb. per sq. in. Dimensions in inches.

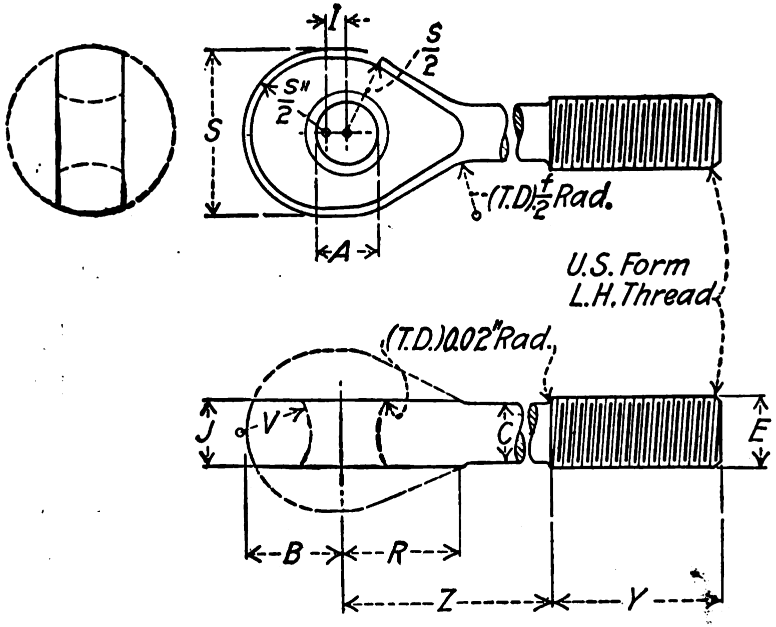
NOTES.—1. Will take 0.018 in. serving. Use same size thimble as cable size.

2. Equals $\frac{S}{2}+I$.

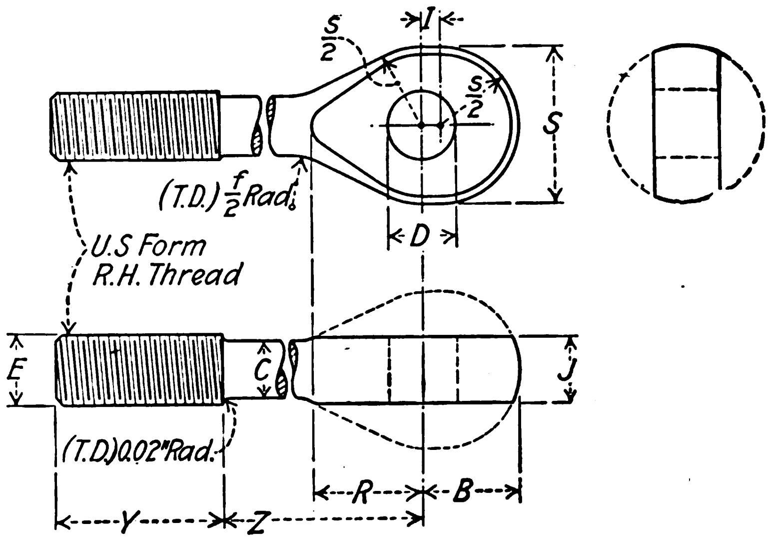
3. Allows approximately 0.0150 in. on diameter below root diameter of thread.

4. Equals $\frac{S+e}{2}$, approximately.

5. Equals 2 E+0.125 in



Eye end of turnbuckle



Clevis end of turnbuckle

TURNBUCKLE CLEVIS END

S. A. E. Symbols (See Key)	Strength, Lb.	Approx. Take-up,	B See Note 1	e See Note 2	D	E Threads, U. S. Form		I	J	R See Note 3	S	Y See Note 4	Z
Tolerances	....	....	+.005 −.005	+.006 −.000	+.010 −.000	+.0000 −.0040	+.010 −.005	...	+.005 −.005	.....	+.007 −.007	+.040 −.000	+.030 −.010
16 S F	1600	0.80	.28	.133	.188 (3/16)	.1900 (No. 10)-32	313 (5/16)	03	188 (3/16)	.326	500 (1/2)	.505	1.125 (1 1/8)
16 L F	1600	1.67	.28	.133	.188 (3/16)	.1900 (No. 10)-32	313 (5/16)	03	188 (3/16)	.326	500 (1/2)	.505	2.000
21 S F	2100	0.59	.28	.155	.188 (3/16)	2160 (No. 12)-28	313 (5/16)	03	188 (3/16)	.328	500 (1/2)	.557	1.125 (1 1/8)
21 L F	2100	1.47	.28	.155	.188 (3/16)	.2160 (No. 12)-28	313 (5/16)	03	.188 (3/16)	.328	.500 (1/2)	.557	2.000
32 S F	3200	0.69	.353	.189	.250 (1/4)	*.2500 (1/4)-28	438 (7/16)	04	219 (7/32)	.402	.625 (5/8)	.625 (5/8)	1.125 (1 1/8)
32 L F	3200	1.56	.353	.189	.250 (1/4)	*.2500 (1/4)-28	438 (7/16)	.04	.219 (7/32)	402	.625 (5/8)	.625 (5/8)	2.000
46 S F	4600	0.68	.384	.243	250 (1/4)	*.3125 (5/16)-24	438 (7/16)	.04	281 (9/32)	.465	.688 (11/16)	.750 (3/4)	1.125 (1 1/8)
46 L F	4600	1.56	.384	.243	.250 (1/4)	*.3125 (5/16)-24	438 (7/16)	.04	281 (9/32)	.465	.688 (11/16)	.750 (3/4)	2.000
61 L F	6100	1.55	.435	.256	.375 (3/8)	*.3750 (3/8)-24	.563 (9/16)	.06	281 (9/32)	.503	.750 (3/4)	.875 (7/8)	2.000
80 L F	8000	1.37	.498	.306	.375 (3/8)	*.3750 (3/8)-24	.563 (9/16)	.06	.328 (21/64)	.619	.875 (7/8)	.875 (7/8)	2.000

KEY TO SYMBOLS.—The numbers indicate the turnbuckle strength in hundred pounds. The following letter, "Short" or "Long." The last letter indicates whether Fork (F) or Clevis (C) End is used in combination with Eye End. When the turnbuckle make-up calls for ends to be alike, one end shall have right hand, and the other left hand, thread.

*Tolerance is +0.0000 in. −0.0060 in. Dimensions in inches.

NOTES.—1. Equals $\frac{S}{2}+I$.

2. Allows approximately 0.015 in. on diameter below root diameter of thread.

3. Equals $\frac{S+e}{2}$, approximately.

4. Equals 2 E+0.125 in.

TURNBUCKLE FORK END

S. A. E. Symbols (See Key)	Strength, Lb.	Approx. Take-up	e See Note 1	D	E Threads, U. S. Form		G See Note 2	H	I	Q	S	§W Min.	Y See Note 3	Z
Tolerances	....	....	+.006 −.000	+.010 −.000	+.0000 −.0040	+.010 −.005	+.010 −.000	+.010 −.005	...	....	+.007 −.007	....	+.040 −.000	+.030 −.010
16 S F	1600	0.520	.133	188 (3/16)	.1900 (No. 10)-32	.313 (5/16)	.150	.469 (15/32)	.03	.250 (1/4)	.500 (1/2)	.074	.505	1 125 (1 1/8)
16 L F	1600	1.395	.133	188 (3/16)	.1900 (No. 10)-32	.313 (5/16)	.150	.469 (15/32)	.03	.250 (1/4)	.500 (1/2)	.074	.505	2.000
21 S F	2100	0.500	.155	.188 (3/16)	.2160 (No. 12)-28	.313 (5/16)	.150	.500 (1/2)	.03	.250 (1/4)	.500 (1/2)	.074	.557	1.125 (1 1/8)
21 L F	2100	1.375	.155	.188 (3/16)	.2160 (No. 12)-28	.313 (5/16)	.150	.500 (1/2)	.03	.250 (1/4)	.500 (1/2)	.074	.557	2.000
32 S F	3200	0.306	.189	.250 (1/4)	*.2500 (1/4)-28	.438 (7/16)	†.203 (13/64)	.625 (5/8)	.04	.297 (19/64)	.625 (5/8)	.108	.625 (5/8)	1 125 (1 1/8)
32 L F	3200	1.181	.189	.250 (1/4)	*.2500 (1/4)-28	.438 (7/16)	†.203 (13/64)	.625 (5/8)	.04	.297 (19/64)	.625 (5/8)	.108	.625 (5/8)	2.000
46 S F	4600	0.320	.243	.250 (1/4)	*.3125 (5/16)-24	.438 (7/16)	†.203 (13/64)	.625 (5/8)	.04	.344 (11/32)	.688 (11/16)	.108	.750 (3/4)	1 125 (1 1/8)
46 L F	4600	1 195	.243	.250 (1/4)	*.3125 (5/16)-24	.438 (7/16)	†.203 (13/64)	.625 (5/8)	.04	.344 (11/32)	.688 (1)	.108	.750 (3/4)	2.000
61 L F	6100	1.040	.256	.375 (3/8)	*.3750 (3/8)-24	.563 (9/16)	†.203 (13/64)	.750 (3/4)	.06	.375 (3/8)	.750 (3/4)	.170	.875 (7/8)	2.000
80 L F	8000	1.000	.306	.375 (3/8)	*.3750 (3/8)-24	.563 (9/16)	†.266 (17/64)	.781 (25/32)	.06	.453 (29/64)	.875 (7/8)	.139	.87 (7/8)	2.000

Dimensions of Aircraft Turnbuckles

KEY TO SYMBOLS IN THE TABLE ABOVE.—The numbers indicate the turnbuckle strength in hundred pounds. The following letter, "Short" or "Long." The last letter indicates whether Fork (*F*) or Clevis (*C*) End is used in combination with Eye End. When the turnbuckle make-up calls for ends to be alike, one end shall have right hand, and the other left hand, thread.

Dimensions in inches.
Ultimate strength, 125,000 lb. per sq. in.
*Tolerance is +0.0000 in.,—0.0060 in.
†Tolerance +0.0150 in.,—0.0000 in.

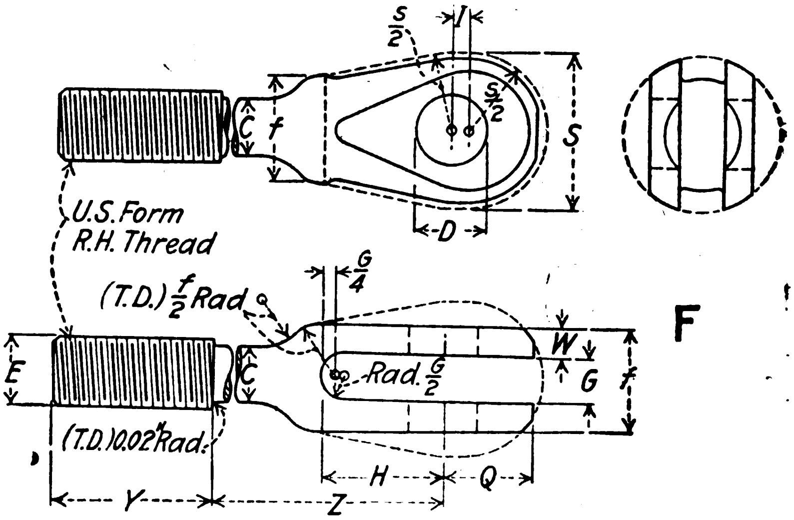
§To prevent off-centering of slot it is recommended that time thickness be governed by formula $W\ (min.) = \frac{F\ (min.) - G\ (max.)}{2}$

NOTES.—1. Allows approximately 0.0150 in. on diameter below root diameter of thread.
2. Four clip thicknesses, 1/16, 1/8, 3/16, 1/4.
3. Equals 2 E + 0.125 in.

All threads U. S. Form in the two tables below. Dimensions in inches. T. D. = Tooling Dimension.

*Finished size including plating or rust preventing treatment when used. Bureau of Standards recommends .00 in. as thickness of plating for rust prevention.

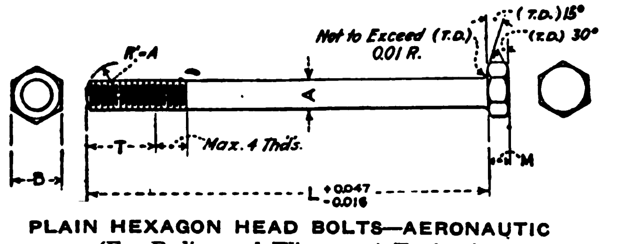
†It is recommended that production of the (No. 12) 28 bolts and nuts become effective at once, and not later than Jan. 1 1919.



Fork end of turnbuckle

Bolts, Size A, Threads per Inch	*Limits A	B	M	R
.1640 (No. 8)-32	0.1640 0.1610	.313 (5/16)	.172 (11/64)	.375 (3/8)
.1900 (No. 10)-32	0.1900 0.1870	.375 (3/8)	.172 (11/64)	.375 (3/8)
†.2160 (No. 12)-28	0.2160 0.2120	.375 (3/8)	.172 (11/64)	.375 (3/8)
.2500 (1/4")-28	0.2500 0.2460	.438 (7/16)	.203 (13/64)	.375 (3/8)
.3125 (5/16")-24	0.3125 0.3085	.500 (1/2)	.250 (1/4)	.375 (3/8)
.3750 (3/8")-24	0.3750 0.3710	.563 (9/16)	.313 (5/16)	.500 (1/2)
.4375 (7/16")-20	0.4375 0.4335	.688 (11/16)	.359 (23/64)	.500 (1/2)
.5000 (1/2")-20	0.5000 0.4960	.750 (3/4)	.375 (3/8)	.500 (1/2)
.5625 (9/16")-18	0.5625 0.5575	.875 (7/8)	.469 (15/32)	.625 (5/8)
.6250 (5/8")-18	0.6250 0.6200	.938 (15/16)	.516 (33/64)	.625 (5/8)

When body length L = 1/2" 5/8" 3/4" 7/8" 1" Over 1"
Length of thread T = 3/8" 7/16" 1/2" 1/2" 1/2" 3/4"

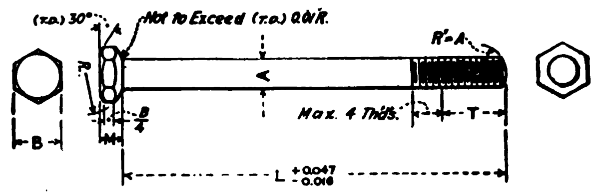


PLAIN HEXAGON HEAD BOLTS—AERONAUTIC
(For Bodies and Wings, not Engines)
T = Min. Length of Usable Thread.

M (for 1/4 in. dia. and larger) $= \frac{A}{2} + \frac{1"}{32}$

Bolts, Size A, Threads per Inch	*Limits A	B	M ±.005
.1120 (No. 4)-48	0.1120 0.1090	.250 (1/4)	.094 (3/32)
.1380 (No. 6)-40	0.1380 0.1350	.313 (5/16)	.094 (3/32)
.1640 (No. 8)-32	0.1640 0.1610	.313 (5/16)	.125 (1/8)
.1900 (No. 10)-32	0.1900 0.1870	.375 (3/8)	.125 (1/8)
†.2160 (No. 12)-28	0.2160 0.2120	.375 (3/8)	.125 (1/8)
.2500 (1/4")-28	0.2500 0.2460	.438 (7/16)	.156 (5/32)
.3125 (5/16")-24	0.3125 0.3085	.500 (1/2)	.188 (3/16)
.3750 (3/8")-24	0.3750 0.3710	.563 (9/16)	.219 (7/32)
.4375 (7/16")-20	0.4375 0.4335	.688 (11/16)	.250 (1/4)
.5000 (1/2")-20	0.5000 0.4960	.750 (3/4)	.281 (9/32)
.5625 (9/16")-18	0.5625 0.5575	.875 (7/8)	.313 (5/16)
.6250 (5/8")-18	0.6250 0.6200	.938 (15/16)	.344 (11/32)

When body length L = 1/2" 5/8" 3/4" 7/8" 1" Over 1"
Length of thread T = 3/8" 7/16" 1/2" 1/2" 1/2" 3/4"

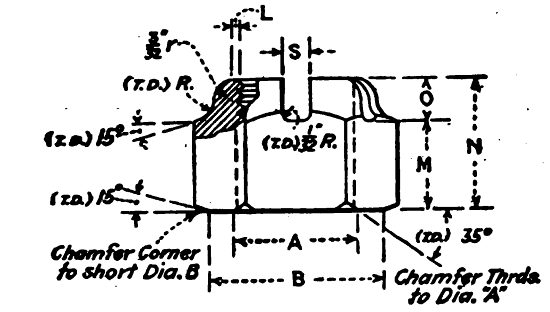


BALL HEXAGON-HEAD BOLTS—AERONAUTIC
(For Bodies and Wings, not Engines)

$\frac{B}{4}$ is min., and is specified to safeguard the width of wrench surface.
T = Min. Length of Usable Thread.

CASTLE HEXAGON NUTS—AERONAUTIC

(For Bodies and Wings, not Engines)

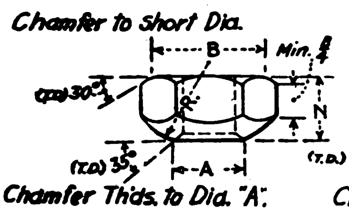


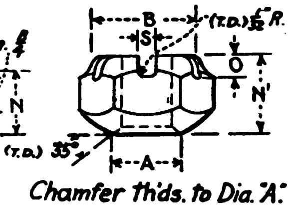
Size A and Threads per Inch	B	N	S	O	M	*L	R
.1640 (No. 8)-32	.375 (3/8)	.234 (15/64)	.078 (5/64)	.078 (5/64)	.156 (5/32)	.016 (1/64)	.094 (3/32)
.1900 (No. 10)-32	.375 (3/8)	.250 (1/4)	.078 (5/64)	.078 (5/64)	.172 (11/64)	.016 (1/64)	.094 (3/32)
†.2160 (No. 12)-28	.438 (7/16)	.266 (17/64)	.078 (5/64)	.094 (3/32)	.172 (11/64)	.031 (1/32)	.094 (3/32)
.2500 (1/4")-28	.438 (7/16)	.281 (9/32)	.078 (5/64)	.094 (3/32)	.188 (3/16)	.031 (1/32)	.094 (3/32)
.3125 (5/16")-24	.500 (1/2)	.328 (21/64)	.078 (5/64)	.094 (3/32)	.234 (15/64)	.031 (1/32)	.094 (3/32)
.3750 (3/8")-24	.563 (9/16)	.406 (13/32)	.125 (1/8)	.125 (1/8)	.281 (9/32)	.031 (1/32)	.094 (3/32)
.4375 (7/16")-20	.688 (11/16)	.453 (29/64)	.125 (1/8)	.125 (1/8)	.328 (21/64)	.047 (3/64)	.125 (1/8)
.5000 (1/2")-20	.750 (3/4)	.563 (9/16)	.125 (1/8)	.188 (3/16)	.375 (3/8)	.047 (3/64)	.125 (1/8)
.5625 (9/16")-18	.875 (7/8)	.609 (39/64)	.156 (5/32)	.188 (3/16)	.422 (27/64)	.047 (3/64)	.156 (5/32)
.6250 (5/8")-18	.938 (15/16)	.719 (23/32)	.156 (5/32)	.250 (1/4)	.469 (15/32)	.047 (3/64)	.156 (5/32)

A = Size of Bolt.
All Threads U. S. Form.
T. D. = Tooling Dimensions.
B = Also Size of Hexagon.
O = Also Depth of Slot.
Dimensions in Inches.
*L = Distance from A to beginning of 3/32 in. radius whose center is floating to satisfy curve.
†It is recommended that production of the (No. 12)-28 nuts and bolts become effective at once, and not later than Jan. 1, 1919.

BALL HEXAGON NUTS—AERONAUTIC

(For Bodies and Wings, not Engines)





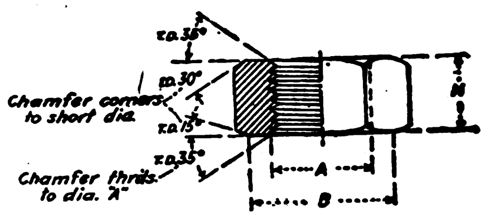
$\frac{B}{4}$ is specified to safeguard the width of wrench surface.

Size A and Threads per Inch	B	Ball Hexagon		Ball Castle		
		N	R	N¹	S	O
.1640 (No. 8)-32	.375 (3/8)	.172 (11/64)	.375 (3/8)	.250 (1/4)	.078 (5/64)	.078 (5/64)
.1900 (No. 10)-32	.375 (3/8)	.172 (11/64)	.375 (3/8)	.250 (1/4)	.078 (5/64)	.078 (5/64)
.2160 (No. 12)-28	.438 (7/16)	.172 (11/64)	.375 (3/8)	.266 (17/64)	.078 (5/64)	.094 (3/32)
.2500 (1/4")-28	.438 (7/16)	.203 (13/64)	.375 (3/8)	.297 (19/64)	.078 (5/64)	.094 (3/32)
.3125 (5/16")-24	.500 (1/2)	.250 (1/4)	.375 (3/8)	.344 (11/32)	.078 (5/64)	.094 (3/32)
.3750 (3/8")-24	.563 (9/16)	.313 (5/16)	.500 (1/2)	.438 (7/16)	.125 (1/8)	.125 (1/8)
.4375 (7/16")-20	.688 (11/16)	.359 (23/64)	.500 (1/2)	.484 (31/64)	.125 (1/8)	.125 (1/8)
.5000 (1/2")-20	.750 (3/4)	.375 (3/8)	.500 (1/2)	.563 (9/16)	.125 (1/8)	.188 (3/16)
.5625 (9/16")-18	.875 (7/8)	.469 (15/32)	.625 (5/8)	.656 (21/32)	.156 (5/32)	.188 (3/16)
.6250 (5/8")-18	.938 (15/16)	.516 (33/64)	.625 (5/8)	.766 (49/64)	.156 (5/32)	.250 (1/4)

All Threads U. S. Form.
Dimensions in Inches.
T. D. = Tooling Dimensions.
N¹ = N + O. A = Size of Bolt.
B = Also Size of Hexagon.
*It is recommended that production of the (No. 12)-28 nuts and bolts become effective at once, and not later than Jan. 1, 1919.

PLAIN HEXAGON NUTS—AERONAUTIC

(For Bodies and Wings, not Engines)



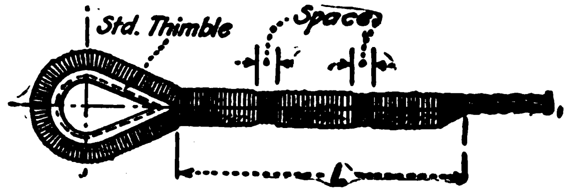
A Size	Threads per In.	B Hex. Short Dia.	*N Full Strength ±.005	*N Thin and Check ±.005
.1120 (No. 4)	48	.250 (1/4)	.094 (3/32)	.094 (3/32)
.1380 (No. 6)	40	.313 (5/16)	.109 (7/64)	.109 (7/64)
.1640 (No. 8)	32	.375 (3/8)	.125 (1/8)	.125 (1/8)
.1900 (No. 10)	32	.375 (3/8)	.141 (9/64)	‡.141 (9/64)
†.2160 (No. 12)	28	.438 (7/16)	.156 (5/32)	‡.156 (5/32)
.2500 (1/4)	28	.438 (7/16)	.188 (3/16)	.125 (1/8)
.3125 (5/16)	24	.500 (1/2)	.234 (15/64)	.156 (5/32)
.3750 (3/8)	24	.563 (9/16)	.281 (9/32)	.188 (3/16)
.4375 (7/16)	20	.688 (11/16)	.328 (21/64)	.219 (7/32)
.5000 (1/2)	20	.750 (3/4)	.375 (3/8)	.250 (1/4)
.5625 (9/16)	18	.875 (7/8)	.422 (27/64)	.281 (9/32)
.6250 (5/8)	18	.938 (15/16)	.469 (15/32)	.313 (5/16)

A = size of bolt.
T.D. = Tooling dimensions.
Dimensions in inches.
All threads U. S. form.

*For full strength nuts, $N = \frac{3A}{4}$ For check nuts, and thin nuts for shear bolts ¼ in. diameter and larger, $N = \frac{A}{2}$

†It is recommended that production of the (No. 12)-28 bolts and nuts become effective at once, and not later than Jan. 1, 1919.
‡Subject to revision.

LOOPS FOR NON-FLEXIBLE SINGLE-STRAND STEEL CABLE—AERONAUTIC



The loop portion is served with 0.0180 in. soft steel tinned wire before thimble is inserted. The splice portion is served with 0.4010 in. soft steel tinned wire, divided into three equal sections as indicated in cut. The entire serving, including thimble and splice, must be soldered without drawing temper of wire.

Diameter of Cable, Inches	Number of Strands	No. of Wires per Strand	Splice L	Space	Length of Loop Serving	Breaking Strength of Cable, Lb.
1/16	1	19	1½	⅛	1	500
3/32	1	19	2	⅛	1¼	1100
⅛	1	19	2¼	⅛	1½	2100
5/32	1	19	2¾	⅛	2	3200
3/16	1	19	3	3/16	2¼	4600
7/32	1	19	3½	3/16	2¼	6100
¼	1	19	4	¼	2½	8000

LOOPS AND FERRULES FOR ROUND TINNED STEEL WIRE—AERONAUTIC

These recommended loops for round wires are made by threading the tension wire through a ferrule, forming a loop of the specified size, slipping ferrule up against loop and bending free end of tension wire over ferrule as shown. The ferrule is then thoroughly soldered in place without drawing the temper of the tension wire.

New Standard List of Pneumatic Tire Sizes

Together with a Collection of Recently Adopted S. A. E. Standards and Recommended Practices Relating to Tires and Rims

FOR years there has been a movement, fostered by the manufacturers of tires, to reduce the number of different sizes and types of tires called for by car manufacturers. The almost endless variety in which these tires were formerly manufactured made it almost impossible for dealers to keep a complete line in stock, and it was also a burden on manufacturers. Action was taken through the Standards Committee of the S. A. E., which formulated a list of standard sizes. A further impetus was given this movement last fall when the Commercial Economy Board of the Council of National Defense requested the War Service Committee of the American Rubber Industry to formulate a new reduced list of sizes and types of tires. It was then decided to discontinue at once the manufacture of tires of certain types and dimensions, to discontinue another list in November, 1918, another November, 1919, and a further one November, 1920. This will lead to the use, in the not distant future, of only seven regular sizes of automobile pneumatic tires and six over-sizes. It is recommended that manufacturers use as regular equipment of cars only the regular size tires and not over-size ones, as this gives the owner a chance to enlarge his tire equipment without changing rims. The sizes of tires given in the table headed Class A Sizes of Pneumatic Tires are to constitute the permanent list of standard sizes, while the manufacture of all other sizes is to be discontinued by November, 1920.

CLASS A—SIZES OF PNEUMATIC TIRES

(Permanent List)

Nominal Size	Average Tire	Rim Diameter	Type of Rim
30 x 3½	31 x 4	23	Clincher
32 x 3½	33 x 4	25	Straight side
33 x 4	34 x 4½	25	Straight side
34 x 4½	35 x 5	25	Straight side
36 x 6	38 x 7	24	Straight side
38 x 7	40 x 8	24	Straight side
40 x 8	......	24	Straight side

CLASS B—PNEUMATIC TIRE SIZES

(To be discontinued November, 1920)

Nominal Size	Type of Tread	Type of Rim
30 x 3	Plain and Non-skid	Clincher
32 x 4	Plain and Non-skid	Straight side
32 x 4½	Plain and Non-skid	Straight side
33 x 4½	Non-skid	Straight side
33 x 5	Non-skid	Straight side
34 x 4	Plain and Non-skid	Straight side
35 x 4½	Plain and Non-skid	Straight side
35 x 5	Non-skid	Q. D. clincher
37 x 5	Non-skid	Straight side

CLASS C—PNEUMATIC TIRE SIZES

(To be Discontinued November, 1919)

Nominal Size	Type of Tread	Type of Rim
33 x 4½	Plain	Straight side
35 x 4½	Non-skid	Q. D. clincher
36 x 4½	Non-skid	Straight-side
37 x 5	Non-skid	Q. D. clincher

CLASS D—PNEUMATIC TIRE SIZES

(Discontinued November, 1918)

Nominal Size	Type of Tread	Type of Rim
29 x 4½	Non-skid	Straight side
30 x 3½	Non-skid	Straight side
32 x 3½	Non-skid	Clincher
32 x 3½	Non-skid	Q. D. clincher
32 x 4½	Non-skid	Q. D. clincher
33 x 4	Non-skid	Clincher
33 x 4	Non-skid	Q. D. clincher
33 x 4½	Non-skid	Q. D. clincher
33 x 5	Plain	Straight side
34 x 4½	Non-skid	Q. D. clincher
35 x 4	Non-skid	Straight side
36 x 4½	Plain	Straight side
36 x 4½	Non-skid	Q. D. clincher
37 x 4½	Non-skid	Straight side

CARRYING CAPACITIES AND INFLATION PRESSURES

Tire Width, In.	Max. Load, Lb. per Tire	Inflation Pressure, Lb. per Sq. In.
3	375	45
3½	570	55
4	815	65
4½	1,100	75
5	1,300	80
5½	1,700	85
6	2,000	90
7	2,700	100
8	3,650	110
Motorcycle Tires		
2¼	175	35
3	325	40
3½	400	45

Detachable and Plain Clincher Rims

Valve holes in wood felloe for detachable and plain clincher rims to be same diameter as valve hole in steel rim.

VALVE-HOLE SIZE, AUTOMOBILE RIMS

The valve hole in automobile rims for S. A. E. standard tire sizes shall be ⅝ in. diameter up to 4½-in. rims, inclusive. Valve-hole sizes for 6, 7 and 8-in. rims are yet to be determined.

DEFLECTION AND SET TEST FOR AUTOMOBILE PNEUMATIC TIRE RIMS

The S. A. E. Standard Deflection and Set Test of rims is a pressure test with predetermined deflection under predetermined pressure. The test is made with water pressure.

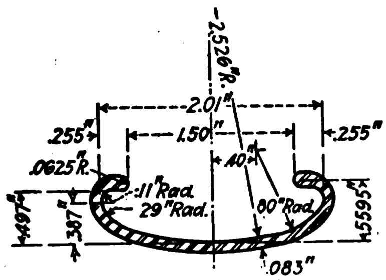
The measurements of deflection for either a clincher or a straight-side rim should be made across the extreme width.

Deflection should be measured from a fixed inflation load of 25 lb. per sq. in. for 3½, 4 and 4½-in. sections, and 50 lb. per sq. in. for 6-in. sizes and larger, up to a predetermined maximum, as follows:

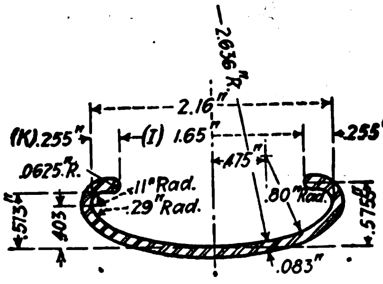
Rim Size Nominal, Inches	Pressure, Pounds	Maximum Deflection, Inches	Total Permanent Set, Inches
3½	140	0.06	0.02
4	160	0.07	0.03
4½	180	0.10	0.06
6	200	0.15	0.06
7	200	0.15	0.06
8		Yet to be determined	

In conducting the tests, measurements of deflection should be made after load increments of 25 or 50 lb. as above are added; at a corresponding set the load should be released.

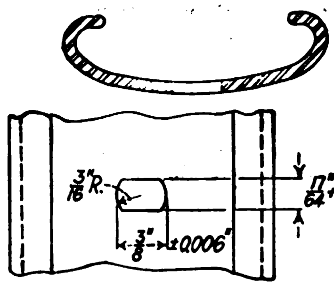
Motorcycle Rim Sections



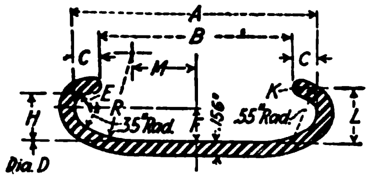
2¼ and 2½-in. B B rim section



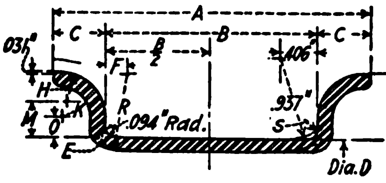
2¾ and 3-in. C C rim section



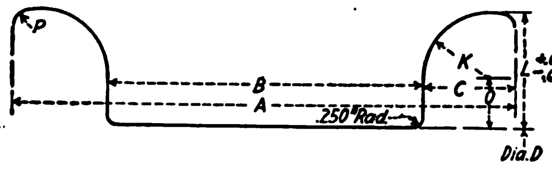
Valve hole for motorcycle rims



Clincher rim, No. 1



Straight side rim, No. 2

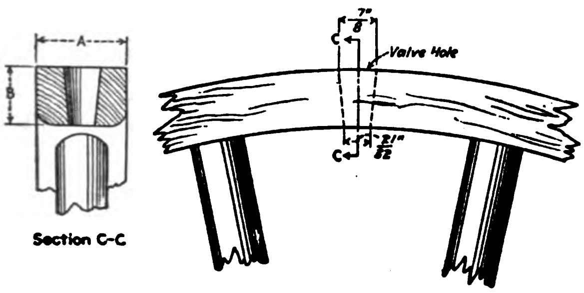


Straight side rim, No. 3

RIMS FOR PNEUMATIC TIRES

Draw No.	Nominal Tire and Rim Size	Rim Dia. (D)	Rim Circum.* (Tire Seat)	Rim, Type	A	B ∓0.047	C	R 0.910	E .1400	F .3400	H 0.50	K 0.0780	L 0.5780	M 0.680	O	P	S ....
1........	30x3½	23	72.257	Clincher	2.600	2.050	0.275										
2........	32x3½	25	78.540	Straight Side	3.432	2.312	0.560	0.840	.1875	.2500	0.32	0.5100	0.6870	0.367	0.1990	....	.0625
	33x4	25	78.540	Straight Side	3.888	2.688	0.600	0.840	.1875	.2500	0.34	0.5600	0.7800	0.440	0.2450	....	.0625
	34x4½	25	78.540	Straight Side	4.380	3.120	0.630	1.095	.1875	.3125	0.38	0.6150	0.8750	0.495	0.3030	....	.0625
3........	36x6	24	75.398	Straight Side	6.330	4.330	1.000	....	....	....	...	0.7187	1.2656	....	0.5469	0.140	....
	38x7	24	75.398	Straight Side	7.000	5.000	1.000	....	....	....	...	0.7187	1.2656	....	0.5469	0.140	....
	40x8	24	75.398	Straight Side	8.500	6.000	1.250	....	....	....	...	0.8750	1.5000	....	0.6250	0.150	....

*Tolerance for rim circumference, ∓0.047 in. All dimensions given in inches.



WOOD FELLOE DIMENSIONS FOR PNEUMATIC TIRE RIMS

Wood Felloe Dimensions

Nominal Tire and Rim Size	†Width (A)	†Depth (B)
30 x 3½	....	....
32 x 3½	....	....
33 x 4	....	....
34 x 4½	....	....
36 x 6	3¼	1⅝ ± 1/16
38 x 7	3 29/32	1⅝ ± 1/16
40 x 8	4¼	1⅝ ± 1/16

Dimensions in inches.
†Dimensions not given are to be determined.
NOTE.—The above values correspond to those adopted by the Automotive Wood Wheel Mfrs. Assn.

Bolt Equipment for Side Flanges of Solid Tires*

Nominal Outside Tire Diameter, In.	Diameter Bolt Hole Circle, In.	Number of Bolts
30	22½	6, 9, or 18
32	24½	8, 12, or 24
34	26½	8, 12, or 24
36	28½	8, 12, or 24
38	30½	10, 15, or 30
40	32½	10, 15, or 30
42	34½	10, 15, or 30

*All bolts to be ½ in. (12.7 mm.) diameter.

Edges of Felloe Band

Bands to be rounded on two outside edges with radius not to exceed 1/16 in. and on both inside edges with a radius of 3/16 in.
In measuring the circumference of the band, if there is not an allowance on the tapeline itself, a correction amounting to three times the thickness of the tapeline should be made.
All of the foregoing, so far as pertinent, applies to metal wheels.

INDUSTRIAL TRUCK TIRES

The S. A. E. standard nominal tire diameters for industrial trucks are 10, 16, 20, 22 and 27 in. Industrial truck tire sections recommended by the Association of Railway Electrical Engineers (given for reference only) are as follows:

Wheel Dimensions: Nominal Diameter with Tire	Diameter of Rim* without Tire	Tire Equipment, 4000-Lb. Truck
10	6.250	3 (Dual)
16	12.125	3½ (Single)
20	16.000	3½ (Single)
22	17.750	3½ (Single)
27	23.500	3½ (Single)

*Permissible tolerance from rim diameters: Minus, 000; Plus, 0.005.
All dimensions in inches. The standard of the Association of Railway Electrical Engineers further specify that all tire equipment is to be of the pressed-on type; the depth of tire section including base shall not exceed 2 in.; and the width of wheel rim shall not be less than width of tire seat. This refers to nominal width of seat, which is 6 in. for the 10 in. tire and 3½ in. for the 20, 22 and 27 in. tires.

SECTION DIMENSIONS OF SINGLE AND DUAL WHEELS

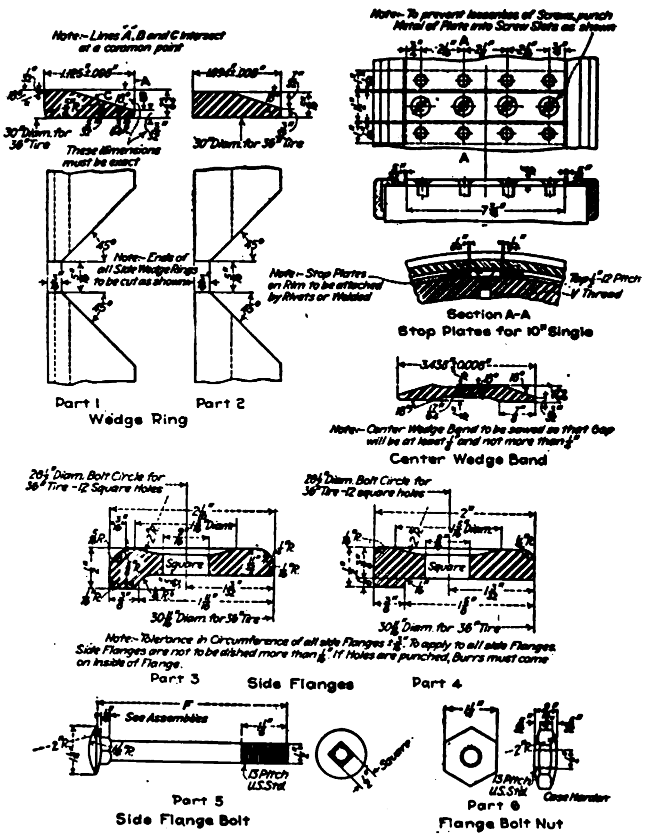
Single Wheels

Nominal Tire Widths, In.	Width of Felloe and Band, In.	Thickness of Steel Band, In.	Minimum Felloe Thickness, In.
2	1¼	¼	1¼
2½	1¾	¼	1¼
3	2¼	¼	1½
3½	2¾	¼	1½
4	3¼	¼	1¾
4½	3¾	⅜	1¾
5	4¼	⅜	2
5½	4¾	⅜	2
6	5¼	⅜	2
6½	*	⅜	2½

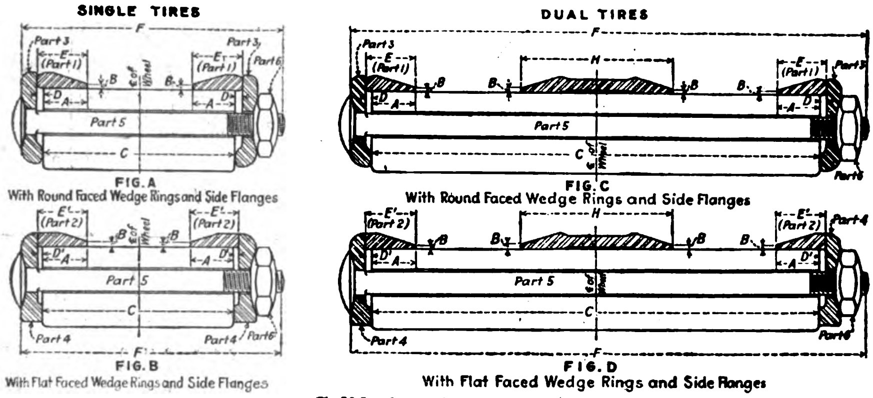
Dual Wheels

Nominal Tire Widths, In.	Width of Felloe and Band, In.	Thickness of Steel Band, In.	Minimum Felloe Thickness, In.
2	4	⅜	1¼
2½	5	⅜	1¼
3	6	⅜	1½
3½	7	⅜	1½
4	8	⅜	1¾
4½	9	⅜	1¾
5	10	⅜	2
5½	11	⅜	2
6	12	⅜	2
6½	†	⅜	2½

*To be ¾ in. less than nominal width.
†To be twice the nominal tire width.



Solid tire demountable rim equipment



SINGLE TIRES

FIG. A
With Round Faced Wedge Rings and Side Flanges

FIG. B
With Flat Faced Wedge Rings and Side Flanges

DUAL TIRES

FIG. C
With Round Faced Wedge Rings and Side Flanges

FIG. D
With Flat Faced Wedge Rings and Side Flanges

Solid tire rim sections

Dimensions for Single Tire Rims

	Figure A						†Figure B	
Size	A	B	C	D	E	F	D′	E′
4 in......	31/32	3/32	3¼	5/32	1⅛	4⅝	⅛	1 3/32
5 in......	31/32	3/32	4¼	5/32	1⅛	5⅝	⅛	1 3/32
6 in......	31/32	3/32	5¼	5/32	1⅛	6⅝	⅛	1 3/32
7 in......	31/32	3/32	6¼	5/32	1⅛	7⅝	⅛	1 3/32
10 in......	31/32	3/32	10	5/32	1⅛	11⅝	⅛	1 3/32

†All other dimensions for Figure B are the same as for Figure A.

Dimensions for Dual Tire Rims

	Figure C							*Figure D	
Size	A	B	C	D	E	F	H	D′	E′
5 in.....	31/32	3/32	10	5/32	1⅛	11½	3 7/16	⅛	1 3/32
6 in.....	31/32	3/32	12	5/32	1⅛	13½	3 7/16	⅛	1 3/32

*All other dimensions for Figure D are the same as for Figure C.

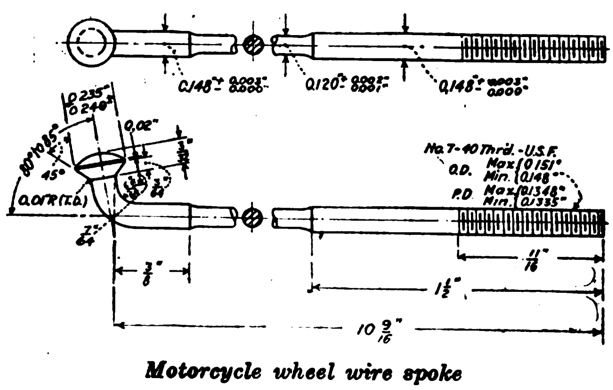
TOLERANCES FOR FELLOE BANDS FOR SOLID TIRES

	Plus	Minus
Band circumference before application..................	0	1/16
Band circumference after application..................	1/16	1/32
Width of band..................	1/32	1/32
Thickness of band	0.006	0.006
Radius of band after application..................	1/16	1/16

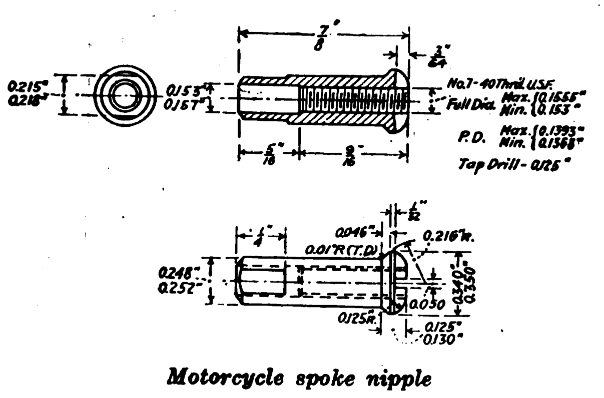
Circumferential deviation must be uniform over entire width of band. Radial deviations must not occur at diametrically opposite points, and there must be no flat spots or kinks in band and finished wheel. Either side of band when laid on a surface plate must not clear more than 1/32 in. at any point.

STANDARDS DIAMETERS OF SOLID TIRES

S. A. E. standard nominal tire diameters are 34, 36 and 40 in.



Motorcycle wheel wire spoke



Motorcycle spoke nipple

MOTORCYCLE SPOKE AND NIPPLE SPECIFICATION

Threads may be either cut or rolled but the unthreaded portion of butt must remain .148 inch + .033, —.000.

The nipple is to be made from free-cutting steel screw stock and is to be finished according to dimensions.

Spoke Wire Specifications

The spoke wire shall have the following chemical content within the limits specified:

Carbon	.40 to .55
Manganese, not under........	.50
Phosphorus, not over..........	.05
Sulphur, not over..............	.05

Tolerance of Diameter

The nominal wire diameter must be .148 inch + .000 — .001.

Bend Test

The wire must be held firmly in a pair of jaws so that it may be bent over a surface having a radius of one-half the nominal diameter of the wire, and shall stand a test of at least four bends, counted as follows: Holding the free length of the wire loosely between clamps so that it cannot bend except at the holding jaws, it is to be bent 90 deg. over one jaw; this to be counted as one bend. It is then to be bent up to its original position; this to be counted as the second bend. It is then to be bent 90 deg. to the other side (3rd bend) and back to its original position to complete the test.

Tensile Strength

The tensile strength of the wire is to be not less than 140,000 pounds per square inch.

Physical Test—Complete Spoke and Nipple

Tensile Strength

The finished spoke, when held at the bent end in the same manner as by the hub flange in a finished wheel and at the threaded end by a standard nipple with the spoke threads filling all the nipple threads, must sustain a dead load of not less than 1580 pounds.

Torsion Test

This test is not required.

MOTORCYCLE WHEEL AND RIM SPECIFICATION

(Motorcycle, Side and Rear Car Wheels)

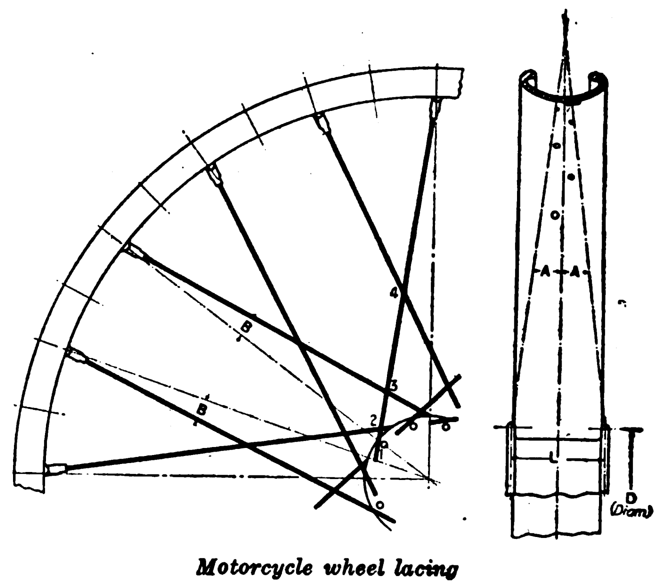
	A	B	D	L	I	K
Nominal	6°	7° 30′	2.86	2.92	1.65	.255
Maximum.	7° 45′	9° 15′	3.56	3.00	1.80	.263
Minimum	4° 15′	5° 45′	2.20	2.25	1.50	.247

Chemical content of steel

Carbon	.10 to .15
Sulphur, not over....	.05
Phosphorus, not over.	.05
Manganese	.40 to .60

Dimensions in inches.

Tolerance for circumference of wire wheel rim after lacing
Circumference
=68.722+.047 (3/64) in. or —.141 (9/64) in.



Motorcycle wheel lacing

Tractor Production Past and Present

Output Doubled During Each of the Last Two Years—Two and Three Plow Tractors Form Bulk of Production—Government Figures of Production, Domestic Sales and Exports

EVERYBODY knows that the production of farm tractors has increased by leaps and bounds during the past few years, but actual figures of production have been impossible to obtain until recently. Farm tractors do not have to be registered with the authorities like automobiles, and the only source of information regarding production is the manufacturers. But obtaining reliable figures from the makers themselves is not as easy a matter as might appear, especially when the attempt is being made by a publication, which immediately gives the manufacturer the impression that the figures are to be published broadcast and may be used by his competitor to his own injury.

But in order to judge properly the growth of the tractor industry, and the capacity of the market for absorbing tractors, it is highly important that such figures should be made available. We do not mean the production figures of individual manufacturers but those of the industry as a whole.

Fortunately the United States Government, when it became necessary to decide how much steel should be allowed the tractor industry, took it upon itself to gather statistics regarding production, domestic sales and exports during the years 1916, 1917 and the first half of 1918. The investigation was made pursuant to the President's Proclamation of May 14, 1918, relating to the farm equipment industry, which was issued under the authority of the Food Control Act.

Number of Tractors Manufactured

1916	29,670
1917	62,742
Jan. 1 to June 30, 1918	58,543
Total for 1916, 1917 and first half of 1918	150,955

Number of Tractors Sold

To Users

1916	27,819
1917	49,504

To Exporters

1917	14,854
1918, first 6 months	15,610
Number of tractors on hand, in transit, or in hands of dealers at time of report (August, 1918)	11,388

It will be seen from the figures published in tabular form herewith that the production of farm tractors increased more than 100 per cent in 1917 as compared with 1916—111 per cent to be accurate—and during the first half of 1918 the production was almost equal to that of the whole of 1917.

What the production was during the last half of 1918 can only be conjectured. If no obstacles had been encountered it would have seen a further substantial growth, but practically all of the factories met with great difficulty in securing materials. In fact, from Oct. 1 on, manufacturers were restricted to 75 per cent of the output of the previous year, which regulation was, however, withdrawn toward the end of the year. Aside from this official direct curtailment of production, there was an indirect curtailment, in some cases much more drastic than the direct one, which was due to the monopolization of forge and foundry output by munitions plants. Tractor manufacturers had a comparatively high priority rating among the industries, but, as one manufacturer put it, what is the good of a B-1 rating when all the foundries are loaded up with Class A stuff?

Taking the natural tendency toward expansion and the increasing demand for tractors among farmers, together with these restrictions on output, it seems reasonable to assume that the tractor output during the last half of 1918 was about the same as during the first half, and that the total production of the year was in the neighborhood of 125,000.

The 15-16 and 18-20 hp. ranges may be considered to cover the two-plow tractor, and the 20-26 hp. range the three-plow tractor. These are the sizes produced in the greatest numbers. Undoubtedly a much greater number of manufacturers are represented in the 22-26 hp. than in the 18-20 hp. class.

The curve of farm tractor production thus shows a rapidly rising tendency. In fact, the figures for the past three years form substantially a geometrical series. But what of the future? If this rate of progression is to be continued it will be only a few years till the tractor industry has attained a status commensurate with that of the automobile industry. There are several factors which will tend to maintain the rate of progress. One of these is the continued scarcity of food throughout the world, which will tend to maintain the prices of farm products and encourage farmers to make investments in equipment enabling them to increase their production. On the other hand, we must consider the fact that the phenomenal growth in the sales of tractors has riveted the attention of industrialists upon this industry and that many of the firms which until recently were engaged on Government war work and have been left with well equipped plants but without manufacturing lines, will seek their salvation in this new industry.

Of course, not all the currents of the changing times will favor the tractor. Farm help will not be as scarce this coming year, when most of our army is demobilized, as it was last year. There will also be more competition again in the markets of Europe from the more distant grain exporting countries such as Argentina and Australia. It is not believed, however, that these latter factors will seriously retard the forward march of the agricultural tractor industry. The main thing is that leading farmers have been convinced of the practical utility of the gas tractor.

Engineering improvement has been rapid during the past two years and will continue at an increasing rate. Next year's tractor will be more economical, more durable, handier and more comfortable than last year's. Engineers have made the tractor a practical farm implement and we may now safely leave it to the sales managers to find increasing markets for this new product of the automotive industries.

To the student of the tractor development the following figures, representing the number of tractors of different horsepower ratings turned out during the first half of 1918, will be of interest: 10-12 hp., 2714; 15-16 hp., 3716; 18-20 hp., 24,128; 22-26 hp., 20,658; 27 hp., 400; 28-30 hp., 2772; 35-36 hp., 1495; 40-50 hp., 1025; 60-80 hp., 1049. These figures seem to indicate that the future belongs to the two and three-plow tractor.

Detailed Technical Specifications

Tabulated Data on 98 Different Makes of American 69 Manufacturers, With Makes of Principal Ignition System, Air Cleaner,

Name and Model	Price	Plow Capacity	Hp. Rating	Engine Make	No. of Cylinders Bore and Stroke	Engine Type	Cylinders Cast	R.P.M.	Make of Governor	Type of Governor	Engine Weight	Lubrication System	Lubricator Make	Oil Pump Type	Ignition System	Impulse Starter	Carbureter Make	Water Injected with Fuel	Fuel Feed	Fuel Tanks and Capacity	Air Cleaner Make
Acme		3	12-24	Beaver	4-4½x6	V	Block	800				Pressure			Mag	Yes	King	No		3½G-20K	Donaldson
Allis-Chalmers		4	15-30	Own	4-4¾x6½	V	Block	830	Own	Fball		Circ	Detroit	Gear	Mag	Yes		Yes	Grav		Bennett
Allis-Chalmers		3	10-18	Own	2-5¼x7	O	Singly	720	Own	Fball		Splash	Detroit	Gear	Mag	Yes	King	Yes	Grav	5G-20K	Bennett
Allis-Chalmers		1	6-12	Own	4-3⅛x4½	V	Block	800	Own	Fball		Splash-Pr		Plun	Mag	No			Grav	10G	Bennett
Allwork		3	14-28	Own	4-5 x6	V	Singly	800	Own	Fball	1000	Circ-Sp		Plun	Mag	Yes	King	No	Grav	5G-25K	Bennett
Appleton	$1800	3	12-20	Buda	4-4¼x4½	V	Block	1000	Pick	Fball	800				Mag		Scheb	Yes	Grav	5G-20K	Opt
Aultman & Taylor		6	22-45	Own	4-5½x8	H	Block	600	Own	Fball		Circ-Sp	Detroit	Plun	Mag	No	King	Yes	Pump	10G-35K	
Aultman & Taylor		10	30-60	Own	4-7 x9	H	Pairs	500	Own	Fball		Circ-Sp	Detroit	Plun	Mag	No	King	Yes	Pump	20G-60K	
Aultman & Taylor		4	15-30	Waukesha	4-4¾x6¾	V	Pairs	800	Wauk		875	Circ-Sp		Gear	Mag	Yes	King	Yes	Grav	6G-16K	Bennett
Avery				Own	4-3 x4	V		1200							Mag		Zeph			G- K	Bennett
Avery		3		Own	2-5½x6	O		600							Mag		King			G- K	Bennett
Avery		4		Own	2-6½x7	O		570							Mag		King			G- K	Bennett
Avery		4		Own	4-5½x6	O		650							Mag		King			G- K	Bennett
Avery		6		Own	4-6½x7	O		500							Mag		King			G- K	Bennett
Avery		8-10		Own	4-7¾x8	O		500							Mag		King			G- K	Bennett
Bates Steel Mule D		3	12-20	Erd	4-4 x6	V	Block	900	Own			Circ-Sp		Plun	Mag	Yes	Bennett	Yes	Grav	2½G-11K	Bennett
Bates		3	15-25	Own	4-4½x5½		Block	800	Own		1000	Circ		Plun	Mag		Own			2G-15K	
Beltrail B		3	12-20	Waukesha	4-3¾x5½	V	Block	950	Wauk		650	Splash		Gear	Mag	Yes	Ensign	Yes	Grav	2G-18K	Bennett
Bull	1075	3	12-24	Toro	2-5½x7	O	Singly	750	Own	Fball	1098	Circ-Sp	Own	Plun	Mag	Yes	King	Yes	Grav	3½G-18½K	Donaldson
Chase	1200	3	9-18	Buda	4-3¾x5½	V	Block	900	Pierce		600	Circ-Sp		Gear	Mag	Yes	Holley		Grav	2G-17K	Bennett
Cleveland H	1585	2	12-20	Weidely	4-3¾x5½	V	Block	1200	Own	Cent	700	Pressure	Weidely	Gear	Mag	Yes	King	No	Grav	1G-12K	Own
C.O.D B	1395	3	13-25	Own	2-6½x7	O	Singly	550	Own	Throt		Pressure	Detroit	Plun	Mag	Yes	King	Yes	Grav	5G-18K	
Coleman	1750	3	16-30	Climax	4-5 x6½	V	Pairs	750	Climax		860	Circ-Pr		Ind	Mag	Yes	Stmbg	Yes	Grav	3G-17K	Bennett
Common Sense D	2200	4	20-40	Hersh-Sp	8-3¼x5	V	Block	1200	Pick	Fball	600	Circ-Pr		Gear	Mag	Yes	King	No	Grav	37G	Own
Craig		3	15-25	Beaver	4-4¾x6	V	Block	950	Pharo	Hyd	1050	Splash-Pr			Mag	Yes	Stmbg	No	Grav	3G-22K	Own
Dart Blue Jay	1750	3	15-30	Buda	4-4¼x5½	V	Block	1050	Pierce	Cent	800	Circ-Pr		Gear	Mag	Yes	Zenith	No	Grav	25G	Bennett
Dill	2480	3	20-	Cont	4-4½x5½	V	Pairs	1000	Pierce		740	Splash-Pr		Plun	Mag	No	King	No	Grav	15G	Donaldson
Eagle F	1853	4	16-30	Own	2-8 x8	H	Pairs	425	Own	Throt	2750		M-Kipp		Mag	Yes	Linga	Yes	Grav	5G-18K	Bennett
Eagle F	1545	3	12-22	Own	2-7 x8	H	Pairs	425	Own	Throt	2205	Pressure	M-Kipp	Plun	Mag	Yes	Linga	Yes	Grav	4G-12K	Bennett
Elgin	1385	3	12-25	Erd	4-4 x6	V	Block	900	Erd	Fball	850	Circ-Sp		Plun	Mag		King	Yes	Grav	5G-18K	Bennett
Emerson-Brantingham AA		3	12-20	Own	4-4¾x5	V	Pairs	900	Own	Cent	1000	Circ-Sp		Plun	Mag	Yes		Yes	Grav	4G-20K	Bennett
Emerson-Brantingham		2	9-16	Own	4-4⅛x4½			800							Mag		Bennett				Bennett
Emerson-Brantingham		3	12-20	Own	4-4¾x5			850							Mag		Bennett				Bennett
Emerson-Brantingham		6	20-35	Own	4-5 x7			700							Mag		Bennett				Bennett
Emerson-Brantingham		10	40-65		4-7¼x9			500							Mag		Bennett				Bennett
Farm Horse	1485	4	16-30	Climax	4-5 x6½	V	Pairs	800	Climax	Fball	1050	Splash-Pr			Mag	Yes	Bennett	No	Grav	5G-18K	Bennett
Farquhar		4	15-25	Buda	4-4½x6	L	Block	900			900	Pressure			Mag		King		Grav	5G-25K	Bennett
Farquhar		5	18-	Own	4-6 x8	I	Pairs	550				Splash	Detroit		Mag		King		Grav	5G-30K	
Farquhar		7	25-	Own	4-7 x8	I	Pairs	550				Splash	Detroit		Mag		King		Grav	5G-30K	
Fitch 3	2500	4	18-26	Beaver	4-4½x6	V	Block	950	Lauson		1080	Pressure			Mag	Yes	King	No	Grav	2G-25K	Bennett
Fordson		2	12-20	Own	4-4 x5		Block	1000				Splash-Gr			Mag		Holley		Grav	20-K	
Franks		2	8-16	Gray	4-3½x5	V	Singly	1000	Monarch						Mag	Yes					
Frick		3	12-25	Erd	4-4 x6	V	Block	900	Pick			Splash			Mag	Yes	King			3G-20K	Bennett
Gile Q	2000	3	20-35	Own	4-4¾x6½	V	Block	875		Cent	1000	Circ-Pr		Gear	Mag	Yes		No	Grav	38G	Bennett
Gray	2250	4	18-36	Waukesha	4-4¾x6¾	V	Pairs	850	Wauk	Cent	950	Circ-Sp		Gear	Mag	Yes	Bennett	No	Grav	34G	Bennett
Hackney		2	12-20	Field	4-3¾x5	O	Pairs	1000	Field	Cent	375	Circ-Pr	Field	Plun	Mag	Yes	King	No	Grav	2G-20K	Bennett
Hackney		3	15-30	Climax	4-5 x6½	V		800	Pierce	Cent	1450	Circ-Pr	Detroit	Plun	Mag	Yes	King	No	Grav	2G-10K	Bennett
Hart-Parr	1395	3	-30	Own	2-6½x7	H	Singly	750	Own	Cent	1300		M-Kipp	Plun	Mag	Yes	Scheb	Yes	Grav	23K	Own

Abbreviations

Bat—*Battery*
Cent—*Centrifugal*
Circ—*Circulating*
Circ-Pr—*Circulating Pressure*
Circ-Sp—*Circulating Splash*
Cont—*Contracting*
Elec—*Electric*
Expand—*Expanding*
Fball—*Flyball*
Fric—*Friction*
Grav—*Gravity*
H—*Horizontal*
Hyd—*Hydraulic*
I—*Valve-in-head*
Ind—*Individual*
L—*L-Head*
Mag—*Magneto*
O—*Opposed*
Plun—*Plunger*
Splash-Gr—*Splash Gravity*

# of Gasoline Farm Tractors for 1919

Gasoline and Kerosene Farm Tractors Produced by Parts, Including Engine, Governor, Lubricator, Gearset, Clutch and Axle

Radiator Make	Cooling System Capacity	Cooling Fluid	Fluid Circulation	Belt Pulley Dia. Face and R.P.M.	Gearset Make	Clutch Make	Clutch Type	No. Forward Speeds	Differential Lock	Final Drive	Plowing Speed	No. Driving Wheels	Dia. and Face	No. of Tracks	Drive Wheel Axle Type	No. Non-Drive Wheels	Steering Arrangement	Frame Material	Wheelbase	Total Weight	Name and Model
			Pump.	14-8-800	Own	Own	Shoe	2	No	Gear	3 1/8	2	54x12			2	Knuckle	Struct	90	6,000	**Acme**
Own		Water	Pump.	15-7	Own		Shoe	2	No	Gear	2 4/5	2	48x12		Live	2	Knuckle		81	5,300	**Allis-Chalmers**
		Water	Pump.	14½-6½-720	Own	Own	Shoe	1	No	Gear	2 9/10	2	60x12		Sta	1		Cast	96	4,800	**Allis-Chalmers**
Own		Water	Ther.		Own	B & B	Disk	1	No	Rim		2	48x 6							1,850	**Allis-Chalmers**
Perfex	13	Water	Pump.	12½-7-800	Own	Own	Plate	2	No	Gear	2 3/5	2	48x12		Live	2	Knuckle	Channel	80	4,800	**Allwork**
Spirex	8	Water	Pump.	12-7½-825	Nuttall	B & B	Disk		No	Gear		2	54x12		Live	2	Knuckle	Steel	102		**Appleton**
Own		Water	Pump.	-1560	Own	Own		2	No	Gear	2 9/10	2	70x20		Live	2	Swinging	Steel	102		**Aultman & Taylor**
Own		Water	Pump.	24-11	Own	Own			No	Gear		2	90x24		Live	2	Swinging	Steel	135		**Aultman & Taylor**
Hooven		Water	Pump.	3-1¾	Own	Own		1	No	Gear	2 1/5	2	70x20		Live	2	Knuckle	Channel		6,579	**Aultman & Taylor**
				9 - -1000	Own	Own		4		Gear	1½	2	30x							2,150	**Avery**
				18 - - 600	Own	Own		2		Gear	1¾	2	50x							4,900	**Avery**
				19½- - 570	Own	Own		2		Gear	1¾	2	56x							7,500	**Avery**
				18 - - 650	Own	Own		2		Gear	2	2	65x							9,250	**Avery**
				22 - - 500	Own	Own		2		Gear	2	2	69x							12,500	**Avery**
				26 - - 500	Own	Own		2		Gear	1¾	2	87½x							22,000	**Avery**
Modine	8	Water	Pump.	12- -725	Own	B & B		2	No	Gear	3½			2	Live	2	Knuckle	Channel		4,500	**Bates Steel Mule** D
Own										Gear	2½	2	50x14			2		Struct		4,000	**Bates**
Sparks	5	Water		10-6-950	Own	Own	Plate	2		Gear	3½			1			Knuckle	Channel		4,500	**Beltrail** B
Own	8	Water	Pump.	12-6½-750			Band	1			2 2/5	1	60x14		Sta	2		Steel	107	4,996	**Bull**
Perfex	10	Water	Pump.	10-8-900	Own	Burman	Shoe	2	Yes	Gear	3	2	48x12		Sta	1		Channel	120	4,800	**Chase**
McCord	8	Water	Pump.	8-6-1200	Own	B & B	Disk	1	No	Gear	3½			2	Sta			Steel		3,175	**Cleveland** H
S.H.J	35	Water	Pump.	18-8-550	Own	Own	Gear	1	No	Axle	2½	2	70x12		Live	2	Swinging	Struct	108	6,500	**C.O.D** B
Modine	14	Water	Pump.	12-7-2100	Own	Own	Expand	1	No	Axle	2 3/5	2	46x10			2	Swinging	I-beam	120	4,925	**Coleman**
Todd	10	Water	Pump.	22-8-400	Own	Own	Shoe	2	No	Chain	3	1	62x24		Live	2	Knuckle	Struct	108	6,000	**Common Sense** D
Modine	7	Water	Pump.	11-8-950	Own		Disk	2	No	Axle	4	2	44x12		Live	2	Knuckle	Steel	88	4,500	**Craig**
Modine	10	Water	Pump.	12-6-750				3	No		2½	2	40x12		Rigid	2	Knuckle	Channel	77	4,500	**Dart** Blue Jay
Eureka	11	Water	Pump.		Cotta	B & B	Plate	3	No	Chain	3	2	42x36		Rigid	2	Knuckle	Struct	148	4,400	**Dill**
Perfex	15	Water	Pump.	24-10-425	Own	Own	Fric	2	No	Gear	3	2	52x12		Sta	2	Swinging	Channel	88	7,100	**Eagle** F
Perfex	8	Water	Pump.	20-8½-420	Own	Own	Fric	2	No	Gear	3	2	48x12		Sta	2	Swinging	Channel	81	5,860	**Eagle** F
	6	Water	Pump.	9-8-1800	Own	Own	Fric	6	No	Chain	3½	2	42x10		Sta	2		Pressed	87	3,300	**Elgin**
Modine		Water	Pump.	12-6⅜-900	Own	Own	Cone	2	No	Gear	2 1/3	2	54x12		Live	2	Knuckle	Struct	87	4,350	**Emerson-Brantingham** AA
				12- -800		Own		2		Gear	2 1/3									4,260	**Emerson-Brantingham**
				12- -708		Own		3		Gear	3 2/5									6,500	**Emerson-Brantingham**
				16- -597		Own		2		Gear	2¼									9,700	**Emerson-Brantingham**
				22- -500		Own		1		Gear	2									23,000	**Emerson-Brantingham**
Modine	10	Water	Pump.	14-8-800	Own	Burman	Shoe	2		Chain	3½	2	48x26			2	Knuckle	Channel	84	4,850	**Farm Horse**
Perfex		Water	Pump.	14-7-800	Nuttall	Own	Cone	2		Gear	4		54x14		Live				90	6,000	**Farquhar**
Own		Water	Pump.	32-9-275		Own	Fric	2		Gear	2 3/10		84x20		Dead				132	16,000	**Farquhar**
Own		Water	Pump.	32-9-275		Own	Fric	2		Gear	2 3/10		84x20		Dead				132	19,000	**Farquhar**
Perfex	27	Water	Pump.	14-12-600	Cotta	B & B	Disk	3	No	Gear	2½	4	42x12		Live		Swinging	Channel	77	6,000	**Fitch** 3
		Water	Ther.		Own	Own	Disk	3		Worm	2¾	2	42x12			2			63		**Fordson**
								2		Chain	3	2	44x 6		Live			Channel	72	3,500	**Franks**
Perfex	8		Pump.		Nuttall	Own		2		Rim	3 4/5	2	60x10		Live	2	Knuckle	Struct	92		**Frick**
Own	12	Water	Pump.	16-8-500	Own	Own	Disk	2	No	Axle	2¾	2	60x12		Live	2	Knuckle	Cast	96	6,800	**Gile** Q
S.H.J		Water	Pump.	11-8-850	Own	Own	Cone	2	No	Chain	2½	1	54x54		Live	2	Knuckle	Struct	104	6,060	**Gray**
Own	15	Water	Pump.	16-8-1000	Own			1	Yes	Gear	2⅞	2	48x 8		Rigid	2	Knuckle	Struct	78	2,800	**Hackney**
Own	10	Water	Pump.	42-8-280	Own	Own	Expand	2	No	Gear	3	2	60x14		Sta	1	Knuckle	Channel	114	7,400	**Hackney**
Perfex	9	Water	Pump.	14-8-750	Own	Own	Cont	2	No	Gear	3	2	52x10		Live	2	Knuckle	Struct	89	5,030	**Hart-Parr**

Splash-Pr—*Splash Pressure*
Sta—*Stationary*
Struct—*Structural Steel*
T—*T-Head*
Throt—*Throttle*
V—*Vertical*

Vac—*Vacuum*

Equipment

B & B—*Borg & Beck*
Cont—*Continental*

Hersh-Sp—*Herschell-Spillman*
King—*Kingston*
M-Kipp—*Madison Kipp*
Pick—*Pickering*
Rayfld—*Rayfield*

Scheb—*Schebler*
S.H.J.—*Shotwell-Hobart-Johnson*
Sparks—*Sparks-Withington*
Stmbg—*Stromberg*
Wauk—*Waukesha*

Detailed Technical Specifications of Gas

Name and Model	Price	Plow Capacity	Hp. Rating	Engine Make	No. of Cylinders, Bore and Stroke	Engine Type	Cylinders Cast	R.P.M.	Make of Governor	Type of Governor	Engine Weight	Lubrication System	Lubricator Make	Oil Pump Type	Ignition System	Impulse Starter	Carburetor Make	Water Injected with Fuel	Fuel Feed	Fuel Tanks and Capacity	Air Cleaner Make
Heider D	1070	2	9-16	Waukesha	4-4¼x5¾	V.	Pairs	800	Wauk.	Cent.		Circ-Sp.		Gear	Mag.	Yes	King	Yes	Grav.	7G-14K	Bennett
Heider C	1395	3	12-20	Waukesha	4-4½x6¾	V.	Pairs	750	Wauk.	Fball	865	Circ-Sp.		Gear	Mag.	Yes	King	Yes	Grav.	7G-14K	Bennett
Hession D	1695	3	12-24	Erd	4-4 x6	I.	Block	1000	Pick	Cent.	800	Splash-Pr.		Plun.	Mag.		King	Yes	Grav.	3G-15K	Bennett
Hollis M	1375	4	15-25	Light	4-3¼x4½	V.	Block	1650	Pierce	Cent.	352	Circ-Sp.		Plun.	Mag.		Zenith	No.	Vac.	1G-30K	Bennett
Holt 45			25-45	Own	4-6 x7	V.	Singly	500	Own	Fball	2300	Circ-Sp.	M-Kipp	Gear	Mag.	Yes	King	No.	Vac.	48½G.	Donaldson
Holt 75			50-75	Own	4-7½x8	V.	Singly	550	Own		3375	Circ-Sp.	M-Kipp	Gear	Mag.	Yes	King	No.	Vac.	74G.	Donaldson
Huber Light 4	1385	3	12-25	Waukesha	4-4¼x5¾	V.	Pairs	900	Wauk.	Cent	650	Circ-Sp.		Gear	Mag.	Yes	King	Yes	Grav.	3G-21K	Own
Hudson K	1985	4	15-30	Buda	4-4½x6	V.	Block	1000	Simplex	Cent.	900	Pressure		Plun.	Mag.	Yes	Rayfield	No.	Grav.	35G.	Holley
Illinois C	2250	4	18-36	Climax	5x6½	V.	Pairs	800	Climax	Fball	1000	Pressure		Plun.	Mag.	Yes	Stmbg.	No.	Grav.	1½G-18K	Bennett
Imperial E	4500	12	40-70	Own	4-7½x9	H.	Singly	400	Pick		4200	Pressure	Detroit	Plun.	Mag.	Yes	King	Yes	Opt.	18G-70K	Bennett
Indiana D	900	1	6-12	LeRoi	4-3⅛x4½	V.	Block	1000			350	Circ-Sp.					King	No.	Grav.		Bennett
I.H.C. International 8-16			8-16	Own	4-4 x5	V.	Block	1000	Own	Fball		Pressure	M-Kipp						Grav.	1G-10K	
I.H.C. Titan			10-20	Own	2-6½x8	H.	Pairs	500	Own	Fball		Pressure	M-Kipp		Mag.		Own		Pump	16K	
I.H.C. Mogul		3	10-20	Own	1-8½x12	Opt.	Singly	400	Own	Fball		Pressure	M-Kipp		Mag.	Yes	Own			13K	
I.H.C. International			15-30	Own	4-5¼x8	H.	Pairs	575	Own	Fball		Pressure	M-Kipp		Mag.		Own			24K	
Interstate Plowman	1595	3	13-30	Buda	4-4¼x5½	V.	Block	900	Own	Fball	750	Splash		Plun.	Mag.	Yes	Bennett	Yes	Grav.	3G-18K	Bennett
Interstate Plowman	1895	4	15-30	Buda	4-4½x6	V.	Block	900	Own	Fball	925	Pressure		Gear	Mag.	Yes	Bennett	Yes	Grav.	3G-18K	Bennett
LaCrosse Happy Farmer F	1150	3	12-24	Own	2-6 x7	H.	Block	750	Own	Fball		Pressure	M-Kipp		Bat.		King	Yes	Grav.	2G-13K	Own
LaCrosse G	1250	3	12-24	Own	2-6 x7	H.	Block	750	Own	Fball		Pressure	M-Kipp		Bat.		King	Yes	Grav.	2G-13K	Bennett
Lausen	1985	4	15-25	Beaver	4-4½x6	V.	Block	950	Own	Fball		Circ-Sp.		Gear	Mag.	Yes	King	No.	Grav.	13⅓G-13⅓K	Orem
Leader B		3	12-20	Own	4-6¼x6	O.	Singly	800	Own	Fball	900	Pressure	Detroit		Mag.	Yes	King	Yes	Grav.	½G-20K	Own
Leader C		6	18-36		4-5 x7½	V.	Block	700			1400	Pressure	Detroit		Mag.	Yes	King	Yes	Grav.	2G-20K	
Little Giant B	1950	4	16-22	Own	4-4½x5	V.	Pairs	900	Own	Fball	850	Circ-Sp.		Gear	Mag.	Yes	King	Yes	Grav.	5G-25K	Own
Little Giant A	2900	6	26-35	Own	4-5½x6	V.	Pairs		Own	Fball	1200	Circ-Sp.		Gear	Mag.	Yes	King	Yes	Grav.	5G-35K	Own
Maxim A	1685	3	12-24		4-4¼x5½	V.	Block	950	Own		700	Circ-Sp.		Gear	Mag.	Yes	Holley	No.	Grav.	1G-15K	Bennett
Moline Universal D	1500	2	9-18	Own	4-3½x5	V.	Block		Remy	Elec.	610	Circ-Pr.		Gear	Bat.		Holley	No.	Grav.	15G	Bennett
Monarch Lightfoot B	1200	2	6-10	Kermath	4-4 x4	V.	Block	900	Own	Fball	400	Splash-Pr.		Gear	Mag.		King	Yes	Grav.	1G-9K	Bennett
Monarch Neverslip M	2050	3	12-20	Erd	4-4 x6	V.	Block	850	Erd	Fball	750	Circ.		Plun.	Mag.	Yes	King	Yes	Grav.	2G-23K	Bennett
Monarch Neverslip N	2350	4	18-30	Beaver	4-4¾x6	V.	Block	800	Beaver	Fball	1000	Splash-Pr.		Gear	Mag.	Yes	King	Yes	Grav.	2G-23K	Bennett
National E	1075	2	9-16	Waukesha	4-3½x5¼	V.	Block	1000	Wauk.	Throt	615	Splash		Plun.	Mag.	No.	Bennett	Yes	Grav.	10G-20K	Bennett
National F	1375	3	12-22	Waukesha	4-4¼x5¾	V.	Pairs	900	Wauk.	Throt	660	Splash		Plun.	Mag.	Yes	King	Yes	Grav.	10G-24K	Bennett
Nilson Junior	1775	4	16-25	Waukesha	4-4¼x5¾	V.	Pairs	900	Wauk		630	Circ-Sp.		Plun.	Mag.	Yes	King	Yes	Grav.	2G-21K	Bennett
Nilson Senior	2475	5	24-36	Waukesha	4-4¾x6¾	V.		800	Wauk		840	Circ-Sp.		Plun.	Mag.	Yes	King	Yes	Grav.	3G-28K	Bennett
Parrett H		3	12-25	Buda	4-4¼x5½	V.	Block	1000	Own	Cent.	800	Pressure		Gear	Mag.	No.	King	No.	Grav.	3G-18K	Own
Peoria J		3	12-25	Climax	4-5 x6½	V.	Pairs	750	Climax	Fball	960	Circ		Gear	Mag.	Yes	Stmbg.	No.		5G-20K	Bennett
Port Huron		3	12-25	Erd	4-4 x6	B.	Block	900	Pick	Throt.	800	Circ-Sp.		Plun.	Mag.		King	No.	Grav.	5G-25K	Bennett
Prairie Dog L	1150	2	9-13	Waukesha	4-3¾x5¼	V.	Block	950	Wauk.	Fball	550	Circ		Gear	Mag.	Yes	Bennett		Grav.	12G.	Bennett
Reed		2	10-20	Waukesha	4-4 x5¾	V.	Pairs	1100	Wauk.	Fball		Splash		Gear	Mag.	Yes	King	No.	Grav.	4G-16K	Bennett
Reed		3	15-30	Waukesha	4-4¼x5¾	V.	Pairs	1000	Wauk.	Fball		Splash		Gear	Mag.	Yes	King	No.	Grav.	4G-16K	Bennett
Reyer	1650	3	12-25	Erd	4-4 x6	V.	Block	900	Pick	Fball	850	Circ-Sp.		Plun	Mag.	Yes	King	No.	Grav.	3G-16K	Own
Rumely Oil Pull		3	12-20	Own	2-6 x8	H.	Block	560	Own	Cent.		Splash-Pr.	M-Kipp		Mag.	Yes	Own	Yes	Pump	1G-20K	Donaldson
Rumely Oil Pull		4	13-20	Own	2-7 x8½	H.	Block	530	Own	Cent	2000	Splash-Pr.	M-Kipp		Mag.	Yes	Own	Yes	Pump	1G-34K	Donaldson
Rumely Oil Pull		5	20-40	Own	2-8 x10	H.	Singly	450	Own	Cent		Splash-Pr.	M-Kipp		Mag.	Yes	Own	Yes	Pump	1G-41K	Donaldson
Rumely Oil Pull		8	30-60	Own	2-10 x12	H.	Singly	375	Own	Cent	7500	Splash-Pr.	M-Kipp		Mag.	No.	Own	Yes	Pump	3G-70K	None
Samson Sieve-Grip S-25	1750	3	12-28	Own	4-4¼x6¾	V.	Block	650	Own	Fball		Circ-Sp.		Gear	Mag.		Opt.	No.	Grav.	18K	Own
Square Turn A	1875	3	18-35	Climax	4-5 x6½	V.	Pairs	850	Climax	Cent.	1150	Circ		Vane	Mag.	Yes	Stmbg.	No.	Grav.	4G-30K	Bennett
Trundaar CC		3	20-35	Waukesha	4¾x6¾			900	Wauk.		875	Splash			Mag.	Yes	Ensign			30G.	Bennett
Turner Simplicity LM		2	12-20	Waukesha	4-3¾x5¼	V.	Block	1000	Wauk.	Fball	550	Splash		Gear	Mag.	Yes	King	Yes	Grav.	5G-15K	Bennett
Turner Simplicity LMU		3	14-25	Buda	4-4¼x5½	V.	Block	1000	Simplex		750	Pressure		Gear	Mag.	Yes	King	Yes	Grav.	5G-15K	Bennett
Twin City		3	12-20	Own	4-4¼x6	I.	Block	1000	Pierce	Cent.	800	Pressure		Gear	Mag.	Yes	Holley	No.	Grav.	3G-23K	Bennett
Twin City A		4	16-30	Own	4-5 x7½	L.	Block	650	Own	Cent.	1700	Splash	Detroit		Mag.	Yes	Holley	No.	Vac.	3G-33K	Bennett
Velie		3	12-24	Own	4-4⅛x5½	V.	Block	1100	Pierce	Fball	995	Circ-Pr.		Gear	Mag.	Yes	King	Yes	Grav.	2G-20K	Bennett
Wallis J		3	15-25	Own	4-4¼x5¾	V.	Singly	900	Own	Hyd	750	Splash		Plun.	Mag.	Yes	Bennett	No.	Grav.	2G-20K	Bennett
Waterloo Boy N	1250	3	12-25	Own	2-6½x7	H.		750	Own	Fball	1275	Splash-Pr.		Plun.	Mag.	Yes	Scheb.	Yes	Grav.	1G-20K	Own
Whitney		2	9-18	Gile	2-5½x6½	O.	Singly	750	Gile	Fball	650	Splash	M-Kipp		Mag.	Yes	Bennett	No.	Grav.	9G	
Wisconsin E	2250	4	16-32	Climax	4-5 x6½	V.	Pairs	800	Climax	Fball	1375	Pressure		Vane	Mag.	Yes	Stmbg.	No.	Grav.	6G-17K	Bennett
Yuba Ball Tread			12-20	Waukesha	4-4½x6¾	V.	Pairs	700							Mag.	No.	Ensign	No.	Grav.	¼G-27K	Donaldson
Yuba Ball Tread			20-35	Wisconsin	4-5¼x7	V.	Pairs	700							Mag.	No.	Stmbg.	No.	Grav.	30G-8K	Donaldson
Yuba Ball Tread			40-70		4-6½x8½	V.	Singly	600		Cent	3750	Circ	McCord	Gear	Mag.	Yes	Stmbg.	No.	Grav.	16G-60K	Bennett

Abbreviations

Bat—*Battery*
Cent—*Centrifugal*
Circ-*Circulating*
Circ-Pr—*Circulating Pressure*
Circ-SP—*Circulating Splash*
Cont—*Contracting*
Elec—*Electric*
Expand—*Expanding*
Fball—*Flyball*
Fric—*Friction*
Grav—*Gravity*
H—*Horizontal*
Hyd—*Hydraulic*
I—*Valve-in-Head*
Ind—*Individual*
L—*L-Head*
Mag—*Magneto*
O—*Opposed*
Plun—*Plunger*
Splash-Gr—*Splash Gravity*

oline Farm Tractors for 1919—Continued

Radiator Make	Cooling System Capacity	Cooling Fluid	Fluid Circulation	Belt Pulley Dia. Face and R.P.M.	Gearset Make	Clutch Make	Clutch Type	No. Forward Speeds	Differential Lock	Final Drive	Plowing Speed	No. Driving Wheels	Dia. and Face	No. of Tracks	Drive Wheel Axle Type	No. Non-Drive Wheels	Steering Arrangement	Frame Material	Wheelbase	Total Weight	Name and Model
Perfex	9½	Water		12-6-700	Own	Own	Fric.		No	Gear	2¼	2	54x 8		Live	2	Knuckle	Channel	90	4,000	**Heider** D
Perfex	9½	Water	Pump	14-7-600	Own	Own	Fric.		No	Gear	2¼	2	57x10		Live	2	Knuckle	Struct.	96	6,000	**Heider** C
Perfex	6	Water	Pump	12-7-	Foote	B & B	Plate	2		Gear	2½	2	48x12		Sta	2	Knuckle	Struct.	83	3,850	**Hession** D
Bremer	25	Water	Pump	12-6-800	Own	Own	Cone	3	No	Gear	2½	2	30x 9		Live	2		Steel	Opt.	2,500	**Hollis** M
Own	19	Water	Pump	14-9-625	Own	Own	Plate			Gear				2				Struct.		13,900	**Holt** 45
Own	53	Water	Pump	22-12-460	Own	Own	Plate			Chain				2		1		Struct.		23,600	**Holt** 75
Perfex	8	Water	Pump	13-7-900	Own	Own	Expand.	2	No	Gear	2⅜	2	60x10		Live	2	Knuckle	Struct.	91	5,000	**Huber** Light 4
Candler	10	Water	Pump	24-8-412	Own	B & B	Plate	2	Yes	Gear	2½	2	60x12		Sta	2	Knuckle	Struct.	92	5,500	**Hudson** K
Modine	7	Water	Pump	14-8½-600	Foote	Cotta	Disk	2	No	Axle	3½	2	54x10		Live	2	Knuckle	Struct.	96	5,000	**Illinois** C
Own	45	Water	Pump	30-12-400		Own	Shoe	2	Yes	Gear	2½	2	96x30		Sta	2	Swinging	Steel	137	4,000	**Imperial** E
Candler	5	Water	Ther.	7½-6-1000	Own	Own	Cont.		No	Chain		2	50x12		Sta	2	Swinging	Struct.		1,850	**Indiana** D
	12	Water	Ther.	12¼-8½-		Own	Fric.			Chain		2	40x12	2	Sta	2			85	3,300	**I.H.C. International** 8-16
	39	Water	Ther.	20-8½-		Own	Fric.					2	54x10		Sta	2			91¼	5,525	**I.H.C. Titan**
		Opt.		20-10½-400				2		Chain	2½	2	54x10						90	5,500	**I.H.C. Mogul**
	40	Water	Pump	18-9-		Own	Fric.					2	66x14		Live	2			86¼	8,700	**I.H.C. International**
Perfex	7	Water	Pump	12-6-590	Foote	Cotta	Disk	2	No	Gear	3	2	60x12			2		Struct.	90	4,400	**Interstate Plowman**
Perfex	7	Water	Pump	14-8-590	Foote	Cotta	Disk	2	No	Gear	3	2	60x12			2		Struct.	99	4,800	**Interstate Plowman**
Modine	9	Water	Pump	11-7½-750	Own	Own	Cont.	1	Yes	Gear	2½	2	56x10		Live	1	Knuckle	Cast		3,800	**LaCresse Happy Farmer** F
Modine	9	Water	Pump	11-7½-750	Own	Own	Cont.	1	Yes	Gear	2½	2	56x10		Live	2	Knuckle	Cast		4,000	**LaCresse** G
Perfex		Water	Pump	18-8-475	Own	Own	Shoe	2	Yes	Gear	2½	2	54x12			2	Knuckle	Pressed	86	6,000	**Lauson**
Eureka	8	Water	Pump	14-6-	Own	Own	Shoe	2	No	Gear	2¼	2	48x12		Sta	2	Knuckle	Struct.	81	4,800	**Leader** B
Eureka	14	Water	Pump	14-8-700	Own	Own	Cone	2	No	Chain	1⅘			2	Sta	2	Knuckle	Struct.	94	6,400	**Leader** C
Own	8	Water	Pump	9-7-900	Own	Own	Cone	3	No	Gear	3	2	54x14		Spring	2	Knuckle	Struct.	87	5,200	**Little Giant** B
Own	10	Water	Pump	13-9-750	Own	Own	Cone	3	No	Gear	3	2	66x20		Spring		Knuckle	Struct.	102	8,700	**Little Giant** A
Perfex	8	Water	Pump	8-8-950	Own	B & B	Disk	3	No	Worm	3½	2	40x10		Live	2	Knuckle	Channel	80	3,865	**Maxim** A
Modine	5	Water	Ther.	9-6-1050	Own	B & B			Yes	Gear	2⅝	2	52x 8		Sta			Cast		3,280	**Moline Universal** D
Perfex	6	Water	Pump	9-7-	Own	Own	Expand.	1	No	Chain	2½			2				Struct.		3,200	**Monarch Lightfoot** B
Perfex	10	Water	Pump	18-8-500	Foote	Burman	Shoe	2	No	Chain	2¼			2				Struct.			**Monarch Neverslip** M
Perfex	12	Water	Pump	18-8-475	Foote	Burman	Shoe	2	No	Chain	2¼			2				Struct.		6,200	**Monarch Neverslip** N
Perfex	9	Water	Pump	10-6-600	Own			4	No	Gear	3½	2	46x10		Live	2	Knuckle	Channel	85	3,800	**National** E
Perfex	10½	Water	Pump	10-6-600	Own			4	No	Gear	3	2	46x10		Live	2	Knuckle	Channel	85	4,200	**National** F
Modine	4	Water	Pump	20-6-360	Own	Own	Shoe	2	No	Chain	2½	3	50x		Live	2	Knuckle	Struct.	84	4,500	**Nilson** Junior
Modine	5	Water	Pump	24-8-320	Own	Own	Shoe	2	No	Chain	2¼	2	52x		Live	2	Knuckle	Struct.	100	5,600	**Nilson** Senior
Perfex	8	Water		12-8-1000	Own	Own	Disk	3	No	Gear	2⅜	2	60x10		Sta	2		Struct.	107	5,200	**Parrett** H
Eureka	9	Water	Pump	14-7-750	Nuttall	B & B		2	No	Gear	3½	2	56x12		Sta	2	Knuckle	Channel	96	5,100	**Peoria** J
Perfex	11½	Water	Pump	14-8-650	Own			1	No	Gear	2	2	56x10		Live	2	Knuckle	Channel	93	5,700	**Port Huron**
Perfex	7½	Water	Pump	10-7-950	Own	Own	Cone	2		Gear	2⅝	1	48x20		Sta	2	Knuckle	Struct.	97	3,200	**Prairie Dog** L
Modine	7	Water	Pump	12-7-875	Own	Burman	Shoe	2	Yes	Gear	2½	2	60x10		Sta	2	Knuckle	Channel	98	6,000	**Reed**
Modine	7	Water	Pump	12-7-875	Own	Burman	Shoe	2	Yes	Gear	2½	2	60x12		Sta	2	Knuckle	Channel	98	6,000	**Reed**
Perfex	9	Water	Pump	18-8-650	Own			1	No	Chain	2¾	2	54x14			2	Knuckle	Channel	84	4,900	**Reyer**
Own	10½	Oil	Pump	18-7-560	Own	Own	Shoe	2	No	Gear	2 3/10	2	51x12		Live	2	Knuckle	Struct.	80½		**Rumely Oil Pull**
Own	15	Oil	Pump	23-8½-530	Own	Own	Shoe	2	No	Gear	2 3/10	2	56x18		Live	2	Knuckle	Struct.	92½		**Rumely Oil Pull**
Own	17	Oil	Pump	26-9-450	Own	Own	Shoe	2	No	Gear	2	2	64x20		Live	2	Knuckle	Struct.	103		**Rumely Oil Pull**
Own	70	Oil	Pump	36-11-375	Own	Own	Shoe	1	No	Gear	1 9/10	2	80x30		Live	2	Swinging	Struct.	141	26,000	**Rumely Oil Pull**
Own	14	Water	Pump	-8-750	Own				No	Gear		2	42x18		Rigid	1		Struct.	106	5,800	**Samson Sieve-Grip** S-25
Perfex	10	Water	Pump	12-8-850	Own			1	No	Gear	2¼	2	60x12		Sta	1		Struct.	130	7,200	**Square Turn** A
Perfex	8	Water		10-8-900	Own	B & B	Disk	2	No		2½			2				Struct.		9,300	**Trundaar** CC
Perfex	8	Water	Pump	14-7-600	Foote	Own	Disk	2	Yes	Gear	2½	2	54x10		Sta	2	Knuckle	Struct.	87	4,000	**Turner Simplicity** LM
Perfex	9	Water	Pump	14-8-600	Foote		Disk	2	Yes	Gear	2½	2	54x12		Live	2	Knuckle	Struct.	87	4,400	**Turner Simplicity** LMU
Spirex	7	Water	Pump	16-6-650	Own	B & B	Plate		No	Axle	2⅕	2	50x12		Live	2	Knuckle	Cast	84	4,000	**Twin City**
Modine	20	Water	Pump	17-8-528	Own	Own	Cont.		No	Rim	2	2	54x14		Sta	2	Knuckle	Struct.	108	7,800	**Twin City** A
Bremer	14	Water	Pump	13-7¾-900	Own	B & B		3	Yes	Gear	2 8/10	2	54x10		Sta	2	Knuckle	Struct.	91	4,300	**Velie**
Modine	8	Water	Pump	18-6¾-430	Own	Own	Shoe	2	No	Gear	2½	2	48x12		Live	1		Pressed	100	3,250	**Wallis** J
Modine		Water	Pump	14-8-	Own	Own	Cont.	2	No	Gear	2¼	2	52x12		Live	2	Swinging	Struct.	89	5,860	**Waterloo Boy** N
Modine		Water	Pump	11-6¾-750	Own	Own	Band	3	No	Chain	2½	2	48x10		Live	2	Knuckle	Channel	82	2,850	**Whitney**
Perfex	12	Water	Pump	16-8-575	Foote	B & B	Disk	2	No	Gear	2⅓	2	52x12		Live	2	Knuckle	Channel	95	5,400	**Wisconsin** E
Own	6½	Water	Pump	12-6¾-700	Own	B & B	Disk	3	No	Gear	2 3/10			2		1		Channel	90	6,750	**Yuba Ball Tread**
Own	15	Water	Pump	-8½-700	Own	Paragon	Disk	2	No	Gear	2 3/10			2		1		Channel	108	10,250	**Yuba Ball Tread**
Own	22	Water	Pump	18-10½-600	Own		Expand.	3	No	Gear	2 3/10			2		1		Channel	120	21,000	**Yuba Ball Tread**

Splash-Pr—*Splash Pressure*
Sta—*Stationary*
Struct—*Structural Steel*
T—*T-Head*
Throt—*Throttle*
V—*Vertical*

Vac—*Vacuum*

Equipment

B & B—*Borg & Beck*
Cont—*Continental*
Hersh-Sp—*Herschell-Spillman*
King—*Kingston*
M-Kipp—*Madison Kipp*
Pick—*Pickering*
Rayfld—*Rayfield*
Scheb—*Schebler*
S.H.J.—*Shotwell-Hobart-Johnson*
Sparks—*Sparks-Withington*
Stmbg—*Stromberg*
Wauk—*Waukesha*

40 Years of Domestic Metal Production

Steady Increases Are Shown Throughout the Years and There Is Evidence of the Strenuous Effort Made to Increase Production to Meet the Demands of War

UNDER normal commercial conditions the state of the metal market has, quite naturally, interested the manufacturer of automotive products both in a general way and also more particularly in regard to those metals which are essentials to the carrying on of his business. In past years the various branches of our industry have been dependent on the prices set for steel, aluminum, copper and other metals for the fixing of their respective selling prices for the product with which they have been individually identified, or, at least, the basic prices of these metals exercised an influence on those of the complete car, truck, tractor, etc.

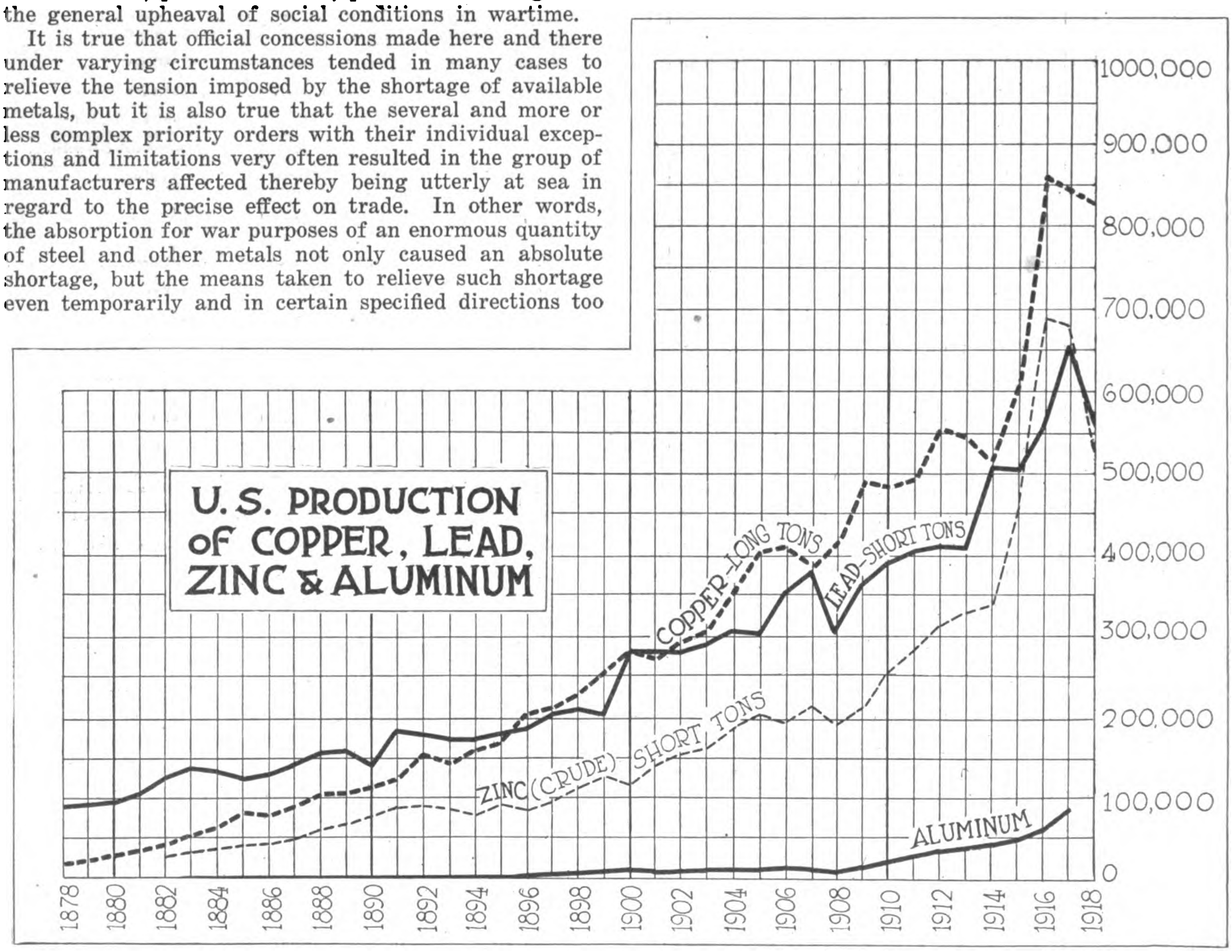
That conditions were abnormal in the highest degree during the past year is an axiom—the truth of the statement is so apparent that no proof or demonstration is needed—and obviously the automotive industry has been practically dominated by the existing position of the metal market, plus restrictions, plus labor shortage and the general upheaval of social conditions in wartime.

It is true that official concessions made here and there under varying circumstances tended in many cases to relieve the tension imposed by the shortage of available metals, but it is also true that the several and more or less complex priority orders with their individual exceptions and limitations very often resulted in the group of manufacturers affected thereby being utterly at sea in regard to the precise effect on trade. In other words, the absorption for war purposes of an enormous quantity of steel and other metals not only caused an absolute shortage, but the means taken to relieve such shortage even temporarily and in certain specified directions too often caused additional troubles and misunderstandings.

That this should be the case is not to be wondered at, for human nature has not changed since Æsop demonstrated it was impossible to please everybody, and, with the best possible intentions, the official allocation of certain metals to specified sections of various industries sometimes brought results which were not pleasing to others.

However, restrictions have been removed, production generally is speeding up, and already there are indications that things will be a bit easier for the automotive products manufacturer in the near future.

We are still faced with problems regarding steel, primarily, and other metals to a lesser degree, but, doubtless, these will be solved speedily. For instance, it is possible that several million tons of steel will be needed to assist in the restoration of devastated France and



Belgium. It is not known how much may be required, but it will be a quantity large enough to make serious demands on our present estimated production of 45,000,000 tons a year.

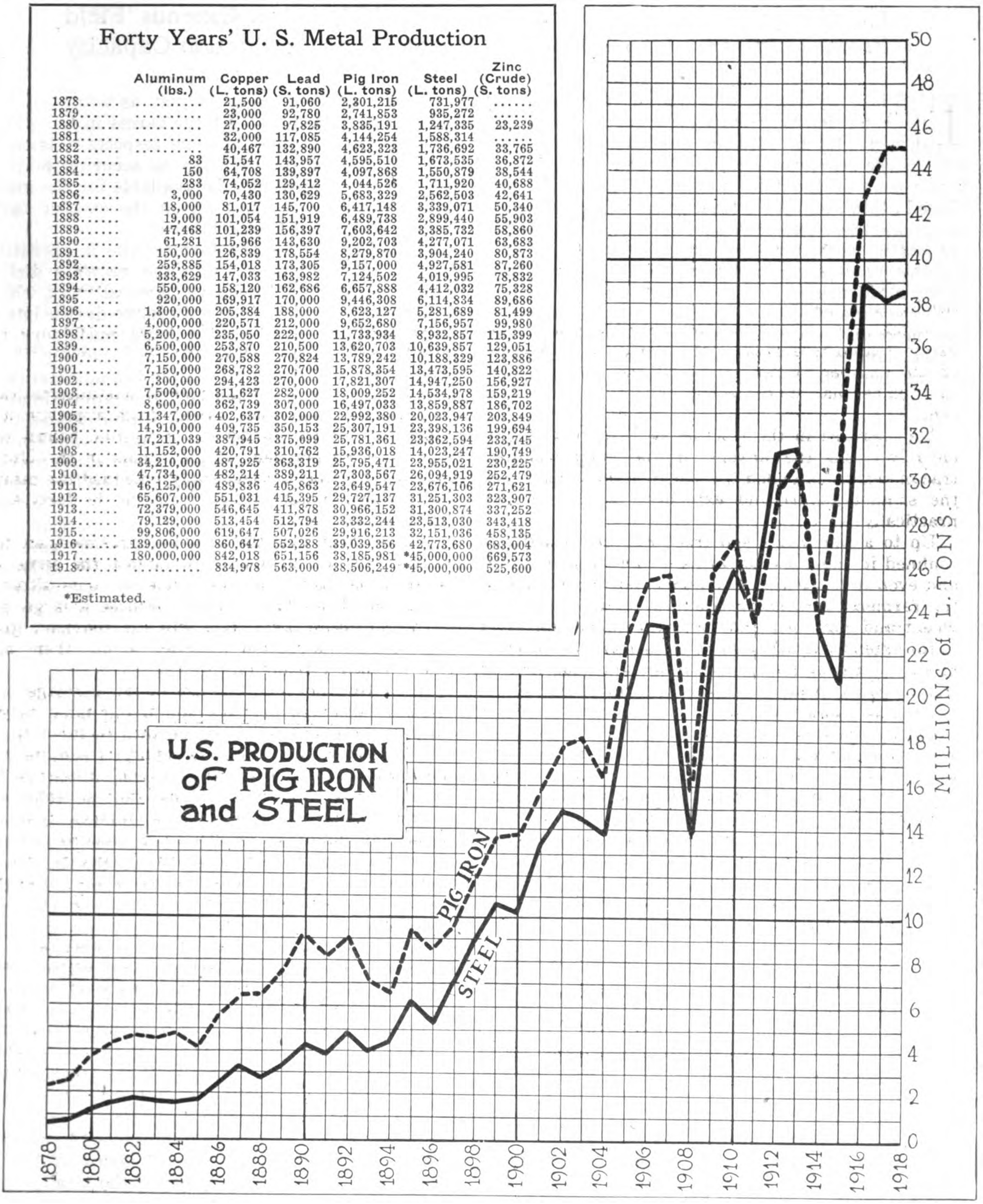
The table and charts herewith are self-explanatory, but in regard to them it should be mentioned that the pressure of wartime business has seriously interfered with the official compilation of production figures for 1917 and 1918. For this reason a few of the items are represented by estimated totals. All figures refer to domestic production only.

The tremendous growth in the use of the comparatively new metal, aluminum, is shown in the table. In 1883 the production was but 83 lb., in 1917 it was 180,000,000 lb., and, although figures for 1918 have not yet been compiled, there is but little doubt that the total is even larger.

Forty Years' U. S. Metal Production

	Aluminum (lbs.)	Copper (L. tons)	Lead (S. tons)	Pig Iron (L. tons)	Steel (L. tons)	Zinc (Crude) (S. tons)
1878	....	21,500	91,060	2,301,215	731,977	......
1879	....	23,000	92,780	2,741,853	935,272	......
1880	....	27,000	97,825	3,835,191	1,247,335	23,239
1881	....	32,000	117,085	4,144,254	1,588,314	......
1882	....	40,467	132,890	4,623,323	1,736,692	33,765
1883	83	51,547	143,957	4,595,510	1,673,535	36,872
1884	150	64,708	139,897	4,097,868	1,550,879	38,544
1885	283	74,052	129,412	4,044,526	1,711,920	40,688
1886	3,000	70,430	130,629	5,683,329	2,562,503	42,641
1887	18,000	81,017	145,700	6,417,148	3,339,071	50,340
1888	19,000	101,054	151,919	6,489,738	2,899,440	55,903
1889	47,468	101,239	156,397	7,603,642	3,385,732	58,860
1890	61,281	115,966	143,630	9,202,703	4,277,071	63,683
1891	150,000	126,839	178,554	8,279,870	3,904,240	80,873
1892	259,885	154,018	173,305	9,157,000	4,927,581	87,260
1893	333,629	147,033	163,982	7,124,502	4,019,995	78,832
1894	550,000	158,120	162,686	6,657,888	4,412,032	75,328
1895	920,000	169,917	170,000	9,446,308	6,114,834	89,686
1896	1,300,000	205,384	188,000	8,623,127	5,281,689	81,499
1897	4,000,000	220,571	212,000	9,652,680	7,156,957	99,980
1898	5,200,000	235,050	222,000	11,733,934	8,932,857	115,399
1899	6,500,000	253,870	210,500	13,620,703	10,639,857	129,051
1900	7,150,000	270,588	270,824	13,789,242	10,188,329	123,886
1901	7,150,000	268,782	270,700	15,878,354	13,473,595	140,822
1902	7,300,000	294,423	270,000	17,821,307	14,947,250	156,927
1903	7,500,000	311,627	282,000	18,009,252	14,534,978	159,219
1904	8,600,000	362,739	307,000	16,497,033	13,859,887	186,702
1905	11,347,000	402,637	302,000	22,992,380	20,023,947	203,849
1906	14,910,000	409,735	350,153	25,307,191	23,398,136	199,694
1907	17,211,039	387,945	375,099	25,781,361	23,362,594	233,745
1908	11,152,000	420,791	310,762	15,936,018	14,023,247	190,749
1909	34,210,000	487,925	363,319	25,795,471	23,955,021	230,225
1910	47,734,000	482,214	389,211	27,303,567	26,094,919	252,479
1911	46,125,000	489,836	405,863	23,649,547	23,676,106	271,621
1912	65,607,000	551,031	415,395	29,727,137	31,251,303	323,907
1913	72,379,000	546,645	411,878	30,966,152	31,300,874	337,252
1914	79,129,000	513,454	512,794	23,332,244	23,513,030	343,418
1915	99,806,000	619,647	507,026	29,916,213	32,151,036	458,135
1916	139,000,000	860,647	552,288	39,039,356	42,773,680	683,004
1917	180,000,000	842,018	651,156	38,185,981	*45,000,000	669,573
1918	....	834,978	563,000	38,506,249	*45,000,000	525,600

*Estimated.



Small Tractor Increases Potential Market From 2% to 60% of Farms

Development of Compact, Easily Managed Machines Extends Field From 15 to 48 States—Market Greater Than Production Capacity

THE last 2 years have seen an entire change in the condition confronting the farm tractor industry. Up to 1916 the number of farm tractors in use represented approximately one-third of 1 per cent of the total number of farms in the United States, and farm tractor use was confined to the great wheat and corn belt. In many of the eastern states very few farm tractors had been sold and the horse-drawn implements were used on practically all farms.

At the close of 1917 the number of tractors in use has increased to a little over one-half of 1 per cent of the number of farms and at the close of 1918 the number had increased to something over 1 per cent.

The increase in the tractor use had come almost entirely from the advent of the small compact tractor which extended the scope of the tractor into the smaller farms and extended its market into practically all states.

Up to a few years ago tractors were practically confined in their use to farms of 500 acres or over, and even in these farms a very small percentage of the farmers were using tractors at all. From the wheat and corn belt and the large farm interested in the extensive cultivation of subserials the developments in tractor design and production has carried the tractor at least to some extent into most of the other states and into farms of a general character down to as low as 50 acres.

It has made extensive markets in the states which previously had no use for tractors at all. It has not only extended the possibilities of the use of the tractor over small areas for cultivation but has made available for belt work in connection with the other power machinery possibilities on the smaller farms so that its economic value is increased and it can earn its way on farms restricted in size and devoted to general crops where the tractor of 3 or 4 years ago could not be economically used.

In New York State, which was not considered as a tractor market before this newer development, there has been a large sale of tractors in the last 2 years, and particularly in the last year, and they have been successfully used on farms as small as 50 acres. Some of the dealers in this state have sold as high as sixty tractor in their section.

The two conditions which have governed the development of the tractor in this way have been the world-wide demand for American food products, developed by the war, and a shortage of labor on the farm.

This shortage of labor is just as acute on the small farm as it is on the large farms in the wheat and corn belts, in fact in some respects it is more acute because of the difficulty in securing help of the character which must be available for the many duties devolving on the man on the smaller farm where jobs cannot be specialized.

In addition to this the farmer who is operating the smaller farm meets with the growing dislike of the laborer with the heavy physical work which is necessary in cultivating with horse-drawn implements, and in operating the hand machinery required in the other jobs.

The advent of the small tractor has automatically increased the potential market from approximately 2 per cent of the farms in the United States to a little over 60 per cent of the farms in the United States and it has automatically extended the market from approximately fifteen states to the forty-eight states of the Union.

It is evident that the demand for American food products is to continue with almost the same imperative necessity for some time to come although actual hostilities have ceased, because a large part of the European farm areas will still require a great deal of re-construction in order to put them back to a pre-war production.

It is also apparent that the labor shortage is to continue although perhaps not to the same degree. There is no evidence of any surplus of labor in the United States and when the readjustment is over there will still be a shortage which is usually felt on the farms more than in any other direction.

Under these conditions it is obvious that the actual immediate market for farm tractors is much larger than the present productive capacity and the potential market is at least as big as the developed market for passenger cars which has come out of the 20 years work in this field.

The development of the small tractor with its extended possibilities of service, less expensive to buy and maintain, with greater opportunities to become economically useful under the varied conditions of farming in this country, have increased the market not only by extending it over states which were not tractor users previously, but by increasing the possibilities enormously even in the states which previously used a good many of the tractors then produced. In Nebraska for instance a number of farms of 500 acres and over represents 11 per cent of the total while the number of farms of 100 to 500 acres represents 70 per cent of the total.

NUMBER OF FARMS OF VARIOUS ACREAGES IN ALL STATES

STATE	Under 20 Acres	20 to 49 Acres	50 to 99 Acres	100 to 174 Acres	175 to 499 Acres	500 to 999 Acres	1,000 Acres and Over	TOTAL
NEW ENGLAND								
Maine	7,113	9,492	17,895	16,633	8,293	461	129	60,016
New Hampshire	4,595	4,509	6,248	6,247	4,774	513	167	27,053
Vermont	4,578	3,481	5,910	9,492	8,516	607	125	32,709
Massachusetts	10,606	8,890	7,981	5,703	3,325	319	93	36,917
Rhode Island	1,377	1,144	1,264	945	487	51	24	5,292
Connecticut	6,035	6,306	6,634	4,999	2,613	188	40	26,815
Total	34,304	33,822	45,932	44,019	28,008	2,139	578	188,802
MIDDLE ATLANTIC								
New York	34,188	31,047	56,821	61,031	31,163	1,104	243	215,597
New Jersey	8,073	7,607	8,194	7,207	2,235	112	59	33,487
Pennsylvania	38,658	39,721	65,687	55,518	18,912	632	167	219,295
Total	80,919	78,375	130,702	123,756	52,310	1,848	469	468,379
EAST NORTH CENTRAL								
Ohio	38,913	50,331	88,047	68,746	25,113	783	112	272,045
Indiana	23,644	40,161	67,221	57,261	26,107	949	142	215,485
Illinois	20,294	33,322	57,917	80,539	57,755	1,842	203	251,872
Michigan	14,785	49,890	73,748	50,622	17,143	607	165	206,960
Wisconsin	10,647	23,460	54,007	58,439	29,467	966	141	177,127
Total	108,283	197,164	340,940	315,607	155,585	5,147	763	1,123,489
WEST NORTH CENTRAL								
Minnesota	5,619	12,028	26,571	55,424	52,836	3,359	300	156,137
Iowa	13,724	15,678	38,712	80,121	66,165	2,430	214	217,044
Missouri	19,756	47,398	74,178	80,020	51,921	3,427	544	277,244
North Dakota	229	450	1,207	23,003	34,393	12,662	2,416	74,360
South Dakota	808	1,121	2,406	28,396	33,041	9,698	2,174	74,644
Nebraska	4,358	4,558	12,618	43,916	47,233	13,128	3,867	129,678
Kansas	8,042	10,738	26,151	57,789	61,286	10,475	3,360	177,841
Total	52,536	91,971	181,843	368,669	346,875	55,179	12,875	1,109,948
SOUTH ATLANTIC								
Delaware	1,535	1,988	2,977	2,849	1,429	52	6	10,836
Maryland	10,232	8,629	9,946	11,457	8,070	506	83	48,923
Dist. of Columbia	122	65	17	10	3	....	....	217
Virginia	39,746	42,390	38,342	32,997	26,101	3,450	992	184,018
West Virginia	15,399	20,323	26,806	20,156	12,248	1,316	437	96,685
North Carolina	43,224	75,629	62,157	43,987	25,254	2,669	805	253,725
South Carolina	37,985	70,582	33,147	19,427	12,539	1,942	812	176,434
Georgia	29,629	117,432	68,510	42,275	27,710	3,950	1,521	291,027
Florida	9,084	17,169	9,999	8,178	4,545	670	371	50,016
Total	186,956	354,207	251,901	181,336	117,899	14,555	5,027	1,111,881
EAST SOUTH CENTRAL								
Kentucky	55,472	58,537	65,778	50,134	26,639	2,181	444	259,185
Tennessee	47,341	72,212	60,105	41,545	22,450	1,878	481	246,012
Alabama	41,858	106,841	55,448	35,563	20,093	2,276	822	262,901
Mississippi	66,943	112,666	44,645	30,172	17,115	2,061	780	274,382
Total	211,614	350,256	225,976	157,414	86,297	8,396	2,527	1,042,480
WEST SOUTH CENTRAL								
Arkansas	36,259	74,983	45,373	39,353	17,149	1,163	398	214,678
Louisiana	29,256	46,389	20,248	13,681	8,406	1,548	1,018	120,546
Oklahoma	7,158	31,489	39,002	75,186	33,812	2,688	857	190,192
Texas	29,371	98,583	112,237	94,574	59,049	12,833	11,123	417,770
Total	102,044	251,444	216,860	222,794	118,416	18,232	13,396	943,186
MOUNTAIN								
Montana	755	956	1,260	10,552	8,339	2,353	1,999	26,214
Idaho	2,005	4,048	5,820	11,891	5,866	921	256	30,807
Wyoming	420	338	645	3,816	3,629	984	1,155	10,987
Colorado	5,070	3,882	4,384	16,355	12,476	2,426	1,577	46,170
New Mexico	6,885	2,812	1,820	15,363	7,388	836	572	35,676
Arizona	3,346	1,477	820	2,591	757	164	72	9,227
Utah	4,674	5,550	4,170	3,660	2,681	551	390	21,676
Nevada	271	320	411	555	540	248	344	2,689
Total	23,426	19,383	19,330	64,783	41,676	8,483	6,365	183,446
PACIFIC								
Washington	10,529	10,252	7,105	13,884	9,215	3,481	1,726	56,192
Oregon	6,030	6,888	6,800	12,009	9,343	2,716	1,716	45,502
California	22,525	20,614	10,680	12,015	12,551	5,119	4,693	88,197
Total	39,084	37,754	24,585	37,908	31,109	11,316	8,135	189,891
Grand total	839,166	1,414,376	1,438,069	1,516,286	978,175	125,295	50,135	6,361,502

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

PUBLISHED WEEKLY

Vol XL Thursday, January 16, 1919 No. 3

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142.

Cable Address - - - - - Autoland, New York
Long Distance Telephone - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - One Year, $3.00
Canada - - - - - One Year, 5.00
Foreign Countries - - - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Car Registrations

THE most remarkable fact that may be gathered from the tables of car registrations, printed elsewhere in this issue, is that the greatest "density of automobiles" on the basis of population is to be found in the Middle-Western farming states. Iowa and Nebraska lead, closely followed by South Dakota —all adjacent states. In Iowa and Nebraska there is now one car to every seven of the population. It would not be quite correct to say that every second family there has its car, as in these states the people do not live in apartment houses and the families average larger than those of the big cities. In the cities of these states there must be many families which for one reason or another do not own a car, and the figures indicate that practically every farmer there now has his machine.

There could hardly be a more conclusive argument to show the utilitarian character of the automobile than that furnished by these figures. The farmer uses his car mainly for driving to town. While he may occasionally make the trip purely for pleasure, as a rule it is business of one kind or another that compels him to make it. With the increasing amount of machinery of all kinds in use on the farm it becomes necessary to drive to town more frequently. The whole method of conducting farm business has been changed by the advent of the automobile. Discussing the "gasless Sunday" rule of last fall and the possibility of still greater restrictions on the supply of gasoline, which might also be extended to that part of the country west of the Mississippi, an Iowa dairy farmer said that without the use of his car he simply could not continue his business.

Another interesting feature in connection with the registration figures is the rather irregular rate of increase. If we make an exception of New Jersey, the states at the head of the list showing the rate of increase are all Southern states. There are several reasons to explain this fact. Most of the Southern states have as yet only a comparatively small number of cars, so that a large proportional increase does not mean a very large absolute increase in the number of cars. New Jersey stands rather alone among the states with a high proportional increase, far from her neighbor states of New York and Pennsylvania. She has made up the former lead of these states in respect to "density of automobiles" and now is on a substantially equal footing with them.

It is only natural that the proportional annual increase in automobile registrations should gradually decrease, and the figure of 20 per cent for the whole country for the year 1918 is remarkably good, considering the circumstances. The full effect of the war's interference with automobile production will probably appear only next year.

Tests of Piston Rings

IT is a great pity that there is not some quick and reliable method for making comparative tests of piston rings. A large amount of ingenuity has been spent in recent years in attempts to improve this rather unimportant looking part of the engine. The claims made for the different special rings are all very much the same and there is no readily available method of checking them up.

How important any slight improvement is from the standpoint of fuel economy may be judged from a recent estimate placing the number of piston rings annually produced in the United States at 200,000,000. This figure may be slightly too high, but when it is considered that one automobile factory alone uses 16,000,000 rings per year it will be seen that it cannot be so very far off.

The two aims of practically all inventors of piston rings are uniform pressure all around the ring and elimination of the leakage path at the cut or joint. Formerly it was customary to obtain the necessary "spring" by making the ring to a larger diameter than the cylinder bore and compressing it after material had been removed at the gap, but lately there has been a tendency to produce the "spring" by hammering or peening, the ring being machined

to the diameter of the bore and then expanded. The advantage claimed is that in this way the pressure can be made more nearly uniform all around the ring.

Another change in the methods of ring manufacture has been the substitution of individually cast rings for cast-iron pots from which about a dozen rings are cut. From the individually cast rings very little material is removed in machining, and it is claimed that the chilled skin of the casting is more elastic or more springy than the core material. But the chilling also increases the hardness and therefore the wear of the cylinder walls by the rings. Recently the suggestion has been made to cast the ring blanks in a centrifugal machine so as to compact the iron while it is solidifying.

The automobile engineer whose duty it is to choose rings for an engine must often be in doubt as to the validity of the claims made for different designs. No generally accepted test for ring efficiency exists. Not even the pressure at different parts of the ring circumference can be accurately measured. Dynamometer tests, of course, will give some idea of the efficiency of the ring, but the difficulty is that when one set of rings is to be substituted for another for the purpose of a comparative test the engine must be dismounted and it is practically impossible to exactly reproduce all the conditions of the test.

Returned Soldiers

THERE is a tendency in some quarters to exaggerate the condition of the returned soldier. It is stated that he is not being given a fair chance to secure a job and that in many instances he is being turned loose without any opportunity of making a living and with a good chance of his money running short before he can get suitable employment.

It would not be correct to say that no such condition exists, because there are no doubt many instances where the soldier would like to get work and for a combination of reasons may not be able to get it. Taking the situation generally, however, as it applies to the Mid-West manufacturing districts centering about Detroit, the condition does not apply.

As a matter of fact there is a reluctance on the part of the soldier to return to the job he left. He is looking for something better, and in many cases camp life has put him in a frame of mind making him long for a rest more than for a job. At the Detroit government employment bureau soldiers come in now and then asking what are the chances of a job in a week or two.

A large majority of the factories and industrial concerns which are able to turn to peace-time pursuits are taking back the men who were drafted or who enlisted, and in practically every case the returned soldier is given the first chance for the job, if his qualifications are anywhere near those considered necessary.

In the smaller towns the problem of the returned soldier does not exist. It is those who have been attracted by the lure of the metropolis and decided to seek employment in the big city, which they perhaps had never seen until the war took them there, who constitute a problem. The farm and factory can absorb the returned soldier readily, the big city cannot do so equally well. The soldier who is brought home to the place where he enlisted or from which he was drafted is not going to prove a dangerous factor in the employment situation.

Air Mail Service

CAN we take our long-distance air mail service seriously? Recent map-making and experimental trips have revealed difficulties and irregularities that do not give any great amount of hope that long-distance air mail service is going to prove a success with the present type of planes. It would be folly, indeed, to go to any great expense until experiments on a small scale have shown exactly what can be expected.

The principal fact which has been learned from experience to date is that it is unwise to fly in stages of over 250 miles. If longer trips are to be made they should be done in relays. Another fact which is becoming apparent is that the Liberty engine, although a great war engine, is not the most satisfactory one for mail-carrying service. The fuel consumption of this engine ranges all the way from 26 to 32 gal. per hour, according to records of the flight fields, and this, of course, is not economical from a weight-carrying standpoint alone.

It must also be taken into consideration that an engine of this size and power requires frequent overhauling, and that after 50 hr. of flight there exists an uncertainty as to how much longer the engine will run without failure. It is a fact that Liberty engines have flown from 125 hr. and upward, yet it is the average that must be considered rather than the exceptional.

If the mail service is going to be materially benefited by the introduction of the airplane post on a large scale, it should be entered whole-heartedly, but a close study should be made of the type of engine and plane best adapted to the work. There is no doubt that we have a large store of Liberty engines on hand, and also a large store of the De Haviland type planes, but if these are not the most efficient type, before we get into the matter on a large scale it would seem wise to have worked out the best type of plane for the purpose and also to have carefully determined the length of the desirable stage. The pilots who recently flew from Texas to Detroit demonstrated the futility of the long-distance service under present conditions.

AT the coming S. A. E. meeting in New York much attention will be paid to the subject of fuels. In view of the present precarious fuel situation and the fact that the future of the automotive industry is absolutely dependent upon a rapid increase in the available fuel supply, the papers committee has certainly shown good judgment in making this the leading topic.

☐ Latest News of the

2000 to Attend S.A.E. Victory Dinner

Society's Chicago Meeting to Discuss Engines of Various Types—New York Has Big Program

NEW YORK, Jan. 15—More than 600 tickets already have been sold for the Victory Dinner of the Society of Automotive Engineers, which is to be held at the Hotel Astor on Feb. 6. It is confidently expected that the number of members and guests in attendance will touch and probably top the 2000 mark.

Plans for the Chicago meeting of the S. A. E., which will be held during the week of the passenger car show, have progressed to the point where a tentative program has been adopted. The meeting will be held in the afternoon of Jan. 30, and the program will comprise a number of short papers on truck, tractor and passenger car engines, with a discussion of the possibilities of air-cooled engines, as well as of steam engines. The evening session is to be preceded by a "Home-Coming" supper.

For the New York session the program has been considerably amplified, and as now arranged will include a report by Dr. David White, chief geologist of the United States Geological Survey, on the unmined supply of petroleum in the United States. This will supplement papers by Dr. E. W. Dean, of the Bureau of Mines, on the status of refinery practice, with particular reference to cracking methods; Dr. J. E. Pogue, who will give an interpretation of the engine fuel problem; Dr. H. C. Dickinson, of the Bureau of Standards, who will present a paper on the status of engine efficiency, and E. De Golger, who will give an estimate of the expense of the utilization of Mexican crudes. John J. Utz will give some historical notes on military truck standardization, and Major A. B. Browne is scheduled to outline some lessons in truck design developed in the war. George F. Crouch will present a paper on the application of the marine internal combustion engine to war needs. An entertaining and illuminating presentation on forest products for aircraft use will be made by Clyde H. Teesdale. Lieut. Alexander Klemin and Grover C. Loening will treat of proportioning planes to engines and of high-speed planes respectively.

The Navy Department will co-operate very generously in the program, Commanders H. C. Richardson and F. G. Coburn speaking on airplane and seaplane engineering and production. Starr Truscott will have dirigibles as a subject. It is hoped that Commander J. H. Towers will tell of the operation of naval aircraft.

—

Elgin in Good Financial Condition

CHICAGO, Jan. 15.—About 1000 were present at the annual stockholders' meeting of the Elgin Motor Car Corp. yesterday. The old board of directors was re-elected, with the exception of A. L. Tull, who resigned. His place was taken by William McMasters, industrial agent of the Indiana Harbor Belt Railway Co. The following directors were re-elected: C. S. Rieman, Gregory L. Baum, W. G. Knoedler, J. M. Smitheler and David Schnitzer. The meeting was a harmonious one throughout and the stockholders passed a resolution of thanks to the management for the satisfactory manner in which the company had been brought through the difficult war period.

—

England Plans World-Wide Airplane Service

LONDON, ENGLAND, Jan. 13—By Mail—England is laying plans to conquer the airways of the world, according to an exhaustive report which has just been made by the Civil Aerial Transport Committee, which was appointed especially to study future legislation both in the British Empire and among the Allied nations. The report urges that all the Dominion be encouraged to build up large air fleets for aerial mail and passenger transportation. None of the sixty members of the committee expressed any doubt that within a few years passenger lines would be running to all parts of the world. It is pointed out that state ownership of aerodromes and landing stations is necessary in the interest of national defense and highly desirable also for commercial purposes. In that part of the report dealing with the choice of air routes the committee suggests that New York be the Western terminus of the Atlantic route, and points to the advisability of designing and arranging for the establishment of sea stations in the form of ships approximately 600 ft. long with a clear upper deck of 400 ft. This would permit the use of airplanes instead of seaplanes. In an appendix the opinion is advanced that planes capable of flying 500 miles without alighting will fill all requirements.

—

$280 Reduction for G. M. C. ¾-Ton Truck

PONTIAC, Jan. 16—The General Motors Truck Co. has lowered the price of its ¾-ton truck, model 16, from $1775 to $1495, a reduction of $280.

Trade-Mark "Ford" More Than Name

Far Reaching Decision Gives Additional Protection Against Infringement

DETROIT, Jan. 13—"I am satisfied that the word 'Ford' is not merely the name of Henry Ford, or merely the name of any other man, it is the name of a machine."

This sentence is taken from the decision of Assistant Patent Commissioner F. W. H. Clay in an opinion reversing the decision of the trade-mark examiner in refusing to register the Ford Co. trade-mark as the business slogan for a new line of rubber goods which Ford proposes to market.

The decision is far-reaching. It not only gives manufacturers of all well known products additional protection against trade-mark infringement but it establishes a precedent by sustaining the contention that the Patent Office stand that names are not good trade-marks, does not hold true in all cases. While it does not bar men of similar surnames from doing business under the same, it prohibits them from using their own name as a trade-mark for their product if the goods they market represent articles similar to the output of another firm having established a reputation and marketing its output under the same trade-mark.

It is a final blow to the efforts of certain concerns to market automobile parts and accessories under the names of well-known companies. The Ford Motor Co., has not only had several cases of this nature to deal with, but a number other companies have also been obliged to combat like attempts to infringe upon their names.

In his ruling the Patent Commissioner says there is some force in the applicant's argument that when an automobile has become as well known as the Ford, it is the natural expansion of the regular business to make automobile tires and to extend the trade-mark to them on the basis of the rights acquired by the usage of the automobile itself. He declares it is his conviction that the Ford mark is a good mark at common law and is the exclusive property of the Ford Co., using the name as its trade-mark.

The commissioner holds that for a great many years the public has had a very wide familiarity with this exact form of this word as a mark on an automobile and parts of automobiles. He declares one cannot be justly ignorant of

(*Continued on page* 192)

Automotive Industries

Manufacturers Band Together

Organize to Facilitate Speedy Adjustment of Canceled Orders—Will Post Others

DETROIT, Jan. 13—Detroit manufacturers of war materials, who have millions of dollars tied up in supplies purchased to fill nearly $300,000,000 outstanding war contracts, all of which have been canceled since the signing of the armistice, have organized to facilitate a more speedy adjustment of those contracts still unsettled.

Leading manufacturers of Detroit and other cities in Michigan met here Friday, Jan. 10, and organized a local section of the National Association of Manufacturers of War Material. The duties of the Detroit branch will be to furnish manufacturers with information emanating from the Washington headquarters as to methods of filing claims and to communicate to members the situation with regard to federal action in adjustment matters.

Because of the money tie-up, a number of plants, especially the smaller ones, are in bad financial shape, it is said. One of the largest companies, however, has $4,000,000 invested in war materials practically useless for any other kind of work. Although the board of claims of the Detroit district department, organized for the purpose of compensating manufacturers for losses due to the abrupt termination of contracts, has been ready for work since early in December, only 24 claims have been presented. Three were approved and two withdrawn.

Delay is due to the vast amount of detail work necessary before the contractor can present his claim. All plants handling ordnance work in the district have either been instructed to suspend work or given a definite time by which contracts must be completed. Up to the present time industrial plants have accepted suspension orders on 260 contracts.

Five Per Cent Tax Retained in War Revenue Bill

NEW YORK, Jan. 15—The Conference Committee of the Senate and House of Representatives, which is considering the new war revenue bill, has retained in it a 5 per cent tax on the sale price of passenger cars, tires, inner tubes, parts and accessories. Previously the committee had eliminated the proposed 5 per cent tax on the sale price of motor trucks, but manufacturers are not altogether sanguine that the tax has been permanently eliminated. When the matter was voted on a number of members of the committee voted against the elimination of the tax, and it is for this reason that some fear is expressed that it may be put back in the bill. It is regarded as practically certain now that the 5 per cent on cars, tires, tubes and parts will be left in the bill. It seems likely that there will be no floor tax.

Farm Equipment Prices Will Be Maintained

KANSAS CITY, Jan. 14—Present prices of farm equipment will be maintained at the same level for an indefinite period, according to G. A. Ranney, of the International Harvester Co., and president of the National Implement and Vehicle Association. The assurances that prices would not be reduced or advanced in the immediate future was given at the meeting of the opening session at the convention of Western Implement, Vehicle and Hardware Dealers to-day. There were more than 500 dealers present at the first session.

Military Airplanes at New York Aeronautical Show

NEW YORK, Jan. 15—It is likely that the forthcoming aeronautical exposition, which is to be staged in Madison Square Garden, Feb. 27 to March 6, by the Manufacturers Aircraft Association, will house a number of military exhibits, including many types of American and allied machines as well as a number of enemy trophies. The exposition is assured of the co-operation of both the naval and military air services.

Metz to Make a Six

WALTHAM, MASS., Jan. 13—The Metz Co., which during the war virtually suspended the production of passenger cars to devote its entire facilities to the manufacture of products for the government, is shortly to place on the market a new six-cylinder model which will sell for $1,495. The friction transmission which has long been a feature of Metz cars has been discarded in favor of a three-speed selective gearset. The engine is rated as 45 h.p. and the principal units of the car include a semi-floating axle, semi-elliptic springs with Hotchkiss drive and an electric lighting and starting system. The wheelbase will be 117 in. and tires 32 x 4.

Cleveland Plant for Sparton Radiators

CLEVELAND, Jan. 15—The Sparks-Withington Co. will establish a plant here for the production of Sparton radiators. It will be operated by a local company.

Labor Situation in Detroit

Position Much Better Than Generally Believed—Surplus of Workers Will Be Absorbed Speedily

DETROIT, Jan. 13—The labor situation here seems to have originated many rumors. As a matter of fact it is not half so bad as is generally believed, and it would appear that politics is playing an important part in the issue. Local papers publish an interview with U. S. employment officials to the effect that approximately 30,000 men are out of jobs, and while these figures may be correct, they do not reflect the true state of affairs.

Employent statistics in normal times show that about 15,000 men are continually shifting from one job to another, and this normal floating labor surplus has now been augmented by 5,000 or 6,000 returned soldiers. A number of manufacturing plants are at present closed for inventory and many other firms, having been engaged in war work, have cut their operations in order to readjust their plans to resume production on a normal basis.

Of the returned soldiers now in Detroit, it is estimated that 60 per cent are well provided with money and are desirous of resting for a short period before seeking positions. Labor officials have found that ex-army men out of work will not accept any job which may be offered, but are taking their time and are picking those they consider the most desirable.

A recent announcement which was given considerable publicity, and which told of a serious labor surplus, may have been prompted, it is hinted, by a certain class of employers with the idea of counteracting the effect of Henry Ford's announcement of a minimum $6 wage scale to all employees in all his plants. Ford's new scale has caused considerable hard feeling in certain business circles. It has not met with the approval of government labor bureau men who declare it is causing a labor movement toward Detroit which is not helping local conditions. It is also said that a feeling of dissatisfaction has been created among the workers of other plants.

Automobile and truck makers aver that in from 60 to 90 days the great majority of the plants will be operating on a normal peace basis. Several companies will greatly increase their production schedules in order to care for unfilled orders as well as new business. Part and accessory makers also anticipate a busy year. Thus, labor conditions will quickly adjust them-

selves and the shops will rapidly absorb the present excessive labor surplus.

Although conditions at other Michigan industrial centers seem to be rather sluggish at present, manufacturers are optimistic as to the future and it is evident that increased commercial activity will solve the labor problem in the near future.

—

Two Released Aviators Return to Industry

WASHINGTON, Jan. 15—The United States Air Service continues to discharge its personnel daily. Among those who have recently secured honorable discharge are 1st Lt. Gerald A. Christopher, who will return to the Eclipse Machine Co. as assistant chief engineer, and Lt. Joseph Leopold, formerly chief engineer of the Walker M. Levett Co., who is now associated with the Jones-Matrola, Inc., New York, as mechanical engineer and sales manager.

—

Firestone Steel Products Co. Adds Three to Its Sales Personnel

AKRON, Jan. 15—The Firestone Steel Products Co. has added three men to its sales force. A. D. Droeger as manufacturers' representative, will travel throughout the entire country. C. W. Flick will cover the eastern territory. He was formerly assistant sales manager of the Mason Tire & Rubber Co., and assistant manager of pneumatic tire sales with the B. F. Goodrich Co. J. C. Bailey has been made western representative. He comes from the Mason Tire & Rubber Co.

—

Eight-Hour Day Adopted in Michigan

LANSING, Jan. 14—Eight hours is made a day's work in any mill, mine or factory in Michigan under the terms of a bill introduced this week in the Michigan house of representatives by John Holland of Gogebic County.

The bill, which is a short one, declares no person shall work more than eight hours in 24 "except watchmen and employees when engaged in making repairs or in case of emergency where life or property is in immediate danger." It states further that employees may work more than eight hours if paid time and one-half for all such over-time. It provides for the imposing of fines from $50 to $500 upon violators of the law.

—

New Officers and Directors of Auto Body

LANSING, Jan. 15—The Auto Body Co., at its annual meeting on Tuesday, added M. V. C. Jackson, A. C. Stebbins and H. F. Harper to its board of directors. L. J. Griggs was permitted to withdraw. The following new officers were elected: President, F. M. Arbough; vice-presidents, M. V. C. Jackson and H. E. Thomas; treasurer, E. S. Porter; secretary, F. C. Rush. The new general manager, M. V. C. Jackson, assumed duties Monday. The plant is now operating at about half normal capacity, turning out 200 bodies daily.

General Motors Buys Reliance

New Plant for Olds Motor Works—First Step in General Expansion Planned

DETROIT, Jan. 14—The General Motors Corp. has purchased the Reliance Engineering Co., Lansing. The purchase price of $290,000 includes 31 acres of land, and buildings with 250,000 ft. of floor space, which will be used for the future expansion of the Olds Motor Works.

The completion of the new motor building, 240 by 500, 700 ft. loading docks and additional sidings left little of the Olds Motor Works site, and later acquired old fair grounds property available for additional building expansion. This cramped condition is now relieved by the purchase of the Reliance company, which adjoins the Olds property on the east.

The sale of the Reliance Engineering Co. was effected privately and the court order confirming the sale was filed Thursday. At 11 a. m. on that date the plant was to have been sold to the highest bidder. Samuel T. Douglas of Detroit was receiver, named under the receivership growing out of the case brought by the Union Trust Co. of Detroit against the owners of the property.

The assets of the company are sold in entirety. The General Motors Corp. assumes all outstanding contracts. The plant consists of factory buildings, pattern shop building, pattern vault building, shipping and office buildings. They are brick one and two stories.

Several years ago the Reliance Engineering Co. organized to manufacture gas, gasoline and kerosene engines, hoists, pumping outfits and cream separators. It was placed in receivership March 9, 1917. Lack of working capital was given as the cause of receivership action.

—

DETROIT, Jan. 14.—Rumors that the General Motors Corp. is planning a period of huge expansion cannot be stilled. Although no definite announcement has been made by officials of the company, those who are in close touch with automotive conditions in Detroit claim that organization wheels have been set turning.

The expansion will undoubtedly affect all parts of the organization, although no advance publicity has been given out as to what will be done. While a great part of the new development will be in the production of motor cars, the manufacture of tractors will not be neglected, it is said.

—

Continental Plans 15 to 25 Per Cent Increased Production for 1919

DETROIT, Jan. 14—Officials of the Continental Motors Corp. have adopted a 1919 production schedule which calls for an increased engine production of between 15 and 25 per cent over the 1918 output. The two plants of the Continental Corp. produced approximately 180,000 engines last year, a large number of which were built for the Government.

The company has installed new machinery and is still working upon government work. It is making a four-cylinder engine, but expects to complete the contract some time in February. It is also announced that A. H. Zimmerman, treasurer of the company, has resigned. His place has been filled by G. W. Yoeman, formerly assistant to the president.

—

England Removes Gasoline Restrictions

LONDON, ENG.—(By Mail), Jan. 2—The Government restriction order, limiting gasoline consumption for private use, which was suspended until Jan. 10, has been revoked entirely. This concession enables motor vehicles to be used for any purpose without limitation of distance. Licenses to obtain gasoline are issued under the Finance Act, 1916, and the license feature must therefore remain in force. However, the Petrol Control Dept. is prepared to issue licenses to new applicants, and to increase the quantities allocated to existing license holders, and will endeavor as far as possible to meet all reasonable requirements.

—

Airplane Manufacture Unrestricted

LONDON, ENG.—(By Mail), Jan. 2—British government orders of 1917 and 1918 which prohibited the experimental manufacture without a license of any airplane, engine, or any part of such a machine have been suspended. "Experimental manufacture" under those orders meant any manufacture not under government contract, and included preparation of working drawings, but not of general arrangement drawings.

—

Standard Castings Co. Acquires Mastodon Tractor Tread

CLEVELAND, Jan. 15—The Standard Steel Castings Co., with headquarters here and in Chicago, has acquired the sales and manufacturing rights for the Mastodon tractor tread from the United States Traction Wheel Co. The Standard company is now in a position to supply the tread to tractor manufacturers.

—

Motor Parts Co. Organized

DETROIT, Jan. 15—The Motor Parts Co. has been organized here by M. F. Ketten, R. B. Merrill and E. F. Wilkinson, formerly associated with the Phillip McCracken Co., and will specialize in the production and marketing of axle shafts for all standard cars. The concern has established offices at 212 Telegraph Building. Mr. Ketten, president of the company, is also president of the Consolidated Truck Co. Besides axles, the Motor Parts Co. will market the Green automobile theft protector, a device upon which a patent is now pending.

Rubber Imports Rise 235 Per Cent

December Improves Greatly as Import Restrictions Are Lifted—3 Years' Totals

NEW YORK, Jan. 13—Since the War Trade Board lifted its restriction on the amount of raw rubber for importation, the imports for December, 1918, show a material increase over the preceding month, jumping from 3363 tons in November to 11,292 tons in December. The December tonnage, however, shows a decrease of 1478 tons as compared with December, 1917, and a decrease of 802 tons as compared with the same month in 1916.

The total imports for 1918 show a loss of 16,381 tons over 1917, but a gain of 39,686 tons over 1917. For the year 1916 imports totalled 115,609 tons; for 1917, 171,676 tons; and for 1918, 155,295 tons. The following statistics for the three years have been compiled by the Rubber Association of America:

	1916 Tons	1917 Tons	1918 Tons
January	9,162	12,788	16,084
February	1,597	10,162	13,108
March	10,070	18,624	17,161
April	10,014	13,000	12,703
May	11,189	18,411	16,288
June	13,153	15,096	24,124
July	6,650	17,290	16,092
August	6,586	17,290	10,421
September	8,296	13,664	5,151
October	8,360	8,970	9,509
November	11,438	13,611	3,363
December	12,094	12,770	11,292
	115,609	171,676	155,295

Wisconsin Dealers to Gather

MILWAUKEE, Jan. 13—A two-day convention of motor car dealers of Wisconsin will be held under the auspices of the Milwaukee Automobile Dealers, Inc., during the twelfth annual show in the Auditorium, Jan. 24 to 30. The Milwaukee association in past years has devoted one day of show week to entertaining the dealers, but since an organization of state dealers was effected at a meeting held during the annual fall show in September, the congregation of the upstate tradesmen this time will assume the style and proportions of a real convention.

French Export Is Simplified

WASHINGTON, Jan. 13—Individual applications for export licenses for France will no longer be referred to the French High Commission, and individual applications for export licenses for Italy will no longer be referred to the Italian High Commission. This supplements the War Trade Board ruling 412, issued Dec. 13, 1918, and W. T. B. R. 453, issued Dec. 21, 1918. Exporters should be very careful before shipping to acquaint themselves thoroughly with the import requirements of the country of destination, as certain of the regulations which were in force prior to the signing of the armistice are still in full force and effect. Information as to French import restrictions may be obtained by applying to the French High Commission, 15th and M Streets, Washington, D. C., and for Italian import restrictions to the Italian High Commission, 1712 New Hampshire Avenue, Washington, D. C.

Export Conservation List Removals

WASHINGTON, Jan. 13—Additional removals from the Export Conservation List include the following, on which licenses will now be granted freely for export:

Ash wood
Balata
Birch wood
Chestnut wood
Crude rubber
Fir timber
Gutta-percha
Gutta-joolatong
Gutta-siak
Lumber
Mahogany wood
Metallic tin
Mica
Oak wood
Pig tin
Pine, yellow, measuring 12 in. by 12 in. and larger size, or 25 ft. long and longer
Plate, as follows:
  Terne
  Tin
Plywood and veneer of all kinds
Pulp wood
Quebracho wood
Rubber, as follows:
  Balata
  Crude
  Guayule
  Gutta-joolatong
  Gutta-percha
  Gutta-siak
Spruce wood
Tin, as follows:
  Block
  Metallic
  Ore
  Pig
  Plate
Walnut wood

Restrictions Lifted on Motor Imports and Exports

WASHINGTON, Jan. 15—The Government restrictions on the importation of agricultural implements, which includes farm tractors, were removed Dec. 24. On Dec. 19, the Government restrictions on the importation of cars, carriages and other vehicles, including motor cars and trucks, were also removed.

Many export limitations have also been lifted. It is understood that motor car, truck and accessory exporters have no difficulty in shipping to South America or to Spain. Permits from the Danish government must still be obtained when making shipment to Denmark.

The embargo prohibiting the importation of motor vehicles into England, France and Italy has not yet been lifted, so that no space is obtainable for such vehicles on outgoing steamers to those ports, although some accessories are being shipped. The necessity of procuring export licenses from the Shipping Board is still in effect.

$31,000,000 Wright-Martin Cancellation

NEW YORK, Jan. 15—It is reported that contracts held by the Wright-Martin Aircraft Corp., totaling $31,000,000, have been canceled. The greatest part of the cancellations will affect the Long Island City Government-owned plant, which was to have turned out 300 hp. Hispano-Suiza engines on a fee basis.

Fit Tractor to Farm or Vice Versa?

Economical Operation Hinges on Proper Answer, Says Farm Management Professor

MINNEAPOLIS, Jan. 10—Who will tell the farmer what he wants to know about tractors—what he must know if a tractor is to be an economical investment for him? The tractor manufacturer does not tell him in the literature he sends out. The tractor salesman does not tell him because he usually does not know himself and because his function is to sell the machine his employer builds. The dealer does not tell him because too often he has contracted to sell a tractor which he may have bought with too little regard to whether it is adapted to his local conditions, and it is up to him to sell it whether or no.

Must the farm be adapted to the tractor, or the tractor to the farm? This is the all-important question to the farmer if he is to make economical use of a tractor. Somebody must tell him—who is going to do it?

The question was asked by F. W. Peck, assistant professor of farm management, University of Minnesota, who spoke to the Minnesota retail implement dealers at their fifteenth annual convention at Minneapolis this week. Professor Peck took as his subject, "The Use of Tractors on Minnesota Farms," and he attacked it from an angle different from any ever before presented to a dealers' convention and one which must vitally interest every manufacturer of tractors.

Things Farmer Wants to Know

Every farmer who buys a tractor must ask certain questions, asserted the professor. These are:

1—Will a tractor do my work more rapidly than my horses can?
2—Will it do as good work?
3—Can I save hired help by using a tractor?
4—Can I farm more land with a tractor?
5—Are my fields adapted for the use of a tractor?
6—Will a tractor displace any of my horses?
7—Can I use a tractor to advantage in work other than plowing?
8—What size of tractor should I buy
9—How many acres will the various outfits plow per day?
10—How much does it cost to plow per acre?
11—Can I use a tractor

The fundamental idea developed by Professor Peck is that profit on the average farm depends upon the proper utilization of labor on the farm, and that in properly utilizing labor lots of power is used. Thus the question resolves itself into whether the tractor is the ideal power unit which will result in the proper utilization of farm labor.

In other words, the test of economy in tractor use is not the displacement of horses nor the cost per acre of plowing,

but the increase in the efficiency of the man per hour or per day.

If, by using a tractor, the man power is increased sufficiently, then the tractor is an economical proposition, otherwise not. For this reason the 11 questions asked by the farmer are logical, common-sense and necessary. Unless some one can answer them affirmatively, or definitely, as the case may be, the farmer cannot know whether or not his particular circumstances will justify the purchase of a tractor and he must take a chance. Taking a chance in farming, too, is likely to prove expensive. This means, therefore, that the manufacturer must build, and the dealer must sell, such a tractor that it will give satisfactory answers to these questions.

The net conclusion reached by Professor Peck is that at the present time the cost of tractor farming is in general no less than the cost of horse farming, irrespective of the fact that it has cost $150 a year to maintain a horse for the years 1917 and 1918, but that, inasmuch as the tractor, provided it is adapted to the particular farm, increases the product of the farm per man, therefore is an economical investment on the average farm of 160 acres and over.

Before adjournment officers for the ensuing year were elected as follows:

President, C. W. Lyman, Northfield, Minn.; vice-president, N. S. Solum, Hitterdahl, Minn.; directors, G. A. Meyer, Lake Elmo, Minn., and Aug. Lundgren, Warren, Minn.; delegate to the National Federation, E. P. Lynch, Faribault, Minn. C. I. Buxton, Owatonna, Minn., was re-elected secretary and treasurer.

Automotive Corp. President Addresses Automotive Engineers

CHICAGO, Jan. 11—"If it is desirable and convenient for the operator to be always on the tractor, then it is desirable and convenient for the farmer to do all his work riding on his horses," was the argument of A. H. Wyatt, president and general manager of the Automotive Corp. of Fort Wayne, Ind., which aroused interest at the monthly meeting of the Mid-West Section of the Society of Automotive Engineers last night.

Mr. Wyatt's paper was entitled "Line Control and Power Steering as Applied to Tractors," and consisted chiefly of a discussion of these features as developed in his design. Mr. Wyatt says that his tractor is just as docile and observant of the rules of the rein as is a horse. Every move the tractor makes is controlled by reins. Two reins are used to steer, operate the clutch and to control the engine speed, and a third is used to shift the gears.

Wyandotte Cleaner Ready

DETROIT, Jan. 11—The J. B. Ford Co., Wyandotte, is now marketing its Wyandotte metal cleaner. This product is intended to remove japan, shellac, paint, oils and greases, preparatory to recoating or repainting. It can also be used as a garage floor cleaner, as it has the quality of cutting and cleaning oil and grease.

Randles Resigns from M.T.C.

Will Return to Duties as Vice-President and General Manager of Foote-Burte Co.

WASHINGTON, Jan. 13—George E. Randles, vice-president and general manager of the Foote-Burte Mfg. Co., Cleveland, who for 16 months has been Director of Maintenance for the Motor Transport Corps, has resigned and will return to Cleveland.

Mr. Randles, during his connection with the Motor Transport Service, contributed greatly to the formidable program of that service, and his tenure of office is looked upon as a concrete illustration of the patriotism, subordination of individual interests to the needs of the Government and the sterling loyalty of the American business man.

Upon the acceptance of his resignation, Mr. Randles was called to the large reception room of the Transport Service and, in the presence of the personnel, officers and civilians, was presented with a gold watch as a token of the high esteem and kind regard of his co-workers. The presentation address was made by Lt.-Col. Edward Orton, Jr.

During his direction of the Maintenance Division Mr. Randles designed and standardized a base repairshop for Army use, which is capable of accomplishing tasks which no commercial or manufacturing institution can do. Also he built a crating shop at Camp Holabird, Md., where trucks can quickly be taken apart for shipment.

Another valuable contribution to the service has been the organization and training of the personnel whose work is the operation of these shops; the securing of the necessary thousands of automobile mechanics, the fitting of them into their respective niches and the drilling of them in the necessary team work to make their efforts efficient. This has been a complex task, but it was successfully handled by Mr. Randles. This work has been accomplished so as to make it possible to carry out not only the present program of the Army but it will also meet the demands of peace and be ready for any future wars.

Necessity of Roads Pointed Out

WASHINGTON, Jan. 13—The Senate Committee on Post Office and Post Roads, which deals with all congressional highways legislation, declared this week that there must be no letup in road construction despite the armistice, due to the need of roads for food distribution. Three measures are pending before Congress on highway matters which are designed to increase the national highways mileage and to improve those roads now in existence, as follows:

Joint resolution "200," authorizing the transfer from the War Department to the Department of Agriculture of all available dispensable and suitable war material for distribution to the highway departments of the several States for use on the highways.

Senate bill "5088," increasing the present unexpended appropriation of about $60,000,000 for road purposes by the addition of $125,000,000 for expenditures to June, 1920, and $100,000,000 a year thereafter for 4 years. It also is proposed to increase the appropriation for national-forest roads of $1,000,000 a year on the present 10-year road building program by a sum sufficient to construct 17,000 miles of forest roads, which the Government has already planned and which are necessary in order to utilize the vast resources of the national forests. The estimated cost of these roads is $50,000,000.

House bill "13308" carries an appropriation of $1,000,000 for an extension of motor-truck parcels post service. This is an increase from the $300,000 provided in the last post office appropriation bill, which also authorized the War Department to transfer to the Post Office Department motor trucks for which it had no further use. Under last year's appropriation 27 motor truck routes were established, all but one of which were operated east of the Mississippi River. The results, even in the initial stage, are such as to warrant an increase in the number of routes and their extension to the trans-Mississippi region, where rail and water facilities of transportation are altogether inadequate.

Senate bill "5088" has the approval of President Wilson and Secretaries Houston and Baker.

Additional Names of Chicago Exhibitors

CHICAGO, Jan. 13—Seven passenger-car, nine truck and twenty-four accessory exhibitors will have their products on display at the Coliseum, Jan. 25 to Feb. 6. The list of names is as follows:

Passenger Cars

Templar Motor Corp.	Cleveland
Maibohm Motors Co.	Racine
Dorris Motor Car Co.	St. Louis
Apperson Bros. Automobile Co.	Kokomo
Saxon Car Co.	Chicago
Rue Motor Co.	Chicago
Marmon Chicago Co.	Chicago

Trucks

Dorris Motor Car Co.	St. Louis
Panhard Motors Co.	Grand Haven, Mich.
Sanford Motor Truck Co.	Syracuse
Mutual Truck Co.	Sullivan, Ind.
Fulton Motor Truck Co.	Farmingdale
Fowler Motor Truck Co.	Chicago
Rue Motor Co.	Chicago
Available Truck Co.	Chicago
Diamond T Motor Truck Co.	Chicago

Accessories

Gray Heath Co.	Chicago
Hercules Buggy Co.	Evansville, Ind.
Jefferson Electric Mfg. Co.	Chicago
Johnson Auto Lock Co.	Chicago
Morand Bros.	Chicago
Natl. Wire Wheel Co. Works	Geneva, N. Y.
Perfex Radiator Co.	Racine
Trindl Machine Works	Chicago
U. S. Auto Supply Co.	Chicago
West Steel Casting Co.	Cleveland
Bell Tire & Rubber Co.	Chicago
Essenkay Products Co.	Chicago
Mitchell Bynon Co.	Chicago
Stahl Rectifier Co.	Chicago
Peter C. Cole	Chicago
Ahlberg Bearing Co.	Chicago
Empire Mfg. Co.	Binghamton, N. Y.
F. W. Wakefield Brass Co.	Vermilion, O.
Radium Dial Co.	Pittsburgh
U. S. Auto Gear Shift Co.	Eau Claire
National Mileometer Co.	Detroit
Holland Brass Works	Chicago
Inland Machine Works	St. Louis
Ahlberg Bearing Co.	Chicago

Boston May Get Truck Show

BOSTON, Jan. 13—There is more hope now for trucks being taken care of at the Boston show than there was a few weeks ago. At first it was figured out that the owners of Mechanic's building would rather keep the wool, flour, etc., stored in the basement where they would get a big rent week after week than have one week of a motor truck section. And that would mean a car show solely. Now there are plans to have the basement emptied and the entire show will be held in one week instead of planning to stretch it over two weeks.

Trial of Jobbers Is Begun

Jury Drawn for Legal Battle, Which Is Expected to Last About a Month

NEW YORK, Jan. 12—The trial of the members of the Jobbers' Association on a charge of violating the Sherman anti-trust law began to-day in the United States District Court in this city.

The first day was taken up with the usual preliminaries and the second day's session was not to begin until 2 p. m. because of other business to which Judge Hand must attend. It is anticipated that the trial will last about a month. The sessions are in the Post Office building in City Hall Square. The prosecution is being handled by District Attorneys Geyler, Matthews and Williamson.

The chief counsel for the defense is James H. Wilkerson, Chicago, formerly a United States district attorney. He is assisted by Claude A. Thompson and Emory Buckner, New York, both experienced in Government cases. The following men are represented by their personal attorneys: George Edmunds, Edmunds & Jones, Detroit, by Attorney L. W. Goodenough; T. M. Brooks, Automobile Supply Co., Chicago, by Attorney C. M. Peters; William K. Norris, McQuay-Norris Mfg. Co., Chicago, by Attorney John F. Greene; F. B. Caswell, Champion Spark Plug Co., Toledo, by Attorney Edward J. Marshall.

The jury was drawn to-day. It is said that an unusual number of witnesses has been called by both sides and it is expected that the case will be fought with unusual vigor by both sides.

Representatives of other trades and trade organizations are interested in the outcome and the representative of at least one other organization, from Texas, is here to watch the proceedings.

Would Establish 600 Motor Truck Routes

WASHINGTON, Jan. 13—Establishment of motor truck routes as a means of reducing the cost of living by transporting farm product to the cities was advocated yesterday by Fourth Assistant Postmaster General Blakslee in asking the Senate Post Office Committee to appropriate $8,975,000 in the Post Office bill for that purpose. Under the House bill $1,000,000 is provided to be used in extending the plan.

No Change in Gasoline Price Likely in Canada

TORONTO, Jan. 13—It is unlikely that there will be any change in prices of gasoline and oils. The flat rate plan, which was put in effect by one of the large firms last April, will be continued. A number of firms handling gasoline and oils have been urging the adoption of a standard rate, but so far little progress has been made.

Some of the oil men are not inclined to regard the plan as feasible for the Dominion, basing their views on the long hauls to various points. In spite of the large falling off in fuel oil sales owing to the closing of munitions plants, the price has only dropped a cent a gallon. The manufacturers are meeting the situation by lessening the output of fuel oil and increasing the production of gasoline. It is stated that the shortage of coal in many districts this season is causing much larger demands than usual for oil for fuel.

Japanese Commission Visits Nash Motors

KENOSHA, Jan. 13—Charles W. Nash and the Nash Motors Co. last week entertained the commission of Japanese army officials who are making a tour of military manufacturing centers of the United States in behalf of the government of Japan. The commission consists of Maj. Saburo Yamanaka, Maj. Tomotsugu Tohara, and Maj. Zenturo Miki. Mr. Nash tendered the visitors a luncheon, following which the big Nash plant was inspected.

Price Changes

Hupp Prices Reduced

DETROIT, Jan. 13—The Hupp Motor Car Co. has reduced the price of its roadster and touring car. The prices of the other models remain unchanged. The new price list is as follows:

Model	New Price	Old Price
Roadster	$1335	$1500
Touring Car	1335	1500
Coupe	2100	2100
Sedan	2185	2185

Grant Prices Down $25

CLEVELAND, Jan. 13—The Grant Motor Corp. has revised the prices of its models as follows:

Model	New Price	Old Price
Roadster	$1220	$1245
Touring Car	1220	1245
Sedan	1745	....
Coupe	1725	....
Detachable Sedan	1500	....

Peerless Prices Advanced

CLEVELAND, Jan. 14—The Peerless Motor Car Co. has advanced its prices as follows:

Model	New Price	Old Price
7 Passenger Touring	$2,760	$2,550
4 Passenger Roadster	2,760	2,550
4 Passenger Coupe	3,320	3,050
7 Passenger Sedan	3,580	3,250
7 Passenger Sedan Limousine	3,720	3,690

Oakland Prices Drop

PONTIAC, Jan. 14—The Oakland Motor Car Co. has reduced the price of all 1919 commercial car models $110. The price list is as follows:

Model	New Price	Old Price
Touring Car	$1,075	$1,185
Roadster	1,075	1,185
Sedan	1,650	1,760
Coupe	1,650	1,760

Liberty Fuel Proves 65% Benzol

Results of Tests by Fuel Administration Revealed—Nearly 30% Kerosene

WASHINGTON, Jan. 14—Liberty Fuel, announced several weeks ago as having been discovered by Captain Wiesgerber, is largely benzol. As a matter of fact it is 65 per cent benzol mixed with 25 to 30 per cent of kerosene with a small percentage of amyl acetate. The Fuel Administration has completed an anlysis of the liquid which shows that these are its principal ingredients. History reveals that there is nothing new in the mixture of benzol and kerosene. As long ago as 1911 and 1912 a number of tests were conducted on the Brooklands Speedway in England on such a mixture which at that time proved quite satisfactory. The limiting factor in the use of such a mixture, however, is the small amount of benzol available and the expense in producing it. It is considered improbable by oil experts that the cost of producing benzol in quantities necessary to make it commercially valuable as a substitute fuel can be brought down to the point where it can be sold as cheaply as gasoline.

The principal difficulty in using benzol is that it solidifies at comparatively high temperature as compared with gasoline. For example, benzol will crystallize at 18 deg. Fahr. On the other hand the boiling point is 175 deg. Fahr. as against about 140 deg. for the average grade of good gasoline. This would indicate that it would be more difficult to start a cold motor on a benzol-kerosene mixture than on gasoline.

Large Space for Accessories at K. C. Tractor Show

KANSAS CITY, Jan. 14—So many unique features have been planned for the coming tractor show to be held in this city Feb. 24 to March 1 that it will be quite a departure from the usual trade display. One of these is the extra large amount of space which is being taken for tractor accessories.

Another feature is that nothing will be allowed upon the grounds except tractors and their accessories. There will be no side shows, no opportunity for a man to exhibit something which does not strictly belong to the aim of the exhibit.

Again no souvenirs will be allowed, no presents to attract visitors to particular exhibits. The only matter allowed to be given away will be literature describing the articles the dealers has to display. Neither will there be any catalogues this year.

Winton Shifting Back to Peace Time Production

CLEVELAND, Jan. 15—All the old officers and directors of the Winton Co. were re-elected at the annual meeting

held Tuesday. The company, which has been devoting its efforts entirely to war work, is gradually shifting back to a peace basis. It is still working on government contracts, but is resuming production at the rate of about five cars daily.

100,000 Ford Tractors for 1919

DEARBORN, Jan. 15—Production of 500 Fordson tractors daily within the next 90 days is called for in the new output schedule of Henry Ford & Son Co. The plant is at present turning out 225 machines daily, and within 30 days will be hitting well above the 300 mark. Officials of the company announce that the 1919 production schedule calls for the completion of 100,000 tractors. This is more than three times the 1918 output, when 30,000 tractors were made and sold.

Hansen Leaves Stewart-Warner to Manage Standex

CHICAGO, Jan. 15—V. N. Hansen has resigned as sales supervisor at the Stewart-Warner Speedometer Corp. He will devote his time to the management of the Standex Mfg. Co., which he has organized with offices and plant at 341-349 E. Ohio Street, to manufacture and market motor specialties under the trade name "Standex." Prior to his connection with Stewart-Warner, Mr. Hansen was engaged in the manufacture of the V-Ray spark plug at Marshalltown, Ia.

Monroe Motor Co. at Receiver's Sale

PONTIAC, MICH., Jan. 14—The receiver's sale of the manufacturing plant of the defunct Monroe Motor Co. will be held here Jan. 25, at 1 p. m. The factory property consists of modern buildings having 100,000 ft. of floor space, sprinkler, heating and lighting systems, and is suitable for automobile, truck or tractor manufacture.

New Studebaker Plant for 100,000 Annually

SOUTH BEND, Jan. 14—The Detroit plants of the Studebaker Corp. will continue the production of six-cylinder cars and parts; the new Studebaker plant here will be devoted to the production of the new light-four. The new South Bend plant will have an annual capacity of 100,000 cars.

Olds Production to Exceed Normal

LANSING, MICH., Jan. 14—The Olds Motor Works expects to reach its normal pre-war production by Feb. 1. The factory is now running at 80 per cent of its normal capacity. The company contemplates to increase its production to exceed by 25 per cent all previous records.

Spencer With Indiana Electric Steel Co.

INDIANAPOLIS, Jan. 15—M. G. Spencer, formerly connected with the Midvale Steel Co. and later with the Watertown Arsenal as chief chemist, is now in charge of the metallurgical operation of the Electric Steel Co. of Indiana.

2,000,000 Tractors on Farms in 10 Years

Agronomist Taylor Makes a Startling Prediction—Says Three-Bottom Is Best

KANSAS CITY, MO., Jan. 15—That 2,000,000 tractors would be operating on the farms of this country within the next 10 years was the startling prediction made this morning by W. E. Taylor, agronomist, of Deere & Co., Moline, to the members of the Western Association of Implement and Vehicle Dealers in session in this city. These 2,000,000 tractors, said the speaker, would displace 50 per cent of the horse-drawn implements used on the farm at present. The 240 concerns making tractors, he asserted. will build 200,000 machines during the coming year.

In discussing the operating efficiency of the present type of tractor, Taylor gave it as his opinion that it has not proved its adaptability for every kind of soil. For example, it was not suited for steep hills or side hills, nor was it adapted to perform on rough or stony soil. However, wherever it could be used it reduced the cost of farm operation and increased production. He cited the results of the Harrisburg demonstration as typical of tractor operation costs.

The three-bottom plow, in Taylor's opinion, was the most economical machine for average farm use. The two-bottom unit, he said, did not show any economy over horse operation. On the other hand, the three-bottom machine and one man could accomplish as much work as two men and ten horses.

The future of agriculture, said Taylor, depended for its growth upon the development of the tractor, and as an earnest of this conclusion he advised the dealers to push the sale of tractors.

The Century Theater, where the convention is being held, was crowded, although the attendance was not as great as in past years. Governor Allen of Kansas also delivered an address.

Fuel Conservation Orders Withdrawn

WASHINGTON, Jan. 15—All fuel conservation orders have been withdrawn by the United States Fuel Administration in so far as relates to coal, and industries can now use any quantity of coal they desire or require. This information was made public to-day in a formal announcement by the United States Fuel Administration.

Portland Show Feb. 24-March 1

PORTLAND, OREGON, Jan. 20—The Portland Automobile Dealers will hold a show Feb. 24 to March 1 in the Portland Auditorium, which affords 40,000 sq. ft. of floor. The show will be limited to the membership of the association, which has 38 members, and will contain probably 44 makes of automobiles, 24 makes of trucks and 6 makes of tractors, as well as considerable automotive equipment. The dealers' state manager, M. O. Wilkins, plans to stage a run a couple of weeks before the show from Portland to Seattle, and has invited the Washington dealers to come to Portland for the show. They also expect to have the Oregon County dealers come to Portland during that week, and it is probable that a meeting will be held Friday, Feb. 28.

Jobbers Meet June 2-6

CHICAGO, Jan. 20—The Automotive Equipment Association, the jobbers' association with its new name, will hold its next meeting June 2, 3, 4, 5 and 6 at the Homestead Hotel, Hot Springs, Va. June 2 and 3 will be taken up with meetings of committees and the directors. The general sessions will be held June 4, 5 and 6.

Sunbeams for Indianapolis Race

PARIS, FRANCE, Jan. 15—Special Cable—Two more foreign drivers have been entered for the 500-mile race on the Indianapolis Speedway, May 31. The British Sunbeam company has entered two cars which are to be driven by Chassagne and Christiaens. It is considered probable that the Fiat company will start a car, though no driver has been nominated yet.

Trade-Mark "Ford" More Than Name

(*Continued from page* 186)

what everybody knows. The use of the term has become so extensive, he adds, that he is convinced there was a time when the word "Ford" did not mean the individual in Michigan who is named Henry Ford, but primarily meant a particular kind of automobile. "The automobile is probably known by numerous people," he continues, "who are not aware of the fact that it is a man's name." He declares it is probable that the man Henry Ford first became widely known because of the reputation of the automobile rather than the automobile becoming known because it was made by Henry Ford.

The commissioner holds that the Ford Co. has a right to curtail the liberties of another by the name of Ford if the other Ford attempts to market automobile parts and accessories under the name of a famous automobile. He declares the right is not in the name but in the particular use of the name, and adds that it is hardly conceivable that another Ford could in mere ignorance infringe upon the Ford company's mark.

In conclusion he avers that if Ford was at one time merely a surname it is now no longer so. It is now as truly an index of a reputation and a mark of origin as any mark one could think of and he declares it ought to be registered as the courts have held it may be monopolized.

Morgan Chief Engineer for Cleveland Co.

CLEVELAND, O., Jan. 15—Major N. B. Morgan has been appointed chief engineer of the Cleveland Tractor Co. He had been engaged in automobile engi-

neering for 14 years until June, 1917, when he was appointed assistant to the chief of the Ordnance Department of the Army.

—

Latin-American Tractor Possibilities

WASHINGTON, Jan. 13—Extensive areas of agricultural land in Latin-American countries offer a rich field for the development of farm tractor trade, states a special tractor report compiled by the Bureau of Foreign and Domestic Commerce. Many of the estates, comprising hundreds of thousands of acres, still cultivate their crops of grain, sugar, and cotton under the old systems, that require large numbers of laborers and horses.

Power farming on these great plantations invariably shows economy of time and expense, and the recent increase in shipments of tractors from the United States to Latin America indicate that the more progressive ranch owners are beginning to realize the value of new methods. In the fiscal year 1918 more tractors were shipped from this country to the Latin American countries than in all the four last years preceding, and in the first quarter of the 1919 fiscal year these exports amounted to more than a third of the total 1918 shipments.

The direct cause of this unprecedented demand for tractors in Latin America is doubtless the awakened interest in agriculture growing out of war-time needs and prices. The value of the tractor in increasing the agricultural production of Latin America is almost equalled by its importance as a road maker. The lack of transportation facilities is acutely felt in some of the richest sections of South America, and the tractor is proving of incalculable advantage in the construction of needed highways.

One of the chief obstacles faced by the manufacturer in the introduction of tractors is the natural aversion of a conservative rural community to new and complicated mechanical appliances. Inexperienced operators, failing to meet with success in the use of an untried machine, condemn and abandon it. The manufacturer must prepare to overcome this difficulty by providing ample instructions and demonstrations and should, moreover, take special pains to furnish the proper kind of tractor for the particular class of work desired.

Another obstacle in selling tractors in Latin America is the high cost of gasoline, but it is probable that with the close of the war there will be a reduction in the price of this fuel. In contrast with the scarcity of fuel for tractors, the ranch owner has available a large supply of horses and practically unlimited natural pasture, making his outlay for animal power comparatively small.

To meet this condition the manufacturer must demonstrate that the land can be much more quickly and evenly worked, and to a much greater depth, with the use of a tractor than with horses.

Tire Export Figures Are Satisfactory

Average Monthly Value for 5 Months Ending November in Excess of That of Previous 12 Months

NEW YORK, Jan. 15—Supplementing the information given in tabular form covering exports of automobile tires by countries and years, given elsewhere in this issue, the following figures representing the value of tire exports during July, August, September, October and November are of interest as indicating that our export trade is being maintained despite shortage of crude rubber and the fact that the cars of many countries are restricted in operation in consequence of the scarcity of gasoline. Our exports of automobile tires for the five months are as follows:

1918	Value
July	$1,217,584
August	1,566,589
September	1,321,034
October	930,204
November	1,268,845
	$6,304,256

During the fiscal year which ended June 30, 1918, our monthly average value of automobile tire exports was $1,166,472. For the four months enumerated above the average per month is $1,260,851.

—

Petry Co. to Bill Baldwin Products Direct

PHILADELPHIA, Jan. 13—By arrangement with the Baldwin Chain & Mfg. Co., Worcester, Mass., the N. A. Petry Co., 1307 Race Street, Philadelphia, will in future invoice all Baldwin products direct to their customers. Large stocks of chain and sprockets are carried at the Philadelphia warehouse.

Exports of Cars, Trucks and Parts, 1902-1906

	1902	1903	1904	1905	1906	Totals by Countries
Europe:						
Austria-Hungary	$13,106	$1,850	$3,500	$26,051	$1,706	$46,218
Belgium	7,797	3,670	22,971	38,220	10,465	83,123
Denmark	9,905	6,431	11,549	8,922	44,858	81,665
France	59,051	98,029	92,576	252,742	282,317	784,715
Germany	24,491	30,798	97,303	154,141	99,732	406,465
Gibraltar	....	....	....	....	4,600	4,600
Greece	....	....	....	520	362	882
Italy	2,200	8,200	10,567	159,396	265,970	446,333
Netherlands	5,285	10,164	11,909	14,690	16,151	58,199
Norway	....	2,500	10,794	9,245	3,653	26,192
Portugal	....	12,904	1,904	3,784	5,417	24,009
Rumania	....	....	240	4,973	60	5,273
Russia in Europe	1,023	1,688	74,842	72,551	47,778	197,882
Spain	....	1,506	17,820	15,184	5,660	40,170
Sweden and Norway	1,697	....	....	....	....	1,697
Sweden	....	1,226	9,625	54,640	55,033	120,524
Switzerland	....	3,660	5,440	5,951	3,846	18,877
United Kingdom	671,553	670,811	649,641	607,401	948,995	3,548,401
North America:						
Bermuda	1,500	....	775	....	130	2,405
British Honduras	....	....	....	....	124	124
Canada	37,439	136,586	830,952	441,425	647,125	1,593,527
Newfoundland and Labrador	....	2,025	997	7,300	1,313	11,635
Central America:						
Costa Rica	....	....	....	....	1,680	1,680
Guatemala	....	21	....	600	1,365	1,986
Honduras	....	....	....	....	10,752	10,752
Nicaragua	....	....	38	125	280	443
Panama	....	....	....	1,020	169	1,189
Salvador	....	....	....	65	....	65
Mexico	27,710	24,762	113,280	119,986	422,626	708,364
West Indies:						
British	....	4,948	5,758	14,982	35,057	60,745
Cuba	11,152	11,345	46,999	96,538	205,250	371,284
Dutch	....	....	....	50	436	486
French	....	800	....	88	300	1,188
Haiti	....	....	....	30	180	210
Dominican Republic	....	....	....	400	....	400
South America:						
Argentina	10,203	6,588	12,997	18,350	20,923	69,061
Brazil	2,150	6,900	2,346	4,010	27,550	42,956
Chile	....	....	1,693	5,659	22,795	30,147
Colombia	....	148	954	983	995	3,080
Ecuador	....	10,921	10,442	658	340	22,356
Guinea:						
British	....	....	....	450	....	450
Dutch	....	....	14	....	20	34
Peru	3,000	....	4,031	50,597	10,195	67,823
Uruguay	....	....	....	....	8,308	8,308
Venezuela	....	....	2,629	666	5,048	8,343
Asia:						
China	6,645	5,200	12,389	11,091	7,764	43,089
British India			70,479	56,790	31,046	158,315
Straits Settlements	4,299	15,082	2,648	5,931	6,277	34,187
Other British			1,440	9,383	321	11,144
Dutch	1,200	2,544	2,335	20,169	18,007	44,255
Hongkong	1,175	1,600	780	815	155	4,525
Japan	9,513	13,737	22,875	13,438	14,775	74,338
Siam	....	....	....	1,782	167	1,949
Turkey in Asia	....	....	....	865	....	865
British Australasia	9,581	48,078	164,130	98,562	160,944	481,295
French Oceania	....	....	....	1,200	....	1,200
Philippine Islands	14,216	3,085	4,252	1,702	9,467	32,722
Africa:						
British Africa:						
West	....	....	....	....	2,500	2,500
South	12,637	59,048	57,202	54,511	24,820	208,227
Canary Islands	....	260	....	....	....	260
French Africa	....	....	....	1,040	....	1,040
Portuguese Africa	....	....	654	679	....	1,333
Egypt	....	....	1,835	10,897	1,200	13,932
Totals	$948,528	$1,207,065	$1,895,605	$2,481,243	$3,497,016	$10,029,457

This table supplements the one appearing on page 104, and giving exports of cars for the 12 years 1907 to 1918.

Pro and Con of Government Railroad Ownership

Sentiment Appears Against It in General, and Both the Association of Railroad Executives and the Holders of Railroad Securities Oppose It

NEW YORK, Jan. 13—During recent weeks there has been a great variety of conversation and "news" about the railroads. There has been a lot of talk about Government ownership, but there is no well defined faction that has come out in favor of it. A few newspapers have advocated it, but *sentiment generally seems to be not in favor of the operation of the railroads by the Government*. However, there is a lot of conversation on the subject of Government ownership.

Early this week, Dow, Jones & Co. sent out from Chicago a lengthy telegram addressed, presumably, to a large number of business publications, among them AUTOMOTIVE INDUSTRIES. The telegram is reproduced herewith:

There are two well defined factions at work:

1—*The railroad executives' association, which is made up of the men who manage the roads.*

2—*The "Warfield faction," consisting mostly of presidents of insurance companies, presidents of banks and trust companies and others, who are the owners of the railroad properties.*

Faction No. 1 is, therefore, the men who manage the roads. Faction No. 2 is the people who own the roads.

Both factions are working toward the same end in that they are opposed to Government ownership.

Faction No. 1, the managers, has advanced a definite plan.

Faction No. 2, the owners, will shortly announce a plan, but has not as yet except that it opposes Faction No. 1's plan.

It is said by some that Faction No. 1, the managers, is trying to carry water on both shoulders, so that their jobs will be safe no matter what happens.

Faction No. 2, the owners, wants the investment in the properties safeguarded.

The Executives' Plan

Faction No. 1, the road managers and executives, wants Government regulation and protection, but NOT Government ownership. It proposes:

A—*Federal incorporation, which would be incorporation nationally instead of in states, as at present.*

B—*A director general of railroads with a seat in the Cabinet of the President of the United States.*

Faction No. 2 will announce its plan shortly, but inasmuch as neither faction will write the bill that Congress must pass on the subject, both factions are disseminating information, and the reading of conflicting stories leaves the average reader somewhat up in the air.

The statement that AUTOMOTIVE INDUSTRIES received concerning Warfield was prompted, it is stated, by the fact that John J. Mitchel, a Chicago banker, who is also vice-president of Warfield's "securities owners' association," was reported the other day to have come out in favor of Government ownership. The telegraphic statement denies that Mitchel favors Government ownership.

Recently Warfield has issued other statements in favor of his ideas. The statement that AUTOMOTIVE INDUSTRIES received was sent from Chicago by Dow, Jones & Co., which prints the *Wall Street Journal* and also operates a ticker and news service. It frequently sends out statements for financial men as a matter of courtesy, which, it states, it did in this case.

Warfield is president of the Seaboard Air Line, a large southern road with 3000 to 3500 miles of trackage and which in 1917 did over $30,000,000 of business. He is also president of the Continental Trust Co. of Baltimore. He some time ago organized and is president of the National Association of Owners of Railroad Securities. He, at the time the Government took over the roads, was active in securing for the roads better contracts than the Government at first offered. It is said that many of the executives in Faction No. 1 are in accord with Warfield's ideas.

SPECIAL DISPATCH FROM CHICAGO TO AUTOMOTIVE INDUSTRIES: CHICAGO, ILL., Jan. 10.—S. Davies Warfield, of Baltimore, president of the National Association of Owners of Railroad Securities, and of the Continental Trust Co., of that city, has been in Chicago since Monday in consultation with the executive committee of the National Industrial Traffic League in connection with plans for the return of the railroads to private operation. As a result of these conferences, it is understood he has adopted many suggestions made by the committee. Mr. Warfield was also in consultation with John S. Miller, of the law firm of Miller, Starr, Brown, Packard & Peckham, who is one of the advisory counsel of the securities association, together with ex-Senator Elihu Root, John G. Milburn, New York; Hugh L. Bond, Jr., Baltimore, and Forney Johnston, Birmingham, Ala.

He conferred with Luther M. Walter, of general counsel of the association and of the firm of Borders, Walter & Burchmore; also with John J. Mitchel, president of the Illinois Trust and Savings Bank, who is vice-president of the Securities Association.

Asked regarding Mr. Mitchel as having been quoted as in favor of Government ownership, Mr. Warfield in passing said: "The intentions of Mr. Mitchel at the time were misunderstood; he is no more in favor of Government ownership than I am." Being told that Director General McAdoo had resigned and would immediately return the railroads to their owners, Mr. Mitchel states: "If this takes place without remedial legislation the financial chaos will be disastrous, and I would prefer Government ownership."

The National Industrial Traffic League is of national scope and represents through constituent membership leagues and others over 250,000 shippers of the country. The executive committee, which has been in session here since Monday, is composed of members of traffic bodies located throughout the country.

Before leaving for the East, when asked regarding the securities association's plans, Mr. Warfield said: "The National Association of Owners of Railroad Securities represents in membership over $5,000,000,000 of the $17,000,000,000 railroad securities in the hands of the public, when you consider that the one-fourth of the total investments of the great life insurance companies are composed of railroad securities; that over 30,000,000 unduplicated life insurance policies are outstanding; that every life insured has, therefore, one-fourth of the provision made after death invested in railroad securities; that 50,000,000 people, nearly one-half the country's population, have a financial interest in the railroads, you can form an idea of how important become the methods under which these properties are to be returned to their owners.

"The responsibility of Congress in providing for this large proportion of our population, together with the business interests of the country, is very great. Unless the railroads are returned under safe and sane methods, the credit structure of the country will not stand the strain and all business will suffer accordingly.

"Our membership includes nearly all the life insurance companies, and directly represents over 25,000,000 of the 50,000,000 investors in railroad securities. These include depositors in mutual savings banks, holders of life policies, individuals, trustees of estates, universities, colleges and fiduciary institutions.

"The executive committee of the securities association has been working on plans for the return of the railroads that shall be fair to all alike. The interests of the shippers and the security owners are largely identical; without adequate railroad facilities the business of the country halts; without the co-operation of the shippers a fair and adequate return cannot be had on railroad investment to afford facilities and service essential to business success.

"My visit to Chicago is in connection with the policy adopted by our association to co-operate with and ask in return the co-operation of the shipping interests in plans for the return of the railroads. Conferences have also taken place in Washington and elsewhere with representatives of the shippers and others from various sections of the country. We are gratified at the evidence of desire to co-operate for the general good. Unless we are tolerant of the views and interests of all and a spirit of 'live and let live' during these days of reconstruction prevails we shall not have learned the lesson for which the blood of millions of men has been shed.

"The conferences with the executive committee of the National Industrial Traffic League have been productive of gratifying results. We shall adopt many of the suggestions made."

Mr. Warfield said that the plans of the association, now nearing completion, will shortly be presented to the Senate committee now holding hearings at Washington.

Mr. G. M. Freer, of Cincinnati, and president of the traffic league, said last night: "The executive committee of the league is appreciative of the co-operative spirit shown by Mr. Warfield in the several days' conferences with our committee and our members, and good results must necessarily come of it.

"This is the first time the owners of the railroad properties have extended hands to the shippers and it cannot fail to produce good results. I think it can be said that the shippers of the country realize, and the war has emphasized it, that unless the railroads are given reasonable return on the investment in them and on the money required to give the shippers additional facilities and service in proportion to the increase in their business, we offer as much as those who own the railroads.

"We are considering the whole subject. The purpose of Mr. Warfield and those of our committee are not far apart. The league will send representatives to Washington to present its views to the Senate committee."

It is understood that the committee of the traffic league is opposed to the compulsory federal incorporation of the railroads and also to the creation of a single political government head for the control of the railroads.—Dow, Jones & Co., 208 S. LaSalle St., Chicago.

Hollis Buys American Strawboard Co.

TIFFIN, OHIO, Jan. 14—The Hollis Tractor Co., Pittsburgh, a company capitalized at $2,500,000, has purchased the plant of the American Strawboard Co., and will begin the manufacture of farm tractors within 30 days.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. .... .02 -.03
- Phosphoric (85%).. .35 -.39
- Sulphuric (60%), lb. .008

Aluminum:
- Ingot, lb. .... .33
- Sheets (18 gage or more), lb. .... .42

Antimony, lb. .... .13 -.13¼

Burlap:
- 8 oz., yd.......... .10½
- 10½ oz., yd......... .16½

Copper:
- Elec., lb. .... .22
- Lake, lb. .... .20 -.23

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.62
- Egypt, combed, sq. yd. 1.30
- Egypt, carded, sq. yd. 1.27
- Peelers, combed, sq. yd. .97
- Peelers, carded, sq. yd. .... .95 -1.05

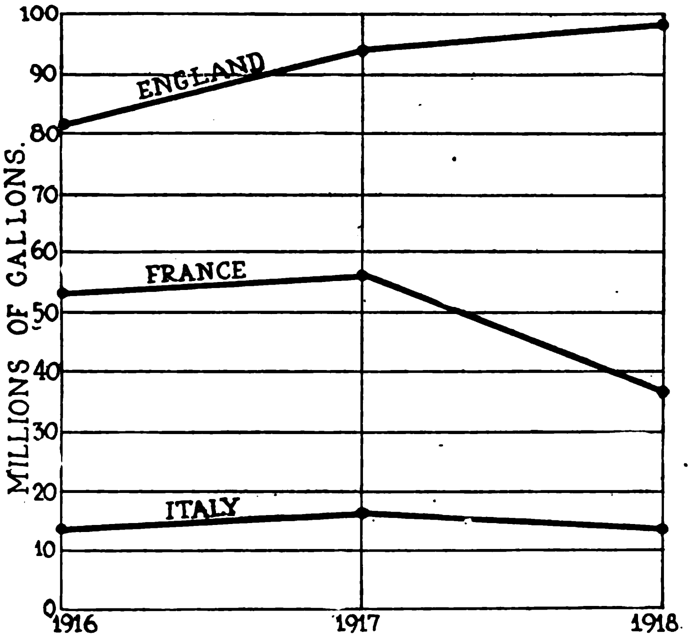
Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
- Ceylon, lb. .... .09 -.22
- Madagascar, lb. .... .10 -.15
- Mexico, lb. .... .03¾

Lead, lb. .... .05¼-.06

Leather:

Hides, lb. .... .18 -.35¼



Exports of lubricating oil to England, France and Italy for the first ten months of 1916, 1917 *and* 1918

Nickel, lb. .... .40

Oil:
- Gasoline:
  - Auto. gal. .... .24½
  - 68 to 70 gal....... .30½
- Lard:
  - Prime City, gal..2.25-2.30
  - Ex. No. 1, gal...1.62
- Linseed, gal. 1.58-1.59
- Menhaden (Dark), gal. 1.20-1.22
- Petroleum (crude),
  - Kansas, bbl. 2.25
  - Pennsylvania, bbl.4.00

Rubber:
- Ceylon:
  - First latex pale crepe, lb. .... .57
  - Brown, crepe, thin, clear, lb. .... .51
  - Smoked, ribbed sheets, lb. ..... .55
- Para:
  - Up River, fine, lb. .60½
  - Up River, coarse, lb. .... .36
  - Island, fine, lb... .54

Shellac (orange), lb.. .70 -.72

Spelter .... .07¾-.08

Steel:
- Angle beams and channels, lb. ..... .03
- Automobile sheet (see sp. table.)
- Cold rolled, lb...... .0625
- Hot rolled, lb....... .039

Tin .... .71 -.72

Tungsten, lb. ....2.00 -2.50

Waste (cotton), lb... .12¾-.17

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock.................	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock................	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Black Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.
- Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close Jan. 11

	Bid	Asked	Net Ch'ge
Auto Body Company........	5	8	..
Briscoe Motor Car, com....	..	..	..
Briscoe Motor Car, pfd.....	40	55	..
*Chandler Motor Car.......	105	107	—1
Chevrolet Motor Car	154	156	+5
Cole Motor Car Co..........	90	105	..
Continental Motors, com....	8	8⅝	..
Continental Motors, pfd....	94	97	..
Edmunds & Jones, com....	19	22	—1
Edmunds & Jones, pfd......	75	90	..
Electric Storage Bat........	50	55	—2
Federal Motor Truck........	33	36	+1
Fisher Body Co., com.......	36	39	..
Fisher Body Co., pfd.......	92	93¾	— ½
Ford Motor of Canada......	265	275	+40
General Motors, com.......	128¾	129¾	—2¾
General Motors, pfd.........	83	85	+1¾
Hupp Motor Car, com......	4¾	5¼	+ ¼
*Hupp Motor Car, pfd......	85	88	+2
Kelsey Wheel Co., com.....	30	35	+1
Kelsey Wheel Co., pfd.....	88	92	+3
Manhattan Electric S., com.	..	48	..
Maxwell Motor, com........	28	29	— ¼
Maxwell Motor, 1st pfd....	52¼	58¼	+1⅞
Maxwell Motor, 2nd pfd....	20⅞	21⅞	+2⅛
McCord. Mfg., com..........	32	35	..
McCord Mfg. pfd............	93	96	..
Mitchell Motor Co..........	28	28	..
Motor Products Corp......	40	..	..
Nash Motors Co., com......	175	200	..
Nash Motors Co., pfd......	90	95	..
National Motor Co...........	..	8	..
Packard Motor Car, com...	110	..	+3
Packard Motor Car, pfdf....	98½	..	..
Paige-Detroit Motor, com..	24¾	25¾	+1½
Paige-Detroit Motor, pfd....	8¾	9¾	..
Peerless Motor Truck.......	18	21	+1
Pierce-Arrom Mot. Car, cm.	42	43	— ½
Pierce-Arrow Mot. Car, pfd.	101½	102½	—1½
Premier Motor Corp., com..	5	..	..
Premier Motor Corp., pfd...	..	75	..
Prudden Wheel Company...	15½	17½	..
Reo Motor Car Co..........	22¼	23¼	+ ¾
Republic M. Truck, com...	35	38	— ½
Republic M. Truck, pfd....	87	90	..
Saxon Motor Car, com......	6⅞	8⅞	+ ⅝
Scripps-Booth Corp.	21	25	..
Stewart-Warner Speed. Corp.	85	87	+2¾
Stromberg Carburetor Co...	33	38	..
Studebaker Corp., com......	51⅞	52⅞	+ ⅞
Studebaker Corp., pfd......	92	97	..
Stutz Motor Car Co........	49¼	50¼	..
United Motors Corp........	33¼	35¼	+ ½
White Motor Co............	44¾	45¾	+ ¼
Willys-Overland, com......	25	26	— ½
Willys-Overland, pfd........	87	88⅛	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	68	69½	..
Firestone T. & R., com.....	140	145	+1
Firestone T. & R., pfd......	95½	100	—4½
Fisk Rubber Co., com.......	84	86	+14
Fisk Rubber, 1st pfd........	97	100	..
Fisk Rubber, 2nd pfd........	85	90	..
Fisk Rubber, 1st pfd. conv.	100	105	+10
Goodrich, B. F., com........	56¾	57½	+ ¾
Goodrich, B. F., pfd........	101½	103½	+2⅛
Goodyear T. & R., com....	221	230	..
*Goodyear T. & R., 1st pfd..	103	105	..
Goodyear T. R., 2nd pfd...	105	107	+2
Kelly Springfield, com......	68½	70	— ½
Kelly Springfield pfd.......	85	92	+5
Lee Tire & Rubber Co......	22¼	22⅞	+1¼
Marathon Tire & Rubber....	..	55	..
Miller Rubber Co., com....	142	148	..
Miller Rubber Co., pfd......	96	98	..
Rubber Products Co.	..	101	..
Portage Rubber Co., com...	145	149	..
Swinehart T. & R. Co......	50	60	..
U. S. Rubber Co., com......	77½	78	—2½
*U. S. Rubber Co., pfd.....	109	110	— ½

*Ex. dividend.

Clas President of Lewis Steel Co.

MILWAUKEE, Jan. 13—Angelo R. Clas, secretary of the Falls Motors Corp., Sheboygan Falls, Wis., has resigned to become president and general manager of the Lewis Steel Co., Toledo, in which concern he recently acquired a financial interest.

—

E. A. Scheu, formerly Eastern district manager of the New York branch of the King Motor Car Co., has been made sales manager with headquarters in Detroit.

—

R. M. Mann, who was in charge of the Brooklyn branch of the King Motor Car Co., has been made assistant sales manager of the home office.

—

J. R. George, formerly connected with the F. S. Carr Co., Boston, makers of automobile fabrics, has become assistant sales manager of the Barley Motor Car Co., Kalamazoo.

—

Gilbert U. Radoys has been appointed advertising manager and assistant sales manager of the Haynes Automobile Co., Kokomo. He has been previously associated with the Hudson Motor Car Co., the Packard Motor Car Co., Detroit, and with the Nordyke & Marmon Co., Indianapolis.

—

D. F. Edwards, treasurer of the Gier Pressed Steel Co., Lansing, has returned to that city and will resume his work at the plant. He held the rank of major in the purchasing and supply division at Washington.

—

Lee Anderson, lately vice-president of the Hupp Motor Car Corp., and recently director of Aircraft Production in the Detroit zone, has severed his connection with the Hupp company to become affiliated with the Theo. F. MacManus Advertising Agency. He will be succeeded in the Hupp company by Oliver C. Hutchinson, who has been supervisor of wholesale branches and sales manager.

—

Milton J. Budlong has retired as vice-president, general manager and a director of the export firm of Gaston, Williams & Wigmore, New York. He has also retired as a director and vice-president of the Globe Steamship Line. His plans for the future have not been made public.

—

Leo N. Burnett, having received his honorable discharge from the Navy, has returned to Detroit and is back at his old position as advertising manager of the Cadillac Motor Car Co. He relieves John A. Cleary, who has returned to Philadelphia to again become promotion manager for the Automobile Sales Corp.

—

P. J. F. Batenburg, chief engineer and designer of the Four Wheel Drive Auto Co., Clintonville, Wis., has severed his connection with the company. He has not yet made any other connection.

Men of the Industry

Changes in Personnel and Position

Frankel Is Now Roller-Smith Co. Assistant Sales Manager

M. Frankel, formerly manager of the Chicago office of the Roller-Smith Co., makers of electrical instruments and circuit-breakers, New York City, has been promoted to the position of assistant sales manager. He will remain at the Chicago offices at 740 Monadnock Building and will supervise its activities, as well as those of the Cleveland office at 711 Williamson Building, and also of a new office which will be established in Detroit at an early date. The latter will be a direct factory branch.

—

Rex W. Wadman has opened a western office in Chicago at 72 West Adams street.

—

J. H. Ficken has resigned from the Carlisle Cord Tire Co. and will in future be connected with the Kelly-Springfield Tire Co.

—

Louis Rosenberg has been appointed advertising and sales manager of the Keystone Tire & Rubber Co., New York.

—

Frank B. Barnett, for 15 years Chicago manager for the Class Journal publications, has resigned that connection to assume the vice-presidency of Motor Life, New York.

—

Homer Blocker, who has been assistant for the past 2 years, has been appointed advertising manager of the Republic Rubber Corp.

—

Norval A. Hawkins, for 10 years sales manager of the Ford Motor Co., has resigned to give all his time to his own business interests. Mr. Hawkins was first appointed auditor of the company, and in December, 1909, was made commercial manager.

—

J. M. Harris, for 5 years service manager of the Milwaukee branch of the Packard Motor Car Co. of Chicago, has been promoted to manager of passenger-car service of the headquarters in Chicago. He is succeeded by W. J. Neumyer.

—

N. F. Ozburn, who has been a lieutenant in the navy, and **Dunbar Abston,** lieutenant in the Field Artillery, composing the firm of Ozburn, Abston & Co., have secured their release from active duty, and are now back in Memphis.

—

Thomas L. Moore has been appointed southwestern district manager for the General Tire & Rubber Co., and will have headquarters at Dallas.

Jackson Leaves Briscoe for Auto Body

LANSING, Jan. 9—W. V. Jackson, vice-president of the Briscoe Motor Corp., of Jackson, Mich., will assume the permanent management of the Auto Body Co., this city on Jan. 15. A. C. Stebbins, vice-president of the Auto Body Co., has been acting as general manager until a suitable man to fill the vacancy can be found. Mr. Jackson has been vice-president of the Briscoe Corp. two years. He was formerly general manager of the A. O. Smith Corp., Milwaukee, and was with that concern five years.

—

A. M. Whaley has been appointed southern sales manager for the General Tire & Rubber Co., with headquarters at Atlanta. He was formerly southern district manager for the Kelly-Springfield Tire Co.

—

Otis H. Adams has been appointed advertising and sales promotion manager of the Connecticut Telephone & Electric Co., Meriden. Formerly he was with the Martin V. Kelly Co., and prior to that was connected with the Class Journal Co.

—

James E. Wood has been appointed manager of the Cleveland office of the Roller-Smith Co., at 711 Williamson Building. He assumes the position formerly held by C. S. Ripley.

—

V. L. Kloepper has been appointed chief engineer of the Automotive Department of the National Tool and Mfg. Co., St. Louis. He was formerly designing engineer for the Dorris Motor Car Corp., St. Louis.

—

D. G. Caywood has been appointed special representative of the Black & Decker Mfg. Co., Baltimore. He will carry on the field work for the distribution of the Black & Decker specialized products. The appointment was effective Jan. 1. Mr. Caywood was formerly sales manager of the Brunner Mfg. Co., Utica, N. Y.

—

Ford Wages Aggravate Labor Discontent

DETROIT, Jan. 13—Henry Ford's recent announcement of a $6 minimum wage scale has started a slight labor movement towards this city, which is having a tendency to aggravate present labor conditions here. Conditions at best are none too good.

Labor officials are endeavoring to stem this flow by sending warnings to other parts of the country notifying workers that there are more men than jobs in Detroit. Mr. Ford's new scale is said to be the cause of considerable adverse comment in manufacturing circles and it is rumored that an attempt may be made to file a protest with the Department of Labor at Washington.

Inasmuch as practically every business in the city was on one side or the other of the recent Ford-Newberry Senatorial fight, it is hinted that politics is playing an important part in the affair.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

O'Bannon Acquires Taunton Oil Cloth

NEW YORK, Jan. 13—The O'Bannon Corp. has acquired the Taunton Oil Cloth Co., Taunton, Mass. The Taunton Oil Cloth Co. is an old established concern that has had its products on the market for more than sixty years. It makes oil cloths. The plant will be run under the personal management of Nathan Newbury, treasurer of the Taunton concern.

Canadian Plant for Clyde

MONTREAL, Jan. 13.—Clyde Cars Co. of Canada has opened a Canadian plant for the assembling and distribution of Clydesdale trucks for Canada and the Imperial Colonies. It is at 73-81 St. Paul Street, Toronto. Clydesdale trucks are constructed in accordance with the subsidy scheme specifications of the British War Office.

Detroit Office for Roller-Smith

NEW YORK, Jan. 13—The Roller-Smith Co. has opened a Detroit office in the new Telegraph Building. It is in charge of C. H. Nicholson, formerly connected with the Chicago office of the company.

Canadian Distributer for Moline Tractor

MOLINE, ILL., Jan. 13.—The Moline Plow Co. has contracted with the Willys-Overland, Toronto, for the distribution of Moline tractors and implements for the Dominion of Canada. Overland branch houses will carry a stock of repair parts.

Automotive Products Co. to Change Name

DETROIT, Jan. 9—Because two other accessory companies are doing business under a like name, papers have been filed to change the name of the Automotive Products Co., incorporated last week, to that of Autoware Corp.

Milwaukee to Unite Motor Trades

MILWAUKEE, WIS., Jan. 13—Plans which have for their purpose the amalgamation of all sections of the motor car and supply industry and trade of Milwaukee under the leadership of the Milwaukee Automobile Dealers, Inc., are being completed by a special committee created a short time ago, with Alfred Reeke as chairman. It is hoped to complete the organization so that it will be one of the results of the annual Milwaukee show, Jan. 24 to 30.

"Shelko" Accessories and Supplies

MADISON, Jan. 13—L. F. Schoelkopf, head of the L. F. Schoelkopf Co., distributer of the Ford in Dane County, has recently created a manufacturing and jobbing department in accessories and supplies, which is marketing a line of goods under the brand of "Shelko."

Dividends Declared

The Kelly-Springfield Tire Co., $1 quarterly, common.

Nash Motors Co., $10 a share, common.

Temporary Receivership for Interstate Tractor Co.

WATERLOO, Jan. 14—The Interstate Tractor Co. has been placed in the hands of receivers. The court appointed as receivers Floyd L. Chamberlain, president of the Chamberlain Machine Works, and Howard S. Miller of the Cedar River Sand & Gravel Co. The receivership is considered a temporary one and the first step toward reorganizing, with the object of continuing the business. The company is held to be solvent with gross assets of approximately $2,000,000.

More Capital for General Tire

AKRON, Jan. 13—The General Tire & Rubber Co. has increased its capital stock from $1,000,000 to $2,500,000. The following officers have been re-elected: President, M. O'Neil; vice-president, W. O'Neil; secretary, W. E. Fouse; treasurer, Charles Herberich; directors, the officers and T. F. O'Neil, G. F. Burkhardt, W. L. Beckley and J. A. Diebolt.

Manitowoc Plating Will Add

MANITOWOC, WIS., Jan. 13—The Manitowoc Plating Works, Manitowoc, Wis., is contemplating the erection and equipment of additions costing about $15,000 early next spring. W. J. Wachowitz is manager.

Highway Trailer Co. 1918 Financial Report

EDGERTON, WIS., Jan. 13—The Highway Trailer Co., at its annual stockholders' meeting, reported unfilled orders in excess of $105,000, while its 1918 business amounted to more than $500,000, consisting largely of Government contracts for special military trailers. The balance sheet showed assets of $222,000, including enlargements and improvements costing $25,000 made during the past year. A total of $49,279.60 was paid for salaries and wages. An interesting item is the disbursement of $14,879.80 for express and freight. The company declared a 7 per cent dividend on a capital of $179,000, payable Feb. 1. President James W. Menhall and other officers and directors were re-elected.

George Wurtz, for several years general Wisconsin traveling representative of the mechanical goods department of the Diamond division of the B. F. Goodrich Co., Akron, O., has been promoted Eastern manager of the same department, with headquarters in Pittsburgh.

Acme Adds to Personnel

CADILLAC, MICH., Jan. 13—The Acme Motor Truck Co. has made the following additions and changes in its organization. H. L. Browne has joined the sales force, and will act as factory representative in Colorado, Wyoming, New Mexico and Utah. He was formerly connected with the Service Motor Car Co. J. E. Bowles, who, for the past year has been special representative in the middle western states, will be transferred to the Pacific Coast, with headquarters at San Francisco, commencing at once. George P. Gould will act as factory representative in Maine, Massachusetts, New Hampshire and Vermont.

New Machine Tool Company for Green Bay

GREEN BAY, Jan. 13—The Conradson Machine Tool Co. has been organized at Green Bay, Wis., with a capital stock of $300,000 to manufacture turret lathes and other machine tools.

Klumb Engine & Machine Co. Dissolved

SHEBOYGAN, WIS., Jan. 13—The Klumb Engine & Machine Co., which disposed of its plant and equipment some time ago, has discontinued business and the corporation has been dissolved.

Ford to Use Power Dams

DETROIT, Jan. 13—The Henry Ford interests have secured options on nearly all power dam locations on Rouge River from Dearborn to Northville. There are three power dams at Northville, three between Northville and Plymouth, one at Plymouth, one at Newberg and one at Nankin. Utilization of all power of nine or ten dams is contemplated, it is said.

Ford Branch Managers Meet

DETROIT, Jan. 13—Branch managers of the Ford Motor Car Co. were in annual convention here Jan. 7 to 11. Practically every sales district in the United States and South America was represented. Managers were unanimous in declaring the 1919 business outlook was unusually promising, and a number predict that the end of the season will see all previous sales records shattered.

The following branch managers were present:

R. S. Abbott, Atlanta; W. C. Anderson, Chicago; O. L. Arnold, Pittsburgh; L. C. Block, Philadelphia; H. M. Buckley, Fargo, N. D.; J. A. Deignan, Oklahoma City; H. C. Ethridge, Jacksonville; A. W. Gilpin, Milwaukee; C. L. Gould, Omaha; B. L. Graves, Los Angeles; E. H. Hampton, Buenos Aires, Argentine, S. A.; J. A. Handin, Salt Lake City; J. J. Harrington, Boston; Charles J. Hendy, Denver; C. C. Hildebrand, Minneapolis; Joseph W. Holt, Charlotte, N. C.; R. P. Jones, Washington; J. S. Keown, Louisville; A. J. Langford, Dallas; J. B. Lund, San Francisco; W. M. MacDonald, Houston; F. E. McClure, Cleveland; W. S. McNamara, Portland, Ore.; P. F. Minnock, Des Moines; H. K. Munroe, New Orleans; R. S. Neeley, New York City; G. C. Nichols, Cincinnati; Gaston Plantiff, Long Island City; R. P. Rice, Kansas City; E. L. Rockelman, Seattle; N. J. Schmucker, Jr., Scranton; G. B. Tyler, Buffalo; N. Udell, Indianapolis; C. S. Williams, Memphis; J. J. Wright, St. Louis.

Calendar

ENGINEERING

S. A. E. Meetings

Feb. 4-6—New York. Winter Meeting. Society of Automotive Engineers, Engineering Societies' Building.

Feb. 6—Victory Dinner, Hotel Astor, New York.

Feb. 5—Minneapolis Section, S. A. E. — Hotel Radisson. "Radiator Cooling Fans."

March 5 — Minneapolis Section, S. A. E.—Hotel Radisson, "Tractor Service and Sales."

April 2—Minneapolis Section, S. A. E.—Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Jan. 11-18—Los Angeles, Cal. Automotive Exposition.

Jan. 15-18 — Spokane, Wash. Progressive Automotive Show in dealers' salesrooms. Auspices of Spokane Automobile Chamber of Commerce.

Jan. 16-18—Dallas, Tex. First Annual Mid-Winter, Adolphus Hotel Annex. Dr. W. G. Langley, Manager.

Jan. 20-25 — Shreveport, La. Shreveport Automobile Dealers' Assn. Henry B. Marks, Manager.

Jan. 20-25 — Hartford, Conn. Broad Street Armory, Auspices of Agricultural Interests.

Jan. 24-30 — Milwaukee, Wis. Eleventh Annual, Milwaukee Automobile Dealers, Inc., Auditorium. Bart J. Ruddle, Manager.

Jan. 25-Feb. 1—Chicago. Passenger cars, Coliseum.

Feb. 1-15—New York. Automobile Dealers' Assn. Charles A. Stewart Manager, Hotel Woodward, Broadway and 55th St.

Feb. 3-6 — Chicago. Trucks, Coliseum.

Feb. 5-8—Fargo, N. D. North Dakota Automobile Dealers' Assn., Auditorium.

Feb. 10-15—San Francisco, Cal. Third Annual Pacific Automobile Show, Motor Car Dealers' Assn. of San Francisco. Exposition Auditorium. G. A. Wahlgreen, Manager.

Feb. 10-15—Rochester, N. Y. Rochester Automobile Trades Assn., Exposition Park. George C. Donahue, Manager.

Feb. 15-22—Newark, N. J. N. J. Auto Exhibition Co. Calude Holgate, Manager.

Feb. 15-22 — Cleveland, Ohio. Cleveland Auto Show Co. Fred H. Caley, Manager.

Feb. 15-22—Minneapolis, Minn. Minneapolis Auto Trade Assn. Walter B. Wilmot, Manager.

Feb. 15-22—Albany, N. Y. Albany Automobile Dealers' Assn. State Armory.

Feb. 17-22—St. Louis. St. Louis Auto Mnfrs. & Dealers' Assn. Robert E. Lee, Manager.

Feb. 17 - 22 — Louisville, Ky. Louisville Auto Dealers' Assn.

Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.

Feb. 17-22 — Pittsfield, Mass. Pittsfield Automobile Dealers' Assn., State Armory. James J. Callahan, Manager.

Feb. 17-22 — Passenger Cars; Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. J. L. Elliott, Manager.

Feb. 17-22—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.

Feb. 18-22—Baltimore, Md. Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland, Fifth Regiment Armory. H. M. Lucius, General Manager.

Feb. 22-Mar. 1—Hartford, Conn. Hartford Automobile Dealers' Assn., Inc., Broad Street Armory. Ben F. Smith, Manager.

Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 24-Mar. 1 — Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.

Feb. 24-Mar. 1—Portland, Ore. Ninth Annual, Dealers' Motor Car Assn., Auditorium. M. O. Wilkins, Manager.

Feb. 27-March 6—New York Aircraft Exhibition by Aircraft Manufacturers' Association, Madison Square Garden.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March — Great Falls, Mont.—Montana Automobile Distributers' Assn.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

Mar. 5-8—Quincy, Ill. Quincy Automobile Trades Assn., Armory.

Mar. 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gardner, Manager.

Mar. 10-15—Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn., Auditorium. Clarke G. Powell, Manager.

Mar. 12-19—St. Joseph, Mo. Sixth Annual, St. Joseph Automobile Dealers' Assn.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Chester I. Campbell, Manager.

Mar. 15-22 — Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.

Mar. 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 22-29, Passenger Cars; April 1-5, Trucks—Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkham, Manager.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.

TRACTOR SHOWS

Jan. 20-25 — Hartford, Conn. Broad Street Armory.

Feb. 24-Mar. 1—Kansas City, Mo. Fourth Annual Tractor Show, Sweeney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show, Wichita Tractor and Thresher Club. Forum.

CONVENTIONS

Feb. 4-6—New York. Meeting Society Automotive Engineers.

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

Lober Mfg. Co. Enlarges

TOLEDO, Jan. 9—The Lober Radiator & Mfg. Co. has been incorporated with a capital stock of $50,000 to take over the Lober Art Brass & Specialty Co. The present plant is to be enlarged and 5000 ft. of floor space and 100 employees added. The concern made airplane radiators during the war.

Motor Vehicle for Every 18 Persons

(*Continued from page* 102)

For four years, Iowa has held first place. She started out after a record in 1915 by registering a motor vehicle for every 16 persons and each year this has been consistently bettered. In 1916 it was 13, and Nebraska tied the record. Prior to 1916, California was the leader, having a motor vehicle for every 27 in 1912 and for every 19 in 1914. Nebraska took first place in the year between, 1915, registering a vehicle for every 25 persons. It is hardly fair to give the place that year to the District of Columbia, which had a vehicle for every 21 persons.

Last year there was one motor vehicle for every 20 persons in the United States.

Two years ago, only five states boasted registering more than 200,000 cars each. Last year eight states went over this figure. This year there are ten states well over 200,000 and one more that has nearly reached this total. Two years ago, not a single state had reached the 300,000 mark; even New York was well below it. Last year, New York, Illinois, Ohio and Pennsylvania topped 300,000. This year Iowa went into the 300,000 class and two states, New York and Ohio, graduated out of it into the 400,000 class.

To-day, eighteen of the forty-nine states and territories can count their motor vehicles in figures of six digits, which is two states more than last year.

Three National Tool Transmissions

ST. LOUIS, Jan. 9—The National Tool & Mfg. Co., is now building three new models of automobile transmissions, designed for small, medium, and heavy types of passenger cars.

Simpson Now Victory Truck

ST. JOSEPH, MO., Jan. 13—The Simpson Truck Co. has changed its name to the Victory Truck Co., and has increased its capital stock from $50,000 to $100,000.

Starkweather-Snook Open Chicago Office

FORT MADISON, IOWA, Jan. 13—The Starkweather-Snook Corp., manufacturer of the S. & S. shock absorbers, has opened a branch office and warehouse at 1402 South Michigan Avenue, Chicago, with Chas. Snook in charge. The main office and factory will continue at Fort Madison and the Chicago branch will carry a complete stock.

Torbensen Axle Co. Erects New Building

CLEVELAND, Jan. 15—The Torbensen Axle Co. have started work on a new two-story brick, steel and mill constructed building, 100 x 140, as an addition to its present buildings, to cost about $75,000. Completion of the building is scheduled within 45 days.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 4

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, JANUARY 23, 1919

Fifteen cents
Three dollars

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, JANUARY 23, 1919—CHICAGO No. 4

Still Higher Standards Are Needed

If America Is to Compete Successfully for World Trade She Must First Set Up the Mark of Quality

IT IS TIME TO BUILD FOR A PERMANENT BUSINESS

Constructive, Institutional Establishments Must Replace Those of Transient and Short-Lived Dividend Production

By H. M. Swetland
President United Publishers Corp.

THERE are many lessons which the American manufacturer can learn from Europe, particularly from England.

The war has performed a great service to both England and France in forcing them into production on a scale which classes their manufacturers among the great quantity producers of the world.

They have learned to use automatic machinery and progressive assembly and the utility of unskilled labor for all routine operations.

Manufacturing plants have been doubled and quadrupled in size and equipment, with modern and permanent construction and facilities for labor saving and maximum production, and the number of employees has been correspondingly increased, ranging from five to forty thousand in automotive, shipbuilding and general munition plants.

This enormous pro-

Mr. Swetland, who is also President of the Class Journal Co., on January 2 returned from Europe, where he traveled extensively through England, Scotland and France as a member of a party of American business paper representatives who were the guests of the British Government. The party was afforded unusual opportunity of investigating social environment, industrial activities and matters pertaining to war

ductive capacity, well organized and fully equipped, will rapidly evolve from the production of munitions and instruments of war into the manufacture of the necessary and luxurious commodities of life.

Further, the British Government during her later war period has fostered the reconstruction of her industries, *and the automotive manufacturer is in some instances well in advance of reconstructed production.*

Some Post-War Models Ready

For example—The Rolls-Royce plant has its product fully determined. It will build two cars—one a large car of practically the same character as the present model, to which will be added a small car, a four-seater with a smaller engine, which will have the Rolls-Royce character in materials and workmanship, but will have less capacity.

The Austin car, which is fully designed and ready for the market, presents many points of interest. In the first place, it has a very artistic and well-finished design. You have to look for the top. It disappears in a little pocket back of the rear seats covered with a narrow leather apron, and is entirely unobservable unless you look for it. This, of course, also protects the top.

Specialized Refinement in Design

This pocket keeps the top clean and dry and renders it easily available in case of emergency. Then the seating is an entirely new feature. There are four seats, two in front and two in the rear, which are adjustable to the passenger, both in height and in the inclination of the back. The back of the seat is high, having a projecting roll at the top which is fitted to the passenger, making a thoroughly comfortable seat for a long journey.

While the design of the car at the rear gives no evidence whatever of a compartment for tires, the entire back opens into a rear door, which discloses a compartment which carries two tires, tubes, tire tools and everything necessary for quick repairs. It is a thoroughly concealed compartment which is not observable as you look the car over.

The complete housing of top and spare tires permits an exterior entirely unmarred by protuberances.

These illustrate some of the points of superiority in design referred to.

Substantial Methods Inherited

Nothing short of a close personal investigation will give the correct impression of the strength and solidity of a British or Continental enterprise.

They seem to have formed the habit or to have inherited the idea of doing things in a strong, substantial way, and the result is that their enterprises run through from generation to generation, improving with each decade in strength and solidity of purpose.

It is at least an English trait of character, evidenced in their architecture of both public and private buildings, their shipping, and the full line of manufactured products. *They construct for durability and have not neglected design.*

Take one look at their locomotive. It is a finished product of harmonious design and utility not to be seen in the same product of any other country.

England Looking to World Markets

If England has learned quantity production, if she builds for quality and durability, if she is sensitive to design and finished product, with her great munition factories yawning for production, is it not fair to assume that she is looking with confidence to the markets of the world?

This is the day of reconstruction.

With all due respect to the quality of American products, which, in many instances, equal or excel those of any other country, if America is to compete for the markets of the world, these conditions of foreign production must have serious consideration.

We Must Develop QUALITY

Has not the time arrived when the American manufacturer should set up first the mark of high quality?

Should not the manufacturer take more pride in the quality of his product and the service which it renders to the world than in

the number of dollars that can be squeezed out of it?

It seems to be all a question of the ultimate desire back of the manufacturer.

If the most important point is the production of large profits and quick dividends then it is perhaps wise to turn out a product which will pass muster in the salesroom, get the check and let the consumer worry about the quality.

Adequate Inspection Vital

But if the desire is a permanent business, well established, with satisfaction to manufacturer, merchant and consumer, then it is time to produce the greatest possible quality, using substantial and well-tried materials, coupled with workmanship adequate to the conditions, followed by an inspection which really *inspects and rejects all imperfections.*

The matter of inspection and rejection needs the attention of the manufacturer in our automotive industry. Too many glaring imperfections are passed along to the consumer.

These things should be coupled still further with the European idea—particularly in France—of combining excellent workmanship and good materials with artistic design.

More criticism of the Liberty engine was offered among the great manufacturers of England because of its design and general appearance and finish than on the performance of the product on which America spent so many millions.

Reconstruction is at hand.

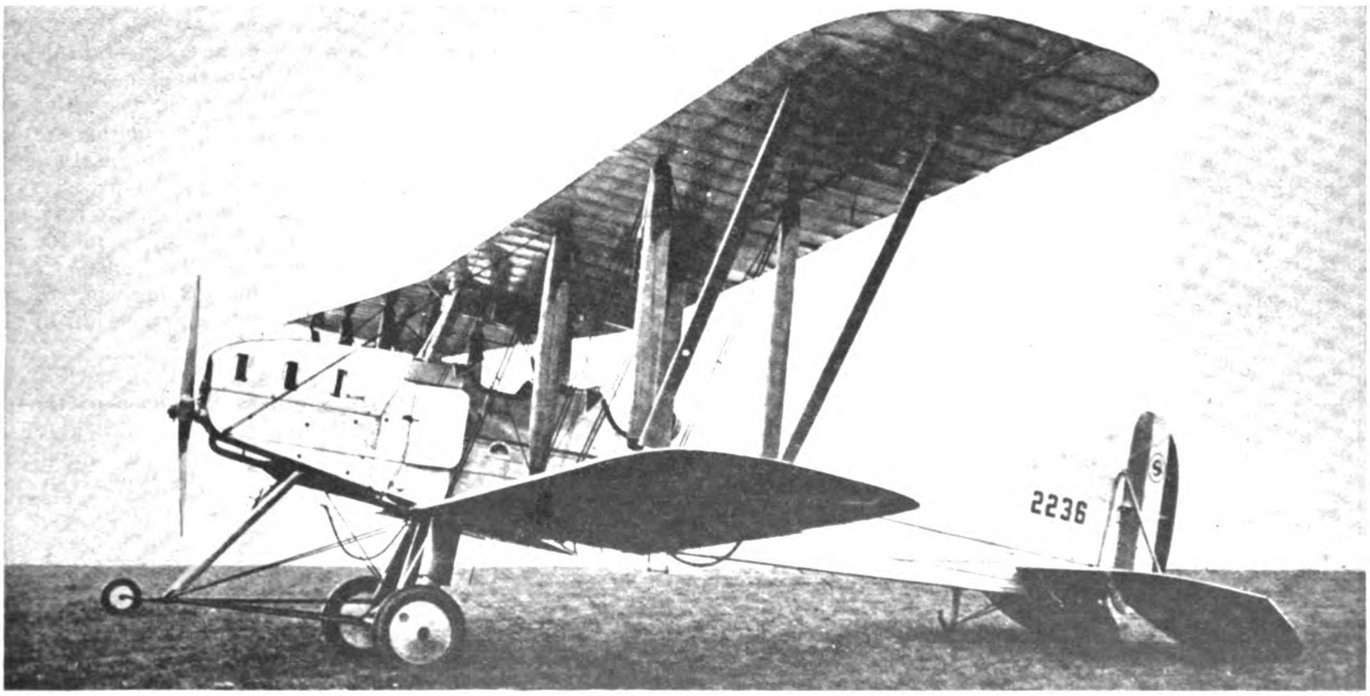
The world is entering on new conditions.

The question of the adjustment of labor and capital, as well as the question of raw materials, transportation and matters of legislation, is to receive a severe shake-up in the next ten years.

It is time to build for a permanent business.

American manufacturing enterprise must now evolve from transient and short-lived dividend production to an institutional, permanent and constructive establishment which will outlive its progenitors and establish the solidity of American industry in the future markets of the world.

R. E. 7 (Reconnaissance Experimental) Biplane



This machine was built at the Royal Aircraft factory and was used as a self-protecting artillery observation machine, night bomber and contact patrol machine. It is fitted with a 138-hp. R. A. F. 12-cylinder engine

Radiator Cooling Fans

The Fan the Controlling Factor in Any Cooling System—Fan Design, Mounting and Drive—Advantages of Fan Housings—Proper Location of Fan Relative to Housing

By Louis Schwitzer*

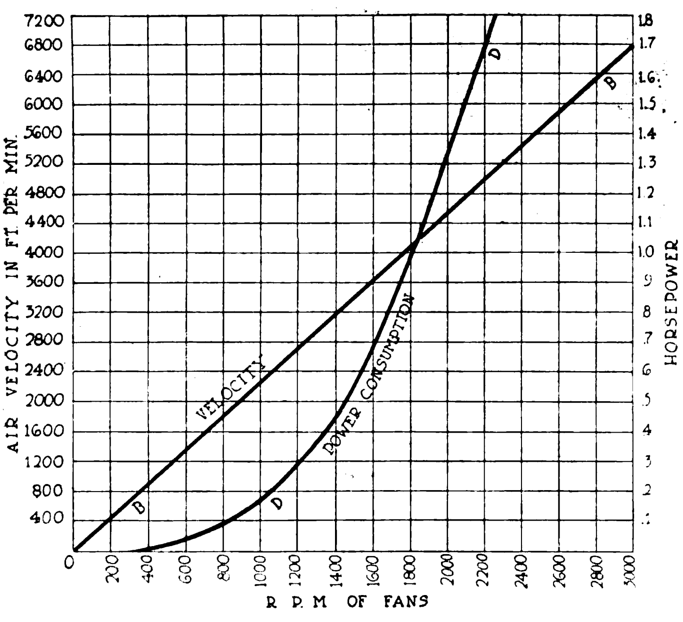
THE problem of cooling, in all water cooled road vehicles, resolves itself into a question of how much air can be passed through the radiator. Researches have shown that when other conditions are reduced to uniformity, the heat dispersal varies directly with the quantity of air drawn through the radiator. Therefore, the fan is the governing factor in cooling, and the determination of its correct type and its installation are of utmost importance. The fundamental condition of effective cooling is that a perfect balance has to be maintained between the heat units carried from the engine into the cooling water and radiator and the heat units disposed of by the radiator to the air passing through it. Expressed in the form of an equation,

B.t.u. imparted to cooling water = B.t.u. imparted to air.

To raise the temperature of 1 lb. of air 1 deg. Fahr., 0.2375 B.t.u. is necessary. The B.t.u. imparted to the cooling water can be determined from the horsepower output of the engine and its fuel consumption per horsepower hour. It is obvious from the above equation that with any given temperature rise a sufficient amount of air must be drawn through the radiator by the fan to secure a heat balance, from which we derive that

B.t.u. per minute imparted to cooling water
= Air volume × specific weight of air × 0.2375 × temperature rise of air.

*President Automotive Parts Co., Indianapolis, Ind.



Speed-horsepower and speed-air velocity curves of fan

The B.t.u. per minute imparted to the cooling water in different types of engines may be taken at the following figures, which are sufficiently accurate for all practical purposes:

80 B.t.u. p. hp. per min. for overhead valve engines
100 B.t.u. p. hp. per min. for L-head engines
110 B.t.u. p. hp. per min. for T-head engines

The specific weight of the air can be taken as 0.071 lb. per cubic foot at 100 deg. Fahr. The question of the temperature rise of the air upon its passage through the radiator has been thoroughly treated by Mr. Modine of the Modine Mfg. Co., in his S. A. E. paper of last January. Reference is there made to the physical laws that the amount of heat given off is proportional to the difference in temperature between the radiating body and the air, and that the loss of heat by convection is nearly proportional to the difference in temperature between the hot body and the air. These laws indicate that we are interested in maintaining the surface of the radiator at as high an average temperature as is practical. A temperature rise of 25 or 30 deg. is well within the practical limit, and these figures may be used in the discussion here.

Limitation of Frontal Area

The air volume is a function of the open frontal area of the radiator, in square feet, and the air velocity in feet per minute. These are the two variables which determine the efficiency and economy of a cooling system. The frontal area is limited by construction details, such as width of frame, height of bonnet, etc., and cost. The size can be determined from the above equation after a consideration of these construction details and the assumption of a certain air velocity. The open frontal area varies between 75 per cent and 83 per cent of the total frontal area, depending on the construction of the radiator core.

If, then, from the above equation with a certain assumed air velocity, the required frontal area of the radiator is determined, it is necessary to design a fan to give this air velocity under conditions of maximum economy. Large diameter fans with comparatively low speeds will be selected.

The power required for operating fans increases very rapidly with the speed of revolution and all out of proportion with the relatively small increase in air velocity or volume. At the left is a typical air velocity and horsepower chart which shows this condition clearly.

A large fan will deliver the same volume of air at a lower speed than a smaller fan and use considerably less horsepower. For instance, to deliver 7000 cu. ft. of air per minute requires 2 hp. with an 18-in. fan, 1.4 hp. with

a 20-in. fan and only 1 hp. when a 22-in. fan is used.

After a fan of the proper diameter and type has been selected that will deliver the largest volume of air with regard to the horsepower and the necessary and desirable radiator frontal area, its proper installation must be considered.

With slow moving vehicles, such as trucks and tractors, where the initial air velocity due to the vehicular motion is negligible, fan housings should be employed to insure not only the most uniform air velocity through the radiator but also the maximum efficiency of the fan. To be able to use the largest diameter fan with a given frontal area this area should be as nearly as possible in the form of a square. This will allow of a simple and efficient fan housing.

The fan housing must be designed so that the fan will be entirely inside of it. Tests have proven that with a fan partly inside and partly outside the housing, the air velocity drops about 10 per cent and the horsepower required is increased 20 per cent, as against running the fan entirely inside the housing.

Below are the data of a test made with a 23-in. fan at different speeds, the fan being located first entirely inside the housing, and then half inside and half outside. The fan was directly coupled to the shaft of the dynamometer, to eliminate any slippage, and the radiator was mounted on a slide, so that observations could be made for different positions of the fan relative to the radiator housing.

RESULTS OF TESTS TO DETERMINE BEST POSITION OF FAN RELATIVE TO HOUSING

Test No.	Distance of fan from radiator core	Relation of fan to housing	R.p.m. of fan	Hp. required	Average air speed ft. per m.	Average air speed per hp. ft. per m.
1a	3 in.	½ in. inside	1000	0.572	1449	2535
1b	4⅝ in.	Half out	1000	0.666	1305	1960
2a	3 in.	½ in. inside	1200	0.915	1692	1850
2b	4⅝ in.	Half out	1200	1.06	1497	1402
3a	3 in.	½ in. inside	1400	1.43	2142	1500
3b	4⅝ in.	Half out	1400	1.73	1803	1043

The fan housing must be deep to prevent sharp angles at the radiator corners, and the fan itself should not be too close to the rear face of the radiator core. There is no fixed rule for calculating the most efficient distance of the fan from the core, but tests should be made in each case to determine it. However, it will be found that when the diameter of the fan is practically equal to the width and height of the radiator core, there is little difference in the effects with this distance anywhere between 2 and 3 in. Fans of small diameter relative to the size of the core should be further from it, to be able to draw air through the corners and give a uniform air velocity through the total frontal area of the radiator. The opening in the fan housing should be such that the distance between the tip of the fan blade and the edge of the housing does not exceed 1½ in., to prevent back drafts. Preferably the outer tip of the blade should be ¼ in. from the edge of the housing toward which the fan blade moves when the belt is tightened and 1½ in. from the opposite side. This gives an opening 1¾ in. larger in diameter than the fan. Direct gear or chain driven fans can, of course, be arranged in the center of the opening of the housing.

In passenger cars, where no housings are used, care should be taken that the fan is not brought too close to the radiator, as this contributes considerably to air noise. No fan housings are necessary, as the initial air velocities are great, and with the small amount of space available underneath the bonnet the housings would have to have such flat corners that they would be more a detriment than an advantage, on account of back draft around these corners.

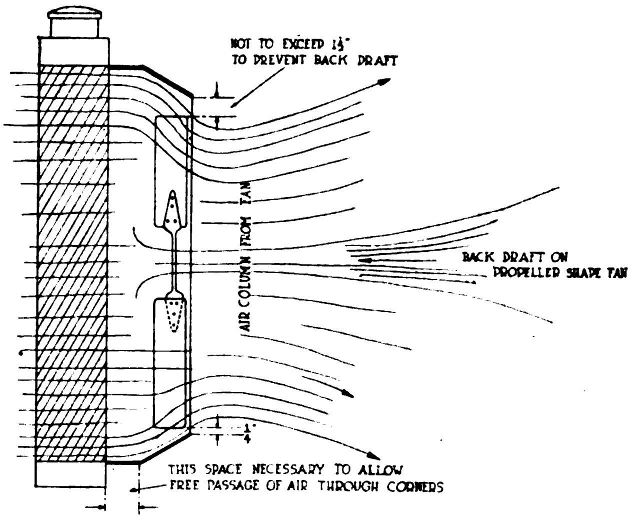


Diagram of fan housing

When designing a housing it is worth while to note the shape of the air column away from the fan. Contrary to common belief, there is no centrifugal discharge of air from the fan, but the air currents assume a hyperbolical shape, as shown in the illustration. This is due to the reverse current around the fan axis. With straight bladed fans this is not as pronounced as with propeller shape blades. On tests with the latter, back drafts have been measured behind the fan as high as 100 ft. per minute, forming a cone toward the center of the fan.

In order to obtain a positive air current through the radiator and to avoid back drafts, more importance should be paid—particularly in passenger cars and trucks—to the air outlet underneath the bonnet. The air expands a great deal under the hood, and with an inadequate outlet a static pressure is built up which seriously interferes with the capacity of the fan and relieves itself by backing out through the radiator. There should be at least 20 per cent more outlet area under the bonnet than the total open area through the radiator. Dust shields between the frame and the engine should not close up tight against the flywheel housing, particularly if the space between the toeboards and the crankcase is restricted, as is the case on most cars. A liberal opening should be left by inclining the dust shields toward the rear or putting louvres in. Many a case of serious heating trouble has been cured by providing ample openings in the dust shields or under-pans.

A good size opening through the under-pan or dust shields on both sides of the engine underneath the dash is much more effective than the louvres in the bonnet, as the motion of the vehicle (particularly of passenger cars) produces an injector action on the air under the bonnet which assists materially in the disposal of the hot air.

If louvres are cut in the bonnet, care must be taken not to get them too close to the radiator, as this would allow the fan to suck air through them, and naturally this would detract from the amount of air going through the radiator and reduce the cooling efficiency. By tests on various vehicles it has been observed that if the first louvre is placed 10 in. from the radiator there will be no negative drafts through it.

A proper size fan and housing will be useless unless means are provided to drive the fan and drive it efficiently for long periods. Therefore, the driving mechanism for the fan deserves serious consideration. Ample width and size of belts and large diameter pulleys must

be used. Sufficient belt contact must be provided to transmit the horsepower necessary to drive the fan positively without slippage and frequent adjustments even with the belt somewhat slack. No pulleys of less than 3-in. diameter should be employed on the fan, and, if flat belts are used, 1¼ in. should be the minimum width for any size of fan. With V belts, according to Graton & Knight, a 28-deg. angle is the most efficient, and a width of ⅝ in. at the top is the least to be employed. Manual belt adjustments have proved more successful than automatic take-ups. These latter give trouble due to spring breakage and undue vibration of the fan. There have been some successful automatic take-ups, but their cost is in most cases prohibitive for ordinary automotive road vehicles.

The fan as a whole should be given the same careful consideration as any other part of the tractor. Pressed steel fans are used most frequently, and are the strongest and lightest for a given diameter. The spiders and blades must be made from a good quality steel, strong enough to withstand the centrifugal stresses, rigid enough to prevent vibration, and perfectly balanced. The curve and angle of the blades must be chosen to give a maximum air velocity with a minimum horsepower requirement. The blade assembly should be bolted and not riveted to the hub, to allow an easy exchange, as the blades frequently get damaged through interference.

Failure of Bearings Troublesome

Failure of fan bearings has been the cause of the most irritating trouble, and the use of the proper bearings is, therefore, of the highest importance. In fact, 90 per cent of the failures of fans are due to improper bearing installation.

In a cooling fan there is both a radial load and a thrust load. The radial load is due to three distinct causes:

First, the weight of the parts supported, including the hub, pulley, blade assembly, etc.

Second, the static tension in the belt.

Third, the belt pull which drives the fan.

The belt pull is the total pull of the tight and loose sides of the belt. The factors determining this pull and the methods of ascertaining its amount are discussed below.

The load produced by the weights of parts resting on the bearing is in most cases very small, varying from 3½ to 10 lb.

The personal equation enters into the adjustment of the fan belt, and consequently the load on the bearing resulting from the tension in this belt cannot be calculated, as it depends on how much force is used in tightening it. It has been found that even crowbars are used to tighten the belt, and this might easily bring the load up to several hundred pounds.

The belt pull is the resultant pull of the tight and loose sides of the belt, and can be figured from the following:

H = Horsepower transmitted
N = Speed of pulley in r.p.m.
R = Radius of pulley in inches.

The torque in lb.-in. is

$$T = \frac{63{,}025 \times H}{N}$$

and the tangential force in pounds on the rim of the pulley, or the effective belt pull, is:

$$P = \frac{T}{R}$$

P is equal to the difference between the tension T_1 in the tight side and the tension T_2 in the slack side of the belt—

$$P = T_1 - T_2$$

The tensions act approximately in the same direction and it is the sum of these tensions which produces the load on the bearings. Therefore, we must solve the formula

$$P_p = T_1 + T_2$$

and get the load produced by the belt pull.

Thrust Loads

On the other hand, the thrust load on the bearing is due to only one factor, namely, the pressure of the air column delivered by the fan. There have been many misconceptions about this thrust load. In ordinary fans, as used at present for radiator cooling, this load is practically negligible up to 30-in. diameter fans. It has been proved by calculation and actual tests to be less than one-twentieth of the radial load produced by a belt pull sufficient to transmit the torque. When considering the additional load put on by the belt adjustment and weight of the fan, the thrust load is still a smaller percentage of the radial load. The pressure per square foot is exerted by a moving air column

$$P_t = 5.2h$$

Where h is the velocity head in inches of water and V the velocity of air in feet per minute.

$$V = 4000 \times \sqrt{h}$$

or

$$h = \frac{V^2}{16{,}000{,}000}$$

and from this formula we can solve

$$P_t = 5.2 \times \frac{V^2}{16{,}000{,}000}$$

In a test a fan was mounted so as to float on a shaft in such a manner that the end thrust was registered directly on a scale. It was found that an 18-in. fan running at 1750 r.p.m. and producing an air velocity of 2000 ft. per minute showed an end thrust of 3.25 lb. This coincides quite closely with the calculation below:

$$P = \frac{5.2 \times 4{,}000{,}000}{16{,}000{,}000} = 1.3 \text{ lb. per square foot.}$$

In the case of an 18-in. diameter fan, which presents an area of 2.54 sq. ft.,

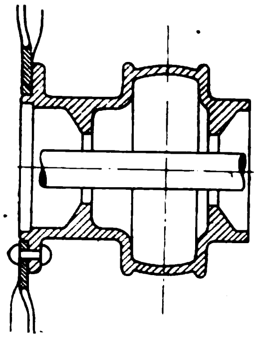
$$1.3 \times 2.54 = 3.3 \text{ lb.}$$

is the total pressure of the air column, or the total thrust load.

Affected by Initial Air Velocity

The end thrust also depends on the initial air velocity produced by the motion of fast-moving road vehicles. This air velocity will naturally tend to drive the fan and will reduce end thrust. At a certain speed the initial air velocity is equal to the one due to the fan, and the thrust loads will be balanced. At speeds above this the thrust will be reversed. This would indicate that on passenger cars there is the least necessity for provisions to take up thrust loads.

The foregoing shows that the radial load is the one that has to be taken care of in cooling fans, and that the thrust load is so small that it does not justify using a combination bearing. The small amount of thrust load is best taken care of by a plain thrust bearing, using a floating bronze washer between two hardened and ground steel surfaces. There is not sufficient pressure to squeeze the oil film out between the washers and the thrust will be carried on an oil film. This arrangement is simple and does not call for means of adjustment or extremely accurate machine work like ball thrust arrangements. The latter also do not stand any abuse or hard handling through the shops and in service, and require expert and careful assembling. Fan mountings equipped with flex-



Fan hub design which is wrong because it requires constant replenishing of the lubricant supply

ible roller and plain thrust bearings have been tested recently in a laboratory to the equivalent of 100,000 miles of automobile service without detrimental depreciation or failure of the thrust washers.

Cup and Cone Bearings

Cup and cone ball bearings have been widely used up to date, but their basic principles are wrong for most of our fan applications. It takes an expert to know when these bearings are properly adjusted, and when not in proper relation to each other they are noisy and deteriorate rapidly. If the bearings are too tight, undue strain is put on the already severely taxed surfaces, with the result that their life is materially shortened. A certain blow or shock at such a time causes indentation of the races and is apt to cause breakage. The slightest wear interferes with the proper action of the cup and cone bearing. Carrying a thrust load in addition to the radial load results in a considerable reduction of the radial load carrying capacity, which is the main load to be taken care of in cooling fans. The best practice is to let the bearings do one thing and do it well, rather than do two things indifferently. With bearings designed to carry one load only, we have none of these complications, hence their design and mounting conditions are simple. This includes annular ball, roller and plain bearings. If such bearings are properly built they will operate indefinitely. Their advantages for this kind of service are many and very quickly seen. If at any time the housing or mounting in which such bearings are operated is taken apart for any purpose, any novice can put it back again without any danger of mistake, for there is no adjustment involved.

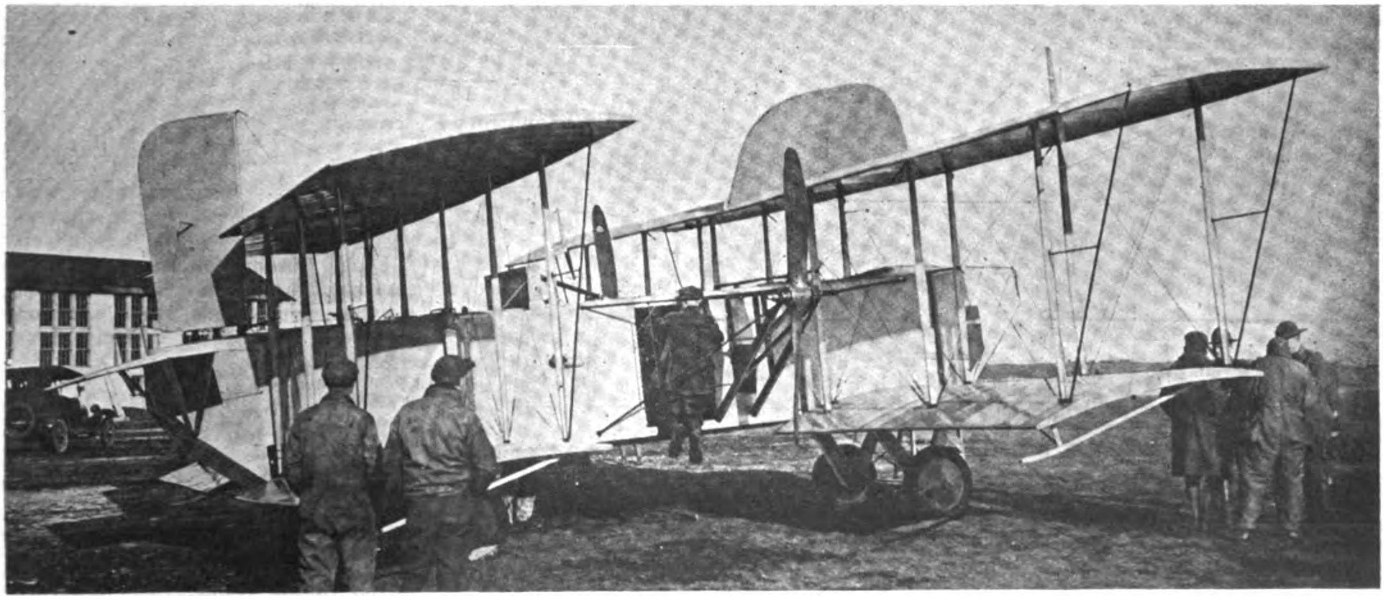
These bearings, it will thus be seen, cannot be adjusted too loosely, causing noise and poor alignment. Neither can they be adjusted too tightly, which would increase the strain on the operating surfaces, and which might even cause breakage in the case of excessive shock.

Hub Design

As none but fluid lubricant should be used for fans, the hub should be designed so that the oil will reach the bearings and not be held by circumferential force against the pulley rim. The bearings therefore should be the largest diameter in the inside of the hub. Designs like that illustrated by the sketch are wrong, as they require constant replenishing of the lubricant. The bearings would run dry even with the hub nearly half full of oil. Provision should be made to keep the dust out and the oil in. This can be done in a simple way by making the center of the fan blade spider solid, bolting it to the front flange of the hub and inserting into the rear a suitable felt retainer. Adjustable stuffing boxes have not proven successful. They are either too tight or too loose, as no care will be given them. When tight, they cause slippage of the belt and deterioration of same, excessive heating of the hub and spindle, scoring of the shaft and destruction of the felt; when loose and not properly locked they cause oil leakage and are being shaken off by the fan vibration. The fan shaft should be made of high-grade material and heat treated to obtain a high resistance against fatigue. The fan supports must be rigid, and rather too heavy than too light, to prevent vibration and breakage. Account should be taken of the fact that in most cases such breakage causes destruction of the radiator and necessitates expensive repairs.

Summarizing the foregoing, it has been shown that the fan is the most potent cooling factor, and the essential features of its design and operation are:

LARGE DIAMETER AND LOW SPEED.
PROPER DESIGN OF BLADES FOR MAXIMUM AIR EFFICIENCY WITH A MINIMUM HORSEPOWER.
WIDE BELT AND LARGE DIAMETER PULLEY.
RADIAL BEARINGS, OIL AND DUST TIGHT.
A SUITABLE FAN HOUSING ON SLOW-MOVING AUTOMOTIVE ROAD VEHICLES.



This new tandem plane recently made its initial flight at Mineola, Long Island. It is one of the regular twin-engine pusher machines, and has an additional set of wings attached to the fuselage

An Analysis of the Hotchkiss Drive*

Loads on Rear Springs the Resultant of Weight Carried and Torque or Brake Reaction—Spring Action Under Road Shock Reduced by Effect of Torque on Spring

By Otto M. Burkhardt

THE reaction of the torque transmitted to the driving wheels of a motor vehicle has a tendency to lift the front wheels off the ground. The torque necessary to raise the front wheels is

$$T \times R = W_f \times b$$

where

T = Tractive force at circumference of driving wheels in lb.
R = Radius of driving wheels in in.
W_f = Load on front wheels in lb.
b = Length of wheel base in in.

From the above equation we find that the force tending to lift the front wheels off the ground if a certain torque $T \times R$ is transmitted to the rear wheels may be expressed by

$$W_f = \frac{T \times R}{b}$$

Let W be the weight of a motor truck when loaded. The weights on the rear and front wheels then will be about ¾ W and ¼ W respectively. The tractive force of heavy commercial vehicles is generally smaller than $0.6 \times W_r$, but for passenger cars it is frequently larger. We may, therefore, take this as a practical average value. For a wheelbase of 8.4 times the radius of the driving wheels, we find that under the above given circumstances the force tending to lift the front wheels off the ground is:

$$W_f = \frac{T \times R}{b} = \frac{0.6 \times W_r}{8.4} = 0.0536\, W.$$

The latter amount is equal to 21½ per cent of the weight on the front wheels. As this phenomenon lends itself admirably for the determination of the tractive force, it was utilized in some well known experiments by Professor Riedler.

We may now with advantage apply our equations to a practical example, that of a 5-ton truck of 20,000 lb. spring-supported weight. Hence

$$W = 20{,}000 \text{ lb.}$$

*From a paper presented to the Buffalo Section of the S. A. E.

$$W_r = \frac{3\,W}{4} = 15{,}000 \text{ lb.}$$

$$W_f = \frac{W}{4} = 5000 \text{ lb.}$$

The truck is equipped with an engine developing 50 hp. at 1000 r.p.m. The total gear reduction is 50 to 1 in low gear, and the efficiency of the mechanism may be taken as 80 per cent. We obtain, therefore, a driving power reaction moment of

$$T \times R = \frac{50 \times 63024}{1000} \times 50 \times .8 = 126{,}000 \text{ lb.-in.}$$

With a 14 ft. = 168 in. wheelbase the force tending to raise the front axle is:

$$W'_f = \frac{126{,}000}{168} = 750 \text{ lb.}$$

The chassis shown in figure 2 is provided with a torque rod, which is provided to impart the wheel power reaction to the frame. As the torque rod is 50 in. long the pressure exerted at the end of the rod is

$$P' = \frac{126{,}000}{50} = 2520 \text{ lb.}$$

This pressure is comparatively small and easily taken care of.

As a single force cannot balance a couple, we must have another force equal and opposite to P' with its point of application in the center of the axle. The latter force, being the reaction of the former, has been denoted with P''. We shall now resolve the force P' into two components P'_f and P'_r with their points of application at the centers of the front and rear axles respectively. The former of the two components is what we have so far known as W'_f as we shall presently see. It is:

$$P'_f = \frac{P' \times 50}{168} = \frac{2520 \times 50}{168} = 750 \text{ lb.} = W'_f$$

$$P'_r = \frac{P' \times 118}{168} = \frac{2520 \times 118}{168} = 1770 \text{ lb.}$$

If we now subtract P'_r from P'' we obtain

$$P'' - P'_r = 2520 - 1770 = 750.$$

The force $P'' - P'_r$ is, therefore, also equal to W'_f, but acting in the opposite direction.

From this it follows that when the maximum torque is transmitted to the rear wheels, the loads on the rear and front wheels have changed to

$$W''_r = W_r + W'_f = 15{,}750 \text{ lb. and}$$
$$W''_f = W_f - W'_f = 4250 \text{ lb.}$$

Let us now take another torque rod of the same length as the one considered but extending from the rear axle equal distances in both directions and having both ends linked to the frame. The pressure on both ends of the torque rod will then be alike, *i. e.*, 2520 lb. If, how-

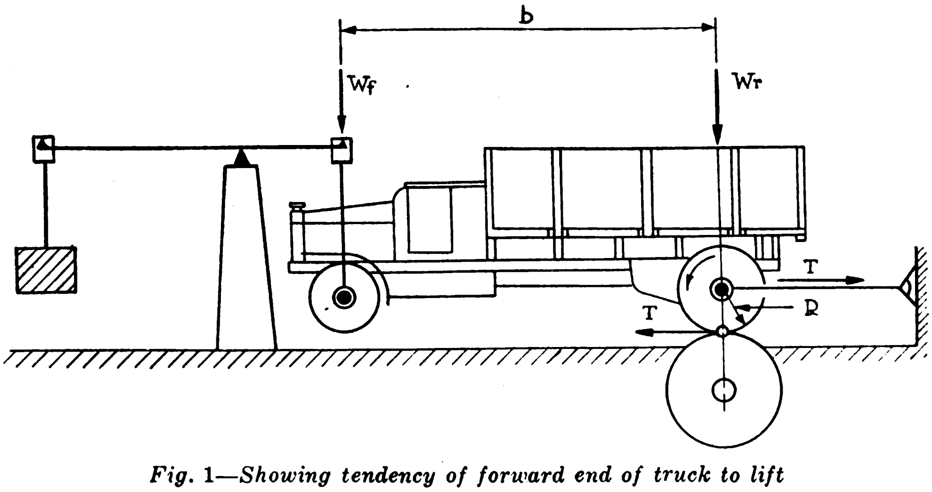
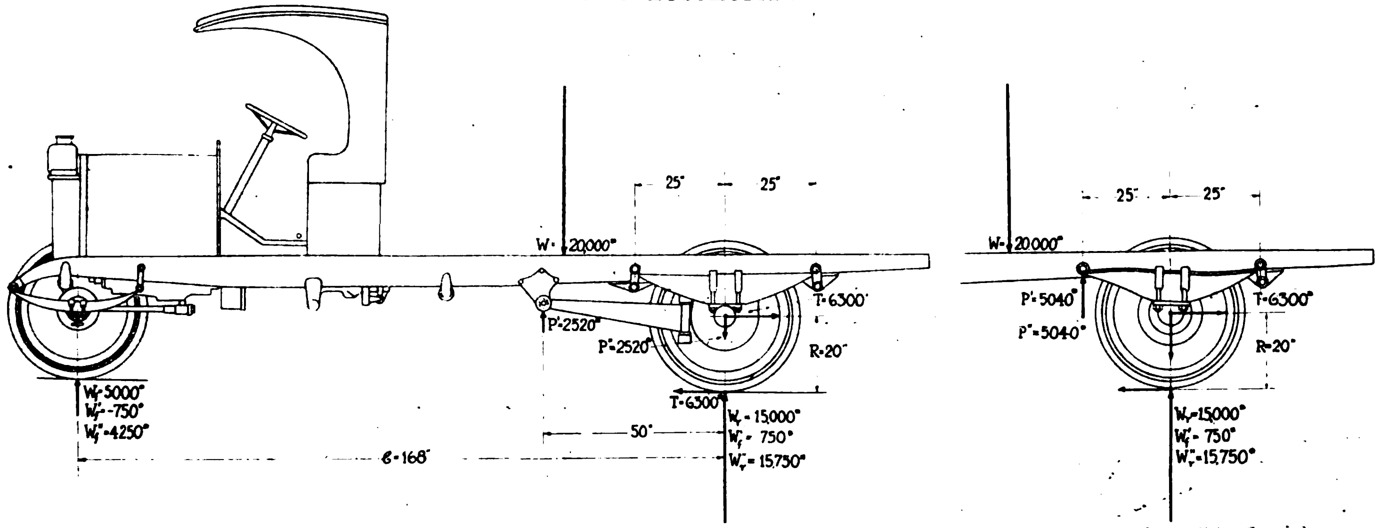


Fig. 1—*Showing tendency of forward end of truck to lift*



Figs. 2 and 3—Loads and reactions with ordinary and Hotchkiss drive trucks

ever, we substitute a rear spring for the torque rod all conditions are changed.

To prove our contention a chassis is shown in Fig. 3 in which the springs act as torque rods. With the same power and gear ratio we obtain the same loads as before on rear and front wheels,

$$W''_r = W_r + W'_f = 15{,}750 \text{ lb.}$$
$$W''_f = W_f - W'_f = 4250 \text{ lb.}$$

Now the whole system is in balance. The springs are centrally secured to the axle and each rear spring bolt must necessarily carry a load of

$$\frac{15{,}750}{4} = 3938 \text{ lb.}$$

The torque reaction is to be imparted to the chassis through the rear springs. As the springs are designed to take loads in one direction only it must be taken for granted that the two rear spring halves to the left of the axle center have to withstand the reaction of 126,000 lb.-in. If we assume the rear springs to be 50 in. long we have two half springs each 25 in. long to take this reaction. This means an extra load of

$$P' = \frac{126{,}000}{2 \times 25} = 2520 \text{ lb.}$$

on each of these spring bolts. It is absurd to think that the right hand halves of the rear springs could take part of this load because this would require a downward pull, whereas it is quite evident that the spring halves here under consideration cannot pull in one direction and at the same time push in opposite direction to support half of the load which is carried by either rear wheel.

In the chassis shown in Fig. 3, we have, therefore, one half of the rear spring loaded as before with

$$\frac{W''_r}{4} = \frac{15{,}750}{4} = 3938 \text{ lb.}$$

while the other half is loaded with $3938 + 2520 = 6458$ lb.

Every motor truck is provided with brakes. If they are in good condition and applied with some force it is generally possible to lock the rear wheels. This produces a moment of about

$$15{,}000 \times 0.6 \times 20 = 180{,}000 \text{ lb.-in.}$$

This braking power acts in a direction opposite to the driving power and its reaction also is opposite in direction to the driving torque reaction. That is, in the case of the Hotchkiss drive, Fig. 3, the rear instead of the front halves of the rear springs transmit the reaction to the chassis. We observe that the braking power is 43 per cent larger than the driving power. In determining this figure the load of which the rear wheels are relieved when the brakes are applied has been neglected because if chains are used the braking power may even be larger than here assumed.

Now in case of the chassis shown in Fig. 2 the rear springs are loaded less than ordinarily when the brakes are applied. However, in the chassis of Fig. 3 the load on the rear halves of the rear springs is much increased by the application of the brakes. Following the same reasoning as before we have:

$$W'_f = \frac{180{,}000}{168} = 1070 \text{ lb. and consequently}$$
$$W''_r = W_r - W'_f = 15{,}000 - 1070 = 13{,}930 \text{ lb.}$$
$$W''_f = W_f + W'_f = 5000 + 1070 = 6070 \text{ lb.}$$

Each of the rear halves of the rear springs receives an additional load

$$P' = \frac{180{,}000}{2 \times 25} = 3600 \text{ lb.}$$

These half springs are, therefore, loaded with $\frac{13{,}930}{4}$ $+ 3600 = 7083$ lb.

The minimum load ever carried by the rear wheels of either chassis may be taken as 6600 lb. (Vehicles running without load.) The minimum load per spring bolt is, therefore,

$$\frac{6600}{4} = 1650 \text{ lb.}$$

If the springs for both chassis are designed to deflect 4 in. under the maximum load, then if the vehicles are running with very little load the spring deflection in case of the chassis shown in Fig. 2 is

$$d_s = 4 \times \frac{1650}{3938} = 1.675$$

while in the case of the chassis shown in Fig. 3 the least deflection is

$$d_s = 4 \times \frac{1650}{7083} = .932.$$

The difference in the riding qualities of the two vehicles is, on this account, quite considerable. In fact, the latter vehicle if badly designed, may be entirely unsuitable for the transportation of light delicate goods.

Fig. 3 illustrates how unequally the springs deflect. This accounts for the well-known phenomenon that in most Hotchkiss drive trucks the brakes hold all right if applied gently but not if applied vigorously, or vice-versa. The trouble of loose spring clips so closely associated with the Hotchkiss drive is also well known. Furthermore, it is well known that the speed of the vehicle is dependent upon the suspension. A vehicle equipped with torque rod may, therefore, safely be operated at somewhat higher speed than one without this member.

So far, we have assumed that the reaction of the tractive force is a constant draw bar pull acting in the center of the rear axle. In practice the tractive force is generally utilized to accelerate the gross weight of the vehicle, to overcome road resistance or resistance due to gradients. During acceleration the reaction of the tractive force has its point of application in the center of gravity of the vehicle. When gradients are negotiated at a constant rate of speed or under other constant running conditions the reaction has its point of application in the front end of the radius rods if such are provided or in the front spring bolts in case of the Hotchkiss drive arrangement.

Now every engineer knows that the center of gravity of

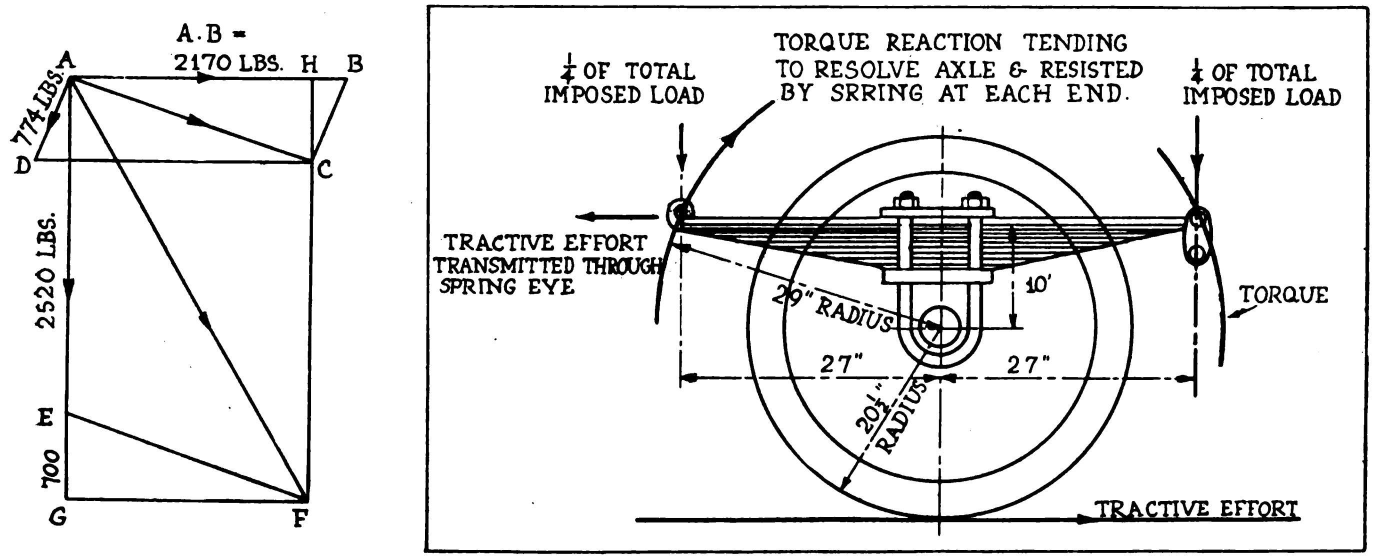


Fig. 4—Drawing revealing a misconception of the action of a Hotchkiss drive

a motor vehicle as well as the other points of reaction above mentioned are generally further from the ground than the center of the rear axle. Consequently in these cases we have to deal with a moment of much larger magnitude than those so far considered.

That such fundamental principles are being neglected is shown by Figs. 4 and 5, which are reproduced from leading trade papers. In connection with Fig. 4 the writer states that the torque reaction is resisted by the spring at each end. This we have proved to be an erroneous conception. Furthermore, we learn from the magnitude of the forces that the writer imagines the reaction of the tractive force to be acting in the center of the axle, whereas in reality it is acting through the top leaf of the spring. The writer shows it there but neglects it. This makes it appear advisable to place the spring way above the axle. Hardly anybody, and least of all the advocates of underslung spring design, can reconcile themselves with such a conclusion. This, however, is no reason and another hypothesis should be invented, because in an exact science like mathematics and mechanics there is no need for hypotheses. Nevertheless, we find in another article by a well known company that in its opinion a load acting vertically in the center of a perfectly symmetric spring can impose unequal loads on the spring bolts. Fig. 5 is reproduced from this article and speaks for itself, for it is all fiction, with not a bit of truth in it.

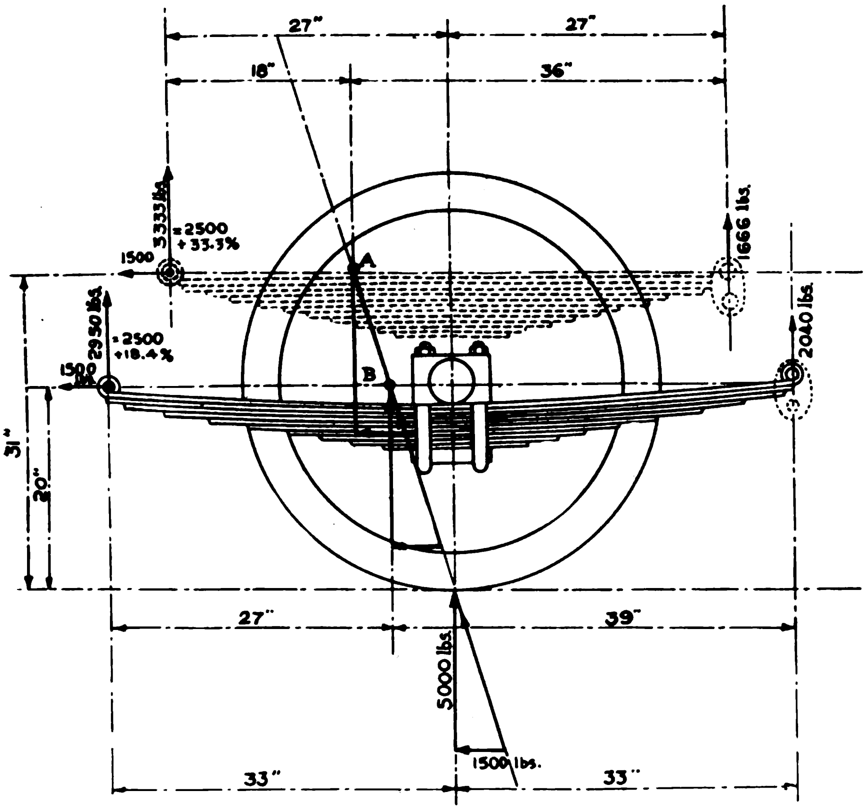


Fig. 5—An incorrect load diagram

Spark Plug Manufacture in Great Britain

PREVIOUS to the war the production of spark plugs in Great Britain was insignificant. There were three firms manufacturing, and their total output for all purposes during 1914 was not more than 5000. To-day five firms in the country are producing mica plugs, and their output for the year ending October 31 last was 2,148,726. The October output was 303,449, as compared with a monthly output of 420 in 1914. It is admitted, however, that there is room for further improvement of the mica plug for aircraft engines.

Acieral Aluminum Alloy Pistons

A NEW aluminum alloy which lends itself well to the production of sand-cast pistons is being marketed by the Acieral Company of America, New York City. The alloy is furnished in sand castings, rods and sheets. It does not contain any zinc, or magnesium, and is claimed to have a high tensile strength, the guaranteed minimum being 20,000 lb. per sq. in. Other physical properties of the alloy are as follows: Elongation, 2.5 per cent; Brinell hardness, 60; fusion temperature, 1380 deg. Fahr.; coefficient of heat expansion, about 50 per cent greater than that of cast iron.

We are informed that the Acieral alloy is the result of experimental and research work in France and the United States. Since there is no zinc in Acieral alloy, it is less given to crystallization than other aluminum alloys. The outstanding physical properties of Acieral are its compactness and homogeneity. The castings machine easily and take a very high polish. The specific gravity of the alloy is only 2.86, which is less than that of pure aluminum. All of the general advantages of aluminum pistons, such as light weight, high heat conductivity, etc., apply also to this alloy.

How Valuable Are Profit-Sharing Plans?

1—To the Employee 2—To the Employer

Any System Which Attempts to Satisfy the Physical Necessities of the Worker Without Increasing His Responsibility Must Fail

By Harry Tipper

THE changes in business organization in manufacturing establishments which have been made in the past few years, in the attempt to provide a common method of expressing the common desires and purposes of the human beings composing the organization, range all the way from complete "republics" to shop committees and boards of appeal indefinitely organized and with no authority. They represent, in fact, all stages of development, from the informal getting-together of supervisors and subordinates for a particular occasion to a thoroughly worked-out system by which the group of workers can be bound closely together for the purposes of production and distribution. While this variety is exhibited in the actual developments of such organizations, the same purpose runs through them all—the idea of getting-together so their grievances may be aired, adjustments made and a common responsibility understood.

Profit-sharing systems have been tried over a much wider field and to a much greater extent than systems of organization for these purposes. Because the wage system is the point of attack in almost all cases, and serves as the text for the actual expression of all forms of discontent, it has been the most usual point of consideration in the endeavors of manufacturers to remove the discontent. In fact, it is evident that for one manufacturer who has dipped deep enough into the causes of discontent to see the necessity for the creation of an organization to undertake their adjustment, fifty manufacturers have observed the fundamental failure of the wage system to satisfy the demand of the workers and have instituted some form of additional remuneration to adjust matters in this respect, which form amounts to profit-sharing to some extent.

Various Forms of Profit-Sharing

But there is a wide difference between these methods of wage adjustment and the organization attempts which have been considered in the earlier articles, in that while organization attempts are all based upon the fundamental principle of getting together and establishing a common responsibility, these attempts at profit-sharing run all the way from a mere arbitrary bonus upon wages given as a reward for production to a full-fledged system of sharing the profits of the organizations among capital, government and governed in the manufacturing establishment.

The numerous forms of profit-sharing which have been established to meet certain immediate necessities are not sufficiently important and do not depart sufficiently from general practice to be worth considering in this connection. Bonus systems for production, stock-sharing systems and time-study systems, where the payment is made for the different requirements of a task, are all valuable as far as they go, but they secure their principal value from the comparison with other establishments in which these systems are not in vogue. The common adoption of such systems would mean their elimination as a means of satisfying the worker and removing the causes of discontent or accelerating their adjustment.

This same thing of course is true in a very much greater degree of systems of high minimum wages with purely paternalistic interest in the worker's welfare, along the lines developed by the Ford company and others. Their present value is undoubted as a means of retaining the best class of skilled workers and of securing a flow of the most efficient skilled workers to replace those that naturally drop out. Such systems undoubtedly reduce the turnover and increase the productive efficiency so long as they represent a departure from the usual practice and have not been commonly adopted. They do not in themselves provide incentive and they are far removed from giving the worker any share in the responsibility for production or any partnership in the responsibility of the organization, and they must inevitably fail whenever the competitive advantage they offer is eliminated by the common adoption of similar systems in a general way. It makes no difference to what extent such systems may appear to remove the causes of discontent, temporarily to reduce the labor turnover and to eliminate strikes for a given period of time.

Must Consider Employee's Responsibility

Any system which attempts to satisfy the physical necessities of the worker or his present physical ambitions without increasing his responsibility in connection with the conditions of his own work in the organization unit of which he is a part is bound to fail ultimately because group organizations of human beings are held together by the common necessity and the common responsibility shared by all members of the group.

In the profit-sharing systems which have come to the writer's attention there are one or two based so evidently upon the responsibility of the various individuals of a group to the group necessities and upon unusual recognition of the value of a permanent working force that some examination of their condition is of interest as indicating the departure which has been made by individual concerns from the usual practice and the lengths to which individual manufacturers have gone in their endeavor to solve this labor question.

Had the following system emanated from a professional Socialist it would have been decried as Bolshevism, but it was established by a successful and hard-headed manufacturer who employs a force of 250 people, most of whom are not organized, and therefore could not at any one time develop much strength in a strike or materially embarrass his production.

The system is based upon three cardinal points:

1. The allowance of 6 per cent on the invested capital as a part of the expense of the business.

2. The provision of a living wage to all employees, from the president to the night watchman, this living

wage being based upon the general cost of living in the social surroundings which must govern to some extent their cost.

3. The division of gross profits equally between the invested capital and the workers in the business, including in the workers all who spend their time in the active organization of the business, from the president down. The details of this organization represent many further interesting facts. The one-half of the surplus of gross profit which is the share of the workers is divided as follows: One-third to the selling force, one-third to the executive department and offices, and one-third to the factory.

All Are Included

In each case this division includes supervisors and supervised alike. There is no distinction between the man who is spending his life governing a department of the business and the man who is spending his life working under that supervisor.

The amount paid out of the fund created by the allotment of this share of the profits for the worker is divided according to the salary which has been designated to each worker under the living wage clause. The wages themselves are adjusted periodically according to necessity, but they are adjusted only from top to bottom when any adjustment takes place. In other words, there is no adjustment of one worker or one department of workers because of a market necessity, so that there can be no discontent arising from an adjustment of wages which must be made.

The payment of the fund which is set aside for the active workers in the establishment has been the one point which has created considerable discussion and which has led to different methods in the three or four organizations which have established practically this system of operation.

In one instance the conditions are laid down by the officers of the company and no worker can secure his share of the fund except under those conditions. In the meantime the fund is deposited for them with the concern as trustee. In this concern the office staff, the selling force and the supervisors are paid their share annually in a lump sum, but the workers in the factory can only draw their money out under the following conditions:

First, leaving the employ of the company.

Second, buying a home.

Third, buying insurance.

Fourth, in emergency, to be determined only by the president of the company. The reasons for this are obvious. It is the desire of the company of course to protect a man against his own weakness to some degree, and it was found when this system was put into operation that some of the workers had spent all their money in a few days upon speculative investments and extended vacation from the work, a period of dissipation, and in other ways lost the value of their year's endeavors.

Profits Distribution Left to Committee

In another organization in which the same problem came up the conditions under which a man could draw the money accruing to him as his share in the profits were left to the determination of the committee of workers drawn by election from every department of the company.

In all these cases the living wage is placed at such a figure that it will pay all ordinary expenses, including the usual medical attendance, the education of children, etc., so that the share in the profits is expected to provide a fund for emergency and for old age.

The weakness of the first attempts in this scheme of profit-sharing was the placing of the fund at the disposition of the company itself, and to this is due some suspicion which has attached to it in the minds of some workers who have been familiar with the system. This difficulty has been eliminated in the later development by placing the control of the fund in charge of a committee of workers, so that it is not decided by the company, which might be suspected of deciding as to its disposition from the interests of the company itself.

There are two other out-croppings which come in as a necessary corollary to the adoption of this system which are in themselves of greater interest and perhaps have as much to do with the success of the system as the actual character of the profit sharing. The most important of these is the necessity for a statement to the employees as to the amount of business done, the cost of doing business, the profit, etc., so that the employees may know what their share will be. Without this of course the system would not remove the old suspicion that the scheme was a scheme to get a lot more work without giving a proportionate share of the increase to the worker. Books might be juggled, statements might be made which were not correct, and expenses introduced so that the result would be that at the end of the year only a small fund was available for distribution.

Keeping the Workers Posted

To clear away any possible misunderstanding in this direction and to give the workers an opportunity to see what the business is doing, a committee of workers, one from each of the different departments, meets once a month and gets up a statement of the condition of the business, being supplied with the information for that purpose from the company's books. Inasmuch as this committee takes in a man from each department, including the auditor's department and the purchasing department, it is obvious that the net result is complete publicity to the workers on the actual profits made.

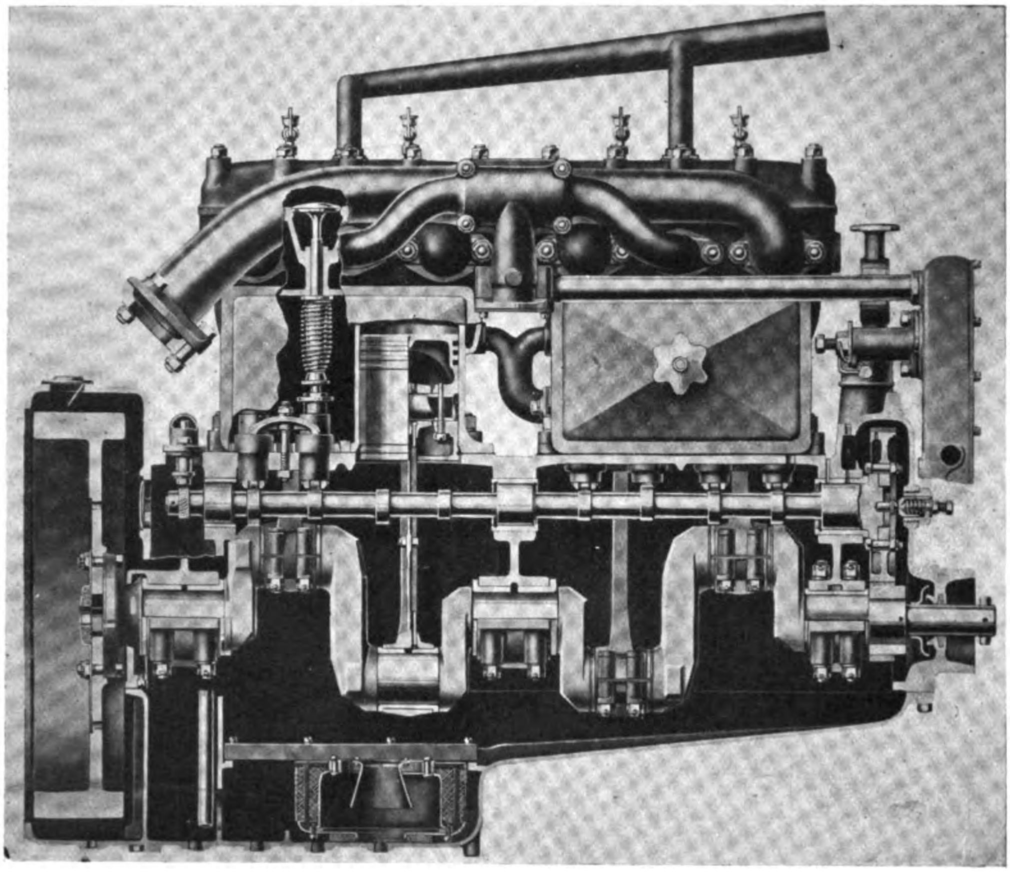
The benefits of this item extend far beyond the confines of the profit-sharing system out of which it grew. The real reason why there is so consistent a demand on the part of the workers for a larger share in the rewards of business without regard to the effect of such demands is the ignorance of the worker as to the percentage which becomes profit and the relation which his wages bear to the cost of doing business. Every worker in this establishment sees the statements simplified so that he can understand them as to the cost of material, cost of labor, cost of all items entering into the total expense of the business, and he has an opportunity to realize the insignificance of the share which capital is securing out of the business as an investment.

Has Stabilized Working Force

The system has been a success in the small establishments in which it has been tried. It has stabilized the working force so that the turnover of labor is very small. It has made each man an inspector, interested in the quality and speed of his output and of the output of the other workers. It has made each man take an interest in the maintenance of quality and accuracy all through the plant, because every worker receives a portion of his material advantage from the way in which the product is received on the market, from the price it secures, and from the contentment of the customer. It has developed an interest all through the organization in the necessity for pleasing the customer in every way, and it has resulted in the payment of a large amount above the 6 per cent allotted to the stockholders, so that the invested capital has not suffered by the development, but has apparently increased its earnings by this method.

Continental Adaptation of Class B War Truck Engine

Designed for Military Use, It Will Now Be Manufactured for Tractors and Heavy Commercial Cars—Aluminum Crankcase and Bell-Housing a Feature



Partial section through Continental B2 truck and tractor engine

THE Continental Motors Corp. has adapted the Class B war truck engine to commercial usage and is now on the market with its Model B2, which in all essential qualities corresponds to the Class B truck engine, being manufactured under the same rigid inspection rules, of the same material and to the same dimensions as this engine which was very successful in Government service. As this engine was designed with little regard to cost, to meet a high standard of performance and endurance, it is not by any means a low-priced engine, but on the other hand one which may be expected to give a good return in service in the tractor and heavy truck fields for which it is being manufactured.

The four cylinders are cast in pairs with detachable heads and mounted on an aluminum crankcase with a removable aluminum pan. The cylinders are L-head, with inclosed valve mechanism, and the engine is furnished in unit powerplant type adapted for three-point suspension.

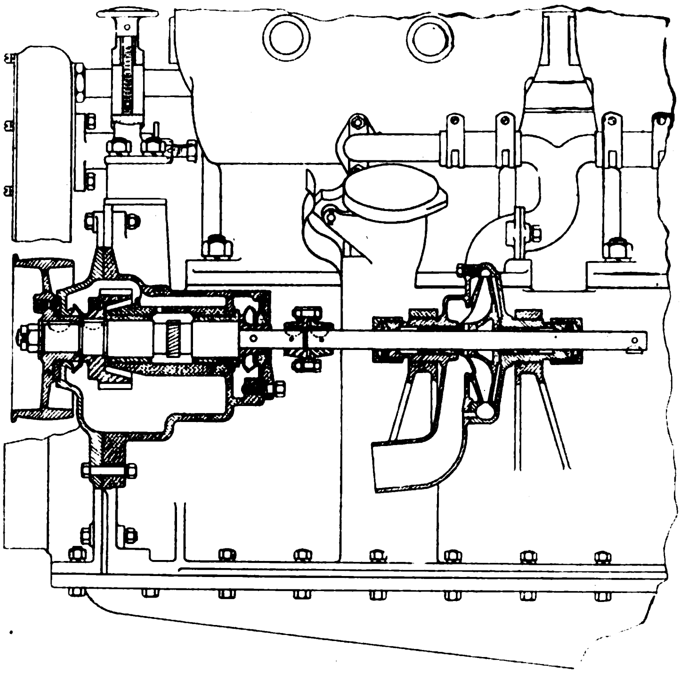
The performance, as taken from a block test, is shown by the accompanying chart upon which are plotted curves of torque, mechanical efficiency, indicated horsepower, brake horsepower, thermal efficiency, fuel consumption and frictional horsepower. The cylinder dimensions are 4¾ in. by 6 in., or 120.7 by 152.4 mm.

The engine is strictly a heavy-duty type, having a piston displacement of 106 cu. in. per cylinder and 424 cu. in. for all four cylinders, with a clearance ratio of 25.3 per cent, giving a normal compression of 60 lb. The firing order is 1-3-4-2. The valves are on the right side of the engine, the head diameter being 2⅜ in. and the diameter of the opening, 2⅛ in. The seat angle is 45 deg. and the lift of both the inlet and the exhaust valve is 11/32 in. The manifolds are on the right side and assembled in a unit to give an exhaust heated intake. The engine is designed to take the standard No. 1 S. A. E. bell housing flange and the standard type of multiple disk clutch. The standard flywheel is 19⅞ in. outside diameter and weighs 126 lb.

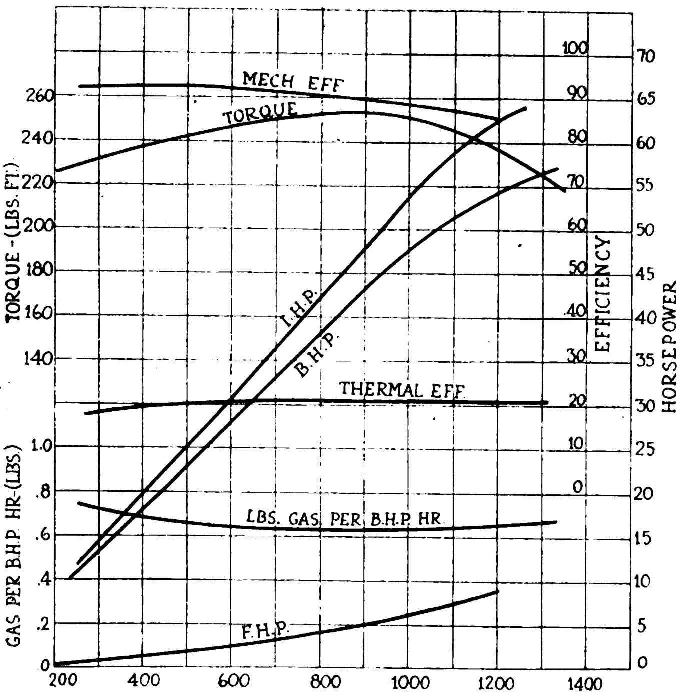
The entire design is suitable for tractor use, in that

there has been no sparing of material where rigidity is required. The crankshaft is 2½ in. in diameter and is carried in three bearings. The camshaft is 1¼ in. in diameter and is also carried in three bearings. The crankshaft bearings are of the following dimensions (front to rear): 2⅜ by 3 in., 2½ by 4 in. and 2½ by 4 in. The camshaft bearings are: 2¼ by 2⅛ in., 2⅛ by 1¾ in. and 2 by 1⅜ in.

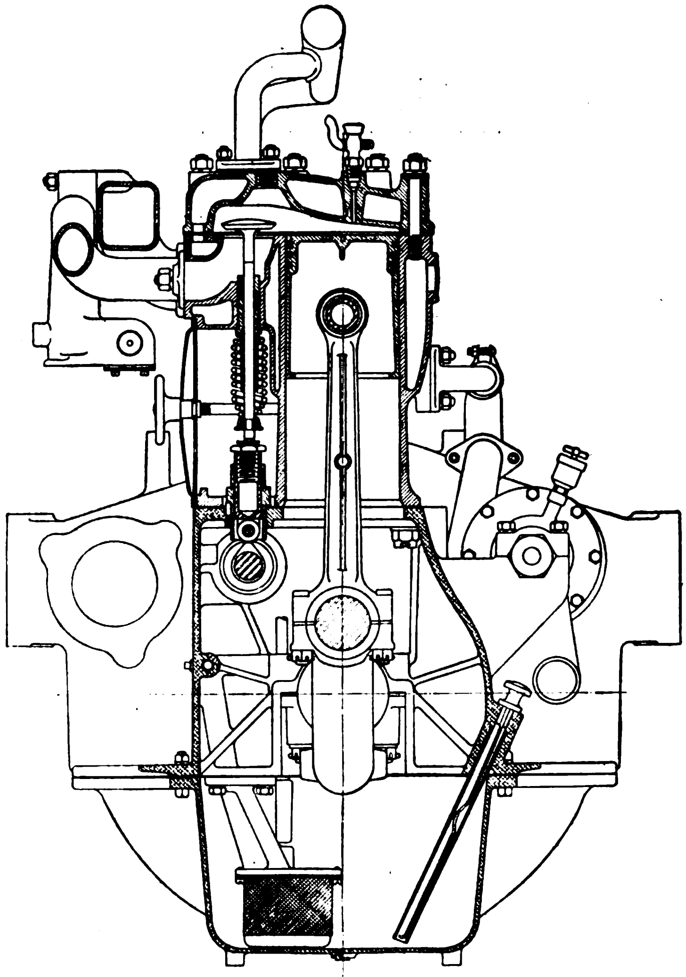
The cooling system is designed to be ample under the most adverse conditions of load and temperature, the water being circulated by a centrifugal pump located on the left side of the crankcase between two cylinder blocks. The water inlet elbow is cast iron, being integral with the pump, with rubber connections to each of the cylinder block intake headers. The water outlet pipe is of brass



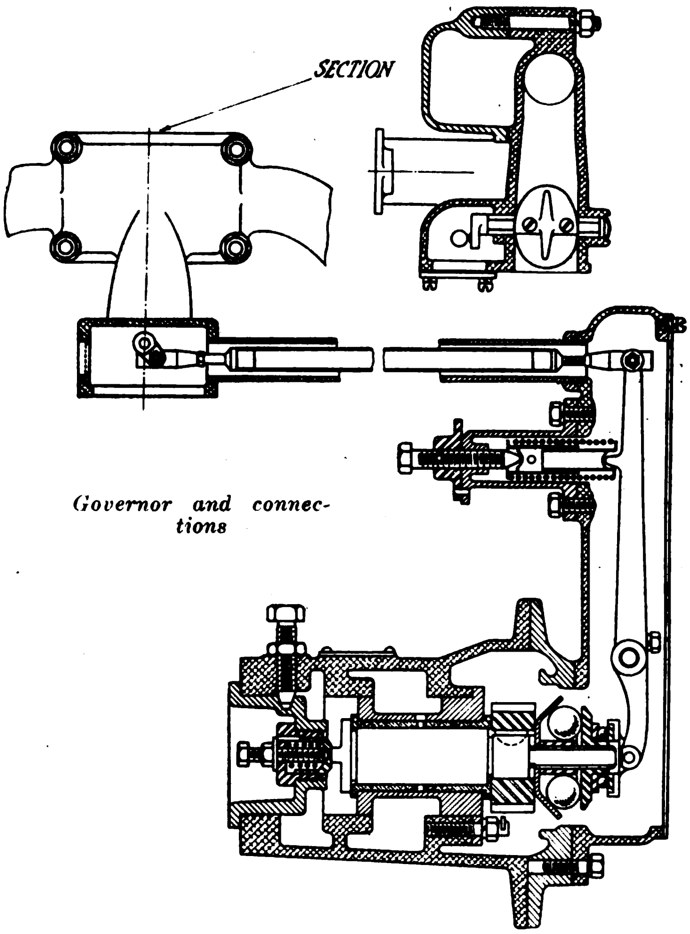
Pump and fan belt drive



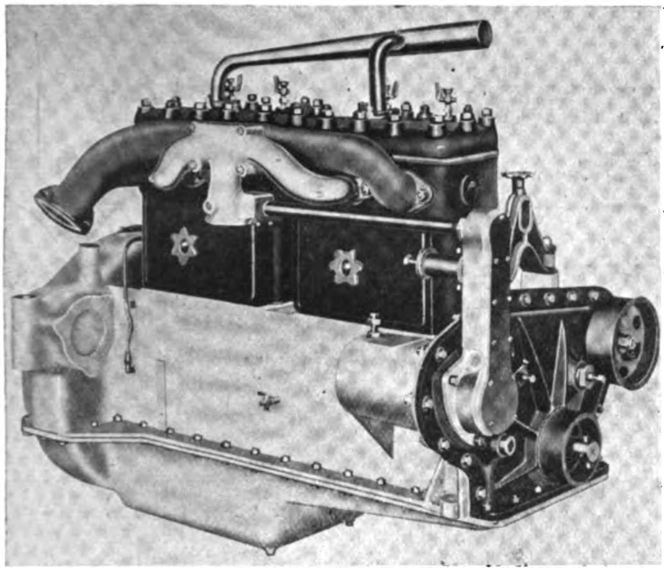
Power, mechanical efficiency and fuel consumption curves

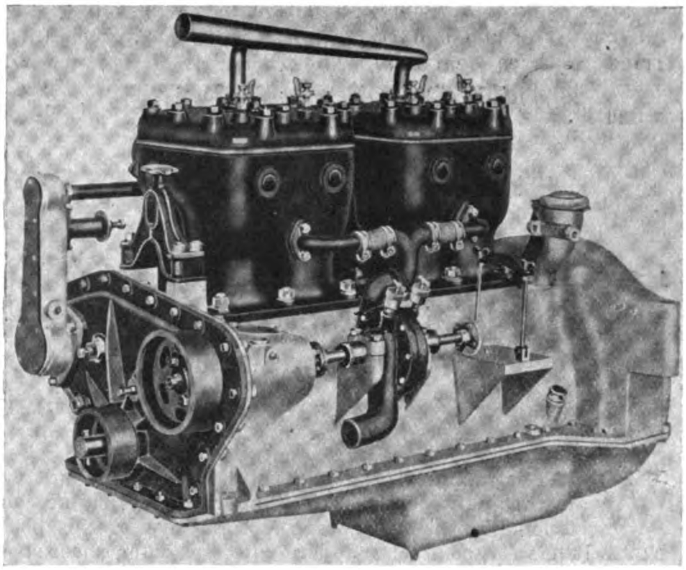


Cross section of engine



Governor and connections





Right side—Continental B2 truck and tractor engine—Left side

tubing and is a separate unit, tapered throughout its length. The water pump shaft rotates at crankshaft speed in a clockwise direction, looking at the front end of the engine. The fan is 20 in. in diameter and is driven by a flat belt, 2 in. in width, the drive pulley being 6⅜ in. and the driven pulley 3¼ in. in diameter.

A complete pressure feed is used for oiling, the oil pump being of the gear type and forcing oil to all bearings of the crankshaft, connecting-rods, camshaft, piston pins and gearcase. Splash is used for the cylinder walls.

The magneto is mounted on the left side and is driven off the water pump shaft. The carbureter fitting is for a vertical type, 1½ in. standard S. A. E. flange. Special provision is made in the gearcase for a distributor to be driven from the pump drive shaft. Spiral gear drive is used for the vertical shaft.

The governor is fitted and mounted on the gearcase cover and driven from the generator drive shaft. It controls the butterfly valve by means of a horizontal rod leading back to the intake passage. Provision is made also for a lighting generator to be secured to the right side of the engine looking at the flywheel end. This is driven by an independent shaft. The starting motor also mounts on the right side of the engine and attaches to pads cast on the side of the crankcase and to the boss on the flywheel housing. The starting motor drives through the teeth on the flywheel, connection being established by means of a Bendix shift.

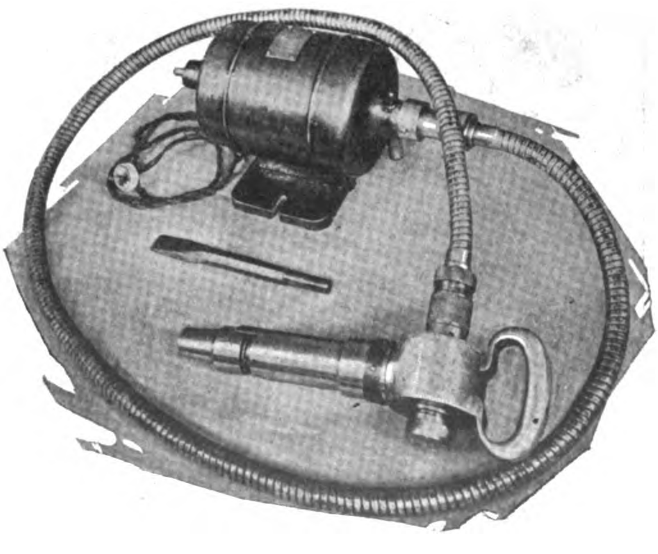
Titan Pneumatic Hammer

A NEW form of power hammer has been placed on the market by the Titan Automatic Tool Company, New York. The motive power is derived from an individual electric motor and is transmitted to the tool pneumatically, but the air is used in the hammer at atmospheric pressure only. The hammer outfit comprises three elements, viz., the hammer proper, the electric motor and a flexible shaft. The motor and shaft are standard construction and do not need to be described here. The motor is of from 1/10 to 1/3 hp., depending upon the size of the hammer used, and is of the shunt wound type. The length of the flexible shaft will vary in accordance with the work for which the hammer is to be used.

Within the body of the hammer is a chamber at one end of which is the tool holder and at the other end of which is a plunger which is reciprocated by the motor through the intermediary of the flexible shaft. Within the hammer is a freely slidable projectile which is hurled against the tool holder at the rate of 2000 times a minute, by the reciprocating plunger, whereby the hammering action is obtained. There are two openings or ports in the chamber, through which it communicates with the atmosphere when the hammer is not working. One of these ports, the lower one, is between the tool holder and the sliding projectile, and is never closed. The other port is between the plunger and the sliding projectile and is closed by the operator when the hammer is to be started operating.

Suppose the plunger to be rapidly reciprocated by the motor, the second port being open; the hammer then will not work because the pressures at both ends of the projectile are equal (atmospheric). Now suppose the second opening to be closed; then that portion of the chamber between the plunger and the projectile is no longer open to the atmosphere, and the travel of the plunger will reduce the pressure within the chamber. The sliding projectile will now follow up the plunger, owing to the fact that air under atmospheric pressure acts on the lower end of the projectile, the lower end of the chamber being always open.

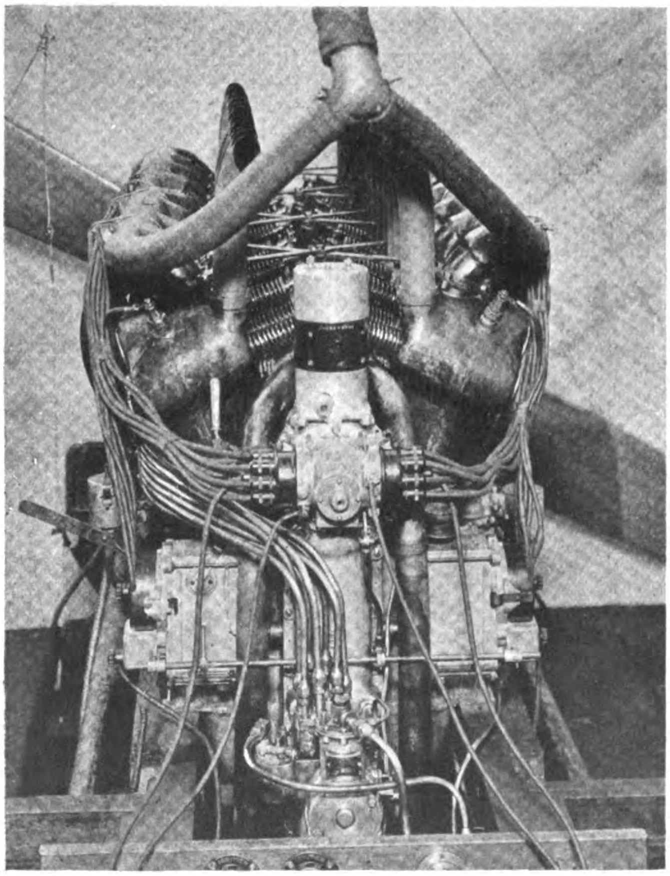
When the hammer is laid aside for a moment, it stops working, but the motor continues to run. One of the advantages claimed for this penumatic hammer is that no moving parts whatever are used to insure the proper return of the sliding projectile to its starting position.



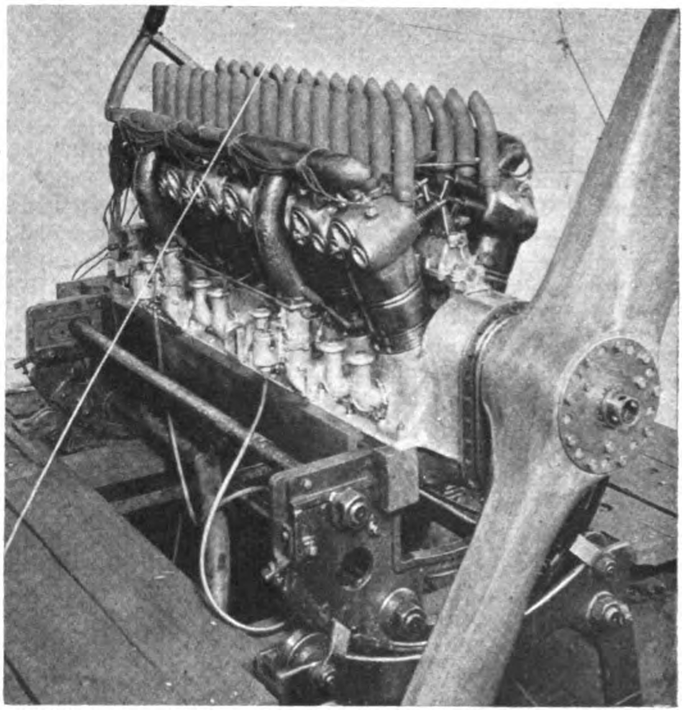
Duesenberg Sixteen-Cylinder Aircraft Engine

Largest Engine for Airplanes Ever Built in This Country—Weight Per Horse-Power Little More Than 1½ Lb.—Cylinder of Wrought Steel and Sheet Steel Jackets Welded On—Both Generator-Battery and Magneto Ignition

WHAT is probably the largest size engine ever built for aircraft purposes is a 16-cylinder V type engine constructed by the Duesenberg Motors Corp. of Elizabeth, N. J. It has forged steel cylinders with welded-on sheet steel jackets and a barrel type crankcase of cast aluminum. The cylinder bore is 6 in. and the stroke 7½ in., corresponding to a total piston displacement of 3393 cu. in. One engine of this design has been completed and has been subjected to a long series of tests and to experimental development. Three others, embodying some slight changes in design suggested by the tests of the experimental engine, are now in course of construction. While it has been the intention to build the engine in both the direct-drive and the geared-down type, the experimental engine has a reduction gear fitted. This consists of the Magg system of gearing, wherewith a greater degree of rolling motion is obtained than with ordinary involute gearing. The gears have teeth of approximately 3⅝ diametral pitch and 4 in. face. They give a reduction in rotative speed from 1800 to 1250 r.p.m., and the center distance of the two shafts is 8 in.



Distributor end of the engine, showing air starter, magnetos, battery distributors, electric generator



Three-quarter view of engine from propeller end

The cylinders are made from steel forgings and are open at both ends. The wall thickness varies along the length in accordance with the stresses to be supported, the average thickness being ⅛ in. On the outside of the cylinder are turned nine circumferential flanges, including the one by which the cylinder is secured to the crank chamber. This latter is located some distance from the lower end, the cylinder being formed with a spigot extending 2¾ in. into the crankcase. Most of the studs holding the cylinders to the crankcase extend through long bosses or lugs and are provided with nuts inside the case. The cylinder head is made of a series of stampings which are gas-welded together. It is cut with an internal thread and screws over the upper end of the cylinder against the topmost flange, after which it is welded in place. No. 18 gage sheet steel is the material from which the jacket is made. The latter is formed in three stampings, as shown in one of the photographs, which are welded together, to the lowest one of the small flanges and to the cylinder head. The object of the intermediate ribs is not only to strengthen the cylinder against radial force but also to help transfer the heat quickly from the cylinder wall to the cooling water. The top part of the head is a steel forging which carries a flange to which the jacket is welded. A couple of corrugations are pressed in the jacket at midlength to take up differences in expansion and contraction between the cylinder and jacket, as well as to stiffen the jacket wall.

As the maximum power which can be obtained from an

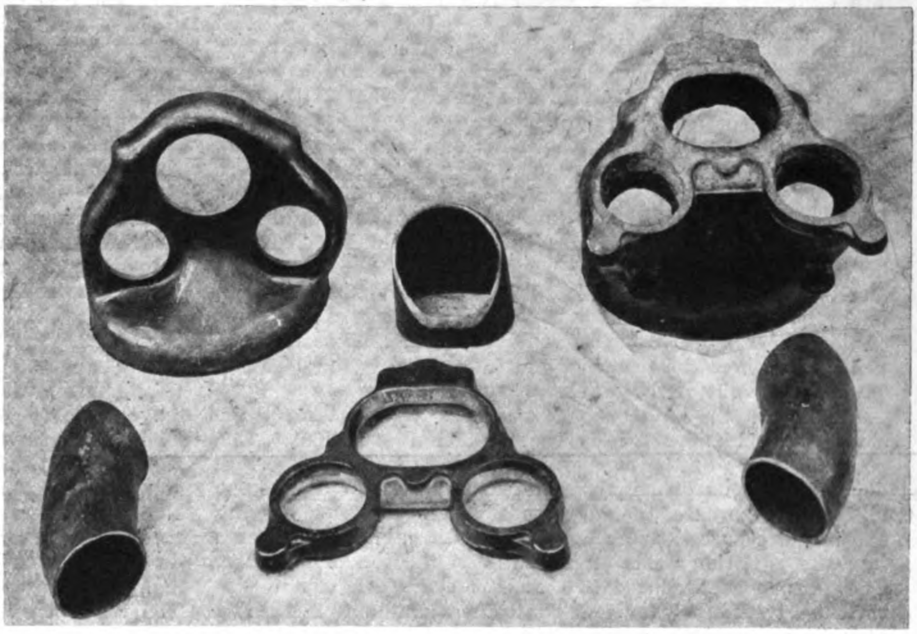
engine of a given piston displacement depends to quite a degree upon the compression carried, considerable interest attaches to the compression ratio of an airplane engine. In the Duesenberg 16-cylinder engine the ratio of compression chamber volume to total volume at the beginning of the stroke is about 21 per cent. The cylinder barrel is forged of low-percentage nickel steel and is case hardened on the inside to afford the best possible track for the aluminum piston.

With cylinders of this large size there are naturally very heavy stresses on the lower end of the cylinder, the base flange and that part of the aluminum crank chamber to which it is bolted, due to the side thrust of the piston against the cylinder wall. By tying the individual cylinders together these stresses can be distributed and the dangers of failure greatly reduced. In the Duesenberg engine the cylinder heads are formed with lugs by which each pair of adjacent cylinders are tied together. These lugs are so located that they overlap and a bolt passes through the two. In addition each pair of opposite cylinders is tied together by a couple of steel stampings which are clamped to lugs formed on the exhaust outlet flanges on the cylinder heads, one stamping being placed on top and one below the lugs and bolts being passed through stampings and lug. Each finished cylinder weighs 22 lb. The valve arrangement is very similar to that which has always characterized Duesenberg engines of smaller size, except that each cylinder has two exhaust valves and a single inlet valve. The valves are located in the cylinder heads with their axes perpendicular to the cylinder axis. The valves are arranged in a triangle, the two exhaust valves being located directly below the single large inlet valve. Thus the cool incoming charge passes directly over the heads of the exhaust valves and tends to keep them cool. The exhaust valves have a clear diameter of 2 3/16 in. each, with ½ in. lift, while the inlet valve has a clear diameter of 2 15/16 in. with 9/16 in. lift.

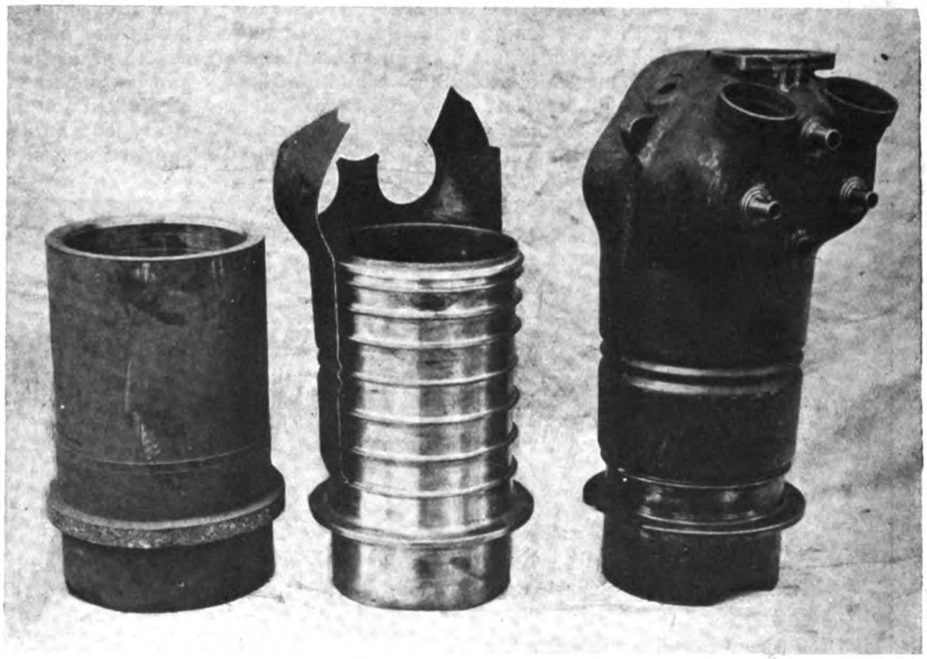
The valve stems pass through guides bushed with Non-Gran bronze and each is surrounded by two concentric springs which together exert a pressure (when the valve is closed) of 60 lb. in the case of the exhaust and 70 lb. in the case of the inlet valve. Each valve is actuated separately through a rocker arm from the camshaft located in a housing directly above the crank chamber. This housing is cast of aluminum, in two parts joined in a horizontal plane through the camshaft axis. It extends the whole length of the crank chamber, to which it is rigidly bolted, and it adds considerably to the strength of the latter in the vertical center plane. All of the rocking levers are bushed and are threaded over a hollow, stationary pivot shaft held between the camshaft housing and caps on same. At their lower ends the rock levers carry hardened steel rollers acting as cam followers. The openings over the valves are closed by means of shaped aluminum threaded plugs. These are formed with flanges on the inside in order to facilitate heat dispersion.

The pistons are cast of Magnalite and are formed with internal ribs for strength and to facilitate the transfer of heat from the piston head to the skirt. Each piston carries a single triple-unit Duesenberg compression ring, the details of which may be seen in the sectional view. The pistons are 7 in. long. The piston pins, which are made of chrome-nickel steel 1¾ in. in diameter, hollow, hardened and ground, have bearings directly upon the aluminum of the piston bosses. The connecting rod is clamped tight in the upper end of the connecting rod by means of a screw through a split lug on top of the rod. The rods are of the tubular type, of chrome-nickel steel. One rod is of the ordinary or straight type, while the other one on the same crankpin is yoked. The practice of having the piston pin bear directly on the aluminum is old with Mr. Duesenberg, having been employed in all of his racing engines, and has proved absolutely satisfactory.

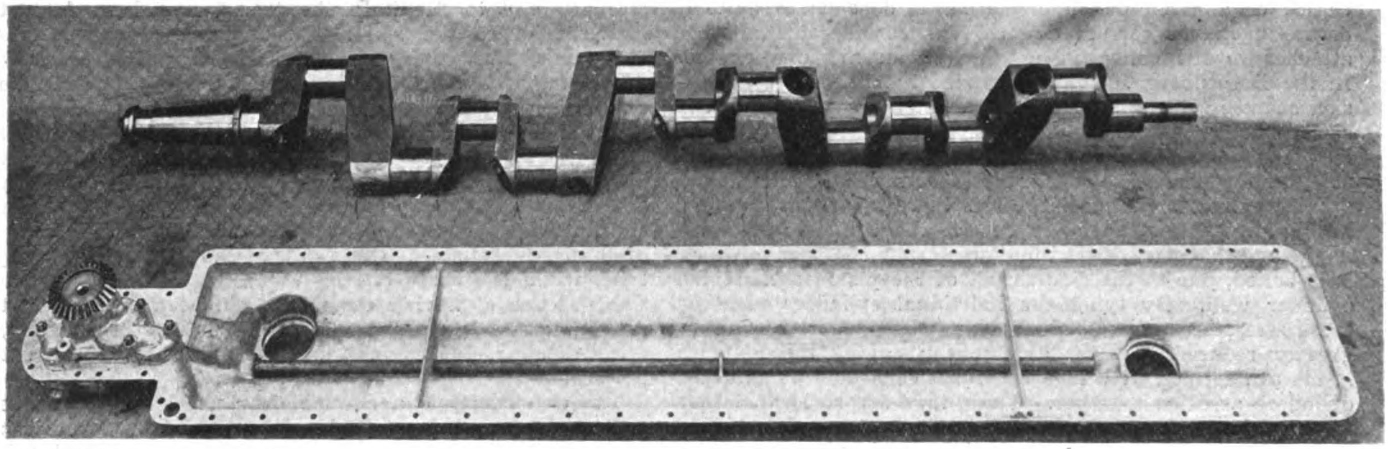
The crankshaft is a chrome-nickel steel forging of very substantial proportions. It is a five-bearing type and in one sense consists of two four-cylinder crankshafts joined end to



Parts from which the cylinder head is built up



Illustrating different stages in the manufacture of a forged steel cylinder with welded-on sheet metal jacket



Crankshaft and oil pan. Note that the oil pump is carried on the oil pan

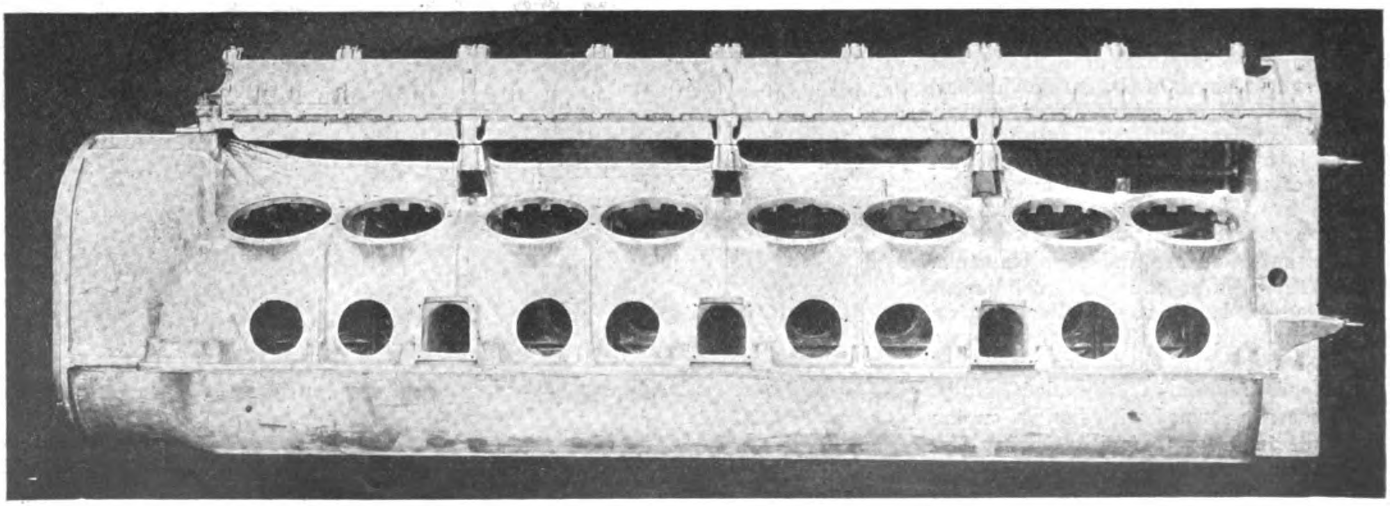
end in such a manner that the planes of the two shafts are at right angles to each other. With the exception of the main bearing at the propeller end, which is a ball bearing, all bearings, both main and connecting-rod, consist of Non-Gran bronze shells with babbitt lining. All bearings are 2⅞ in. in diameter and 3 in. long. As indicated above, there are always two throws between adjacent main bearings and the crank pins of these two throws are connected by a long crank arm which is of nearly square section but is drilled lengthwise for lightness. The short arm at the propeller end also is drilled out in this way. While the crankshaft is quite husky, it contains absolutely no surplus material. The bores of the journals decrease from the valve gear end to the propeller end where the torque to be transmitted is the greatest. The total weight of the crankshaft is 199 lb.

As far as the intermediate bearings are concerned, the crankshaft is supported by the crankshaft positions. The partition walls of the case which carries these bearings are double or of box girder type, and to still further add to the rigidity of the case, the four studs which hold each bearing cap in place pass through holes drilled through enlargements in these partition walls all the way to the top of the case. These studs are reduced in diameter over their middle unthreaded portion. They screw into the aluminum of the case at both ends and in addition are secured by a cottered nut at the top.

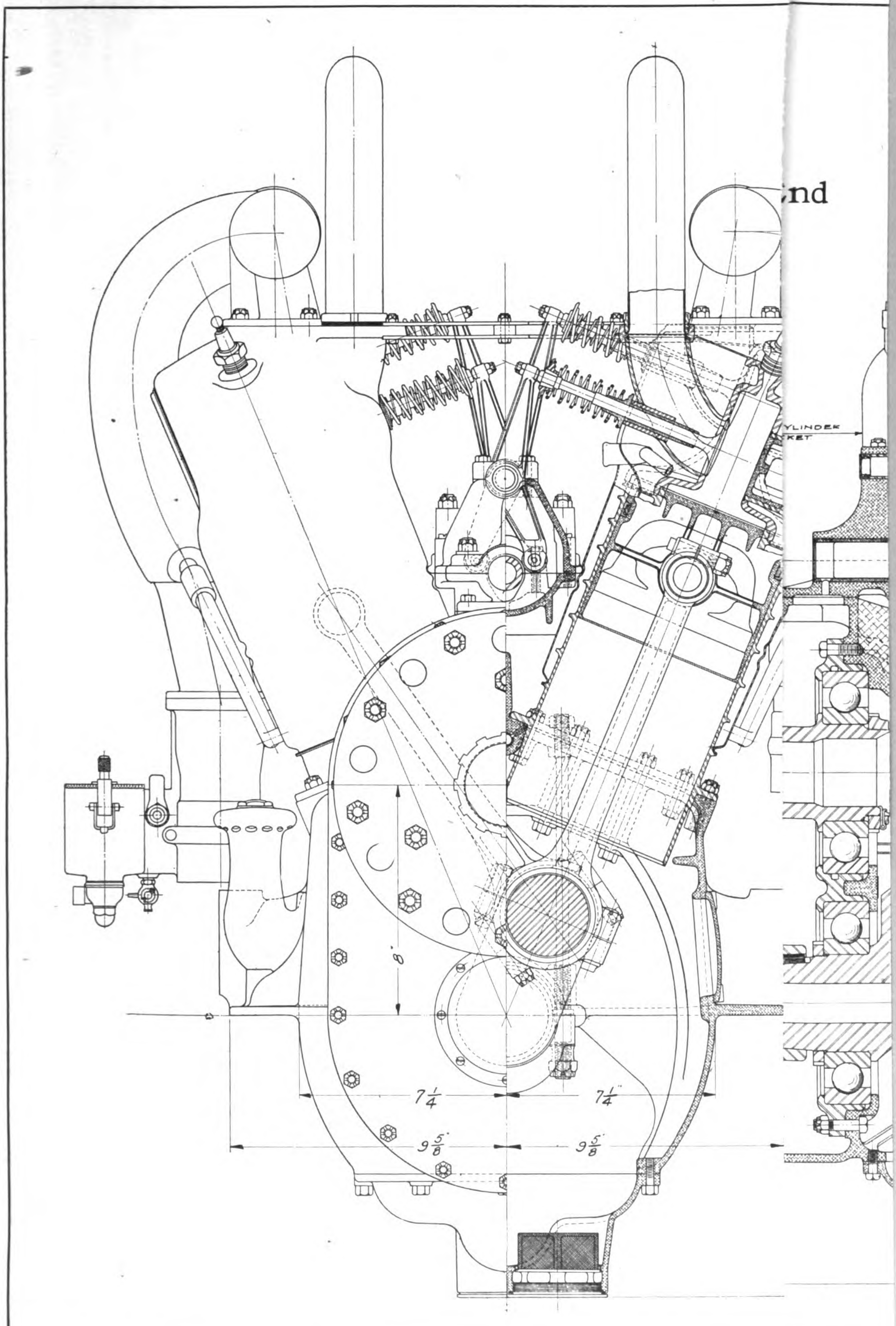
Naturally the large number of closely spaced large holes for the cylinder tends to weaken the crankcase structurally, and to compensate for this weakening effect the case is made of the barrel type. The bottom is left open in the crankcase casting and is closed by means of a shallow aluminum base plate; the propeller end is also left open and is closed by means of a steel end plate worked out from a solid slab of steel with ribs, etc., to give the very strongest form for the weight. There are round hand holes on one side of the crankcase opposite each set of connecting-rod heads, which are closed with suitable cast cover plates. While there are box girder partitions in the crankcase at each intermediate crankshaft bearing, midway between these box girders there are substantial arch-shaped ribs and the panels of the lower portion of the case have inside diagonal or cross ribs to add to the strength of the case. A supporting flange is cast on each side of the case at the height of the crankshaft axis, for supporting the engine in the fuselage. The weight of the crankcase casing when machined is 180 lb.

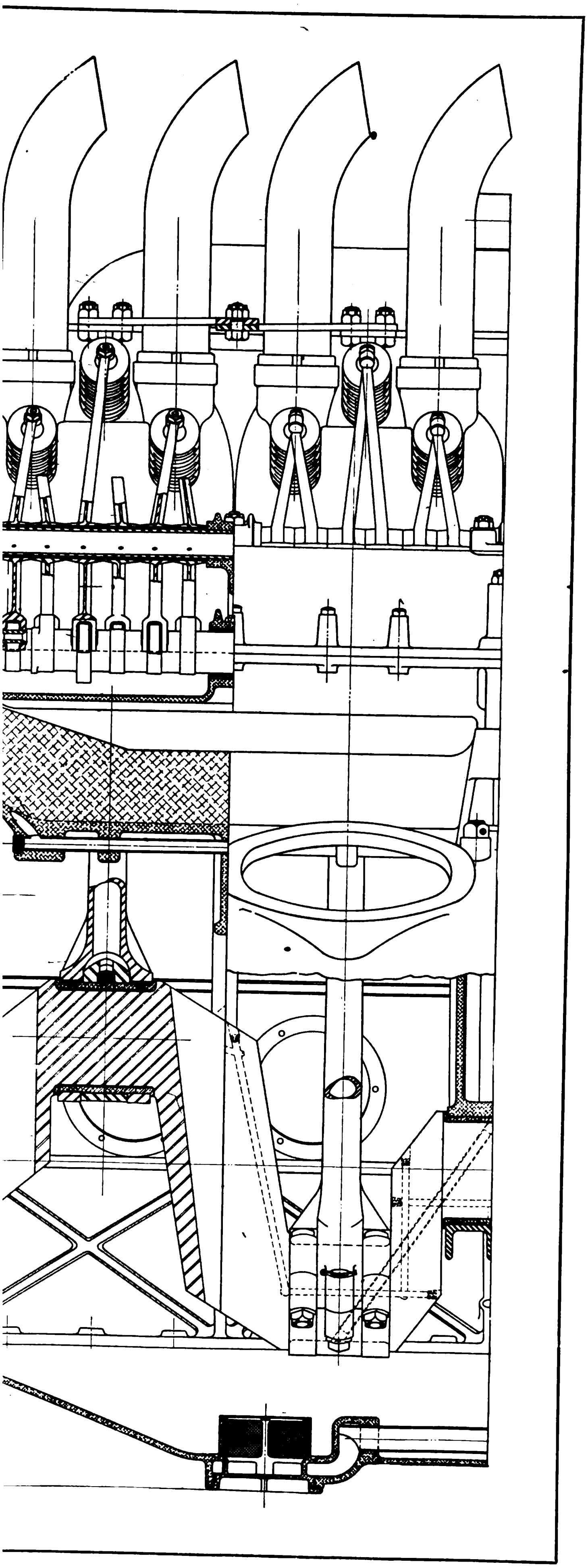
Intermediate Shaft High Speed

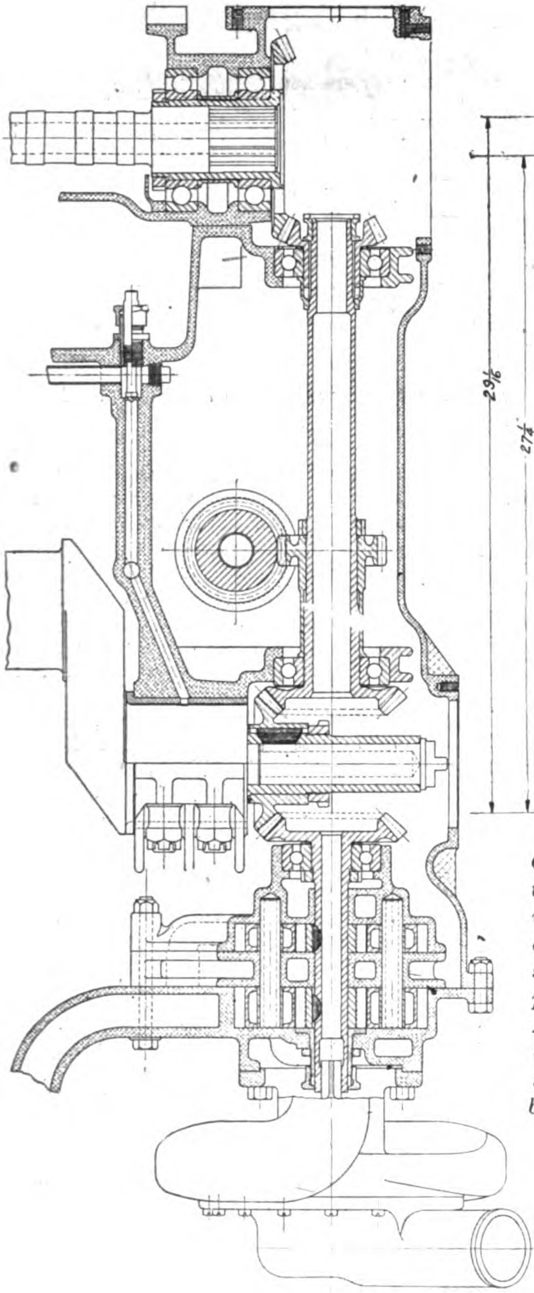
The camshaft is driven through the intermediary of a vertical shaft with bevel gears at both top and bottom. The drive from the crankshaft to the vertical shaft is without change in speed, so that the latter shaft runs comparatively fast and can be made correspondingly light. This shaft is supported in annular ball bearings at both top and bottom. Near its lower end the vertical shaft carries a helical gear meshing with another helical gear on a cross shaft which drives the two Dixie magnetos used for ignition. These magnetos are set on bases cast integral with the crankcase. The reduction of 2:1 required for the camshaft is obtained at the upper end of the vertical shaft, where a small pinion meshes with a bevel gear of twice the number of teeth on the forward end of the camshaft. As a matter of construction it is interesting to point out that the bevel gear at the lower end of the vertical shaft is forged integral with the shaft, while the bevel pinion at the upper end of this shaft and bevel gear on the camshaft are secured in place by means of splined joints. Both of these latter gears have comparatively long hubs on which are mounted the inner races of the supporting ball bearings.

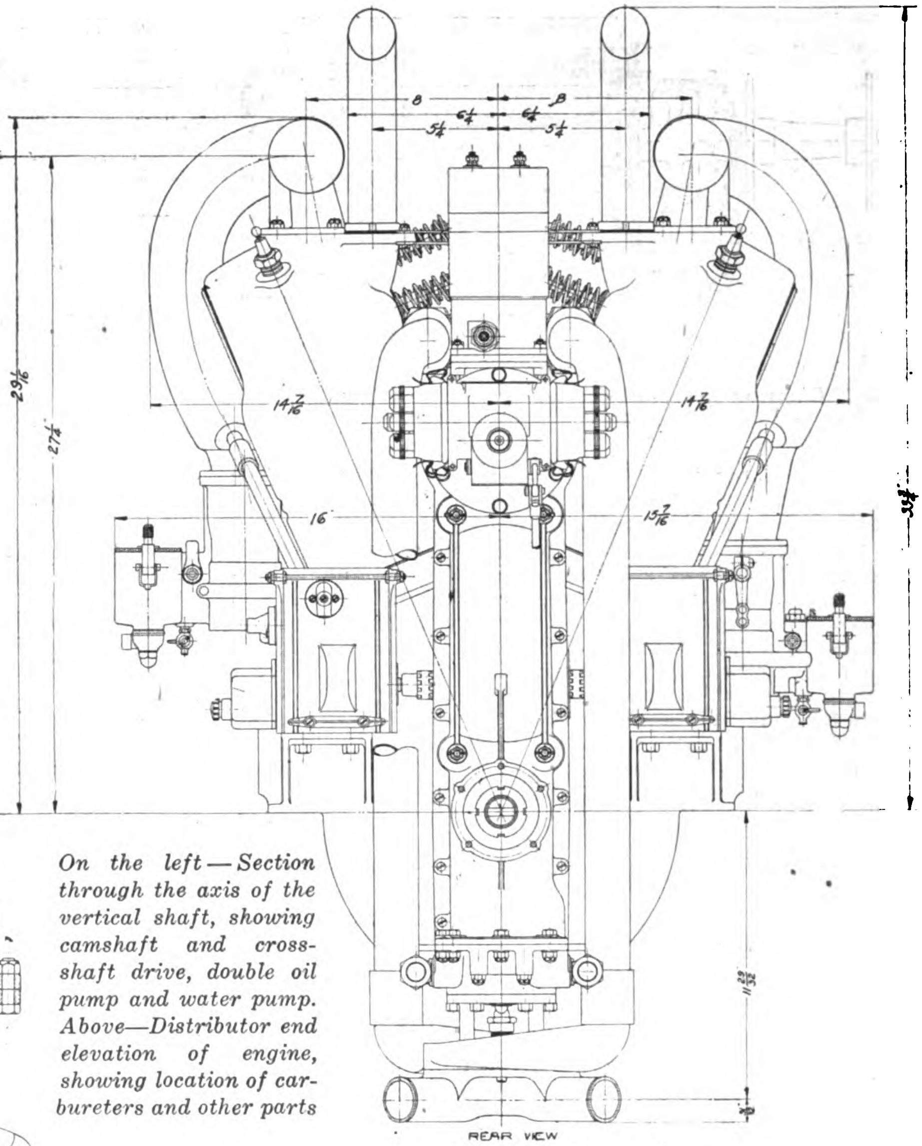


Side view of crankcase and camshaft housing, bringing out the girder effect of the camshaft housing


nd
7 1/4
7 1/4
9 5/8
9 5/8
8"







On the left — Section through the axis of the vertical shaft, showing camshaft and cross-shaft drive, double oil pump and water pump. Above—Distributor end elevation of engine, showing location of carbureters and other parts

The camshaft is an integral forging with a main diameter of 1¼ in., the base circle of the cams being 1 5/16 in. The vertical shaft together with the gearing for the camshaft and the accessories is enclosed in an aluminum housing forming part of the crankcase casting. To the top of this housing may be bolted a vertical generator of Delco design, which is driven from the camshaft bevel gear. Directly below the crankshaft is mounted the oil pump, which is of the triple gear type and made in two sections, and below this is arranged the water pump, which is of the centrifugal type with two outlets. Both the oil pump and the water pump are driven through the same vertical shaft, which is in fact the shaft of the oil pump and which has the driving bevel gear forged integral with it.

In addition to magneto ignition provision is made for battery ignition, and a combination interrupter and distributor of Delco design is bolted to the vertical shaft housing directly in line with the camshaft. This distributor is driven from the camshaft by means of an integral key engaging with a transverse slot cut into the forward end of the camshaft. It is double-ended, eight cables extending from each end to one set of cylinders.

Combustible mixture is supplied to the sixteen cylinders by four carbureters of 2¼ in. size. Miller carbureters have been used on the experimental model. Air is drawn into the carbureters through the hollow partition walls of the crankcase, which at the sides of the crankcase debouch into semi-cylinders with their axes vertical. Caps are bolted over these outlets so as to form cylindrical sockets into which the carbureters are set. **On one side of the motor two of the carbureters are connected directly to the crank chamber and on the other side the two carbureters are fastened to an air duct, which in turn is secured to the crankcase opposite the central box girder. The ends of the box girder passages through which the air enters are intended to be connected up to funnels or scoops extending forward from the engine outside the fuselage, so as to take advantage of the speed of the plane to fill the cylinders.**

Of the two sections of the oil pump one is a feed pump and the other a scavenging pump, the lubricating system used being that known as the dry sump system. The pumps are mounted on the crankcase pan and are driven at crankshaft speed. The delivery pump forces oil through a single main oil lead fitted into the crankcase to each main bearing. The main distributing lead is fitted into the crankcase with packing glands, this being made necessary by the comparatively high oil pressure employed, which rises to 75 lb. per sq. in. when the engine runs at full speed. From this main distributing line a lead is taken off at the valve drive end, containing a regulating or pressure reducing valve which reduces the pressure on the oil to 2/8 lb. per sq. in. This low pressure line extends along the top of the crank chamber and from it there are two upward passages to the hollow camshaft and to the hollow rocker shaft. There are also passages through the cylinder flanges and cylinder walls, through which oil is

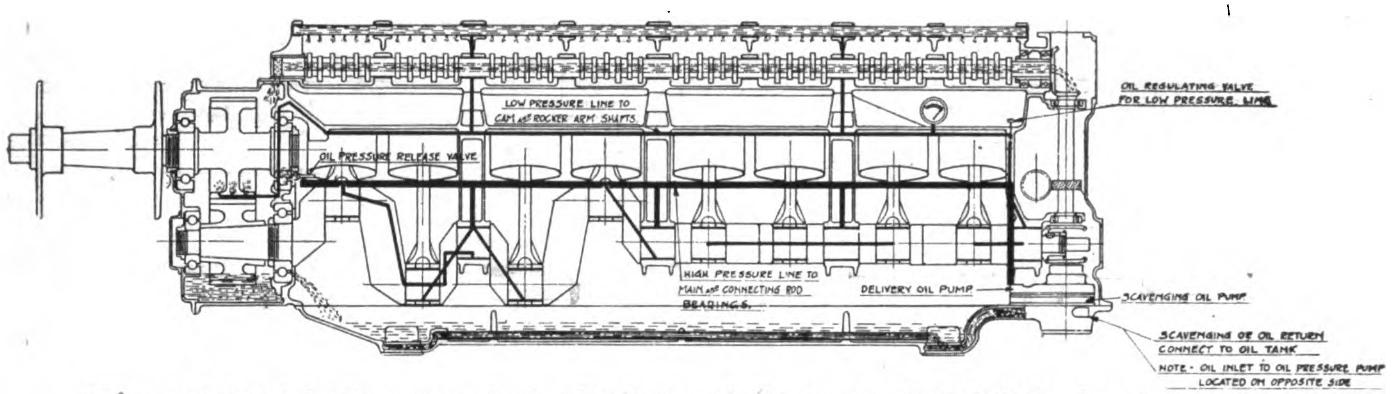


Diagram of the lubricating system, showing distribution of oil to main and crankpin bearings, to camshaft and rocker arm shaft

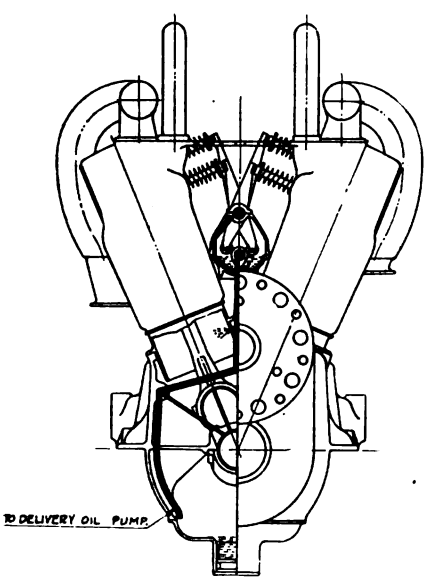
injected into the cylinders to insure their lubrication. The excess oil from the rocker shaft drops on to the camshaft and insures effective lubrication of the cams and rollers. The oil working out at the ends of the hollow camshaft returns through the reduction gear case, and the housing of the vertical shaft is at the opposite end of the engine. There is also a lead from the low pressure distributing pipe extending through the upper part of the crankcase into the gear reduction case, which has three lateral outlets opposite the gear close to where they mesh, so that there is a constant supply of oil to the gear teeth as they come in contact. There is at all times a supply of oil in the bottom of the gear reduction case, the height of which is determined by the ball bearing on the end of the crankshaft. The scavenging pump draws oil through large-sized strainers at each end of the crankcase. Owing to the use of these two inlet pipes, this scavenging pump will drain the crankcase no matter in which direction the engine is inclined.

It was stated above that all of the main bearings of the engine were supplied with oil directly from the main distributing line. The crank pin bearings get their supply from the main bearings through passages drilled through the crankshaft. In the case of the crank pin bearing closest to the propeller end the oil has to pass from the nearest intermediate bearing through a short crank arm, a crank pin and a long crank arm. While the oil overflows from the cam housing at both ends, there is a dam at the vertical drive shaft end which determines the level of the oil in the camshaft housing.

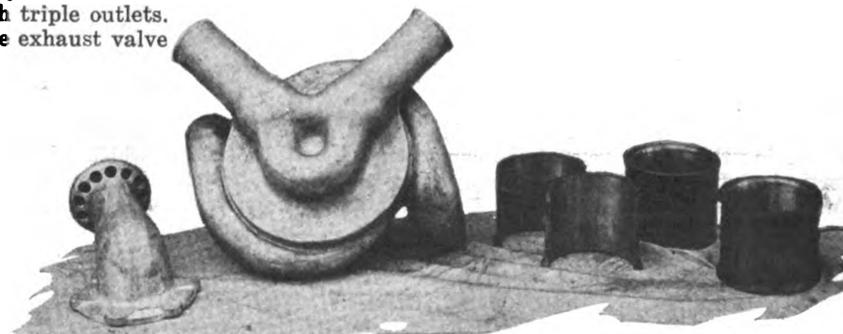
Water circulation is insured by the centrifugal pump already referred to, which, as stated, has a double outlet, one to each cylinder set. The water enters the jackets of the cylinder heads through water distributors with triple outlets. Two of these outlets direct streams against the exhaust valve seats, whereas the third outlet directs a stream down the cylinder jacket. In addition to the regular water return connection there is an outlet connection at the bottom of the cylinder jackets, the object being to prevent the formation of any dead spaces in the cooling jacket. The intake manifolds are water-jacketed and the water leaving the cylinder jackets passes through the jackets of the intake manifolds and thence to the radiator. The inlet manifold is held in position by means of a stamped steel piece, which also acts as a tie rod.

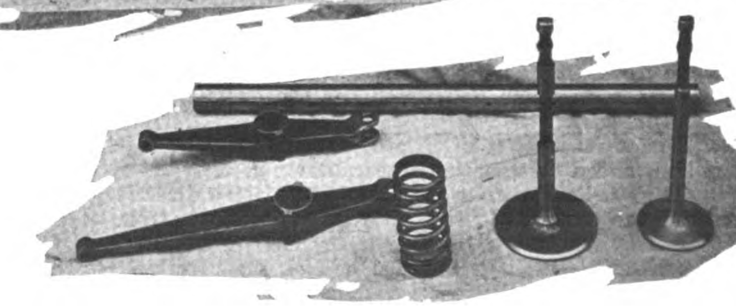
The weight of this engine with carbureters and magnetos is 1250 lb. Its output on direct drive, that is, with the propeller mounted directly on the end of the crankshaft, which does not admit of the highest speed of which the engine is capable, is 700 hp. When produced as a geared job, with the propeller turning at 1350 r.p.m., the output is given as 800 hp. No very extensive fuel consumption tests have been made, but from what observations have been taken it is believed that the consumption can be held within 0.56 lb. per hp.-hr., and the oil consumption is very light. The engine shows remarkable accelleration, and when under test on the dynamometer the torque was observed to be unusually steady.

A few words may be added regarding the reduction gear with which the experimental machine is equipped. The housing of this gear is cast integral with the crankcase, but the bearings are located in steel plates worked out from solid steel slabs which are secured to the aluminum housing by numerous bolts. The use of these very strong steel bearing plates prevents the spreading of the bearings in spite of the enormous radial pressure due to the gear reaction.



Illustrating oil delivery to cylinders from pressure system





Above—Double outlet water pump and crankshaft bushings
Below—Valve spring, rocker arms and rocker shaft

Reducing Industrial Fatigue

An Outline of the Principal Causes of Diminished Output, with Concrete Suggestions for Overcoming Them

IN the present emergency caused by the war it is desirable to understand all practicable ways by which industrial work may be made more efficient and output may be increased to a maximum without resorting to unwise or burdensome demands on labor. It is often possible to increase output temporarily by increasing the work of the employee, but if he is overworked his output soon falls off; hence such a method, if carried far, quickly defeats itself and in the long run is not profitable. Given adequate equipment, adequate administration of the plant, and a proper spirit among the employees, fatigue is the greatest single obstacle to a maximum output. Fatigue diminishes output not only directly, but indirectly, by increasing accidents and the proportion of spoiled work and by causing sickness and absences of employees. It will, therefore, be profitable to employers, to employees and to the Nation itself, to inquire into the ways that fatigue may be reduced.

Ways of Improving Efficiency

1—Introducing recess periods
2—Introducing variety into work
3—Adjusting the speed
4—Omitting unnecessary motions
5—Providing adjustable seats
6—Ventilation of work-rooms
7—Sanitary conditions within factories
8—Alternating day and night work
9—Adjusting hours of work
10—Avoiding overtime
11—Omitting Sunday work
12—Sanitary conditions outside factories

Everyone knows that a certain degree of fatigue is the normal result of bodily activity and is harmless. But it is not so generally recognized that the onset of overfatigue may be greatly hastened, and that through it deleterious effects on both the worker and the plant may be caused by the conditions of work inside the factories, or by the occupation, habits and conditions of living of the workers outside the factories, or by both.

In order to be sure that an individual is really fatigued, objective methods of measurement must be used —one often feels tired without actually being so, and likewise fatigue is often present before it is recognized by the individual. Fatigue may be detected by various tests, some of which have been studied so carefully and so improved that they can now be considered as fairly accurate and useful for practical purposes. Different methods are applicable to different cases.

Amount of output.—One of the readiest means of detecting fatigue is by keeping a record of the output of the individual employee by the hour, the day, or the week, and observing its course. A falling off in the output, when not explicable by other changes in the conditions of the work, indicates fatigue. Where the duration of the working period has been changed, fatigue can also be tested by comparing the average output per hour under the earlier and the later schedules.

Amount of power used.—A fall in the amount of electrical or other power consumed in a factory, or one of its departments, is often an excellent index of decreased output and thus of the fatigue of the workers. Lessened consumption of power must of course be discounted where it results from temporary shutdowns or other causes.

Other indicators of fatigue. — Fatigue is also often indicated by the amount of spoiled work turned out by the workers, by the number of accidents to the workers occurring during a working period, by the number of absences from work, and, in extreme cases, by records of sickness.

Laboratory tests of fatigue.—There are various tests of the presence of fatigue that have been supplied by the laboratories, some of which are applicable to industrial workers. These concern the muscles, the nervous system, sight, and hearing, and certain chemical changes within the body.

Ways of Reducing Fatigue

Various ways are now known by which fatigue can be reduced without decreasing the output and even in some cases with an increase of it. When fatigue is caused by work inside factories it is obviously controlled more easily than when caused by the conditions of living of the workers outside.

Introducing recess periods.—One of the common methods of reducing fatigue is by introducing recess or resting periods during a working spell. During such periods, which, in order to be effective, must be obligatory, and not discretionary on the part of the workers, they should have an opportunity to rest, relax, move about

The Divisional Committee on Industrial Fatigue has been active in planning and conducting investigations in factories that are manufacturing war supplies, for the purpose of determining whether unnecessary fatigue is present and discovering the conditions under which a maximum continuous output may be obtained. The work of investigation has been carried on under the auspices of the Division of Scientific Research of the United States Public Health Service, which appointed to its staff several members of the committee and paid the entire expenses of the investigations. In addition to the work of investigation, the divisional committee has prepared this paper on "How Industrial Fatigue May Be Reduced." It is intended chiefly for manufacturers, and presents in direct form some of the principal phases of the subject as it is now known.

and engage in other simple recreation. A little food or a cup of tea or cocoa taken at such a time is often remarkably restorative. A very striking instance of the benefits of resting periods has recently been published. "Two officers at the front recently, for a friendly wager, competed in making equal lengths of a certain trench, each with an equal squad of men. One let his men work as they pleased, but as hard as possible. The other divided his men into three sets to work in rotation, each set digging their hardest for five minutes and then resting for ten, till their spell of labor came again. The latter team won easily." It often happens that several five-minute resting periods may be advantageously introduced into a working spell. Where this is not practicable a single recess, of suitable duration, may suffice. The recuperation thus gained by a tired worker often increases his working capacity for the remainder of the spell. If pieceworkers object to such compulsory resting periods, fearing loss of wages, it is even profitable to guarantee that during the introduction of the change the total day's wage shall not be less than before the resting periods were installed. Experience has demonstrated that after such periods have been established the resulting increased efficiency usually yields equal, if not greater, output.

Introducing variety into work.—Much of the modern industrial work consists of a constant and rapid repetition of the same movement. A woman worker in one of our munition factories was recently observed to handle during her day's work 24,000 pieces of a shell fuse and put them through a special process. From 7 o'clock in the morning until 12 and from 1 until 6 she sat at her machine and fed it with the succession of brass pieces. The occasional introduction of a little variety into her work by training her to some alternative process might easily have diminished her fatigue without diminishing the number of finished pieces.

Adjusting the speed.—The capacities of different workers vary greatly. In order to secure uniformity in the work of a squad, where a single motor operates a number of machines, the speed of the motor must be adjusted to the average pace. It may be advantageous to transfer to another job an especially fast or slow person. It is of the utmost importance that each member of the squad should be able to work with the same rhythm and that the speed of operation should be adjusted to this rhythm. Fatigue is least when the speed is in consonance with the worker's customary rhythm, and the output may be twice as great as with a speed a little slower or even faster than this. The worker's speed, however, depends not merely on the adjustment of mechanical appliances, but is also often increased by a well-planned system of incentives, which may consist of piece rates or bonuses, or the making of the work itself more interesting and attractve.

Omitting unnecessary motions.—The pieces which the worker has to handle should be so placed with reference to height and distance from his hands that he is obliged to make no awkward, unrhythmical and unnecessary motions or excessive muscular exertions in handling them. His work can thus be done with the least possible waste of energy and time.

Providing adjustable seats. — Where workers are obliged to sit instead of stand at their work, the seats should not be of uniform heights, but should be adjusted to the individual worker, with backs of such shape and position as best to fit and support the worker's back. Such seats have recently been introduced in some of our large factories. Where the worker's feet can not reach the floor, foot rests should be provided. Such rests can be simply made by fastening a narrow board platform to the legs of the seat at the proper height from the floor.

Ventilation of workrooms.—The ventilation of workrooms is an important aid to efficiency and should conform to the principles of ventilation now accepted. The recent investigation of ventilation has demonstrated that excessive heat and humidity should be avoided so far as possible and that air should be kept in motion. When the worker is in a hot room, and especially when heat and humidity are combined, his bodily temperature rises, often several degrees, and he is put into a feverish state. While movement of the air will not cool the air, it will cool the skin and hence will keep down the bodily temperature to the healthful level. If possible, windows should be wide open; but where this is not possible and wherever even with open windows the heat of the workrooms rises above 68 deg., forced drafts or electric fans should be used to keep the air in motion. It is astonishing how easily a comfortable and refreshing bodily condition may be maintained by the use of electric fans. Air currents should not, however, be too strong. Bodily discomfort is caused by excessive drafts, and a gentle movement of air is the most effective. Uniformity in the play of air on the skin is undesirable; an oscillating electric fan or a frequent change in the rate of the forced drafts gives the best results.

Sanitary conditions within factories.—As accessory but none the less important means by which fatigue may be lessened and the efficiency of workers increased, there may be mentioned certain general sanitary conditions within factories:

1. Adequate lighting, with the light properly distributed and yet sufficiently concentrated on the work in hand to prevent eye strain.
2. An exhaust system to remove deleterious fumes and dust.
3. Abundant drinking water, cool but not ice cold, within easy reach of the worker.
4. Attractive, quiet rest rooms, especially for women, in which in times of need tired workers may find relief.
5. Lunch rooms or canteens, where a hot lunch of nourishing food, selected according to a scientific dietary, and well cooked, may be purchased at cost prices and eaten amid attractive surroundings free from the influence of the saloon.
6. Clean, well-ventilated modern toilets.

Washing facilities, with abundant soap and clean towels, and especially shower baths, where the hot, sweaty, begrimed worker may become cool and clean before leaving the plant.

Alternating day and night work.—The industrial urgencies of the war have caused many factories to run both day and night, and have thus increased greatly the total amount of night work performed. Man is not naturally a nocturnal animal, and under our present social arrangements night work must always be regarded as inadvisable on physiological grounds. Lack of sleep produces fatigue. The day sleep of night workers is likely to be curtailed, and in the long run night work is likely to be detrimental to health. This is probably more true of women than of men. The needs of the nation may require night work as an emergency measure, but this necessity should not obscure its dangers to health. If night work must at times be done, the question arises whether it is more profitable to keep the same workers on the night shift, or to change them at intervals, say every other week, from night to day, at the same time shifting the day workers to night work. The British Health of Munition Workers Committee has made a very careful statistical study of the output under both systems and has found that where the same night shift continues to be employed the total output is less than where there is an alternation of day and night work. This is

true of both men and women. Where night work is unavoidable, therefore, fatigue can to some extent be avoided by allowing the workers to alternate at intervals between day and night, the periods to be not less than one month in duration. Frequent changes of habits may be deleterious to health.

Adjusting hours of work.—A very obvious way to reduce fatigue is by adjusting the number of daily hours of labor. The British Health of Munition Workers Committee has found that it is a mistake to recommend a uniform day for all kinds of work, that the most profitable duration of the working period varies considerably with the nature of the occupation, and that women and boys, even when engaged in moderate and light types of work, are unable to stand as long hours as men. Within obvious limits, the length of the working day that avoids excessive fatigue can be determined for the individual process only by a careful study, in each combination of circumstances, of the effect of the work on the workers. The general tendency for many years in industrialism has been to decrease the hours of labor. The one great objection that is usually raised against a proposal to decrease hours is that the output would be correspondingly diminished; and accordingly, whenever, as at the present time, unusual strain is brought upon industries and the greatest output is desired, there is a tendency to increase hours and to introduce overtime work. This objection to decreased hours and this tendency to increase them rest in considerable part on a mistaken notion. It is obvious that a man can do more work in two hours than in one hour; but it does not necessarily follow from this that he can do more in 12 hours than in 10, or more in 10 hours than in 8. In fact, whenever the work is of such duration that fatigue begins to be pronounced, it has been shown again and again that shortening the working period actually increases the amount of work done.

This may not always be evident in the first few weeks, but it appears later. Innumerable instances of this might be quoted. Thus a certain granite-cutting company found that "the same man under identically the same conditions accomplished more of exactly the same kind of work when he was working 9 hours than he did when he was working 10 hours. And again when the hours were reduced to 8 hours this same man accomplished still more in an 8-hour day than he did in a 9-hour day, or a considerable amount more than he did when the day was 10 hours long." In an English munition factory when the average weekly hours of men sizing fuse bodies were reduced from 58.2 to 51.2 the total output was increased 21 per cent. In the English factories the absences of employees from their work have increased enormously since the war began. In one of the largest munition factories, employing 70,000 hands, the efficiency of the work was thus greatly interfered with. The employers were advised to give their hands a whole holiday, instead of a half holiday, on Saturday. This was done, and the absences were diminished by 50 per cent.

The exact relationship between length of day and quantity of output is not yet fully investigated for all conditions, but the great preponderance of evidence favors a reasonably short working day even in the interests of the industries themselves.

Avoiding overtime.—Arguments that favor the short working day apply directly to the question of overtime. If the usual day's work is such as just to stop short of undue fatigue, overtime means overwork. It is of course sometimes necessary, in order to complete a contract within a required time, to call on the workers to expend the greater effort required. It is, however, a dangerous expedient and a particularly insidious way of diminishing a worker's efficiency. Overtime work is apt to result in an increased amount of spoiled work and in lessened output and increased absences on subsequent days, and because of this and also in view of the increased rate of wages that must usually be paid overtime is not as profitable as is often supposed.

Omitting Sunday work.—The same principle holds for the duration of weekly labor. It is generally acknowledged by those who have studied the question most carefully that all workers should have one day's rest in seven. At the beginning of the war the amount of Sunday work in the industries of the world was greatly increased. After little more than a year the British Health of Munition Workers Committee reported as follows:

> Statements are made by many employers that seven days' labor only produces six days' output, that reductions in Sunday work have not, in fact, involved any appreciable loss of output, and even the less observant of the managers seem to be impressed with the fact that the strain is showing an evil effect. * * * The evidence before the committee has led them strongly to hold that if the maximum output is to be secured and maintained for any length of time, a weekly period of rest must be allowed. Except for quite short periods, continuous work, in their view, is a profound mistake and does not pay—output is not increased. On economic and social grounds alike this weekly period of rest is best provided on Sunday.

Sanitary conditions outside factories.—Fatigue resulting from the work inside the plant will appear sooner and be a more serious hindrance to output if the worker is not in sound condition of body and mind when he comes to his task. Anything which an employer can do outside the plant to promote bodily health and vigor and mental contentment is in the long run profitable. It aids in securing a higher class of workers, greater loyalty to the company, a lessened labor turnover, greater skill, and greater general efficiency. Modern housing, attractive home surroundings, opportunities for healthful recreation, club facilities—whatever will keep workers away from the saloons and other places deleterious to health—are all safeguards against industrial fatigue.

The above are some of the ways by which fatigue in industrial occupations may be reduced. Their applicability varies with the different occupations of workers. Conservation of the working power of our industrial army is as essential to our success in the war as is conservation of our military and naval efficiency and our food. Great Britain has been foremost among our allies in recognizing this, after having made during the first year of the war the costly mistake of wasting her industrial forces through needless and avoidable fatigue.

In this country the Division on Industrial Fatigue, composed of scientists organized under the Committee on Labor of the Council of National Defense and working in co-operation with the Public Health Service, is now engaged in examining munition factories and other industrial establishments that are manufacturing war supplies. It aims to bring together the combined resources of scientific investigation and the practical experience of industries in this and other countries to show how avoidable fatigue may be eliminated, and how in the present exigency the greatest output of the necessities of war may be secured compatible with the maintenance of the working power of the workers. The Divisional Committee is contributing freely the time, knowledge and experience of its members for the benefit of the industrial work of the country and thus for the Federal service. Should any industrial corporation that is now engaged in manufacturing war supplies desire the services of the committee, communications should be addressed to the executive secretary at the office of the committee, 437 West Fifty-ninth Street, New York City.

Heald No. 65 Cylinder Grinder

Of More Rigid Construction Than the Older Type and Is Better Adapted to Manufacturing Operations—Driving Mechanism Also Improved

THE Heald cylinder grinder, which has long been favorably known to gasoline engine manufacturers, has recently been redesigned, the new model being known as the No. 65. The machine has been made more of a one-purpose manufacturing tool and less of a universal machine, whereby its efficiency in manufacturing operation has been increased.

Both the eccentric grinding head and the work table are now supported by a solid bed, where formerly the work table was supported on a knee that could be moved up and down on the face of the column of the machine. This arrangement may have been an advantage in repair work, as parts of widely different form could be put into the machine and lined up for having holes in them ground out. In manufacturing operations, however, when the work is confined to cylinder grinding, this wide range of vertical adjustment is of no advantage, and the greater rigidity obtained when both the grinding head and the work table are mounted on the same bed is especially desirable. Sometimes it will happen that one of the bores in a multi-cylinder casting is machined with its axis out of plane with the other bores. It then becomes necessary, in centering the grinding head, to adjust the work table, and for this purpose a means of vertical adjustment, affording a range of ⅛ in., has been provided. This adjustment is obtained by means of a slide between the main bed and the cross slide. This slide moves on inclined ways on the bed, and when moved in the direction of the axis of the main table, also moves up or down. It is moved by means of a bevel gear and screw and nut mechanism. The shaft of the driving bevel gear extends out from the bed at the front of the machine, and can be turned by means of a hand crank, which can be applied to it.

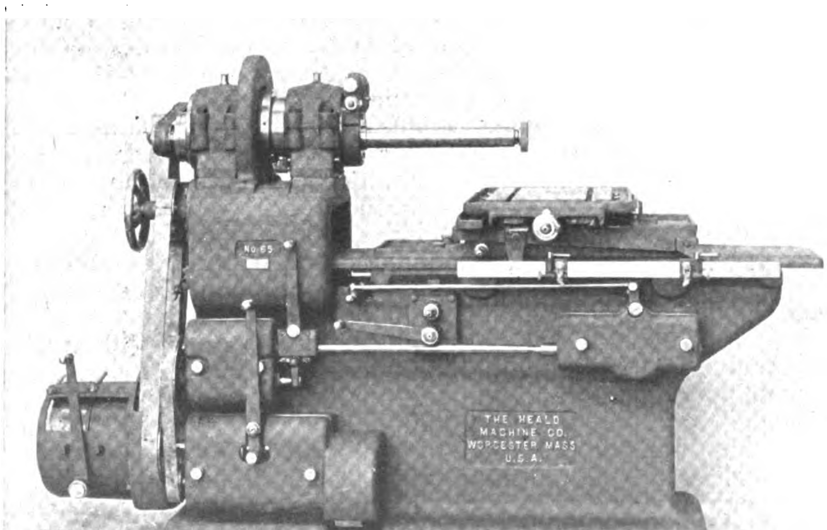
The dogs for controlling the travel of the table, instead of being mounted on the bed, are carried on a dog bar which is supported by the intermediate slide. The advantage of this arrangement is that the position of the grinding wheel relative to the work is not changed by any vertical adjustment of the work.

On the rear of the machine is the main driving shaft, which takes the power directly from the main line, thus dispensing with a countershaft. This constitutes what is known as a single pulley drive, and makes the machine entirely self-contained. The grinding spindle is driven from this main shaft through a flexible idler, which maintains a uniform belt tension. This idler and the long spring putting it under tension are clearly shown in the end view of the machine herewith. For grinding holes of various diameters, different speeds of the wheel are required, and these are obtained by means of interchangeable pulleys on the wheel spindle.

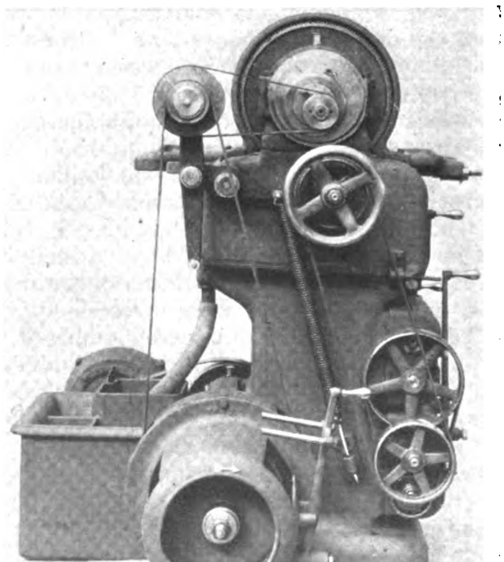
Speed Box in Front

Looking at the front of the machine, in the lower left hand corner of the bed is seen the main speed box, which is driven directly from the driveshaft by a belt through the bed. By means of this speed box the eccentric can be given two different speeds, the speed box containing two pairs of spur gears controlled by individual friction clutches. The lever for operating these clutches is plainly seen in the front view. The box above the one referred to controls the main table and affords three different rates of speed at which the work can be fed past the wheel. It contains a double cone of gears, which is operated by means of a sliding key controlled by an upright lever.

The speed box is connected with the automatic reverse box on the right hand end of the machine by a plain shaft, which can be seen in the front view. The reversal of the table may be controlled independently by a small hand lever located directly above the starting lever. This reversing lever is located in a position very convenient for the operator. In fact, all of the control levers are located close together, so that the operator can reach them without any



Front view of Heald No. 65 grinder, showing speed boxes and control levers



End view of grinder, showing automatic belt tensioning device

special effort. By means of a friction clutch inside the base, which is operated by the large horizontal lever at the front of the machine, the main table can be started and stopped. In order to permit the operator to rapidly adjust the work slide, a hand feed has been provided for the table.

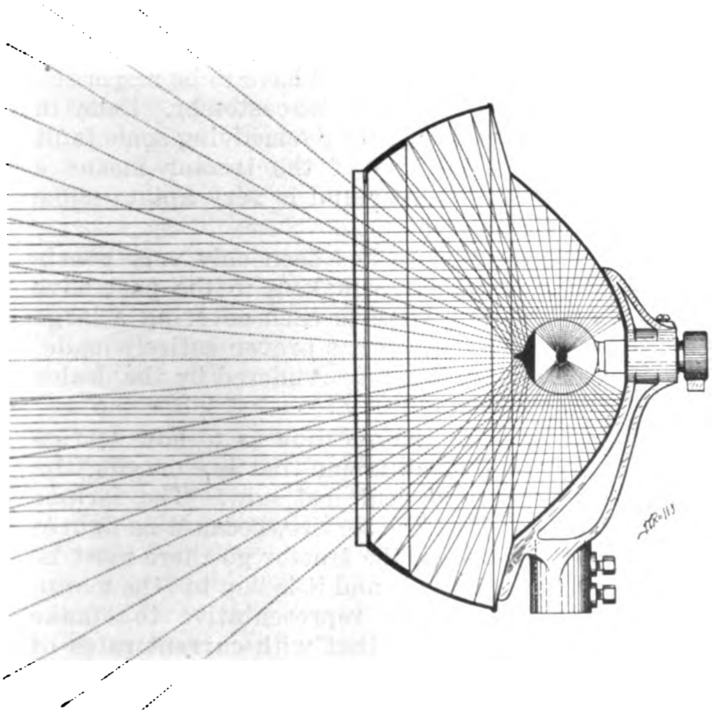
The main table slides on ways of the dove-tail form with a heavy gib. Oil pockets and rolls provide for ample lubrication. The main table is provided with large bearing surfaces and has been made of sufficient length to protect the ways on which it slides from grit and dust.

The machine has a cross-slide for accurate cross adjustment of the work. The feed screw has a graduated dial reading to thousandths of an inch, and adjustable dogs are also provided for indicating the center to center distance between cylinder bores. No important changes have been made in the design of the grinding wheel spindle and the feeding arrangement for the eccentric, as these features have been found very satisfactory in the former No. 60 machine.

On the main driving shaft at the back of the machine is a pulley for driving the lubricant pump. This latter is of the horizontal centrifugal type. Provisions are made in the design of the work table and intermediate slides to catch the lubricant which flows through a channel in front of the rear of the bed, and then into the pump reservoir. The cover of this reservoir has several compartments, the partitions being so arranged that most of the sediment is removed before it enters the tank proper. Provisions are also made for driving an exhaust fan from the main drive shaft. These fans are sometimes used in cylinder grinding to carry away the material as fast as it is removed by the wheel.

Roffy Non-glaring Headlamp

J. T. ROFFY, of Brooklyn, N. Y., who has done considerable work in the vehicle lighting field, has recently developed a new headlamp which projects a very strong beam of light forward and at the same time permits of complying with the laws prohibiting annoying glare. In the Roffy lamp a reflector similar to the usual type is combined with an inverted reflector ahead of the bulb. The forward part of the bulb is frosted, so that no direct rays from the filament can strike the eyes of persons in the road. The main reflector, instead of being of parabolic form, is a compromise between a parabolic and a spherical reflector. Mr. Roffy states that with a parabolic reflector and the ordinary type of filament, rings of light are produced, while with a plain spherical reflector the light is dispersed too much, and it is impossible to obtain a strong parallel beam. The intermediate type of reflector does away with the rings, giving a uniform beam of great intensity. The light bulb is surrounded by the main reflector to an angle of 105 deg. The annular reflector in front of the main reflector does not throw the rays back upon themselves, as is sometimes done to intensify the source of light, but has its focus at a point ahead of the focus of the main reflector. As a matter of fact, the rays of light from the filament striking this annulus are reflected on to the screen surrounding the tip of the bulb, and are reflected by this screen, which thus presents a large, luminous surface giving a mellow light. No part of the filament is directly visible to the eye, and Mr. Roffy contends that owing to this fact, where it is required to dim the light, it is not necessary for him to cut down the illumination to the same degree as is necessary with an ordinary reflector.



Sectional diagram of Roffy headlamp

In order to conform to anti-glare laws in various states, the lamp is set at an angle with the horizontal such that its axis is inclined 3:100 to the horizontal. This inclines the beam of light forwardly, and at a distance of 75 ft. from the lamp, the intensity of illumination at a height of 42 in. above the ground level is not at all objectionable.

Provisions have been made for adjusting the bulb in the lamp. The stem of the socket is held in the rear of the lamp by means of a set screw, and when this has been released, the socket can be moved forward or back and can also be rotated on its axis, which has been found to be of great advantage, as the filament does not always lie in the axis of the bulb.

In his experiments Mr. Roffy has found that what he calls the critical angle for metal reflectors is 52½ deg. That is to say, if a metal reflector is made to embrace a greater angle of light than this, the result is reduced visibility at a distance.

Tests made by the Electrical Testing Laboratory, New York, with a Roffy 7¼-in. reflector lamp containing a 28-candlepower bulb with frosted tip showed 130,000 apparent candlepower in the axis of the lamp 100 ft. away and 150,000 apparent candlepower at 1 ft. to the left of the axis 100 ft. away. In the median vertical plane 1 deg. of arc below the level of the lamp it showed 2100 a.c.p. at a distance of 100 ft., and 4 deg. of arc to the left of this plane and 1 deg. of arc above this level it showed 800 c.p.

Water Pump Drive in Liberty Engine

A VERY evident error occurred in the description in AUTOMOTIVE INDUSTRIES of the manner of driving the water pump on the Liberty aircraft engine. The paragraph in question occurred at the bottom of page 994 and read as follows: "The water pump is driven from a vertical shaft which takes its drive from the same vertical shaft that drives the camshaft driveshaft and the generator. This shaft extends downward and has a bevel gear which meshes with a bevel gear on the end of the pump shaft, thus accomplishing the drive."

This is evidently an error, since the camshaft driveshaft extends upward and not downward, and the passage should read as follows: The water pump is driven from the water pump bevel driver. The bevel driver has two bevel gears on an integral spool mounting. The upper gear takes its drive from the crankshaft bevel gear and the lower meshes with the gear on the end of the water pump shaft. An inspection of the drawing on the insert opposite page 992 will readily explain the drive of the water pump and oil pump.

Automobile Most Prosperous German Industry

IN an article in the *Frankfurter Zeitung*, dealing with the war boom of the German automobile industry, it is stated that the latter has been more prosperous during the period of the war than any other German industry. Throughout the war the demand for automobiles and gasoline engines ran ahead of the supply, numerous additions to plants were made, and the investment of new capital has been much in request.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol XL. Thursday, January 23, 1919 No. 4

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142.

Cable Address - - - - - Autoland, New York
Long Distance Telephone - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - One Year, $3.00
Canada - - - - - One Year, 5.00
Foreign Countries - - - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.
Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.
Member of the Audit Bureau of Circulations.
Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Pay Informal Contracts Immediately

IF Congress would devote its energies toward quickly passing a bill for the payment of informal contracts instead of becoming hysterical over a reported labor surplus it would quickly balance labor and capital conditions.

For several months the Treasury Department has refused to pay holders of informal war contracts—those contracts made via telephone, telegraph or verbally and therefore not legally executed. For several weeks the House debated bills authorizing payment of these contracts. Finally it passed the Dent bill.

Since that time three additional bills have been presented amidst delay, procrastination, argument and discussion—wasting valuable time, hindering the War Department, the Treasury and particularly manufacturers throughout the country.

Manufacturers in Michigan and Ohio holding $300,000,000 worth of war contracts not legally executed are becoming impatient, and rightly so. Their bankers are anxious and they have had to lay off workers while awaiting adjustment.

Very recently there has been much talk about "too rapid demobilization" by Congressmen stimulated by labor organizations. They point to the growing surplus of labor in Detroit and Toledo.

Less talk about labor surplus and more action toward just payment to the manufacturers is what is needed. Give the employers their money and they will quickly absorb any labor surplus.

The bill now before the Senate Military Affairs Committee drawn by the War Industries Board and approved by the U. S. Chamber of Commerce, the Motor and Accessory Manufacturers' Association and other industries appears to include all the necessary features.

This bill or some other equally equitable should be passed at once.

Tractor Service

IT is a well-known fact that tractors require a comparatively large amount of service from the dealer if they are to give satisfaction and "stay sold." The tractor is a recent development and its details have not yet been worked out to the same nicety as those of the automobile, for instance. Moreover, tractor work is very severe, the engine running under nearly full load all the time and all parts being stressed to a high degree. The majority of tractors burn kerosene and the use of this fuel involves greater difficulties than that of gasoline and is the cause of considerable trouble, especially to operators unfamiliar with it.

Not only does the tractor require a considerable amount of service, but this service is of a kind that is rather expensive. It has to be given on the farm and very often in the field. Most of the calls upon the dealers or service men will be made during certain very busy seasons and will have to be responded to at once in order to satisfy the customer. Delay in furnishing a necessary part or remedying some fault interfering with the use of the tractor means a serious loss to the farmer and is very apt to make him dissatisfied.

So far tractor service has been only very poorly organized. Several large makers in the past have had a few traveling experts each covering a large territory, but this method has proven entirely inadequate. The service must be rendered by the dealer who is always nearby.

This brings us to the question as to how service is to be paid for, which is one that is worrying the tractor trade a good deal just now. The farmer expects more or less free service, because he figures that if he cannot make the tractor go there must be something wrong with it and it is "up to" the manufacturer or the latter's representative to "make good." The dealer feels that with current rates of discount he cannot give much in the way of free service. He has his organization to maintain and his establishment to keep up, and after all neces-

sary expenses are deducted there remains only a trifling profit. He realizes that service is necessary to keep the tractor at work and that the farmer expects him to give much of this service free of charge, yet he feels that he cannot give such service and still earn a reasonable profit.

The service situation would seem to afford an excellent opportunity to the Tractor Manufacturers or the Implement Manufacturers' Association to standardize practice regarding this matter. Without some standardized rule it will not be long before one manufacturer is played off against another and there will be keen rivalry among them in regard to the amount of free service promised. The logical solution of the problem would seem to be to discontinue all free service. The farmer must pay for the service in any case, so why shouldn't he pay in accordance with the amount of service he requires? So-called free service is apt to render him careless and unreasonable in his demands on the dealer's time. If he knows that he has to pay for every trip made by the dealer on his behalf he is likely, when something doesn't work right, to cudgel his brain before calling for help, but if he is given the impression that free service is included in the sales price, why shouldn't he take advantage of it?

For the growth and success of the tractor industry it is necessary that adequate service facilities be provided, but it is not by any means necessary that service be furnished free of charge.

Readjustment of Values

THE automobile industry evidently is feeling its way slowly through the uncertain period of readjustment. What we are passing through is really a period of changing values. Although it is quite certain in which direction the adjustment of values will proceed, no one can tell how far it will go and when it will be over.

All business planning is based upon an intelligent forecast of conditions of supply and demand, which regulate prices, and it has seldom been so difficult to make such forecasts as it is now. There has been much talk of "war prices" and "adjustment to peace conditions" and buyers naturally assume a waiting attitude. No dealer will load up with stock in a receding market and the ultimate consumer also is prone to hold aloof as long as there is a chance for a further drop.

There are indications, however, that those who are waiting for a big slump are doomed to disappointment. The present situation has nothing in common with a business depression following a financial panic. Stock quotations may tumble over night, the reason for such disastrous slumps usually being that the values at which the stocks were being held and sold were not in them. Practically all the value in industrial products represents labor spent upon them. The price which must be obtained for articles of manufacture depends upon their manufacturing cost and this in turn depends upon the cost of labor. It is quite true that the cost of labor has gone up very much during the war, and there is no doubt that eventually it will come down again. This adjustment, however, can be only very gradual, as the cost of living is bound to remain high for some time, and probably for years.

Meanwhile business must go on. Certain risks connected with the possibility of depreciation of materials must be willingly incurred, as they are of little importance compared with the great losses that would result from the stagnation of the industries. There is no ground for a pessimistic feeling. The present situation did not come unexpectedly. We all realized long before the war came to an end that the period of readjustment would bring with it certain disturbances in our commercial life; but just as certain as was the advent of these disturbances is the fact that once we become attuned to the new condition of things we will enter upon a period of great industrial activity and prosperity. A country that can produce 20,000,000 tons of foodstuffs a year in excess of its own requirements, besides large surpluses of staples, metals, fuels and chemicals, need never lack prosperity for any extended period.

Commercial Airplanes

ALTHOUGH little is being heard on the subject, a large amount of feverish activity is being developed in different parts of the country, particularly in Detroit, Cleveland and Dayton, in the low-priced airplane field. There are a large number of able men who have pinned their faith on the early arrival of the commercial airplane. These men have not only expressed an opinion but have staked their futures on the development.

The announcement of a prominent motor car company to the effect that it will have a production airplane to sell at $15,000, to be marketed through its dealers, is the first step in the direction of what may become a very important branch of the automotive business. The future plane will sell for less than $15,000, however, and it will not be until planes sell for $1500 that they will really be considered a commercial product.

The wings of the future plane will be removable or folding so that the entire machine can be packed in small space and put in a garage back of the house in the same way that the automobile is now kept. It must have a landing speed of not more than 45 miles per hour and probably not more than 35 miles per hour. Its engine must be simple, easily taken care of and of inexpensive manufacture. At first thought the idea of a low-priced airplane engine seems rather far-fetched, but there are developments in this direction which have already made successful runs. In the not distant future there will be airplane engines which can be manufactured for a few hundred dollars.

The next two years will see developments along lines which the war never suggested, because the planes required for military service were so different. Nevertheless, these light, low-priced yet well-built and safe little planes are surely going to be the next transportation development.

Latest News of the

Draw New Bill to Validate "Informal" Contracts

Measure Prepared by War Industries Board Has Support of M. A. M. A. and the Industry in General—Provides for Appeals Commission—Prompt Action Urged

WASHINGTON, Jan. 21—The Senate Military Affairs Committee to-day reported out a bill for the payment of informal contracts. Early passage is expected. The bill reported is the one drawn up by the War Industries Board and is supported by the United States Chamber of Commerce, the Motor and Accessory Manufacturers Association and industries generally.

As printed herewith, the bill for the payment of informal contracts reported by the Senate Military Affairs Committee with an amendment differs radically from the original bill proposed by the War Industries Board and approved by the United States Chamber of Commerce, the Motor and Accessories Manufacturers' Association and other industrial bodies.

The new bill includes a section by which for the first time in the history of the United States Government one department is authorized to investigate every act of another department. The Department of Justice is authorized by the bill to examine and investigate all of the contracts which have been made by the War Department. This is an objectionable feature in the bill because it is expected to considerably delay payments.

The bill also contains a new amendment authorizing the Secretary of the Interior to pay contracts not legally executed and others which call for the production or appropriation of ores, metals, minerals and mineral substances needed for war purposes.

It is expected that this bill, with the amendment, will be discussed on the floor of the Senate to-morrow. Considerable delay is again anticipated before passage of a relieving measure, due to the constant additional amendments and changes which are being made in each bill offered. The various industrial bodies fear that unless an equitable bill is passed, and passed promptly, there will be serious business difficulties, critical labor conditions and important obstacles to the success of the next Liberty Loan resulting. Following is the bill:

AN ACT

To provide relief where formal contracts have not been made in the manner required by law.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That whenever during the war emergency and prior to Nov. 12, 1918, any individual, firm, company, corporation, or foreign government has made an agreement with the Secretary of War, or with any officer or agent acting under his authority, or with any agency of the Government authorized to procure or aid in procuring the same for the War Department, for the production, manufacture, sale, acquisition or control of equipment, materials or supplies, or for services, or for facilities, or other purposes connected with the prosecution of the war, and such agreement was reduced to the form of a contract or accepted procurement order and executed or signed on behalf of the Government, but the agreement did not comply with statutory requirements, in every such case the Secretary of War is authorized and directed to waive, on behalf of the Government, such noncompliance: Provided, That he finds such waiver is not inconsistent with the public interest, and in this event the said agreement shall have the same validity and effect it would have had if such statutory requirement had been complied with.

That whenever, prior to said Nov. 12, 1918, any individual, firm, company, corporation, or foreign Government has made any agreement, oral or written, express or implied, with, or has received any order or request, oral or written, from the Secretary of War or any officer, agent, or agency as aforesaid, for any of the purposes aforesaid, and the same has not been reduced to contract form, but such individual, firm, company, corporation, or foreign Government has in good faith made expenditures, incurred obligations, acquired or furnished facilities, equipment, materials, or supplies, or rendered services, in reliance on such agreement, order, or request, in every such case the Secretary of War is authorized and directed, on behalf of the Government, to enter into such contract with such individual, firm, company, corporation, or foreign Government as will, under all the circumstances, fairly and equitably compensate him or it for the expenditures made, obligations incurred, equipment, materials, or supplies furnished or acquired, or services rendered, as aforesaid: Provided, That in no event shall such contract provide for compensation on terms more favorable than the terms, if any, for which the aforesaid agreement, order, or request may have provided.

That whenever, prior to said Nov. 12, 1918, the War Department, through its officers or agents, has taken possession of any land, or whenever the holder or owner of any land has removed from or removed any improvements from such land at the order or request of the War Department and no valid contract has been made with respect thereto, then the Secretary of War, if he finds that the public interest does not require the possession or occupancy of such land by the Government, is authorized to make compensation to the owner or holder thereof for the fair value of such improvements so removed and the expense incurred by such owner in removing therefrom or for the fair value of the use of such land of which the War Department has taken actual possession and for any expense or loss incurred by the owner or holder by reason of such possession.

SEC. 2. That a commission is hereby created and established, to be known as the War Contracts Appeals Commission (hereinafter referred to as the commission), which shall be composed of three members, who shall be appointed by the President, by and with the advice and consent of the Senate, and shall continue in office for one year from the date of this Act. One member of the commission shall represent the War Department, one member shall represent the Department of Justice, and one member shall represent the business interests of the country. None of the members of the commission shall be interested in any order, contract, or agreement within the purview of this act or have any interest in any firm or corporation having such orders, contracts, or agreements. Each member of the commission shall receive a salary of $7,500 a year, payable in the same manner as the salaries of judges of the courts of the United States. The commission shall choose a chairman from its own membership and may appoint a secretary, who shall receive a salary not exceeding $5,000 a year, to be determined by the commission and payable in the same manner as the salaries of the members of the commission.

That there is hereby appropriated, for the purpose of defraying the reasonable expenses of the commission, including the payment of salaries herein authorized, out of any money in the Treasury of the United States not otherwise appropriated, available immediately and until expended, the sum of $50,000.

That within thirty days of the date when the Secretary of War tenders any contract or compensation as provided in this act, or refuses to tender such contract or compensation, the party to whom said contract or compensation is tendered or refused, or the Government by a dutly authorized officer from the Department of Justice may file with the chairman of the commission a notice of appeal: Provided, however, That if the representative of the Department of Justice agrees with the action of the War Department there shall be no appeal by the Government, but settlement can be made at once. Thereupon, the commission shall proceed to examine and review the facts and circumstances of the case and make its award or finding thereon. Upon giving receipt in full of all demands against the United States arising out of the transaction by reason of which the award is made, the appellant shall be entitled to receive the amount of any award so made, and the proper officer of the United States is hereby authorized and directed to pay the same, but if the appellant is dissatisfied with the amount so awarded he shall be paid 75 per centum of the amount awarded and shall be entitled to sue the United States in the Court of Claims to recover such further sum as added to said 75 per centum shall make up such amount as will be fair and just compensation as provided in this act, and the Court of Claims is hereby given jurisdiction to hear said suit and render judgment therein.

That whenever any dispute arises in the matter of the adjustment or settlement, or as the interpretation or application of the terms of any contract which has been made for any of the purposes set forth in this act, and in the execution of which there has been

(Continued on page 234)

More Room for Airplane Show; Dates Now March 1-15

NEW YORK, Jan. 21—The aeronautical show which is to be staged by the Manufacturers' Aircraft Association has been considerably enlarged in scope, and the time of the exhibition extended from one to two weeks. Due to inability to get Madison Square Garden for the original dates, the time for the show has been altered from Feb. 26-March 6, to March 1-15. Because of the extent of the exhibits which the military and naval air services wished to have on view, it has been found necessary to use the Sixty-ninth Regiment Armory in addition to the Garden. No allotment of space has been made as yet, though it is expected that these details will all be worked out within the next few days. It is likely that the admission charge will be 50 cents.

Automotive Industries

Federal Supervision of Supply Sales

Definite Plan Adopted Covering All Sales of Government-Owned Property

WASHINGTON, Jan. 20—Close co-operation between the Government and industry, generally, in the sale of surplus Government supplies is planned by the Director of Sales of the War Department and the War Service Executive Committee of American Industries. The War Service Committee, which was named at the recent meeting of the Chamber of Commerce of the United States, will be consulted in all instances by C. W. Hare, Director of Sales, whenever sales are to be made in a volume that is likely to disturb trade conditions.

The first important sales to be made by the Government are of machine tools. Arrangements for the disposition of machine tools, made following a conference between the industry and the War Department, include plans by which the industry will absorb Government-owned machine tool equipment without serious disarrangement. The following agreement satisfactory to both the War Department and the machine tool industry was drawn up and will be followed:

The inventory of all machine tools and equipment which is being made will be expedited to the greatest possible extent.

As soon as it is known that a quantity of machine tools is available for disposal, the manufacturers of these tools will be given an opportunity to purchase them at a price and on terms of settlement which will be satisfactory to all parties concerned.

In case it is impossible for the manufacturer to purchase his product outright, an effort will be made to arrange for the marketing of the product by the manufacturer, in an equitable manner, securing for the Government and the manufacturer alike the best possible terms.

In case both these methods of disposition fail, the material will be offered for sale to the general public in a manner prescribed by law.

In settlement of plant contracts, which involve the sale of large groups of various kinds of tools and equipment, an effort will be made to prevent the sale for resale of any equipment, as it is realized that considerable injury might be done by indiscriminate sales of this character.

New Plans for Lincoln Motors

DETROIT, Jan. 20—A well-defined and semi-authentic report current of late in automotive circles is that the Lincoln Motors Co. plant is being prepared for the manufacture of an 8-cylinder motor car. It is known that an experimental car has been on the road, but it is stated on good authority that this design has been superseded. It is understood that engineers are working on engine plans and that a set of blueprints has already been completed. The plant had a $60,000,000 contract for 16,000 Liberty engines. This contract, partly filled, was superseded recently by another contract, cutting production to a minimum, which will bring operations almost to a standstill in the course of the next few weeks.

Apperson New Standard Model

KOKOMO, IND., Jan. 20—The Apperson Bros. Automobile Co. has brought out a new model which is to be known as its Standard model and which is to sell for $2,600. This is in addition to the Anniversary model, which sells for $4,000. The Standard model is equipped with the regular Apperson 8-cylinder engine, has a 130-in. wheelbase and will carry seven-passenger touring and four-passenger bodies. It is finished in thistle green.

Ford Now Making 1000 a Day

DETROIT, Jan. 20—The Ford Motor Car Co. is now producing 1000 cars daily, but before it can commence upon its 1919 production schedule, which calls for 3000 cars a day, over $1,000,000 worth of machinery, installed for war work, must be removed, replaced or scrapped, and several buildings readjusted to handle peace instead of war production. The big plant is working night and day on reconstruction work, but officials assert it will be 90 days before production can regain its pre-war level.

The Ford fiscal year ends July 1. Because of delay caused by the necessity of re-adjustment, the company does not expect to make more than 300,000 cars between January and July. The fiscal year of 1919-1920, they predict, however, will see production reach $1,250,000. The company has enough orders ahead to keep the plant in operation nearly two years.

Drop in Gasoline Price Expected

WASHINGTON, Jan. 22—A considerable drop in the price of gasoline is expected in the near future as a result of the United States Shipping Board's action in turning back 145 tankers which had been commandeered for war purposes and which are now returned to their owners. The majority of these vessels will be employed soon to transport oil to this country from Mexican fields. The total dead weight tonnage of the ships returned to their owners is 1,140,000.

Beecroft Now Due Feb. 1

NEW YORK, Jan. 23—Due to a hold-up in the sailing of the steamer Adriatic, the vessel will not reach New York until Feb. 1. Hence, David Beecroft, directing editor of the Class Journal Co., who was scheduled to arrive Jan. 27, will reach New York until a week later.

Deeds Is Completely Exonerated

War Department Board of Inquiry Finds Him Not Guilty of Court-Martial Offense

WASHINGTON, Jan. 16—Complete exoneration of Col. E. A. Deeds, head of the Dayton Electric Laboratories Co., and a member of the U. S. Air Service, has resulted from an investigation by a special War Department Board of Inquiry. Col. Deeds was recommended for trial by court martial by Charles E. Hughes in his report on aircraft production, which charges that Col. Deeds had given out misleading information with regard to production. Secretary Baker announced yesterday that he approved the findings of the Board of Inquiry and the case is completely closed.

The findings of the Judge Advocate General were submitted together with a letter by Secretary of War Newton D. Baker to the Chairman of the Committee on Military Affairs of the House. Secretary Baker's letter states that Col. Deeds, absorbed in the activities of aircraft production, neglected to attend to personal transactions and this neglect created appearances which these findings show in their true character.

The findings deal completely with all of the correspondence relative to the charges against Col. Deeds and include letters and telegrams showing that Col. Deeds was reluctant to accept a Government position because of his airplane interests, but that he did so at the urgent request of both Howard E. Coffin and the Secretary of War. Perusal of all of the telegrams which passed between Col. Deeds and the Dayton companies shows, it is said in the findings, that the colonel "zealously tried to protect the best interests of the Government." "It must be remembered," says the findings, "that at the time Mr. Deeds received his commission he was in Washington and not in Dayton where his business interests were located, and he could not reasonably have been expected to attend to the details of the stock transfers himself and did not attempt to do so."

With regard to the accusation that Col. Deeds uttered exaggerated public statements about aircraft production last spring, it is shown in the testimony that although the colonel testified that he had seen the publicity prior to its publication, he had actually not seen those parts which contained the erroneous statements. Regarding this matter the Judge Advocate General states: "It is recommended that no court-martial proceed-

(Continued on page 235.)

Ships, Credit, Cables for Brazil Trade

These Are the Things Principally Needed to Develop Trade with America

WASHINGTON, Jan. 17—The establishment of American banks, long credit, fast passenger and freight service, independent cables, and the development of port and harbor facilities in Brazil by American capital are recommendations among others made by Capt. C. T. Vogelgesang of the U. S. Navy in a special report to the Secretary of the Navy. Capt. Vogelgesang went to Brazil to study the measures that will cement relations between that country and the United States. His report includes the following:

"Brazil desires a closer relationship with the United States. They want more American banks run according to the United States banking system. They want our credit and our capitalists to extend it to them in unstinted measures, for supporting that credit Brazil can offer an incomparable wealth of resources.

"But first of all, and above all, we need direct communications. Few people are awake to the value, the actual indispensability of direct communication between peoples who are trying to do business with each other, and the overwhelming disadvantages that underlie indirect and intermittent communication.

"As important as is the need of using our own carriers to dispense our goods throughout the world, it is of equal importance that we should link up our own cables to those countries with which we seek to do business, instead of having to depend, as we do now, upon the use of foreign cables, which, while not perhaps owned by foreign governments, are certainly administered in the interest of the nationality owning them to the detriment of alien clients and alien business.

"We cannot achieve economic freedom or count upon fair play in the game of international trade so long as we are tied down to a system of doing business through foreign banks and over foreign cables. In this connection it is interesting to speculate upon the possibilities of aerial mail communication from the United States to South America. Although but a few months have elapsed since this method of communication has been tried in the United States, it has already passed the experimental stage and is an unqualified commercial success. It will take no stretch of imagination, with this fact in mind, to see within a short time an aerial mail service connecting Washington or New York with Rio de Janeiro.

"The United States radio service, while it can never supplant cable service, will unquestionably supplement that service and become a most valuable commercial asset.

"In the development of a closer relationship we Americans may be assured that Brazil will do her part if we will do our part. The problem is for us to solve, because it takes capital to solve it. We have the capital and Brazil has not. We have her abundant good will and confidence and we can maintain that unimpaired by square dealing.

"The lines along which our capital may be best employed are the following in their order of importance as I view the situation:

"1. An independent American cable direct from New York to South America.

"2. More American banks and long credit.

"3. Fast passenger and freight steamer lines to Brazil, run on fast and regular schedules, and strictly first class in every particular.

"4. Development of Brazilian railways. Brazil's need of railways is as great as the need of China in that respect.

"5. Development of port and harbor facilities and coastwise commerce.

"6. Development of mining regions containing illimitable wealth of ores of all kinds.

"7. Development of industrial plants for the manufacture of material needed locally and for which raw material and water power exist in abundance and for which skilled labor will have to be supplied.

"The field is at this time wide open to energy and enterprise, and if United States capital, backed by a strong and enduring policy of Government support does not avail itself of the golden opportunity that is now presented, foreign capital will control, and we will not have established that community of interest that Brazil looks for in her relations with us."

Philippine Imports Limited by Amounts Obtainable

WASHINGTON, Jan. 20—Imports of automobiles and parts in the Philippine Islands in 1917 were limited by the amount obtainable, according to a Commerce Report made public here to-day. Cars totalled 1,540,401 as compared with 1,352,572 in 1916. The year 1917, adds the report, brought the foreign commerce of the Philippine Islands to its high-water mark, and developed the internal trade to a maximum. The growth of business in the islands is founded upon the staple production of the country. Agricultural, commercial and industrial pursuits have increased several hundred per cent in the past few years. Trade has grown particularly with Japan and China, while it has declined with Great Britain, France, the Netherlands, Italy and Switzerland. It has increased more than 72 per cent in the past year with the United States. The hemp industry retains its leading position, although exports of sugar, tobacco, lumber, pearl and cocoanut oil have increased promisingly. A lack of shipping facilities has been one of the greatest obstacles to a still greater import and export business.

Exports to Mexico Simplified

WASHINGTON, Jan. 18—Applications for export licenses to Mexico are no longer required to have attached thereto an order from the consignee bearing the visé of an American consul. The War Trade Board announced Jan. 16 that such procedure in connection with shipments to Mexico is no longer required.

This simplification will expedite shipments to Mexico by enabling the shipper to get his license more quickly, and will result in getting exports under way without the delay incidental to the procedure of awaiting consular communication.

Manganese Import Restrictions Lifted

WASHINGTON, Jan. 18—Restrictions on the importation of manganese ore or manganese dioxide from Asia and Australasia, and upon the importation of chrome ore or chromite, or copper ore and copper concentrates from any country are lifted completely by the War Trade Board. All restrictions on the importation of iron ore are removed. Applications for the importation of ferromanganese from Great Britain covering shipments contracted for by American consumers prior to April 6, 1917, will now be allowed. The affidavit of the importer, or written statement from the consumer, of the existence of the contract will be considered sufficient.

Belgium Is Ready for Business

Minerva, Pipe and F. N. Have Plans Made—To Produce in Few Months

PARIS, Jan. 1 (Special Correspondence)—The Belgian automobile industry has already laid its plans for a return to working conditions. Three of the leading factories, Minerva at Antwerp, Pipe at Brussels and F. N. at Liege, hope to get into production within a few months. The Metallurgique company at Marchienne-au-Pont states that it has machinery in storage ready to be shipped and installed, and that production will begin at very short notice.

The Belgian Government has decided to divide among the leading Belgian automobile manufacturers 5000 army trucks and automobiles, and also to distribute among them all the automobiles, motorcycles and bicycles captured from the German army. A portion of the army supply of machine tools and factory equipment will be distributed among the automobile factories. It is intended to distribute raw material in the same manner.

All the Belgian automobile factories have been stripped by the enemy. In some cases the machinery was sent directly into Germany; in other cases the enemy waited until it was evident that Belgium would have to be evacuated before removing everything.

Before the war Belgium had twenty-three automobile factories and produced about 10,000 cars a year. Very few trucks were built. There was only one tire factory—the Englebert, at Liege. In 1914 the German army took charge of this and turned it over to Engineer Tischbein of the Continental Tire & Rubber Co., of Hanover. The Germans immediately requisitioned one million dollars' worth of tires and raw material, and a little later seized most of the machinery. The factory was kept going on a small scale for the last 3 years of the war making waterproof clothing for the civilian population.

High Import Duty and Gas Price in Way of South American Business

BUENOS AIRES, Dec. 5 (By Mail)—The price of the gasoline said to be on hand, and the high rate of duty probable on motor importations, it is feared may limit the South American import business. It is claimed that there is still four to six months' supply of gasoline here, although there are no definite proofs either affirmatively or to the contrary. The price has not been raised recently, but the charge at the pumps in this city is 38 cents per liter, or about 62 cents per gallon, while all through the interior they are paying practically double this price, and in some instances even three times. The restrictions on purchasing are many, and there is a great deal of speculation.

A law is now proposed to raise the duty on motor cars and accessories. While this law has not been acted on as yet, the general opinion is that it cannot fail to pass, and will be in effect in a very few months. Up to February, 1918, motor cars and accessories paid a duty of 10 per cent on their value. From February to the present date they have paid 32 per cent. Now it is proposed that the duty shall be raised again so that they will pay 47 per cent in 1919. This will undoubtedly cause a serious decrease in importations, as the price to the public will be almost prohibitive.

—

Opportunity For South African Export

WASHINGTON, Jan. 20—Shortage of shipping and the difficulties of obtaining cargo space hampered the automobile trade of Johannesburg, British South Africa, according to a report by the vice consul, during 1917, but notwithstanding, business was fairly well maintained.

This is important from the viewpoint of the American manufacturer, for South Africa has now become an outlet of consequence for this export trade.

The gross value of the imports of motor vehicles, accessories, tires, gasoline, etc., increased from $8,594,200, in 1916, to $9,948,080, in 1917, or about 15¾ per cent. However, the advanced prices of all these goods indicate a higher aggregate cost rather than a larger volume of business. Imports from the United States amounted to $5,279,943, or 53 per cent of the total; and the United Kingdom furnished $1,872,639, or 19 per cent. In 1916 the percentages were as follows: United States, 55 per cent; United Kingdom, 24 per cent; and other countries, 21 per cent.

The average declared value of the English automobile amounted to $1,144, while the approximate value for custom purposes of the American and Canadian car was $779 and $438, respectively. The latter has grown greatly in popularity in recent years, and imports from Canada rose 71 per cent, compared with those for 1916. On the other hand, imports of automobiles from the United Kingdom decreased 45 per cent, or from $325,218 to $178,805; and the figures for the United States fell from $2,717,051 to $2,525,881 for the same period.

A decrease of 16 per cent was noted in the gross value of motorcycles and parts imported into this district in 1917, compared with the preceding year. The United Kingdom lost its supremacy in this market to the United States, imports from which were valued at $352,865, or 53 per cent of the total.

Tires were supplied to the value of $1,374,227 by the United Kingdom, which still continued to be the principal source of supply with 53 per cent of the total imports to its credit. Imports from the United States increased from $692,114, in 1916, to $705,681, in 1917, and a material gain resulted to French and Italian manufacturers, imports of their goods increasing by 71 per cent compared with the figures for 1916.

The motor trade of the Union has now reached such a stable state that it is capable of absorbing annually imports of considerable value. It will no doubt grow in volume and importance because the isolation of certain districts cannot be eliminated altogether by railroads. Heretofore, railway facilities have been practically the only means of communication between distant settlements, and regular motor traffic would tend greatly to hasten the industrial development of districts whose progress has been retarded in the past.

—

Foreign Trade Opportunities

WASHINGTON, Jan. 20—A man in France desires an agency for motor car bodies, trimmings, etc. Further information can be secured from the Bureau of Foreign and Domestic Commerce by mentioning Foreign Trade Opportunity No. 28087. A firm of Chinese merchants in Trinidad desires an agency for the sale of motor cars and rubber tires. No. 28095.

November Exports from New York

Satisfactory Increases in Cars and Trucks—Parts Drop Nearly 60 Per Cent

NEW YORK, Jan. 21—November exports of automotive products from this port are much more satisfactory than might be expected. There is no doubt but that the switching of a large number of ocean-going ships for service in transporting the foodstuffs still needed in great quantities overseas has tied up our commercial shipping to a very great extent, but, nevertheless, our exports of cars during the month totalled 806, valued at $1,003,416, as against 557, having a value of $735,558, during October.

Our November exports of trucks were 549, valued at $1,733,489, as against 328, valued at $1,057,003, in October. Parts (excluding engines and tires) show a serious falling off, the November value being but $593,414 as against October's $1,473,655. Tires, which appear in this tabulation for the first time, represent a normal month's export trade.

In the order named, the principal buyers of passenger cars during November were British South Africa, Uruguay and Japan. France was by far the best customer for trucks, Japan taking second place. During November there were also exported from New York alone 181 motorcycles, valued at $46,050, and 35 gasoline automobile engines, having a value of $3,242.

—

Garages to Secure Ford Parts from Dealers

DETROIT, Jan. 20—The Ford Motor Co. is handling the selling of Ford parts to garages through its authorized dealers, and not through the factory. Announcement of the plan of the Ford Motor Co. to sell its parts directly to garages has created a number of inquiries and orders to the factory and factory branches direct. The company, however, states that it prefers that the sale of Ford parts to garages be handled through its regular authorized dealers, instead of being shipped direct from the nearest branch.

AUTOMOBILE, TRUCK, PARTS AND TIRE EXPORTS FROM NEW YORK FOR NOVEMBER

	Cars		Trucks		Parts	Tires
	No.	Value	No.	Value	Value	Value
Aden	..	......	..	......	$6	......
Argentina	21	$22,285	..	......	32,965	$154,904
Australia	..	......	..	......	15,278	......
Azores Is.	..	......	..	......	1,600	......
Barbadoes	..	......	1	$3,000	758	4,043
Bolivia	2	5,089	..	......	1,004	14,662
Brazil	39	49,761	2	5,467	17,859	40,584
British East Africa	14	14,445	..	......	3,471	165
British East Indies	..	......	..	......	......	......
British Guiana	3	2,600	1	2,600	7,643	12,546
British India	2	2 688	..	......	31,175	5,596
British South Africa	161	158,682	15	20,346	53,039	79,577
British West Africa	..	......	..	......	2,861	......
British West Indies	1	709	1	1,650	103	2,793
Canary Islands	..	......	..	......	45	......
Chile	22	48,116	8	17,700	33,800	85,589
China	2	3,300	6	5,600	3,276	14,711
Colombia	9	10,840	1	405	2,571	3,427
Costa Rica	..	......	..	......	116	94
Cuba	24	69,468	20	46,469	76,364	162,581
Danish West Indies	2	2,000	..	......	32	488
Denmark	39	52,726	..	......	3,711	......
Dutch East Indies	26	34,926	18	26,882	28,963	11,452
Dutch Guiana	..	......	..	......	180	640
Dutch West Indies	..	......	..	......	185	328
Ecuador	1	3,000	1	540	654	4,221
England	31	98,003	26	55,297	47,510	38,881
France	2	3,600	311	1,325,016	48,662	102,365
French Africa	..	......	..	......	......	......
French West Indies	6	4,422	1	1,200	5,387	5,176
Guatemala	..	......	..	......	577	295
Haiti	2	1,300	..	......	2,068	8,462
Honduras	1	1,300	..	......	629	547
Hongkong	..	......	..	......	......	2,360
Iceland	..	......	..	......	......	......
Italy	..	......	5	8,400	29	......
Jamaica	1	750	..	......	4,033	715
Japan	70	65,099	51	83,527	5,332	4,842
Korea	..	......	..	......	339	......
Madagascar	..	......	..	......	40	565
Mexico	26	36,798	13	17,706	10,938	57,451
Morocco	..	......	..	......	1,254	......
Newfoundland	15	15,806	..	......	456	716
New Zealand	43	35,265	36	24,719	47,604	......
Nicaragua	2	1,550	..	......	207	373
Norway	17	30,525	21	55,074	38,279	4,396
Panama	2	1,837	..	......	1,590	13,606
Peru	31	57,081	6	17,481	14.058	29,123
Philippine Islands	..	......	..	......	......	......
Portugal	..	......	..	......	6,493	2,014
Portuguese Africa	..	......	3	6,000	12	92
Russia in Asia	3	11,734	..	......	......	......
Salvador	1	1,242	..	......	657	1,188
Santo Domingo	2	1,818	..	......	8,602	5,640
Siam	..	......	..	......	39	......
Spain	38	75,467	1	7,210	5,725	......
Switzerland	..	......	..	......	......	......
Trinidad	1	950	..	......	8,941	17,760
Uruguay	135	64,740	..	......	11,809	......
Venezuela	9	13,499	1	1,200	4,290	12,200
Totals	806	$1,003,416	549	$1,733,489	$593.414	$902,067

Suit Against Jobbers Slow-Moving

First Witness Heard Tells of Operation of So-Called Syndicate Catalogs

NEW YORK, Jan. 20—The trial of twenty-one members of the Jobbers' Association is showing a little more interest and speed this week than it did last week. It opened last week with George Woelfel, Jr., Commissioner Webster's former secretary, on the stand, and the various prosecuting attorneys reading great masses of documentary evidence.

In the opening days the jobbers were quite encouraged when Judge Hand, who is an old timer in the United States District Court here, showed a disposition to speed things up. He repeatedly asked if it were necessary to bring in all the masses of documents that the Government attorneys presented. And when one of them proposed to read some 1400 letters into the record the judge flatly refused to listen to them. He also jogged the defense at times and seemed anxious to get the case over with. Estimates of the period run from a month to six weeks.

The court scene is anything but exciting, and at times the spectators' benches contain only two or three. To-day, however, when things began to liven up, there were twenty-five or thirty spectators.

Most of the evidence during the "literary stages," when documents were being read, seemed to be to establish some of those facts which are well known to the trade, such as the formation of the association, the passage of resolutions and the existence of the "jobbers' list."

To-day, however, real witness' stories were heard. The first on the slate this morning was G. A. Smale, who operates the Catalog System Co. in Wilmette, Ill. He told of the association's resolution which frowns on the use of syndicate catalogs. The substance of his story was that he protested against this resolution to various individuals and at two different meetings, but to no avail. He said also that thereafter quite a long list of former customers declined to take space in his catalogs, giving as an excuse the association's resolution.

The cross examination by the association's counsel tended to show that Smale showed only those goods whose makers paid him money for space, that he did little investigating as to the status of those who bought space and catalogs, that he sold the catalogs, imprinted with the buyer's name, to anyone who would pay for them, that he imprinted on the front cover any copy the buyer supplied, and that this tended to cause many "illegitimates" to secure jobbing rates on merchandise to the general disadvantage of the whole trade.

These catalogs, it was developed, did not contain a complete list of the trade's goods, but simply a list of the goods of those makers who paid to get in. This fact, however, was not, as a rule, explained to those dealers and jobbers who bought the catalog for use among their trade.

He distributed over 100,000 copies a year to more than 100 customers at from 5 to 10 cents each and charged the manufacturers about $1.50 per page per thousand. Charles E. Miller was on the stand for a few minutes, but didn't stay long. He may be called again.

And then came Clement M. Biddle of "Biddle's Purchasing Agency." He said his company rendered a service in giving daily price changes and other information and catered to the jobbers in the hardware, iron, steel, plumbing supplies, grocery, metals and automotive equipment trade.

Biddle's story related to the association's resolution to the effect that there is no field in this trade for a purchasing agency, and he endeavored to show that his business is of service and that the resolution is unjust.

Crow-Elkhart Settlement

SOUTH BEND, Jan. 22—At a meeting of the representatives of the Crow-Elkhart Motor Car Co. it was practically decided to accept a settlement of 25 cents on the dollar. This decision is not to go into effect immediately. The total liabilities of the company are $330,000.

Bruce Daniels Joins Seeds

INDIANAPOLIS, IND., Jan. 20—Bruce Daniels, in charge of advertising for Prest-O-Lite Co., has resigned that position to join the staff of the Russel M. Seeds Co., an advertising agency. For the last eight years he has been closely identified with the motor industry. Originally automobile editor of the Indianapolis *Star*, he has successively been in charge of the Motor Car Manufacturing Co., the Stutz Motor Car Co., and was for the last five years with the Prest-O-Lite Co.

McLaughlin-Buick Price Down

OSHAWA, ONT., Jan. 21—The McLaughlin Motor Car Co., Ltd., of Canada, which is the Canadian representative of the Buick Motor Co., and which assembles and sells the standard Buick models under the name of the McLaughlin-Buick, has reduced car prices as follows:

H-62 Roadster, $1,500; H-62 Special, $1,545; H-63 Touring, $1,500; H-63 Special, $1,575; H-62 Coupe, $2,075; H-63 Sedan, $2,225; H-44 Roadster, $1,925; H-44 Special, $2,050; H-44 Extra Special, $2,090; H-45 Special, $2,050; H-45 Extra Special, $2,090; H-46 Coupe, $2,625; H-49 Seven Passenger, $2,365. All prices, however, are subject to war tax.

Chicago Office for Warnock-Wirth

SIOUX CITY, Jan. 22—The Warnock-Wirth Sales Co. has located its department of sales at 624 S. Michigan Avenue, Chicago, under the management of C. H. Scribner.

Bosch Magneto Is Reorganized

The American Bosch Magneto Corp. Takes Over Entire Plant of Old Company

NEW YORK, Jan. 23—American Bosch Magneto Corp. is the new name of the entirely reorganized Bosch Magneto Co. which on Dec. 7 was sold by Alien Property Custodian A. Mitchell Palmer. Under the new regime, the Bosch company is 100 per cent American, and has as its officers the following: President, A. T. Murray, president of the Bethlehem Motors Corp.; vice-president and treasurer, George A. MacDonald, president of the Chicopee National Bank, Springfield, Mass.; vice-presidents, A. H. D. Altree and Leon W. Rosenthal; secretary and assistant treasurer, J. A. MacMartin. Directors: Geo. A. MacDonald; A. T. Murray; Martin E. Kern, president of the Penn County Trust Co., Allentown; Henry N. Sweet and H. B. Benedict, of Hornblower & Weeks, bankers; C. H. Dwinnell, vice-president First National Bank of Boston; H. C. Dodge, chairman of the board of directors of Gray & Davis; Duncan C. Holmes, vice-president of the Chase Securities Co.; Philip L. Spalding, president of the New England Telephone & Telegraph Co., Boston.

The new company has taken over the entire holdings and property of the old, including the Springfield plant and all American and foreign patents and trademarks under which the old company operated. At the time the plant was sold by the Alien Property Custodian it was operating practically to capacity on government work.

Goodyear Dealer Method Is Legal

NEW YORK, Jan. 23—The method of the Goodyear Tire & Rubber Co. in doing business with its dealers and in refusing to sell to those who will not maintain its resale prices is legal, according to a decision by Judge Hand, rendered late last week. H. P. Baran, a Goodyear dealer, filed suit against the Goodyear Tire & Rubber Co., claiming infringement of the Sherman and Clayton laws.

He alleged that Goodyear conspired to obtain a monopoly and restrain trade and commerce in their tires; that they selected the dealers who should sell their tires, forbade them to sell other dealers, and instructed them to sell only at the prices and terms fixed, under penalty of forfeiting their position as Goodyear dealers.

Counsel for the Goodyear company pointed out that the company's object was to protect the public and insure their getting maximum service from Goodyear products. Judge Hand ruled that the Goodyear method is legal, stating that the selected dealers could do as they pleased with the merchandise, that there was no agreement among dealers to fix prices or restrict sales, and that the principal point at issue was whether the Goodyear company was within its rights in attempting to prevent price-cutting by refusing to sell to dealers who did not maintain the suggested prices. No decision to which he was referred, said Judge Hand, "prevents a single trader from rejecting a customer because he did not like the prices at which the customer resold."

Packard Biplane at $15,000

Two-Seated Machine to Be Sold Through Dealers—Other Dealers Interested

DETROIT, Jan. 23—The Packard Motor Car Co. is shortly to place on the market a two-seated biplane which is to be sold through Packard dealers at a figure close to $15,000. The Packard Company, therefore, becomes the first manufacturers of passenger cars and trucks to take up, in a commercial way, the production of airplanes for general use.

The decision of the company to enter this new field is not altogether surprising in view of its experience in the development of an airplane engine of its own and of the intimate relationship between the Packard engineering force and the finished Liberty engine. It was largely through the efforts of Jesse G. Vincent, at that time vice-president of engineering of the Packard Company, that the Liberty engine was designed and brought to perfection.

Machines Ready in 30 to 60 Days

Beyond the fact that the machine is to be a two-seated biplane, little regarding the design and construction has been permitted to become public. It is expected that the first machine will be ready in from thirty to sixty days, and it is planned to supply them to dealers as rapidly as possible. Already the Chicago dealer has ordered one and other dealer organizations see in the machine a potential market composed of well-to-do sportsmen.

That dealers will take readily to the sale of planes, and that they believe in the possibilities of selling such machines is indicated by the fact that in both Milwaukee and Philadelphia, dealers have recently arranged to handle aircraft. George W. Browne, Milwaukee distributer of Overlands, is to take on the distribution of Curtiss machines, which are made by the Overland interests; and in Philadelphia, Isenberg Brothers have prepared plans and shortly will erect a building to be used for the exhibition and sale of heavier-than-air machines. The company will sell both new and used machines.

—

Banquet for "Rick" Feb. 3

NEW YORK, Jan. 23—Rickenbacker is coming back. He has already sailed, and in honor of his home-coming, the Contest Board of the American Automobile Association will tender him a monster banquet. It is to be held at the Waldorf-Astoria, New York, Monday, Feb. 3. Associated with the A. A. A. in the arrangements for the dinner are the N. A. C. C., the Automobile Club of America, the S. A. E., the M. A. M. A., the Aero Club of America, the New York Dealers' Association and the Aircraft Manufacturers Association. It is expected that 1000 will attend.

—

PARIS — Enlisted in the American Army as a first-class sergeant in early 1917, race driver Eddie Rickenbacker will sail for America in a few days with the rank of Captain and Squadron Commander, wearing the red ribbon of the French Legion of Honor, the highest military decoration which can be bestowed by France; with the French Croix de Guerre and three citations, with the American D. S. C. and seven citations, and a record of 26 German planes officially shot down in combat, this constituting the record of the American army.

U. S. Exports More Cars and Trucks

November Figures Show Gain in Vehicles and Drop in Parts

	Cars	Value	Trucks	Value	Parts
1918					
Nov.	2,226	$2,576,622	974	$2,709,362	$2,166,719
Oct.	1,708	1,881,462	737	2,192,556	3,700,687
1917					
Nov.	5,006	4,820,738	1,496	3,538,077	2,535,230

WASHINGTON, Jan. 22—So much is dependent on the amount of ocean shipping available and the conditions regarding gasoline and tires existing in a number of countries with which in more normal times we have steady and uninterrupted business relations, that it is obviously unfair to compare any one month's exports with those of another.

There is no doubt whatever that there are plenty of orders for automotive products from Europe, Asia, Africa, Australasia and Latin America, but it is equally true that in a greater or lesser degree United States manufacturers still experience difficulties in shipping promptly. It is also obvious that the demand for passenger cars is bound to fall off in countries where gasoline is either rationed or where no fuel at all is available. Happily, these conditions are mending rapidly. The figures given above and those contained in the table herewith are self-explanatory and disclose a satisfactory state when abnormal trading conditions are considered.

—

Saxon Back to Car Production

DETROIT, Jan. 21—The Saxon Motor Car Corp. is getting back to passenger car production.

Exports of Automotive Equipment for November and Eleven Previous Months

	Month of November				Eleven Months Ending November, 1918			
	1918		1917		1918		1917	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	19	$189,000	1	$17,250	48	$607,255	139	$1,082,957
Airplane parts	......	56,900	......	3,083,275	......	4,634,641	......	14,245,485
Commercial cars	974	2,709,362	1.496	3,538,077	9,412	24,178,263	13,672	35,162,355
Motorcycles	657	165,400	637	136,829	8,731	2 054,980	13,036	2,741,707
Passenger cars	2,226	2,576,622	5,006	4,820,738	35,232	34,074,635	59,309	46,492,703
Parts, not including engines and tires	......	2,166,719	......	2,535,230	......	31,415,539	......	26,672,348
Totals (trucks, cars and parts value only)	......	$7,452,703	......	$10,894,045	......	$89,668,437	......	$108,327,406

	EXPORTS BY COUNTRIES NOVEMBER, 1918				ELEVEN MONTHS ENDING NOVEMBER, 1918			
	Passenger Cars		Trucks		Passenger Cars		Trucks	
	No.	Value	No.	Value	No.	Value	No.	Value
Argentina	22	$23,864	......	....	1,465	$1,520,139	43	$39,863
Australia	260	228,416	......	....	3,372	3,031,942	......	....
British India	7	8 688	......	....	64	58.834	......	....
British South Africa	161	158,682	......	....	1,076	933,661	......	....
Canada	301	287,115	159	$238,872	8,487	7,065,188	1,499	1,892,135
Chile	23	53,176	......	....	1,605	2,061,598	......	....
Cuba	150	213,947	36	59,345	1,788	2,429,204	......	....
Denmark	39	52,726	......	....	71	110,873	507	1,021,986
Dutch East Indies	139	229,856	......	....	1,066	1,293,903	......	....
France	2	3,600	422	1,784,870	999	1,118,928	2,986	11,213,845
Mexico	160	176,596	......	....	1,828	1,429.626	......	....
New Zealand	148	134,755	......	....	1,355	1,156,986	......	....
Norway	17	30,525	......	....	198	430,514	......	....
Philippine Islands	8	16,017	......	....	1,640	1,416,540	......	....
Russia in Asia	3	11,734	......	....	3	11,934	15	18,200
Russia in Europe	......	....	......	....	10	8,325	2	5,454
Spain	38	75,467	......	....	761	974,843	......	....
United Kingdom	31	98 003	32	66,764	422	1,081,347	2,254	6,651,869
Uruguay	135	64,700	......	....	1,351	299 787	......	....
Other Countries	582	708,715	334	564,491	7,471	7,150,363	2,106	3.334,911
Totals	2,226	$2,576,622	974	$2,709,362	35,232	$34,074,635	9,412	$24,178,263

Load Trucks with 3% Tax

Conference Committee Puts the Impost Back, But Lets Farm Tractors Off

WASHINGTON, D. C., Jan. 20—The Conference Committee of the Senate and House of Representatives has put back in the new War Revenue Bill a tax of 3 per. cent on commercial vehicles. The action of the committee was not altogether unexpected, for the vote of the Senate in eliminating the 5 per cent tax from the original bill was very close. Thirty-three voted for its elimination, as against twenty-eight for its retention in the measure.

In deciding definitely the tax for the motor trucks, the Conference Committee appears to have been guided by three principal ideas. These are:

1. That motor truck manufacturers were not really limited in their production prior to the signing of the armistice, but instead were permitted to expand considerably;
2. That during this period of only slightly restricted production and expansion, manufacturers made considerable money; and
3. That commercial motor vehicles have done much damage to the public highways, and are continuing to do so.

As the War Revenue Bill stands at present, it includes the tax of 5 per cent on the sales price of passenger cars, motorcycles, tires, spare parts and all accessories (the tax on tires and parts and accessories applies only when sold to other than a manufacturer) and 3 per cent on motor trucks. The proposed tax on farm tractors has been definitely eliminated by the Conference Committee.

Inasmuch as both the Senate and the House of Representatives have agreed upon a tax of 5 per cent on the sale price of passenger cars, it is practically a foregone conclusion that this impost will stand. The Conference Committee, in fact, has no authority to eliminate this tax because of its previous acceptance by the Senate and House.

Certificate Necessary for Norwegian Imports

WASHINGTON, Jan. 18—Exporters shipping to Norway must hereafter obtain advice from the prospective importer in Norway that an appropriate import association or the Norwegian Finance Department has issued a certificate permitting the import of the proposed consignment, before filing application with the War Trade Board here. The certificate must be either issued or confirmed subsequent to May 10, 1918. Inquiries regarding the Norwegian Import Association's regulations and their certificates should be addressed to the Norwegian Legation, Commercial Department, Washington, D. C.

All questions of Norwegian import control or difficulties relating thereto should be settled before filing applications with the War Trade Board.

In filing applications for licenses to ship commodities which are controlled by Norwegian import associations, the application must show as the consignee the association that issued the certificate, and the exporters are also required to state on applications the name of the person or firm in whose favor or on whose behalf the import certificate was issued; as, for example:

Consignee—Oil and Colour Merchants' Association, Christiania, Norway.

Purchaser Abroad—Here state person or firm to whom certificate was issued. Address of such person or firm.

Applications for licenses to export commodities which are not controlled by Norwegian import associations must be covered by a guarantee certified by the Norwegian Finance Department and further certified by an American consul in Norway. Shipments falling within this class may be consigned directly to the importer.

Sixth National Foreign Trade Convention in April

CHICAGO, Jan. 18—The National Foreign Trade Council will hold its sixth National Foreign Trade Convention at the Congress Hotel, on Thursday, Friday and Saturday, April 24, 25 and 26. The convention will deal with foreign trade as a factor in stabilizing American industry. It will take up problems involving the conversion of war industries to the needs of peace; development of our foreign trade to provide employment for our soldiers, sailors and war workers; and the formation of a definite policy dealing with shipping.

N. A. C. C. Meetings During N. Y. Show

NEW YORK, Jan. 20—The National Automobile Chamber of Commerce has two meetings scheduled to be held during the New York show period. The first of these will be devoted to passenger cars and is to be held on Feb. 5; the second will be devoted to commercial vehicles and will be held Feb. 11.

Canada Revises Truck License Fees

TORONTO, Jan. 18—The Canadian Department of Highways has put into effect a new scale of license fees for trucks. The change is a double one, both the fee and the basis for computing it having been revised. In the past 1 and 2-ton trucks have paid $10. For each additional ton they have paid a fee of $5. In the future $10 will be the minimum charge for a truck of 2 tons "combined weight and carrying capacity," which corresponds approximately to a 1-ton truck under the old method. For trucks exceeding 2 tons, weight and carrying capacity, there is a sharp increase. Up to 8 tons the extra fee is $5 a ton additional as formerly, but the actual amount paid will be increased by the new basis. On trucks of over 8 tons up to 10 tons the rate will be $7.50 per ton, and on all trucks of over 10 tons, $10 per ton.

Another change made in license fees makes the rate for the dealer's license and markers $20, the dealer having the right to use the markers on any car in his establishment apart from cars used for hire. This does away with the system that allowed a dealer to pay $10 for the license and original markers and $5 for each extra set of markers. That system was discontinued because of misuse of the extra markers.

Continue 9 Standard Tire Sizes

Rubber Association at Annual Meeting Decides Not to Revert to Former Schedules

NEW YORK, Jan. 17—The nine standard sizes of pneumatic tires which were evolved by the War Service Committee of the Rubber Association of America in conjunction with the Society of Automotive Engineers are to be continued. This was decided at the annual meeting of the Rubber association held at the Waldorf yesterday.

These nine sizes include both plain and non-skid treads in the following dimensions, all being straight-side type except the two smallest, which are clincher: 30 x 3½, 31 x 4, 32 x 3½, 33 x 4, 34 x 4½, 35 x 5 for passenger cars, and 36 x 6, 38 x 7 and 40 x 8 for commercial vehicles.

These are the sizes which the industry decided it could get along with during the war, eliminating all other of the 287 sizes which heretofore have been made. Now that the war is over, it has been decided that the benefits of standardizing on these sizes may well be perpetuated.

Nothing has been done as yet with regard to the continuation of the standard sizes of solid tires adopted soon after the pneumatic sizes were decided upon. This is a matter which is to be taken up at a later date. It was the consensus of opinion of the meeting that the solid tire standards be continued, though there may be some slight change in one or two of the sizes.

Prior to the meeting at which this action was taken the War Service Committee was formally disbanded, and to the Pneumatic Tire Division of the association there has been added a solid tire division, which is headed by A. G. Partridge, sales manager of the Firestone Tire & Rubber Co.

Homer E. Sawyer, vice-president in charge of the footwear division of the U. S. Rubber Co., was elected president of the association, other officers elected being: First vice-president, Harry T. Dunn (Fisk Rubber Co.); second vice-president, F. A. Seiberling (Goodyear Tire & Rubber Co.); secretary and treasurer, Harry S. Vorhis. Seven new directors were elected as follows: John F. Lowman (Philadelphia Rubber Works Co.), Seneca G. Lewis (Pennsylvania Rubber Co.), James Newton Gunn (U. S. Rubber Co.), C. W. McLaughlin (Mohawk Rubber Co.), John Morgan (McGraw Tire & Rubber Co.), G. W. Henne (Mansfield Tire & Rubber Co.), A. D. Thornton (Canadian Consolidated Rubber Co.).

Would Appropriate $600,000,000 for Roads

WASHINGTON, Jan. 18—The Senate Committee on Post Offices and Post Roads is considering an amendment to the rural post roads bill of 1916 which will appropriate $600,000,000 between

1919 and 1924 for development of the rural post roads. The amendment was offered by Senator Bankhead and calls for appropriations of $50,000,000 immediately, $75,000,000 July 1, 1919, $75,000,000 July 1, 1920, $100,000,000 July 1, 1921, $100,000,000 July 1, 1922, $100,000,000 July 1, 1923, and $100,000,000 July 1, 1924, to be used in the construction of highways under House Bill 7617, which was passed in July, 1916. This bill authorizes the Secretary of Agriculture to co-operate with the various state highway departments in the construction of rural post roads. The bill allows the Secretary of the Department of Agriculture to apportion funds to each state. The original bill appropriated $75,000,000 between 1917 and 1921 for this purpose. A large part of this sum—more than $60,000,000—is still available under the original act due to the delay in highway construction caused by the war.

Milwaukee Tire and Supply Men Organize

MILWAUKEE, Jan. 20—Tire and supply dealers of Milwaukee have organized an association for mutual benefit and to eliminate trade abuses of various kinds, notably promiscuous discounting. The new body is known as the Tire Dealers' Association of Milwaukee and officers have been elected as follows:

President, Russell L. Stephens, manager Republic Tire Co., 472 Milwaukee Street; first vice-president, George A. Brown, Brown's Tire Shop, 2428 Lisbon Avenue; second vice-president, Henry F. Stenzel, president and manager Milwaukee Tire & Supply Co., 457-459 Milwaukee Street; secretary, H. A. Packard, Standard Racine Rubber Co., Oneida and Jefferson Streets; treasurer, Lawrence J. Engel, Milwaukee Tire & Rubber Co., 456 Milwaukee Street.

Free Motor Mechanics' School for Chicago

CHICAGO, Jan. 21—A school for training motor mechanics is being established by the Board of Education of this city. It will operate on a continuation plan, the students attending two half days a week and the school being run continuously. It will be a trade school to train men and women in the proper maintenance and operation of motor cars, trucks and other automotive apparatus. Men from service stations, garages and repairshops are sought in particular. Those who conduct the motor car business here, it is said, are going to send employees from their service stations and repairshops to this school and will pay them while attending.

The school is to be located in the building which has been used by the government for training mechanics for the motor transport corps and mechanical divisions of the army. The plan for study includes English, drawing, mathematics, chemistry, physics and mechanics in general. Mechanics will include all units of the motor car. There will be classes in carburetion, ignition, starting, lighting, mechanics of the engine, of the transmission and the differential.

Gasoline Restriction Off in France

Motorists Can Now Buy All They Want at $1 to $1.20 a Gallon—Plenty on Hand

PARIS, Jan. 1 (Special Correspondence)—France removed all her gasoline purchase restrictions to-day and gave greater liberty to motorists than they have possessed since the beginning of the war. To purchase gasoline it is no longer necessary to apply to the police or the civil authorities; all that is necessary is the cash to pay for the fuel.

Since the signing of the armistice the gasoline supply has been fairly plentiful. The retail price is $1 to $1.20 per gallon outside the city of Paris. At the present time France has a stock of 90,000 tons of gasoline and 50,000 tons of kerosene. Shipments are being made into France at the rate of 90,000 tons per month, and it is expected that this rate will be maintained for a long time. By reason of the return of Alsace and Lorraine to France the country has secured at least 50,000 tons of gasoline per year from the Pechelbronn wells. These wells have been exploited by the Germans for the last four years.

Travel restrictions have not all been removed, but in the interior zone of France motorists can travel within a radius of 30 miles of their homes without any permits or formalities. Beyond this radius it is necessary to show a sufficient reason why the journey should be made by automobile. In the army zone automobile travel is still forbidden except to holders of a special pass issued by the military authorities. It is understood that these travel restrictions are only of a temporary nature. Except in the army zone, there is no sound reason for the 30-mile radius restriction; it is doubtful, indeed, if this law will be enforced with any amount of vigor, for France is too short of man power to place police on the roads for the purpose of holding up motorists.

The French Government is anxious to get the devastated regions thrown open to visitors as early as possible. One government department is working on this problem now, and is planning routes and arranging for the rebuilding of hotels, so that foreign visitors may be received in France this summer. As an indication of the spirit at work, preliminary arrangements have already been made for a huge motor and cycle tour through Alsace during the summer, probably in the month of August.

Price Effect of Oil Discovery in Texas

DALLAS, Jan. 21—Since the recent oil discovery in West Texas and the enormous production that is being made daily, it is generally predicted that within a few months the price of gasoline will be reduced. In fact in some places the price has already been reduced from ½ to 1 cent per gallon, and in Chicago there is a merry little price war between Texas and Standard. Many refineries are planned or are already under construction in the new oil field. Eight refineries have been erected at Wichita Falls and four at Ft. Worth. Others are to be erected at Abilene, Weatherford, Ranger and Dallas. The average daily production, in Burlburnett and Ranger alone, is said to be about 79,000 bbl. per day.

Highways Committee Formulates New Plans

WASHINGTON, Jan. 18—Post-war plans for highway development by the Highways Transport Committee are being completed. They include uniform state traffic laws and police traffic regulations; stimulation of food production by food distribution via motor truck; a survey of facilities available for highways, transportation and city marketing; transportation facilities for soldier farms, including movements to open up large tracts of grounds for settlements; development of transportation facilities for resources other than agricultural; co-operation with railroads and waterways taking in feeder extensions; coordination of highways transport with rail and electric line freight or express; standardization of highway shipping methods, and the placing of returned soldiers experienced in highways transport.

Campaigns for snow removal in the various states are being undertaken through the regional and district organizations. New Jersey has initiated definite plans for handling snow. Other states such as Pennsylvania, New York, Michigan and Ohio are working in co-operation with the Highways Transport bodies through the Highway Commissioner offices. Raymond Beck, field engineer of the committee, is compiling bulletins dealing with the causes of snow drifts, methods of prevention and methods of fighting snow and removing it. These bulletins will be distributed to the various interested agencies.

Employment of Returned Soldiers

BOSTON, Jan. 20—The problem of employing returned soldiers will be discussed by the automobile dealers at a meeting here next week. As the half-page advertisements urging them to re-employ soldiers did not meet with the approval of all the dealers, they have decided to have a conference on the matter. Many dealers have already taken back all the soldiers who have returned, and they will continue the policy as far as possible, regardless of any concerted action.

Johnson to Direct N. A. D. A. Road Work

ST. LOUIS, Jan. 20—Pike Johnson of Washington, who put over the highway transport movement in Colorado, has been made good roads representative of the N. A. D. A. He is at present engaged in good roads educational work and will supply any information desired.

Complete Program for S. A. E. Meeting

Annual Gathering Includes Four Professional Sessions, Ladies' Night and Dinner

NEW YORK, Jan. 22—The complete program for the forthcoming annual meeting of the Society of Automotive Engineers, which is to be held in the Engineering Societies Building Feb. 4-6, is now ready and printed copies are being distributed.

Prior to the opening professional sessions on Wednesday morning, Feb. 5, there will be a meeting of the Standards Committee on Tuesday, Feb. 4. Following the close of the professional sessions there will be a ladies' night on the evening of Feb. 5, a reception and dance being scheduled for the North Ballroom of the Hotel Astor.

On the following evening, Thursday, Feb. 6, the society's Victory Dinner will be held in the Grand Ballroom of the Hotel Astor at 7 o'clock. Job E. Hedges will be toastmaster.

After the dinner members and their guests will attend the Midnight Whirl at the Century Grove on the roof of the Century Theater. The S. A. E. has purchased the entire house. The complete program is given at the top of the next column.

PROGRAM FOR THE S. A. E. ANNUAL MEETING

Wednesday, Feb. 5

Tanks	Lieut.-Col. Herbert W. Alden
Automotive Ordnance Apparatus	William G. Wall
Principles of the Wheeled Farm Tractor	Edward S. Hewitt
Automotive Applications of Marine Engines in the War	George F. Crouch
Probable Effect of Aeronautic Experience on Automobile Practice	Henry M. Crane, Howard Marmon, O. E. Hunt
High Efficiency Automobile Engines	D. McCall White
Development of the U. S. Standard Military Truck	J. G. Utz

Thursday, Feb. 6

Symposium on Fuel	Dr. Joseph E. Pogue
Unmined Supply of Petroleum in the U. S.	Dr. David White
Present Status of Refinery Practice in the U. S.	Dr. E. W. Dean
Status of Engine Efficiency in the U. S.	Dr. H. C. Dickinson
More Efficient Utilization of Fuel	C. F. Kettering
Mexico as a Source of Petroleum and Its Products	E. De Golyer
Liberty Engine	J. G. Vincent
Fixed Radial Cylinder Engine	John W. Smith
Proportioning Airplanes to Their Engines	Lieut. Alexander Klemin
Making the Airplane a Utility	Grover C. Loening
Problems of the Naval Aircraft Factory	Commander H. C. Richardson, U. S. N.
Navy Dirigibles	Starr Truscott
Operation of Naval Aircraft	Commander J. H. Towers, U. S. N.

Bill to Validate "Informal" Contracts

(*Continued from page 226.*)

compliance with statutory requirements, the contractor or the Government by a duly authorized officer from the Department of Justice may give notice to the Secretary of War of intention to appeal to the commission, and provided notice of appeal is filed with the chairman of the commission within thirty days: Provided, however, That if the representative of the Department of Justice agrees with the action of the War Department there shall be no appeal by the Government but settlement can be made at once. On an appeal being taken the commission shall thereupon proceed to determine the questions at issue as set forth in said notice of appeal; and the contractor shall be entitled either to receive the whole amount of such award as may be made as in full of his claim on the questions submitted or 75 per centum of the same and sue the United States in the Court of Claims for any remainder, all as provided next above as to agreements otherwise within the purview of this act.

That in executing the duties and powers conferred by this act the commission may make its own rules and regulations and may hear and determine issues informally. It shall be the duty of the Secretary of War to furnish to the commission such evidence, documents, or papers pertaining to transactions as to which notice of appeal has been filed as the commission may request. The commission is authorized in its discretion to appoint an examiner in any region or district when such region is within the United States where in its judgment the taking of additional testimony is necessary to the determination of any case. Such examiner shall be a resident of the region or district for which he is appointed, and shall not have any interest, directly or indirectly, in any contract or transaction coming before him or receive any compensation save and except such per diem compensation and expenses as shall be fixed by the commission. Whenever the commission shall refer to any such examiner any claim presented hereunder, the examiner shall proceed, under the direction of the commission, to hear the parties, take the proofs, and return the same to the commission with his recommendations thereon as promptly as possible.

SEC. 3. That nothing in this act contained shall be held to validate any such contract unless the officer who was at the time of the making of such contract the chief of the division or bureau, as the case may be, in which said contract was negotiated, or in the event that such officer was not responsible for the making of such contract, then the officer in such division or bureau who was so responsible, together with the officer who signed said contract, shall each severally make and subscribe to an affidavit in writing, giving the definite terms of such contract, the name or names within his knowledge, of any such officer or officers who took part in the negotiation or making of the same, and stating whether or not within his knowledge any officer aiding in such making was interested, directly or indirectly, in said contract, and in addition subscribing to an oath to be appended to said affidavit in substantially the following form and tenor:

"I, ———, Chief of the Division or Bureau (naming it) in which the contract hereinbefore mentioned was negotiated, at the time of negotiation thereof, and the officer in the Division or Bureau (naming it) responsible for the making of the contract hereinbefore mentioned, and I, ———, the officer who actually signed said contract, do hereby each severally swear that I am not and was not at the time of the making of said contract directly or indirectly interested in said contract."

That in respect to any such contract as to which any one of said officers can not take the foregoing oath, or after diligent search or inquiry by the contractor cannot be found, or is at the time actually engaged in foreign service, or refuses to take said oath, then upon such facts and the fact required in the oath of such officer, appearing by an affidavit, of the contractor, or of one of its partners, chief officers or chief agents acting in its behalf, the Secretary of War shall promptly report such contract to the War Contracts Appeals Commission, and furnish to said commission such evidence, documents, and papers pertaining to the transaction as may be within his control, and such commission may request, and original jurisdiction is hereby vested in, said commission to hear and determine said claim with the powers and upon the procedure hereinbefore described in this act. Said commission shall make its award or finding thereon, and deny said claim or grant it in whole or in part, according to the justice and equity thereof, and the award or finding shall have the same force and effect, and create the same rights as if made under the provisions of section three of this act. And it shall be the further duty of said commission in hearing, investigating, and determining such claim to find and determine whether any of such officers is or was at the time of the making of said contract directly or indirectly interested in said contract.

SEC. 4. That nothing in this act contained shall be construed to relieve any officer or agent of the Government from prosecution under the penal statutes of the United States for any fraud, criminal conduct, illegality, or irregularity in connection with any of the agreements or orders referred to herein or the execution or signing thereof.

French Plant for Doble-Steamer

DETROIT, Jan. 20—The Doble-Detroit System Motors Co. has closed a deal whereby their car will be placed on the European market by the Society of Francais Doble, Paris, and the Detroit plant is about to ship its first complete machine to France. The French company is given the exclusive manufacturing and sales rights in France.

Henry Chevalier, formerly in charge of the Russian Renault Co., as director of technic, has retured to Paris after spending several months in Detroit, testing the car and studying manufacturing details. Paul Sicault, for a number of years identified with the Renault company in both France and Russia, is general manager of the Francais-Doble plant. A number of prominent French munition and automobile makers are interested in the foreign company and immediate production is being planned on a large scale.

Olympian Building Cars Again

PONTIAC, Jan. 21—The Olympian Motors Co., which for several months has engaged almost exclusively in war work, is getting back into passenger car production again. Although the Government contract calling for the manufacture of aerial drop bombs will keep the munition end of the plant running for some time, the company is busy re-organizing for resumption of its peace time business, and is now building three cars weekly.

The war contract will be completed by March 1. By that time the company expects to be turning out from ten to fifteen complete cars daily and have 400 men working in the motor car department.

The new Olympian car will be identical to that shown at the New York show last year with the exception of a few minor changes, the nature of which will be announced in a short time. No price reduction is contemplated, and the company is guaranteeing its dealers and distributers against a price drop. It sells for $1,240. The 1919 production schedule calls for the manufacture of 5000 cars. Frost-Norton Motors Co. of Pittsburgh, ordered 500 cars for immediate shipment.

Coal Production Increases 34,092,437 in Year

WASHINGTON, Jan. 21—Bituminous coal production for the week ended Jan. 11, 1919, totalled 10,287,000 tons as compared with 8,428,000 tons for the week ended Jan. 4, and 10,163,000 tons during the week of Jan. 11, 1918.

Anthracite coal production for the week totalled 1,651,000 tons, an increase of 262,000 tons over the production of the week of Jan. 4, but a decrease of 68,000 tons as compared with the corresponding week of 1918.

During the week ended Jan. 4, total losses of output of bituminous coal were 25.4 per cent, of which no market comprised 12.3 per cent, labor shortage 5.9 per cent, mine disability 3.6 per cent, car shortage 2.1 per cent and all other causes 1.5 per cent.

Bituminous coal production for the year 1918 amounted to 585,883,000 tons as compared with 557,790,563 tons for 1917, an increase in production of 34,092,437 tons for the year. Following is the bituminous coal production by months for 1917 and 1918:

—

Deeds Is Completely Exonerated

(*Continued from page* 227)

ings be instituted against Col. Deeds based upon those publications, because it is doubtful whether he ever saw the paragraph which has been adversely criticized and the statement contained in it was in accord with what Col. Deeds apparently believed and had reasonable cause to believe to be the facts."

In conclusion, the findings quote John D. Ryan, former head of aircraft production, to the effect that Col. Deeds performed a great service in expediting Liberty engine production and by not observing the strict regulations probably hastened quantity production by many months. Following is the letter correspondence from Secretary Baker to the Military Affairs Committeee:

Chairman Committee on Military Affairs,
House of Representatives:

Upon the submission to the President of the report of Honorable Charles E. Hughes and the report of the Attorney General covering the Aircraft investigation, I directed that the specific recommendations contained in these reports be extracted for my consideration and for such action by me as might be required in the premises. These extracts were referred to the Judge Advocate General of the Army, directing a thorough and comprehensive inquiry into the allegations affecting the conduct of Colonel Deeds. He was directed, not only to review all evidence taken by Judge Hughes, which the Attorney General kindly made available, but to secure all other facts obtainable in this case.

The Judge Advocate General committed the matter to a board of review consisting of officers of high ability and character wholly disassociated from any previous business or personal relations either with Colonel Deeds or with any matters affecting aircraft production. This board carefully and systematically examined all of this evidence and obtained all possible additional facts, and its conclusions are, therefore, based upon fuller inquiry than was found possible within the time and opportunities at the disposal of Judge Hughes, and this examination is in effect the accomplishment of the thorough inquiry which Judge Hughes had in mind when he suggested that these transactions be examined by a court martial. The purpose of Judge Hughes' suggestion is therefore accomplished.

This record undoubtedly shows that Colonel Deeds, absorbed in the activities of aircraft production, neglected to give his personal attention to transactions affecting his personal financial affairs, and this neglect on his part gave rise to appearances which required painstaking investigation in order to show their true character.

The unanimous report of this board of review, approved by the Acting Judge Advocate General, recommends that Colonel Deeds be not tried by court martial on any of the grounds suggested, and this recommendation has been approved by me.

Colonel Deeds was one of a large group of men who came to Washington at great personal and pecuniary sacrifice to render service to the Government, in the great emergency caused by our participation in the war.

My duty as Secretary of War with regard to any public servant under my jurisdiction is clearly to bring about proper punishment for wrongdoing and equally clearly to protect those public servants whose conduct is faithful and upright against embarrassment, humiliation or loss.

Very wide publicity has been attached to the acts of Colonel Deeds as a member of the Aircraft Board. Whether it will ever be possible to overtake the judgments which have been formed upon partial information on this subject I do not know; but this Department will make every effort to secure the widest publicity for the action now taken and for the grounds upon which it rests. To carry this into effect, I am therefore transmitting to your Committee for its information, and with the request for its publication in the Record, if the proprieties of the situation permit, a copy of the report of the Judge Advocate General. Similar copies are being furnished the Chairman, Committee on Military Affairs, United States Senate, the Attorney General and Colonel Deeds.

Inasmuch as the purpose of Judge Hughes' suggestion has been accomplished, I have directed that all the records in this case be filed in the War Department and that this matter be considered as closed. Cordially yours, Newton D. Baker, Secretary of War.

—

A Summary of the Movement of Crude Petroleum in November, 1918

WASHINGTON, Jan. 21—The comparative summary of the movement of crude petroleum, compiled from reports received by the U. S. Geological Survey, represents the operations of 220 pipe-line and refining companies handling or receivig oil directly from the productive fields east of the Rocky Mountains. Statistics of petroleum movement in California are not included for the reason that first-hand data were not available.

1918 Output of Petroleum Breaks Record

WASHINGTON, Jan. 21—The quantity of crude petroleum marketed from oil wells and field storage tanks in the United States in 1918 reached the record-breaking total of 345,500,000 bbl., as shown by preliminary estimates made by John D. Northrup of the United States Geological Survey. This output is an apparent gain of 3 per cent over the former high record, 335,315,601 bbl., established in 1917.

The output in 1918 includes no less than 6,500,000 bbl. of crude oil removed from field storage, but excludes drafts aggregating 20,500,000 additional bbl. from stocks of pipe-line companies. The surface reserve of crude oil held by oil producers and pipe-line companies in the United States at the end of 1918 is estimated at 123,000,000 bbl., compared with 150,000,000 bbl. at the end of 1917. These figures show that the demand for domestic petroleum in 1918 amounted to about 366,000,000 bbl. The exports of crude oil, most of it to Canada and to northwestern Mexico, aggregated about 5,500,000 bbl., leaving a total of 360,500,000 bbl. available to supply domestic needs. This quantity was insufficient, however, and about 36,500,000 bbl. was imported, nearly all from Mexico, to meet domestic requirements, which amounted in all to about 397,000,000 bbl.

The output is apportioned among the major fields as follows:

Field	1918	1917
Appalachian	25,300,000	24,932,205
Lima-Indiana	3,100,000	3,670,293
Illinois	13,300,000	15,775,860
Oklahoma-Kansas	139,600,000	155,043.596
Central & North Texas	15,600,000	10,900,646
North Louisiana	13,000,000	8,561,963
Gulf Coast	21,700,000	26,087,587
Rocky Mountain	12,660,000	9,199,310
California	101,300,000	93,877,549
Alaska & Michigan	....	10,300

—

Stroh Insures Employees

DETROIT, Jan. 20—The Stroh Casting Co. has purchased a group life insurance policy to cover the employees of its plant. Insurance will be issued each employee according to his length of service and automatically increases in amount as his term of service increases. Those employed from 3 to 6 months will benefit to the extent of $250, from 6 months to 1 year, $500; from 1 to 2 years, $1,000; from 2 to 3 years, $1,500; from 3 to 4 years, $2,000; from 4 years and over $2,500. In case of permanent disability, the company is prepared to pay the insured the amount of his policy.

Crude Petroleum Moved from Field Sources

Field	November, 1918.	October, 1918.	November, 1917.
Appalachian	2,160.909	2,398,947	2,132,583
Lima-Indiana	237,315	242,054	282,227
Illinois	1,019,300	1,145,193	1,246,105
Oklahoma-Kansas	11,334,048	11,763,898	13,822,893
Central and No. Texas	1,904,399	1,740,443	989,486
North Louisiana	1,321,715	1.483,168	290,487
Gulf Coast	1,591,685	1,866,393	1,502,122
Rocky Mountains	1,214,528	1,196,740	781,913

Apparent deliveries of crude petroleum.

Class of Oil.	November, 1918.	October, 1918.	November, 1917.
Appalachian	2,179,361	2,387,174	2,312,448
Lima-Indiana	390,943	176,805	259,368
Illinois	1,019,300	1,342,725	1,258,959
Oklahoma-Kansas	15,251,099	13,897,644	15,033,159
Central and No. Texas,	1,362,330	1,732,453	1,016,318
North Louisiana	1,305,950	1,354,441	653,030
Gulf Coast	1,656,674	1,699,138	1,612,927
Rocky Mountains	1,213,252	1,235,470	868,043

Stocks of crude petroleum at end of month.

Class of oil.	November, 1918.	October, 1918.	November, 1917.
Appalachian	3,428,226	3,446,978	4,062,729
Lima-Indiana	1,207,569	1,361,197	2,002,660
Illinois	2,177,090	2,177,607	4,154,867
Oklahoma-Kansas	73,813,897	77.730,948	99,194,063
Central and No. Texas	5,155,017	4,612,948	2,382,671
North Louisiana	4,766,964	4,751,199	2,926,185
Gulf Coast	7,905,067	7,970.056	9,277,697
Rocky Mountains	965,407	964,131	494,878

Plan a Limited Air Service

War Department Bill Provides Personnel for 2000 Planes—M. T. C. Small, Too

WASHINGTON, Jan. 20—Indications of the size of the future Air Service, Motor Transport Corps and Tank Corps Division of the Army are given in a proposed bill drawn up by the War Department this week. The bill, which will probably be held in abeyance pending possible developments in Europe, calls for an Air Service of 1923 officers and 21,853 enlisted men. The officers include one major general, one brigadier general, twenty-two colonels, forty-five lieutenant colonels, 126 majors, 438 captains, 696 first lieutenants and 594 second lieutenants. An organization of this size would require approximately 2000 airplanes in constant service.

The Motor Transport Corps, according to the proposed bill, will comprise one brigadier general, eight colonels, twenty-two lieutenant colonels, fifty-eight majors, sixty-one captains, 283 first lieutenants, 649 second lieutenants and 20,737 enlisted men. This organization will constantly require 10,000 motor trucks and other vehicles for its equipment. The Tank Corps will comprise 377 officers and 5855 enlisted men.

—

Direct Phone Connection with Airplane

WASHINGTON, Jan. 20—Communication between an airplane in the air and a regular telephone on the Washington city line was established yesterday at the office of Major-General William L. Kenly, Director of Military Aeronautics. Although regular radio telephonic conversation frequently has been held with planes in the air at flying fields, this is the first demonstration of the combination of the radio-phone and regular land telephone.

General Kenly, Colonel F. R. Kenney and Colonel C. C. Culver were present in the office of the Director of Military Aeronautics and talked with Lieutenant Lucas, who was piloting a plane from Bolling Field. The two links in the line were the radio-telephone from the plane to the small station at Bolling Field, and the city telephone system from Bolling Field to General Kenly's office. The conversion of radio to direct wire was made automatically at the Bolling Field station with apparatus devised by members of the Air Service Radio Branch under the direction of Colonel Culver.

—

New Aviation Insignia

WASHINGTON, Jan. 17—An insignia for fliers has been approved with certain changes as follows: (a) Military aviators, junior military aviators and reserve military aviators: a device of oxidized silver consisting of a pair of wings with the shield between; to measure 3 in. from tip to tip.

(b) Military aeronaut, junior military aeronaut and reserve military aeronaut: a device of oxidized silver consisting of a pair of wings with a balloon between; to measure 3⅛ in. from tip to tip.

(c) Observer: an oxidized silver single wing to the left of the letter "O" in bright silver; the "O" to encircle the letters "US" in oxidized silver in relief on an oxidized silver background; the device to measure 1⅞ in. in length.

Flying instructors: gilt insignia of the same design and size as the insignia for officers of the Air Service, omitting the propeller; to be worn just above the right cuff on all coats.

—

Navy Dirigible in Air 40 Hours

WASHINGTON, Jan. 20—Two remarkable endurance flights by the Navy Dirigible A-236 from the naval air station at Key West, one lasting 32 hours and covering 750 miles, and the other 40 hours and 48 minutes, and covering about 850 miles, constituting a service record, were described in official reports made public last night.

Rising winds and threatening storm stopped the first flight Nov. 24, although sufficient fuel and oil remained for 8 more hours. During the first 10 hours the ship was lightened 300 lb. by consumption of gasoline. Her crew brought her down to within 50 ft. of the sea and with buckets and line took up enough water to restore her propeller balance.

The second trip, made Dec. 24-25, was made under overcast skies with a wind ranging from 20 to 36 miles an hour. The propelling motor was stopped only twice, for 3 minutes each time, to fill the oil reservoir.

—

U. S. Naval Aircraft Production

WASHINGTON, Jan. 20—The U. S. Naval Aircraft factory at Philadelphia produced aircraft valued at $5,435,000 up to the time the armistice was signed, according to an announcement made here to-day. It had completed, ready for shipment, 183 twin-engine flying boats at an average cost of $25,000. It had also produced 4 experimental Liberty engine seaplanes carrying the Davis non-recoil gun, at a cost of $40,000 each, and 50 sets of twin-engine flying boat spare parts worth $10,000 per set. In addition, considerable minor experimental work and overhauling of machines from other stations was done.

—

Two Aviators Killed in Week

WASHINGTON, Jan. 21—According to the official statement, there were two fatalities at the aviation training fields throughout the United States during the week ended Jan. 11, one occurring at Park Field, Millinton, Tenn., and the other at Carruthers Field, Benbrock, Tex.

—

No Show for Montreal

MONTREAL, Jan. 21—At the special general meeting of the Montreal Automobile Trade Association, Ltd., it was decided that no show will be held under the auspices of the association during 1919.

Much Confusion About Labor

Conflicting Reports Regarding Shortages and Unemployment Unreconcilable

WASHINGTON, Jan. 20 — Considerable confusion and doubt as to accurate labor conditions throughout the country exist here as a result of conflicting statements made by various officials. On one hand during the past week there have been reports from the Department of Labor and officials of the American Federation of Labor indicating increasing labor surpluses and threatening possible labor troubles as a result. On the other hand, there are denials of these conditions made by Congressmen following receipt of information directly from the various cities supposed to be suffering from labor surplus.

It is stated on one hand that the reports of surplus of labor are to some extent calculated to produce a slackening of army demobilization and consequently continue labor shortage as much as possible, with a consequent maintenance of the war wage standard. Labor authorities, however, maintain that the surplus reported is correct, and that if demobilization continues at the present rapid rate serious unemployment conditions will result.

Reports received during the past week by the Department of Labor indicate a demand for agricultural labor in Arizona, South Carolina, Texas, a slight demand in the building trades in Arkansas, Maine, Oklahoma and Virginia. There is a surplus of labor throughout California, Colorado, Connecticut, Illinois, Indiana, Iowa, Kentucky excepting Louisville, Massachusetts, Michigan, Missouri, New Mexico, New York, Oregon and Utah.

Normal conditions exist in Kansas, while the demand exceeds the supply in Maryland, Minnesota, New Jersey, Pennsylvania, Virginia, Washington and Wyoming. A large surplus of unemployed is reported from Detroit. Rubber workers are in demand in Ohio, and unsettled labor conditions are reported from Toledo. The United States Employment Service reports registering 147,774 applicants for jobs, of whom 103,868 were placed in positions. During the same period 247,619 calls for labor were received. Of the registrants 15,882 were women.

As evidence of the confliction of reports, Pennsylvania shows 18,808 registrations for positions wanted during the week and 57,428 calls for help wanted in the same period.

Twelve states reported a surplus of common labor, according to the department's statement, which adds that Detriot has a surplus of 20,000, Cleveland 20,000, Buffalo 12,000 and Toledo 10,000 workers, while Baltimore has a shortage of 4800, Philadelphia 6000 and Pittsburgh 4000 workers.

Present Organization of Department of Military Aeronautics

DIRECTOR of MILITARY AERONAUTICS

Directs the Department of Military Aeronautics through the Assistant Director and Executive Officer.

MAJ. GEN. W. L. KENLY.

ASSISTANT DIRECTOR

Duties correspond to those of chief of staff; responsible for efficient administration of the Dept. of Mil. Aeronautics.

COL. H. H. ARNOLD.

CONTROL BOARD

Determines policies, makes organization plans, acts as clearing house for all matters outside jurisdiction of any one section. Has supervision over promotions and changes in organization and methods.

Pres.	Lt. Col. W.E. Gillmore.
Member	Lt. Col. J. R. White.
"	Maj. R. P. Cousins.
"	Maj. B. F. Castle.

ORGANIZATION SURVEY

Devotes entire time to questions of organization including, Functions, Facilities, Equipment, Personnel, Methods and Records, to bring about more unified and co-ordinated organization.

In Charge	Mr. R. A. Pettengill.

FOREIGN MISSIONS

Places at the disposal of the Dept. of Mil. Aero. the experiences gained by the Allies in the European War to date.

British	Brig. Gen. C.F. Lee.
French	Lt. Col. J. Tulasne.
Italian	Maj. L. Falchi.

AERO INFORMATION

Procures Indexes, Catalogues, Edits. Files and distributes all information pertaining to the subject of Aeronatuics.

Chief	Maj. J. A. Drexel

EXECUTIVE SECTION

Administration of headquarters; promulgates policies and decisions of Control Board; Co-ordinates work of administrative sections; issues circulars & memo orders, charge of passes & leaves of Hdq'rs, personnel. Ex. Officer & Assts. are the only officers authorized to communicate orally with Gen. Staff, except as specified by Director or Ass't. Director of Mil. Aero.

Executive Officer	Lt. Col. F R. Kenney.
Personnel	Lt. Col. G.H. Shields.
Adm' & Training	Maj. O.H. White.
Radio	Lt. Col. C.C. Culver.
Gunnery	Maj. A.H. Hobley.
Operation & Tech.	Maj. L.H. Drennan.
Supply & Fin'ce	Capt. S.V. Schermerhorn.
Handley-Page Proj.	Capt. F. Briscoe.
Correspond's	Capt. J.B. Reynolds.
Cables	Lt. D.G. Keeble.
Office Mge'm't	Mr. H.W. Cuddy.

TECHNICAL SECTION

Passes on such design of aircraft and its accessories as are submitted to it by the Bureau of Aircraft Production.

Chief	Lt. Col. T.H. Bane.
Exec't Officer	Maj. Geo. Stevens.
Design	Lt. Col. V.C. Clark.
Airplanes	Maj. H.S. Martin.
Armament	Lt. C. Frick.
Instruments	Lt. W.W. King.
Engines	Lt. Theo. Mayns.
Radiators	2nd Lt. G.S. Jacobs.

MEDICAL SECTION

Handles all matters affecting the Medical Department, which relate to development, maintenance, organization and operation of aeronautical personnel their equipment supplies, etc.

Chief	Brig. Gen. T.C. Lyster.
Exec't Officer	Col. G. H. Grabtree.
Property & Sup.	Lt. Col. N. Gapen.
Reports & Stats	
Hospitals	Lt. Col. S. M. De Loffre.
Research Board	Lt. Col. E. G. Seibert.
Care of Flier	Lt. Col. I. H. Jones.
Care of Flier	Maj. E.J. Martal. Chief Physical Director.

ADMINISTRATIVE SECTIONS

PERSONNEL SECTION

Responsible for procurement of all records concerning personnel for Dept. Mil. Aero. including officers enlisted men and civilians. also examines and selects candidates for commissions and secures commissions. Handles routine correspondence relating strictly to matters of personnel.

Chief	Lt. Col. Arthur Woods.
Exec't Officer	Maj. R.B. Lincoln.
Procurement	Maj. E.H. Litchfield.
Commissions	Capt. J.A. Ripley.
Officers	Capt. A.C. York.
Enlisted Men	Capt. J. Milledge.
Civilian	Capt. J.E. Enright.

TRAINING SECTION

Responsible for all training in the Department of Military Aeronautics including both commissioned and enlisted personnel. Administraters affairs of Mil. Aero. Flying Gunnery, Balloon, Enlisted Mechanics, Photo. and Radio Schools.

Chief	Col. M.F. Davis.
Ass't for Heavier-than Air	Maj. M.F. Harman, Jr.
Ass't for Lighter-Than Air	Lt. Col. A.L. Fuller.
Exec't Officer	Maj. J.R. Moultbrap.
Ground Sch'l	Capt. Geo. A. Washington.
Flying	Maj. W.P. Jernigan.
Photographic	Maj. J.S. Sullivan.
Mech. Instr'c't	Maj. A.J. Hanlon.
Gunnery	Capt. R.S. Potter.
Radio	Lt. Col. T.L. Crystal.
Balloon	Lt. Col. A.L. Fuller.

OPERATIONS SECTION

Operates all commissioned and enlisted personnel after completion of training, including all activities in the Dept. of Military Aero, in which the personnel is not undergoing school training and control of the activity or unit is not specifically assigned to another section. Responsible for organization of all aviation units, both home and insular, and for home defense. Administers aviation concentration camps and has jurisdiction over Dept. Mil. Aero. Officers on all matters relating to organization, operation and movements of organized aviation units.

Chief	Lt. Col. G.G. Brant.
Exec't Officer Home Defense	Maj. Wm. J. Fitzmaurice.
Exec't Officer Organization	Maj. Leigh Sypher
Organization	Lt. C. Du Bosque.
Post Adm tion	Capt. J.C. Tureck.

SUPPLY SECTION

Performs usual functions such as purchase, Storage and transportation of equipment, also transportation of personnel, and all movements of organized aviation units as directed by the Chief of Operations.

Chief	Col. C.G. Edgar.
Ass't Chief	Lt. Col. E.L. Jones.
Exec't Officer	Capt. C.G. Brown.
Asst. to Ex. Officer	Lt. D.M. Osborne.
Engineering	Maj. T.G. Gallagher.
Material	Maj. F.L. Martin.
Motor Transportation	
Eng & Plane Main't	Capt. H.R. Eyrich.
Repair Depots	Capt. D.L. Deacon.
Oil & Lubrication	Mr. W.H. Parish.
Bldg. & Grounds	Capt. Edw. Burns.
Conservation	

Directs and supervises construction and maintenance of all structures and utilities through Officers on Staffs of commanding Officers. Also administers supply and Repair Depots, Audits all Dept. of Military Aeronautics accounts and is responsible for all disbursements. Maintains Consolidated aviation property accounts and supervises examination returns from Property Officers.

Finance	Maj. H. Bennington.
Asst. for Finance	Capt. C.M. Neubauer.
Accounting	Mr. S.B. Button.
Disbursing	Capt. R.C. Baldwin.
Propt'y. Acc'tibility	Capt. T.A. Grant.
Ass't Aud't	Lt. G.A. Pfau.
Traffic & Stor.	Maj. C.S. Benton.
Traffic	2nd Lt. D.R. Darner.
Storage	Capt. L. Dominick.
Embarkation	Lt. Wm. Penick.
A.P.C. #2.	

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. .... .02 -.03
- Phosphoric (85%).. .35 -.39
- Sulphuric (60%), lb. .008

Aluminum:
- Ingot, lb. .... .33
- Sheets (18 gage or more), lb. .... .42

Antimony, lb. .... .07¾-.08

Burlap:
- 8 oz., yd.......... .10½
- 10½ oz., yd........ .16½

Copper:
- Elec., lb. .... .23
- Lake, lb. .... .20 -.23

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.62
- Egypt, combed, sq. yd. 1.30
- Egypt, carded, sq. yd. 1.27
- Peelers, combed, sq. yd. .97
- Peelers, carded, sq. yd. .95-1.05

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
- Ceylon, lb. .... .09 -.22
- Madagascar, lb. .... .10 -.15
- Mexico, lb. .... .03¾

Lead, lb. .... .05¼-.06

Leather:
- Hides, lb. .... .18 -.35¼

Nickel, lb. .... .40

Oil:
- Gasoline:
  - Auto. gal. .... .24½
  - 68 to 70 gal...... .30½
- Lard:
  - Prime City, gal..2.05-2.10
  - Ex. No 1, gal...1.25
- Linseed, gal. 1.58-1.59
- Menhaden (Dark), gal. 1.20-1.22
- Petroleum (crude):
  - Kansas, bbl. 2.25
  - Pennsylvania, bbl.4.00

Rubber:
- Ceylon:
  - First latex pale crepe, lb. ...... .53½
  - Brown, crepe, thin, clear, lb. .... .46 -.47
  - Smoked, ribbed sheets, lb. .... .52½
- Para:
  - Up River, fine, lb. .60
  - Up River, coarse, lb. .... .36
  - Island, fine, lb... .54

Shellac (orange), lb.. .70 -.72

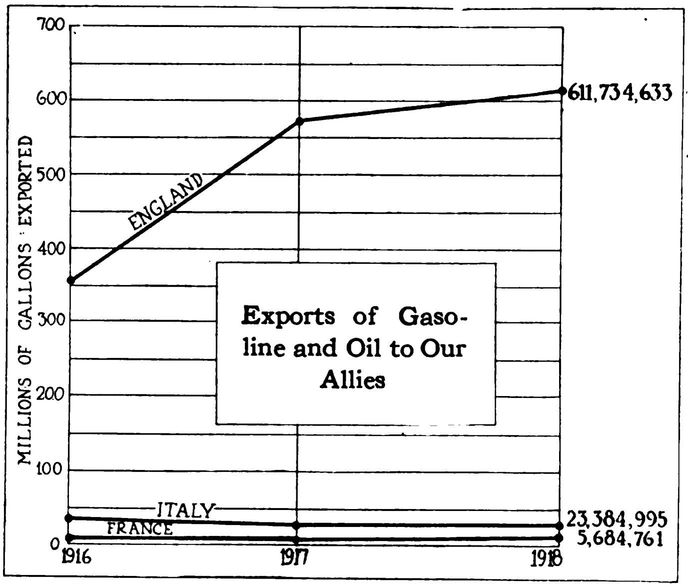
Spelter .... .07 -.08

Steel:
- Angle beams and channels, lb. ..... .03
- Automobile sheet (see sp. table.)
- Cold rolled, lb..... .0625
- Hot rolled, lb...... .039

Tin .... .71 -.72

Tungsten, lb. ....2.00 -2.50

Waste (cotton), lb.. .12¾-.17



Our exports of gas and fuel oil to England, France and Italy during the first 10 *months of* 1918 *indicate the enormous needs of Britain's navy. No doubt a large quantity was shipped for use by the U. S. overseas fleet*

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock..................	$5.95	$5.85
Automobile body stock, deep stamping.	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock.................	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping...............	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping......................	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Black Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.
- Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close Jan. 18

	Bid	Asked	Net Ch'ge
Auto Body Company.........	6½	8½	+1½
Briscoe Motor Car, Com.....	11	..	..
Briscoe Motor Car, pfd.....	40	55	..
*Chandler Motor Car........	103	105	—2
Chevrolet Motor Car.......	154	156	..
Cole Motor Car Co..........	90	105	..
Continental Motors, com....	8	8½	..
Continental Motors, pfd.....	94	97	..
Edmunds & Jones, com.....	19	22	..
Edmunds & Jones, pfd......	75	90	..
Electric Storage Bat........	50	55	..
Federal Motor Truck........	32	35	—1
Fisher Body Co., com.......	36½	42	+½
Fisher Body Co., pfd........	92½	93¾	+½
Ford Motor of Canada......	245	260	—20
General Motors, com.......	123	124	—5¾
General Motors, pfd........	83¾	85¼	+¼
Hupp Motor Car, com.......	6¼	6¾	+1½
Hupp Motor Car, pfd........	86½	..	+1½
Kelsey Wheel Co., com....	30⅛	34½	+⅛
Kelsey Wheel Co., pfd......	86	90	—2
Manhattan Electric S., com.	..	48	..
Maxwell Motor, com........	27¼	28¼	—¾
Maxwell Motor, 1st pfd......	51¼	52¼	—1
Maxwell Motor, 2nd pfd....	19½	20½	—1⅜
McCord Mfg., com..........	32	35	..
McCord Mfg., pfd...........	93	96	..
Mitchell Motor Co..........	24	30	+1

	Bid	Asked	Net Ch'ge
Motor Products Corp........	40	..	..
Nash Motors Co., com......	160	175	—15
Nash Motors Co., pfd.......	90	95	..
National Motor Co..........	6	10	..
Packard Motor Car, com....	112	..	+2
Packard Motor Car, pfd.....	100	..	+1½
Paige-Detroit Motor, com...	24	25	—¾
Paige-Detroit Motor, pfd...	8¾	9¾	..
Peerless Motor Truck.......	18	21	..
Pierce-Arrow Mot. Car, cm.	39½	40½	—2½
Pierce-Arrow Mot. Car, pfd.	101¾	102	+¼
Premier Motor Corp., com..	5	..	..
Premier Motor Corp., pfd...	..	75	..
Prudden Wheel Company...	15½	17½	..
Reo Motor Car Co...........	21½	22½	—¾
Republic M. Truck, com....	35	38	..
Republic M. Truck, pfd.....	87	90	..
Saxon Motor Car, com......	6¾	8¾	—⅛
Scripps-Booth Corp.........	21	25	..
Stewart-Warner Speed Corp.	87⅜	89⅝	+2⅜
Stromberg Carburetor Co....	33	38	..
Studebaker Corp., com......	48	49	—3⅞
Studebaker Corp., pfd.......	92½	97	—½
Stutz Motor Car Co.........	49½	50½	+¼
United Motors Corp.........	34⅝	36⅝	+1⅜
White Motor Co.............	45¼	46¼	+½
Willys-Overland, com.	24	25	—1
Willys-Overland, pfd........	88¼	88⅞	+1½

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.............	73½	74	+5½
Firestone T. & R., com......	140	145	..
Firestone T. & R., pfd......	95½	100	..
Fisk Rubber Co., com.......	84	86	..
Fisk Rubber, 1st, pfd........	97	100	..
Fisk Rubber, 2nd pfd........	85	90	..
Fisk Rubber, 1st pfd. conv..	100	105	..
Goodrich, B. F., com........	61	62	+3¾
Goodrich, B. F., pfd.........	101	103¾	—½
Goodyear T. & R., com......	230	235	+9
Goodyear T. & R., 1st pfd..	104½	106	+1½
*Goodyear T. & R., 2nd pfd.	103	104	—2
Kelly Springfield, com.....	71	71½	+2½
Kelly Springfield, 1st pfd...	90	100	+5
Lee Tire & Rubber So......	22	22½	+¼
Marathon Tire & Rubber...	..	55	..
Miller Rubber Co., com......	142	148	..
Miller Rubber Co., pfd......	96	98	..
Rubber Products Co.........	..	101	..
Portage Rubber Co., com...	145	149	..
Swinehart T. & R. Co......	50	60	..
U. S. Rubber Co., com......	76½	76¾	—1
*U. S. Rubber Co., pfd......	109	110	..

*Ex. dividend.

Men of the Industry

Changes in Personnel and Position

Capt. Harold J. Vogler was appointed district sales manager for the Service Motor Truck Co., assigned to District No. 2, which includes Maryland, Virginia, District of Columbia and the Carolinas, and took up his new work on Jan. 1. Previous to entering the army, Captain Vogler was wholesale manager for the Willys-Overland Co. and also had charge of its dealer organization in the East. Prior to his connection with Willys-Overland he was Eastern superintendent for the Maxwell Co.

P. J. W. Kelley has joined the sales force of Gray & Davis, Inc., as sales engineer.

Roy T. Middleton, who in May, 1917, resigned as Detroit manager for the Steel Products Co. to enter the air service in France, reached Detroit last week as Capt. Roy T. Middleton and is on his way to Cleveland to become general representative for the Standard Steel Casting Co.

Glenn L. Orr, who has been connected with the Briscoe Motor Corp., Jackson, as purchasing agent, has resigned to become secretary of the M. H. Herrmann interests, Detroit.

M. L. Hemingway has been appointed assistant manager of the Motor and Accessory Manufacturers' Association. He assumed his new duties Jan. 18. For the past year he has been secretary of the War Service Committee of the Rubber Association of America.

L. P. Prossen has resigned as mechanical superintendent of the Black & White Taxicab Co., New York, and has become associated with the Nilson-Miller Co., Hoboken, where he has been elected vice-president, and will be in charge of the gear cutting, piston and piston ring departments.

E. R. Greer, at one time engineer of the Emerson-Brantingham Implement Co.'s tractor plant at Minneapolis, has been placed at the head of the service department of the Four Wheel Drive Auto Co.

C. H. Smith has recently joined the A. B. C. Casting Co., Cleveland, to take charge of its aluminum forging development work. He was formerly with the Driggs-Seabury Ordnance Corp. and later with the Ladish Drop Forge Co., Cudahy.

Sutherland G. Taylor, Jr., who has been appointed export manager for the Holt Mfg. Co., assumed his duties at the Peoria plant Jan. 1. For several years Mr. Taylor was vice-president and New York manager of Cyrus Robinson & Co., engineers and exporters of New York and London. He has recently received his discharge from the army, where as lieutenant in the Ordnance Department he was assistant to the chief of the Motor Equipment Section.

Larger Duties for Lt. Col. Jones

WASHINGTON, Jan. 17—Lt. Col. R. M. Jones, A. S., A. P., was appointed Assistant and Executive Officer to the Acting Director of Aircraft Production on Dec. 28. In addition to his present duties as Executive Officer, he will also be charged with such activities as pertain to liaison, correspondence with the War Department and other departments or bureaus of the government.

Lt. Col. H. C. Clark, A. S., A. P., in addition to his other duties, will take over the duties of adviser and assistant to the Acting Director on matters pertaining to personnel for the bureau.

Lt. Col. O. Westover, A. S., A. P., is appointed assistant to the Acting Director of Aircraft Production.

Major George F. Lyons, A. S., A. P., is hereby appointed assistant to the Acting Director of Aircraft Production.

Two New Vice-Presidents for the Republic Rubber

YOUNGSTOWN, Jan. 10—Harvey J. Woodard and Mark W. Roe have been advanced to the position of vice-president of the Republic Rubber Corp. Mr. Woodard becomes vice-president in charge of sales and Mr. Roe vice-president in charge of the plant. Mr. Roe joined the Republic as consulting engineer.

Lt. Ezra W. Clark, having received his discharge from the Air Service, has become advertising manager for the Clark Equipment Co., Buchanan, Mich. Mr. Clark was for many years editor of the Chicago Inter-Ocean, and later business manager of the Mobile Item and advertising manager of the Memphis News Scimitar.

Fred M. Elvidge, Jr., has received his discharge from the army and has resumed his desk at the New York office of the Ajax Rubber Co., where he is the branch store supervisor. He left Ajax in February to join his regiment and then went through the Officers' Training School at Camp Gordon, emerging with a commission of second lieutenant. The resumption of his duties will once more place him in charge of the branch stores throughout the country.

Eugene W. Lewis, former vice-president of the Timken-Detroit Axle Co., which position he relinquished to become chief of the production branch of the general staff of the army in Washington, has completed his work, and will take a long rest before resuming his business activities.

W. E. Biggers, who has been appointed assistant to the president of the Owosso Mfg. Co., maker of screen doors and window screens, at Owosso, Mich., will take up his new duties on Feb. 1. For four years Mr. Biggers was advertising manager of the Hyatt Roller Bearing Co., and is now advertising manager of the Motor Equipment Division, United Motors Section, General Motors Corp., which includes the advertising managership of the Hyatt Roller Bearing Co., the Klaxon Co., the Jaxon Steel Products Co. and the Harrison Radiator Corp.

Walter A. Almy has been promoted from the position of manager of the passenger transportation department to that of general distribution manager of the Packard Motor Car Co., Philadelpia.

Captain G. F. Aitken of the U. S. Army Ordnance Department has returned to the sales organization of the Detroit Cadillac Motor Car Co., New York.

W. J. Johnson, who for some years has looked after the interests of the Connecticut Telephone & Electric Co. with automobile manufacturers, has been promoted to the position of field sales manager.

Norman S. Hobson, on his release from military service, has associated himself with the Connecticut Telephone & Electric Co. and will handle the sales in New England and upper New York State.

Victor W. Peterson, formerly advertising manager of the Stewart-Warner Speedometer Corp., has now become associated with the Wm. R. Johnson Mfg. Co., 359-361 E. Ohio Street, Chicago, in the capacity of general manager.

F. W. Sutton, formerly production manager of the Continental Motors Corp., and later general superintendent of the Dayton-Wright Airplane Co., is now the chief engineer of the Charles E. Dedeaux Co., industrial engineers, with headquarters in Cleveland.

R. Y. Cooke has been made secretary and general sales manager of the Racine Rubber Co., Racine, and director of the Ajax Rubber Co., New York. He succeeds Mr. Severance, who died recently.

Gilbert U. Radoye has become associated with the Haynes Automobile Co., Kokomo, as advertising manager and assistant sales manager. He was formerly affiliated with the advertising division of the Hudson Motor Car Co., the Packard Motor Car Co. and with the Nordyke & Marmon Co.

Charles M. Jessup, who for the past 4 years has been directing the motor equipment of the Remy Electric Co., Detroit, has been appointed assistant to O. F. Conklin, president of the company. In addition to his new duties as assistant to the president, he will have charge of the sales of the motor equipment division, and will be located at the Detroit office.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

U. S. Light & Heat Corp. Devoted 75 Per Cent Activities to Government

NIAGARA FALLS, Jan. 20—The U. S. Light & Heat Corp. had 75 per cent of its plant capacity devoted to war work, this percentage including 900 employees. The production of their output was apportioned as follows: Batteries, 10 per cent; parts for tanks, 60 per cent; parts for gas shells, 8 per cent; parts for army trucks, 1 per cent; parts for airplanes, 1 per cent, and products for the U. S. Railroad Administration, 5 per cent, making a total of 85 per cent. To carry out this program, fifteen of a group of nineteen buildings were devoted to war work, and it was necessary to make two additions to its plant representing 27,960 sq. ft., besides a new building of 17,000 sq. ft. It has been making only 50 per cent of its normal peace time product.

Delaney Oil Now Lindsay-McMillan Co.

MILWAUKEE, Jan. 20—The Delaney Oil Co., 45-47 Third Street, a large wholesaler and jobber of petroleum products, greases, etc., has changed its name to Lindsay-McMillan Co. The principal owners are Lieut. Walter S. Lindsay and William A. McMillan. The works and storage houses are located at 83 South Water Street.

Manufacturers Hardware Corp. Formed

MILWAUKEE, Jan. 20—The Manufacturers Hardware Corp. has been incorporated with a capital stock of $100,000 to manufacture and sell machinery, accessories, supplies, etc. Lyle E. Beeman, head of the Universal Mfg. Co., 491 Broadway, manufacturer of farm lighting systems and other direct-connected generating units, is one of the incorporators.

Prest-O-Lite to Rebuild Milwaukee Plant

MILWAUKEE, Jan. 20—The Prest-O-Lite Co., Indianapolis and New York, has awarded contracts for the erection of a new acetylene gas making and compressing plant here to replace the unit which was destroyed by explosion and fire on Nov. 22. The building will be 60 x 120, of fireproof construction.

Gas Tank Plant to Be Rebuilt

MILWAUKEE, Jan. 18—The entire plant of the Gas Tank Recharging Co., 1245 Twenty-third Avenue, was destroyed by explosions and resulting fires on Monday night, Jan. 13, causing an estimated loss of $50,000. The company will rebuild at once. The plant is used for manufacturing and compressing acetylene gas for the oxy-acetylene welding industry and for other industrial purposes. The main plant of the company is at Keokuk, Iowa, where $500,000 was invested during 1918 in the erection and equipment of one of the largest carbide works in America.

Vocational School for Willys-Overland

TOLEDO, Jan. 20—The Willys-Overland is to establish a vocational training school for its employees at its plant here. Training will be given in machineshop work. The school will occupy a separate department in one of the factories.

New Officers for Turnbull Motors

DEFIANCE, OHIO, Jan. 21—A. F. Mitchell, vice-president of the Northern National Bank of Toledo, was elected president of the Turnbull Motor Truck & Wagon Co. at the company's annual meeting. He succeeded W. O. Allen, general manager of the Allen Motor Car Co., Fostoria, who continues as a member of the board of directors. Other officers elected were: Vice-president, R. G. Holgate, vice-president of the Merchants' National Bank; treasurer and general manager, Charles C. German; secretary, L. J. Spafford; general sales manager, W. L. Krapp; advertising manager, George A. Wieland; chief engineer, H. K. Rienoehl; directors, the officers and T. T. Shaw, C. H. Kettenring, vice-president and general manager of the Defiance Machine Co.; J. G. Schrag, secretary and treasurer of the Screw Machine Products Co.; R. C. May, general sales manager of the Defiance Machine Co.; F. J. Papenhagen, secretary and manager of the Defiance Printing & Engraving Co., and W. O. Allen.

Kramer Increases Capital

GRAND RAPIDS, Jan. 20—F. W. Kramer Motor Co. has increased its capital stock from $20,000 to $40,000.

Dividend Declared

Sterling Tire Corp., Rutherford, N. J., 4 per cent quarterly, common; 7 per cent annual, preferred; paid Jan. 15.

Service Motors Declares Dividends

WABASH, Jan. 20—The Service Motor Truck Co. declared a 6 per cent dividend, payable to stockholders of record Dec. 31, 1918, making a total of 15 per cent for the year just closed.

Ford's Manchester, England, Production

In an article in AUTOMOTIVE INDUSTRIES last week it was stated that the Ford Company is producing 3000 cars daily in its Manchester, England, plant. This should have read a total of 3000 cars, parts for which are being imported by special government arrangement.

Nathan Novelty Mfg. Co. in New Factory

NEW YORK, Jan. 21—The Nathan Novelty Mfg. Co. will move to its new factory at the corner of Twelfth Street and Fifth Avenue on or about Feb. 1.

Reo Back to Peace Time Production

LANSING, Jan. 17—Less than 100 government vehicles are incomplete on the contract held by the Reo Motor Car Co. All government parts, equipment and fixtures are being moved from the main plant to the truck plant this week. Moving work will be completed in a few days and the company will by that time have swung back to its own production in its main plant. The last motor for tractors went through the plant several days ago. Assembling of the tractors is all that remains before completing the contract. That no time may be lost in production, the company will this year take a running inventory.

Maibohn Motors to Have Michigan Plant

RACINE, Jan. 16—The Maibohn Motors Co., it is understood, is seeking a location in Michigan. Reports from several cities are that the mayors and Board of Trade heads have received letters asking for privileges in event of locating there. This company's plant was destroyed by fire recently. It was announced that the plant here would be rebuilt.

Long Island City Plant for Phianna

NEW YORK, Jan. 20—The Phianna Motor Co. has leased a factory in Long Island City and has started production on a revised model of the car which it has had on the market during the past year. This will have a four-cylinder 3 29/32 x 6 engine, 125-in. wheelbase and 32 x 4½ tires. The chassis is essentially the same as the previous model and sells for the same price. Bodies are to be custom built, the standard brougham model selling for $6,000. A slight change has been made in the external appearance of the car through the use of a square radiator.

Templar Enlarges Plant.

CLEVELAND, Jan. 20—The Templar Motors Corp. has had erected a three-story, 500 x 72 ft. addition to its plant. It is a concrete structure with the outside walls practically all glass. This increased floor space of almost 2½ acres is now being equipped with machinery.

More Capital for Gardner Machine

BELOIT, WIS., Jan. 20—The Gardner Machine Co. has increased its capital stock from $500,000 to $750,000 to cover the extension of its facilities and growth of its business.

New Plants for General Motors

DETROIT, Jan. 20—Rumors are current here that the General Motors Corp. is planning the construction of a new differential gear plant here. The company is also said to have its eye on the Canadian market, and that a big assembly plant may be built soon in some Dominion city.

Contracts Placed

WASHINGTON, Jan. 16—Following are contracts placed by the Motors and Vehicles Division of the Quartermaster Department, under date of Jan. 6, 1919:

Walker Mfg. Co., Racine, 1200 Badger 5-ton truck jacks, $7560.
Fisk Rubber Co., Washington, 250 casings, $9100.
Fisk Rubber Co., Washington, 5725 casings, $20,925.
Winton Motor Car Co., Cleveland, motor parts, $10,113.54.
United States Tire Co., New York, 385 casings and tubes, $11,804.25.
Standard Woven Fabric Co., Walpole, motor parts, $6750.
Silvex Co., South Bethlehem, motor parts, $11,284.
Goodyear Tire & Rubber Co., Akron, 700 casings, $25,480.

WASHINGTON, Jan. 16—Following is a list of contracts placed by the Motors and Vehicles Division of the Quartermaster Department:

Jan. 2, 1919.

Kelly-Springfield Tire Co., Akron, 300 casings, $10,920.
Miller Rubber Co., Akron, 3000 casings, $31,250.
Locomobile Co. of America, Bridgeport, 180 radiators, $28,800.
Dodge Bros., Detroit, 30 sets spare parts, $424,450.

Jan. 4, 1919.

Eisemann Magneto Co., Brooklyn, motor parts, $16,456.35.
Federal Rubber Co., Washington, 700 bicycle tires and casings, $5495.
Eisemann Magneto Co., Brooklyn, motor parts, $5,009.50.
Federal Rubber Co., Cudahy, 3500 bicycle tires, $13,720.
Firestone Tire & Rubber Co., Washington, 250 tires, $7582.
Marvel Carburetor Co., Flint, motor parts, $24,026.40.
Packard Motor Car Co., Detroit, motor parts, $14,491.60.
Peerless Motor Car Co., Cleveland, motor parts, $19,923.21.
United States Rubber Co., New York, 900 casings, $16,345.
The Goodyear Tire & Rubber Co., Akron, 8640 tires, $344,736.
The Goodyear Tire & Rubber Co., Akron, 1684 tires, $53,994.38.
The Goodyear Tire & Rubber Co., Akron, tubes and casings, $26,358.85.
Splitdorf Electrical Co., Newark, motor parts, $14,500.
Silvex Co., South Bethlehem, 22,500 spark plugs, 15,000 petticoat spark plugs, insulator type plugs, $8463.

Motor Imports to New Zealand Fall Off

WASHINGTON, Jan. 22—The motor car, motorcycle, and tricycle trade in New Zealand has fallen off materially during the last 2 years, and will doubtless continue at a lower rate as long as the exceptionally high price of benzine, gasoline, etc., continues, according to a consular report.

However, motor cars are being put to more practical use in the country than ever before, since farmers are using them extensively for different kinds of work about the farm and in transport wherever it is possible, using such attachments and improvements as are now on the market to adapt them to different kinds of work.

The high-water mark was reached in 1916, when the number of cycles imported was 2,287 and the number of motor cars 6,174. The following table gives the imports for the years 1914 and 1917:

Motor Bicycles and Tricycles

Imports from	1914 No.	1914 Value	1917 No.	1917 Value
United Kingdom	2,296	$191,292	896	$87,120
United States	189	27,310	970	202,595
All other	15	2,307	....	....
Total	2,500	$220,909	1,366	$289,715

Automobiles, Trucks, Etc.

Imports from	1914 No.	1914 Value	1917 No.	1917 Value
United Kingdom	1,093	$1,535,940	72	90,141
Canada	873	482,639	1,010	411,574
France	134	163,513	1	1,722
United States	1,308	1,338,997	3,596	2,597,246
All other	58	103,744	1	730
Total	3,466	$3,624,833	4,680	$3,101,413

It will be noted that in 1914 motorcycles and tricycles were nearly all imported from the United Kingdom, while in 1917 a large majority of them came from the United States. This is largely true in regard to motor cars, but not to the same extent, for in 1914 there were 1,093 motor cars imported from United Kingdom, as compared with 72 motor cars in 1917, while from the United States there were 1,308 imported in 1914, as compared with 3,596 in 1917.

These favorable conditions enjoyed by American cars and motorcycles cannot be expected to continue after the closing of the war, and American manufacturers and exporters will need to look carefully after the trade in this part of the world.

Farm Tractors in Tunisia

WASHINGTON, Jan. 22—The Direction de l'Agriculture, du Commerce et de la Colonisation of Tunis is at present making plans for the purchase, on behalf of Tunisian farmers, of a certain number of recent type caterpillar tractors, 45 hp., with their complete plowing outfits, according to a report by the vice-consul.

These caterpillars were bought in the United States some time ago by the French Government for military purposes, but have not been used. They are now placed on sale by the French Government. If the prices can be agreed upon a first lot of 20 tractors is expected to be bought, and other purchases to follow.

An important consideration is that these machines are all of the same type and their upkeep will thereby be simplified, the same interchangeable repair part fitting any of them.

It is not so much the capital involved in the purchase of the tractors that makes the Tunisian farmers hesitate to buy American tractors, but the expenses and difficulties connected with their upkeep and in procuring repair parts.

A number of 75-hp. used caterpillar tractors are also stated to be offered for sale by the French military authorities, and their purchase is being considered.

Boston May Have Truck Show

BOSTON, Jan. 20—Chester I. Campbell has finished his government labors and is again directing the work of the Boston automobile show. The question of a truck show will be decided next week, when a conference is held on the subject.

Foreign Trade Opportunities

WASHINGTON, Jan. 22—Foreign trade opportunities have been received by the Bureau of Foreign and Domestic Commerce as follows. Additional information can be secured from the Bureau by mentioning the opportunity number in each instance:

A man in Italy desires an agency for automobiles, motorcycles and side cars. Foreign Opportunity No. 27967.

A man in France desires an agency for automobiles and trucks. No. 27978.

An agency is desired by a firm in Italy for trucks to be used for passenger service with a carrying capacity of 1½ tons, 30 to 40 hp., and 4 tons, 50 to 70 hp., and also solid rubber tires. No. 28054.

An agency in France for automobile accessories and farm tractors is desired. No. 28051.

A firm in Italy desires an agency for passenger cars and motorcycles. No. 28060.

A man in India desires a farm tractor agency. No. 28066.

An automobile accessory agency is desired by a Frenchman who is now in this country and who desires an agency for Belgium and northern France. No. 28080.

An Italian firm desires an agency for automobile accessories. No. 28081.

A Frenchman desires an agency for motor cars, farm tractors and accessories. No. 28075.

A citizen of Costa Rica, who is at present in the United States, desires an agency for the sale of automobiles and accessories. No. 27958.

An agency is desired by a man in France for the sale of motor cars and accessories through Roumania and the Balkan States. No. 27959.

A firm in France desires to purchase several thousand bicycles and motorcycles and accessories. No. 27988.

A man in Italy desires to secure an agency for the sale of agricultural implements and machinery. No. 28016.

A merchant in Algeria desires to secure an agency for the sale of open and closed automobiles and trucks. No. 28017.

Growth of Italian Automobile Industry

WASHINGTON, Jan. 20—The Italian automobile industry is of great importance, and during the war has given proof of extraordinary development, extending its sphere of action also to the fields of aviation, says the Board of Trade Journal in quoting *Il Tempo*, of Rome. The number of companies engaged in this industry has increased from 32 on Dec. 31, 1913, to 55 at the end of 1917, while the capital employed has risen from $9,489,231 to $31,212,160 as shown below:

Departments	Companies	1917
Piedmont	18	$18,767,840
Liguria	5	1,133,600
Lombardy	25	8,482,080
Venetia	1	80,000
Emilia	1	4,800
Tuscany	2	124,800
Umbria	2	64,640
Lario	2	468,800
Campania	4	2,085,600
Total	55	$31,212,160

The average dividend has increased from 3½ per cent in 1913 to 8 per cent in 1917.

As regards foreign trade, the import of automobiles has declined from a value of $2,611,554.80 in 1913 to $1,236,784 in 1917 (up to Dec. 13), a falling off of $1,374,770.80. Exports, however, have increased from $5,468,949.92 to $18,511,008.80.

No Visé for Mexican Export Licenses

WASHINGTON, Jan. 18—Applications for export licenses to Mexico will no longer require the visé of an American consul.

Calendar

ENGINEERING

S. A. E. Meetings

Jan. 30—Chicago—"Home-coming" Supper, Morrison Hotel.

Feb. 3—New York—Banquet in honor of Capt. E. V. Rickenbacker, Waldorf-Astoria, Contest Board, American Automobile Association.

Feb. 4-6—New York. Winter Meeting. Society of Automotive Engineers, Engineering Societies' Building.

Feb. 6—Victory Dinner, Hotel Astor, New York.

Feb. 5—Minneapolis Section, S. A. E.—Hotel Radisson. "Radiator Cooling Fans."

March 5 — Minneapolis Section, S. A. E.—Hotel Radisson. "Tractor Service and Sales."

April 2—Minneapolis Section, S. A. E.—Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Jan. 20-25 — Shreveport, La. Shreveport Automobile Dealers' Assn. Henry B. Marks, Manager.

Jan. 20-25 — Hartford, Conn. Broad Street Armory, Auspices of Agricultural Interests.

Jan. 24-30 — Milwaukee, Wis. Eleventh Annual, Milwaukee Automobile Dealers, Inc., Auditorium. Bart J. Ruddle, Manager.

Jan. 25-Feb. 1—Chicago. Passenger cars, Coliseum.

Feb. 1-15—New York. Automobile Dealers' Assn. Charles A. Stewart. Manager. Hotel Woodward, Broadway and 55th St.

Feb. 3-6 — Chicago. Trucks, Coliseum.

Feb. 4-7—Fargo, N. D. Fargo and Moorhead Automotive Trade Assn.

Feb. 6-15—San Francisco, Cal. Third Annual Pacific Automobile Show, Motor Car Dealers' Assn. of San Francisco. Exposition Auditorium. G. A. Wahlgreen, Manager.

Feb. 10-15—Rochester, N. Y. Rochester Automobile Trades Assn., Exposition Park. George C. Donahue, Manager.

Feb. 15-22—Newark, N. J. N. J. Auto Exhibition Co. Calude Holgate, Manager.

Feb. 15-22 — Cleveland, Ohio. Cleveland Auto Show Co. Fred H. Caley, Manager.

Feb. 15-22—Minneapolis, Minn. Minneapolis Auto Trade Assn. Walter B. Wilmot, Manager.

Feb. 15-22—Albany, N. Y. Albany Automobile Dealers' Assn. State Armory.

Feb. 17-22—St. Louis. St. Louis Auto Mnfrs. & Dealers' Assn. Robert E. Lee, Manager.

Feb. 17 - 22 — Louisville, Ky. Louisville Auto Dealers' Assn.

Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.

Feb. 17-22 — Pittsfield, Mass. Pittsfield Automobile Dealers' Assn., State Armory. James J. Callahan, Manager.

Feb. 17-22 — Passenger Cars; Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. J. L. Elliott, Manager.

Feb. 17-22—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.

Feb. 18-22—Baltimore, Md. Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland, Fifth Regiment Armory. H. M. Lucius, General Manager.

Feb. 18-22 — Oklahoma City, Okla. Automotive Show. R. H. Haun, Manager.

Feb. 22-Mar. 1—Hartford, Conn. Hartford Automobile Dealers' Assn., Inc., Broad Street Armory. Ben F. Smith, Manager.

Feb. 22-Mar. 1—Atlantic City, N. J. Auto Trades Assn. of Atlantic City.

Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.

Feb. 24-Mar. 1—Burlington, Ia. Second Annual.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 24-Mar. 1 — Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.

Feb. 24-Mar. 1—Portland, Ore. Ninth Annual, Dealers' Motor Car Assn., Auditorium. M. O. Wilkins, Manager.

Feb. 26-Mar. 1—Mason City, Ia. Fifth Annual, Mason City Auto Show Assn.

Feb. 26-Mar. 1—Madison, Wis. Seventh Annual, Automobile Dealers' Division of Madison Assn. of Commerce, Union Transfer Bldg.

March 1-15—New York Aeronautical Exhibition, Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

Mar. 5-8—Quincy, Ill. Quincy Automobile Trades Assn., Armory.

Mar. 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gardner, Manager.

Mar. 10-15—Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn., Auditorium. Clarke G. Powell, Manager.

Mar. 12-19—St. Joseph, Mo Sixth Annual, St. Joseph Automobile Dealers' Assn.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Chester I. Campbell, Manager.

Mar. 15-22 — Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.

March 17-22 — Great Falls, Mont.—Montana Automobile Distributers' Assn.

Mar. 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.

Mar. 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 22-29, Passenger Cars; April 1-5, Trucks—Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkham, Manager.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

TRACTOR SHOWS

Jan. 20-25 — Hartford, Conn. Broad Street Armory.

Feb. 15-22—Minneapolis, Minn.

Feb. 24-Mar. 1—Kansas City, Mo. Fourth Annual Tractor Show. Sweeney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show, Wichita Tractor and Thresher Club. Forum.

CONVENTIONS

Feb. 4-6—New York. Meeting Society Automotive Engineers.

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

Detroit War Contract Claims to Be Settled by March 1

DETROIT, Jan. 18—It is understood that every war contract claim in the Detroit district, and there are approximately $500,000,000 worth of them, will be approved and settled by March 1. Ordnance Department Claim Board officials state that $100,000,000 in cash has been placed at the disposal of their board to cover all immediate adjustments. Red tape has been abolished and every effort is being made to refund the contractor the money tied up in machinery and materials. Bankers declare that many large checks have already passed through their hands and that contractors affected are entirely satisfied with their settlements. Because of the greater amount of work connected with the audit and inventory demanded by the Government before an adjustment is made, the larger munitions makers are still busy, and have not submitted their claims.

Aviator Lands on a Roof.

PARIS, Jan. 19—Jules Vedrines won a $5,000 prize to-day when he made a landing on the roof of the Galeries Lafayette, a large department store near the St. Lazare station. This is said to be the first time an aviator has made a landing on the roof of a building on a flight. Although the machine was slighly damaged, Vedrines was uninjured. The plane he used is 36 ft. wide, and the roof on which he landed is 52 x 75 ft.

Work for Better Roads in Ohio

COLUMBUS, OHIO, Jan. 20—The Good Roads Federation and a number of other organizations held a Road Congress here last week. The Ohio Automobile Trade Association has been taking an active part in this and has appointed a Good Roads Committee, which will cooperate with the Good Roads Federation to secure better roads in Ohio. The association has also appointed a committee of 50, which consists of automobile dealers, who will take up questions pertaining to their own individual business. There are also committees on tires and vulcanizing, garages and repairing, storage batteries, accounting and stock systems, automotive equipment sales, truck sales and legislation.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, JANUARY 30, 1919—CHICAGO No. 5

Chicago Dealers' Show Has National Aspect

Regarded as Weather Vane of Future Business—Nothing New from Engineering Standpoint

CHICAGO, Jan. 25—Chicago's nineteenth annual automobile show opened to-day with the same crowds, the same attendance of dealers and manufacturers' representatives, and the same general business aspect as in previous years, although this time it is a dealers' and not a national show. Manager Sam Miles, who has conducted all of the previous national motor car shows, is again in charge of the exhibit, and both in the conduct of the affair and in the attitude of manufacturers toward the show it is as much a national affair as ever.

Manufacturers and dealers unanimously look upon this show as the opportunity to again break into normal business activity. Makers of accessories, as well as cars, are here to get business in order that their plants, which are now released from war work, can start production. This show is regarded as the weather vane of business. It will be a dominant factor in determining the manufacturers' sales policies during the coming year. It is regarded as the one opportunity to repair the shattered sales organizations which exist in many instances, due to the claims of war upon the dealers' personnel.

It is not a show of surprises in the form of new models, advanced designs, and altered equipment. Every manufacturer at the show knew exactly what was to be exhibited by his commercial competitors before the doors opened. In this respect the show differs from previous years. In other respects the general aspect is the same, except that there is a more intense interest in the lining up of new dealers by concerns which were not able to produce at all, or only to a very modified extent during the European war.

Exhibitors at Chicago

Type	Coliseum	Armory	Total
Touring	85	31	116
Roadster	16	1	17
Limousine	7	4	11
Sedan	30	10	40
Coupé	17	3	20
Sport Roadster	4	2	6
Berline	1	1	2
Coupelette	2	..	2
Sport Touring	3	4	7
Town Cars	5	1	6
Suburban Brougham	1	..	1
2-4 Roadsters	3	..	3
4 Roadsters	3	2	5
Total			236
Electric	..	9	9
Cutaway engines	2	..	2
Operating chassis	3	..	3
Stripped chassis	7	4	11
Engines	2	2	4
Wire wheel equipped	50	26	76
Disk wheel equipped	4	..	4
4-cylinders	38	13	51
6-cylinders	128	36	164
8-cylinders	16	16	32
12-cylinders	9	..	9
Total			256

From this general view of the Coliseum some idea may be gained of the elaborate nature of the purple and gold decorations of Chicago's nineteenth annual automobile show

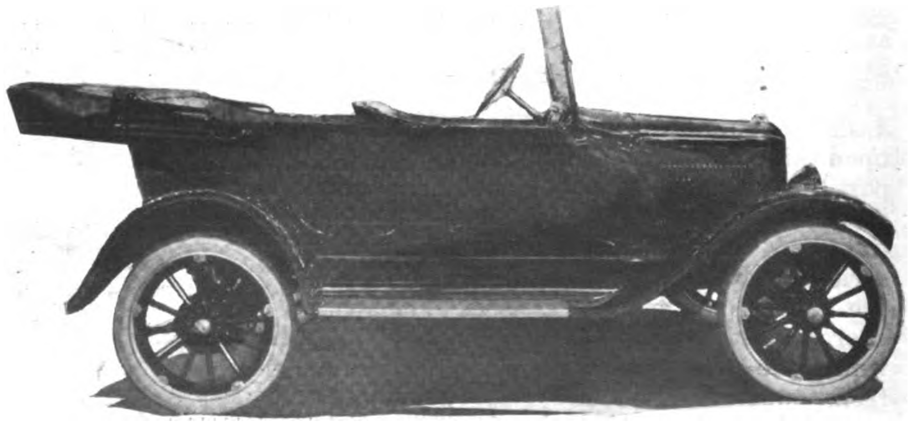
A noticeable feature is the absence of bad weather this year. Chicago is having the same mild winter as the East, with clear skies and a temperature more suggestive of late March than mid-January. The result is that there has been no freight tie-up and all exhibits were on the floor and uncovered when the doors swung open at 2.30, and admitted the crowd which waited. This year the number of exhibitors of cars is 68, and of accessories 135. Last year there were 79 car exhibitors and 146 exhibitors of accessories.

Preponderance of Touring Cars

There was a much greater preponderance of touring cars than would be expected at this season. The total number of touring cars on the floors of both the Coliseum and Armory numbered 116. This is interesting in comparison with the 40 sedans and 20 coupes. The total number of cars at the show was 236 gasoline cars and 9 electrics.

The overlapping of the show dates in New York and Chicago cut down the number of stripped chassis, cutaway engines, and other mechanical exhibits to a large extent, as manufacturers have been in the habit of shipping these from New York to Chicago so that one exhibit would do for both shows. There are only six engines exhibited, two of which are cutaway. The number of stripped chassis is eleven, whereas generally there are two or three times this number. There are three chassis operating so as to show the functions of the parts. Paige has its sawn-in-two chassis which was on the floor last year. The Studebaker gold chassis is replaced this year by one in nickel finish.

It is estimated that the crowd which attended the show on the opening day was 30,000. Dealers have already started to arrive from out-of-town points and it is pre-

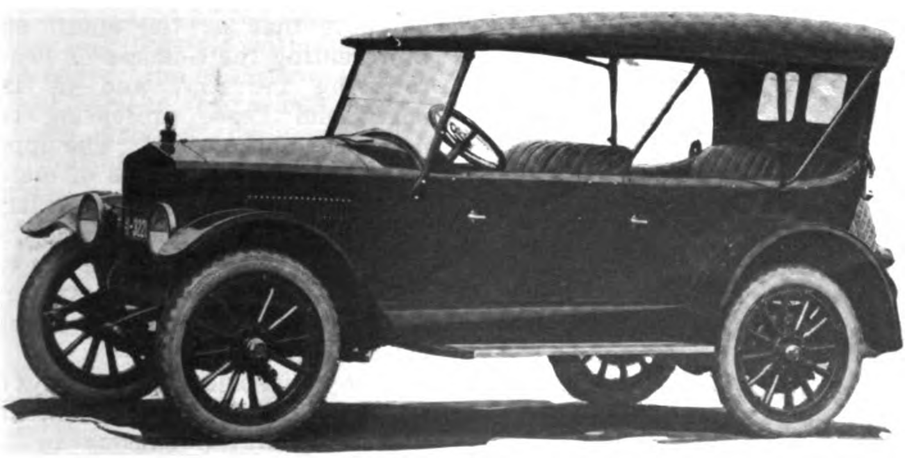


The new small Overland was exhibited for the first time with the body mounted on the chassis

The Armory, too, which held part of the Chicago show, was decorated in harmony with the general plan, hangings and embellishments being in purple and gold throughout

dicted by most of the exhibitors that the attendance of out-of-town dealers would be heaviest on Thursday and Friday. Quite a number of the dealers are planning to attend both shows for the purpose of combining a business and pleasure trip to New York and to look over the lines thoroughly.

There is more color apparent at this exhibition than in previous years. The cars are brighter in hue, and this is not due to an increase in the number of strictly show jobs on the floor, but, on the contrary, due to an increase in the number of stock models painted in other colors than black. To be exact, there are twenty-seven black cars out of a total of eighty-five. The next popular color is green, which is represented by fourteen cars, the shades of green being so different, however, that they can be classed as cars of different colors.



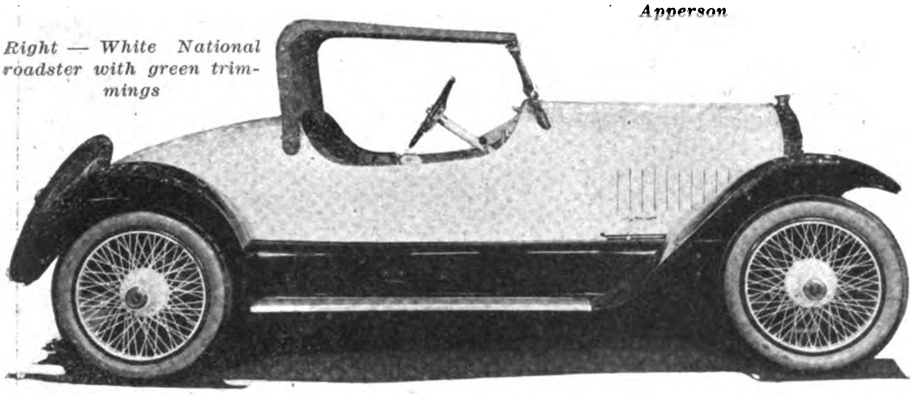
The Essex made its first appearance at any show, and because of its newness attracted a lot of attention

The use of colors other than black is appreciated by dealers as well as by the show visitors. This is evidenced by the fact that it was commented on probably more than any other feature of the show by the exhibitors. The air of individuality given to the cars by these color differences, and carried out further by a greater variety of body line than two years ago, gives a much wider range of choice in selection.

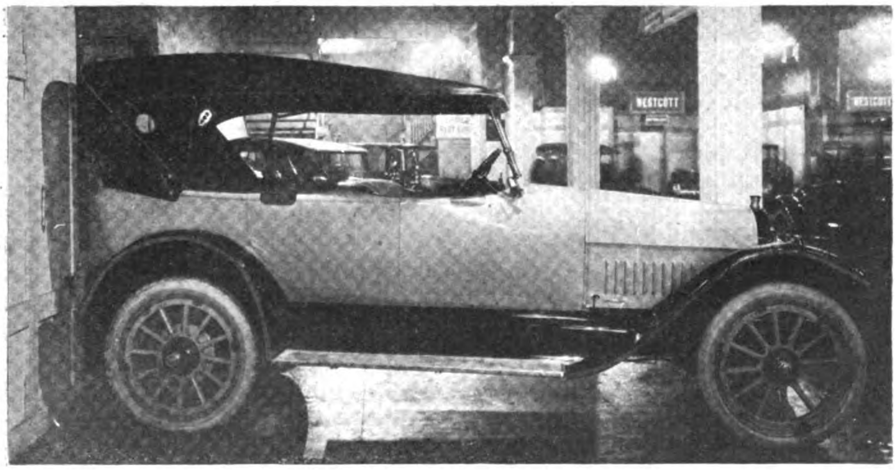
Essex Attracts Attention

From an engineering standpoint there is nothing new at the show. The main attractions from the standpoint of novelty were the first showing of the Ford closed cars equipped with electric starters, the exhibition of the new small Overland in both chassis and complete form, and the showing of the new Essex car, which while previously announced is just getting into manufacture and is furthermore a newcomer at the shows.

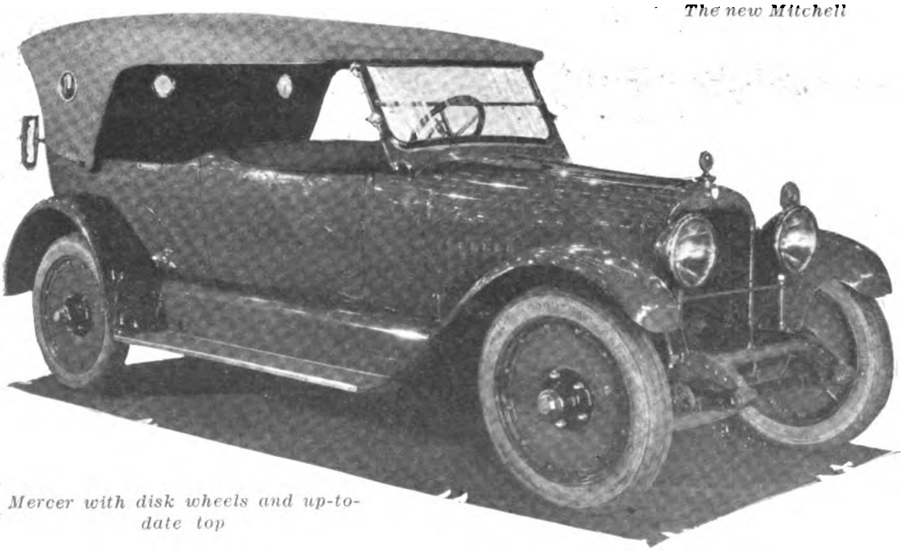
Apperson



Right — White National roadster with green trimmings



The new Mitchell



Mercer with disk wheels and up-to-date top

Concerns which exhibited cars last year that were not yet in production and which were not able to get into production on account of Government restrictions have all taken advantage of the interval to thoroughly test out their cars and eliminate minor imperfections. The result of this is a variety of minor refinements, none of which indicate any marked trends of an engineering nature.

Bevel Edges Increase

In body lines the great increase of bevel-edged jobs is noticeable and there are also a large number of four-passenger cars on the floor which stand out in marked attractiveness, due to the graceful lines made possible by the absence of the deep wheel housings in the sides of the body. The double-cowl type of body is still popular and is represented by a number of makes, but the rear cowl is more subdued than in previous examples of the type.

As an exhibition the present show has all the glamour of its predecessors. The same elaborate decorations and lighting effects are carried out in the Coliseum and Armory as in the past. The decorations are on the same gigantic scale as usual, but a softer color tone is utilized. The main canvas, which forms the ceiling, is decorated with scroll effects of purple and gold; it measures 300 by 240 feet.

About the Decorations

At the ends smaller curtains extend from the ceiling to the lower edge of the balcony, also carrying out the scroll effect. At either end of the Coliseum there is a transparency, that at the south end representing the Goddess of Peace receiving industry, and at the north end Peace presenting the motor car to the world. The upper side shows various types of motor cars in outline. There are thirty-two pillars on the floor of the Coliseum decorated to outline the exhibits, and sixteen in the Armory. The Annex decoration is a Japanese garden effect.

The accessories are mainly on the balcony of the Coliseum, and some are in the balcony in the Armory. The accessory field is in

the same position as the car field as regards new products. Very few of these are to be found at the present time, but there are indications of many improvements to come. Wheeler & Schebler are showing their new line of carbureters for the first time, and there are a number of new tools and garage accessories in the booths along the balcony.

Some Striking Bodies

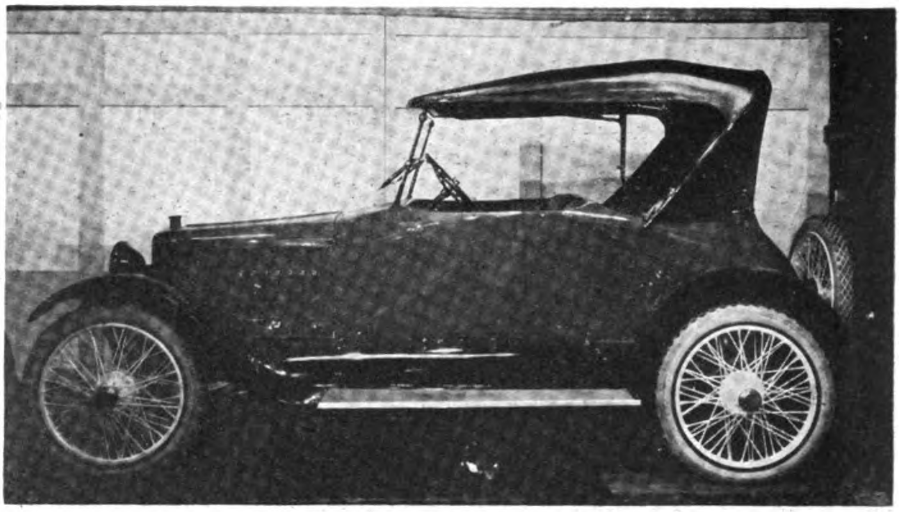
There are some striking body designs, made up as special show jobs, which are of interest as pointing the way for probable future standard body development. One of the features of the show as a piece of fine body work is the National white torpedo roadster with green running gear. This has a tan top. Its low lines and the artistic curve of the top give it an appearance of speed and comfort.

Kissel has a yellow roadster on exhibit which also is attracting attention as a good example of sport work. This roadster has an exceptionally low top and low windshield, which give it its distinctive lines. Scripps-Booth is showing a roadster in maroon in which the curve of the body is continued behind the seat, leaving an open storage space between the back of the seat and the curve of the body. The new little Overland touring car carries out the customary Overland lines exactly.

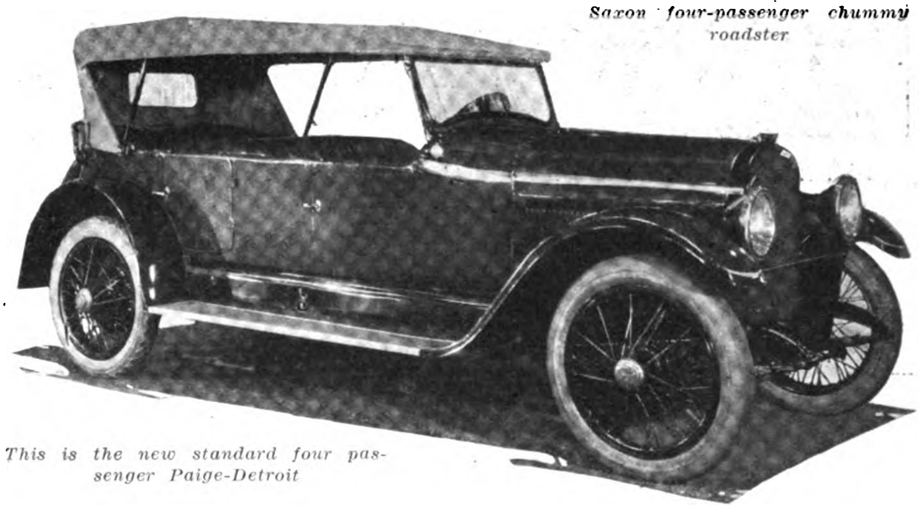
New Four-Passenger Jobs

Among the four-passenger exhibits Paige is showing a car which is put out as a standard body for this year. It is in a shade of blue green with tan upholstery. The car is featured by the long narrow lines only possible with the four-passenger type of design, and has a low, well-cut top which gives it a very striking appearance.

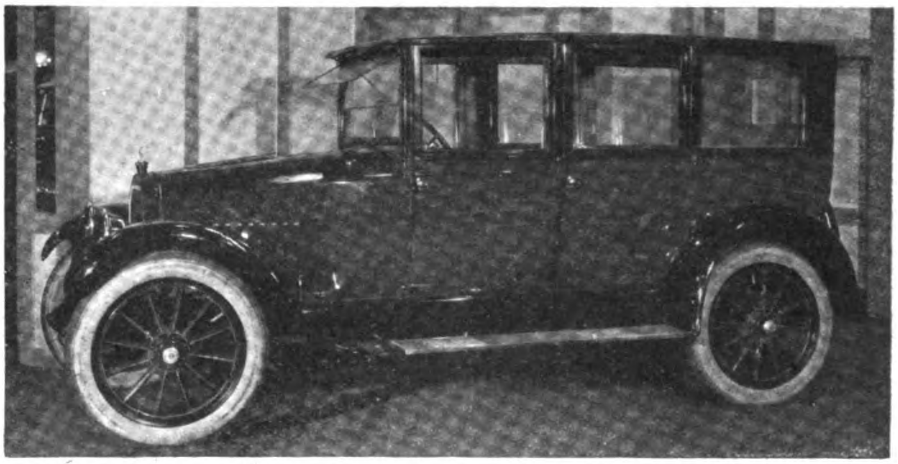
The Holmes car, which made its first appearance at New York last year in an office building near the Palace, is exhibited at the show this year in the Annex. This is an air-cooled car and the particular model on the floor is in a striking shade of blue with a tan front hood, in which the tan painting is brought back in a V shape toward the cowl. Essex also has its cars in the Annex, the exhibit being

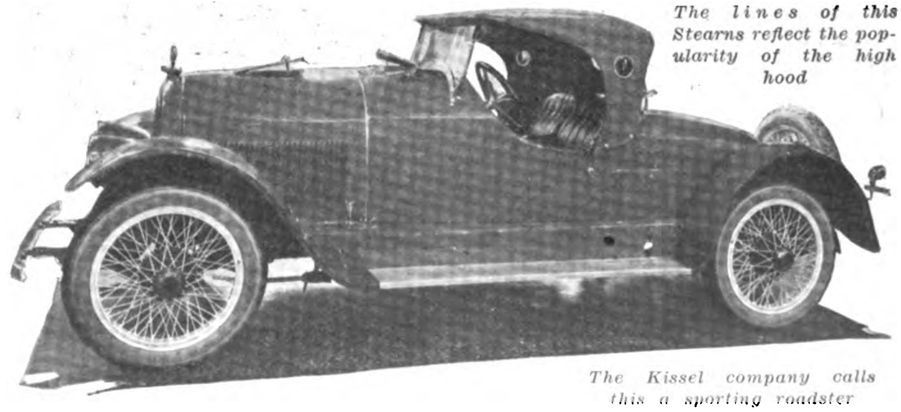


Saxon four-passenger chummy roadster



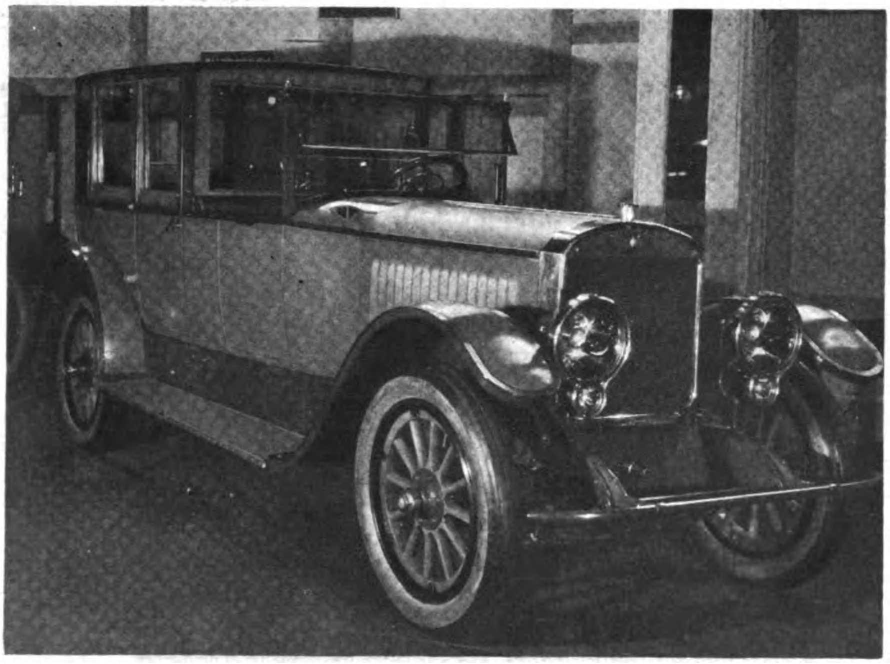
This is the new standard four passenger Paige-Detroit





The lines of this Stearns reflect the popularity of the high hood

The Kissel company calls this a sporting roadster



This Winton limousine was the largest car on view. The radiator cap is practically shoulder high

three standard touring cars in the standard blue green shade. As one of the new exhibits this car is attracting the crowds. Missing from the show this year are the steam cars, there being none of this type to be found.

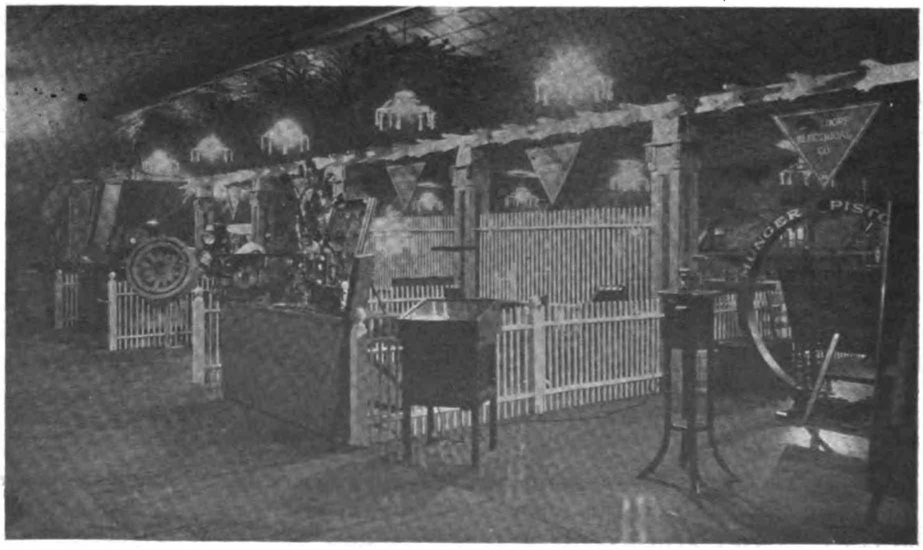
There are indications that there is going to be greater individuality in body design during the coming year than ever before since the earliest days of car manufacture. Probably as striking an example of sport carwork as can be found anywhere on the floor is the Daniels, which is showing a five-passenger sport design in light blue. This has a double cowl and has steps on the side instead of a runningboard. It is completely outfitted as a sport job, even having a golf bag to match the body carried in a support on the side of the body.

Apperson is showing a good example of top work in which a detachable gypsy curtain is utilized to conceal the top bows. There is an inside as well as an outside flap to the gypsy curtain which conceals the bows, both inside as well as outside of the car. In fact, one of the features of the show throughout is the great improvement in tops; instead of the ugly square, angular rear to be found on tops in the past every one has endeavored to secure a graceful curve which is enhanced by the practically universal employment of plate glass for the rear curtain lights.

Experiments on Flame Propagation

WHEN a mixture of gas and air is ignited within a closed vessel, the flame travels through the mixture in a manner and at a rate which depend upon the nature and the proportion of the gas, the position of the point of ignition, the intensity of the means of ignition, the shape and size of the vessel, and also upon the agitation of the gas mixture. The latter factor is of importance in gas engines where turbulence may be set up during the introduction of the charge. Professor R. V. Wheeler has recently studied these phenomena in mixtures of methane and air at Eskmeals (Transactions of the Chemical Society, November, 1918, pages 840 to 859), with particular reference to the development of pressure and to the speed of the flame propagation. Using spherical vessels (machined bronze castings) of 19.5 cm. and 31.5 cm. diameters and capacities of 4 litres and 16 litres, and mixtures containing from 6 per cent to 13.9 per cent of methane—the lower and upper limits of inflammability are 5.6 per cent and 14.8 per cent of methane—he observed a maximum pressure of 6.97 atms. (above atmospheric pressure), both in the big and small vessels, for the 10 per cent mixture. His values were lower than those of Le Chatelier and Mallard (1883), who obtained irregular values, however, but agreed better with those of Beyling (1902), who experimented with cylindrical vessels of 42 litres and 11 litres capacities. Le Chatelier had also used cylinders of 17 cm. diameter and height, and, like Wheeler, central ignition. In spherical vessels the flame probably travels as a spherical wave; in cylindrical vessels the flame may touch some portions of the cool wall earlier than others. Wheeler found that the flame would, in the latter case, travel upward and downward at the same speed in mixtures containing from 7.5 per cent to 12.5 per cent of CH_4, but would travel faster upward in mixtures outside that range. The maximum pressure observed need not come up to the full theoretical pressure attainable, for apart from radiation and conduction

(*Continued on page* 278)



View of part of the accessory exhibit

Refinement in Detail Principal New Feature at Chicago

Mixture, Temperature and Chassis Lubrication Subjects of Study—Bevel-Edge Bodies Popular, But Often Faulty

By J. Edward Schipper

FROM an engineering standpoint the greatest feature of interest at Chicago is the refinement of detail. No radical departures from previous practice can be found and what there is that is called new has already been discussed and the details previously published. The Essex is on the floor for the first time and the new Overland small four which was shown last year in chassis form now appears with its complete body as well. Ford has the electrically-equipped closed cars on exhibition. Mitchell has a refined car which will be at its showroom early in the week, but which has not made its appearance on the floor of the Coliseum.

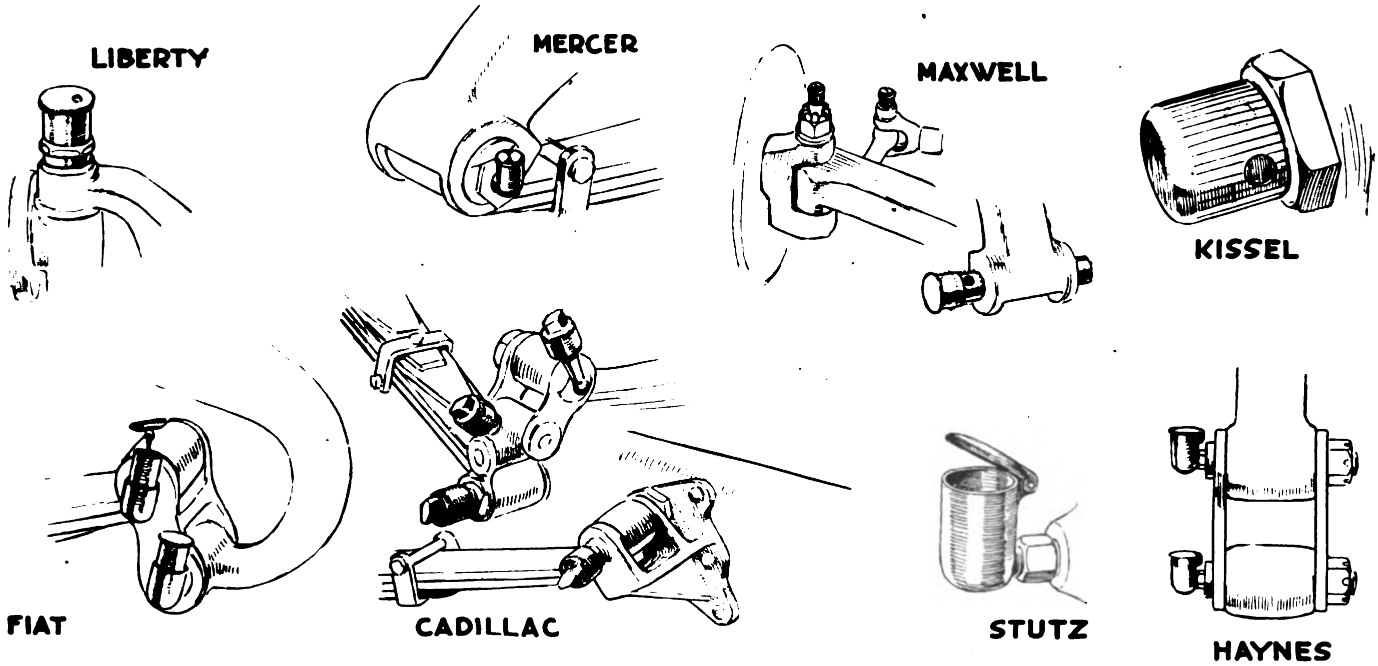
Mitchell's new car is a refinement of its smaller six-cylinder model, bringing it more in line from a production standpoint with the larger car and at the same time considerably improving it. The rear axle is being changed and the same axle as is used for the larger car will now be used for the smaller. This is a Mitchell product and is full floating, replacing the three-quarter floating type previously bought outside. The cone clutch is now being replaced by a Borg & Beck disk, and the tire pump is also being increased in size. A larger bevel-edge body is also fitted.

The electrical system used on the Ford has been made a production proposition and it is freely predicted will soon be standard equipment on all Ford cars. It is manufactured by the Liberty Starter Co., Detroit, and is a two-unit, 6-volt type with the generator mounted on the right side of the engine, taking the drive from the timing gears. The starting motor is mounted on the left side and drives through the flywheel. The car is also fitted with an ammeter mounted on the dash and a Yale switch lock. The rims are now demountable and 30 x 3½-in. tires are used all around. This car sells for $850 f.o.b. Detroit.

Throughout the exhibits there has been a checking over of tire sizes so as to bring these in line with the Government specifications. The use of disk wheels on an increased number of cars is

Color at the Show

Color	Annex	Armory	Total
Black	8	19	27
Maroon	4	5	9
Blue	4	6	10
Green	5	9	14
Khaki	1	2	3
Red	1	5	6
Olive	1	..	1
Gray	1	6	7
White	..	1	1
Tan	..	3	3
Cream	..	2	2
Total			83



The cleaning up of chassis lubrication problems is one of the noticeable features of the various models on view. Here are a few examples showing the use of oil cups to replace grease cups

noticeable, this of course being special equipment. The Disteel wheel is on quite a few of the special show cars.

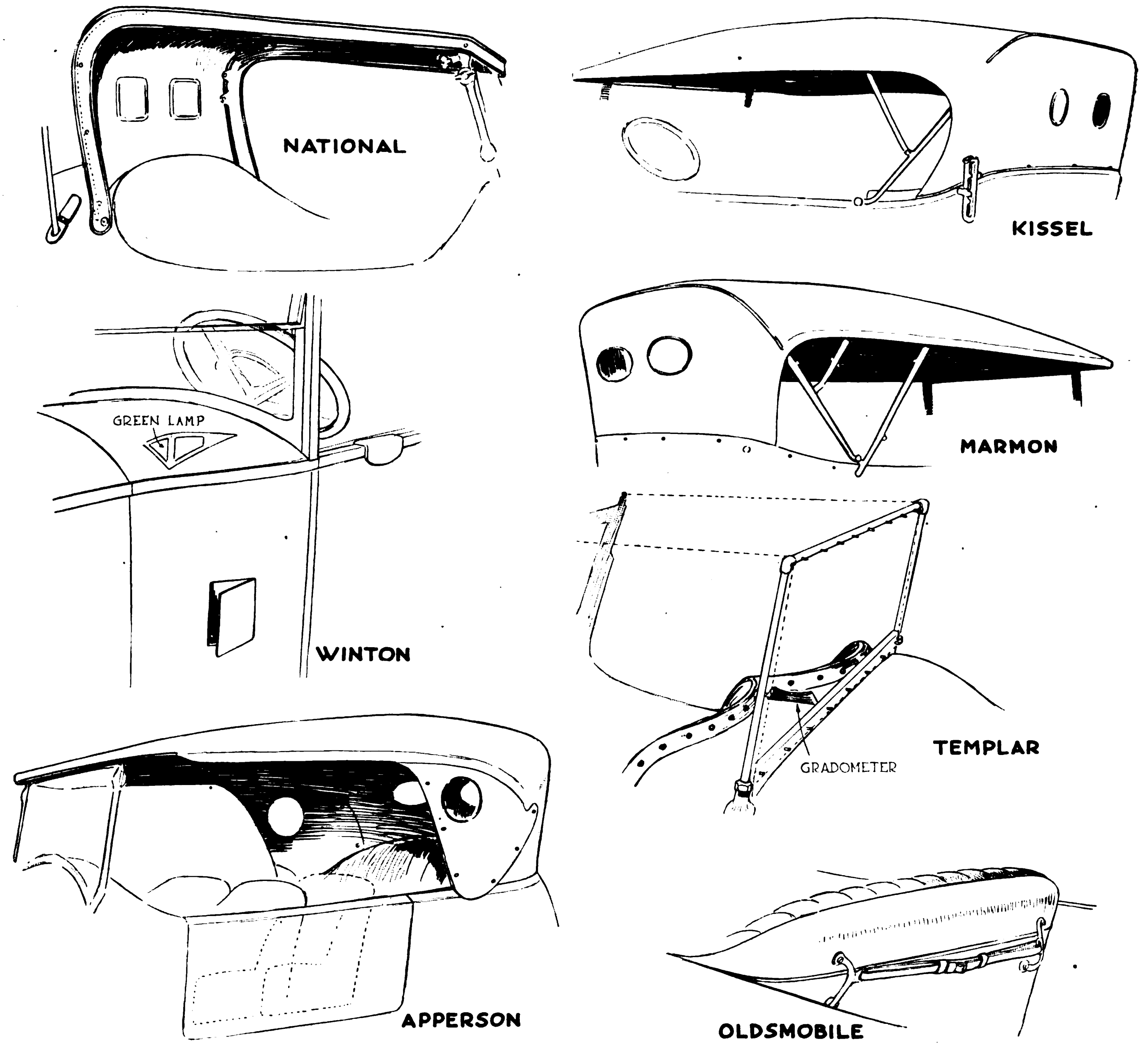
If there is anything of engineering importance to be noted it is the cleaning up of chassis lubrication questions. This does not by any means imply that the inaccessible grease cup has been done away with, because this is not so. It is there in just about as great numbers as at the show last year. There has, however, been an increase in the use of oil cups for spring shackles. The cars on the floor with oil cups on the shackles include Maxwell, Studebaker, the new Overland, Haynes, Oldsmobile, Packard, Nash, Franklin, Briscoe, Mercer, Cole, Kissel, Westcott, Premier, Stutz, Elgin, Liberty, Paterson, and Jordan.

Some of the cars are using self-lubricating bushings at the shackles; these include Holmes, Lexington, Moline, and Marmon. A number of the above cars use oil cups on the steering knuckle pins, although this practice has not become nearly so well represented as the practice of using the oil cups on the shackles.

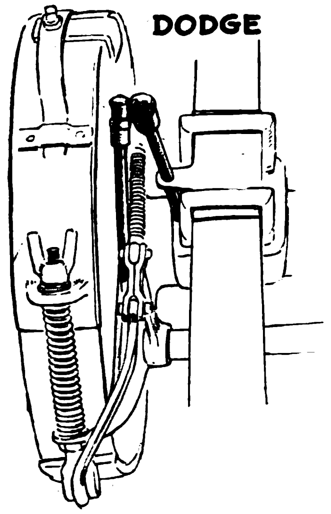
Another feature that is receiving attention is that of the admission of heat to the air intake. Where a lack of foresight may be noticed is in the possibility of controlling the heat. There should be some sort of damper or by-pass which will allow of the admission of air at atmospheric temperature during warm-weather operation. Some of the cars are using a damper which can be adjusted by means of a screwdriver. It would seem that the better way is to follow the practice of others and make the heat control a matter of hand adjustment.

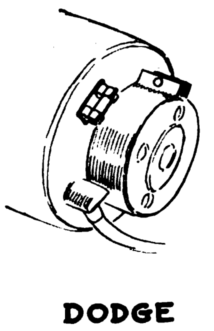
Nash has a linked control by means of which the heat entering the mixing chamber is controlled by the motion of the throttle. At low throttle opening when the heat is required, it is admitted, and at wide-open throttle the heat is shut off from the mixing chamber. The heated air intake, however, is used continuously.

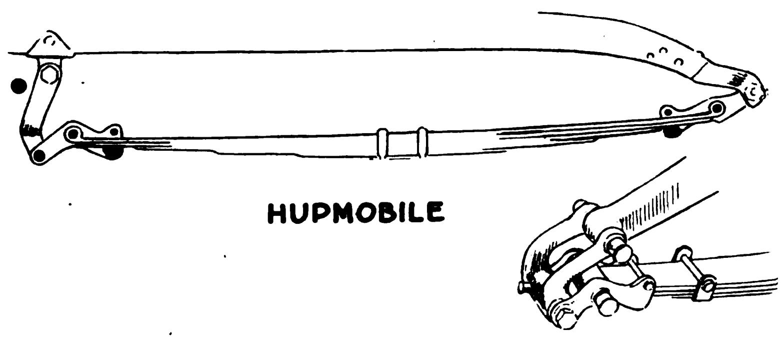
A detail that is growing in popularity with designers



In general, tops appear to be slightly lower, and in many cases gypsy curtains are being made to cover the rear bows. The use of plate-glass windows gives evidence of growing in popularity







A FEW EXAMPLES OF REFINED DESIGN

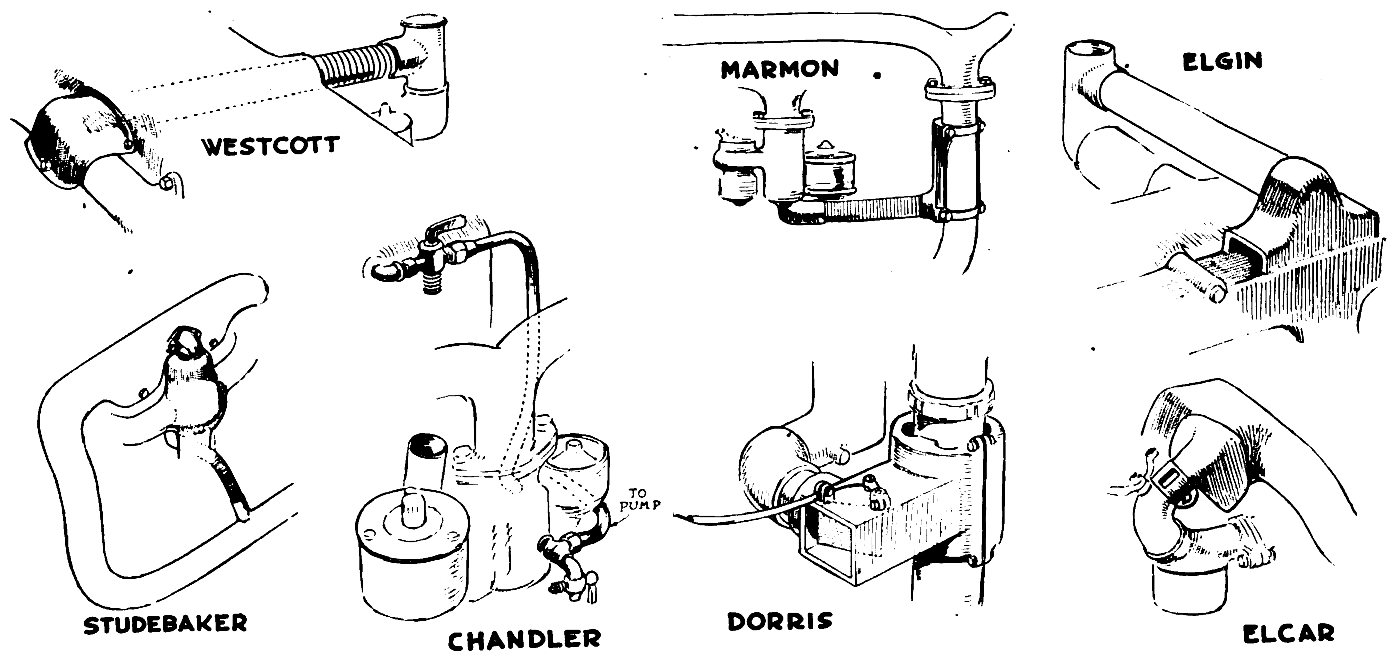
Dodge makes sure of the lubrication of the internal brake mechanism by providing an oil cup at the end of a tube; the generator fuse is located directly on the generator. In one of the Hupmobile models there is a new type of combined spring shackle and shock absorber

is the use of a cross-member at the front extremity of the frame. The cross-member is usually of tubular construction and is not only a stiffening element in the frame itself, but also is of value as a bumper in case of collision. National, Hudson, Mercer and others use this to advantage.

From the standpoint of body design probably the most noticeable feature is the increase of the bevel-edge bodies. From what can be seen at the show it would appear that the use of this type of body should not be attempted by makers who cannot afford to put the best workmanship and materials into the body. In the low-priced body where the material used is of light gage not well reinforced, the bevel edge is hard to keep in a straight line and the result is a very loose-jointed appearing job.

The largest car at the show is a Winton limousine. The chassis is the larger Winton six and the body is by Kimball of Chicago. The size of the car may be judged from the fact that the radiator cap is level with the shoulder of a man of average height. As a rule the makers are going to smaller bodies, and the four passenger type with its narrow lines is making an appeal this year. It is very probable that a six-passenger design carrying out the lines of the four-passenger with the extra seats well upholstered and folding neatly into the backs of the front seats would prove popular. It is surprising that there are no six-passenger jobs shown.

The cars at the show with bevel-edge bodies include all price classes and number among them the following: Studebaker, Hudson, Haynes, Cole, Kissel, Westcott, Lexington, Winton, Scripps, Stearns, Liberty, Essex, Paterson, Jordan, Case and Dorris. In a great many instances these cars are four-passenger design in which the hood is higher than the straight side of the body. Paint colors are in great variety and these four-passenger cars in particular are colored to accentuate their individuality.



SOME EXAMPLES OF HOT-AIR EQUIPMENT

On all these carbureters, except the one used on the Chandler, makers have provided for supplying hot air to the mixture. Chandler prefers the use of a water-jacketed carbureter

Production and Import of Tungsten Ores

A Slight Falling Off as Compared with the Two Preceding Years—Tungsten Important as an Alloy in High Speed Tool and Valve Steels and as a Material for Incandescent Lamp Filaments, Electric Contact Points, Etc.

THE production of tungsten ores in the United States in 1918, according to preliminary statistics collected by Frank L. Hess of the United States Geological Survey, Department of the Interior, was equivalent to 5065 short tons of concentrates, carrying 60 per cent tungsten trioxide, of which 5015 tons, valued at $5,156,500, was marketed or consumed by the producers and 50 tons was reported as left on hand at the mines at the end of the year. Although the output was very large, it was less than that of the 2 previous years—1916, with 5923 tons, valued at $12,075,400, and 1917, with 6144 tons, valued at $6,783,400. The production in 1917 was the largest made by any country, although it was much smaller than the combined output of the countries under British rule.

Colorado regained its lead as the largest producing State, with 1910 tons of ferberite, against California's 1781 tons of scheelite and Nevada's 885 tons of scheelite. In 1917 California had "led by a nose," with 2781 tons, against Colorado's 2707 tons, though in 1916 Colorado had produced 2401 tons to California's 2171 tons. Nevada's output was 689 tons in 1916, 143 tons in 1917, and 885 tons in 1918.

Large Production of Scheelite

One of the remarkable developments of the year was the large production of scheelite in the Great Basin region from the contact-metamorphic deposits, limestones altered by solutions accompanying intrusions of granite. Much the larger part of the ore mined in Nevada; in fact, all reported except that from the Tungsten Dyke mine at Sodaville was taken from contact-metamorphic deposits. The deposits at Bishop, Cal., also furnished a considerable quantity. Altogether the contact-metamorphic deposits gave an ouput of 1413 tons. In the Eugene Mountains, about 7 miles northwest of Mill City, the Nevada Humboldt Tungsten Mining Co. and the Pacific Tungsten Co. erected mills which began work late in the year. A pipe-line 22,000 feet long, to bring water from wells in the valley of Humboldt River, two pumping stations to lift the water more than 1100 feet to the mines, and a power line 32½ miles long to bring electricity to them were built by a mutual subsidiary company, the Mill City Development Co. A tramway 3½ miles long, with a gasoline locomotive and steel cars, hauls the ore of the Mill City Mining Co., a closely related concern, to the Pacific Tungsten Co.'s mill. The mines have gasoline hoists that will soon be replaced by electric hoists. Earlier in the year these companies shipped their ore to the mill of the Humboldt County Tungsten Mines & Mills Co. at Toulon, 60 miles southwest of their mines, for treatment. This company also treated ores from its own mines and from a number of other properties.

At Bishop, Cal., the Standard Tungsten Co., which had been working contact-metamorphic deposits, ran out of ore and after re-treating a part of the tailings closed its mill. The Pine Creek Tungsten Co. began active work on the development of a contact-metamorphic deposit about 25 miles northwest of Bishop, at an altitude of about 11,000 feet. The country is very rough and steep, and many miles of road had to be constructed. It is expected that the mill will be put in operation in 1919. The altitude is so high that during a large part of the year snow hampers operations unless they are carried on under cover.

The famous mine of the Atolia Mining Co. at Atolia, Cal., made a much smaller output in 1918 than in 1917 but was still the largest producer in the United States. In the Boulder, Col., field ferberite was taken from the principal mines in quantity comparable with that mined in 1917, but the output from the lesser mines was so much smaller that the total dropped nearly a third. The Wolf Tongue Mining Co. had bonanza ore in its Cold Spring mine and was the largest producer in the district.

In Arizona the production was equivalent to about 213 tons of concentrates carrying 60 per cent tungsten trioxide, valued at $245,000, and it included wolframite, hübnerite and scheelite. The Yucca Tungsten Co. was the largest single producer.

The Homestake Mining Co. produced considerable wolframite from the replacement deposits at Lead, S. D. The production of other tungsten ores in the Black Hills was so small as to be negligible. A small quantity of scheelite was produced in Utah, and a little hübnerite was taken from Blue Grouse Mountain, near Deer Park, Wash.

Prices

The prices of tungsten ores were fairly steady during the greater part of 1918. Scheelite that was free from phosphorus, sulphur and other harmful impurities brought about $25 a unit most of the year. The other minerals brought from $18 to $25. Impure ores were always a matter of bargaining. Toward the end of the summer and in the fall the demand was very heavy, owing to the huge orders of the Government for war materials. With the signing of the armistice on Nov. 11 orders were canceled, the demand slowed down and prices fell accordingly. At the end of the year wolframite of good quality that carried more than 60 per cent of tungsten trioxide was offered in New York for $12 a unit.

Imports

The imports during the year were much the largest ever made; for the first eleven months they amounted to 10,448 short tons, valued at $10,224,668. As nearly as can now be determined, 3581 tons came from South America, 6465 tons from China, Hongkong and Japan; 260 tons from Mexico, and 142 tons from other places, though it may have been transshipped from Asia or South America. The ores credited to China and Hongkong are of course all Chinese, though part of them may come from the British-controlled mainland. The ores credited to Japan are probably also largely Chinese but are shipped by way of Japan by Japanese firms.

The largest Asiatic shipments of the eleven months were those of November. The Chinese deposits are alluvial and are now probably mined more cheaply than any others in the world.

—

Warning Against Waste of Natural Gas

A word of warning is being uttered by C. G. Gilbert, Curator of the Division of Mineral Technology, U. S. National Museum, with regard to wastefulness in the handling and use of natural gas, in a foreword to a technical paper by S. S. Wyer, published by the Bureau of Mines.

Natural gas, says Mr. Gilbert, is the least appreciated, consequently the most abused, of the mineral resources in popular use. The issues involved are of direct concern to some ten millions of the inhabitants of the United States, and their range of influence does not stop even here; for they form a prominent feature in the nation-wide problem of fuel supply which may be solved effectually only through coordinated attention to the component parts.

WANTED—SANE HANDLING

Labor Situation Does Not Warrant Hysterical Outbursts—Condition Only Temporary

INVESTIGATION BY AUTOMOTIVE INDUSTRIES REVEALS FACTS

If All Men Withdrawn from Industry for War Purposes Were Reabsorbed, It Would Still Require About 2% More to Take Care of Probable Productive Necessity for This Year

By Harry Tipper

THE public agitation in connection with the question of the readjustment of labor due to the return to peace conditions continues unabated. There is now before Congress a bill to restrict immigration for a period of 5 years on the plea that there is not sufficient employment for the workers now in this country, and that widespread immigration is likely to occur which may lead to destructive competition in labor circles.

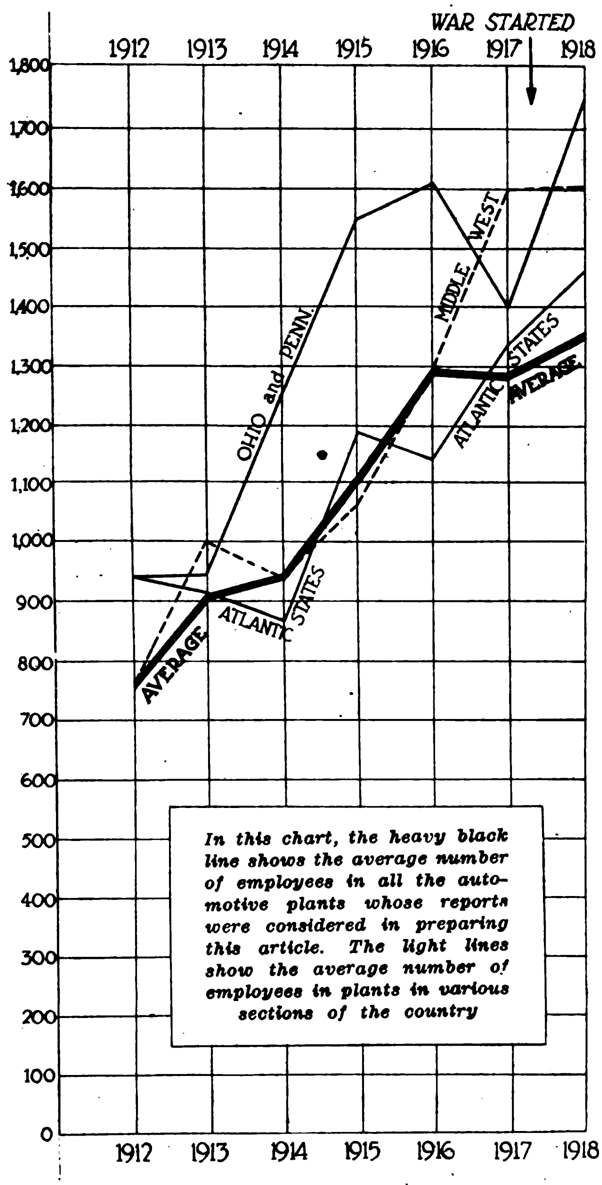
Newspaper articles are appearing from time to time expressing a fear of the growth of Bolshevism and unrest due to increasing unemployment and the difficulties of readjustment.

On the other hand authorities who ought to be acquainted with the matter state that there is no surplus of labor in this country, and that the question is one of movement of labor from its present location to spread it out over the surface of the country where it is naturally required for the continuance of peace production.

To some extent all these views have at least a temporary basis in the actual conditions of the moment.

It is true that there is considerable unemployment, particularly in the coast cities in the East and the large manufacturing centers.

It is also true that there is



some difficulty in placing the returned soldiers at work as they are demobilized, and it is probable that the labor readjustment will mean sufficient difficulty in various localities to provide a reason for a certain amount of unrest and a certain amount of dissatisfaction with the government.

These, however, are only temporary conditions, and unless they are likely to become permanent they do not justify the hysteria which has been exhibited in the discussions upon the subject; and they do not justify such drastic measures as Congress is proposing in connection with immigration.

Analysis of Condition

During the four years previous to the European war the total number of immigrants into this country amounted to a little over 4,100,000. During the war there have been taken out of industry for war duty something over 4,000,000 men, and there have been introduced into industry not more than 300,000 women.

The immigration during the war amounted to just over 1,000,000, or a shortage of a little over 3,000,000, leaving a matter of 1,500,000 to 2,000-000 who must be returned to industry in this country over and above the normal supply which would have been secured during the same period by the usual process of immigration.

There are in all upwards of 20,000,000 workers in this country of all kinds, and the reports of total unemployment according to the labor organizations whose reports are not likely to be underestimated amounted to 210,000 at the time this article is written, or approximately 10 per cent of the total labor of the country.

On the other hand, the United States Employment Bureau reports that in forty-four states during the week of Jan. 11 there were 153,763 applications for jobs, of which 99,000 were placed, but that during the same week the employment service received 202,757 applications for help, *or nearly* 50,000 *more applications for help than there were applicants for jobs.*

From all the figures which can be secured from all interested sources there is no evidence showing actual surplus of labor in the country in any more important sense than a survey in September, 1914, would have shown in actual surplus.

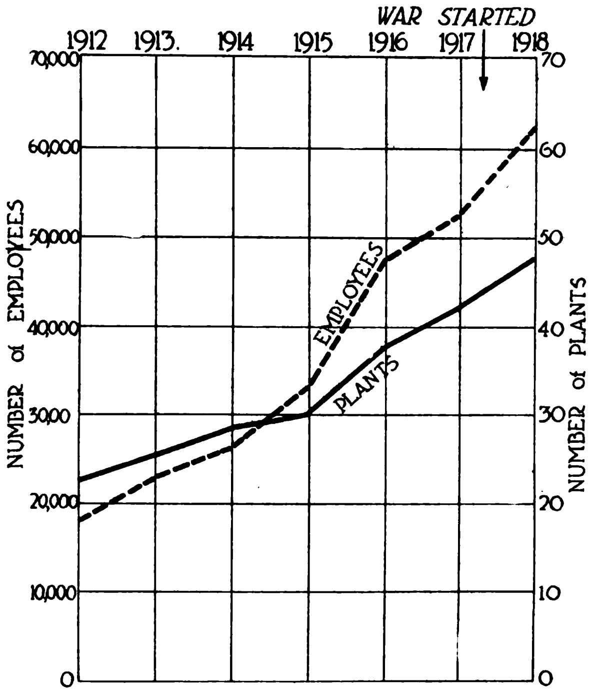


Chart showing the increase in the number of plants and the increase in number of employees during 7 years

The beginning of the European war showed a very pronounced drop in industrial activity for some little time, with a corresponding surplus of labor for a few months. But this surplus was occasioned only by the temporary financial condition and did not indicate more people for the work than were necessary to continue the country's business.

It is evident from the reports which have been received from most of the states that the unemployment is due to four causes:

1—A desire of returning soldiers to engage in new occupations and to settle in new parts of the country. In New York City the Red Cross, the Knights of Columbus, the Y. M. C. A. and the United States Employment Service have all noted the large majority among the demobilized soldiers applying for jobs whose homes are in different cities scattered all over the country, but who do not wish to go home if they can avoid it. In the writer's own little office, out of twelve applicants for work in one week, all of them returned soldiers, only one lived in the vicinity of New York, and a personal examination of the record in a number of offices in this city discloses approximately the same condition.

Cancellation of War Orders Increases Unemployment

2—The shutting down of employment in war industries due to the cancellation of war contracts. This has resulted in the sudden increase of the ranks of the unemployed by thousands of laborers, skilled and unskilled, who have up to this time been making unusually large pay. These workers do not attempt until necessity drives them any other work at a lower rate, and they will not move away from the manufacturing centers except under the same conditions.

3—The dilatoriness of the Government in legalizing in former contracts the red tape surrounding the cancellation of contracts, and the inability of the manufacturer to proceed with production plans with the existing unsettlement of all its financial arrangements. There is no excuse for this governmental waste of time in the settlement of these matters, notwithstanding the desirability of preventing undue profiteering. There was no hesitation in writing off more than $1,000,000,000 of the cost of the merchant marine in order to put it upon a competitive basis, and there seems to be no hesitation about the guaranteed price of food products with the producer of food. The length of time occupied by the present hesitation about production and the severity of the disturbance itself are greatly affected by the action of the Government in connection with these contracts, which are very numerous and which involve billions of dollars.

4—The tendency of all parties concerned, whether the leaders of organized labor or individual manufacturers or politicians, to use its period and its present uncertainty in order to gain an advantage and not unitedly attempt to solve it. There is a great deal of junkerism in all official bodies, and particularly in the bureaucracy which represents them, and there is nothing much to choose between the political junkers who see in a disturbance only the means of pushing their particular theory of politics and the labor junkers who use this disturbance primarily as a means of increasing the power of labor, the industrial junkers who see in it an opportunity to regain control of the labor bargain.

As the third largest industry in the country, the automotive industry is deeply interested in the size of this question, in the means which must be taken to settle it, and in its political significance.

Investigation Made in Automotive Industry

For this reason a survey has been conducted through the industry in the attempt to determine the present condition, the way in which the employment has been effected by the war, and the possibility of reabsorbing rapidly the workers who were taken away for war duty and who may have been involved in the reduction of activity.

From the chart which is shown it will be observed that in the automotive field, out of approximately 125 concerns investigated, the increase in employment required by the growth of the industry calculated on the basis of the average number of employees to a plant per year showed 18 per cent as between 1912 and 1913, 3 per cent as between 1913 and 1914, the drop in this respect being due directly to the reduction in industrial activity at the outbreak of the European war; as between 1914 and 1915 this rose again to 18 per cent. It showed 17 per cent in 1916.

The restrictions imposed upon the industry by our entry into the war are indicated by a decrease of 1 per cent in 1917 over 1916, and the recovery from these conditions is indicated by an increase of 5 per cent between 1917 and 1918.

In the three years of normal activity for which the figures are given, that is, in 1913, 1915 and 1916, the increase is almost exactly the same, varying only 1 per cent in any one year from the other years. It is a little in-

teresting to note that the average number of employees who were drawn from the industry from these same establishments for war purposes is 17 per cent, or almost exactly the yearly increase in employment in a normal year.

If all the men who were withdrawn from the industry for war purposes were reabsorbed into the industry, it would still require about 2 per cent more in order to take care of its probable productive necessities for this year. This, however, must be taken in conjunction with the reductions which have occurred in some of the plants in the last month.

These reductions average about 6 per cent of the total number of employees reported, and they could be taken care of by the necessities for increased forces in a number of the concerns reported.

It is interesting to note that while the automotive industry did a great deal of war work, this was confined to a comparatively small number of concerns. The larger portion of the concerns in this industry were restricted by the war in their activities without receiving any corresponding compensation in the nature of war work. Their mechanics were absorbed into other industries or into the larger plants, and they are now attempting to rebuild their organizations.

Most of the concerns which were on war work report temporary reductions in employment to the extent of from 10 to 30 per cent. Most of the concerns who were not engaged upon war work report a necessity for increasing their working forces anywhere from 5 to 50 per cent.

It is very evident that the process in the automotive field is one of readjustment. Even in the plants which have been engaged on war work the increase in employment has not been very abnormal.

One concern, for example, that has been extensively engaged in work for the Government increased its employees in 1915 over 1914 by 1700. In 1916 it increased over 1915 by 1300. In 1917 it increased over 1916 by 2600, and in 1918 it increased over 1917 by 1600, showing that its increase on account of our entering into the war was less than the increase necessitated by the demand upon us from our Allies.

A number of other facts are brought out by this analysis resulting from the information secured from the actual manufacturers in the automotive field which illuminate the labor situation still further.

In the reports from the East it is interesting to note that all the reports from Buffalo show a surplus of labor. A majority of the reports show a surplus of both skilled and unskilled, while the other reports indicate a scarcity of the unskilled. Syracuse also shows a surplus of both kinds; Rochester a surplus of semi-skilled, by which is evidently indicated machinists that were trained during the war to operate a certain machine in a few weeks' time.

But the small manufacturing towns in the northern part of New York State, such as Binghamton and Jamestown, are still suffering from a scarcity of labor, or at any rate have no surplus.

It will be some time probably before the labor which is unemployed in Buffalo will have spread itself over the smaller manufacturing towns in that area.

The same difference in the situation is to be observed in Pennsylvania and Ohio. Philadelphia, Pittsburgh, Harrisburg, Cleveland and Springfield report considerable surplus, while the smaller towns in the same state are not yet aware of any increase in the applications.

It is obvious from the survey that reductions in employment which have taken place in the automotive field affect only about 25 per cent of the firms reported, while increases affect about 35 per cent.

The number of employees affected by the reductions is slightly larger than the number of employees demanded by the increases, but the demand is not sufficiently great to indicate any real diminution of activity even temporarily, and in most cases it is expected evidently that the reductions which have occurred will only be enforced until about March or April, by which time the operations will have become sufficiently near normal to permit of the organization going ahead on the full complement of men.

It would be of great advantage to the automotive field if the manufacturers who are interested in their organization activities in the localities would institute activities looking to the more rapid transfer of labor from the manufacturing centers to the smaller industrial towns, and from the East, particularly the coast cities, to some of the sections in the interior where there is still a scarcity of labor and no immediate prospects of getting all the labor that is required.

The propaganda which has been established from various sources is unfortunate because it has led to a misconception of the matter, and the problem is conceived to be of far greater proportions than it actually assumes.

Even conceding the estimates of unemployment issued by the labor organizations, the problem is not nearly so severe as it was in 1914, when the beginning of the European war practically stopped industrial activity in this country for several months. *The problem requires sane, common sense handling and not the hysterical outbursts which have been so much in evidence in the newspapers and general publications.*

Extinguishing and Preventing Oil and Gas Fires

DURING the period of 10 years from Jan. 1, 1908, to Jan. 1, 1918, approximately 12,850,000 bbl. of oil and 5,024,506,000 cu. ft. of gas were destroyed by fire in the United States, entailing a total estimated property loss of $25,254,200. During this period 503 fires were reported. Three hundred and ten of these fires were caused by lightning and 193 by all other causes. The losses from the fires caused by lightning were estimated to be $11,148,000, and from those due to all other causes $14,106,200. Directly and indirectly, the fires resulted in the deaths of nearly 150 persons and were responsible for almost as many more being permanently disabled.

For the past three years the Bureau of Mines has been conducting investigations to determine the nature and the specific causes of these fires, with a view to suggesting means whereby they may be successfully combated and, in some places, perhaps eliminated entirely. The results of this investigation are given in Bulletin 170 of the Bureau of Mines, by C. P. Bowie.

As the subject of oil and gas fires is necessarily broad, no attempt is made in the bulletin to treat it exhaustively; rather the bulletin aims to point out what has been done by operators in the past, and to describe various fire-prevention methods and fire-fighting apparatus which are being used or adopted by many of the larger oil companies. These methods and apparatus, it is believed, if universally employed by operators, will largely decrease the present enormous losses.

Wismach American Gage Blocks—Correction

IN the article on the above named blocks in AUTOMOTIVE INDUSTRIES of Dec. 5, the limit of accuracy of these blocks was erroneously stated to be 1/10,000 in. This should have been 1/100,000 in.

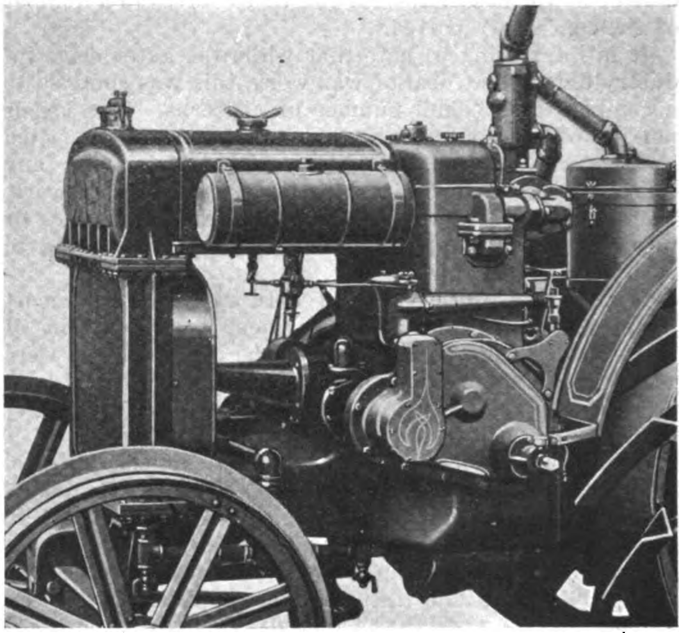
Case 15-27 Hp. Tractor

New Addition to the Case Line Embodies the Same Unit Construction as the 10-18 Hp. Model—Burns Kerosene or Distillate and Is Rated as a 3-4 Plow Tractor

By P. M. Heldt

WHILE the J. I. Case T. M. Co. of Racine, Wis., has long been prominent in the tractor field, and for years has been marketing a complete line of tractors, a little over a year ago it began to redesign its machines on lines in accordance with the latest ideas in the tractor industry. The first model of the new line was the 10-18 hp., a 2-plow machine which was fully described in AUTOMOTIVE INDUSTRIES of April 18, 1918. Recently the company has come out with another model, embodying the same features, known as the 15-27, which is the particular subject of this article. The present line is completed by a third model, rated at 20-36 hp., and capable of pulling 4-5 plows. The latter machine is equipped with a four-cylinder 5½ x 6¾-in. engine. The design of transmission is almost identical with that of the two smaller sized tractors, except that the differential is located on the jack shaft, which is geared to both rear wheels. All the gears on this larger tractor are inclosed and run in oil. This model, however, does not embody the unit construction characteristic of the two smaller models, the engine, transmission and rear axle housing being independent, supported by a frame of channel steel.

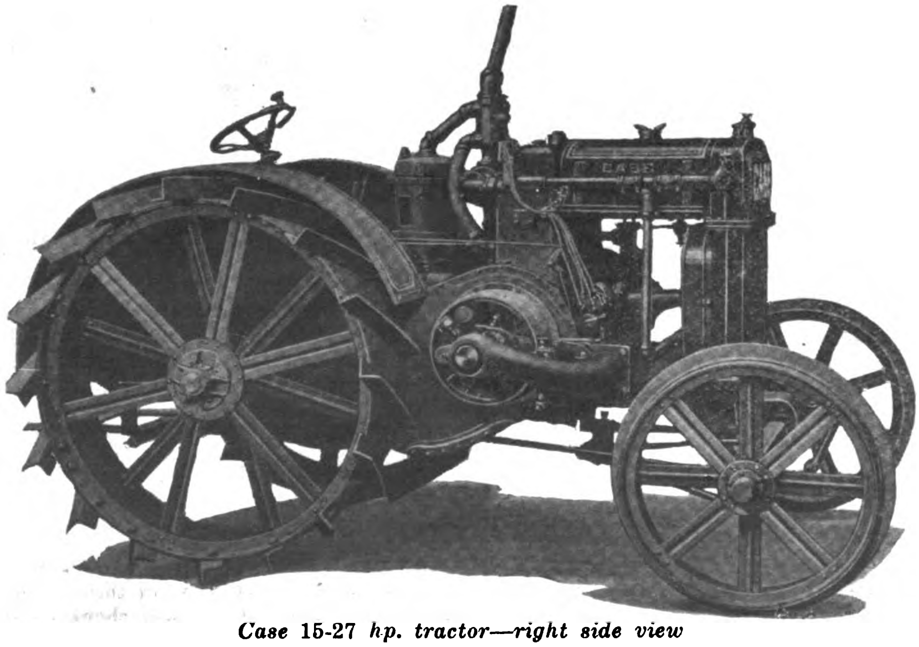
The most interesting feature of the Case 15-27 tractor is the main frame, which is a single iron casting so designed that in addition to serving as a frame it also serves as the main part of the transmission case, the crankcase and the rear axle housing. This construction permits all the main bearings of the engine, transmission and axle to be machined in this one casting, which makes it impossible for them to get out of alignment. At the front end of the main frame there is a cast steel extension which is firmly bolted to the main frame. To the center of this extension is pivoted the front axle, thus giving a three-point support to the main frame and allowing the wheels to accommodate themselves to uneven ground surface.



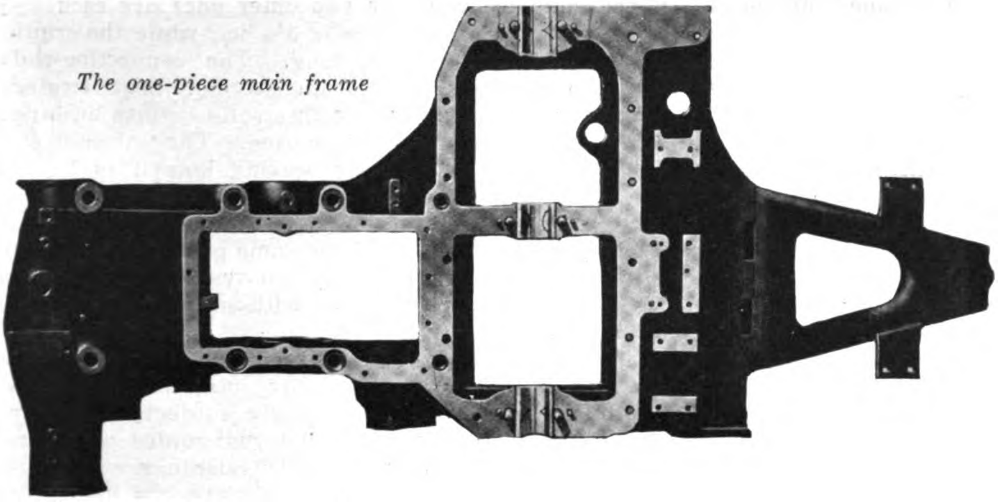
Left side view of forward part

The main frame casting is machined on special milling and boring equipment. The bores for the rear axle bull pinion shaft, first reduction shaft and main engine bearings are bored in one operation. This insures absolute alignment of these parts, which cannot be changed in the process of erecting.

The front axle is of the automobile type, both the axle proper and the steering knuckles being drop forgings. A worm and wheel steering device is used, and the tractor is said to be quite easy to steer. The rear axle is mounted in roller bearings in the axle housing forming part of the main frame casting. Roller bearings are also used throughout the transmission, and are carried in a dustproof case. The tractor can be turned around in a circle of 27 ft. 3 in. outside diameter. The drawbar is so connected to the tractor as to bring



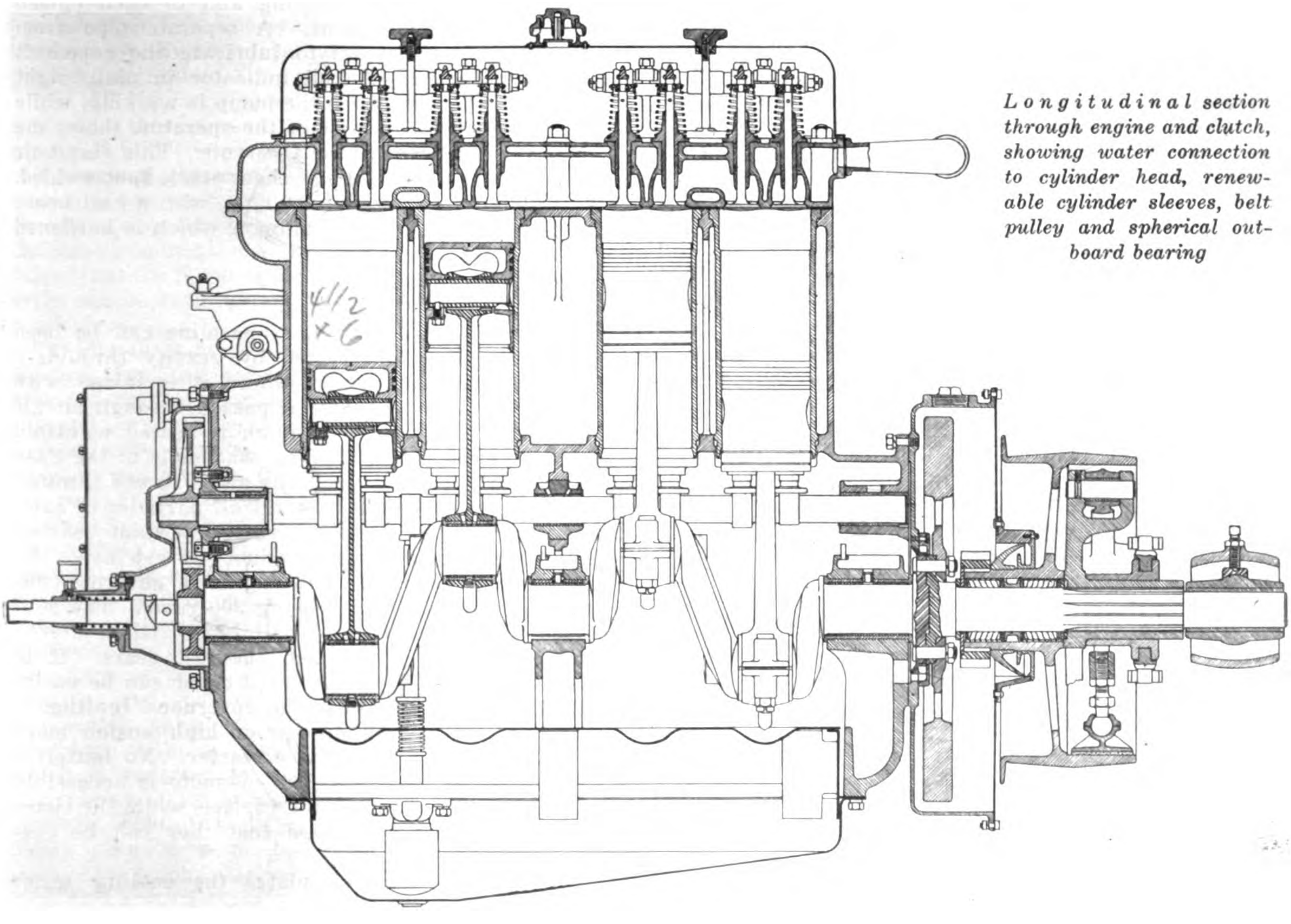
Case 15-27 hp. tractor—right side view


The one-piece main frame

the pull under the rear axle, and the load pulled has no effect upon the steering of the tractor. The drawbar is made heavy so that it may be able to stand the strain of backing up a load, and it may be left swinging or locked in any position desired.

The 27-hp. engine is a special tractor engine, designed to stand the heavy strain common in tractor work, and, like the engines of the other models, is claimed to be capable of developing more than its rated power. The engine is designed to burn kerosene, and all of its parts are easily accessible. It is of the four-cylinder, vertical type, with a bore of 4½ in. and a stroke of 6 in. In order that the transmission may be entirely through spur gears, and that the belt pulley may be mounted on an extension of the engine crankshaft, the engine is mounted transversely on the frame.

The entire valve mechanism, including the rocker arms, springs, stems and rods, is inclosed in a dustproof case, and lubricated by oil spray from the crankcase. In case the operator should wish to inspect the parts, it is an easy matter to remove the cover over the mechanism. The cylinder block is made with removable barrels or liners, which in case of wear or accident can be easily replaced with new ones. This feature is considered to be a most important one in a tractor engine. The sleeves are made of close-grained iron and their bores are ground to a smooth finish. The cylinder head is a separate casting and affords ready access to the valve and cylinders. All parts which require effective cooling, such as the spark-plug bosses, valve seats and valve-stem guides, are surrounded by water. The top of the cylinder head is inclosed with a stamped steel cover. This cover is provided with a felt gasket where it rests on the cylinder head. On top of this cover is placed a breather valve which allows the motor crankcase to vent past the operating parts of the valve gear, so as to keep them well lubricated. This breather valve is so constructed that it is closed when



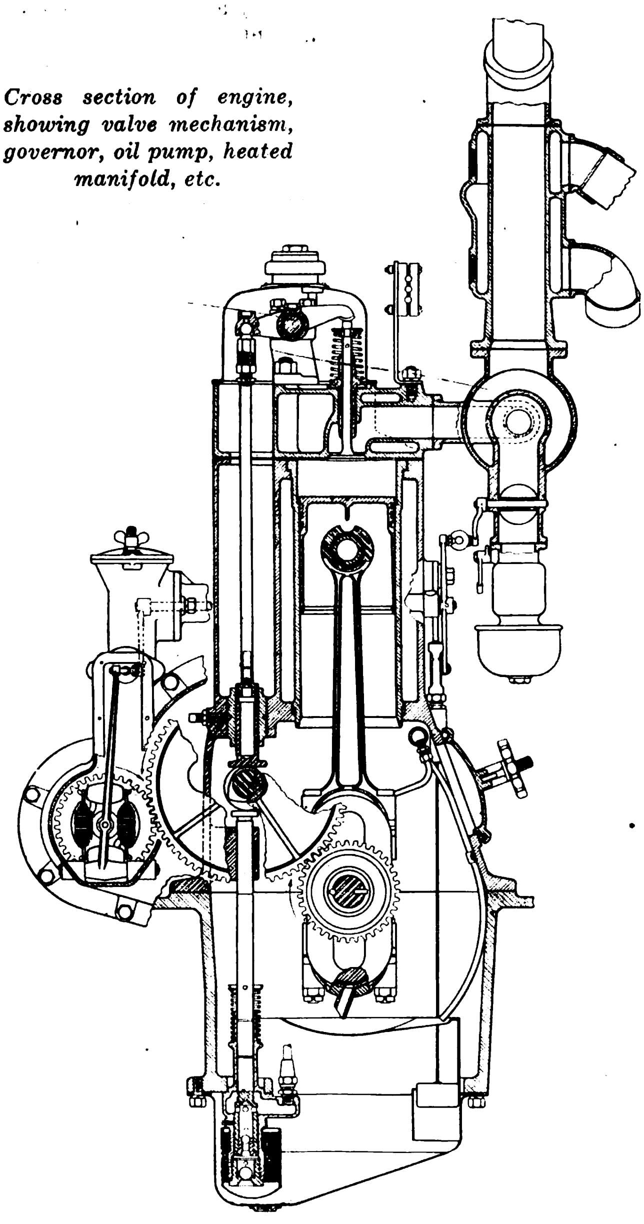
Longitudinal section through engine and clutch, showing water connection to cylinder head, renewable cylinder sleeves, belt pulley and spherical outboard bearing

subjected to any pressure from the outside, but opens to allow the pressure to escape from the inside of the crankcase.

As already pointed out, the lower half of the crankcase is a part of the main frame. This gives the engine a solid bed on the frame and makes it impossible for it to get out of alignment with the other parts of the tractor. The crankshaft main bearings are carried by the main frame castings, with bearing caps on top. There are two large hand holes in the upper half of the crankcase through which the caps of the main bearings can be easily removed, or adjustment to the bearings be made. There are three main bearings, which are of the bronze-back, babbitt-lined type, and their total length is 12⅛ in.

Adjustment of the crankpin or main bearings can be made after the removal of the oil pan. The design is such that the piston with its rod can be removed past the crankshaft, and these parts, of course, can also be taken out through the upper end of the cylinder when the cylinder head is removed.

The crankshaft is a steel drop forging, heat treated. Its bearings are accurately ground to size, and are of the substantial dimensions demanded in tractor work. All main and crankpin bearings are 2½ in. in diameter.



Cross section of engine, showing valve mechanism, governor, oil pump, heated manifold, etc.

Of the main bearings the two outer ones are each 4½ in. long and the central one is 3⅛ in., while the crankpin bearings are 2¾ in. long. The connecting-rods are drop forgings of I-beam section, heat treated. The upper end is provided with a solid bronze bushing, in which the piston pin is carried. The latter has a diameter of 1⅜ in. and its bearing length is 2¾ in. The bushing in the upper end of the connecting-rod is made of Non-Gran bronze.

The pistons are made of the same grade of cast iron as the cylinders, and cut with grooves for three piston rings at the upper end, and with oil grooves at the lower end.

Throughout the entire design care has been taken to see that such parts as require adjustment can be readily reached and parts that are subjected to wear, such as valve-stem guides, push-rod guides and camshaft bearings, are provided with bushings which are easily replaced at little expense. Care has also been taken to see that the engine parts can be taken out and replaced readily.

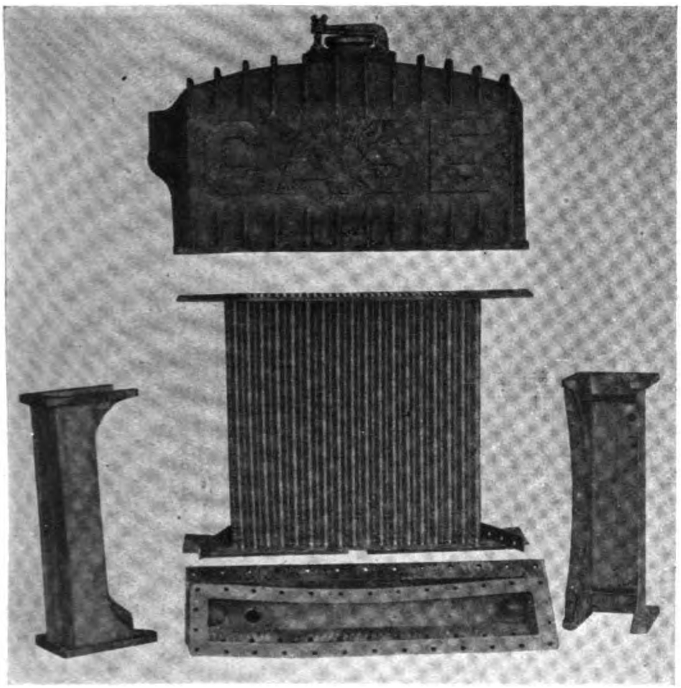
Combination Lubricating System

The engine is lubricated by a combination force feed and splash system. Pistons, connecting-rods, bearings, and valve rocker arms are lubricated by splash, while the crankshaft bearings, camshaft and governor are oiled by force feed from a pump. This pump is of the plunger type and located at the lowest point of the oil pan. The suction side of the pump is provided with a large screen and the whole pump assembly can be easily taken out for inspection. This pump delivers oil to a manifold which is located inside of the crankcase and from this manifold separate pipes carry oil to each main bearing and to each splash trough under the crankpins. A separate pipe from this manifold supplies oil to lubricate the camshaft gears and governor. An oil indicator in plain sight of the operator shows when the pump is working, while a float, also directly in view of the operator, shows the height of the oil level in the reservoir. This reservoir is made of No. 16 U. S. gage sheet steel, spot welded. The oil pump is of the plunger type, with a cast brass body and a cold-rolled steel plunger which is hardened and ground.

Fuel System Details

Either kerosene, distillate, or gasoline can be used as the fuel. The fuel is fed by gravity through a 1⅜-in. Kingston carbureter, where it is mixed with air which has previously been passed through an air washer, and then passes through a heated manifold to the engine cylinders. The air washer is of the Case company's own design. In it the air is forced through water and screens which take out all particles of sand and dirt. This feature has a very important bearing on the life of the engine, as no dust can get inside the cylinders, it is claimed. The engine is governor-controlled, the governed speed being 900 r.p.m. The governor is of the centrifugal ball type, and is driven from the camshaft by helical, cut-steel gears. It is inclosed and runs in oil. A small cover can be easily removed and gives access to the governor. Ignition is effected by means of a dust-proof high-tension magneto equipped with an impulse starter. No batteries are required for starting. The magneto is accessibly located and easy to remove and replace, while the timer and distributor are so located that they can be conveniently examined.

A centrifugal pump circulates the cooling water



Parts of the Case radiator

through the cylinder jackets and radiators. The latter is of the tube and fin type, with cast-iron frame. A gear-driven fan is mounted behind the radiator, and is provided with a friction safety hub, designed to relieve the fan of undue strain when the engine accelerates very quickly. The fan shaft runs on New Departure ball bearings. The cooling water is kept at the proper temperature for successfully burning kerosene by means of a Sylphon thermostat which is inserted in the cooling system.

One of the accompanying drawings illustrates particularly the accessories drive. It will be seen that ball bearings are used for mounting the shaft driving the pump, fan and magneto. Oldham couplings are so placed that the pump or fan drive can be removed as a single unit.

The clutch is of the expanding type. Its spider is provided with a splined hub, and the shoes are faced with asbestos friction fabric. As will be seen from the right-hand view of the tractor, the clutch is very conveniently located for adjustment. It is inside the belt pulley and is operated by means of a lever from the operator's seat. A single clutch serves for both traction and belt work. The clutch pulley is also provided with a brake which is operated by the clutch lever. This brake is used to hold the pulley from spinning when the gears are being changed, and when the gears are in mesh it can be used as a brake for the tractor.

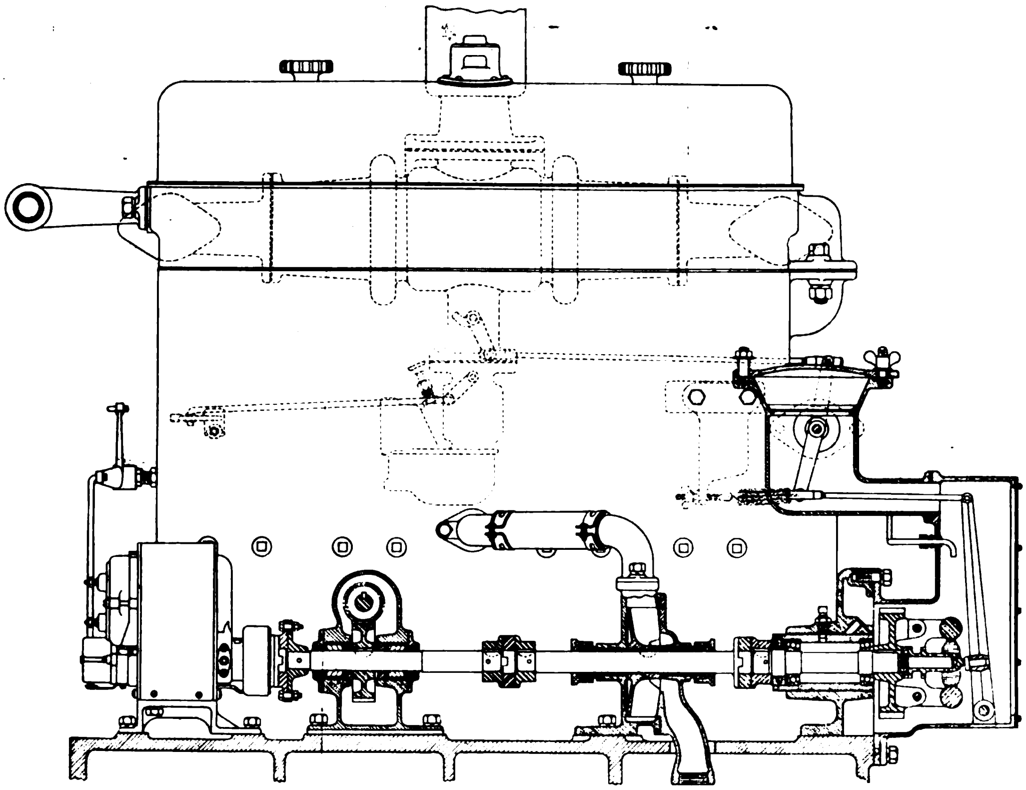
Location of the belt pulley is ideal for belt work, the pulley being mounted on an extension of the crank. The belt pulley is supported not only by the engine main bearing, but also by an outboard bearing. This construction takes considerable load away from the main engine bearing when the tractor is used either in the belt or in the transmission. It should be noted that the clutch arm is fastened to the shaft by means of splines and that the belt pulley is mounted on Hyatt roller bearings.

Design of Transmission

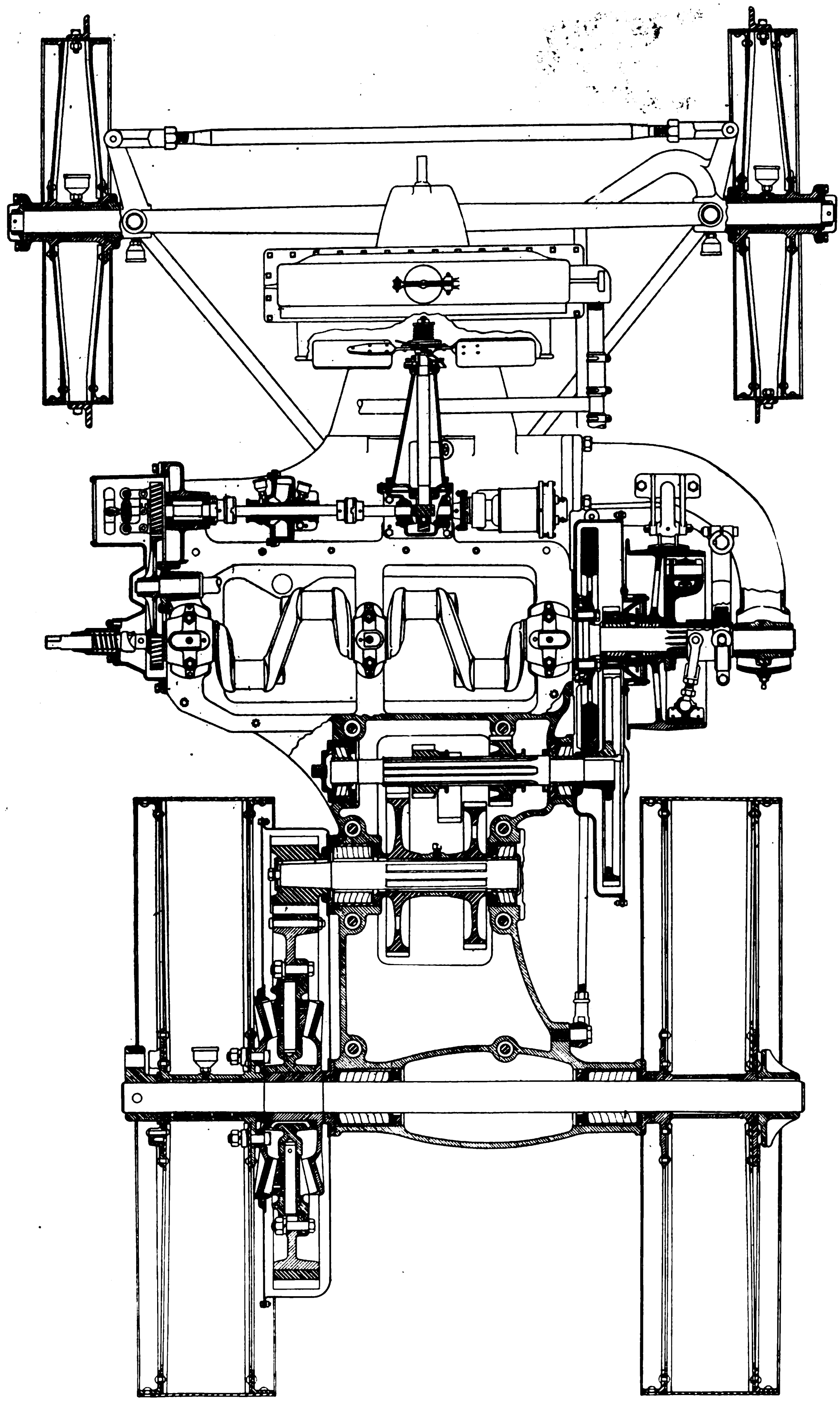
Only cut-steel spur gears are used in the transmission of the Case tractor, and these are inclosed in a dust-proof case and run in oil. The bearings are contained in the frame castings, making it impossible for them to get out of alignment. By removing the cover all of the transmission gears can be easily reached. The gear ratio from the engine to the bull wheel is 62 to 1 for the low gear and 40 to 1 for the high gear.

The crankshaft pinion is made of a steel forging and meshes with a semi-steel first reduction gear, keyed to the first shaft in the transmission. This shaft runs in Hyatt roller bearings and is provided with six splines through which the two-speed changing gears are driven. These sliding gears are drop forged, cut and hardened, and they provide two forward speeds, 2½ m.p.h. for plowing and 3½ m.p.h. for road work and for some of the lighter work in the field.

The low and high-speed gears are both made from drop forgings, are cut and hardened. The shaft which carries these gears also carries the bull pinion, and runs in Hyatt roller bearings. The bull pinion and master gear are steel forgings. Both of these have cut teeth, and run in oil in a dust-proof case. The differential bevel gears and bull pinions are made from cast steel, and they are inclosed to protect them from dust



Accessories, drive shaft, magneto, pump and governor



Plan view of Case 17-25 tractor, showing layout of transmission and drive

and provide for easy lubrication. The differential is carried on the rear axle and runs in Hyatt roller bearings.

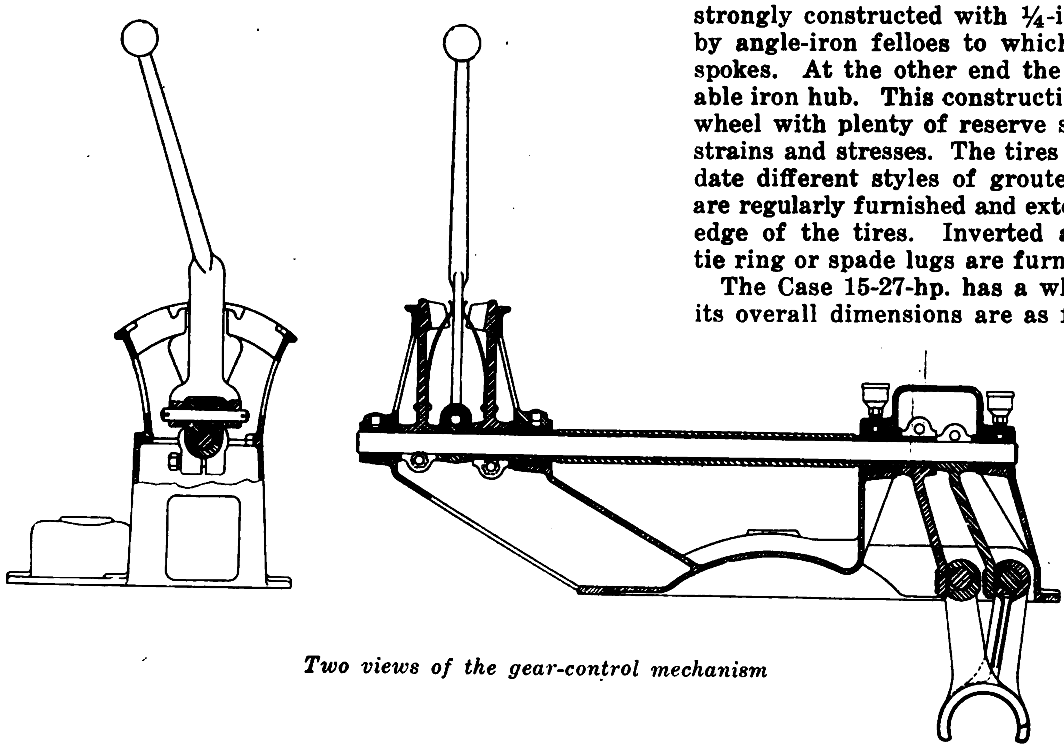
The transmission case is made of cast steel of deep section and is secured to the under side of the main frame by bolts of such length that they extend through the main frame and this case. These bolts are located at each side of the first and second reduction shafts and add strength to the main frame.

The transmission case performs the function of an oil pan for the transmission. The babbitted portion of this case is for the support of the reverse pinion shaft. This shaft is flattened on both ends, the flattened ends coming against the main frames, which prevents the shaft from turning and makes an easy assembling proposition as well as for the easy removal of the reverse gear and its shaft.

The belt pulley, which is 16 in. in diameter and has a 6½-in. face, is mounted on an extension of the engine shaft, and therefore runs at engine speed—900 r.p.m. The pulley being located on the same side as the tractor steering wheel makes it easy for the operator to line the machine up with the machine to be operated.

Power is transmitted to both rear wheels, which are 52 in. in diameter and have a 12-in. face. They are strongly constructed with ¼-in. plate tires, reinforced by angle-iron felloes to which are riveted twelve flat spokes. At the other end the spokes rivet to a malleable iron hub. This construction makes a solid, durable wheel with plenty of reserve strength to stand sudden strains and stresses. The tires are punched to accommodate different styles of grouters. Angle-iron grouters are regularly furnished and extend 6 in. beyond the outer edge of the tires. Inverted angle-iron grouters with tie ring or spade lugs are furnished on special order.

The Case 15-27-hp. has a wheelbase of 76½ in., and its overall dimensions are as follows: Length, 126 in.; width, 72 in.; height (without exhaust pipe), 68 in. The shipping weight is 5500 lb. The tractor pulls three 14-in. plows in tough sod or four plows under usual conditions. It is also adapted for other drawbar work requiring a similar amount of power, and it will operate either a 20 x 36 or 26 x 46-in. thresher.



Two views of the gear-control mechanism

Development of Military Aircraft in Great Britain

THE earliest type of British reconnaissance machine was the B.E.2 C., designed and produced by the Royal Aircraft Factory at Farnborough. The design was completed just prior to the outbreak of war, a fact which facilitated immediate production for the use of the Expeditionary Force. As far as possible, speed, climb and maneuvering ability were combined, although, compared with modern types, it was a relatively slow machine, making only 50 miles to 60 miles an hour with the 80-hp. engine with which it was originally fitted. This was followed by the Armstrong-Whitworth F.K. 8, fitted with 160-hp. Beardmore engines, which made an average speed of 82 miles an hour and could climb to 10,000 ft. in about 27 minutes. Toward the end of 1916, a forward stride was taken by the production at the Royal Aircraft factory of the R.E. 8 with a 12-cylinder R.A.F. engine. This machine has done the bulk of the artillery observation work in France, directing all the big-gun fire and barrage work. At 10,000 ft. it has a speed of 92 miles an hour, and can climb to that height in 11 minutes. It is fitted with camera and wireless equipment, and takes photographs of every "shoot." A bigger advantage was marked by the introduction of the "Bristol Fighter," a long-distance fighting reconnaissance machine, capable of traveling at 113 miles an hour at 10,000 ft. and climbing to that height in 11 minutes. Had the war continued, the Bristol Fighter would have entirely replaced the R.E. 8 for long-distance artillery work.

Aerial bombing was first undertaken in France by the Avro, a machine of moderate speed fitted with an 80-hp. Gnome engine. The observer's seat was used as a receptacle for the bombs, which were merely thrown overboard without the aid of the scientific bombing sights and elaborate bomb-dropping gear which have since made possible more accurate work. The first British machine specifically constructed for bombing purposes was the Short, a modified sea-plane, fitted with a 250-hp. engine and carrying four 112-lb. bombs under each wing. This type, which did most useful work in France, was followed by the Sopwith 1½ strutter, and later by the improved D.H. 4 and D.H. 9 machines. The D.H. 4 machine was originally destined as a fighter, but its trials disclosed such excellent lifting powers that it was converted to bombing purposes. It is capable of climbing to 10,000 ft. in 9 minutes, and has an endurance of 3¾ hours. The D.H. 4 and D.H. 8 machines have been fitted with Rolls-Royce, B.H.P., and latterly the Liberty engines.

Finally, the large Handley-Page machines were devised for the bombing of Germany. The first quantity production was begun in August, 1917, and the performance of the machine has justified its expectations. It is capable of carrying 2000 lb. weight of bombs in the fuselage, or 1500 lb. to suspend externally. The machines used by the R.A.F. Independent Force in the bombing of Germany have been the Handley-Page, D.H. 4, D.H. 9, and Sopwith "Camel." Not until the middle of 1915 were production machines armed with standard equipment. Two of the earliest types were the F.E. 2 B and the Vickers "Fighter." Both had an open cockpit, and were equipped with Lewis or Vickers machine guns. The year 1916 witnessed the introduction of the fixed machine gun firing through the propeller and fitted with the ingenious Constantinesco interrupter gear. Other types followed rapidly, leading up to the S.E. 5A, and lastly the Sopwith "Dolphin," the best and latest British fighting scout in the field.

Trend of German Airplane Design

A Summary of Features of Captured Enemy Machines, Issued by Technical Department (Aircraft Production), British Ministry of Munitions

ENEMY aeroplanes which have been captured intact or reconstructed have, under test, generally shown themselves poor in performance, judged by British standards, especially in point of speed at heights; but it would seem that as a rule they are fairly good in point of climb, and notably good in regard to maneuverability. Pilots report them, in the main, comfortable to fly and easy to land, especially the more modern types.

Wing Section

Scale drawings showing the wing sections employed are included in the detailed reports on the various enemy aeroplanes. In general they do not differ very markedly from British wing sections, though there is a distinct tendency toward rather greater camber. It is thought probable that this principle has been adopted so as to yield better results at high altitudes when the angle of incidence would necessarily be somewhat big.

Practically all German aeroplanes have a pronounced wash-out at the tip of the trailing edge. In the most recent example of Halberstadt design, namely, the C4 type, the lower wings are given a heavy wash-out at their junction with the bottom of the fuselage, the idea being to minimize the surface of discontinuity which would otherwise exist between the bottom surface of the fuselage and the wing roots. Thus the front spar is straight, but the rear edge is markedly concave. This effect exists to such an extent that the trailing spar is considerably bent as well as twisted.

The Fokker wing section is in a class by itself, not only on account of its great depth, but also in having only a very slight camber on the bottom surface. The performance of this machine is, however, by no means despicable, and it is generally conceded to be a redoubtable opponent in spite of the departure from optimum wing section which has been made.

Bays

As far as single and two-seater machines are concerned, the usual wing construction involves a single pair of struts at each side, but it is noticeable that in the latest model Pfalz scout, the D12, this practice has given place to double pairs of struts. Indications point to great strength having been made a matter of prime importance in this design.

In some types, notably the Pfalz and the Fokker, the upper plane is made as a single unit. In the latter case, the lower plane is also in one piece. In the generality of machines, however, the center section principle appears to be gaining vogue. Thus, whereas the L. V. G. C5 has a cabane consisting of the usual pyramid of struts, its successor, the C6, is furnished with a center section embracing a gravity petrol tank and the radiator, both of which are let into the plane flush with its top and bottom surfaces. The Halberstadt and Hannoveraner designs employ the same scheme.

Spars

Shortage of ash and spruce has led to the general adoption of built-up spars, which are of such a variety of types that a separate report is being issued upon their design. In nearly all cases ply-wood plays an important part. Thus in the Fokker biplane the spar, which, owing to the absence of the usual wire bracing of the wings, is extremely deep, consists of two thin rails of spruce united by deep ply-wood webs. In the Gotha bomber a built-up I-section spruce spar is covered in with ply-wood at each side. On the Giant four and five-engined bombers the spars are of hollow rectangular section, strengthened by a transverse web across the middle of the box. The latter is built of numerous components tongued and grooved together. The whole is strengthened by walls of multi-ply glued on each side. In the Halberstadt's design the built-up spruce spars are reinforced by broad horizontal webs of ply-wood running longitudinally, and at each edge of these are stringers. The whole spar construction thus represents a section similar to an H lying on its side, of which the central box spar forms the cross bar.

The A. E. G. machines are alone in employing steel tubular spars.

Other German designs, such as the Pfalz, D. F. W., L. V. G., Rumpler, and Albatross, employ built-up spars of the ordinary accepted type, either of box or I section.

Wiring

With the exception of the Fokker biplane and triplane, which have no external wire bracing whatever in the wings, the rigging of German machines is upon the accepted lines. The standard material is multi-strand cable furnished with whipped and sweated splices at the loops. Quick detachment devices, which at one time were fitted on several German models, have now disappeared. For internal wiring, both plain wire and stranded cable are used. In the Fokker design, the angle of the drag bracing cables between the struts seems to be very bad, but according to reports this machine is actually unusually strong. Drag bracings are in some cases taken from the front of the fuselage, but in most designs are confined to the interior of the wings. In no case is the undercarriage used to form a component of the bracing system.

In most machines the compression struts between the spars, for drag bracing, are steel tubes, but in some cases, notably the Fokker, Halberstadt and Albatross, wooden box ribs are used for this purpose.

Fuselages

The standard type of German fuselage construction embodies a three-ply shell built up on light wooden formers. It is generally of the wireless form, but in some cases the forward portion in the neighborhood of the wings and engine is strengthened with diagonal bracing. This is adopted also in the Gotha in that part of the body which embraces the cockpits and petrol tanks.

Exceptions from this general rule are the A. E. G. two-seater, the A. E. G. bomber, and the Fokker (biplane and triplane). In all of these steel is exclusively used for the fuselage construction, the transverse members being welded to the longerons. In the four and five-engined Giant bombers the rear portion of the fuselage, including the longerons, is of steel tube, while in the

Friedrichshafen bomber wooden longerons are used in conjunction with steel tube compression members.

In nearly all cases the wooden fuselage is roughly rectangular in section, with corners rounded off, and tapers to a vertical knife-edge at the rear. In the Halberstadt, on the contrary, it tapers, in a manner similar to that of the Bristol fighter, to a horizontal edge. In the Pfalz designs great pains have been taken to produce a fish-shaped body of perfect stream-line form; this is of approximately elliptical section throughout, though leaning toward a sharp "backbone" near the tail. The performance of this design is, however, relatively poor, and the rather elaborate streamlining appears to bring no great material benefits.

In the Albatross and the earlier Pfalz the fin is built in one with the fuselage, and very neatly faired off; but it is notable that in the latest Pfalz this practice has been discarded in favor of a detachable fin.

Tail Surfaces

The use of fixed fins and tail planes is now standard on all German aeroplanes, and in nearly all cases both the rudder and elevator are balanced. In some cases—notably the Fokker biplane—the fin is offset so as to mitigate the turning effect due to the swirl of the slipstream. In the Hannoveraner fighter a biplane tail is incorporated with a view to reducing the blind area of the movable machine gun.

In all the big bombers—the Gotha, the Friedrichshafen, and the Giant machines of both types—a biplane tail is now a standard fitting, though it has not yet been adopted on the A. E. G.

In practically all cases the framework of the tail organs is of light steel tube, and in general this applies to the fixed planes as well as to the controllable surfaces. In the Pfalz, Albatross and L. V. G. designs the fixed plane frames are of wood and covered with thin plywood.

In some cases—notably the A. E. G. bomber—the fixed planes are of heavily cambered streamline section. The same practice, though to a less noticeable extent, is embodied in the latest Halberstadt; but in the Fokker, which is to be regarded as one of the most up-to-date German types, flat uncambered surfaces are exclusively employed. In this case, too, the fixed tail plane is made in one unit and dropped into brackets on the top side of the fuselage, instead of being constructed in two halves, and placed one on either side. This principle has also been adopted in the most recent Halberstadt.

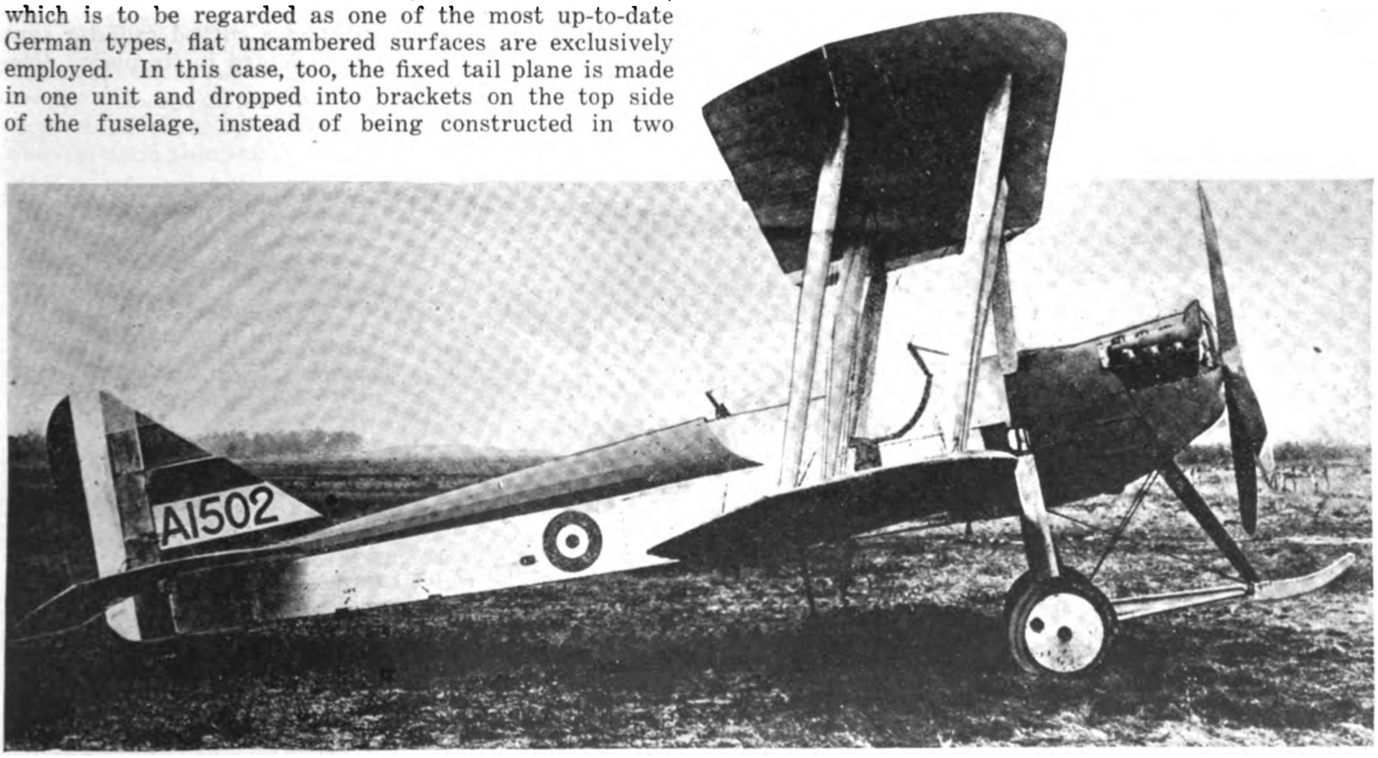
The control gear on German aeroplanes calls for very little comment, being, in all but the large bombers, of the standard universally jointed stick pattern. The arrangement of the rocking shaft varies, being, in some cases, fore and aft, and in others transverse. The rudder bars are almost invariably made of welded sheet steel, and are generally fitted with toe straps. In recent machines the pilot's seat is frequently adjustable, whereas in earlier designs it was more common to find the leg reach adjustable on the rudder bar. In several cases a locking device is employed, so that the elevator can be fixed at any angle. In the Fokker biplane the control gear is extremely light compared with that of other enemy designs.

Wheel control for the ailerons is only used on the large bombers, such as A. E. G., Gotha and Friedrichshafen. In the first-named, a dual control for the elevator and rudder is provided, but in the others no form of dual control at all is found. In the giant aeroplanes double control, operated by two pilots simultaneously, is adopted, as the physical effort called for is beyond the capacity of a single man.

Struts

Probably owing to a shortage of timber, wooden interplane struts are very little used, and are only found in the Friedrichshafen, L. V. G., and the older type of Pfalz. Steel struts are either tubes of round section faired off with a three-ply or solid wood streamlining, or of oval section, the latter practice being increasingly popular. In some cases the strut ends are tapered and welded to a socket; in others the tube is kept full section, and is dropped over an eyebolt at each end. N struts for the junction of the top plane and the fuselage are common, and are also used between the planes in the Pfalz and Fokker models. Oval steel tubes for undercarriage struts are practically universal, the L. V. G. being the only design incorporating wooden members in this position.

In general, there are two types of fabric found on



Armstrong-Whitworth with 90-hp. R. A. F. engine. Note front skid

enemy aeroplanes. They are of similar material, but differ in coloring. That intended for scouts and fighters is camouflaged in the familiar pattern of irregular polygons of light colors, while that for bombers is of such dark tones that the shapes of the polygons can scarcely be discerned. In some examples of the Fokker biplane the upper surface of the wings is painted a bright color, such as red, over the top of the dyed camouflage scheme. The Pfalz was formerly covered with an aluminum dope; but this has now given way to the standard coloring.

The quality of fabric is, in general, good, but in most cases the dope seems to be carelessly applied, and not thoroughly "worked in" to the material, from which it readily peels off.

Body Coloring

The bodies of aeroplanes are sometimes left in natural wood colors, as in the L. V. G.; sometimes, as in the Fokker, painted in two bands of bright colors; but more often covered with a cloudy camouflage effect, consisting of soft, low-toned colors, gradually fading into one another and apparently sprayed on.

It would appear that in recent designs the necessity of giving the pilot a good view has received more consideration than in the past. The Fokker, Hannoveraner and Halberstadt machines are excellent in this respect. The bombers seem also to be good, with the exception of the A. E. G., which is very awkward indeed.

Undercarriage

For scouts and two-seaters the plain axle slung to V struts is invariably adopted. In most cases neither the axle nor the tie rod is faired off, but in the Fokker types, both monoplane and triplane, the axle fairing has been developed into a lifting surface. In the larger bombing machines current practice varies considerably. Thus in the Friedrichshafen there are three two-wheeled axles —one under each engine and the third under the nose of the fuselage. This system has been adopted in some of the giant aeroplanes. In the Gotha there are two two-wheeled axles under each engine, while in the four-engined giant under each engine unit is a ponderous single axle supporting at each end four wheels placed side by side.

Rubber bands have now entirely disappeared, and their place has been taken by steel coil springs. In some cases three coils, of alternate "hand," are placed one inside the other; in others, three small coils are grouped together in a "clover leaf" and covered in with cotton fabric. The weight of spring used on the average machine is about 5 lb. for each wheel. In the Gotha the shock-absorber springs are concealed in the undercarriage struts, and are worked by a cable passing over pulleys. Steel-shod wooden tail skids are almost always used, but are not made steerable.

Engine Bearers

In most scouts and two-seaters wooden bearers, sometimes of ash, but more often of pine, are supported on multi-plywood bulkheads, but in the Fokker and A. E. G. designs the construction is of steel tubes, to which flat clips are fixed for the support of the crankcase arms. In the A. E. G. bomber the bearers are hollow steel of rectangular section. Owing to shortage of suitable timber, the bearers on the giant aeroplanes, which are necessarily very long, are built up of a soft wood center piece, reinforced top and bottom with five half-inch layers of ash.

Engine Controls

On a few machines—notably on the Hannoveraner—this is fitted in duplicate, there being, in addition to the usual throttle lever, another controlled by Bowden wire from the control stick. In the multiple-engined bombers separate engine throttle levers for each engine are installed, and in the two-engine type they are so placed as to be operated together when required. The same applies to ignition advance levers, but where Mercedes engines are used the ignition control is coupled up to the throttle.

Radiators

Several types of radiators are in use on German aeroplanes, and in nearly all cases they are fitted with some simple form of shutter, which is used in conjunction with an electrical rheostat thermometer. Formerly it was the general practice, especially in two-seaters of the D. F. W., Rumpler, A. E. G. and L. V. G. patterns, to mount a rectangular radiator in front of the cabane, just underneath the top plane; but in the latest L. V. G.'s this method has been discarded, and a curved radiator sunk flush in the center section is adopted in its place. Gen-

Armstrong-Whitworth plane with 160-hp. Beardmore engine

The twin engined FE-4 of the British Royal Aircraft Factory

erally speaking, this plane radiator is now standard in two-seater designs, but in the Pfalz, which previously incorporated this scheme, the latest pattern has a nose radiator of vertical tubes, the arrangement being somewhat similar to that of the Fokker biplane; these two machines are in this respect in a class by themselves.

On bombers the usual design embraces a car type radiator at the front end of the engine bearers, but in the four and five-engine giant machines the use of gear boxes has prevented this practice being adhered to, and in these the radiators are carried well up above the motors, and fixed either on the engine bearer struts or on wires.

In the flush pattern of radiator the tubes are horizontal and of flattened oval section, and are set with their major axis inclined. The tubes are in two cells, which are separated by baffle plates, which insure that the water runs from side to side, then down, and then from side to side back again. A short-circuit tube is nearly always provided to guard against the formation of air locks in the upper portion of the water tank. Another fitting frequently met with is a small subsidiary water tank mounted above the radiator and connected to the main filler cap with a tube. The top of this tank is fitted with a trumpet-shaped nozzle pointing forward.

Gears

It is significant that in the four and five-engined giant aeroplanes massive gear boxes are used in conjunction with standard engines of the Mercedes and Maybach types. As might be expected with six-cylinder motors, the gear boxes are very heavy. In the four-engine machines they had shallow casings fitted with cast aluminum cooling fins, and were connected to the engines by flexible couplings and external shafts. In the five-engine design the shafts are inclosed within the gear box. Plain spur pinions are fitted and the ratio employed both for tractor and pusher screws is 21/41. The gear boxes are of two distinct types—a short one for the tractor screw and a long one for the pusher. The latter is given considerable overhang in order to obviate the need for cutting away a section of the trailing edge to give clearance for the screw. This idea had been adopted both on the Friedrichshafen and Gotha designs, doubtless with some noticeable loss in efficiency.

Each gear box, including the flywheel on the engine which it necessitates, the flexible coupling, and the oil radiator, adds a weight of 346 lb.—a little over 1.15 lb. per horsepower. It is obvious, however, that the gain in propulsive efficiency is considerable.

The oil radiator referred to consists of a semicircular tank slung under the gear box, and containing 65 tubes of, roughly, 20 mm. diameter. Oil is circulated through this and the sump in the gear box by a pinion pump driven through worm gears and a flexible shaft from the driving pinion shaft of the gear box.

Fuel Systems

These generally incorporate two tanks—one gravity and one under pressure supplied by an engine pump—except where Benz engines are installed. In this case a fuel pump is employed, which supplies a tubular chamber, from which the overflow returns to the main tank; a hand fuel pump of the semi-rotary type is used for filling the gravity starting tank. The last named is frequently let flush into the center section of the upper plane, or is strapped on to it, except in the D. F. W. and Pfalz designs. In the former it is placed on the top of the main tank, and forms the back of the pilot's seat; in the latter it is under the engine cowling. In the Fokker, the main, auxiliary and oil tanks are incorporated in one unit, and a hand pressure pump is fitted for starting purposes. A small windmill, similar to that on the D.H.9 aeroplane, was found in the wreckage of the five-engined giant, and it is conjectured that the enemy may have turned his attention to this kind of fuel supply mechanism.

Owing to the shortage of the best classes of timber, mahogany and walnut are now frequently replaced by ash, pine, sycamore and maple. The screws of the giant bombers, being geared down, roughly, to 2 to 1, are not very heavily stressed, and are made entirely of soft wood covered with thin veneer, the grain of which runs across the blade.

The majority of German aeroplanes are internally wired for greater wireless capacity, but are only fitted with transmitting apparatus when this is actually going to be used. In some cases the dynamo is driven from a pulley on the engine in conjunction with a hand-controlled clutch, but in modern types it is commoner to find the dynamo supported on one of the undercarriage struts, and driven by a screw in the slip-stream of the tractor. On the five-engined giant a Douglas type horizontally opposed engine of about 3 hp. drives the wireless and heating generator.

Women Can Handle Exacting Work

Work Better in Groups—Temporary Lull in Demand for Women Likely

By J. Edward Schipper

ONE of the great lessons of the war in American manufacture has been the ability of women to handle exacting jobs. Considerable interest has been exhibited in the question of what is to be done with the women employees when the soldier comes back to claim his job. It presents a problem which is being solved differently in different plants.

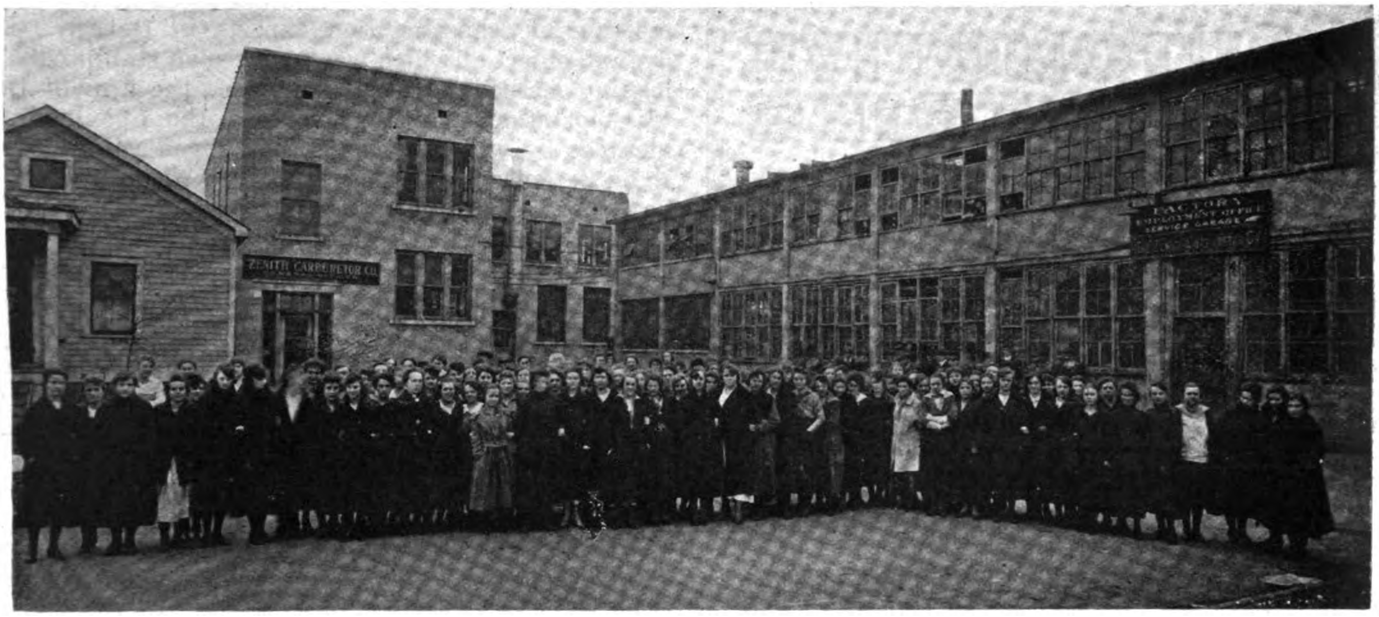
A large number of concerns have terminated the war work upon which the women were engaged and have laid off the women as well as the men who were doing the work before swinging back into normal manufacture. Nevertheless, the lesson has been learned that women can do this sort of work and do it as well as or better than men. There may be a temporary lull in which the excess of labor will compel factories to engage men and returned soldiers in preference to women, but it is quite certain that when the reconstruction period fully hits its stride the temporary surplus of labor will be readily absorbed.

The immense programs laid down by the Government for big engineering works and the policy of expansion determined upon by the largest manufacturers indicate that in about a year the pre-war scale of production will be exceeded. It is inconceivable that we are to go back to pre-war conditions. We have made advances in a great many ways, and the proof of the ability of women to hold their places in the industrial world has been one of these.

Never have any closer inspection systems been laid down than those used in Government airplane practice. Everything is required to be so exact that even minute variations from standard in the exterior finish of an airplane product have been deemed sufficient cause for rejection. At first, many who were used to commercial manufacture along other lines put forth strenuous objections, on the ground that not only was necessary production being delayed, but that costs were being run foolishly high because of the closeness of the work required.

With real adaptability, however, manufacturers soon began to meet requirements, and with a little yielding on the part of the Government along certain lines where

Girls at work in the Holbrook plant of the Cadillac Motor Car Co. welding the cylinders for Liberty airplane engines



Women employees of the Zenith Carburetor Co., which was engaged in the work of making carburetors for the Liberty engine

it was admitted that closeness of inspection was not essential, a happy balance was struck. Nevertheless, the work as a whole was to far closer limits, and held there with greater rigidity than was ever deemed possible in previous commercial manufacture in anything but precision instruments.

Adaptability of Female Labor

What is the most astonishing fact of all is that it was possible in this sort of work to employ female labor where it had never been previously thought of. Some of the illustrations herewith show a large number of girls doing acetylene welding on the water jackets of the Liberty engine cylinders. Cadillac and Packard both employed women for this welding operation, and both were highly satisfied with the results.

Work of this kind, which is departmentized, permitting women to be used in groups, has proved to be far more satisfactory than individual work where both men and women are employed in the same department. Experience has taught that in employing women for any sort of shop work, they are working to their best advantage in groups of five or more, under the control of a foreman or forewoman.

On war work the patriotism and *esprit de corps* of the woman workers was very noticeable. They were imbued with the idea that every job turned out was helping the cause, and this was a great spur to their endeavors.

An example of concentration on the work is very clearly shown in the large illustration herewith, depicting the welders employed on the Liberty cylinders at the Holbrook plant of the Cadillac Motor Car Co. Notwithstanding the time-honored reputation for curiosity, not one of the welders stopped her work or looked up at the camera while the picture was being taken.

Peace Also Will Need Woman Labor

The opportunities for women to be active in industry may decrease somewhat during the next few months, but if they do, it will only be a temporary lull, and as soon as the commercial and governmental manufacturing programs now being laid down are in full swing, every one of the women who found congenial industrial employment during the stress of war will find a job awaiting her in times of peace.

Inflammability of Aluminum Dust

ALUMINUM dust burns quietly when in a pile, but if this pile be disturbed in such a manner as to raise a cloud of the dust into the air the burning takes place with explosive violence. If a dust cloud already formed that has a density within the explosive limits be ignited, a violent explosion results. As several disastrous explosions of this dust have happened in manufacturing establishments, the Bureau of Mines has thought it worth while to investigate the physical and chemical properties of the dust with especial regard to inflammability and to the problem of extinguishing fires and of minimizing the force of explosions once started. The results of this investigation are recorded in Technical Paper 152 of the Bureau of Mines on The Inflammability of Aluminum Dust, by Allan Leighton. Water is worse than useless for extinguishing such fires. One method of subduing fires of aluminum dust is to pour oil onto the fire until it is smothered, and then use carbon tetra chloride to extinguish the fire in the oil.

A job where care and thoroughness are required—spraying the Liberty engine with oil to prevent rusting from dampness, before crating for overseas shipment

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, January 30, 1919 No. 5

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142.

Cable Address - - - Autoland, New York
Long Distance Telephone - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - One Year, $3.00
Canada - - - One Year, 5.00
Foreign Countries - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.
Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.
Member of the Audit Bureau of Circulations.
Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Freight Car Loading Methods

DURING the freight car shortage of the past year many new methods of loading cars with automobiles were devised, all tending to make one car hold more automobiles than it had ever held before. As in so many other cases, necessity was the mother of invention. The automobiles had to be delivered, and it was impossible to get a sufficient number of freight cars. The only alternative to shipping by railroad was to deliver the cars by the drive-away plan, which was expensive and involved considerable risks. So the men in charge of the shipping departments began to ponder over the problem and evolved the new methods, some of which have been described and illustrated in these pages.

These new methods not only helped in tiding over the temporary car shortage, but will permit of saving on the transportation of automobiles in the times of peace ahead. Naturally the solution of the problem differed in the different factories, and as a result practice in loading cars has gotten into a chaotic state. The whole subject was discussed at a recent meeting of transportation experts in Detroit, the avowed object of which was to agree on standardized loading methods. It can hardly be the aim of the transportation men to revert to the old loading methods by which no more than three automobiles could be gotten into a car. What will undoubtedly be done is that the various new methods will be thoroughly discussed, their respective strong and weak points compared and a method standardized which will combine as many of the good points of the various plans now in use as possible. If this is accomplished the freight car shortage of 1918 will have yielded a permanent benefit to the automobile industry.

The Hotchkiss Drive

IT was predicted a year and a half ago, when the Government adopted the Hotchkiss drive for its Class B trucks, that if these trucks stood up under the severe condition of operation behind the battle front it would have a far-reaching influence on truck design after the war. A vehicle with Hotchkiss drive is obviously cheaper to manufacture than one having separate torque and thrust members, and as in connection with motor trucks considerations of economy usually predominate, the saving that may thus be effected is likely to prove an important item. Of course, it would not be quite right to say that the expense of making and assembling a pair of radius rods and a torque arm measures the difference in cost of a truck with Hotchkiss drive and one with special torque and thrust members. The problem is not quite as simple as that, for if the springs are only just sufficiently strong for the purpose of carrying the weight, it will not do to burden them with the torque and thrust loads in addition. Not only must the springs be made heavier for the Hotchkiss drive system—assuming, of course, the same flexibility—but special provisions must be made to adapt them to taking thrust loads without injury.

There is one other thing in favor of the Hotchkiss drive besides reduced manufacturing cost, and that is the flexibility which it gives the drive and which tends to protect the entire mechanism from the engine to the driving wheel when the driving power or the traction resistance is suddenly varied through a wide range. A slight amount of flexibility is usually obtained by supporting the forward end of the torque arm between springs, but it is readily seen that if the torque is resisted by the chassis springs the range of angular yield of the axle may be considerably greater.

Against these advantages of the Hotchkiss drive must be set its disadvantages. The springs of a truck with Hotchkiss drive are really combination or multi-purpose devices. They serve, in fact, a triple purpose, and it is logical to assume that if a special part were designed to serve each of these purposes it could be made to do it more satisfactorily or more efficiently. For instance, it is claimed, and apparently with good reason, that with the Hotchkiss drive the springs do not cushion shocks as well

as with other drives. This is probably due to the fact that in order to make the springs capable of giving satisfactory service as thrust members their arch or camber must be kept small, and this necessarily means that they must be made stiff.

It is well to consider these various advantages and disadvantages of the Hotchkiss drive, but the final decision regarding its relative merits, as compared with the conventional drive, will have to be left to the user. It has been proved that trucks can be built and made to stand up both with the Hotchkiss drive and with separate torque and thrust members. Any superiority in merits on the part of one or the other system must be slight, and we can hardly expect a convincing proof to be given on paper.

Truck Transmissions

IT is generally known that the operating conditions affecting the change gear or transmission are much more severe on a truck than in a passenger car. Gears are changed much more on the truck, which has to operate a great deal in congested traffic; the truck is usually operated by a driver of little skill, and the weight which must be accelerated and decelerated if at the moment of meshing the two gears run at unequal pitch line velocities are very much greater than in a passenger car. Therefore the clashing of teeth where sliding gear transmissions are used is often very severe.

Various engineers in the past have held the opinion that the sliding gear could not be used successfully on trucks. This belief has been disproved by practice. However, we are now reaching a stage of development where it is not a question of what can be used but what is best under the circumstances. And we believe the time has come when the question must be squarely faced whether the jaw-clutch type of gear is not more satisfactory, all things considered. True, it increases the bulk and weight of the transmission, but the destructive clashing is eliminated and it can hardly be doubted that the life of the vital parts is prolonged.

Heretofore the positive clutch type of transmission has not figured very conspicuously in American practice, but as a result of the war and its lessons in regard to various features of design new departures in different branches of automotive engineering are imminent. Rumors of new types of truck transmission are rife. Can it be that the positive clutch type of transmission is about to supersede the sliding gear for truck use?

The Chicago Show

ALTHOUGH technically known as a dealers' show, there is as much of a national aspect to the Chicago exhibition as ever. Manufacturers are just as strongly represented, and their business interest in the exhibition is keener this year than it has been for some time past. In fact, the Chicago affair is both a show and a post-war convention of the industry at which manufacturers of both cars and accessories are meeting their selling or field organizations for the purpose of laying down lines for the reconstruction period.

It must be remembered that in many cases dealer organizations have been rudely broken up by the call of war on the manhood of the country, also that under the stress of war conditions dealers were sometimes cut off by manufacturers who chose to keep a few large dealers alive with their limited production rather than attempt to spread this production so thinly over the country that it would do no dealer any good. In other words, except in the case of large production concerns, the organizations for intensive sales were destroyed.

The Chicago show is always looked upon as the business show of the year. Under present conditions the business end of the exhibit is vital. It is at the convention, which is going on in the different headquarters of the manufacturers in the Congress, Auditorium, Sherman and other hotels, that a great deal of constructive work is being done. Here practically every sales executive in the industry is busily engaged discussing plans for the coming year and mapping out territories. The results of this show are going to be a big factor in determining the production schedule in many factories.

There is also an important retail sales angle to the show, which is generally expected to release buyers. It is felt that what price reductions are to be announced will surely be disclosed at the show, so that in buying immediately after the show the prospect does not need to fear that his purchase will be followed in a few weeks by a price cut. It has been said, further, that the retail market is slow because buyers are holding back waiting for new chassis models. The absence of these at the show will clear this situation also.

Foreign Trade Conditions Improving

GRADUALLY the barriers which have hampered or prevented automobile trade between nations, except for war purposes, during the past several years are being removed. No step has yet been taken to lift the ban of automobile imports for private purposes into England and France, but when the doors are opened again, as they must be some time in the near future, commercial intercourse with these countries will be facilitated by the phenomenal reductions of 66⅔ per cent in ocean freights announced this week. The return of freight rates to a pre-war basis will be hailed with satisfaction by all industries and should result in a quick renewal of pre-war international commercial activities.

In Canada, which for a long time was the best customer of our automobile industry, conditions are also improving. Even as late as 1917 Canada imported a very large number of vehicles, but toward the end of the war the customs duty and local taxes were increased to such an extent as to almost kill the automobile business. This unfortunate result seems to have been noted by the Government, which has lost no time in rescinding the war taxes.

Latest News of the

Passenger Car Market Practically Drained at End of 1918

Only 15,000 Completed Cars on Hand December 31—Truck Production of 327,930 Planned for This Year—Will Make Chiefly 1, 2 and 5-Ton Vehicles

WASHINGTON, Jan. 24—On Dec. 31, 1918, only 15,545 finished passenger cars were in the hands of automobile manufacturers. This represents only three days' normal production—three days' normal sales. At the same time truck manufacturers planned a production of 327,930 motor trucks for 1919—plans made after the armistice was signed—a production of 100,000 trucks more than that of 1918 and based on purely commercial absorption.

These figures exhibiting a passenger car market practically drained and a motor truck business anticipated for the coming year far in excess of even war demands are made public in a letter from C. C. Hanch, Chief of the Automotive Section, War Industries Board, to the industry. The letter states that production of passenger cars in 1918 totaled 926,388 as against 1,740,792 in 1917—a reduction of approximately 50 per cent.

Total motor truck production for 1918 was 227,250 as against 128,157 in 1917. The 1918 production included 164,264 for civilian use as against 109,865 for civilian use in 1917 and 62,986 for military use in 1918 as compared with 18,292 in 1917—indicating a huge increase of trucks for commercial purposes during the war and despite it.

Production of trucks in 1919 as planned by the manufacturers shows a predominance of 1-ton trucks with 2-ton, 1½-ton, ¾-ton, 3½-ton and 5-ton next and in the order named.

A summary of the Government truck business shows 204,760 ordered, 98,000 delivered, 78,081 canceled and the balance of 26,679 due. The Post Office Department has made requisitions on the Army for 17,135 trucks.

Passenger cars ordered by the Government up to Jan. 1, 1919, totaled 38,-

(*Continued on page* 278)

—

S. A. E. Dinner List Tops 1000

NEW YORK, Jan. 29——More than 1000 tickets have been sold for the Victory dinner of the Society of Automotive Engineers, which is to be held at the Hotel Astor, Feb. 6. Reservations for the Midnight Whirl are above the 500 mark. Seats for both are limited, though a number can still be accommodated.

During the commercial vehicle section of the New York show a meeting will be held at the Automobile Club of America, which will be devoted largely to motor truck subjects. B. B. Bachman, engineer of the Autocar Co., will present a paper on the use of pneumatic tires for trucks. The date of the meeting is Feb. 10.

During the national tractor show at Kansas City there will be a combined dinner and meeting on the evening of Thursday, Feb. 27, at the Hotel Baltimore. A program of farm tractor subjects will be arranged.

Still another meeting of the society is to be held in New York during the Manufacturers' Aircraft Association's exhibition at Madison Square Garden. The date has not been definitely set as yet.

—

White to Make Trucks Only

CLEVELAND, Jan 27—The White Motor Car Co., while not withdrawing from the passenger car field, will devote its entire time to the manufacture of trucks. No passenger cars have been made since the start of the war, and the company does not contemplate putting out a new passenger car at present, but has planned the most extensive truck construction schedule in its history. A new type of White truck has been brought out and will be on exhibit at the New York and Chicago shows.

—

No Army Cars or Trucks to Be Sold

WASHINGTON, Jan. 28—No passenger automobiles or motor trucks have been or are being sold by the army, despite all rumors and reports to the contrary. AUTOMOTIVE INDUSTRIES makes this statement authoritatively, based upon information secured directly from the Motor Transport Corps of the army.

Various reports have been current throughout the East to the effect that passenger cars are being offered to the public by the army in lots varying from twelve to 100, and at ridiculous prices ranging from $300 to $700. Many of the reports even include the name of an imaginary army officer who is credited with offering the vehicles for sale. Army officials here have thoroughly investigated the rumors, probing deeply into the matter but have been unable to determine their origin.

As was announced earlier and officially by the War Department, no passenger cars will be offered for sale and no motor trucks will be placed upon the market except those which are unsuitable for army use. In this event they will be placed on the market. But none of the cars or trucks which will be so sold will be in driving condition.

—

Motor Guests at Aero Banquet

NEW YORK, Jan. 29—The Aero Club of America will hold its thirteenth annual banquet at the Waldorf-Astoria on the evening of Feb. 19.

Rear Admiral Robert E. Peary has accepted an invitation to speak upon flying over the North Pole, and the opportunity for great aerial transportation systems to be extended all over the United States.

Major General Charles T. Menoher, director of the Air Service, will speak on military aeronautics, and Rear Admiral Bradley A. Fiske, U. S. N., retired, will speak upon recent developments in naval aeronautics.

Rodman Wanamaker has accepted an invitation and will undoubtedly have some interesting announcements to make in regard to transatlantic flight.

Among the aces expected to be present are Colonel William A. Bishop, V. C., D. S. O., M. C., D. F. C.; Lieutenant Colonel William Thaw, Captain Edward V. Rickenbacker, Captain Arthur J. Coyle, in command of the First Aero Squadron, and one of the 300 aviators trained by the Aero Club of America in 1915-16, and as many of the American aviation officers from the front as are free to attend.

The Honorable Fiorello H. La Guardia, major in the Air Service and member of Congress, will speak on the developments in aviation in Italy. An invitation has been extended to Signor Gianni Caproni, who is expected to arrive in this country.

—

Army to Keep Soldiers Until Employed

WASHINGTON, Jan. 25—To prevent a serious unemployment situation in this country, the War Department has ordered that no soldier be discharged from the army against his desire until such time as he can obtain employment in civilian life.

—

Roamer to Make Custom Bodies

KALAMAZOO, Jan. 29—The Barley Motor Car Co., maker of Roamer cars, has added a custom body department to its factory, which will enable it to make all roadster bodies as well as open and closed jobs.

Automotive Industries

Detroit Optimistic Regarding Future

Unprecedented Prosperity Anticipated When Contracts Are Adjusted

DETROIT, Jan. 25—Immediate settlement of war contracts will bring to this district an unprecedented era of prosperity. Approximately $300,000,000 outstanding on uncompleted contract work is the brake grinding against the wheels of the automotive and allied industries and it is this brake which will keep the city's great manufacturing plants at slow speed until Congress acts to lift it.

For the most part, this idle money represents working capital. Plants invested heavily in war materials on the assumption that the war would continue for some time. But the war ended abruptly. It caught them just commencing new contracts or in the very midst of government work. Heavy material expenditures had strained their finances and contract cancellation found the mass of contractors short of the funds necessary to meet the unexpected expenditures required for production.

To-day the business outlook was never more golden. There is already a brisk demand for automotive products. Every other line of business is facing a great year. But business here seems to be held in leash. It is waiting for something and that something is action on the part of the big manufacturer. It waits for him to lead the way, but as a purely business proposition he is going to play safe. His resources are badly strained and he in turn is waiting for the Government to refund him his money before he starts operations on a greater scale. While contract delay is not the only factor retarding industrial work during these trying reconstruction days, it is without a doubt the greatest, and its elimination will go far toward dispelling the element of uncertainty now dominating business circles.

The work of transition from gun carriages, airplanes and shell to the production of cars, trucks, tractors, parts etc., is being accomplished with remarkable swiftness and precision in scores of local plants. Over 90 per cent of the automotive plants of the city were engaged in war work of some kind or other. Some factories conducted munition departments and continued their regular automotive departments as well. Others devoted their entire energies to war work.

The automotive industry right now is devoting more of its attention to getting ready for business than in the production of cars, tractors and trucks. In many plants February will find reconstruction work about complete. Sales departments, more or less disorganized when companies were engaged in from 50 to 100 per cent war work, are now reorganizing. New dealers and distributors are being lined up and purchasing departments are busy arranging for parts and material. Sixty days will see the majority of the local firms rounding into normal pre-war production again.

Organization of Director of Sales

WASHINGTON, Jan. 29—The organization of the office of the director of sales of the War Department includes Colonel Fred Glover, who will handle trucks and motor equipment, including motors, motorcycles, side cars and all surplus supplies and repair parts; Colonel A. LaMar, in charge of machine tools, including cranes, storage equipment, steam shovels, etc.; Major W. M. Crunden, who will handle building material; L. H. Hartman, in charge of Quartermaster stores, including rubber goods, gasoline, etc.; G. F. Woods, who will control real estate; Captain A. L. Mercer, in charge of raw materials, including pig iron, platinum, manganese, chrome, etc., and one other who is to be named, in charge of the disposition of ordnance supplies, including artillery, guns, etc. Under the director of sales, C. W. Hard, is an assistant, E. C. Morse, who serves as chairman of the Board of Sales Review, which also includes those officers and civilians named above.

Exporters to Confer on Parcel Post

WASHINGTON, Jan. 29—Second Assistant Postmaster General Praeger has sent out an invitation to exporters throughout the country for a conference to consider important questions and exchange views on the improvement and expansion of the international parcel post. The conference is called for 10 a. m., Feb. 11, at the Post Office Department in Washington.

Withdraw Ban on Aircraft Show

WASHINGTON, Jan. 29—As was announced in a recent issue of AUTOMOTIVE INDUSTRIES, restrictions upon private airplane exhibitions are withdrawn. This announcement, following a cable from President Wilson, has now been confirmed by a proclamation.

826 Farm Tractors in France

According to French Ministry of Agriculture, 779 Are American-Made

By W. F. Bradley

PARIS, Jan. 16 (By Mail)—France possesses 826 agricultural tractors, of which 779 are of American origin. The forty-seven of French manufacture comprise twenty Fitz, twelve Doizy, three De Dion-Bouton, ten Tourand-Latil, and two Julien. These figures are issued by the French Ministry of Agriculture and are official. They appear, however, to cover gasoline tractors only, for there are a certain number of steam tractors in use in France which have not been taken account of.

Although practically 95 per cent of the tractors used on French farms are of American origin, they are not all of a suitable type. During the war the French Government has imported tractors and frequently has purchased what happened to be available, rather than what was most suitable. Very little has been done with tractors for working in vineyards. These tractors should have a maximum width of 39 in. They should be able to plow to a depth of 4 to 6 in., and scarify to a depth of 2 in. These tractors, together with the plow or cultivator, should be able to turn around within a distance of 116 in., and weight should not exceed 2400 lb.

The manufacture of agricultural tractors has been dormant in France during the war, for neither material nor labor was available for this work. All indications point to the tractor business getting into the hands of the automobile manufacturers. Those who are in a position to produce almost immediately are De Dion-Bouton, who has two types of tractors ready and the Latil Co., who has specialized on one type.

Latil is the leading French manufacturer of four-wheel type tractors, which he has been building during the war for the Allied armies. This factory is entirely modern and is well equipped for producing agricultural tractors. The type adopted has been developed by M. Tourand, who has specialized in agricultural work for a number of years.

This combination of an agricultural machinery specialist and an automobile manufacturer is a good one. In France there is a tendency for automobile manufacturers who have good engineering experience, but who possess little agri-

(*Continued on page* 282)

British May Drop Import Embargo

American Automotive Importers in London Have Hopes of Speedy Relief

NEW YORK, Jan. 28—Advices from London, England, state that although much apprehension has been felt by the distributers of American cars, trucks and automotive products generally in regard to the attitude of the British Government on the question of restrictions on imports, it would seem that the chief anxiety exists on account of the possibility of maintaining the wartime embargo, rather than that there will be a partial restriction effected by the imposition of a duty.

The main reason for believing that something along the lines of a maintained embargo would be advocated arose from an interview granted a deputation of British manufacturers by the president of the British Board of Trade, who said he "pledged himself that the restrictions on importations which had been lifted for three months shall be reimposed at the expiration of that period, and that there shall be no further removal without the manufacturers of the country being consulted."

He also stated that he "realized that it might be necessary to impose further restrictions."

Naturally this statement created a certain amount of unrest among importers of American goods and as a result a deputation of the automotive men in London interviewed the head of the Department of Import Restrictions, in the absence of the president of the Board of Trade. This official promptly stated that it was a mistake to suppose that the British Government contemplated a policy of exclusion and added that it was anxious to consider any and all representations made by importers of American made products. He suggested that the automotive importers should draw up a statement of the amount of goods each firm expected it would need to maintain itself until the situation cleared.

It is now considered that there is every hope of relief and that with increased shipping facilities the position of imports of automotive products into the United Kingdom will be greatly facilitated. It is noteworthy that the American automotive men in London were the first to take active steps to ascertain the exact position and the feeling of the British Government in regard to the situation. The deputation was representative of the motor trade group of the American Chamber of Commerce in London.

Simplified Export Application Form

WASHINGTON, Jan. 25—A new and more simple export license application, known as form X-A, has been placed in use by the War Trade Board for applying for export licenses to ship to any country, in place of form X used heretofore. When form X-A is used it will no longer be necessary to use supplementary information sheet X-119 for shipments to Denmark, Holland, Norway or Sweden.

Cheap British Cars a Thing of the Future

NEW YORK, Jan. 23—For the time being at least the United States has little to fear from British competition in the motor industry. British manufacture, hampered and restricted by the war for the past 4 years, will take some time to get back on its feet, according to Gerald Bliss, writing in the London *Daily Mail.* Discussing the very doubtful possibility of cheap car manufacture in England at present he says:

"One of the many post-war mysteries is the price at which motors of all sorts and sizes will be sold, a mystery unknown to the very manufacturers themselves.

"All they can do is to invite the public to put their names down on what are in many cases already very long waiting lists to 'wait and see' in conjunction with themselves.

"Some articles upon the $500 car written during the period of suspended motoring have led a considerable portion of the public to anticipate a sort of 'Rolls-Ford' presenting itself at their doorsteps and asking to be bought at that price for a Christmas present.

"The $500 car will come, but it will take some years of quantity production with our enlarged factories working at full swing under rebalanced peace conditions, and with raw material neither rationed nor being sold under conditions of the keenest competition for limited supplies.

"Meanwhile the present price of the proverb'al Ford (minus any suggestion of the Rolls)—if and when obtained—shows that even in this pioneer case war conditions have put the cost up very considerably, and that it, too, for the time being, shows no eagerness or ability to sell at $500. So what chance for others?

"There are four prime and direct factors affecting the price of cars, not only in this country but others as well, though not so much so in America for reasons more or less obvious. First, the price of raw materials; second, rationed quantities limiting production and fettering organization, thereby raising the all-round cost of running a factory; third, the cost of factory reorganization and the attendant difficulties, and fourth, the great increase in wages all round—not only in motor factories.

"Practically no cars have been manufactured in this country for civilian consumption for over four years. In consequence, second-hand prices for immediate purchasers have been soaring for some time, not without a suspicion of profiteering in certain cases, and the automobile industry in all its branches does not want to be tarred with the same brush.

"In 1914 prices, with stability, improved production and established organization were dropping. Since then there have been no price lists. When the industry is next in a position to issue such official lists cars will be found to be up 40, 50 or possibly even more per cent to start with, and it will look a big jump. But I do not fancy that they will be found to have risen in the same proportion as most other things we have been buying without interruption. That will be the first touchstone of their cheapness. Meanwhile the British industry has to find its feet again."

Canada Expects Car Tax Reduction

Total Taxation Plus Duty Over 50 Per Cent—War Tariff May Be Removed

WINNIPEG, CANADA, Jan. 24—Two Ottawa dispatches of the last few days refer to important tariff revisions and indicate that the automobile, which has been bearing a big burden of the wartime taxes, may shortly be relieved of some of the load. Representatives of the organized automobile industries of Canada recently waited on Sir Thomas White, acting premier, and Hon. A. K. MacLean, acting minister of trade and commerce, urging the removal of the excise war tax on automobiles. This surtax, which was imposed in the last budget, amounts to 10 per cent on all automobiles, and is applicable to imported cars or cars manufactured in Canada and unsold on April 30, 1918. The plea for the removal of this excise duty is being considered by the authorities at Ottawa.

Another measure which it is rumored in Ottawa dispatches will feature in the budget at the coming session is the removal of the general war tariff increase of 7½ per cent, put into force during the early months of the war on almost all commodities. This, of course, has been tacked on to the high cost of automobiles for some time, and its removal will be a relief to dealer and consumer.

Prospective buyers who have watched the soaring prices of motor cars during the past year or two have no doubt attributed most of the increase to the rising costs of materials and labor. Few, probably, have been aware of the taxes borne by the automobile since August 4, 1914.

The original duty at that date was 35 per cent. Shortly after war broke out, the Canadian Government imposed the war tariff increase of 7½ per cent; total tax from that date onward—42½ per cent. Then the United States placed a 3 per cent tax on factory output. This increased the cost of the car to the dealer 3 per cent, and he was also forced to pay the 42½ per cent on this additional 3 per cent. Then along came the Canadian excise war tax of 10 per cent on the list price of the car and freight increases have jumped just about 100 per cent.

American and British Governments Cut Ocean Freight Rates 66 Per Cent

NEW YORK, Jan. 28—The British Ministry of Shipping announced yesterday that ocean freight rates on vessels free from Government requisition had been reduced 66 2-3 per cent on shipments from the United States to Great Britain. This applies to all export commodities except cotton, and it also applies to British ships which have from 20 to 30 per cent of their cargo space available, the remaining being under control of the Ministry of Shipping.

To meet this cut the United States Shipping Board announced a similar reduction in charges between Atlantic and Gulf ports and the United Kingdom, France, Italy, Belgium and the Netherlands.

Approximately, the reduction means a drop from $3.50 to $1 per 100 lb. and a reduction from $1.75 to 50 cents per cubic foot for goods shipped by measurement. Shipping men say that even with the present high cost of operating vessels the new rates will leave a margin of profit.

Mexico Sends 3,838,195 Bbl. Oil Here in November

WASHINGTON, Jan. 25—Declared exports of crude oil and petroleum products from Tampico, Mexico, to the United States in November, 1918, totalled 3,838,195 bbl. The movement from Tampico was 2,575,700 bbl., from Tuxpam 852,094 bbl. and from Port Lobos 410,401 bbl. Shipments to points other than the United States during the same period from this district totalled 1,617,542 bbl.

December Oil Exports Decrease

WASHINGTON, Jan. 27—Mineral oils totaling 2,714,430,452 gal., valued at $344,290,444, were exported during the year of 1918, as compared with 2,651,118,349 gal., valued at $2,252,977,476, in 1917. December, 1918, shipments of mineral oils totaled 186,723,651 gal., valued at $29,027,415, as against 300,286,827 gal., valued at $29,173,907, in December, 1917. The decrease in quantity in December, 1918, was undoubtedly due to the armistice. Following is a tabulation of the complete exports during December, 1918, and December, 1917, and the years 1917 and 1918:

Months	1917	1918
January	47,967,354	42,607,206
February	41,352,711	44,384,937
March	47,868,652	48.631,115
April	41,854,320	46,590,570
May	47,086,452	50,927,195
June	46,824,646	51,758,214
July	46,291,572	55,587,312
August	47,372,226	55,782,092
September	45,107,956	51,757,334
October	48,387,726	52,885,518
November	47,689,801	44,386,987
December	44,037,147	40,684,525
Total	551,790,563	585,888,000

Imports to Mexico Exempt from Tax

WASHINGTON, Jan. 25—In view of the export figures of cars, trucks, parts, etc., from the United States to Mexico for the past few years, the report received here from Ambassador Fletcher should be of importance to those engaged in automotive export lines. According to this report, exemption from import duties has been granted on motor vehicles of all descriptions by the President of Mexico under a decree signed last week.

From 1908 to 1918 exports of passenger cars from the United States to Mexico were 7,540 cars at a value of $6,462,511. Within the past six years Mexico received from the United States 249 motorcycles, valued at $64,830; 689 trucks, valued at $939,679; nine airplanes at a value of $68,500, and airplane parts to the amount of $19,725.

France Provides for War Car Repairs

Makers to Repair French Cars —Army Shops to Handle Foreign Makes

PARIS, Dec. 23—Definite announcement has been made by the French Government on the method of handling the trucks and cars it has in its possession and which will no longer be required when the armies are disbanded. The total number of vehicles is 79,318, composed as follows:

French-built Vehicles	
Trucks	34,385
Tractors	4,812
Touring cars	19,044
	58,241

Foreign-built Vehicles	
Trucks	13,360
Tractors	2,217
Passenger cars	5,500
	21,077

All the French built cars and trucks will be returned to their respective manufacturers in order to be repaired at Government expense, and will then be sold through the usual dealers. If the manufacturer refuses to take back his cars for this repair work, they will be turned into the army repairshops for the necessary work. When the vehicles are returned to the manufacturer for repair and sale, it is understood that a price will be fixed by mutual agreement, and also the commission which the manufacturer and the dealer will be allowed for their part in the transaction.

Foreign built automobiles and trucks will all be repaired in the army shops. It is intended to form a company in which all the big transportation organizations will have a part, which will take over all the foreign-built automobiles now in the French army and such French automobiles as the manufacturers refuse to handle. This company will thus have to receive a minimum of 20,000 automobiles, but in case the manufacturers do not care to handle their own vehicles, may have to receive more than 50,000.

The company will rent the vehicles placed in its possession to whatever organizations are in need of transportation. These will include many of the local railroad companies, the various municipalities in the devastated and other regions, builders undertaking reconstruction work, etc.

The holding company will be responsible for the maintenance of these automobiles so long as it is possible to keep them in service. As the vehicles wear out they will be scrapped, and the importance of the holding company will gradually decrease.

Although not forming a part of the Government scheme, it is known that many American manufacturers having cars and trucks now in the service of the French army will establish supply depots in order to help keep these trucks in service. Without such depots it is obvious that the cost of maintenance will soon run so high that the trucks will have to be abandoned at an early date.

An impression has gotten abroad in France that automobiles owned by the English and American armies would be left behind, and would have to be absorbed by the French nation. This is quite incorrect. The British authorities have arranged for all English army trucks to return to England, and the American army will send across the Atlantic the 81,000 automobiles it now possesses in France—or, at any rate, as many of them as are worth shipping home.

Automobile Manufacturers of France Entertain Louis Renault

PARIS, Jan. 12—Louis Renault was the guest of honor yesterday at a banquet given by the Automobile Manufacturers of France, in order to commemorate his promotion to the rank of officer of the Legion of Honor, which was awarded him because of the important role his factory has filled during the war and particularly for the designing and production of the Renault light tank.

This tank was designed late in 1917 and went into action in the beginning of 1918. Louis Renault equipped his factory to produce 12 tanks per day and when the armistice was signed had delivered about 2,500. In addition, the tank was built in accordance with his designs by other factories in France, Italy and America.

The banquet, which was attended by all the leading members of the automobile industry, was presided by M. Loucheur, who, during the war, was Minister of Armaments, and now occupies the post of Minister of Industrial Reconstruction.

Egyptian Cotton Import Restrictions Off

WASHINGTON, Jan. 26—The War Trade Board has removed all restrictions on the importation of Egyptian cotton, except as to the relations with the Textile Alliance, Inc., but it is still too soon to estimate its effect on tire manufacture. In fact, since the restrictions are off, none of the raw Egyptian cotton has had time to come into the country. During the past year, however, while the regulations were in effect, only about 50 per cent of the usual amount of 100,000 bales of Egyptian cotton came into this country. Of that amount the Government took about three-fourths for its own needs, leaving only 25 per cent for the manufacturers. As a result, tire makers were forced to manufacture with domestic cotton, which did not prove as satisfactory as the imported.

Licenses will now be granted freely for the importation of cotton of all grades from any country when the applications are otherwise in order. As the importation of Egyptian cotton is largely a question of steamship space, even with the restrictions off, the amount brought into this country will depend on the amount of shipping space available.

Consider Validating Measure

Senate Starts Hearings on Bill to Legalize Contracts —Two Amendments

WASHINGTON, Jan. 28—Consideration of the bill to validate informal war contracts was begun by the Senate yesterday. The contracts, which total $2,000,000,000 and include $300,000,000 worth of business with automotive companies, are those which were not formally made. The bill, which was published in these columns last week, permits the Secretary of War to adjust the contracts and provides for a commission to which appeals may be taken if Secretary Baker's decisions are unsatisfactory.

Senator Chamberlain, in charge of the bill, stated that delay in passage of the bill will bring disaster upon the country, continue to increase unemployment and work serious hardships upon industry.

A three-cornered discussion took place when adherents of the Dent bill, which has already been passed by the House and which was published in these columns several weeks ago, attempted to urge their bill, and Senator Hitchcock in turn spoke in behalf of a bill he has presented at the behest of the New York City Chamber of Commerce, while Senator Chamberlain demanded the passage of his bill at an early date. No definite action was taken.

Senator Hitchcock offered an amendment which was characterized as an attempt to again place complete charge of validation of informal contracts in the hands of the War Department, and Senator Pomerene offered an amendment to "protect the sub-contractors."

Following is the amendment suggested by Senator Hitchcock, which was ordered printed and will be laid before the Senate to-day:

"In line 3, page 1, after the word 'that' strike out all down to and including line 24, page 3, and insert the following:

"Where during the present war and prior to November 12, 1918, officers or agents acting under authority of the Secretary of War and placed orders or made contracts with manufacturers or contractors for war supplies or materials, or for the performance of work thereon, or for the construction or enlargement of plants or other preparations necessary to furnish supplies or material for the War Department, the procurement of which has heretofore been authorized by Congress, and any of said orders or contracts has been partly or wholly performed, or expense has been incurred by the manufacturer or contractor prior to the twelfth day of November, 1918, in preparation or partial execution of said contract or order, the fact that any such contract or order or agreement has not been made in the form or signed in the manner required by law shall not invalidate the same, if it was entered into in good faith and lacked only the sanction of a contract in legal form. Nothing herein provided, however, shall be held to validate any contract, order, or agreement given or made by an officer or agent of the War Department not legally qualified or authorized to give a formal legal contract, except where such officer has signed as the representative of a superior officer authorized to make such contract, nor to permit an officer to make such contract with any company, corporation, or firm in which he has, or had at the time, directly or indirectly any interest.

"Sec. 2. That in all cases as above included it shall be lawful to make payments under the terms of the contracts or orders so made or given to the extent that performance thereof has been made, expenditures incurred, or supplies thereunder have heretofore been received and accepted by the United States, provided that payment in such cases shall not exceed the fair value of the supplies or materials delivered to and accepted by the United States, together with remuneration for expenditure properly incurred in preparing to perform said contract, orders, or agreements.

"Sec. 3. That in case of the cancellation, suspension, or annulment of any contract, order or agreement as described in this act, by the Secretary of War, or officers or agents acting by his authority, and in cases where no property or supplies have been delivered to and accepted by the United States, or where only partial delivery and acceptance has been made, contractors shall file with the Secretary of War within 60 days after the passage of this act any claim for remuneration arising out of the discontinuance, cancellation, or suspension of such contract, agreement, or order, properly itemized and set forth. Each claim shall thereupon, or as soon as possible, be transmitted to and filed with the commission hereinafter provided for, together with a statement attached thereto, showing the amount, if any, which the War Department deems to be justly due to said claimant. If the claimant shall file a statement offering to accept the amount awarded by the War Department in full for said claim, the commission shall, within 10 days, order the same paid in the absence of evidence that it is excessive.

"Sec. 4. That for the adjustment of all claims arising out of the cancellation of contracts, orders, and agreements for supplies or materials of war, as described in the foregoing paragraphs of this act, there is hereby created an adjustment commission to be composed of 3 members, to be appointed by the President and confirmed by the Senate, one representing the War Department, one representing the Department of Justice, and one representing the business interests of the country, none of whom shall be interested in any contracts with the Government or have any interest in any firm or corporation having war contracts, who shall hold their offices for 1 year and receive as compensation a salary of $10 000 each. It shall be the duty of said commission promptly to examine and pass upon all claims for compensation and reimbursement arising out of cases as set forth in this act of supplies furnished, expenditures or obligations necessarily incurred, or materials purchased under faith of contracts in legal form or orders received from officers and agents of the Secretary of War as heretofore set forth.

"Sec. 5. That in each case, as soon as the commission has made an award, the contractor shall be entitled to receive the same upon giving receipt in full of all demands against the United States arising out of the transaction, or if the contractor is not satisfied with the amount so awarded he shall be entitled to receive, and shall receive at once, 75 per cent of the amount that has been awarded him, and he shall thereupon be entitled to appeal the case to the Court of Claims, which is hereby given jurisdiction to hear the case and render final judgment in such sum as may be required to reimburse the contractor for supplies and materials delivered to and accepted by the United States and expenditure necessarily incurred in good faith in the partial performance of the contract or order above referred to, or in preparing for the same.

"Sec. 6. That in no case, however, shall any award, either by the commission or the Court of Claims, include prospective or possible profits on any part of the contract beyond the goods and supplies delivered to and accepted by the United States and a remuneration for expenditures necessarily incurred in preparing to perform said contract or order so canceled.

"Sec. 7. That the purpose of this act being to secure prompt settlement of claims, the commission is authorized to make its own rules and regulations and to hear and determine the issue informally and promptly upon presentation of the case. The commission is authorized to appoint, under such rules and regulations as it shall prescribe, one or more regional boards of examiners to serve in such districts throughout the country as the commission shall fix and determine to investigate and determine the facts concerning claims, legal or equitable, that may be presented as herein prescribed. The members of such board shall be composed of one representative of the War Department, one representative of the Department of Justice, and one from the business interests of the region, none of whom shall have any interest in the contract, directly or indi-

(*Continued on page* 275)

Makers Discuss Plans of Loading

N.A.C.C. and Master Car Builders Confer on Method of Freight Car Loading

DETROIT, Jan. 24—A meeting to determine how motor vehicles should be loaded for shipment was held Thursday, Jan. 23, at the Board of Commerce. It was arranged by the National Automobile Chamber of Commerce and J. S. Marvin of that organization, explained that the purpose was to receive from army officers and the Master Car Builders' Association their proposed specifications and blue prints to govern the loading of motor vehicles on freight cars.

This follows a preliminary conference at Washington a month ago, and as a result of the meeting the Government officials are to be furnished with specifications and other data showing the present loading methods of the various factories here. Many suggestions were made by the shippers and the changes in the proposed rules adopted. It was expected that further changes would be made before the final approval of the rules which will be binding on all shippers when printed and approval by the Railroad Administration.

This matter is of vital importance to the motor vehicle makers, many of whose shipments run from 50 to 100 carloads per day, and any serious deviation in the fastenings of the machines in the cars for transportation makes an important item of expense, weight of load and liability of damage.

The meeting was attended by Captain H. R. Moody, chief of the packing and service division, Quartermaster Corps; Captain E. S. Evans of the same department; J. J. Burch, chairman, and other members of the committee on loading, Master Car Builders' Association; L. J. Markwardt and H. J. Hegal, forest products laboratory, Forest Service, U. S. D. A.; William E. Metzger, chairman, traffic committee, National Automobile Chamber of Commerce; E. N. Hodges, chairman of the Detroit traffic committee of that organization and representatives of the following motor vehicle manufacturers: Anderson Electric Car Co., Cadillac, Chalmers, Dodge, Denby, Ford, General Motors, Hudson, Hupp, King, Maxwell, Packard, Paige, Saxon, Scripps-Booth and Studebaker, Detroit; General Motors Truck Co., Pontiac; Reo Motor Car Co., Lansing; Buick and Chevrolet Motor companies, Flint, and Nordyke & Marmon Co.

Moline Plow Co. Earns 9.14 Per Cent

MOLINE, ILL., Jan. 28—The Moline Plow Co., having changed its fiscal year, has issued its report for the fifteen months ending Oct. 31, 1918. Net profits are $2,038,779, after deducting all operating expenses, allowing for depreciation of fixed assets, for interest on borrowed money and for bad debts.

Deny Labor Surplus Reports

Congressmen Point Out Condition Is Temporary—Suggest Propaganda

WASHINGTON, Jan. 27—Congress will devote much time this week to the labor situation, and is expected to pass Senator Kenyon's bill providing $100,000,000 as an emergency fund to start public works to employ those now unemployed.

Reports of labor surpluses at various sections of the United States were denied in Congress last week by a number of Congressmen. The surplus of labor reported by the Department of Labor as existing in the State of Washington was said to be actually a result of a strike and this, it was stated, could not be called a real surplus. Youngstown, Ohio, and other points reported as having large surpluses of workers and being in serious condition by the Department of Labor, were said by Congressmen to be in much better condition than reports indicated.

The fact that Congress has held up the payment of informal contracts is regarded as a very important reason for whatever unemployment exists. Employers, it was said, waiting for their payments from the Government on war contracts, planned to use these funds for engaging in normal peace time production and are unable to take on workers until they are paid.

There are also reports that the official statement indicating labor surpluses and similar announcements from organized labor form a propaganda in part designed to secure future army wages for discharged soldiers and also in part to slacken the demobilization and thereby maintain labor shortage and consequently the war wage standards.

—

Consider Validating Measure

(*Continued from page* 274)

rectly, and receive no compensation, save and except such per diem compensation as shall be fixed by the commission. Whenever the commission shall refer to any such regional board of examiners any claim they shall proceed informally to hear the parties, take the proofs, and return the same promptly to the commission with their recommendation thereon.

"Sec. 8. That the sum of $50,000, or so much thereof as may be necessary, is hereby appropriated, out of any money in the Treasury not otherwise appropriated, for the reasonable expenses of said commission, to be paid out upon the warrant of the chairman, who shall be chosen by the commission from among their own members, and approved by the secretary, who may be selected by the commission, and who shall receive a salary of not exceeding $5000 for the period of 1 year, or so much thereof as may be necessary, to be determined by the commission."

Amend the title so as to read: "A bill to legalize informal or defective orders for war supplies and materials: to provide for the cancellation of orders and contracts, for the reimbursement of contractors and manufacturers, for the adjustment of claims on canceled contracts or orders, to provide for the partial payment of awards pending final determination, and for the creation of an adjustment commission."

Following is the amendment suggested by Senator Pomerene for the protection of subcontractors:

"Whenever, under the provisions of this act, the Secretary of War shall make an award to any prime contractor who shall have sublet any part of said contract for material, equipment, or supplies to any other person, firm, or corporation who has in good faith made expenditures, incurred obligations, rendered service, or furnished material, equipment, or supplies to any prime contractor, with the knowledge and approval of any agent of the Secretary of War duly authorized thereunto, the Secretary of War shall apportion the amount of said award justly due to each of the subcontractors of said prime contractors. Before payment of said award the Secretary of War shall require any prime contractor to present satisfactory evidence of having paid said subcontractors or of the consent of said subcontractors to look for their compensation to said prime contractor only; and in the case of the failure of said prime contractor to present such evidence or such consent, the Secretary of War shall pay directly to said subcontractors the amount found to be due under said award; and in case of the insolvency of any prime contractor the subcontractor of said prime contractor shall have a lien upon the funds arising from said award prior and superior to the lien of any general creditors of said prime contractor."

—

Standard Parts Back to Peace Plan

CLEVELAND, Jan. 29—In placing its operations on a peace-time basis, the Standard Parts Co. has reinstated the plan of separate general management for its various plants. This method replaces the centralizing of all activities in the general offices which was made necessary in order to conserve man power during the war and especially during the time when a great part of all production was for one customer, viz, the Government. The executive and supervisory offices, credits, collections, disbursements and contracting for the larger material supplies will remain in the general offices.

The several plants will be under general managers as follows: Standard Welding plant, H. H. Newsom; Perfection Spring plant, F. F. Grimmelsman; Bock Bearing plant, George H. Kleinert; American Axle and Cincinnati Axle plants, both producing Stan-Par Axles, D. K. Moore, with headquarters in Cleveland; Canton Spring and Canton Forge plants, J. B. Childe; Connersville Spring and Axle and Wheeling Axle plants, E. V. Overman, with headquarters in Cincinnati; Pontiac Spring plant, B. A. Litchfield; Flint Spring plant, R. T. Armstrong; St. Louis Spring plant, N. B. Champ; Perfection Heater plant and Spring Jobbing division, B. R. Winborn.

—

Harry S. Harkness is Dead

NEW YORK, Jan. 24—Harry S. Harkness, formerly president of the Sheepshead Bay Speedway Corp., died last night at his home in this city. He was 38 years old. Mr. Harkness was one of the first automoblie owners to drive his own car in races, and competing against a number of the wealthy owners who in earlier days drove their own cars in contests. He was also a pioneer aviator.

—

Kentucky Wagon Buys Dixie

LOUISVILLE, Jan. 28—The Kentucky Wagon Manufacturing Co. has purchased the Dixie Motor Car Co. and is preparing to materially increase the production of Dixie cars. The Kentucky company manufactures Old Hickory motor trucks.

Reports Show Labor Surplus

U. S. Employment Service Says 25% of Cities Report Shortage; 60% a Surplus

WASHINGTON, Jan. 27—Labor conditions, according to reports from the Department of Labor, are serious and growing more so. The United States Employment Service of the Department of Labor, which has for several weeks insisted that there is a labor surplus and a consequent unemployment, despite contrary reports from many localities, states that 25 per cent of the cities reported shortages of labor, 60 per cent that the supply equals the demand, and 12½ per cent a surplus of labor on Dec. 10, 1918.

From that date until the current week, says the department, there has been a steady decrease in shortage and an increase in surplus reported, and telegraph reports during the current week indicate that 13 per cent of the cities have a shortage of labor, 44 per cent have a surplus and 43 per cent have a supply equal to the demand. On Dec. 21, six States reported a surplus of labor, according to the statement, and during the current week twenty States reported a surplus.

On Dec. 3, there was a total shortage of labor of 34,000 reported and a surplus of 12,000, and during the following eight weeks this shortage was reduced to 12,000 and the surplus increased to 210,000.

New England reports indicate a surplus in practically every center. New York State reports a surplus of labor in every large city. New Jersey reports a supply equal to the demand. Pennsylvania reports indicate shortages of labor everywhere except at Erie, which has a heavy surplus. Ohio has a surplus of labor totalling 55,000 in Cleveland, 10,000 in Toledo and 7000 in Dayton.

The Middle West reports a surplus of 30,000 workers at Detroit, 4400 at Indianapolis and 400 at Minneapolis, with surpluses reported from most every other point. There is a slight demand for machinists. The copper districts are suffering serious conditions. Copper producers are unable to market their total outputs, and are laying off workers. Nebraska reports a shortage of workers.

In the South there is some demand for miners and agricultural help, while Savannah, Ga., reports shortage of mechanics, ship yard workers, and Delaware, Kentucky and Virginia have shortages of machinists and ship yard workers. Tennessee, North Carolina and Florida are suffering from a surplus.

—

More Import Restrictions Lifted

WASHINGTON, Jan. 29—Restrictions upon the importation of pyrites, graphite, plumbago and graphite crucibles have been removed by the War Trade Board and licenses will now be issued freely.

Overland to Divide Profits with Men

Capital and Labor Will Split 50-50 After Provision for Wages and Normal Profits

TOLEDO, Jan. 27—A profit sharing plan whereby the Willys-Overland Co. will divide profits equally between capital and labor after wages and normal profits in relation to the capital invested are taken out was announced by John N. Willys at a meeting of the foremen of the plant held to-day.

The profit sharing plan will be retroactive to Jan. 1, 1919, and the wage scales in effect from time to time will not be affected. Mr. Willys' statement, in part, follows:

"After permanent capital and permanent labor have each been justified, having due regard to the cost of each, the cost of capital and the cost of living, then the additional profits accruing from the joint employment of permanent capital and permanent labor shall be divided between them, 50-50. The detailed plan, when ready to present, will recognize and reward individual efficiency, departmental efficiency and increasing reward for continuous service, and these plans will have no influence on periodical adjustment of wages."

It is understood that every employee of the Willys-Overland factories will be affected and that if the plan proves satisfactory in operation it will be extended to the subsidiary plants.

Two Official Entries for Indianapolis Race

NEW YORK, Jan. 27—Two official entries have been received for the 500-mile Liberty sweepstakes on the Indianapolis Speedway on May 31. R. C. Durant will drive a Chevrolet special model, and Ralph Mulford will drive a Frontenac. Opening races on the Uniontown, Pa., speedway have been sanctioned for May 17.

19,500 Ft. Altitude Record for Monoplane

WASHINGTON, Jan. 25—A record for altitude in a monoplane has been made by Major R. W. Schroeder. The War Department received a telegram yesterday from the commandant at McCook Field, Dayton, that Major Schroeder, with two passengers, in a monoplane climbed to a height of 19,500 ft. in 31 minutes. With him were Lieutenant George V. Elsy and K. A. Craig, a mechanician. The previous record for a machine of this type is said to be about 16,000 ft. The plane was built by Grover C. Loening of Long Island City, N. Y., and was powered with an 8-cylinder engine. It has developed a speed of 145 m.p.h.

Aviation Secretary for Cabinet

Creation of Air Bureaus Suggested to Develop Mechanical Flight in U. S.

WASHINGTON, Jan. 23—Creation of a separate air department, with its head a member of the Cabinet, was advocated yesterday by Senator Chamberlain of Oregon, chairman of the Senate Military Affairs Committee, in a statement in which he expressed the belief that the control of the air would "unquestionably be the decisive factor in the next war, overshadowing in importance the forces on either land or sea."

"The United States," said Senator Chamberlain, "ought to profit by the experiences of the war with Germany and formulate a constructive program accordingly. We ought to continue to manufacture airplanes in reasonable quantities, but, more than all, we should endeavor to develop mechanical flight, so as to be able, should the emergency arise, to maintain control of the air.

"The air problem in the future seems to rest on efficient co-ordination. It is for this reason that we—speaking for a majority of the members of the Senate Military Affairs Committee—recommend a unification of effort and still urge such a policy. What I would like to see would be the creation of a separate air bureau or department, whose head shall sit in the cabinet along with the Secretaries of War and Navy."

Platinum Imports

WASHINGTON, Jan. 27—Imports of platinum into the United States during the year ended June 30, 1918, totaled 48,745 troy ounces unmanufactured, and 3117 ounces of ingots—bars, plates, etc. Following is a table showing the imports by countries of origin:

	Unmanufactured		Ingots, bars, plates, etc.		Vases, retorts,
From—	Troy ounces.	Value.	Troy ounces.	Value.	Value.
France	166	$18,142	814	$78,674	....
Netherlands	....	....	....	....	$165
England	1,073	80,834	357	29,614	....
Canada	76	7,249	253	23,671	1,682
Panama	372	35,254	....	....	....
Mexico	9	749	....	....	....
Cuba	....	....	3	260	....
Brazil	27	2,312	....	....	....
Chile	3	300	....	....	....
Colombia	25,365	2,112,211	1,665	129,533	700
Peru	3	300	....	....	....
Venezuela	162	12,960	....	....	....
China	489	38,207	....	....	....
Russia in Asia	21,000	2,000,000	....	....	....
British South Africa	....	....	25	2,344	....
Totals	48,745	$4,308,518	3,117	$264,096	$2,547

Commercial Airplane Tests Permitted

Use of McCook Field by Companies or Individuals Authorized by War Department

WASHINGTON, Jan. 27—Peace-time development of aircraft was given an impetus to-day when the War Department authorized the use of McCook Field, Dayton, Ohio, for testing of experimental planes by individuals or private companies. The regulations provide that all unofficial tests will be at the owners' risk and expense and after examination of the planes by army experts to determine the safety of the trials in the air.

Official tests will also be conducted at McCook Field by Army pilots experienced in experimental work. Owners desirous of having official tests made must submit two planes, one for destruction tests and one for performance. The Government will defray the expenses of official tests.

Following are the complete regulations applying to both private and official tests:

1. The Chief of the Technical Section is charged with the responsibility for all tests of experimental airplanes at Air Service fields.
2. Such tests will be conducted at McCook Field, Dayton, Ohio, unless otherwise permitted by the Director of Military Aeronautics.
3. Such tests will be entirely at the owner's risk and expense, and he shall supply the pilot therefor. No Air Service pilot will be permitted to engage in these tests.
4. Flight tests will be permitted only after a technical examination by a representative of the Technical Section. If, in the opinion of this officer, the airplane is unsafe to fly, no flight will be permitted at an Air Service field.

Official tests of experimental planes will be authorized only at McCook Field, Dayton, Ohio, and under the following conditions:

1. The owners of such airplanes must submit 2 models—one for destruction test and one for performance test.
2. Tests will be at Government expense and the flight test will be made by an Army pilot detailed by the Chief of the Technical Section.
3. Flight tests will be permitted only after a technical examination and sand-test by a representative of the Technical Section. If, in the opinion of this officer, the airplane is unsafe to fly, no flight will be permitted at an Air Service Field.

Pilots unexperienced in flying experimental airplanes will not be permitted to fly such planes until after they have been placed "in production."

Commanding officers at Flying Fields will be held strictly responsible that no flights are made at their fields in violation of the foregoing instructions.

Civilian Flying Unrestricted

WASHINGTON, Jan. 24—The Joint Army and Navy Board on Aeronautic Cognizance has removed restrictions on civilian flying, and will grant permits to all qualified civilians who apply under the President's proclamation of Feb. 28, 1918.

Until the action of the Joint Army and Navy Board on Aeronautic Cognizance, civilians were only permitted to fly experimental machines and then only under permits from the Board.

Applications from civilian pilots should be addressed to the Joint Army and

Navy Board on Aeronautic Cognizance, Building "D," Sixth and B Streets, N. W., Washington, D. C., Lt. L. G. Haugen, A. S. A., Secretary.

Cars and Trucks Only for Omaha Show

OMAHA, Jan. 28—Omaha's fourteenth annual show will be an exhibit of passenger cars and trucks only, and will be bigger than any in the past.

The show is set for March 10-15. It will be staged in the Auditorium, a building occupying half a block, and affording one floor and a small basement. To this the directors of the Omaha Automobile Trade Association have decided to add the McCaffrey-Ford Building adjacent, which gives a quarter of a block more space, and possibly the building of Andrew Murphy & Son, comprising the remaining quarter block. Part of the McCaffrey Building was utilized last year.

Thus the whole show, with more floor space than ever before, will yet be housed in a single, solid block. But no tractors or accessories will be shown, unless it is by the enterprises of the individual dealers in their separate showrooms.

$300,000,000 for Road Improvements

WASHINGTON, Jan. 27—About $300,000,000 will be put into road building this year, according to estimates by experts of the Department of Agriculture, submitted to the Division of Public Works and Construction Development of the Department of Labor. It is understood that about half this amount will go to labor.

The $300,000,000 of construction estimated will not be sufficient to make up deferred war construction, it is believed, for normally the amount spent on roads in the United States is not far below $300,000,000. During the war road building almost came to a stop in many states.

Estimates prepared for the following States are considered accurate within one or two per cent, according to officials of the Department of Agriculture: Maine, $1,500,000; Rhode Island, $90,000; Connecticut, $4,000,000; New York, $12,000,000; New Hampshire, $175,000; Kentucky, $1,500,000; Alabama, $1,000,000; West Virginia, $16,000,000; Illinois, $9,000,000; Iowa, $15,574,000; Louisiana, $4,674,000; Texas, $20,000,000; Nebraska, $1,657,089.07; North Dakota, $3,000,000; Wyoming, $653,000; Colorado, $3,900,000; California, $20,000,000; Arizona, $900,000; Nevada, $1,148,849.80; Idaho, $1,000,000. New Jersey, Maryland and Montana are expected to make considerable expenditures on roads this year.

Increase Road Cost Limits

WASHINGTON, Jan. 27—The House Committee on Roads yesterday favorably reported a bill increasing the limit of cost of roads to be built with Federal aid from $10,000 to $15,000 per mile.

This action was taken to permit the various States to proceed with projects stopped by the Government's fixing the limit to be paid for construction at a figure at which no contracts could be placed.

"The construction of public works," said the report, "is recognized throughout the country as one of the means for solving the questions of unemployment due to cessation of the production of materials required for carrying on the war."

Road Builders Meet in New York

Will Discuss Efficient Methods of Road Building and Maintenance Feb. 25-28

NEW YORK, Jan. 25—The Ninth American Good Roads Congress and the Sixteenth Annual Convention of the American Road Builders' Association will be held at the Hotel McAlpin, Feb. 25-28. It is planned to devote Feb. 25 and 26 to the presentation and discussion of papers and the 27th and 28th to the consideration of reports of committees. The business session will be held on the afternoon of Feb. 28, and the annual banquet on the evening of the 26th or 27th. It is proposed to show motion pictures pertaining to highways on two evenings during the congress.

Among the subjects to be discussed are:

National Highways and Federal Aid for State Highway Improvements.
Relation of Highways to Railways and Waterways.
Efficient Methods of Contracting for Highway Work During the Reconstruction Period.
Efficient Methods of Promoting Highway Bond Issues.
Efficient Methods of Drainage for Different Geological Conditions.
Foundations for Heavy Horse-Drawn and Motor Truck Traffic.
Methods of Maintaining Highway Systems Prior to Construction by the State or County.
Economic Utilization of Labor Saving Machinery.
Cost Keeping for Highway Contractors.
Street Systems, Their Relation to Highways Outside of Urban Districts.
The Efficiency of the French Broken Stone Roads During the War.
Efficiency of Bituminous Surfaces Under Motor Truck Traffic.
Recent Developments in the Construction, Maintenance and Reconstruction of Cement Concrete Pavements.
Present Status of Brick Pavements Constructed with Sand Cushions, Cement Mortar Beds and Green Concrete Foundations.
Recent Practice in the Construction of Stone Block Pavements.

Committees will submit reports on the following subjects:

Regulations Covering Speed, Weight and Dimensions of Motor Trucks.
Methods of Financing Highway Improvements for States, Counties and Towns.
Civil Service Requirements for Highway Engineering Positions.
Sources of Supply of Unskilled Labor for Highway Work.
Convict Labor on Highway Work: Organization, Administration, Camps and Cost Data.
Reconstruction of Narrow Roadways of Truck Highways with Adequate Foundations and Widths for Motor Truck Traffic.
Methods of Strengthening and Reconstructing Highway Bridges for Heavy Motor Truck Traffic.
Efficient Methods of Snow Removal from Highways Outside of Urban Districts.
Guarantees for Pavements on Roads and Street.
Uniform Highway Signs.

Because of the war, it was decided to postpone the exhibit of road machinery, equipment and materials until next year.

Good Roads Chairmen Appointed

LANSING, Jan. 24—The executive committee appointed by Governor Sleeper to arrange for establishing rural motor truck routes in every county in the state met Wednesday, Jan. 22, and adopted a resolution favoring the senate bill for amending the state constitution to allow state appropriations for good roads. The following chairmen of counties were appointed:

Ottawa, Nathaniel Robbins, Grand Haven; Kent, Fred A. George, Grand Rapids; Ionia, M. Chapman, Ionia; Muskegon, S. H. Klink, Muskegon; Newago, J. B. John, Newago; Montcalm, F. E. Runney, Greenville; Osceola, A. R. Davey, Evart; Oceana, Thomas Reed, Shelby; Mecosta, George F. Fairman, Big Rapids; Mason, C. H. Curtis, Ludington; Lake, G. F. Duffey, Baldwin; Manistee, R. M. Hoffman, Manistee; Wexford, Henry M. Knowlton, Cadillac; Missaukee, Henry Curtis, Jennings; Benzie, J. H. Hoffstetter, Frankfort; Kalkaska, J. H. Greacen, Kalkaska; Grand Traverse, F. H. Hamilton, Traverse City; Leelaneau, D. H. Day, Glenhaven; Charlevoix, Harry Nichols, Charlevoix; Emmett, A. L. Deuel, Harbor Springs; Sheboygan, H. A. Frombach, Sheboygan; Antrim, E. R. Harris, Ellsworth; Otsego, S. W. Buck, Gaylord; Crawford, T. W. Hansen, Grayling.

National Highway Conference Invitation

NEW YORK, Jan. 25—A conference on "Regulations Covering Speed, Weight and Dimension of Motor Trucks" will be held under the auspices of the National Highway Traffic Association at the Automobile Club of America, 247 West Fifty-fourth Street, at 8 p. m. on Friday, Jan. 31. An informal dinner, at $1.50 a cover, will be served in the grill room of the club at 6.30 p. m. Those interested should address Secretary Elmer Thompson, 247 West Fifty-fourth Street.

No Truck Show for Boston

BOSTON, Jan. 25—Manager Chester I. Campbell has announced that there will be no commercial vehicle show here this year unless something unforeseen develops. The basement of Mechanics' Building is filled with goods which it was believed belonged to the government. When an appeal was made to the Federal officials to move the stuff and an investigation was made, it was found that the things were owned by the Quincy Market Cold Storage Co. of Boston. And as the owners of Mechanics' Building are getting a big rent for the basement they are not in any hurry to get rid of the goods to accommodate the automobile association. One last effort is being considered, that of appealing to the Boston Chamber of Commerce, to try to have that body interest the owners to remove the goods, but it is not believed that this will be successful.

Muskegon Holds Third Annual Show

MUSKEGON, Mich, Jan. 27—Muskegon will hold its third annual show at the same time Detroit is staging its exhibition, March 3-8. It will be under the auspices of the Elks Lodge and will be held in the armory, which has a floor space of 10,000 sq. ft.

Shipping Space for Commercial Exports

WASHINGTON, Jan. 28—The British Government has allocated 10 per cent of all space on liners for commercial shipments. There are prospects for early release of additional space.

Detroit Hears Talk on Patents

Attorney for Standard Parts Co. Gives S. A. E. Comprehensive Summary of Laws

DETROIT, Jan. 25—Addressing the Detroit section of the Society of Automotive Engineers at their meeting last night, B. M. Kent, patent attorney for the Standard Parts Co., gave a comprehensive summary of the patent laws. He outlined the procedure necessary to secure a patent, and declared that a great deal of the trouble incurred by inventors and manufacturers in connection with the purchase of patents would be eliminated were Congress to grant the Patent Office at Washington a reasonable working appropriation instead of curtailing its budget to a minimum.

To this end, he suggested that the S. A. E. get behind a movement to secure for the Patent Office an individual appropriation, separate from that of the Department of the Interior, under whose jurisdiction it is conducted. He further declared that the Patent Office employees were insufficiently paid and that the Government was unable to secure expert legal and engineering advice because first class men would not work for the meager salaries offered.

In his address Mr. Kent dealt with the laws governing the granting of patents, commencing with the definition of a patent, the rights granted and their limitations in actual fact. He referred to the matters of prior patents, research, etc., and to the advantage of maintaining a file of the classes of patents relating to individual businesses or manufacturers, to the definition of a person eligible, by reason of his discovery of a new and useful art, etc., to have a patent granted him and to the formal manner in which application for such patent should be made.

—

Experiments on Flame Propagation

(*Continued from page* 248)

losses of heat, the combustion products are not in thermal equilibrium. Hopkinson showed, in 1906, that the temperature round the point of ignition may be several hundred degrees higher than the mean temperature (as reduced from the pressure), owing to adiabatic compression there, while near to the walls the temperature was much below the mean. Wheeler's pressures first rose rapidly, then kept constant for a short period, and finally dropped off owing to cooling. The period of constancy might be ascribed to a combustion in several stages and to exothermic secondary reactions between CO and steam; but the size of the vessel is of importance in this connection, and from Wheeler's experiments, some of which were made with a fan revolving in the mixture, the constancy period seems to be due rather to the equalization of temperature within the gaseous mass.

The time of first manifestation of pressure does not synchronize with the ignition moment. There is a time-lag (as Bairstow and Alexander had shown in 1905), and disregard of this fact may account for the high flame propagations stated by Le Chatelier. Wheeler observed that when the flame traveled at the rate of 28 cm. per second in a 6.3 per cent mixture, the time-lag (between ignition and first appearance of pressure) amounted to 0.18 second, and the maximum pressure developed within 0.348 second. That was in the 4-litre vessel. In the 16-litre vessel a flame of 15 cm. velocity took 0.423 second and 1.037 second for the two periods. Owing to this time-lag the flame will actually travel about 5 cm. in the small vessel and about 10 cm. in the large vessel before setting up any noticeable pressure, which is rather curious. The pressures were registered by means of a style fixed to a steel plate 2.6 cm. in thickness; ignition was by electric sparks.

—

Car Market Drained in 1918

(*Continued from page* 270)

472, of which 18,808 were delivered, 19,649 canceled, 7904 shipped overseas and but 15 remain to be delivered.

No motor trucks now overseas will be returned to this country, and but few of the trucks in the hands of the Army in this country will be offered for sale to the public, states the letter.

Following is the complete letter:

37 of 38 Jobbers Go Before Jury

Court Decides They Must Put in Defence—Case Against One Is Dismissed

NEW YORK, Jan. 28—Thirty-seven of the thirty-eight defendants in the suit brought by the Government against the Jobbers' Association will have to put in a defence and abide by the verdict of the jury. Judge Hand decided this to-day, and in doing so dismissed the case against the thirty-eighth, who is J. Stanley Clemence of Ballou & Wright.

The action of the court was a little surprising in view of the aspect of the situation up to this afternoon. It would not have been surprising if the cases against the entire thirty-eight had been dismissed. Yesterday saw the start of the taking of evidence before the jury.

—

Motorize New Zealand Post Office

WASHINGTON, Jan. 23—The Post and Telegraph Department of New Zealand has been allowed $48,665 for motor cars, motorcycles and bicycles for the use of that department. The Department of Mines has been allowed $65,698 to develop the mineral-oil industry of the country.

WAR INDUSTRIES BOARD
WASHINGTON

B. M. BARUCH
Chairman

In Your Reply
Refer to............

From: Chief, Automotive Products Section.
To: Passenger Car and Motor Truck Manufacturers.
Subject: **Passenger Car and Motor Truck Data.**

1. Manufacturers' Reports submitted to this section supply information which will be of general interest.

2. TOTAL PASSENGER CAR PRODUCTION.

1917	1918
1,740,792	926,388

Sworn Reports received from the Passenger Car Manufacturers as of December 31, 1918, show that the Manufacturers had an aggregate of 15,545 finished Passenger Automobiles on hand. This represents only about three days normal production.

3. TOTAL MOTOR TRUCK PRODUCTION.

	1917	1918	Proposed 1919
For civilian use	109,865	164,264	
For military use	18,292	62,986	
	128,157	227,250	327,930

DISTRIBUTION OF PROPOSED PRODUCTION FOR 1919.

½ ton	9,300	2 tons	49,947	4 tons	1,149
¾ ton	30,043	2½ tons	10,063	5 tons	16,992
1 ton	138,738	3 tons	6,155	5½ tons	1,000
1½ tons	43,308	3½ tons	19,212	6 tons	1,069
				7½ tons	954

A sheet showing distribution in price retail has been previously mailed to all contributing manufacturers.

The large increase in production of Motor Trucks during 1918 for civilian use may be attributed in part to indirect war demand. It will be noted that the manufacturers in the aggregate propose to greatly increase production for 1919.

The proposed production figures for 1919 were supplied by the manufacturers after the signing of the Armistice.

4. SUMMARY OF U. S. GOVERNMENT MOTOR VEHICLES AS OF JAN, 1, 1919.

	Total Ordered	Total Delivered	Total Canceled	Balance Due	Shipped Overseas
Trucks	204,760	*98,000	78,081	28,679	54,343
Pass. cars	38,472	18,808	19,649	15	7,904

*Includes foreign purchases.

In December the Post Office Department made requisitions on the War Department under the Act of July 2, 1918, for 17,135 Motor Trucks, mostly from ¾ to 2-ton sizes.

5. From the best information available, it is the opinion of this section that none of the Motor Vehicles now overseas will be returned to this country and we have reason to believe that few, if any, of the Motor Vehicles in the hands of the military establishment in this country will be offered for sale to the public.—C. C. Hanch.

P.S.: Fnished trucks, including those for military use, in the hands of the manufacturers on December 31, 1918, represent only about fifteen days normal aggregate truck production.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. ..... .02 -.03
- Phosphoric (85%). .35 -.39
- Sulphuric(60%),lb. .008

Aluminum:
- Ingot, lb. .... .33
- Sheets (18 gage or more), lb. .... .42

Antimony, lb. .... .07½-.07¾

Burlap:
- 8 oz., yd........ .10½
- 10½ oz., yd...... .16½

Copper:
- Elec., lb. .... .23
- Lake, lb. .... .20 -.23

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.62
- Egypt, combed, sq. yd. 1.30
- Egypt, carded, sq. yd. 1.27
- Peelers, combed, sq. yd. .97
- Peelers, carded, sq. yd. 95-1.05

Fibre (⅛ in sheet base), lb. .... .50

Graphite:
- Ceylon, lb. .... .09 -.22
- Madagascar, lb. .. .10 -.15
- Mexico, lb. .... .03¾

Lead, lb. .... .05 -.055

Leather:
- Hides, lb. .... .18 -.35¼

Nickel, lb. .... .40

Oil:
- Gasoline:
  - Auto. gal. ..... .24½
  - 68 to 70 gal.... .30½
- Lard:
  - Prime City, gal.1.90-2.00
  - Ex. No. 1, gal..1.10
- Linseed, gal. 1.58-1.59
- Menhaden (Dark), gal. 1.10-1.12
- Petroleum (crude):
  - Kansas, bbl. ..2.25
  - Pennsylv'a, bbl..4.00

Rubber:
- Ceylon:
  - First latex pale crepe, lb. ..... .54
  - Brown, crepe, thin, clear, lb. ..... .48 -.49
  - Smoked, ribbed sheets, lb. ... .52
- Para:
  - Up River, fine, lb. 58½
  - Up River, coarse, lb. .... .34
  - Island, fine, (lb.) .49

Shellac (orange) lb. .70 -.72

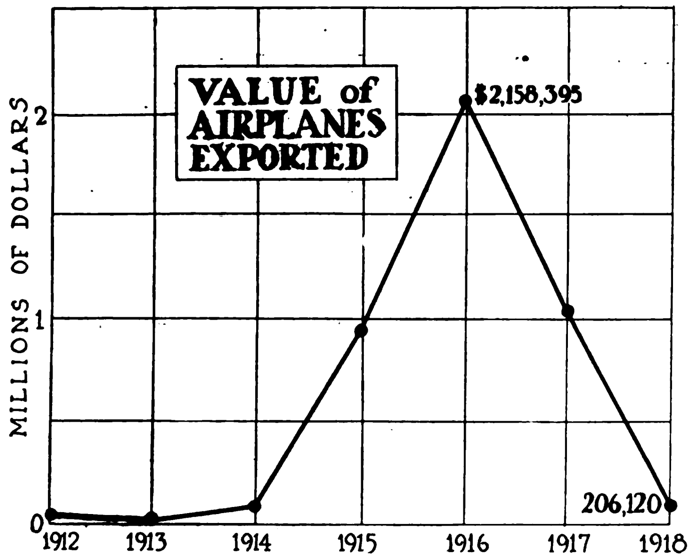
Spelter .... .07 -.08

Steel:
- Angle beams and channels, lb..... .03
- Automobile sheet (see sp. table.)
- Cold rolled, lb.... .0625
- Hot rolled, lb..... .039

Tin .... .71 -.72

Tungsten, lb. 1.50-2.10

Waste (cotton), lb.. .12¾-.17



Our exports of airplanes during the past seven years are more extensive than usually supposed, particularly when it is taken into consideration that the figures do not include planes sent overseas for war

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6 30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Black Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.
- Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close Jan. 25

	Bid	Asked	Net Ch'ge
Auto Body Company	6½	8½	..
Briscoe Motor Car, com	11	..	..
Briscoe Motor Car, pfd	40	55	..
*Chandler Motor Car	102	104	—1
Chevrolet Motor Car	149	151	—5
Cole Motor Car Co	90	105	..
Continental Motors, com	7	8	—1
Continental Motors, pfd	94	97	..
Edmunds & Jones, com	19	22	..
Edmunds & Jones, pfd	75	90	..
Electric Storage Bat	50	55	..
Federal Motor Truck	32	35	..
Fisher Body Co., com	36½	42	..
Fisher Body Co., pfd	92½	93¾	..
Ford Motor of Canada	250	260	+5
General Motors, com	125	126	+2
General Motors, pfd	82½	84½	—1¼
Hupp Motor Car, com	5½	6½	—¾
Hupp Motor Car, pfd	89½	..	+3
Kelsey Wheel Co., com	30⅛	34½	..
Kelsey Wheel Co., pfd	86	90	..
Manhattan Electric S., com	..	48	..
Maxwell Motor, com	26½	27½	—¾
Maxwell Motor, 1st pfd	51½	52½	+¼
Maxwell Motor, 2nd pfd	19½	20½	..
McCord Mfg., com	32	35	..
McCord Mfg., pfd	93	96	..
Mitchell Motor Co	24	30	..
Motor Products Corp	35	41	—5
Nash Motors Co., com	160	175	..
Nash Motors Co., pfd	93½	97	+3½
National Motor Co	6	10	..
Packard Motor Car, com	115	..	+3
Packard Motor Car, pfd	100	..	..
Paige-Detroit Motor, com	23	24	—1
Paige-Detroit Motor, pfd	8¾	9¾	..
Peerless Motor Truck	18	21	..
Pierce-Arrow Mot. Car, com.	39¾	40¾	+¼
Pierce-Arrow Mot. Car, pfd.	101¾	102	..
Premier Motor Corp., com	5	..	..
Premier Motor Corp., pfd	..	75	..
Prudden Wheel Company	15½	17½	..
Reo Motor Car Co	21¼	22¼	—¼
Republic M. Truck, com	38	40	+3
Republic M. Truck, pfd	87	90	..
Saxon Motor Car, com	6¼	8¼	—½
Scripps-Booth Corp.	21	25	..
Stewart Warner Speed. Corp.	86½	88½	—⅞
Stromberg Carburetor Co	33	38	..
Studebaker Corp., com	49⅛	50⅛	+1⅛
Studebaker Corp., pfd	92½	97	..
Stutz Motor Car Co	49	50	—½
United Motors Corp	34¼	36¼	—⅜
White Motor Co	44¾	45¾	—½
*Willys-Overland, com.	24⅛	25⅛	+⅛
Willys-Overland, pfd.	88¼	88⅞	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co	70¾	71	..
Firestone T. & R., com	145	150	+5
Firestone T. & R., pfd	95½	100	..
Fisk Rubber Co., com	89	91	+5
Fisk Rubber, 1st pfd	97	100	..
Fisk Rubber, 2nd pfd	85	90	..
Fisk Rubber, 1st pfd. conv.	100	105	..
Goodrich, B. F., com	58	59	—3
Goodrich B. F., pfd	102	103½	+1
Goodyear T. & R., com	230	235	..
Goodyear T. & R., 1st pfd.	104	105½	—½
*Goodyear T. & R., 2nd pfd.	103	105	..
Kelly Springfield, com	70	71	—1
Kelly Springfield, 1st pfd	90	100	..
Lee Tire & Rubber Co	21¼	22	—¾
Marathon Tire & Rubber	..	55	..
Miller Rubber Co., com	142	148	..
Miller Rubber Co., pfd	96	98	..
Rubber Products Co	114	118	..
Portage Rubber Co., com	145	149	..
Swinehart T. & R. Co	50	60	..
U. S. Rubber Co., com	74½	75	—2
*U. S. Rubber Co., pfd	109	110	..

*Ex. dividend.

Four Men Added to F. W. D. Staff

CLINTONVILLE, Jan. 25—Four men, all recently released from government service, have been added to the Four Wheel Drive Auto Co. organization. Lt. Willetts, who was chief instructor in the Motor Training School which the government formerly maintained at the F. W. D. plant, is now a member of the F. W. D. force and will be in charge of the instruction work connected with the plant.

F. A. Da Pron and Walter Hewitt have been added to the foreign sales department. Mr. Da Pron is a constructional engineer, who, for a number of years, was associated with the engineering firm of Reed & Stern, and who for the past year has been an engineer in the air service. He is a graduate of the Boston Technological Army School. Mr. Hewitt was an army instructor in gunnery.

A. B. Parks of Elmira, N. Y., has recently joined the sales force. For the past two years he has been connected with the Curtis Aeroplane Corp., Hammondsport, N. Y.

—

Two Ex-Army Men on Staff of Standard Parts Co.

CLEVELAND, Jan. 25—Lewis P. Kalb, formerly major of design, testing and specification work in the engineering division of the Motor Transport Corps, has joined the engineering staff of the Standard Parts Co. as assistant to the director of engineering. Before entering Government service he was chief engineer of the Kelly-Springfield Motor Truck Co., and previous to that was assistant truck engineer of the Pierce-Arrow Motor Car Co.

A. L. Watts, formerly captain in charge of the specification and record section of the engineering division of the Motor Transport Corps, will assume similar duties on the engineering staff of the Standard Parts Co. Before entering service in 1917 he was with the Pierce-Arrow Motor Car Co.

—

K. K. Hoagg has been appointed engineer in the sales department of the Hyatt Roller Bearing Co., Detroit. Mr. Hoagg, who has been connected with the company since 1912, left his position as assistant chief engineer to go into government service. For 11 months he was in the engineering division of the Motor Equipment Section of the Ordnance Department, stationed in Washington and Indianapolis. Previous to this he was for 7 months assistant to the manager of the Washington office of the S. A. E.

—

L. M. Baker has been engaged as special sales engineer for the Hyatt Roller Bearing Co., Detroit. At one time he was sales manager of the United Motors Service, Inc., and previous to that was western sales manager for the Standard Steel Spring Co., Detroit.

—

I. O. Taft, recently St. Louis zone superintendent for the Maxwell Motor Car Co., has been made manager of the Mississippi Valley territory with headquarters in St. Louis.

Men of the Industry

Changes in Personnel and Position

Edwin Denby a Major

DETROIT, Jan. 24—Edwin Denby, treasurer of the Denby Truck Co., former congressman, who enlisted in the marines as a private 20 months ago, has been advanced to the rank of major. He is stationed at Beaufort, S. C., having recently returned from several months of active service over-seas. He was a former president of the Detroit Board of Commerce.

—

Justin R. Weddell, Cleveland, will be advertising manager of the Firestone Tire Co., Akron, after Feb. 1, succeeding E. S. Babcock, recently resigned. Mr. Weddell comes from the Corday & Gross Co., where he is the sales manager.

—

J. L. Hibbard, foreign sales manager of the Cleveland Tractor Co., will sail on the Adriatic, Feb. 1, for a three months' business trip in Europe.

—

W. F. Winkelman has been appointed district manager of the Hupp Motor Car Corp. for the Philadelphia district. Mr. Winkelman was special representative of the Liberty Motor Car Co. and later of the J. E. Fields Co., as sales manager.

—

J. B. Siegfried, formerly general manager of the King Motor Car Co., Detroit, has been made sales manager and assistant general manager of the Auto Wheel Co., Lansing.

—

Major Mason P. Rumney will be out of the service Feb. 14, and will return to the Detroit Steel Products Co. as assistant general manager. He has been located in Washington with the Ordnance Department.

—

Major Howard Blood, executive officer of the Aeroplane Engineering Division, hitherto located at Dayton, has just been transferred from Dayton to Detroit and is now connected with the finance division. Major Blood is a member of the Blood Bros. Machine Co., Allegan, Mich.

—

F. R. Strunk, president of the Kansas City Foundry Co., Kansas City, has entered the Coleman Tractor Corp. as works manager and treasurer.

—

H. T. Melhuish, for some years advertising manager of the Fulton Motor Truck Co., Farmingdale, L. I., is going to Philadelphia to take charge of the Fulton office in that city, succeeding M. R. Sanborne, who goes to the Kansas City office. Mr. Melhuish is a brother of William Fulton Melhuish, president and founder of the Fulton Motor Truck Co.

General Lee Returns to England

WASHINGTON, Jan. 27—Brigadier-General Charles Frederick Lee, Royal Air Force, chief of the British Aviation Mission, sails for England Feb. 8, returning to command the Training Brigade, R. F. C. General Lee has been in the United States since Nov. 30, 1917.

—

Major George D. Wilcox, who commanded the Detroit district of the Motors Division of the Quartermaster Corps, has been honorably discharged and returned to the Commerce Motor Car Co., Detroit, as director of sales and advertising.

—

A. C. Miller has resumed his duties as vice-president of the Miller-Judd Co., Liberty distributers, Detroit, after serving one year in the navy.

—

J. K. Gould, formerly advertising manager for the Ford Motor Car Co. of Canada, has been discharged from the army and has rejoined the staff of the Campbell-Ewald Co., Detroit.

—

E. V. Sidwell, former assistant manager to Edward D. Bland, manager of the Fulton Motor Truck Co. of Michigan, has been made successor to Mr. Bland, who died some time ago of influenza.

—

Glen T. Purdy, who has just returned from active service, has gone back to the King Motor Car Co., where he has been appointed assistant purchasing agent.

—

C. A. Watson, formerly a minister, has been appointed sales manager of the Four-Drive Tractor Co., Big Rapids. While pastor at Grand Ledge, Mich., Mr. Watson was distributer for the Studebaker car and also operated a machine-shop. Prior to that time, he sold Underwood typewriters and National biscuits. He was also an auditor and cashier for the U. S. Steel Co. in the Minnesota mining district. He has been a clergyman for 10 years.

—

B. F. Wulff has been appointed general sales manager for the International India Rubber Co., South Bend. He was formerly sales manager for the Century-Plainfield Tire Co., and prior to that was connected with the Kelly-Springfield Tire Co. at Chicago.

—

W. T. Horton, Jr., formerly in charge of the executive branch of the Engineering Division, Motor Transport Corps, has been appointed chief engineer of the Russel Motor Axle Co., North Detroit.

—

Sales Representative of F. W. D. Co. Dies Suddenly

W. N. Durphy, sales representative of the Four Wheel Drive Auto Co. in the Des Moines territory, died suddenly at the home of the F. W. D. dealer in Des Moines on Jan. 15. Ptomaine poisoning is supposed to be the cause of his death.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Republic to Put Out New ¾-Ton Truck

ALMA, MICH, Jan. 27—Twelve leading distributers of the Republic Motor Truck Co. met at the plant last week for an informal conference to discuss sales plans for the coming year. When the conference ended the distributers had organized the Republic Distributers' Association, chosen directors and elected officers.

The company sought the advice of the dealers relative to the proposed manufacture of a new model truck, a ¾-ton machine, and what the distributers immediately termed a "speed wagon." The matter of price-rating and specifications were taken up and led to much constructive debate.

The distributers inspected the two improved truck models, known as models 19 and 20. Both of these machines are practically the same as last season, with detail improvements. Model 19 is a 2½-ton truck. Model 20 is a 3½-ton machine. The five other standard Republic models are being manufactured as usual.

The company, while running below capacity, is completing 1000 jobs a month and will increase this as soon as the material situation clears up. The last war contract will be finished by the end of February. The contract was a big one for the manufacture of the "Class B" truck.

The Republic company is organizing agencies in Sweden, Norway, Japan, India, China, Australia, New Zealand and South America.

Transport Puts New 2-Ton Model on Market

MT. PLEASANT, MICH., Jan. 28—The Transport Motor Truck Co. is now entering production. The new truck is 2-ton capacity with a Clark internal gear drive, Continental engine, Eisemann magneto, duplex centrifugal governor, Stromberg carbureter, Fuller clutch and transmission mounted in the unit power plant, Columbia front axle, Jacox steering gear and Prudden wheels. The truck is mounted on a pressed steel frame.

The wheelbase is 150 in. and the truck is built in chassis form equipped with tools, jack, oil lamp, tail lamp, motometer and odometer. The truck has been on the road for several months in experimental form, and was intended to be in production by July, but owing to the material situation was held until the present time, when the production schedule has now gone into effect. The price is $2,585.

King Cars Ready March 1

DETROIT, Jan. 25—Reconstruction is the big problem before the King Motor Car Co. This company, which was operating 90 per cent on war contracts, was hit hard by the sudden cancellation of the contract work. The company is now rapidly getting back into passenger car production again. Assembly work is in progress, but completed cars will not be turned out before March 1. At that time production will start with five cars daily.

General Motors' Subsidiary to Finance Dealers

NEW YORK, Jan. 27—A subsidiary company incorporated under New York State laws and called the General Motor Acceptance Corp. has been formed by the General Motors Corp. to assist car and truck dealers in financing their purchases. Paid in capital is $2,000,000 and surplus is $500,000. The stock was subscribed by W. C. Durant and his associates. Paul Fitzpatrick, formerly vice-president and director of the Continental Guaranty Corp., is vice-president and general manager of the new concern. J. A. Haskell is president and Alfred H. Swayne is vice-president and financial manager.

Although the primary purpose of the new company is to finance automotive transactions, it is understood that the business in acceptances will be carried on in other directions, probably in connection with the various du Pont enterprises.

Ford Reopens Omaha Branch

OMAHA, Jan. 28—The Omaha branch of the Ford Motor Co. has resumed operations after being closed since last summer for an indefinite period because of war conditions.

The body department was the first to open, and when about 600 bodies have been completed the assembling department will start, which should be within a week. It is stated that the number of employees will be about 500, the same as were used before the closing, and that all former employees who so desire may have their old jobs back. Charles L. Gould remains in charge as branch manager.

Harroun Back to Peace Time Production

DETROIT, Jan. 28—The Harroun Motors Corp., Wayne, Mich., will complete its war contract calling for the manufacture of 155 mm. shells by Feb. 1 and is getting back to a peace time production schedule. The company will run 100 cars monthly in January and February and will increase this production in March if materials come easily. Rumors that Ray Harroun, vice-president and chief engineer, had left the organization, are unfounded.

Receivership for Hurlburt

NEW YORK, Jan. 27—William B. Hurlburt has been appointed receiver for the Hurlburt Motor Truck Co. by the United States District Court, under bond of $25,000. The company claims assets of about $500,000 and liabilities of about the same amount.

Willys-Overland Producing 300 Cars Per Day

TOLEDO, Jan. 27—The Willys-Overland factory has increased production to a point where 300 cars per day are being turned out. January schedules call for from 6000 to 6500 cars, and it is expected that in early spring the monthly figures will run at least twice this number, or at a rate which will insure a year's output at least as high as in 1916, the last normal year. Shipments last year were approximately 82,000 cars. At the tractor end of the business, it is stated that the Moline Plow Co. branch is building from sixty to seventy-five machines per day. This figure will be increased to 125 as soon as the supply of raw material is sufficient. It is expected that 25,000 Moline tractors will be built this year.

Dodge 6-Cylinder Reo Rumor

LANSING, Jan. 27—Officials of the Reo Motor Car Co. do not throw additional light on the rumor current in automotive circles that the Reo company is making and will place a 6-cylinder car on the market June 1. They declare the rumor is "stock-market talk," but otherwise will neither confirm nor deny it.

The Reo Co. has finished its government tractor contract. While not running at normal capacity at present, the plant is now turning out 100 cars and trucks daily. The company expects its domestic trade to keep it too busy to cater extensively to the foreign market.

Studebaker Averaging 60 Cars a Day

SOUTH BEND, Jan. 27—Indications are that some of the manufacturers of motor cars may get back into production earlier than they anticipated. Word from the Studebaker Automobile Co. says that it has been able to get into after-war production thirty days ahead of schedule. At present, this concern is averaging sixty cars per day, and this figure will be increased 100 per cent by March 1. The Studebaker company expects to produce approximately 6500 cars during the first quarter.

Pearce Making 100 Tires a Day

ASHTABULA, Jan. 28—The Pearce Tire & Rubber Co. is now in full operation in its new plant. Officials say that within 60 days their production will exceed 100 tires daily. This will be increased gradually until the full capacity of the factory, 500 tires a day, is reached.

Franklin Coming Back to Normal Production

SYRACUSE, Jan. 27—The Franklin Automobile Co. is rapidly getting back to its normal manufacturing basis. Although the week following the signing of the armistice the company turned out only four cars, the production schedule for January calls for 26 cars a day. By May it will be increased to 35, by September 40, and by the end of the year it is expected that the company will produce 50 cars daily.

WASHINGTON, Jan. 25—Following is a list of contracts made by the office of the Director of Purchase for the Bureau of Aircraft Production:

Wright Martin Aircraft Corp., New Brunswick, 13 Hispano Suiza type "E" or "I" built from rejected parts, $26,000.
Curtiss Aeroplane & Motor Corp., Buffalo, spare parts for JN4-D planes, $14.97.
Corbin Screw Corp., New Britain, miscellaneous bolts, screws, etc., $292.43.
Wright Martin Aircraft Corp., Van Dyke negatives—Hispano Suiza—1 set and bill of material, $40.
Wright Martin Aircraft Corp., New Brunswick, 6 items of special tools for Hispano Suiza type A engine, $87.90.
Wright Martin Aircraft Corp., New Brunswick, 10 No. 11894 lower half water pumps (Hispano Suiza "I" engine), $57.60.
Wright Martin Aircraft Corp., New Brunswick, repairs for Hispano Suiza engine, $1.20.
Wright Martin Aircraft Corp., New Brunswick, 36 No. 9642 Magneto gears for Hispano Suiza engines, $331.70.
Wright Martin Aircraft Corp., New Brunswick, 500 piston pin set screws, $70.
Zenith Carburetor Co., Detroit, spares for Zenith Carb., $154.
Wright Martin Aircraft Corp., New Brunswick, 8 No. 11988 pistons for Hispano Suiza type "E" engines, $120.56.
Wright Martin Aircraft Corp., New Brunswick, 100,000 No. 11169 steel cotter pins, $33.
Barber & Ross, Washington, D. C., 4 kegs nails, $17.40.
Bay State Tap & Die Co., Mansfield, Mass., 29 chasers, screw plates, and wrenches, $39.63.
John A. Roebling Son's Co., Trenton, 150 pieces balloon cable, 30 feet long, $513.

826 Farm Tractors in France

(Continued from page 271)

cultural knowledge, to enter into the tractor field.

Among other automobile firms who have announced their intention of entering the agricultural field, are Saurer, a Swiss firm, with a big factory in the suburbs of Paris; Panhard & Levasseur, one of the oldest automobile firms in the world; Renault, who possesses the biggest automobile factory in France, and Paris General Omnibus Co., which is now a producing as well as an operating concern.

In Italy, Fiat, which possesses the largest factory in Europe, has already produced an agricultural tractor and intends to considerably develop this field.

In connection with factory developments, announcement is made by Renault that in addition to passenger automobiles and tractors, he has decided to manufacture shaftings, pulleys, bearings, etc., for machine shops, as well as standardized gear sets giving four or eight speeds, to be installed on all types of machine tools enabling them to have a single driving pulley or for use with electric drive. Renault will also manufacture drills, taps and dies, wrenches and other small tools.

Although at the present moment France possesses very few tractors, the possibilities in this direction are immense. Practically the whole of the automobile service of the French Army has been handled by elderly men drawn from the agricultural classes.

France possessed 95,000 trucks and passenger cars in army service. Estimating two men per vehicle, and the regulations call for two drivers on every truck, this gives a total of 190,000 men who have had from one to four years' truck-driving experience. The artillery service has also made an extensive use of automobiles independently of the general automobile service of the army.

Thus, the total is certainly not less than 200,000 men, of which the great majority are connected with farming, who have had a thorough automobile training. All these men, on returning to civilian life, will not only be capable of taking charge of tractors, but will be anxious to use them in preference to horses, even if horses are available.

Contracts

N. A. C. C. Truck Meeting Papers

NEW YORK, Jan. 30—Problems of the greatest importance to the motor truck industry will receive consideration at the Motor Truck Manufacturers' convention, to be held at the headquarters of National Automobile Chamber of Commerce on Tuesday, Feb 11, which is during the week of the Motor Truck Show in New York. Following are the topics:

Present Status of the Motor Truck Business—By C. A. Wales, Truck Sales Manager, Locomobile Co. of America.
The Need for Federal Highway Policies and a Federal Highway Commission—By E. J. Mehren, Editor, *Engineering News-Record*.
What Should Be the Limitation of Weights, Speeds and License Fees on Motor Trucks in the Proposed Uniform Vehicle Law—By George M. Graham, General Sales Manager, Pierce-Arrow Motor Car.
Disposition of Surplus Military Trucks Here and Abroad—By Col. Fred Glover, Quartermaster's Department, U. S. Army.
What New Standardization Can Be Done on Motor Trucks?—By David C. Fenner, International Motor Co.
What the Post Office Will Require in Motor Trucks During 1919—By James I. Blakeslee, Fourth Assistant Postmaster General, Washington.
What Are the Opportunities for Motor Truck Sales in Europe?—By David Beecroft, Directing Editor, *Automotive Industries*.
Can We Improve the Present Standard Service and Standard Parts Policies and Guarantees?—By E. J. Herbig, Sales Manager, Service Motor Truck Company.

Vesper Again Heads Dealers

CHICAGO, Jan. 29—F. W. A. Vesper of St. Louis, was re-elected president of the National Automobile Dealers' Association at the close of its 2-day annual convention here to-day. One of the resolutions pledged the organization to complete co-operation with the manufacturers in the solution of reconstruction problems.

Plans were formulated for campaigns in all sections through local and state associations for the promotion of good roads. The association will take up national road aid.

The necessity for better business methods for the motor car dealer was urged by Henry Paulman, Chicago, who talked from his seventeen years of experience in the automobile business as a dealer. Why the dealer should be a factor in good roads work was told by Pyke Johnson, good roads representative of the N. A. D. A. in Washington.

Life membership was voted to W. G. Tennant, Chicago, for work in the early days of the association's development; an engrossed resolution was presented to George W. Brown, Milwaukee, for having conceived the thought which led to the formation of the organization. A silver loving cup was presented to President Vesper for his work in building the association during the period of the war. This afternoon dealers from all over made four-minute talks on business subjects. The officers follow:

President, F. W. A. Vesper, St. Louis; first vice-president, E. W. Steinhart, Indianapolis; second vice-president, Harry D. Austin, Seattle; treasurer, Thomas J. Hay, Chicago; re-elected directors, G. B. Kimball, Boston; A. E. Maltby, Philadelphia; A. E. Mitzel, Canton; George D. McCutcheon, Atlanta; J. A. Graham, Minneapolis; H. L. Robertson, Houston; P. E. Chamberlain, Denver; W. J. Brace, Kansas City; P. E. Greer, San Francisco.

The convention closed with a banquet this evening. Addresses yesterday were by George M. Graham, sales manager of the Pierce-Arrow Motor Co., on "Getting Back to Normal"; John N. Willys, president of the Willys-Overland Co., on "The Automobile Business; Past, Present and Future"; Edward S. Jordon, president of the Jordon Motor Co., on "The Automobile Dealers' Problems in Sales and Advertising." The report of the secretary gave the membership as 4475.

WASHINGTON, Jan. 25—The following orders have been placed by the Bureau of Aircraft Production:

Standard Aircraft Corp., Elizabeth, spare parts for Dh-4 planes, $36.96.
Washington Loose Leaf Co., Washington, steel bands for Proudfit binder (12), $1.80.
Western Electric Co., New York, 1,500 feet lamp cord, $111.
Barber & Ross, Washington, 24 U blocks, $66.
Starr Piano Co., Richmond, Ind., 300 boxwood toggles, $48.
James William Bryan Press, Washington, book, "Who's Who in Bureau of Aircraft Production," $7.50.
Wright Martin Aircraft Corp., New Brunswick, Hispano Suiza A-150 horsepower, engine spares, $39.49.
Willys-Overland Co., Toledo, 40 pieces, No. 3363 studs, $14.80.

Contracts Completed

WASHINGTON, Jan. 25—The Holt Mfg. Co., Peoria, has completed a supplemental tank for the Ordnance Department at a cost of $22,000.

The Cleveland Tractor Co., Cleveland, has completed a tractor and spare parts for the Ordnance Department at a cost of $1,405.07.

Bieler to Make "Argonne" Cars

NEW YORK, Jan. 30—Otto R. Bieler has formed the Automotive Engineering Co., with headquarters at - East Forty-second Street, and will market a 6-cylinder car which will be manufacturered for him by the Jersey City Machine Co., Jersey City. It is planned to produce 100 to 150 cars this year and to sell them for about $3,500. The car will be styled "Argonne" and will be supplied in two- and four-passenger capacities. It will have a high speed engine with a four-speed gearset, 120 in. wheelbase and 32 x 4 tires; bodies will be custom built throughout.

Automotive Industry of Great Aid in Winning the War

Took On Military Works, Exclusive of Trucks, Amounting to $1,000,000,000 —Curtailment of Car Production Held to Have Been Necessary

WASHINGTON, Jan. 24—That the War Industries Board policy of curtailment of peace industries was proper and necessary and that the automobile industry thoroughly co-operated in a most commendable manner with the War Industries Board is the text of an outline of the activities of the Automotive Products Section by C. C. Hanch, Chief of the section.

The outline, made public to-day, states among other things that during the last 6 months of 1918, when reduction of passenger cars was limited to 50 per cent of 1917, manufacturers requested permits for production of 295,468 cars, which was allowed. Of these, 186,178 cars were produced during the third quarter, leaving 109,290 to be produced during the last half of the year.

This total of 295,468 cars is approximately 50 per cent of the production during the same period of 1917, not counting Fords. The Ford company made no request for permission to manufacture passenger cars in the last half of 1918.

That the automobile industry "was most valuable to the war machine and took on military works exclusively of motor trucks to the extent of $1,000,000,000," is a statement in Mr. Hanch's report. "The industry has been of incalculable aid to the successful prosecution of the war," testifies Mr. Hanch.

Control of the industry by the War Industries Board and its curtailment insofar as passenger car manufacture is concerned was found, according to the statement, to be "necessary due to the drafting of millions of men and the resulting shortage of labor, transportation, fuel, etc.," which made it "obvious that non-war industries could not reasonably expect to continue normal activities." Following is the complete account of the activities of the Automotive Products Section during the war and up to the time of the cessation of its activities as told by Mr. Hanch:

Work of the Automotive Products Section

By C. C. Hanch

Chief Automotive Products Section

THE Automotive Transport Committee, a co-operative committee of the Advisory Commission of the Council of National Defense, was organized June 4, 1917. The committee was created as a channel of communication between the automotive industries and the governmental departments and continued under the same jurisdiction until September 4, 1917, at which time the committee was reorganized and placed under the War Industries Board, and was thereafter known as the Automotive Products Section.

At the time the Automotive Transport Committee was organized Charles Clifton was made chairman. K. W. Zimmerschied served as vice-president from June 4, 1917, to September 4, 1917. H. L. Horning served as Chief of the Automotive Products Section from September 4, 1917, to June 19, 1918, and C. C. Hanch served as Chief from June 20, 1918, until the Section disbanded. The final form of organization of the Section is indicated in the chart.

The first report of the Automotive Transport Committee is contained in the first annual report of the Council of National Defense at page 89. Report for the fiscal year June 30, 1917, to June 30, 1918, is contained in the second annual report of the Council of National Defense.

Composition of Committee

The Committee or Section as originally constituted consisted entirely of representatives of the automotive industry. When the committee was reorganized in September, 1917, an army representative and a member of the War Industries Board were added. After the functions of the War Industries Board were defined by the President's letter of March 4, 1918, the form of organization of the Automotive Products Section was further modified so that it consisted entirely of representatives of six Governmental departments presided over by the Chief and assisted by the staff of the Section.

Regular meetings of the Section were held monthly and conferences were held with the different Section representatives at frequent intervals. The procedure of the Section in performing its functions was determined at the regular meetings. Automotive subjects generally were discussed and particular attention was given to such matters as clearances, interferences, facilities and allocations.

Jurisdiction of Products Section

The Automotive Products Section had jurisdiction over the following line of automotive material on the clearance list of the War Industries Board (which list and the regulations thereunder governed the purchasing departments of the Government in the procurement of these commodities), including combustion engines and their application, their accessories, parts, etc., with the exception of agricultural tractors and stationary and portable engines for agricultural and other purposes:

Bicycles	Armored cars
Motorcycles,	Military tractors
Motorcycle side cars	Military tanks
Motor cars	Airplane engines
Motor ambulances	Airplanes
Motor trucks	Marine gas engines
Motor truck bodies	Automotive accessories and parts
Motor truck tractors	
Motor truck trailers	

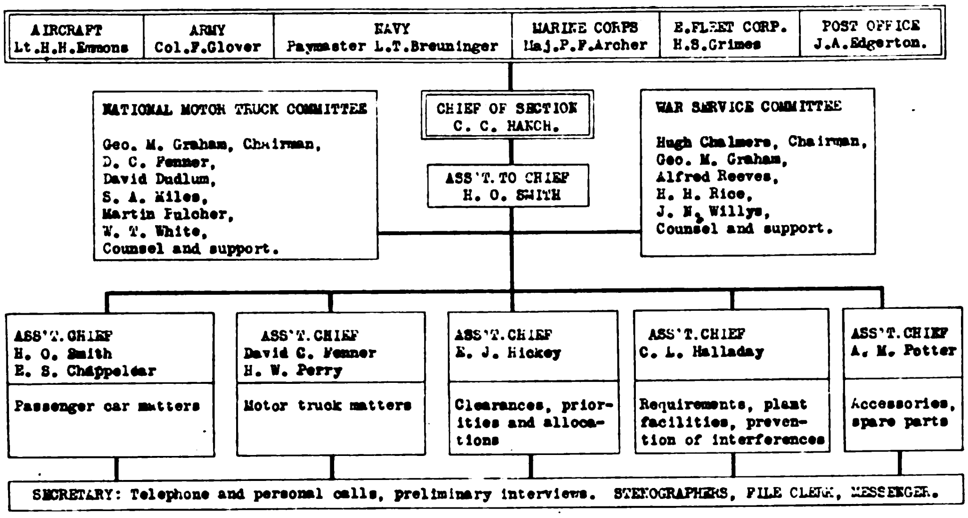
Purchases of automotive equipment or materials covered by the above list which the Allied Governments desired to make in the United States through the Allied Purchasing Commission were sent to the Automotive Products Section for recommendation before purchases were made.

Advised With Priorities Division

The Automotive Products Section advised and made recommendations to the Priorities Division in reference to individual applications for priority certificates filed by subcontractors on United States and Allied Government purchases of automotive equipment and materials, and also gave advice in reference to applications filed by others for materials for commercial purposes.

Among other functions of the Section actually being performed at the close of the war were the following: Granting clearances on purchases of automotive equipment by the various departments of the United States Government and tho Allies. Recommendation of sources of supply where there was a shortage of facilities and the allocation of orders where there was interference or shortage of capacity. Personal contact was constantly maintained by a member of the Section staff with all Governmental departments represented on the Section, thereby providing intimate knowledge of all requirements and facilities for their execution. Help was extended the Governmental agencies in classifying requirements and the conversion or arrangement of same to meet existing facilities where possible. This called for a close study of and a calculation of aggregate facilities. These reports were placed in the hands of departments concerned and were of assistance in the final balancing of requirements and facilities. Co-operation with the various procurement divisions was maintained and lists of possible sources of supply were edited or compiled and additional sources suggested when needed. Request for increased facilities for war purposes were examined and recommendations submitted. Applications for stock and bond sales, increases in capitalization and creation of new companies referred to the Section by the representative of the Capital Issues Committee were examined and recommendations submitted. Engineering and production problems as relating to alternate selection of

Chart of Organization of the Automotive Products Section



materials or ways and means, were solved informally with Governmental departments which represented them. Suggestions were made to automotive manufacturers as to how their facilities could best be used and their representatives were given introductions to the proper officials negotiating the work.

The most interesting and difficult problems were encountered by the Section in connection with the administration of the regulatory arrangements made between the War Industries Board and the automotive industries such as passenger automobiles, motor trucks, bicycles, motorcycles, ball and roller bearings.

The automobile and motor truck industry was in a remarkably active condition at the beginning of and during the first half of 1918. During the calendar year 1917 there were produced 1,740,792 passenger automobiles and 128,157 motor trucks, the aggregate sales value of which at wholesale prices amounted to $1,238 979,891. There were approximately 300,000 men employed by the automobile and motor truck manufacturers and 320,000 men employed by the accessory and component parts makers in 1917. High grade steel and other metals were being consumed by the automobile and motor truck industry at the rate of 2,000,000 tons per annum. Shortage of material and labor had began to be felt in the fall of 1917 and were becoming acute during the first half of 1918. With millions of men being drafted, or enlisted, and taken from the ranks of productive labor with the resulting shortage of labor, transportation, fuel, etc., it was obvious that non-war industries could not reasonably expect to continue normal activities. Under these circumstances if the automotive industry had attempted to operate with continued normal activity on civilian business it would have either hampered itself and other industries or the Government in the prosecution of the war.

Production Reduced 30 Per Cent

Early in March, 1918, representatives of the automobile industry were called into conference by the War Industries Board and after full discussion it was agreed that a 30% reduction in the current manufacturing schedules of passenger car makers would not cause disturbance in the automobile industry and would help solve the problems of transportation and raw materials.

Upon request the manufacturers proceeded with this reduction, effective March 1, 1918, and continuing up to the end of the fiscal year, ending June 30, 1918, and not later than July 31, 1918.

Representatives of the motor truck industry made an interesting and forceful presentation of the important needs of their industry with the result that early in August, 1918, the War Industries Board reached the decision that "motor trucks, insofar as they are used directly or indirectly for war purposes, are war essentials and their production for such purpose must be facilitated, and further, insofar as motor trucks are employed in civilian industries for essential uses, they constitute an important transportation medium and any curtailment of such uses should be avoided as far as practicable." The Board further defined its attitude in a special Circular No. 11 addressed to manufacturers of motor trucks in which the Priorities Commissioner stated that "it appears, however, that there exist in this industry, as in many others, factors of non-essentiality which must, as a war measure, be removed." As a practical means of eliminating this degree of non-essentiality, a pledge was framed by the War Industries Board to be given by all truck manufacturers and their distributers and dealers before any preference could be accorded them in procuring materials.

Issues "Industry Priority Certificate"

Instead of issuing individual priority certificates to motor truck manufacturers for each purchase of parts and materials the Automotive Products Section recommended that an "Industry Priority Certificate" be issued to each manufacturer under which the manufacturer could order his materials in the usual way by attaching the prescribed form of affidavit to his purchase orders. This plan facilitated the procurement of materials by the manufacturers and avoided an enormous amount of clerical work by the War Industries Board and the manufacturers.

The pledge bound the manufacturers and dealers, among other things, to sell no motor trucks except for essential uses, to sell no user an unnecessary number of trucks even for essential uses, to discourage the purchase of any motor truck to replace a usable truck already in service, to give maximum encouragement to the repair of trucks, and to make monthly reports to the Automotive Products Section. It was expected that the effect of this pledge would be to reduce the output of trucks to some extent, not because the transportation facilities and economies afforded by motor trucks were considered unimportant or undesirable, but solely because of the shortage of labor, steel and other materials entering into the construction and use of trucks.

To conserve iron and steel without working undue hardships on some truck manufacturers as compared with others, the supply of these materials was allocated among all on the basis of past production of trucks by each company during a normal production period. Industry Priority Certificates issued to the manufacturers permitted them to proceed during the last half of 1918 at the average rate during the period of the 18 months ending June 30, 1918. Greatly expanded production schedules of some of the newer companies were necessarily curtailed as a war measure and new enterprises involving the use of material, labor and capital were discouraged as unnecessary for the reason that existing facilities were ample to produce all motor trucks required for essential uses or for which steel could properly be furnished. There was no restriction whatever on the production of trucks for military purposes—on the contrary, every effort was made to expedite the manufacture of trucks ordered by the United States Government and the Allies.

The manufacturers of passenger automobiles were again called into conference by the War Industries Board in pursuance of the curtailment agreement made in March, 1918, and after full consideration of all phases of the situation a further understanding was reached between the automobile industry and the War Industries Board which was expressed in a letter written Aug. 24, 1918, by the War Industries Board to the National Automobile Chamber of Commerce. It appeared that the stocks of raw materials and semi-finished goods in the hands of the manufacturers of passenger automobiles were large and greatly unbalanced and that they could not be liquidated until they had been matched up with other materials necessary to manufacture the completed cars.

Assists in Liquidation of Stock on Hand

It was becoming obvious that under the priority preference being given to the production of direct and indirect war needs, the withdrawal by the Government of labor from establishments then producing materials for the Government and the automobile industry and the increasing difficulties of securing transportation and fuel, manufacturers of passenger automobiles would have been unable on their own account to secure materials to match up their unbalanced inventories and continue production upon a basis which would support their organizations.

Under these circumstances the conclusion was reached that it was in the public interest as well as in the interest of the automobile industry that it be assisted as far as practicable without interfering with the war program in the liquidation of its stocks then on hand. To that end it was decided to accord a degree of preference to each manufacturer of passenger automobiles who would subscribe to a pledge, the essence of which was as follows: "That its production of passenger automobiles and all repair parts therefor, shall not, for the six months ending with Dec. 31, 1918, exceed 25 per cent of its production for the calendar year 1917." This pledge meant that passenger automobile manufacturers were permitted to operate on a 50 per cent basis during the last six months of 1918, as compared with the year 1917. It was believed that this basis

would support the organizations of the manufacturers until they could utilize their facilities as far as practicable for the production of direct and indirect war requirements which they were urged to do. The attention of the manufacturers was called to the urgent war requirements for iron and steel and the uncertainty of being able to procure materials for the manufacture of passenger automobiles after Jan. 1, 1919, if the war continued.

The administration of the arrangement made with passenger automobile manufacturers was assigned to the Automotive Products Section, which developed the following procedure:

Procedure of the Section

A. Submission by the manufacturers of sworn inventory figures approximately as of July 1, 1918, showing value of material on hand and value of material required to balance the inventory; also tonnage of principal classes of steel and the number of principal assembled units on hand and tonnage of principal classes of steel and number of principal assembled units required to balance up the material on hand.

B. A statement of the number of finished cars which could be built from the inventory when balanced and the time required to complete them.

C. Submision of sworn production figures separately for the years 1916, 1917 and the first half of 1918.

Upon receipt of the foregoing information the Automotive Products Section certified to the Director of Steel Supply the requirements of each manufacturer for the principal classes of steel in tons and principal assembled units to balance up inventory on hand and produce the passenger automobiles allotted under the manufacturer's pledge. Each manufacturer was then notified that he was privileged to build a specified number of cars and that materials therefor might be obtained by filing in triplicate with the Director of Steel Supply applications for "Permit to Purchase." The manufacturer's copy of application for "Permit to Purchase" when granted constituted the necessary authority for the supplier to fill the manufacturer's order.

In case the supplier or parts manufacturer was not the original source of supply of the raw materials required, such supplier or parts manufacturer made application for "Permit to Purchase" in like manner and on the same form as required from the maker of passenger automobiles. Materials required for the manufacture of essential repair parts both by the makers of passenger automobiles and by their suppliers were obtained on "Permits to Purchase" when endorsed by the Automotive Products Section and approved by the Director of Steel Supply.

Certified Manufacturers' Requirements

Under this procedure the Automotive Products Section certified to the Steel Division the requirements of 95 manufacturers covering the production of 295,468 passenger cars during the last half of 1918.

The application for "Permit to Purchase" carried an undefined degree of preference, which was sufficiently flexible to meet the needs of the manufacturers and the routine was simpler and more rapid in its results than under the usual procedure of application for individual priority certificates. The equitable control of the industry, under the arrangements made with it, was accomplished by monthly reports of operation submitted by the manufacturers carrying the following information:

1. Number of finished cars on hand at beginning of month.
2. Number of cars produced during the month.
3. Number of cars delivered to United States Government during month.
4. Number of cars delivered to Allied Governments during month.
5. Number of cars delivered for civilian use during month.

Of the total productive allotment of 295,468 cars for six months as certified to the Director of Steel Supply by the Automotive Products Section, 186,178 cars were produced during the third quarter, leaving 109,290 cars to be produced during the last quarter of the year.

On Nov. 11, 1918, the date when the armistice was signed, a circular was issued which removed 50 per cent of the restrictions which had been imposed on the production of passenger automobiles.

Material requirements for parts and accessories were handled by the section through "Permits to Purchase," and this arrangement made it possible to obtain materials to keep in operation the passenger cars in use. No definite ruling was made as to what allowance of material could be made to manufacturers of automobile repair parts, replacement parts or accessories. In the absence of any such ruling the manufacturers were advised to make application for "Permit to Purchase" and each application was considered on its merits and either approved for the quantity of material which conditions warranted and sent to the Director of Steel Supply, or disapproved.

Permits Governed by Production

The quantity of material allowed under applications for "Permit to Purchase" was in most instances governed by the applicant's previous output of production. The section usually recommended that the applicant be permitted to purchase sufficient materials to carry him through a period of from 60 to 90 days at a production rate of about 50 per cent of normal.

In cases where the article which the applicant desired to produce was of such a character as to be unnecessary for repair, maintenance or upkeep of existing automotive equipment and in cases where the applicant had sufficient material on hand to meet his requirements for a considerable period on a conservative production basis, the application was disapproved. Disapproval was also given applications for permit to purchase where the material desired was for the purpose of producing new or untried devices or alleged improvements which were not supported by reliable endorsement. In all cases the replacement of entire assemblies where the simple repair, replacement or readjustment of an individual part would serve to restore the machine to normal running condition was vigorously discouraged.

In short, all necessary steps were taken to convert the automotive industry from peace time activities to the most effective condition and efficient form of organization for the prosecution of the war and prompt reconversion after the end of hostilities. Too much credit cannot be given the automotive industry for the effective and patriotic work it has done in the war emergency.

275,000 Vehicles for Allies

Before the United States entered the war American truck manufacturers had furnished more than 40,000 motor trucks to England, France and Russia. After entering the war and prior to the signing of the armistice, motor truck and passenger car manufacturers had contracted to furnish the American army and navy about 35,000 passenger cars and 200,000 trucks and ambulances. About half of this number had been completed when the armistice was signed, of which 54,343 trucks had been floated for use of the American Expeditionary Forces. About 15,000 trucks were in use by the military establishment in the United States. More than 30 manufacturers supplied trucks to the military establishment. In response to the needs of the Government many manufacturers gave up all or most of their civilian trade in order to furnish trucks and automotive equipment to the army and navy.

The motor vehicle industry supplied the engineering talent, mechanical genius and facilities to carry through the greater part of the airplane program. Automobile companies had accepted orders for about 70,000 Liberty airplane engines before the war ended and at that time the production of engines had reached a rate of several thousand per month.

In this connection it should not be assumed that automobile and motor truck manufacturers confined themselves to the production of automotive equipment. Among other articles manufactured by passenger car and truck makers, in addition to passenger cars, motor trucks, airplane engines and parts, were the following:

Military Production of the Industry

Eagle submarine chasers	Artillery wheels
Tractors	Litters
Kitchen and other trailers	75 mm. and 155 mm. shells
Ambulance bodies	Depth bombs
Tanks	Airplane bombs
Gun carriages	Mine anchors
Gun recoil mechanisms	Grenades
Naval gun mounts	Shell adapters
Escort wagons	Torpedo directors
Water carts	Balloon winches
	And many other articles.

The highly trained mechanical knowledge and skill of the automotive industry was most valuable to the war machine, and the great capacity and modern machinery of the automobile plants fitted them better than most industries to execute the varying requirements of modern warfare. The automotive industry, including passenger car makers, took on military work exclusive of motor trucks to the extent of approximately $1,000,000,000.

It is highly to the credit of the men in the industry that those orders were taken at prices that afforded a relatively small percentage of profit with the object of rendering patriotic service to the country. Without exception, motor truck and passenger car manufacturers have exhibited a willing spirit of co-operaton with the War Industries Board in taking on war work, accepting its decisions affecting production of civilian trucks and passenger cars and in faithfully observing the pledges given regarding the use of materials and the restrictions of sales to essential uses.

As a whole, the industry has been of incalculable aid to the successful prosecution of the war.

Clark Equipment in Movies at Shows

BUCHANAN, Mich., Jan. 25—The Clark Equipment Co. is showing at the Chicago and New York automobile and truck shows a series of industrial films portraying the actual processes of manufacture in its plants. The films are being shown at the Hotel LaSalle in Chicago and the Waldorf-Astoria in New York as supplementary exhibits to the disc wheels and axles displayed at the regular shows. Complimentary tickets of admission will be mailed on application to the company, or may be obtained at the booth at the shows.

Indian Service Wants Car

WASHINGTON, Jan. 25—The United States Indian Service, Department of the Interior, asks for bids on one light weight 5-passenger touring car from manufacturers or regular dealers. Cut and description of car, equipment and date of delivery, together with delivery point, are to be submitted with the bid, which should be made to the United States Indian Ware House, 308 South Green Street, any time up to 10 a. m. Jan. 30.

Tractors Needed in Greece

WASHINGTON, Jan. 25—Greece is suffering from a shortage of agricultural machinery and particularly tractors. The government has just placed an order with an American company for 15 motor plows and 200 tractors fully equipped with plow, harrow, hoe and thresher. Greece is cultivating more than 1,300,000 hectares (1 hectare equals 2.47 acres) of land, and has at its disposal only 160 thrashers, 1,200 reapers, 100,000 plows and no tractors.

Motorine, Gasoline Substitute in Greece

WASHINGTON, Jan. 25—Due to a shortage of petroleum in Greecce, a substitute called "motorine" has been produced, which comprises spirits of turpentine twice refined, or a mixture of alcohol and turpentine in proportions of 85 to 15. It has been very successfully used in Diesel petroleum engines.

Weather Bureau Helps Keep Roads Open

WASHINGTON, Jan. 27—Help given last winter by the Weather Bureau in keeping the Lincoln Highway open between Harrisburg and Pittsburgh, during the season of heavy snows, is being arranged this year for portions of New York and New Jersey.

The Bureau has called the attention of

Calendar

ENGINEERING

S. A. E. Meetings

Jan. 30 — Chicago—"Home-coming" Supper, Morrison Hotel.

Feb. 3—New York—Banquet in honor of Capt. E. V. Rickenbacker, Waldorf-Astoria, Contest Board, American Automobile Association.

Feb. 4-6—New York. Winter Meeting. Society of Automotive Engineers, Engineering Societies' Building.

Feb. 5—Minneapolis Section, S. A. E. — Hotel Radisson. "Radiator Cooling Fans."

Feb. 6—Victory Dinner, Hotel Astor, New York.

March 5 — Minneapolis Section, S. A. E.—Hotel Radisson. "Tractor Service and Sales."

April 2—Minneapolis Section, S. A. E. — Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Jan. 25-Feb. 1 — Chicago. Passenger cars, Coliseum.

Feb. 1-15—New York. Automobile Dealers' Assn. Charles A. Stewart, Manager, Hotel Woodward, Broadway and 55th St.

Feb. 4-7 — Fargo, N. D. Fargo and Moorhead Automotive Trade Assn.

Feb. 5-6 — Chicago. Trucks, Coliseum.

Feb. 6-15—San Francisco, Cal. Third Annual Pacific Automobile Show, Motor Car Dealers' Assn. of San Francisco, Exposition Auditorium. G. A. Wahlgreen, Manager.

Feb. 10-15 — Rochester, N. Y. Rochester Automobile Trades Assn., Exposition Park. George C. Donahue, Manager.

Feb. 12-15—Defiance, O. Second Annual Show under auspices of Defiance Automobile Dealers' Assn.

Feb. 15-22—Newark, N. J. N. J. Auto Exhibition Co. Calude Holgate, Manager.

Feb. 15-22 — Cleveland, Ohio. Cleveland Auto Show Co. Fred H. Caley, Manager.

Feb. 15-22—Minneapolis, Minn. Minneapolis Auto Trade Assn. Walter B. Wilmot, Manager.

Feb. 15-22—Albany, N. Y., Albany Automobile Dealers' Assn. State Armory.

Feb. 17-22—St. Louis. St. Louis Auto Mnfrs. & Dealers' Assn. Robert E. Lee, Manager.

Feb. 17-22 — Louisville, Ky. Louisville Auto Dealers' Assn.

Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.

Feb. 17-22 — Pittsfield, Mass. Pittsfield Automobile Dealers' Assn., State Armory. James J. Callahan, Manager.

Feb. 17-22 — Passenger Cars; Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. J. L. Elliott, Manager.

Feb. 17-22—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.

Feb. 18-22—Baltimore, Md. Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland, Fifth Regiment Armory, H. M. Lucius, General Manager.

Feb. 18-22 — Oklahoma City, Okla. Automotive Show. R. H. Haun, Manager.

Feb. 22-Mar. 1—Hartford, Conn. Hartford Automobile Dealers' Assn., Inc., Broad Street Armory. Ben. F. Smith, Manager.

Feb. 22-Mar. 1—Atlantic City, N. J. Auto Trades Assn. of Atlantic City.

Feb. 23-March 1—Cedar Rapids. Auditorium. Automobile Dealers' Assn.

Feb. 24-Mar. 1—Burlington, Ia. Second Annual.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 24-Mar. 1 — Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.

Feb. 24-Mar. 1—Portland, Ore. Ninth Annual Dealers' Motor Car Assn., Automobile Palace. M. O. Wilkins, Manager.

Feb. 26-Mar. 1—Mason City, Ia. Fifth Annual. Mason City Auto Show Assn.

Feb. 26-Mar. 1—Madison, Wis. Seventh Annual. Automobile Dealers' Division of Madison Assn. of Commerce, Union Transfer Bldg.

Feb. — Wheeling, W. Va. Automobile show at Market Auditorium.

March 1-15—New York Aeronautical Exhibition, Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

Mar. 3-8 — Muskegon, Mich. Third Annual, Armory, Muskegon Lodge No. 274, B. P. O. E. John C. Fowler and George M. Friant, Managers.

Mar. 3-8—Scranton, Pa. Ninth Annual, 13th Regiment Armory, Scranton Automobile Assn. Hugh B. Andrews, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

March 5-8—Quincy, Ill. Quincy Automobile Trades Assn., Armory.

Mar. 8-15 — New Brunswick, N. J. Armory, New Brunswick Motor Trade Assn. William Kuehle, Manager.

March 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gardner, Manager.

March 10-15 — Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn., Auditorium. Clark G. Powell, Manager.

March 12-19—St. Joseph, Mo. Sixth Annual. St. Joseph Automobile Dealers' Assn.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Chester I. Campbell, Manager.

March 15-22—Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.

March 17-22 — Great Falls, Mont.—Montana Automobile Distributors' Assn.

March 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.

March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 22-29, Passenger Cars; April 1-5, Trucks—Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkham, Manager.

Mar. 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brode Manager.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

TRACTOR SHOWS

Feb. 15-22—Minneapolis, Minn.

Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show. Wichita Tractor and Thresher Club. Forum.

Feb. 24-March 1—Kansas City, Mo. Fourth Annual Tractor Show. Sweeney Building. Kansas City Tractor Club. Guy H. Hall, Sec.

CONVENTIONS

Feb. 4-6—New York. Meeting Society Automotive Engineers.

Feb. 19—New York, 13th annual banquet of Aero Club of America, Waldorf-Astoria.

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

Feb. 25-28 — Ninth American Good Roads Congress and 16th Annual Convention of the American Road Builders' Assn. Hotel McAlpin, New York.

April 24-26—Chicago — National Foreign Trade Council, Sixth National Foreign Trade Convention, Congress Hotel.

---

its officials in charge of stations to the service they may give the public by co-operation with state highway commissions, automobile associations and others in keeping open main highways, especially those used for rural express, motor truck and parcel-post routes.

The work in the winter of 1917-18 was in co-operation with the Pennsylvania State Highway Commission. Reports of the amount and condition of snow were made by the assistant superintendents of highways at points along the Lincoln Highway to the Weather Bureau office at Pittsburgh, which bulletined the reports to the press, automobile clubs and motor truck associations.

The official in charge at Pittsburgh also issued warnings of heavy snows for the mountain regions of western Pennsylvania, based on the State forecasts. These were furnished to the press and telegraphed to the State Superintendent of Highways, who gave instructions to his assistants for keeping the routes open.

Increase Gas Shipments to Argentine

WASHINGTON, Jan. 27—The serious shortage of gasoline in Argentine, which, during the war and up to the present time, considerably decreased the use of motor vehicles in that country, will soon be alleviated. The shortage of gasoline was created by the scarcity of shipping space. This matter has been brought to the attention of the shipping officials by the Ambassador from Argentine, and, according to a report from him, steps are being taken so that gasoline shipments to South America will soon be considerably increased.

Foreign Trade Opportunities

WASHINGTON, Jan. 27—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has inquiries for the agencies of automobiles and tractors. Full information regarding each of the following can be secured by addressing the Bureau of Foreign and Domestic Commerce and referring to the foreign trade opportunity number.

A man in France desires to purchase or secure an agency for the sale of low priced automobiles. Terms, thirty to ninety days for large accounts, ordinarily cash. Correspondence in English. References have been filed. Foreign Trade Opportunity No. 28169.

An agency is desired by a man in Switzerland for the sale of tires. Correspondence may be in English. References have been filed. No. 28182.

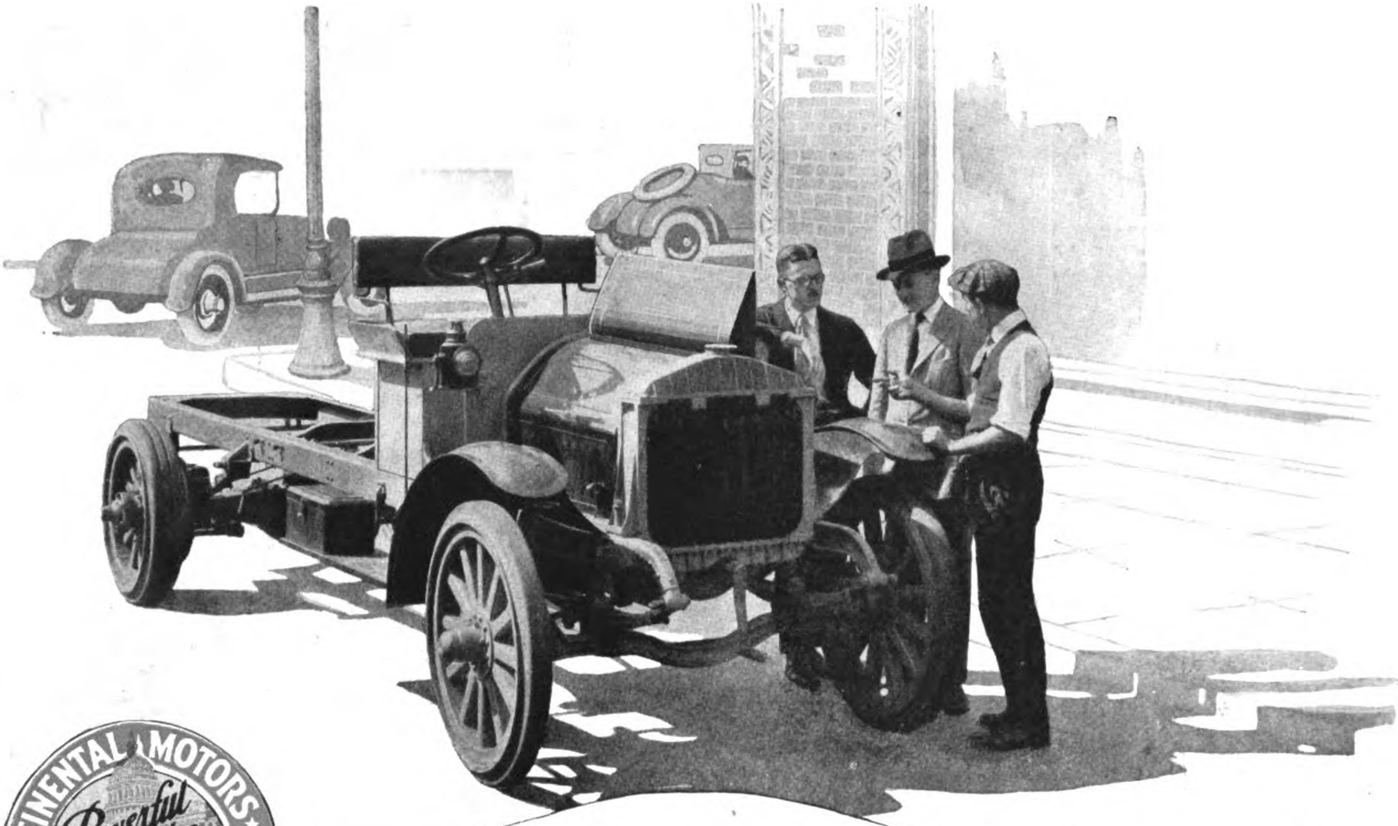
AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 6

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, FEBRUARY 6, 1919

Fifteen cen[ts]
Three dolla[rs]

[illegible] matter Jan [illegible] at the post office at New York, N. Y., under the Act of March 3, [illegible]



CONTINENTAL MOTORS
Powerful as the Nation
AMERICA'S STANDARD

"This Continental Red Seal Does More Than Guarantee a Good Motor"

When you see a motor with the Continental Red Seal you know that you've found a good motor.

When you see a truck with a Continental Red Seal Motor you can be pretty sure that you've found a good truck.

Good motors marked with the Continental Red Seal are not accidents, but certainties. These motors have been tried out, in hundreds of thousands of truck and passenger cars, under every conceivable condition of service over a period of sixteen years. Their merit, consequently, is sure, essential, dependable.

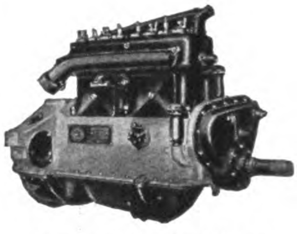
Good trucks embodying the Continental Red Seal Motor are the rule rather than the exception. The several-score manufacturers of trucks and cars that use Continental Motors in their product year after year, thus show their willingness to buy the best obtainable. Their judgment in respect to the other units selected is apt to be equally good. Certainly these manufacturers are among the most stable and most successful in the entire industry.

Make sure that the Continental Red Seal is on the motor in the truck or car you buy.

CONTINENTAL MOTORS CORPORATION

Offices: Detroit, Michigan — **Factories:** Detroit—Muskegon

Largest exclusive motor manufacturers in the world.



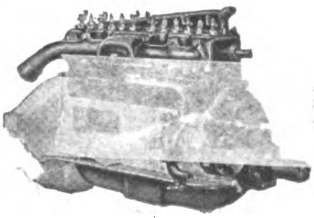
America's Standard Truck Motor. Look for the Red Seal Nameplate.

"Let's all keep industry humming by working together — employers and employees—in harmonious co-operation.

"U. S. DEPARTMENT OF LABOR.

"Wm. B. Wilson, Secretary."

Continental Motors



America's Standard Passenger Car Motor. Look for the Red Seal Nameplate.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, FEBRUARY 6, 1919—CHICAGO No. 6

Views Held on Commercial Possibilities in Aviation

Conservative Control of Industry Essential to Avoid Errors of Over-Optimism That Would Give Setback to Aerial Commerce

By David Beecroft

LONDON, Jan. 21—The undreamed of growth of military aviation in Great Britain since August, 1914, constitutes the greatest reason for her laying bold plans for unexpected progress in commercial aviation now that peace has come. Figures of aviation growth during war read like chapters from the Arabian tales. In 1914 Britain had but 285 officers in her Royal Air Force. When the armistice was signed she had over 30,000. In 1914 she had but 1853 of all other ranks, which insignificant total had reached 260,000 in November, 1918. To this total must be added 30,000 women and boys connected with the force in November, 1918.

British Capacity 40,000 Planes Yearly

When the armistice was signed Great Britain had factory capacity to build 40,000 airplanes and 30,000 aircraft engines per year. Some of her finest war factories have been built for aircraft production. Not only are these among the largest, but they are the most modern. The world has nothing that surpasses them and few that rival them.

Add to this the history of the Royal Air Force during the war and it is not surprising that the future of aviation in England is provoking more discussion and is the cause of more comment than any other subject. This is rightfully so, because the aircraft industry is the only one that was entirely without pre-war standing, and hence had no pre-war establishment to fall back upon as have practically all other war industries. There is little wonder that in a land like the British Isles, where there have always been more men than jobs, that not only the government but also those back of the aircraft factories should be bending every effort in weighing the possible future of aviation, which means largely commercial aviation.

Military Requirements Relatively Small

There is no disputing the fact that army and navy requirements on a peace basis cannot consume more than a small fraction of the possible production of the aircraft factories now in existence. Either these factories must be turned over to other uses, such as manufacture of bicycles, motorcycles, furniture, motor car bodies, etc., or be salvaged by the government.

The possible alternative is forcing commercial aviation, which could not possibly take up the factory slack. Fortunately the conservative element in British aviation is so far in control of the situation and it appears that Great Britain and probably the

world is to be spared the debacle that would inevitably follow should all kinds of commercial, passenger, and mail services be hurried into existence, with the primary aim of keeping the aircraft factories on a rational scale of production.

Lord Weir, who until the recent election was head of the Royal Air Force, has been a leader in the present plan for conservatism in commercial aviation, and who incidentally is one of the greatest aviation enthusiasts, summed up in his recent Manchester address the sane policy for commercial flying when he said:

Impatience Will Prejudice Future

"I am an enthusiastic optimist on the future of aviation, but I hope my optimism is sane, and therefore I shall venture to insist that in this highly critical period in the history of the new transport nothing but harm can come from not facing the facts; and I will add my opinion that the future of aviation may be greatly prejudiced by impatience for showy results. The success of the operational side of air transport will depend upon measures that cannot be carried out in 5 minutes.

"These measures are: The development of navigational instruction by really sound and severe navigational training, the creation of an energetic meteorlogical service specially designed to help air transport, the adoption of improved systems of wireless telegraphy and telephony, and the adoption of a first-class system of day and night marking of landing places and aerodromes.

"If these measures are taken I am quite clear that 5 years hence there will be no more difficulty in navigating an airplane over a long course in foggy or otherwise bad weather than there is now in navigating a ship at sea.

"If these measures are not taken, if hard and continuous experimental study is not put into the problems yet unsolved, then trouble, delay and discouragement will certainly ensue.

Study and Experiment Necessary

"The technic of flying and the organization of air transport still demand long study and many experiments for their perfecting. True, wondrous stunts are performed in the air, and these stunts have been immediately useful in the art of war and they will continue to be useful for the testing of machines, but aerial gymnastics and acrobatics in the firmament have really little to do with the operational side of aviation.

"The air traveler of the future will have no desire to take part in a circus. He will want to be sure that on a given day, to be settled in advance, he can leave, say, London at a certain hour in the morning and arrive, say, at Marseilles at a certain hour in the afternoon, whatever the weather."

This view of the essentiality of conservatism is shared by most of the leading aviation spirits in Great Britain, including those with large financial investments in factories and aerodromes. They all agree that rash precipitation in the starting of passenger and freight aircraft services, and attempting to operate them even on a symptom of schedule would prove the sorest boomerang to the development of commercial aviation along all lines.

The opinion is very generally shared by all in Great Britain, France and Italy that the worst that possibly could happen would be starting a passenger service from London to Paris and endeavoring to maintain a schedule. Such a service is to-day impossible except for purely military uses, but if the laws of international flying, which will be approved so far as the Allies are concerned at the Peace Conference, permitted such it would be equivalent to suicide for the future of the industry to attempt such at once. One serious accident such as a crash of a large plane with twenty to forty passengers aboard would almost certainly result in the death of most of the party and would set back passenger aviation transport perhaps a decade. Such an accident is the very thing not needed today. Such an accident is the very thing that all those men with heavy investments in factories are doing all in their power to guard against. This conservatism of theirs is the best proof of their confidence in the future of flying and the truest criterion of their deep-founded enthusiasm and optimism in the art.

One Accident in 25,000 Miles

This conservatism does not mean that planes have not been a success in war, or that the art of flying has not been adequately mastered. A few figures on the amount of flying done in certain periods of the war disprove this. Accidents during the war appear less alarming when the facts are considered. Figures obtained since the armistice show that in training and flying there has been only one accident for every 25,000 miles covered by the Zeppelins and the Gothas, the latter the large German bombing planes.

This percentage of accidents can be reduced very greatly under a peace regime, and even in war they do not appear so great when the amount of work accomplished by planes is considered. Take photography alone: the R. A. F. in 6 months of 1918 took 250,000 photographs on the western front, photographing every acre of the 6000 square miles covered. In area this is equivalent to a rectangle 200 miles long and 30 miles wide. Over much of this territory it was impossible to land without crashing the machine, a condition which would not rule to anything like the same extent in commercial flying. A portion of these photographs were taken at night by the use of flares, which proved successful.

War Aviation Achievements

In war flying there was much work done that gave an indication of what may be expected from commercial developments. Bombing by airplane started in 1917, when the British dropped 1000 tons of bombs, but in 6 months of 1918, and the first 6 months, 6000 tons were dropped on the western front alone. This amount was only limited by the lack of bombing planes which were only getting into production in England when the armistice came up.

Had the war lasted a few weeks longer there would have been British planes bombing Berlin, and hundreds of new bombing planes would have been produced each month.

G. Holt Thomas, head of one of the largest aircraft factories in England and who for 10 years has taken a leading interest in commercial aviation, summed up his convictions on the subject in these words:

"Aerial navigation will revolutionize the world not only from a commercial viewpoint, but from a humanitarian point, much more indeed than it has revolutionized warfare, although the effect on warfare has been very great.

Flying a Transportation Adjunct

"I am not one of those who think that commercial aeronautics are going to beat railways and other forms of transport out of existence, but rather that flying will act as an adjunct to the present modes of transport.

"For those in a hurry nothing can compete with the airplane, and for those going on special services it is of the greatest use. This alone opens a very wide field indeed.

"Commercial flying will be carried out in short stages of 250 miles per flight, and pilots will not fly more than three or four days per week. It will be necessary before flying can be carried out commercially to have landing fields every 10 miles.

"Our commercial machines will have a speed of at least 100 miles per hour and engines for these should have a useful life of 500 hours between complete overhauls. Our engines will be heavier than those used in war machines, and cost of manufacture will be reduced as weight of engine is permitted to increase. In 5 years no water-cooled engine will be used. Air-cooling is certain to become universal in commercial aviation and the star or radial design of engine with fixed cylinders offers the greatest possibility in this field of development.

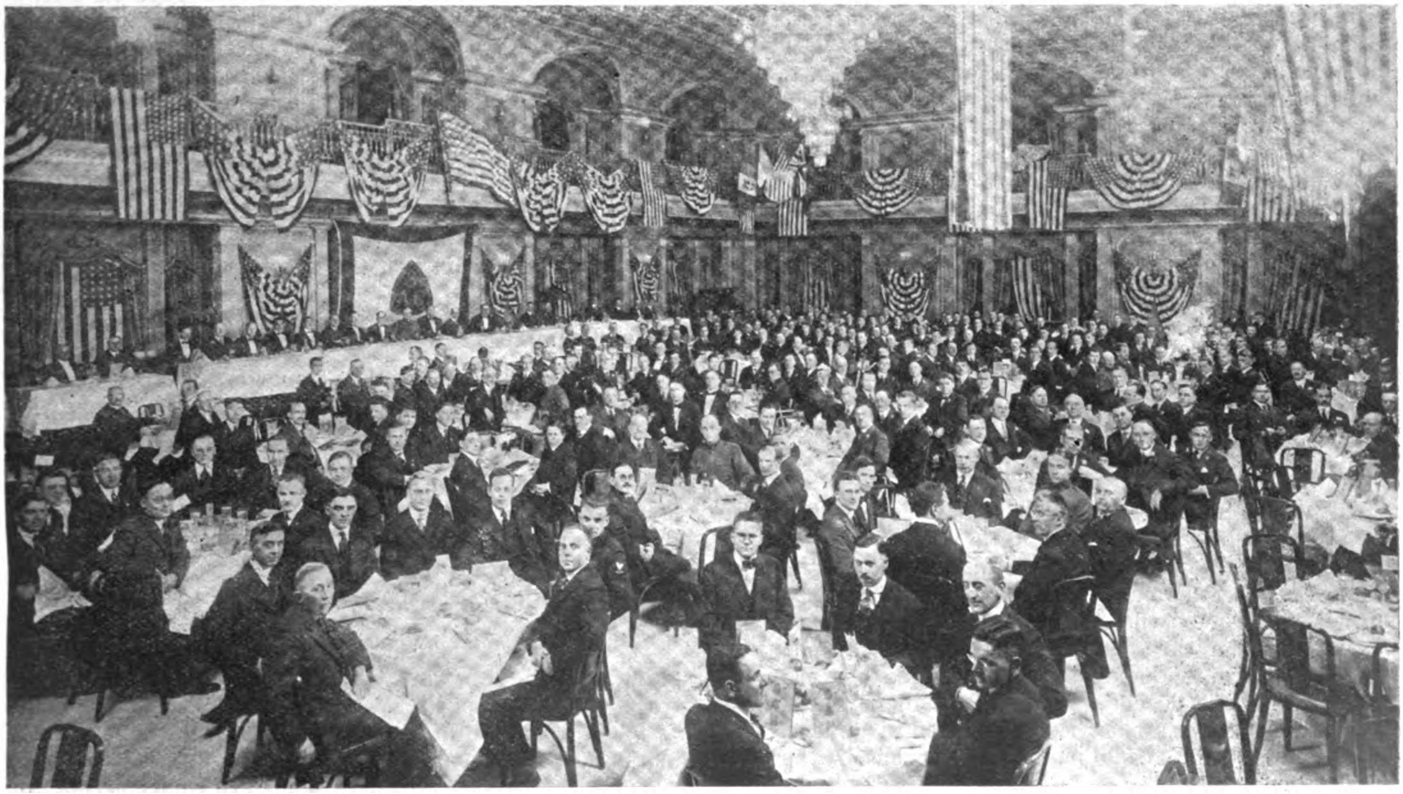
"The future of the dirigible is one to attract firms considering the aircraft field. The dirigible is destined to be the great vehicle for oversea transport, and is the only machine suitable for transatlantic work. The Atlantic may be crossed this year by an airplane, but such accomplishment will serve of little value as a commercial accomplishment, but rather will merely serve as a demonstration of aircraft pioneering. The future of trans-ocean travel lies locked-up in the lap of the dirigible.

The Freight-Carrying Plane

"The freight-carrying airplane has yet to be developed, although several types used in war can be used in this field. The freight airplane will have a speed of at least 75 miles per hour, and its primary requisite must be reliability. Its engines must be the last word in efficiency and reliability."

Like Lord Weir, Mr. Holt Thomas is a great aerial enthusiast, but he is an equally conspicuous aerial conservatist. He, too, recognizes the ill that will

Home-Coming Supper of the S. A. E. During Chicago Show



More than 400 members of the Society of Automotive Engineers and their guests attended the Home-Coming Supper of the S. A. E. during the Chicago show

come to the industry if precipitate rashness is given a rampant leash.

Perhaps the final word from Great Britain on the commercial possibilities of aviation and the best attitude to take with regard to the aircraft industry in Great Britain comes in the final report on civil aerial transport recently issued by a committee of representative character on this subject. This committee recognizes the gravity of the present factories and the industry as a whole and also the course to pursue regarding commercial flying. They reported that:

"We strongly support the views that the carriage of mails, of passengers, and of certain classes of goods by aircraft will present no difficulty from the technical point of view. We are confident that demands for aerial services to provide such carriage will arise immediately at the conclusion of the war, and that it is imperative that every endeavor should be made to prepare for these demands. Such aerial transport service cannot be developed by the ordinary commercial methods so as to secure the required result, and the state must take action of some kind in developing such service."

This committee looks forward to several improvements in aircraft before it has progressed far in its commercial stages. The increased use of folding wings and the use of some form of braking mechanism so as to diminish the space needed for landing must be anticipated. Possible developments in the gyroscope, the turbine and directional wireless are looked for.

Great Britain to Continue War-Time Restrictions on Automobile Apparatus

Some Months Needed for British Industry to Start Peace Plans

LONDON, Jan. 17.—For the present there is little hope of a removal of the total restriction order prohibiting the importation of automobiles and motor trucks into Great Britain. Ever since the signing of the armistice automobile and truck importers of French, Italian and American makes have been asking for a ruling but without success.

To-day a group of manufacturers representing practically all of the leading industries waited on Sir Albert Stanley, president of the Board of Trade, which has the power on such matters, and they were assured that there will be no removals of restrictions on any class of merchandise without first consulting with the British manufacturers engaged in the same line of manufacture. This can only be interpreted as meaning that in the case of the automobile, truck and farm tractor the British maker will express his opinion to the Board of Trade before any removal or consideration of removal of restriction will take place. This declaration of policy is not considered favorable to the importer, who has the feeling that the British maker wants the total restriction continued for several months until he gets squared around, decides what he is going to produce as a post-war model and gets ready for production of such.

Will Impose Additional Restrictions

In a few instances import restrictions have been removed since the armistice, but the Board of Trade announced that in every case these restrictions would be reimposed and further intimated that additional restrictions will be imposed as necessary. None of the restrictions on motor car imports had been removed except in one or two individual cases, and so this clause of the Board of Trade decision does not specifically apply.

The Ford company has been permitted to go ahead with the manufacture of 3000 passenger car chassis, the parts for which were imported by the government for war uses. These are now being assembled at the rate of 60 per day, and when the supply of parts is exhausted the production will practically cease. In the meantime the company is getting ready to manufacture all of the parts in Manchester. These cars are being sold at $1,000, which is a high advance on pre-war prices and which price is understood to apply only to these 3000 chassis. The parts were purchased at war prices and war freights paid on most of them, which explains to an extent at least the high price. It is understood Sir Percival Perry, manager of Ford interests in Great Britain, was given permission to go ahead assembling these 3000 chassis in consideration for his having cancelled certain government contracts at once. The permission to assemble these 3000 chassis would otherwise be considered a special favor to one importer over another. Ford, however, is the only concern with an assembly factory in England, and this comes as a natural favor for such enterprise. The bodies for these were made in the Manchester factory, as are radiators, the sheet iron work and some other parts.

Other Importers Concerned

In the meantime the other importers are not over-optimistic. They maintained their salesrooms and service buildings during the four and one-half years of war and at the same time most of the men were engaged on one kind of war work or another. Since the armistice they have been doing a good business in used cars of all makes. In some instances the same car has been sold not fewer than three different times since 1914, and the last selling price was 25 per cent above the original sales price when new.

These importers have kept their service departments going during the war, many having government contracts for small parts of munitions. Some have made as much money as in peace times, and some have greatly increased these departments since 1914.

In the meantime their salesrooms are empty except for a used car or two, as the only action they have obtained

(Continued on page 341)

Dealers' Interpretation of Public's Desires Real Show Lesson

Individuality in Outline and Color, with Great Attention to Detail in Show Cars

By J. Edward Schipper

THERE is a lesson in the New York Show for automobile manufacturers, one which if taken cannot help but leave its stamp on the industry. The lesson is brought home by the dealers of New York who have produced a show which is a brilliant success from a merchandising standpoint. What the dealers have learned in their intimate contact with the public, the manufacturer can in turn learn from the dealer by a study of the underlying features of the display at Madison Square Garden and the 69th Regiment Armory.

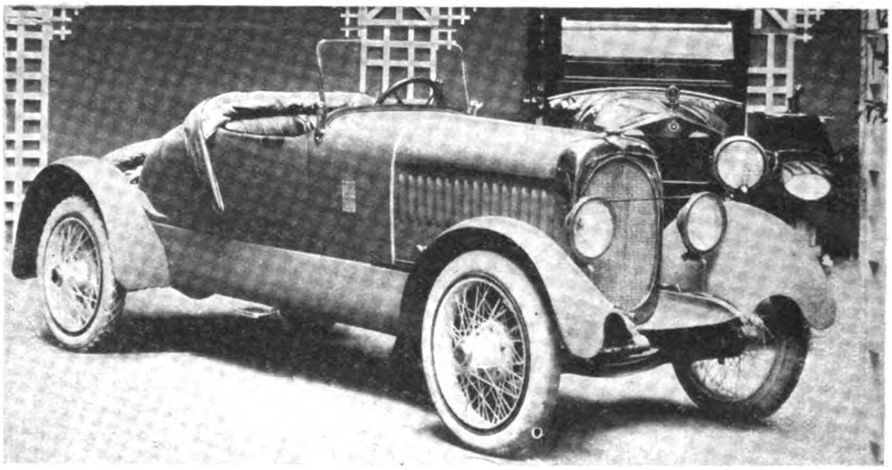
Manufacturers have felt themselves at a loss during the last few weeks to interpret properly the feeling of the public as expressed in their desire for cars. The dealer knows the public because he is constantly rubbing elbows with it and is always in touch directly with the ultimate buyer. He has not had to turn his attention to war manufacture in a way which would cause him to lose that intangible contact which is so necessary to successful sales plans.

The fact that this is a dealers' show has made it possible for the dealers to give free rein to their knowledge of the psychology of the buyer, with the result that the display fairly sparkles with silent salesmanship that is really compelling the attention of buyers to a degree not equaled at any show for years. Cars are being bought off the floor in record numbers and prospect lists are growing with a rapidity that is astonishing the most optimistic of dealers.

* * *

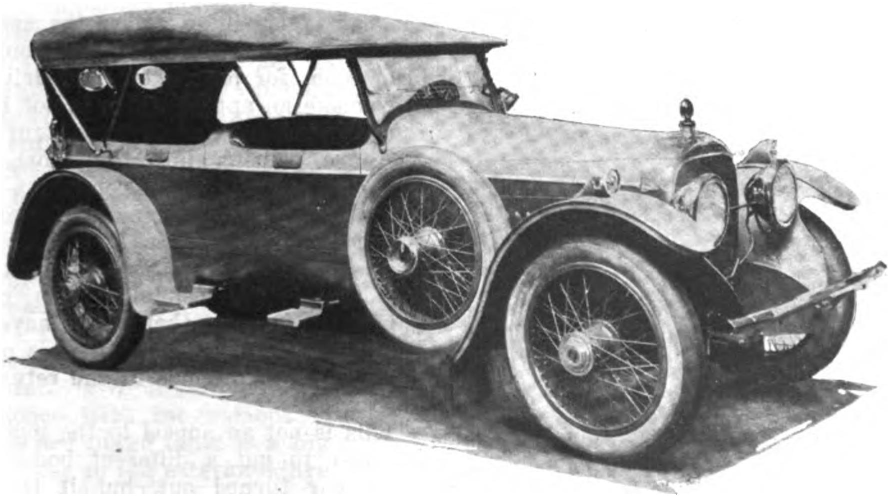
Distinctive Bodies the Keynote

It is in the body of the car that the secret seems to be contained. The American public, at least that part of it centering along the upper Atlantic seaboard, is yearning for individuality. There is a desire to break away from the somber color, the cut-and-dried body line—and to have a car which expresses the purpose for which it is intended. The New York Show is an exhibit of special bodies. Many dealers have not a single stock body on the floor. They are showing bodies which have been designed for them to meet the ideas of the public that they are used to serving. The result is that in the Garden and the Armory there is a display of striking bodies that practically equals what we have been used to finding at the Importers Salon.



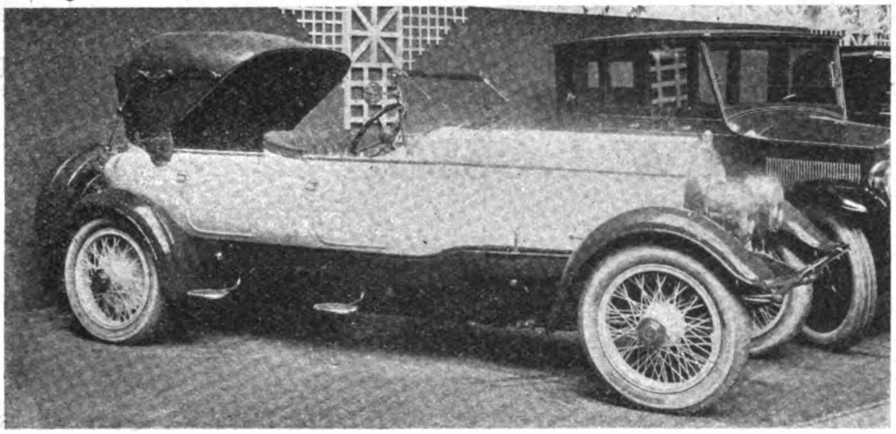
The Noma, which is the only really new car at the show, features a distinctive type of roadster body

It is not possible to put these bodies into production. It would not be desirable to put many of those which are proving of the utmost interest to car buyers into production, but the bodies which occupy the booths of the exhibitors are so replete with suggestion for the manufacturer that his engineer and designer could spend a week in close study of the ideas here evolved without exhausting the subject. Refinement of detail alone could occupy the attention of a man for three days.

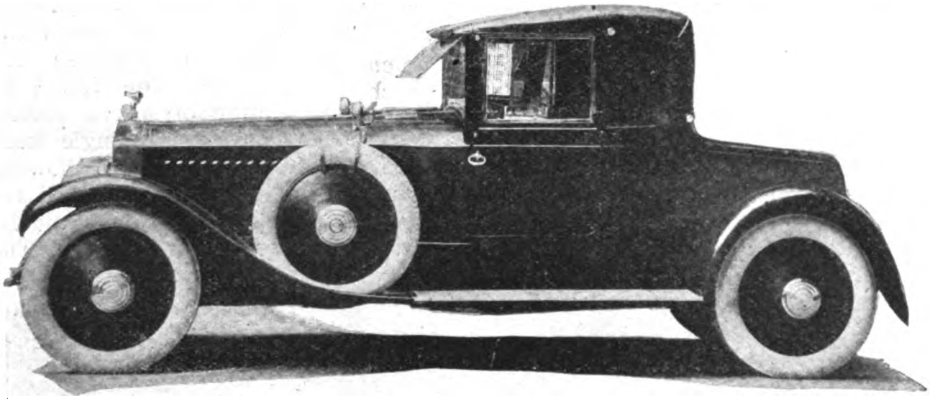


Unusual treatment of the body panels and the absence of runningboards mark this special Cunningham model

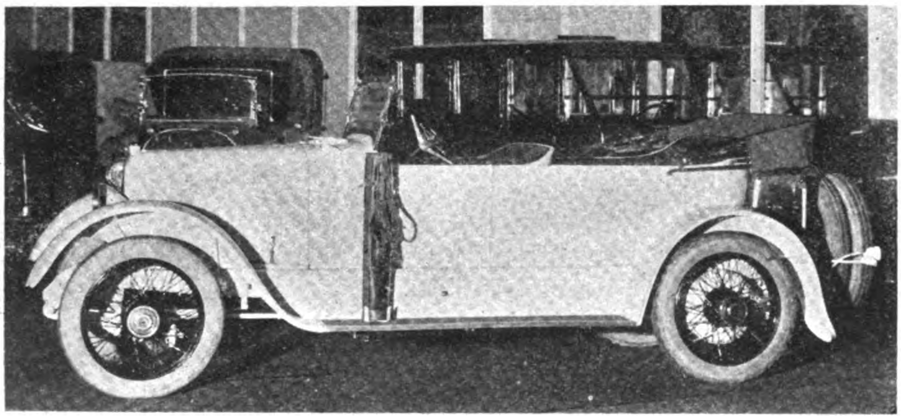
Equally important is the departure



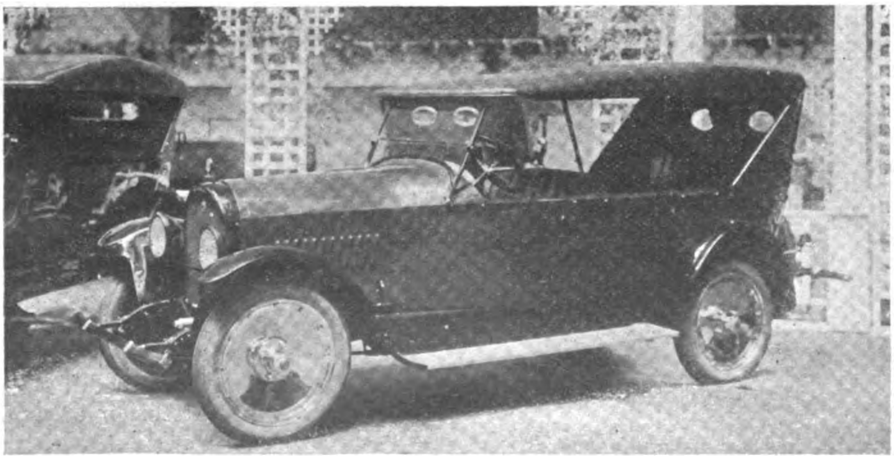
This is a Brooks-Ostruk touring body on a Pierce-Arrow chassis



Another Brooks-Ostruk body—a cabriolet model fitted to a Rolls-Royce chassis



Daniels exhibited a white touring car, reflecting individuality in bodies



Disk wheels very considerably alter the appearance of a stock model, as may be seen by this standard Westcott

from the conventional lines of the past and the suggestion of exterior lines which not only lend themselves with the greatest of adaptability to useful purposes but which strike the American buyer at a point where he is becoming very vulnerable, that is his taste for personal individuality.

It is true that the buyer of the Metropolitan district is different from the buyer of other districts. He does not use his car for business nearly as much, since, as a rule, he is a dweller of the larger cities, where the impossibility of parking makes it necessary for him to keep his car in the garage for the business week. This makes him perhaps an even more enthusiastic motorist than his Mid-Western brother who uses his car every day of his business life. Since the dwellers in the Eastern district number about 10,000,000, or one-tenth of the population of the country, the wishes and modes of living of this part of the country become a considerable factor.

* * *

Sport Bodies in Demand

If the manufacturer will study what the dealer in New York has found to be a potent factor in the selling of cars, he will find that the man who uses his car for pleasure always seeks to get away from the usual and get something which interprets the purpose for which the car is intended. In a word, there is a demand for a sport type of car that is unfilled, and yet this demand is so keen that special cars of this type made up by dealers and mounted on standard chassis are being snapped up by the public. They are being bought eagerly off the floor of the Garden and the Armory.

The sport type is not the only car that appeals. The closed car of special lines is even more popular. When the car is low-hung, when the seats are comfortable and yet have enough head room for passengers and driver they make an appeal which is not being resisted by the Metropolitanites who are pouring into the show in record numbers. The pendulum is swinging over to the side of unrestrained desire for the gratification of wishes that were denied during the war days. The pendulum has not gained the impetus that it will have a little later. In fact, the show is one of the first indications of the return ing swing.

This is not an appeal to the manufacturer to put a different body on every car turned out, but it is an attempt to reveal a lesson that can be taken home and interpreted on a production basis—the necessity for re-

fined detail, the advantage of breaking away from the crowd, if it can be done without the semblance of freakishness and with the accomplishment of a result in usefulness as well as appearance. A study of many of the bodies on the floor which at first sight are special all the way through brings to light that it is only the fit of the doors, the arrangement of the trim and the really artistic paint work that distinguish it from the regular stock model.

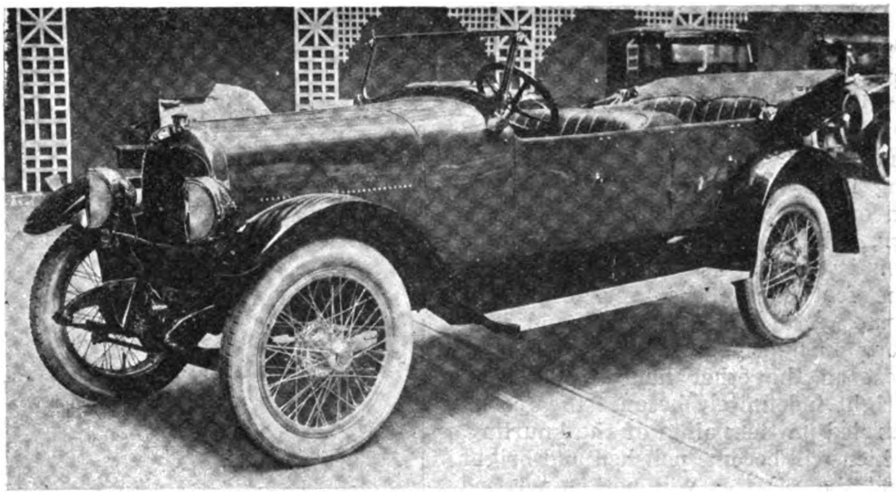
* * *

Special Bodies Not for Low-Price Cars

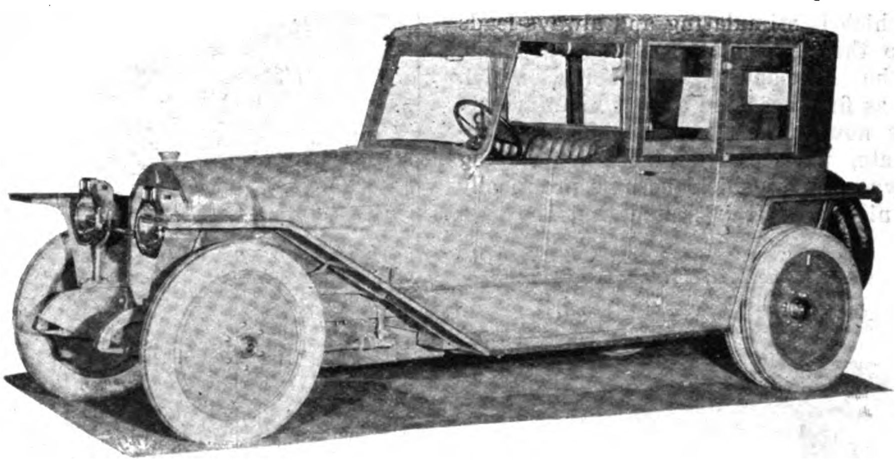
One of the points which cannot help be noted is that it is foolish for the manufacturers of low-priced cars to attempt things in body design which can successfully be carried out in higher-priced cars. There is nothing, for instance, so difficult to produce commercially at a low price as a body in sheet metal that depends for its appearance on a bold straight line. A line of that sort is either straight or crooked. There is no intermediate. It cannot be more or less straight. It is either straight or not. This means careful work and substantial building which cannot be taken care of on a production basis where a matter of 50 cents per car is regarded as serious.

Imitation of a successful thought by another manufacturer who perhaps makes a car costing five or six times as much cannot always be made a success. This is quite evident when the cars stand side by side at the show. This has another angle which does not show itself on the surface. Often the design of the higher priced car is one which entails structural weakness unless it is accompanied by the best kinds of materials or by compromises in other directions. A simple example of this will explain what is meant. The concealed hinge on the doors of touring and other open cars was first adopted by manufacturers who could pay a high price for the skillful work required in making concealed hinges as nearly correct as they could be made. Manufacturers of cars of all price ranges fell in line, with the result that door rattles on American cars are practically as common as the cars themselves. Furthermore the doors do not open as far, and there have been many torn garments as a result. After the bad experience with the various types of concealed hinge there is a big return this year to the exterior hinge, where even in the lower priced jobs the strength is sufficient to allow a man to sit on the door without making an incurable rattle in the joint.

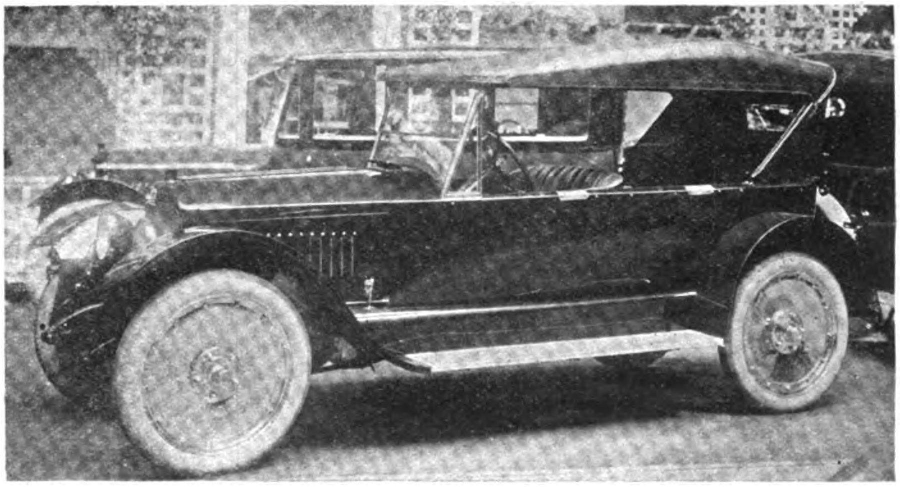
Beading over the edge of doors has proven very satisfactory. It is possible in the high priced cars to get a flush door that really fits, but an inspection of the doors of the lower priced cars shows that the difference in the width of the opening is very marked on bodies coming through in the same production run. The moulding allows for this nicely.



Paige exhibits a type of sporting touring model in which the high hood and rather unusual lamps are noticeable



Special type of Locomobile limousine designed for the use of General Pershing. Note dual rear tires and windshield



A Standard touring model has an unusual windshield with side pieces that increase protection and brace the shield

There are a great many little kinks that make their appearance on the special bodies, however, which can be readily taken as production items without adding materially to expense and at the same time greatly increasing utility or beauty. For instance, on one of the Locomobiles there is a knurled foot rest. The advantage of this is quite evident. In a short time the foot bar in the average car becomes scratched and worn and is a very unsightly affair. The knurled rest on the other hand will remain bright indefinitely because the foot is carried on the points of the knurling, which will become polished and bright and the recesses will not be touched by the foot, thus allowing them to retain their finish.

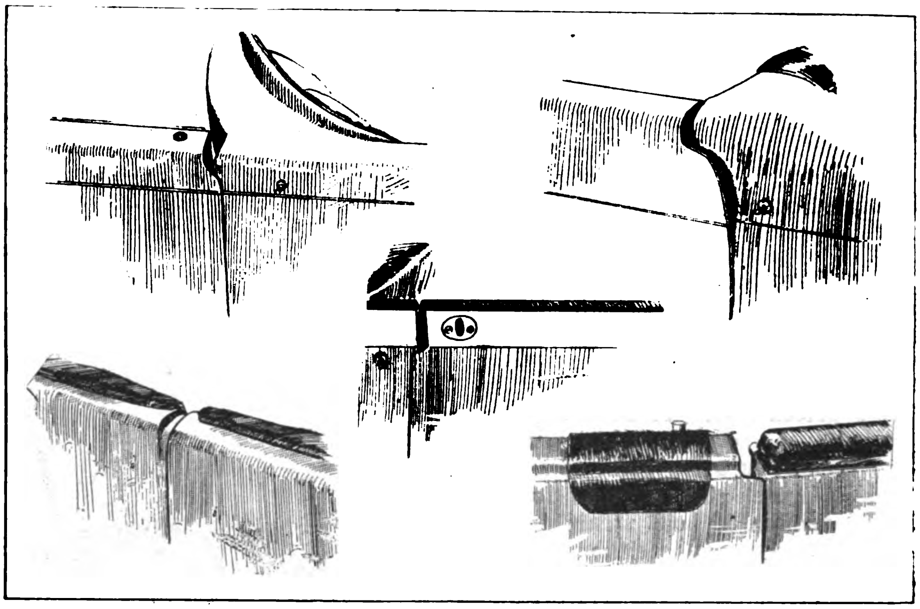
Differences in opinion over details in body design provoke a discussion which is stimulating and always leads to the best solution of the problem. The overlapping windshield which was first accepted almost unanimously is now a matter of considerable debate, particularly since the sloping type of windshield became practically universal. It is stated that the rain is swept into the overlap groove and that no protection is offered at all. The result is that many of the cars at the show have a rubber moulding inserted in the strip. This is not the kind that was used three years ago and was always falling out or becoming lost, but is a semi-permanent fixture.

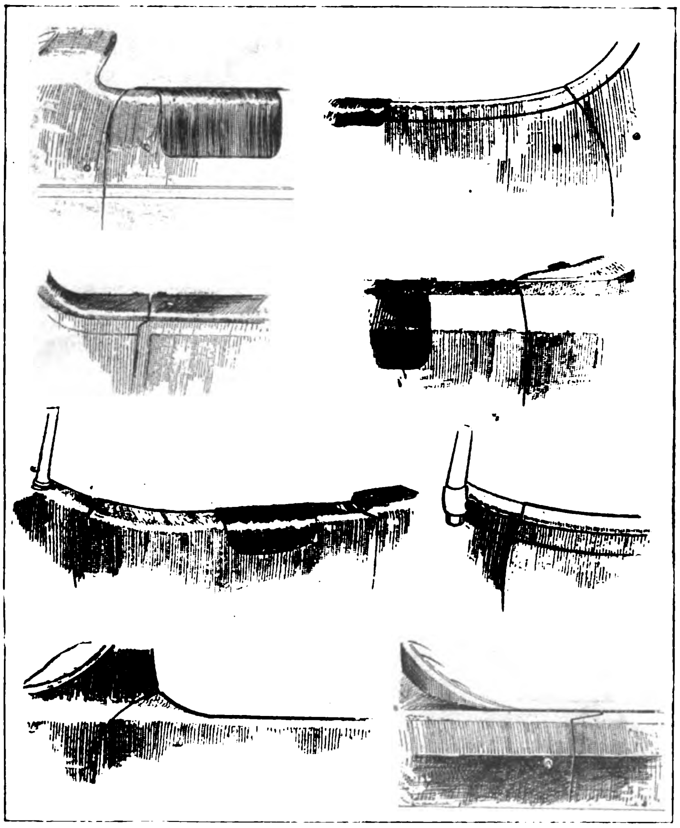
* * *

Are American Cars Too High?

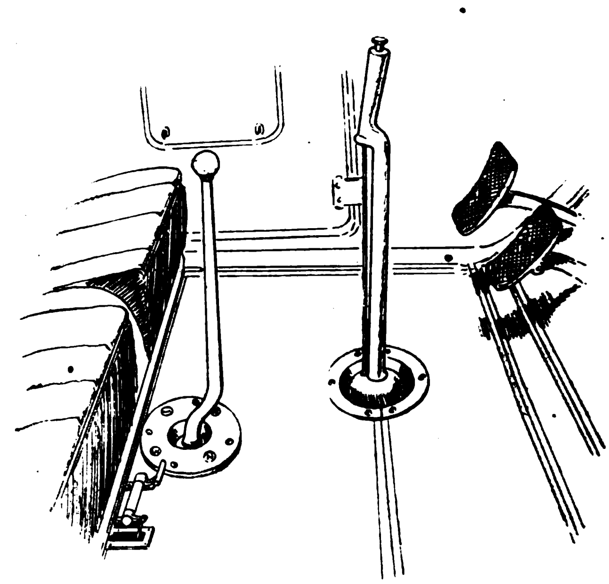
Returning travelers from Europe who are close students of automobile design say that their first impression of our cars after a long sojourn abroad is that they are all too high. They state that it is not because we have more clearance than the cars abroad, but because of the smaller wheels and the suspension layout. It is a matter of comment among these men that our cars seem high in the air, particularly at the rear. The closed cars of Europe have their tops often on the level of the top of a man's head when he is standing on the ground. As there are many of our cars which are so high that it takes an upstretched arm to reach the top, it cannot be solely a matter of clearance. Our cars have more head room inside, but it is a question if this is really needed, as there is no necessity to stand in the car.

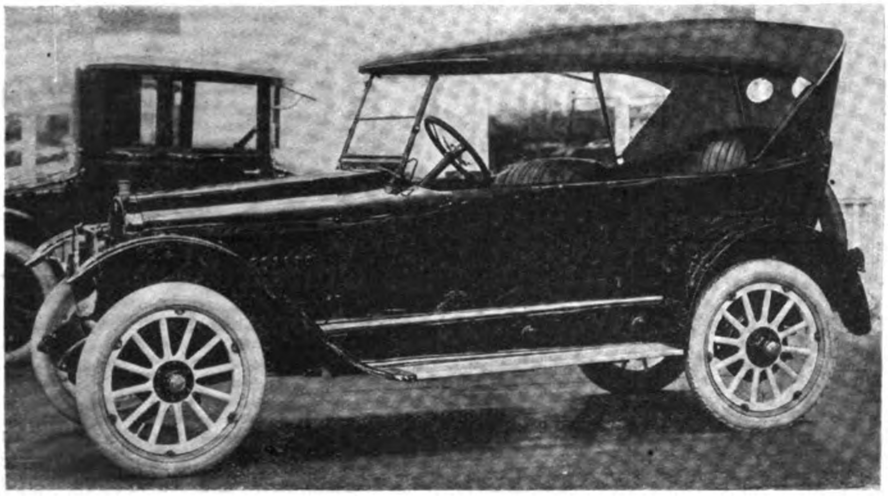
All of these matters deal with de-





Above are a few prominent examples of poor body fitting, both at the hinge and at the jamb ends of doors. At the left are a few examples of well-fitting doors. Below is the unusual arrangement of the control levers in the McFarlan





A new Mitchell model makes its appearance at the show

tail and yet they serve to bring out the general fact that since the cars at the show excel in this respect, and since the cars are largely special insofar as body design is concerned, it is necessary for the manufacturer to get a closer interpretation of the desires of the buyer. It is going to be a matter of getting back in this respect because the ordinary avenues of information have been closed during the war period.

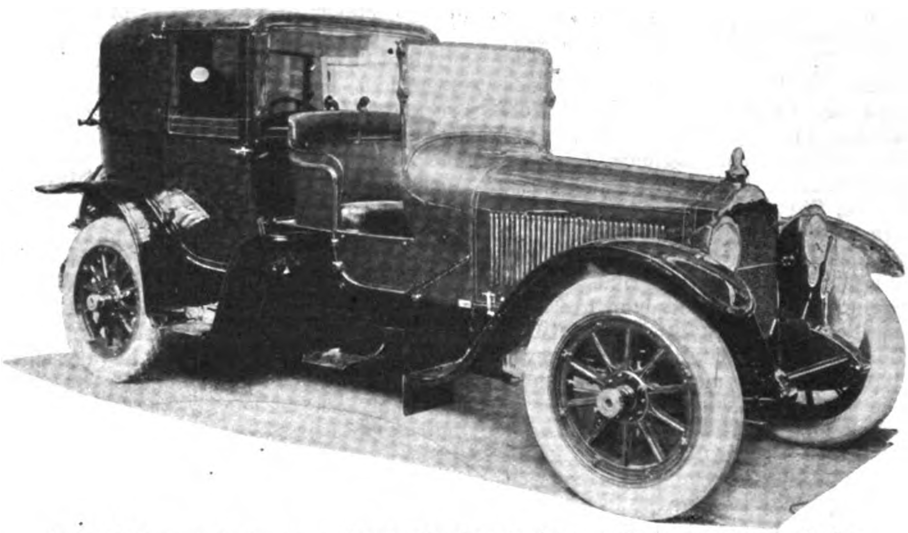
The use of more colors than ever shows that there has got to be a departure from the old standard black. Where we get into color it means that more than one color has to be offered, which brings us back to where we were 5 years ago in the matter of color options. These were gradually weeded out by the manufacturer who made cars in quantities, although the 10-a-day maker has kept some of the options.

There is a well-established demand for a real sport car. This demand is evident enough to justify its production in quantities. Abroad, the makers have realized this market far more than we have, and there is hardly a maker who does not have a stock sportster. This car would not only sell along the Atlantic seaboard, but would be in demand throughout the country, although the Metropolitan district would no doubt present the greatest demand for the reasons already explained. This sport car must not be something freakish, but should satisfy the lover of suburban excursions or of country-club life, a person who is greatly on the increase in large as well as small communities. This type of car is admittedly a recreation vehicle or implement to as great an extent as a golf bag or a tennis racket. Automobiling is the recreation of tens of thousands of Americans. A big percentage of these would be appealed to directly by such a car. The New York show tells that story.

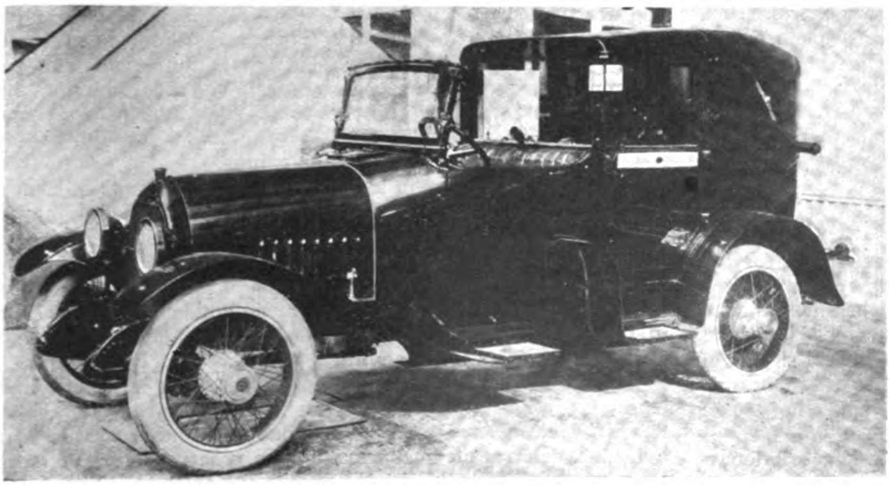
* * *

Public Has Been Educated

One great thing must be remembered in selling our new products. We are selling to a public which is buying its second, third or fourth car. This means a public which wants something different in appearance from what it had before; something refined, in which the little past mistakes are corrected. Refinement of detail, individual bodies, distinctive but enduring and serviceable color, all are being looked for, far more than radical engineering development at this particular stage of the industry's development.



This Holbrook body on a Packard chassis is a well-proportioned design, though quite out of the ordinary



Somewhat similar treatment of the fenders is apparent in this Daniels town car model, which, however, has front doors

Fiat Supplied Over 50,000 Motor Vehicles

NOW that restriction against publishing the actual output of factories supplying material to the armies has been removed, the Fiat Co., Turin, Italy, has made public the statement of the number of cars and lorries it supplied for army use.

In 1914, while Italy was neutral, only about 500 vehicles were supplied. Between Jan. 1, 1915, and Oct. 30, 1918, the number totalled 50,000. Of this number 30,000 went to the Italian army, 15,000 to the French and 5000 were divided among the American, British and Portuguese armies.

New Engineering Features at Chicago Truck Show

Ten Makers Exhibit for First Time and There Are Nine Other New Models—Tendency Toward Oil Lubrication of Chassis Parts Apparent—One Steam Truck Appears

CHICAGO, Feb. 3—Contrary to general expectations, there is much in the way of engineering advances and in the number of new models at the exclusive motor truck show which opened here to-day under the auspices of the Chicago Automobile Trade Association.

No less than ten new companies exhibited their vehicles for the first time at any show and nine brand new models of trucks of old concerns are shown. Among the new concerns formed during 1918 and putting their wares on display for the first time are the following:

Winslow Motor & Engineering Co., Chicago, maker of the only steam truck at the show; Mutual Truck Co., Sullivan, Ind.; Paige-Detroit Motor Car Co., Detroit; All-American Truck Co., Chicago; Dearborn Truck Co., Chicago; Hebb Motors Co., Lincoln, Neb.; Tower Motor Truck Co., Greenville, Mich.; Transport Truck Co., Mt. Pleasant, Mich.; Nelson Motor Truck Co., Saginaw, Mich.; and the Panhard Motors, Grandhaven, Mich. New models of Acme, Master, Commerce, Signal, Dorris, Stewart, Available and Fulton trucks are shown.

The Brockway modified Class B war truck could not be shipped to the show in time, although two other makes, the Signal and the Clydesdale, are fitted with modified Class B engines as offered by the Continental Motors Co., Detroit. Both of these installations, however, have single instead of double ignition, making use of magnetos. This requires the use of a new detachable cylinder head with only one set of spark plugs. The electric starter and lighting as originally furnished on the Class B engines are missing from those so far employed for commercial service.

A tendency toward the use of oil instead of grease for the lubrication of the springs, bolts and shackles is also evident, fourteen of the fifty-two makes of trucks exhibited employing some form of oil lubrication. These include the Patriot, Couple-Gear, Brockway, Paige, Master, Rainier, Clydesdale, Bethlehem, Indiana, Nash, Lapeer, Oneida, Available and Dorris. The Mutual truck, which at first used oil, is the only make shown which now employs grease.

The turning up of grease cups at the proper intervals has always been one of the hardest things to get a motor truck driver to do. The use of oil cups makes it much more convenient for the driver. Two brands of trucks use the Alemite method of greasing, in which a small cylinder is screwed into the hollow spring or spring-shackle bolt. This cylinder has a small check plunger which is forced in to admit the grease from a regular grease gun so that the lubricant does not have to be put in with the fingers.

Closed Cabs Increase

There is also evident a tendency to fit inclosed cabs for the protection of the driver, and about six of the models exhibited are so equipped. In most cases these are furnished as standard equipment and included in the set price of the chassis without the body. Some are of wood and others of metal, more of the latter type being evident this year than ever before. Some others accomplished the same end through the use of curtains.

Two new models of Available trucks have several departures in design, including a new method of brake equalizing, a new method of front axle mounting and a two-step running-board. The brake equalizing is accomplished by two flat equalizer rods, one above the other, which run in slotted members fastened to the under side of the truck frame near the midpoint of the chassis. These rods extend crosswise of the frame and move forward in a longitudinal direction toward the front end of the truck as the brakes are set and backward as they are released.

The Timken rear axle used has two brakeshoe segments in each drum, and under the ordinary method the two forward shoes are moved into contact with the drum when the emergency brake lever is pulled, or vice versa, and the two rear shoes when the foot pedal is used. This sets up a strain in the axle which the Available company has overcome by connecting one of the rear shoe rods to the transverse equalizer rod on one side and one of the front shoes on the other side, thus tending to equalize the entire action.

Improved Steering Connections

The front axle of each of the new models is set on a slant from the front to the rear by making the rear end of the spring lower than the front. When an obstruction is encountered, the wheels tend to mount it without the strains set up when the axle is set level. The steering arm knuckle is also set over the centerline of the axle so that its arc of movement is very small when the spring is deflected. This gives an easier steering truck.

The All-American truck heats its fuel four times before it enters the cylinders. These four heatings are made possible by mounting the gasoline tank directly above the engine under the hood, by a hot-air jacket around the air intake pipe leading to the carbureter, by passing the gas through the cylinder block after it has left the carbureter and by then making it impinge on the hot sides of the intake manifold, which is cast integrally with the exhaust manifold.

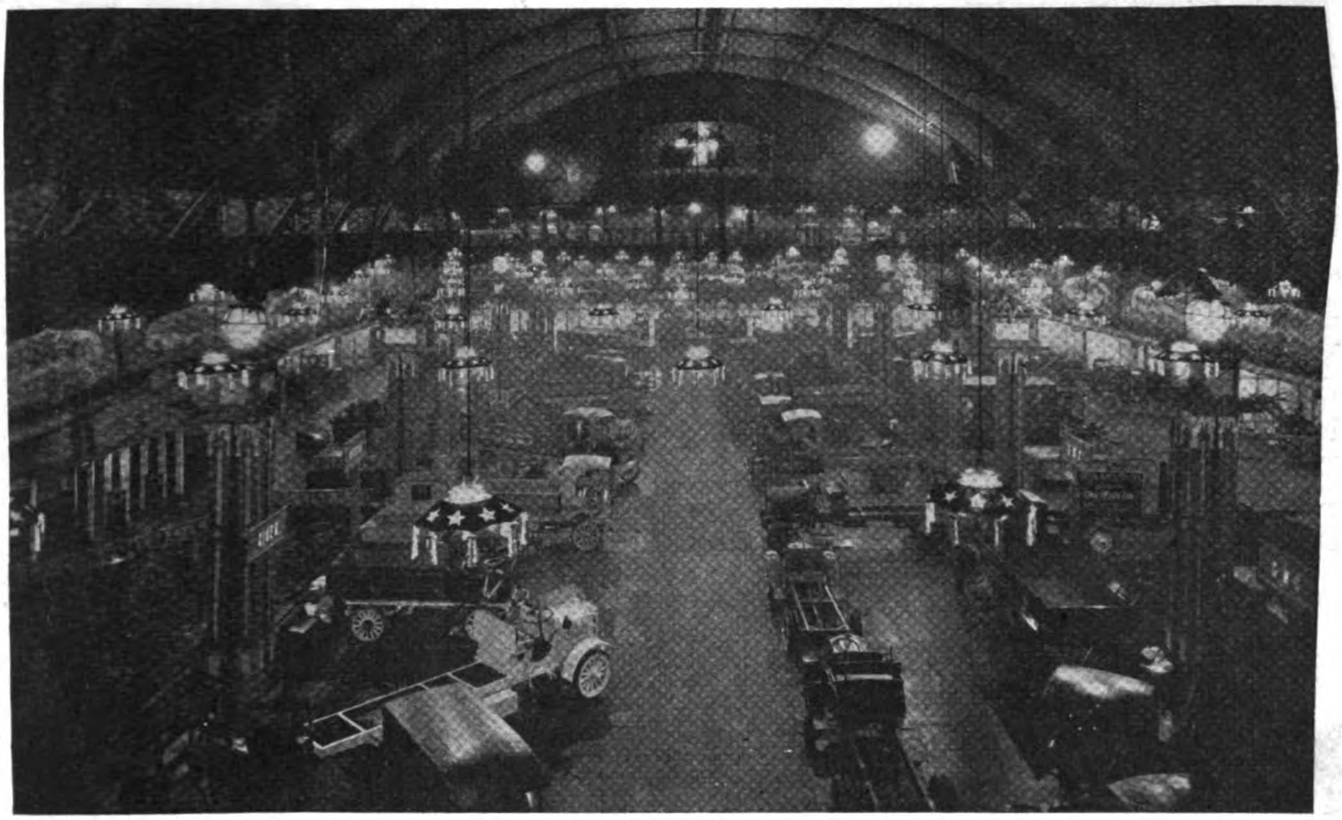
The Winslow steam truck is perhaps the newest vehicle at the show. The Winslow company has built only one model to date, the 5-tonner at the show, although it is intended to bring out smaller units at a later date. The truck is fitted with a four-cylinder engine with the cylinders cast in pairs and set in a V of 90 degrees. The engine is placed under the floor of the cab and drives direct without any clutch through a tubular propeller shaft with universals to the worm-driven rear axle. An emergency gear reduction 3.5 to 1 is provided, making the total gear reduction to the rear wheels 41 to 1. The final drive is taken through radius rods and the torque through the springs.

The water is carried in a transverse tank under the driver's seat and is fed, by a special worm-driven boiler feed pump; to a horizontal water-tube boiler carried in a crosswise compartment behind the driver's seat above the floor.

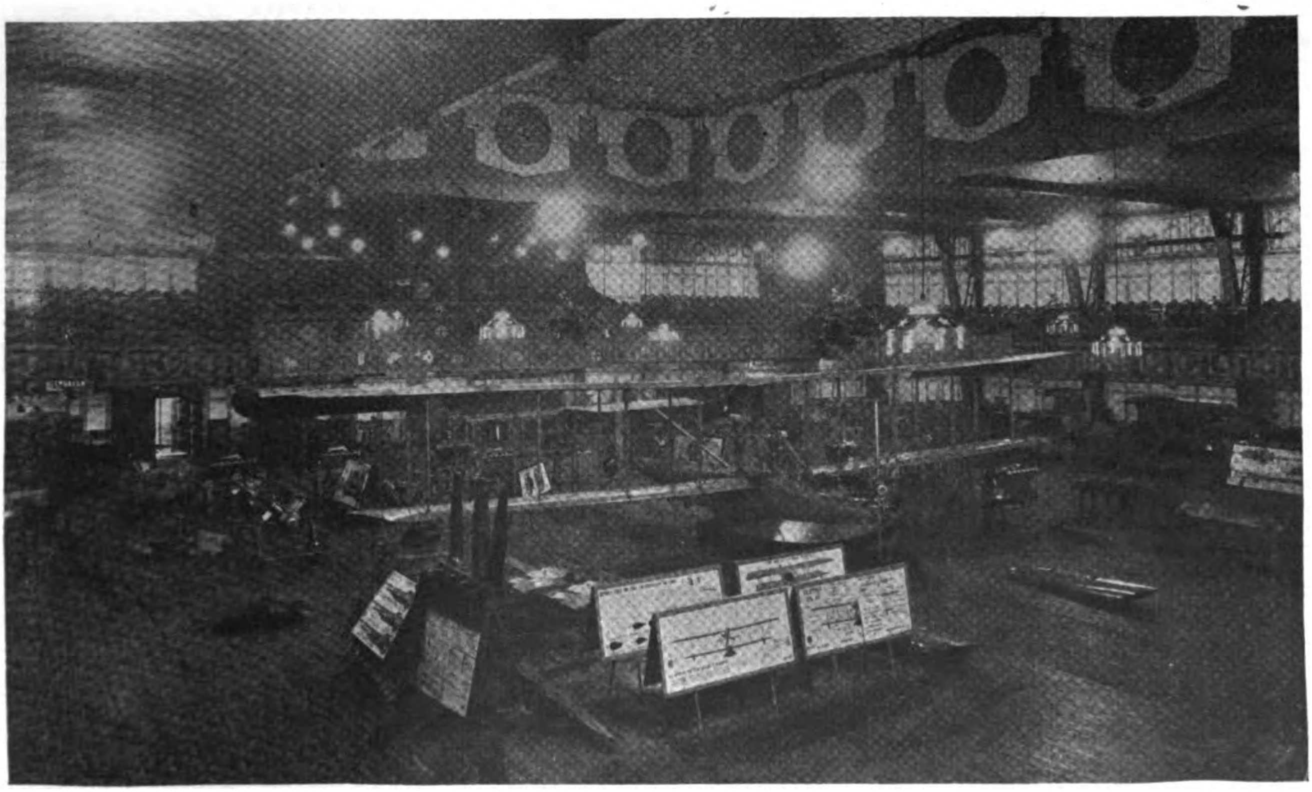
The boiler is fired by kerosene, which is also carried in a tank under the driver's seat. A large condenser is mounted in the place of the usual radiator. Its makers claim that one of the truck's main advantages is the low cost of fuel.

Another claim is for a great tractive effort in starting, it being said that the truck has an available torque of 13,200 lb. in., making a maximum available torque for the rear axle drive shafts of 45,100 lb. ft. or a tractive effort of more than 12,500 lb., which will far exceed the friction between the wheels and the road, even when the truck is fully loaded.

Two Views of the Chicago Motor Truck Show

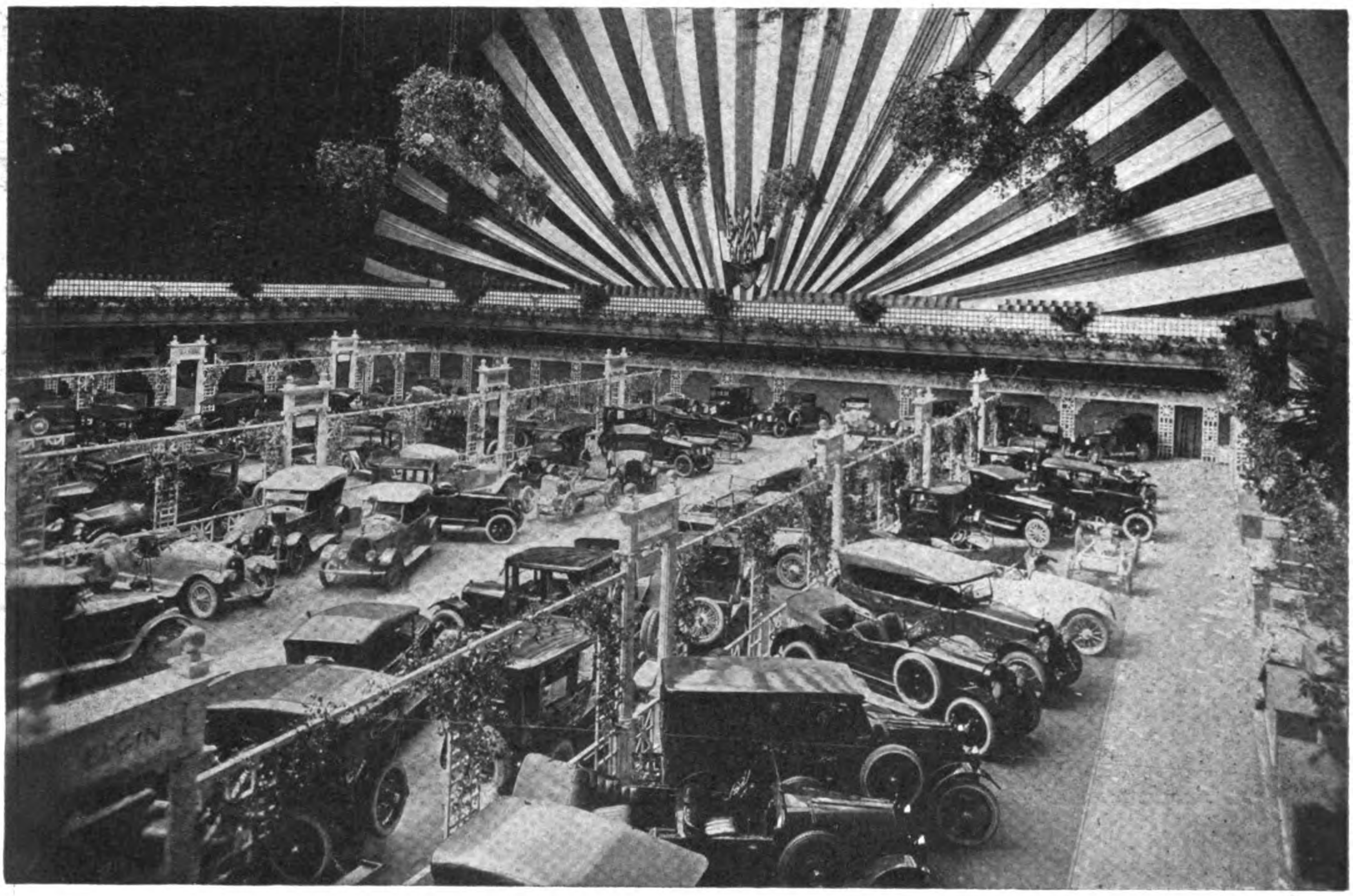


Present appearance of the Coliseum which last week housed the passenger car show but this week holds the motor truck exposition

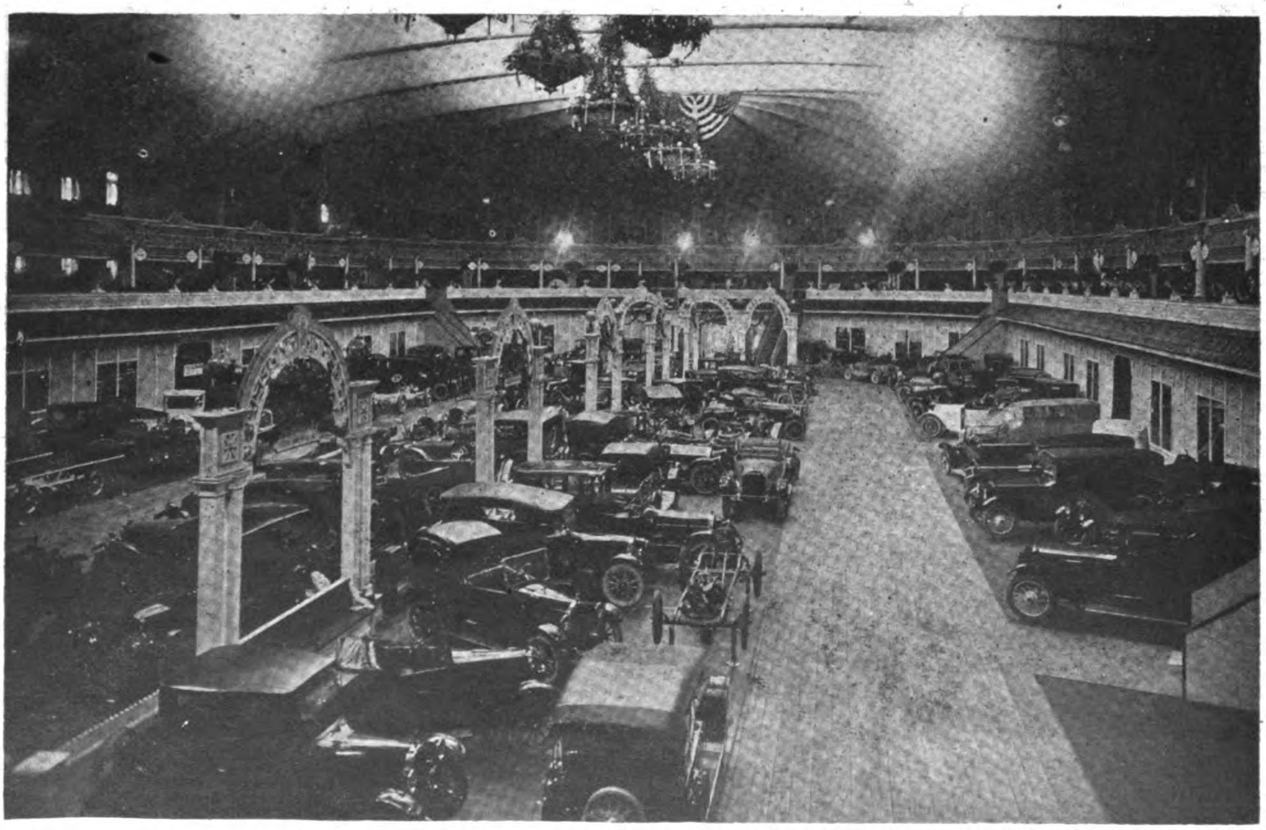


In the First Regiment Armory, where part of the truck show is staged, a Navy seaplane occupies the center of the floor and attracts a lot of attention

Two Views of the 19th Annual New York Show



Looking over the 69th Regiment Armory from the balcony over the entrance



General arrangement of Madison Square Garden

Analyzing Body Design at New York Passenger Car Show

Close-Coupled Touring Bodies Are Prominent—Light Colors and Color Combinations Are Popular—Many Minor Refinements

By George J. Mercer

BOTH Madison Square Garden and the Sixty-ninth Regiment Armory may be termed "body shows" in the sense that while there may be nothing startlingly new there are many very good-looking jobs and a high average of uniform excellence, design and workmanship is evident.

Small, close-coupled touring bodies are very prominent. These are designed to carry four or five passengers, have no extra seats and are fitted with four doors. Body sides are lower and the adoption of the bevel top edge accentuates the low effect. Straight lines give a clean cut, well defined contour and give a pleasing air of definiteness. It should not be assumed that finality in body design has been reached in this type, the ability to produce something new is far from being exhausted and there is still opportunity for enterprising designers.

There are three distinct points in connection with these bodies which afford great possibilities to the designer: First, the carrying of the body line forward across the cowl; second, the blending of the back line of the cowl with the body side, and, third, the blending of the front seat back with the body line. There are numerous instances illustrating the different manner in which these may be carried out. Some are excellent—some are not so good.

In the case of the first point, the effect is always best when the line of the top of the body side is continued through to the radiator. Sometimes this is accentuated by a paint stripe which looks well, but it should be a straight line, although it may deviate at the rear of the body. For instance, on a runabout it may drop downward and on a touring body it can go upward, but for the major part of its length, and especially at its front end, it must be straight.

It is not easy to explain the second of the three points clearly. Briefly, the line of the back of the cowl should join the top line of the body without being abrupt. An angle is better than a radius, but the best results are obtained when the line of the cowl is curved, making the meeting of the two lines at a tangent so that the cowl line blends easily.

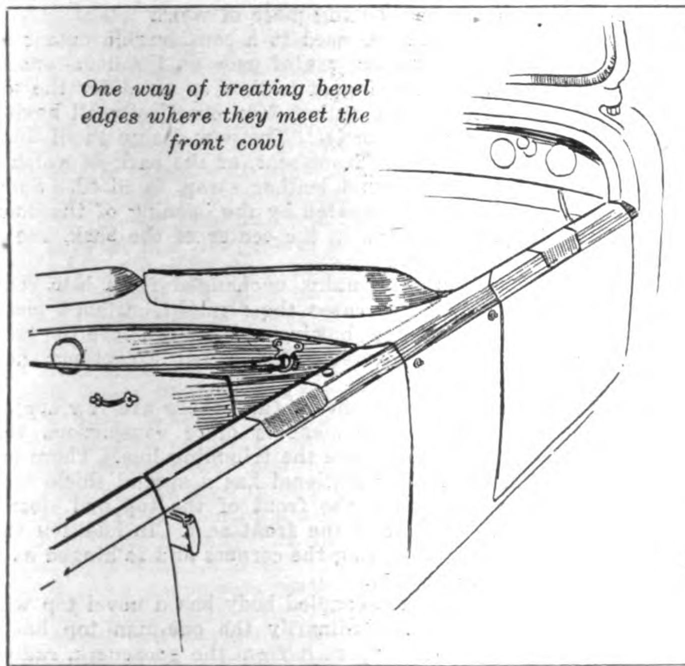
More thought has evidently been expended on the third point, although it has been difficult to illustrate many of the good effects by means of the sketches reproduced. The Paige is a typical instance. It is one of the newest, and has merit, as it permits the use of any form of second cowl or seat-back to fit to the body side without destroying the continuity of the latter. Good results can be obtained when the second cowl is a continuation of the bevel of the top line of the body side, but conditions must be favorable to assure relative perfection, as in the case of the Westcott.

The Essex has square rear corners. These look well on a short body and are favorable for fitting the guards to the body side. A finish panel covers the back end of the chassis frame and the gasoline tank. The Daniels small touring body has a platform at the rear which is used for a trunk.

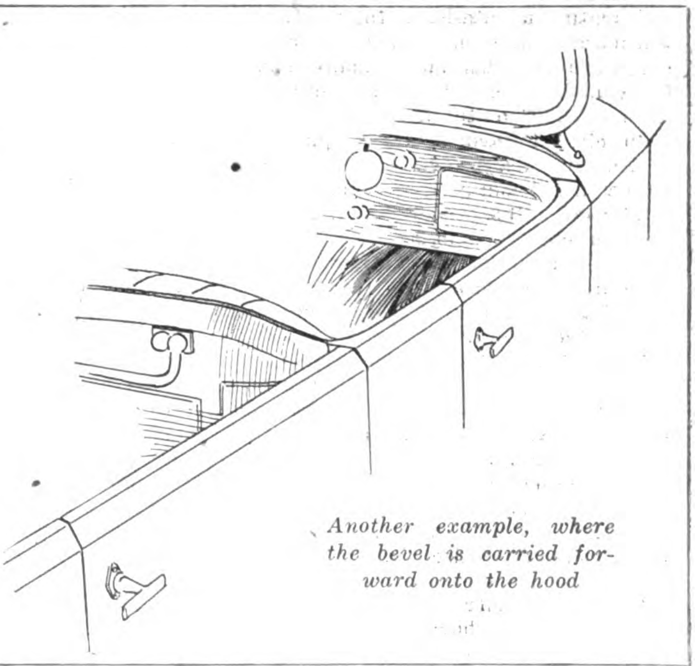
The idea of having a body as long as the chassis is seemingly going by the board and indications are that short bodies will become more popular than ever before.

Although body sides are as low as is possible while retaining comfortable seating, the hoods and cowls are kept up, undoubtedly for the reason that it adds to the snappiness of the car when these parts possess a relatively good bulk. They then convey the impression that the motive power of the car is ample. There are instances, however, in which this idea is exploited to an excessive degree.

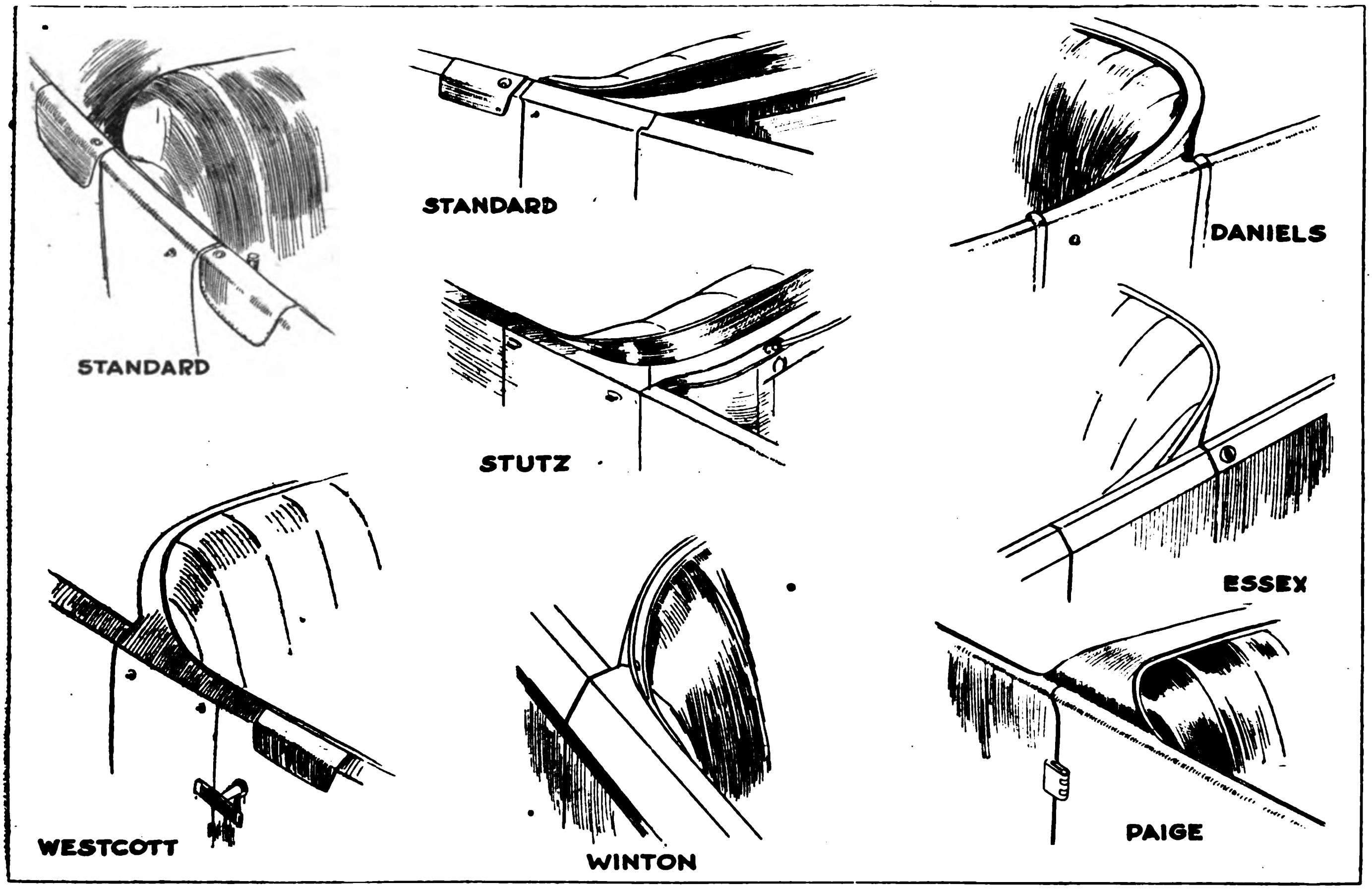
The hood at the dash must not be greatly higher than at the radiator; in fact, this line looks best when it slopes mod-



One way of treating bevel edges where they meet the front cowl



Another example, where the bevel is carried forward onto the hood



METHODS ADOPTED IN BLENDING THE CENTER COWL WITH THE BODY LINE

Good results are obtainable when the second cowl is a continuation of the bevel of the top line, but unless conditions are favorable it is difficult to make a perfect job

erately downward toward the front. This rule also holds good for the effect across the hood when the straight line of the body is continued forward to the radiator. The center of the hood does not look right when its height is accentuated above the corner line on the sides.

The advent of this small four-passenger body will result eventually in the disappearance of the four-passenger runabout types for the reasons that it is more sensible, more comfortable, is built on lines which are standard and is less subject to criticism as a freak.

A feature of interest is the great number of bodies without ventilators either in the sides or on top of the cowl. Many bodies are so fitted, but in many instances the lower part of the windshield is relied upon for ventilating the interior of the front part of the body.

An element favoring the sought-after low effect is the use of wire and disc wheels of 32 in. and 34 in. diameter. The former are strongly in evidence and are generally painted a light color. Disc wheels are numerous and look best when the disc part is painted a dark or solid color. This method reduces the size of the metal center and gives a better balance in appearance. One car is fitted with wheels having discs finished in nickel, which have the effect of making them appear too large in relation to the tire.

This latter instance tends to emphasize the fact that it is not always safe to apply conditions which are all right in a given place to another part without giving consideration to the effect. Nickel radiators look well, as do windshield frames and headlights, but when applied to wheel disks the result is not altogether happy. In this connection the accompanying illustrations show that the round Rolls-Royce type of headlight has many followers. These are usually finished in nickel and vary in size from the large type on the Rolls-Royce to those of average diameter.

There are plenty of good fenders. Those of the Packard and the Daniels show particularly well for the rear. They come well down and give the appearance of actually encircling the wheel. Brooks-Ostruk has one car with cycle fenders and steps without runboards. This body is on a Pierce-Arrow chassis with a new round-topped radiator. The body is a combination sport type on Rolls-Royce lines, attractive on account of its unusual lines and of excellent workmanship and finish.

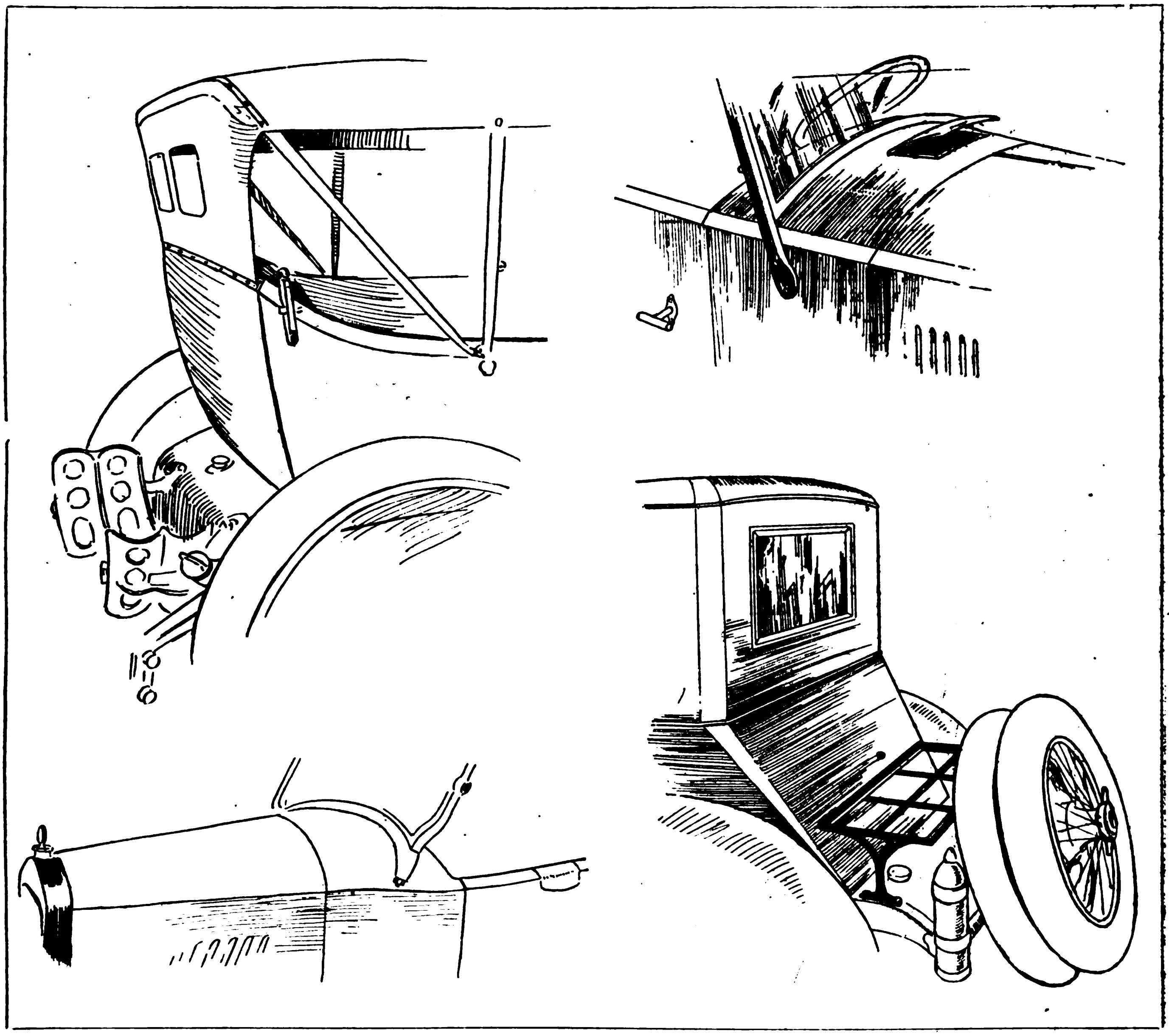
Louvres on engine hoods are long and narrow in many cases, and for the most part lack the exaggerated appearance of former years. A novel type is that of the Winton, the formation to make the louvre being inward instead of outward. Consequently the line of the hood side is flat on the outside, making a clean-looking piece of work.

Outside door handles are used to a considerable extent on open bodies, eliminating the use of pads on the door-tops to facilitate closing. Trimming of leather or wood for the top finish of the sides is used by but few, practically all having clean-cut lines of painted metal. The new design small touring body has an unbroken front seat, at the back of which a robe rail, generally a round leather strap, is fitted. Some bodies have step lights operated by the opening of the door. As these lights are located in the center of the back, one is sufficient for both doors.

Upholstery trimming remains unchanged from last year. In the great majority of cases the straight, stitched pleat, finished with welt and not showing noticeably above the back seat line, is the style affected. One or two exceptions show a single row of buttons.

Where one-man tops are fitted (and there are few special tops) the gooseneck attachment is quite conspicuous this year, coming completely above the trimming line. There are a few victoria tops. One National has a special shield with celluloid lights connecting the front of the top and closing the space from the back of the front seat. In addition this shield has side wings forming the corners and so hinged as to facilitate entrance or exit.

The Pierce-Arrow close-coupled body has a novel top with several good features. Ordinarily the one-man top has a cluster of bows which support it from the gooseneck, radiating from this center with the forward one of the group con-



Left, top—The flat back and square corners of the Essex tend to give the effect of a long body. Top, right—Treatment of the Essex body, showing continuation of bevel along cowl. The lower sketches show a method of connecting the body edge to the hood and a treatment which involves running out the body bevel to the rear

siderably ahead of its supporting point. On this individual body the forward bow is straight up and the quarter thus formed is closed with a curtain. This form of construction results in giving the job an excellent appearance.

The interior appearance of these open bodies gives an idea of comfort and the general appearance is in good taste and in conformity with the color scheme. For the most part, light colors prevail on open bodies, low-tone grays, coffee and black, green and cream under gear and black fenders are some of the combinations which look well.

As a matter of fact, all the color combinations are in good taste except the reds and the reds and yellows. These bodies look best in cases where, when two colors are used, the dividing line occurs at the chassis—that is, the body one color and the chassis and fenders another.

Painting the hood in two colors seldom looks well, the one "best" way of insuring a distinctive appearance being to have the radiator nickeled. If, in addition to this, the headlights and the windshield are also finished in nickel, the combination adds more snappiness to the car than all the paint in the world. Striping is used to some extent on the higher-priced cars, and it is worth its cost. It dresses up the painted surface and gives it a character that is appreciated when two cars, one striped and one without stripes, are placed side by side. There are but two cars with the dull finish paint which was common a few years ago. The majority have that varnished surface which shows off the shape and design of a body to the best effect.

Closed bodies include examples of all the jobs that have been on show in previous years, with the high-priced special bodies in larger number than ordinarily in proportion to the total exhibit. There are a number of attractive cabriolets, the large radius corner of the top at the rear being modified on quite a number. The designing of the top of the driving seat is better than usual. Brooks-Ostruck have a Rolls-Royce chassis with English line body, and Packard exhibits one with the modified roof corner. Holbrook shows a body with six fenders and steps. This is a sensible fender design, as it provides for the effective protection of the step by having a large flap hanging from the front fender.

The Marmon cabriolet possesses good color combination, and here it may be mentioned that the front seat cushion should always be divided as on this body. The reason for this is that it enables the driver to have his half built up to suit, leaving the other normal. Another reason is that in filling the tank or when gaining access to underneath seat the half cushion can be laid over on the other side in of being removed to the floor.

Only two of the town cars have pillar lamps, and there are but few dash or cowl lamps among all cars. It is true of closed bodies as of open that there are fewer ventilators in the cowls, windshields being made to do duty as ventilators to the front compartments. Windshields on enclosed cars are of regulation design. A few have double upper visors, but this is not generally the case.

There are several really good coupes. This body design is usually a factory standard and therefore does not come in the special design class. With the present trend for smaller bodies of all kinds it would seem that the small two or three-passenger inside drive body merits more attention than has been given it in the past.

Modern bodies of this kind are made with a window on the side, back of the door, and sometimes the division pillar is taken out and the entire side is open. As the top is so light, the criticism that the roof weight may break the pillars cannot be sustained against this type of body as may be the case with the large, seven-passenger jobs. Therefore it would seem that this type of body will become popular.

There is about the usual proportion of convertibles, identical in design with those of former years. The offset door type is the most popular of these, as it eliminates the necessity for crowding past the occupants of the rear seat.

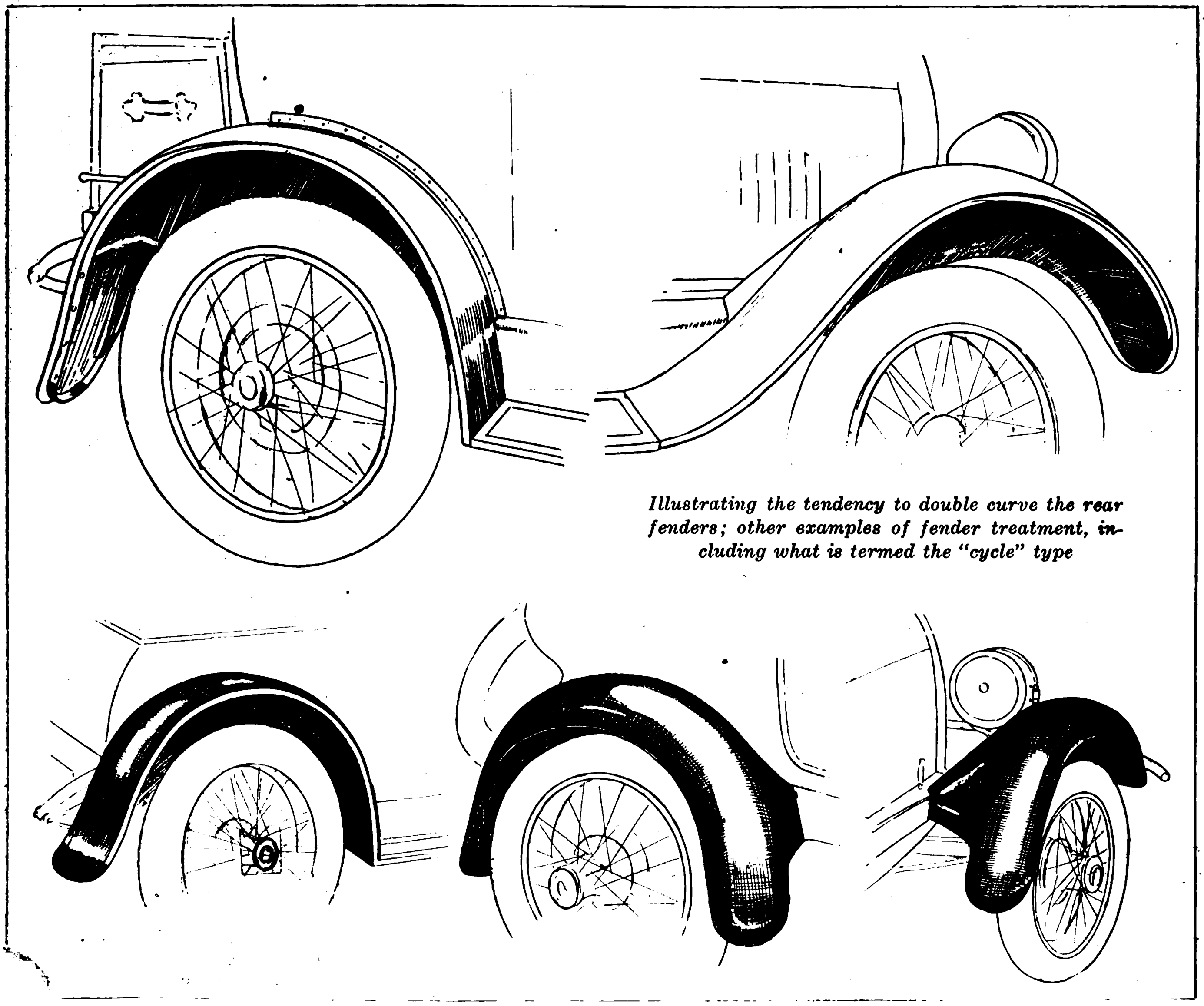
Wire wheels are used largely on closed as well as on open bodies. When wood wheels are fitted they are frequently painted a light color or given a natural finish, giving a light appearance to the car. Some few of the bodies have square rear corners, showing that the old horse-carriage style of body still has a faithful following. One closed body has cubist corners, a style which has had examples at shows for the past three years, but not in increasing numbers. It simply is different from the regulation line without being an improvement and it looks better when painted in light colors.

There are no new features in construction. In rare cases doors are made with tee mouldings, overlap panels covering the door openings in most instances. This is not generally considered the best practice, but it is the most practical, as it requires more careful workmanship to make the door flush and have a uniform opening all around. On the higher-priced body work the flush door is used, but the difference in the two methods is really more noticeable on open bodies than on closed types.

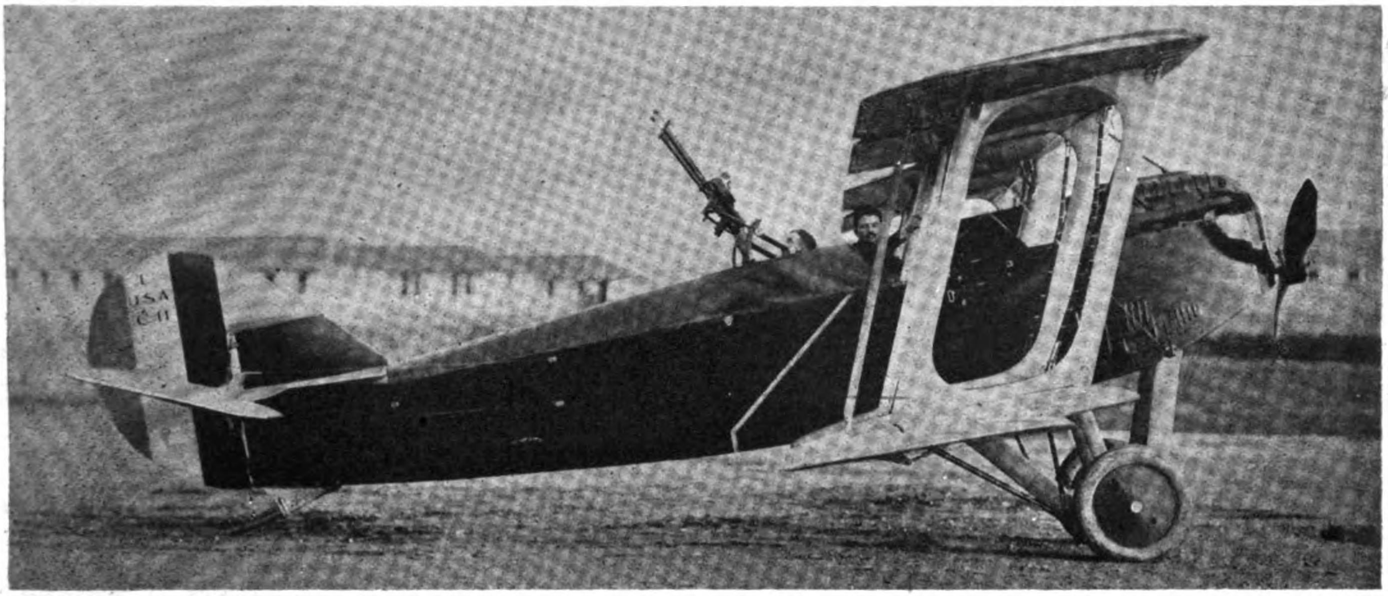
Trimming on closed bodies is plain in pattern and color of material. Quite a number use velour material of somber color. Plain pleats are used uniformly, with shaped arm rests for the rear seat and pockets on the doors.

Paint is uniformly brighter than usual and a few cars give evidence of an unfortunate selection of the dividing line for the changing from one color to another. When two tones are used on closed bodies the dividing line is best when horizontal and at the belt is best for most colors. One National sedan has a nice blending of two blues, using the belt and continuing the two colors on the hood and to the fenders. This made an attractive combination. A town body on which similar colors were used with a perpendicular dividing line was a less fortunate effort.

Striping is executed very nicely on many of the light blue cars, in some cases two colors being used for the striping as well as for the body.



Illustrating the tendency to double curve the rear fenders; other examples of fender treatment, including what is termed the "cycle" type



Side view of the Le Pére plane showing continuous strut and machine gun mounting

Production of Le Pére Planes Was Well Started

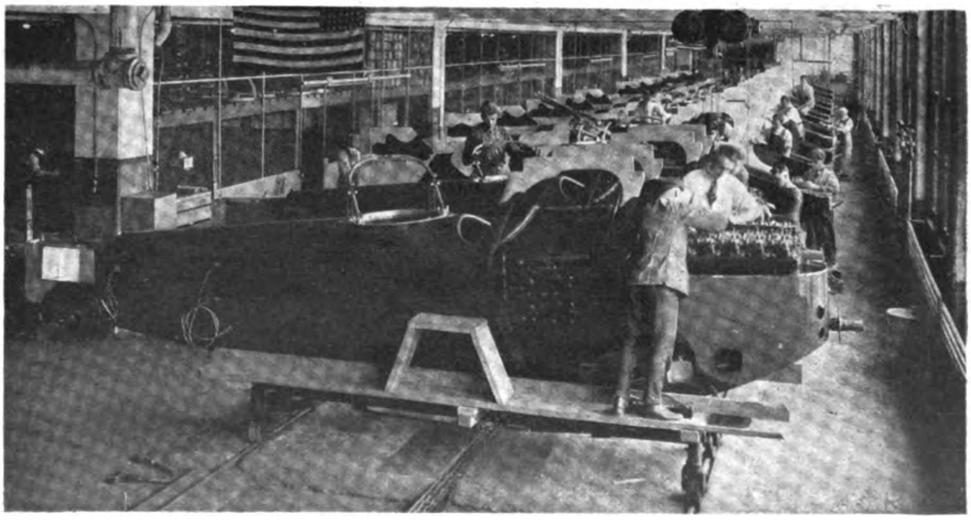
This Machine, Built in the Packard Plant, Is a Better Climber and Has a Higher Ceiling Than the D. H.-4—Excels in Detail Fittings

By J. Edward Schipper

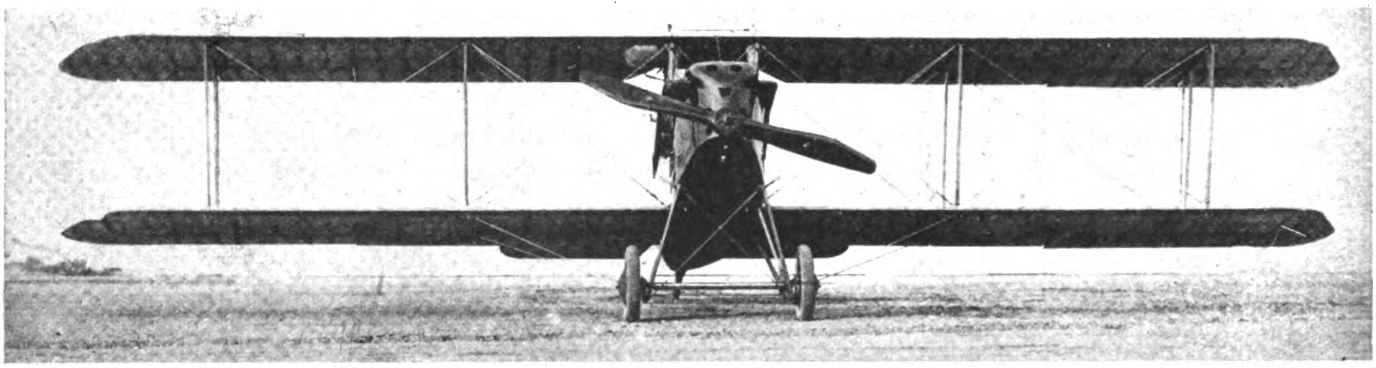
JUST a few months before the armistice was signed Captain Le Pére and the French Aviation Mission of which he had charge evolved a plane which is recognized to be the most efficient two-seated fighting machine yet developed. Frequent reference has been made to this plane in the columns of AUTOMOTIVE INDUSTRIES. The first 1000 planes had been started through production and a number of them were completed.

This plane, as developed by the French Mission, was purely a two-seated fighting machine, designed particularly for the Liberty engine. It was brought over here by the French Mission in embryonic form and then developed around the Liberty engine. As manufactured to date, this machine did not have a bomb-carrying or photographic attachment, being designed exclusively for fighting. It is in many respects an improvement over the D. H.-4. Owing to its lower weight—partly due to its construction and partly to the elimination of bomb-carrying and photographic features—it has a faster climb than the De Haviland and also a higher ceiling. It maneuvers better and it is also a better production job than any plane of its class.

A number of novel features, particularly as regards construction, appear in the design of this plane. These are apparent from the exterior photographs shown here-



Assembling Le Pére planes at the factory of the Packard Motor Car Co., Detroit



Front view of the Le Père plane designed by the French Aviation Mission and built at the Packard factory, equipped with the Liberty engine

with. Probably the most noticeable feature is the new type of strut construction, in which a continuous unit is employed to form the front and rear members of the strut. This is a naturally rigid form of construction, and one which increases the strength without interfering with the streamline construction. A considerable stagger is used, which gives a much greater range of vision than is obtained on the D. H.-4.

The machine-gun mounting is the same as that used on the D. H.-4, but the seats for the pilot and observer are so located as to concentrate the weight of the passengers and powerplant, thus increasing the maneuvering qualities of the plane to a marked extent. Captain Flachaire, the noted French ace, who was in this country during the past summer and fall, stated that this machine was one of the best to handle that he had ever driven. He was able on his first flight to put it through a series of flying feats which are generally possible only with a smaller machine.

This plane is also faster than the D. H.-4, which is probably due to the better streamlining. Some credit for the better performance is given to the stagger of the wings, but this is not fully settled. The plane has exactly the same wing area as the D. H.-4, although the load distribution is entirely different.

On the sand test this machine shows a factor of safety of eight. The spruce veneer work is unusual, particularly as regards the landing gear, which may be seen from the illustrations of the plane herewith. This plane excels in its detail work, and the fittings are particularly well designed. The inter-strut bracing fittings are very strong and yet do not break the streamline of the wing surface.

The plane was developed by the French Aviation Mission and was being built at the factory of the Packard Motor Car Co.

Performance of British Airplanes

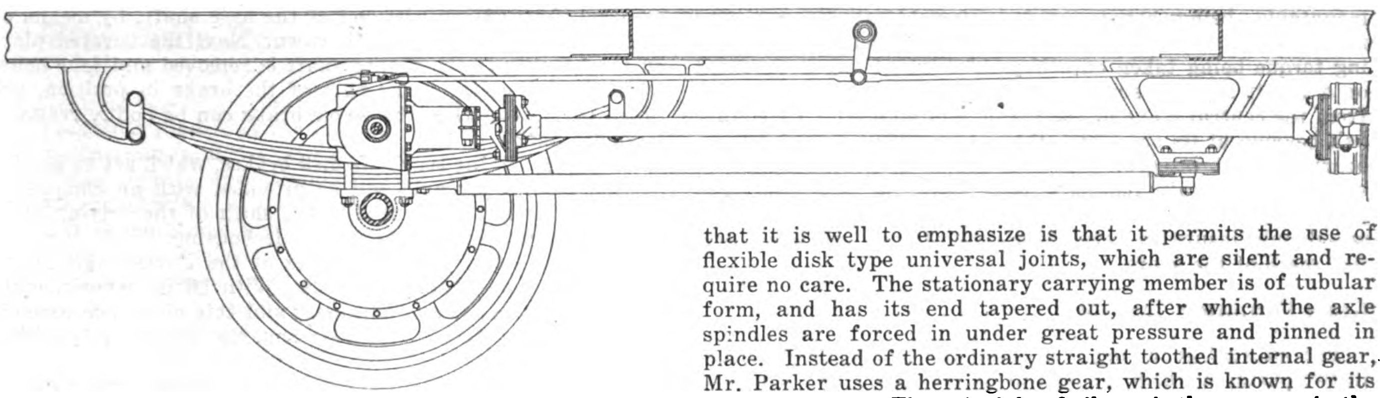
MANY new types of airplanes were developed in Great Britain during the war, designers constantly striving to produce machines that would excel those of the enemy in performance. This necessitates constant experiment and alterations, and complaint was sometimes heard that production was seriously interfered with. The following table shows the performance of the leading British types. (At lower altitudes the machines will, of course, develop higher speeds):

Machine	Speed at 10,000 ft.	Time Required to Climb 10,000 ft., minutes	Continuous Flight Capacity, hours
F.E. 2B	76	40	3½
Vickers Fighter	76	40	3½
Sopwith 1½ Strutter	103	10	...
Bristol Scout	111	10	1¾
A.W.	88	27	3
Sopwith Camel	118	10	2½
D.H.-4	120	11	4
D.H.-9A	120	11	6
Bristol Fighter	113	11	3
S.E.-5A	126	10	3
Dolphin	128	8¼	1¾

Final steps in assembling the Le Père plane at the Packord factory

Parker Silent Internal Gear Axle

Internal Gear Completely Inclosed and Running in an Oil Bath—Raybestos Disk Brakes on Driving Shafts—High Ground Clearance and Ready Accessibility Features



ONE of the great engineering problems of the times is that of the best final drive for commercial motor vehicles. For passenger cars the bevel gear drive is now about universal, but for commercial vehicles some form of double reduction must be used, unless resort is to be had to the worm drive. Whatever the ultimate type of final drive may be, there can be no doubt that it will be noiseless in operation and completely inclosed, so as to permit of effective lubrication and the exclusion of dust and grit from its bearing surfaces.

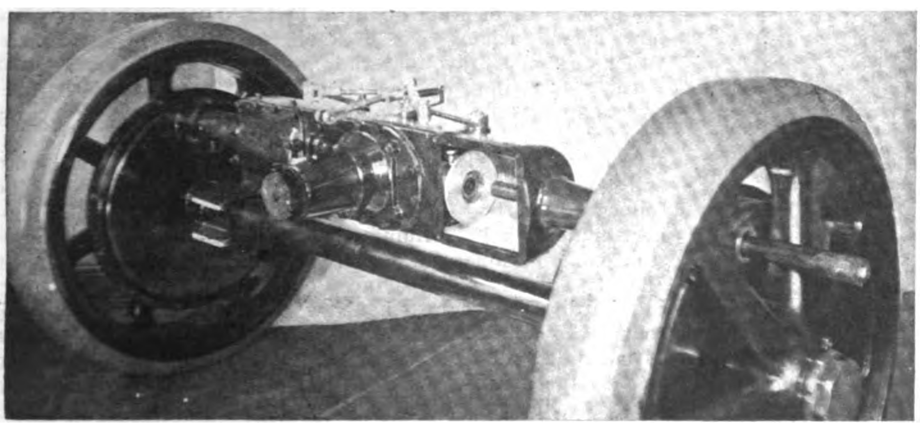
It is the attainment of these two qualities—silent operation and thorough inclosure—which has been aimed at particularly in the design of a new truck axle just brought out by the Parker Axle & Products Corporation of New York, of which Clark W. Parker is the organizer. The Parker axle is of the internal gear type, but it differs in almost every detail from previous axles of this class. Like other internal gear driven axles, it comprises a stationary carrying member, and a driving member supported thereby, carrying at its ends the pinions meshing with the internal gear rings on the wheels themselves. While in all, or at least nearly all, previous internal gear driven rear axles the driving member has been located either in front of or behind the carrying member, in the Parker axle it is located on top of it, the object of this change from conventional practice being to secure a straight line drive.

It is not necessary here to dwell upon the advantages of the straight line drive, as they are well known, but one point that it is well to emphasize is that it permits the use of flexible disk type universal joints, which are silent and require no care. The stationary carrying member is of tubular form, and has its end tapered out, after which the axle spindles are forced in under great pressure and pinned in place. Instead of the ordinary straight toothed internal gear, Mr. Parker uses a herringbone gear, which is known for its silent operation. The principle of silence is the same as in the well known helical gears now so much used for camshaft operation, but the herringbone gear has this advantage over the helical gear that it does away with end thrust in the shaft.

In former designs of internal gear driven axles, the gear reduction has been obtained in two steps, a first reduction at the center of the axle and a second one by the internal gear sets at the driving wheels. Mr. Parker uses a pair of miter gears at the center of the axle and obtains his whole reduction by the internal gears at the wheels. This makes the driving member of his axle a comparatively high speed device and permits of using a small differential and small axle shafts.

Oil Cooled Disk Brakes

The most striking innovation in the new axle is the brakes. These brakes are of the disk type, and are located on the differential shafts. The brakes comprise an internally splined drum which is securely held in the housing of the driving member and an internally and externally splined sleeve, which is in driving connection with the differential shafts. One set of metal disks is threaded upon the splined sleeve, and the other is threaded into the splined drum. The metal disks are not the ordinary flat disks, but are of composite construction, comprising two flat disks separated by a radially corrugated disk, which affords passages for oil from the center of the brake to the outside. Between the metal disks are located Raybestos disks, which may either be secured to one set of the metal disks or allowed to float.



Three-quarter view of Parker axle

The brakes are engaged by compressing the disks endwise, or in an axial direction. To this end the innermost disk is provided with a tubular extension formed with a groove for the shifting collar. The brake operating mechanism is of an ingenious design, combining a toggle device for multiplying the effort of application and an equalizing device, by means of which the pressure is equally divided between the two brakes. The toggle links are in the form of turnbuckles, and permit of quick adjustment of the brake linkage. A coiled spring acting at the center of the toggle moves in a guide slot, which prevents one of the brakes from being engaged automatically when the truck slopes sideways. It is, of course, necessary

to keep the toggles adjusted in such a way that the guide pin enters the slot substantially centrally. Not only is this adjustment very easily accomplished, but there should be very little occasion for readjusting the brakes, as the latter have an enormous surface in proportion to the work they have to do, and the oil circulation which is maintained also tends to keep down heating and wear.

For radial bearing loads, use is made in the Parker axle of Hyatt flexible roller bearings, while in points where thrust loads are to be taken care of the New Departure double row bearing is used.

Hollow spoke cast steel wheels are a distinguishing feature of the Parker internal drive rear axle. These wheels are demountable, being bored out to a considerable taper, and forced over a corresponding taper of the wheel hub, the driving torque being taken on a key. The wheel hub is mounted on a Hyatt roller bearing at the inner end, which is not far from the central plane of the wheel, and on a New Departure ball bearing at its outer end, this latter acting as a steadying bearing. Cast integral with the hub is a driving flange to which the internally toothed driving gear ring is riveted. The gear ring being riveted directly to the driving flange on the wheel hub, insures a very rigid support, and continued perfect mesh of the gears.

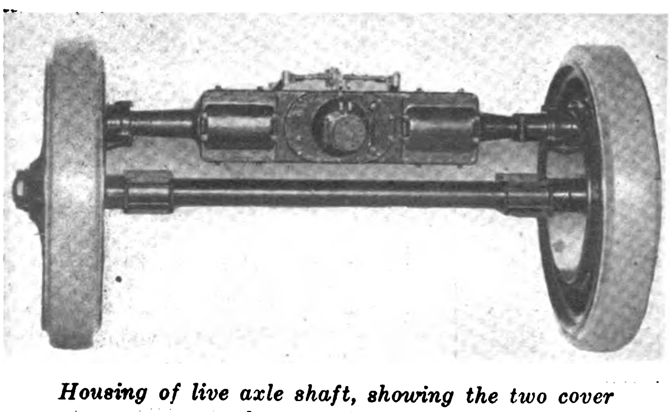
Gears Completely Inclosed

The internal gear ring is surrounded by a housing formed in two parts, of which the part away from the wheel is a casting which also forms the bearing support for the differential shaft. The part close to the wheel is a sheet metal stamping which is flange-bolted to the cast part, and which closely follows the outline of the driving flange carrying the internal gear ring. This sheet metal housing at its inner edge is formed with a groove for packing material, insuring a dust-tight joint with the revolving wheel hub.

A most interesting feature of the axle is its circulating lubricating system. A certain amount (about a gallon) of lubricating oil is carried in the gear housing. Mr. Parker figures that at a truck speed of 5 m.p.h. the centrifugal force on the oil is sufficient to carry it around with the gear ring. The differential shaft is made hollow from the wheel end to a point where the brake is located and the oil will be forced through this shaft by the centrifugal effect upon it. At that part of the shaft where the splines for the disk brakes are located, a considerable number of radial holes are drilled in the shaft. The oil will be forced through these radial holes and by the centrifugal action through the spaces in the composite disks of the brake. After having passed through the brake, it collects in the housing of the countershaft, and when it reaches a sufficient level, it returns to the housing of the internal gear ring, a channel for its return being provided in the bearing hub of the differential housing.

Oil lubrication not only is more efficient than grease lubrication, but eliminates the need for a lot of attention usually required by a truck. On the Parker axle there is not a single grease cup or oil cup to be looked after. The only attention required by the lubricating system is that involved in the replenishment of the oil supply once or twice a year.

Special attention has been paid in the design of the Parker



Housing of live axle shaft, showing the two cover plates on front side

axle to requirements of accessibility and quick adjustment. The housing of the live axle shaft, within which the brakes are located, is provided with two cover plates on the front side, which can be removed quickly, and permit of the withdrawal of the whole brake. It is Mr. Parker's intention to provide these cover plates with small inspection holes, so that it is not necessary to remove the cover plates when it is merely desired to inspect the brakes. In order to permit of the removal of the brakes, the live axle shaft is made of floating design. There is a small covered opening in the gear housing opposite the shaft end, and when it is desired to remove the shaft, the wheel is first turned until this opening is between two adjacent spokes. Then the small cover plate is removed, and a screw inserted into the end of the axle shaft, by means of which it can be readily withdrawn. Next the covered plate on the housing of the countershaft is removed and four bolts, which hold the stationary part of the brake in position, are taken out. After this, the whole brake can be bodily removed from the axle.

In addition to the rear axle disk brakes, which act as service brakes, the Parker axle will be provided with an emergency brake, which will be secured to the shaft of the driving bevel pinion, where it enters the rear axle housing.

Not the least of the advantages of the Parker axle is the high ground clearance it affords. With 36 in. wheels, more than 16 in. clearance is obtained, and this clearance extends from wheel to wheel, as the gear housings are entirely within the wheel.

The Parker Axle & Products Corporation has only recently been incorporated, and will immediately begin operations. The first axle design is a 2-ton type and embodies the Hotchkiss drive principle. The spring pads are formed integral with the hub of the driving gear housing on which the torque reaction comes, consequently the torque is transmitted to the rear springs in the most direct way possible.

Owing to the fact that the weight carrying member of the axle is of tubular form, and that the countershaft operates at high speed, the unsprung weight is comparatively small. This is of importance on account of the effect of the unsprung weight on tire wear. The cast steel wheels are of Mr. Parker's own design. Owing to the principle of detachability involved, the customer can be given an option between single pneumatic, twin pneumatic, single solid, twin solid and plain steel rim wheels, all being interchangeable.

Coming Developments in the German Iron Industry

HOW German engineers and manufacturers propose to deal with the new difficulties of industry consequent on the war is shown by the report of the managing director of the Iron Founders' Association read at the general meeting in Berlin on Sept. 14 last:

The report says in effect: The scarcity of raw materials will continue far into the years of peace. We must, therefore, prepare for an intensive use of materials and human intelligence. With our instructive experience in wartime in mind, we must apply the latest scientific knowledge to the problems before us, to smelting, casting and cooling, and to the production of other qualities by the use of new alloys, and new means arising out of increased chemical knowledge. Other forms of raw material, more economical methods of burning fuel, improved construction of furnaces, more effective temperatures, these invite research and suggest progress in new directions. The Kaiser Wilhelm Institute for research in iron has been founded to deal with these problems, and a sister institute for research in other metals is soon to follow. From both these the iron founders' industry is hoping for much help. Aluminum and zinc in their various possible combinations will replace copper and nickel and their alloys. The future importance of these metals for Germany can hardly be over-rated. New forms of construction will reduce the consumption of the rarer metals for certain parts of machines. The iron founder will look to the chemist to remedy the evil of a lack of hematite. A number of German blast furnaces are already prepared to use the phosphorus-free ores of Scandinavia and other countries in place of the supposed indispensable hematite.—*Giesserei-Zeitung.*

Standards Committee Acts on Division Reports

New Ball Bearing, Electrical, Engine, Spring, Tire and Rim and Miscellaneous Standards Recommended—A Few Items Referred Back to the Divisions

EIGHT divisions of the S. A. E. Standards Committee presented reports at the meeting of the Committee held on Tuesday, presided over by Chairman B. B. Bachman. Most of the reports were accepted after little or no discussion, but considerable opposition was raised to the adoption of certain recommendations and some of the latter were referred back to the divisions. It must be understood that any recommended standard reported as adopted in the following is not yet an S. A. E. standard; before it reaches that state it has to be passed upon by the Society at the general meeting, by the Council and, through the instrumentality of a letter ballot, by the entire membership.

The first report read was that of the Ball and Roller Bearings Division, by Division Chairman F. G. Hughes. In this it was pointed out that with the broadening application of ball bearings it had become advisable to extend the Society's standards to include both larger and smaller bearings, and the Division had prepared tables of dimensions for both types.

Extra Large Type Ball Bearings

In the extra large types it was considered desirable to standardize series of sizes with dimensions progressing proportionately, as far as possible without conflicting with current practice. It appears that certain sizes of extra large ball bearings have already been put in production, but it is felt by the division that changes can be better made now than after these large size bearings have become more firmly established. The tables of extra large types recommended contain only the bores and outside diameters, leaving the widths and all tolerances to be decided on later. An extra small series of ball bearings are also recommended, these being intended for use in airplane sheave pulleys and special apparatus. The report also contains dimensions of separable (open) type bearings which are extensively used in magneto construction and other small types of machines. That part of the report dealing with the extra light series of ball bearings was intended as a progress report only and not for action by the Standards Committee at this time, as difficulties had been encountered by the Division in discussing the width of the bearings and further consideration was necessary.

An angular contact bearing is also dealt with in the report, and the recommendation is made to standardize this in three series, heavy, medium and light, the same as the regular annular ball bearings. It will not be necessary to print special tables of dimensions for this type of bearing, but instead the following note is to be appended to the tables of the regular annular bearings: "Ball bearings of the angular contact type are identical in sizes and boundary dimensions with S. A. E. Standard annular ball bearings in the light, medium and heavy series, as printed on pages 29, 29a, and 29b, S. A. E. Handbook, Vol. I."

Roller Bearing Majority and Minority Reports

Mr. Hughes stated that at the Dayton meeting of the Society a special sub-division on roller bearings was appointed, which had held many meetings since. All of the members of this sub-division with one exception signed a majority report to the Division recommending that the present S. A. E. standard roller bearing sizes, which are metric sizes, be retained. A minority report was made by Mr. Porter, of the Timken Roller Bearing Co., who was chairman of the sub-division, this report being to the effect that the Timken company would reduce the present number of sizes to make an acceptable inch standard. Mr. Manly made reference to a matter in connection with ball bearing manufacture which had given him a great deal of trouble. This was that the chamfer specified at the corners of the inner and outer races was put on during the machining operation and before the final grinding, with the result that when the races were ground the chamfer was reduced in amount. Assurance was given that this matter would receive the attention of the committee.

High Speed Ball Bearings for Aero Work

President Kettering of the S. A. E. called the attention of the Division to the fact that there would shortly be a demand for ball bearings for aeronautic work to run at very high speed, as from 13,000 to 18,000 r.p.m. These bearings were required in gyroscopic compasses and similar apparatus. A motion was made that the Division be requested to investigate the subject of such bearings, and was adopted, but it was later on pointed out by Chairman Hughes that past experience had shown that the Standards Committee must limit itself to standardizing the outside dimensions of bearings. No end of trouble was encountered if it was attempted to standardize the internal construction, as the Committee did not possess equipment for carrying on the necessary research work.

That part of the Committee's report which was presented in completed form, including a table of dimensions for annular ball bearings of the separable (open) type, the extra small series and the angular contact type, was adopted by the Committee.

W. F. Cole presented the report of the chain division. The only recommendation made to the Standards Committee, a matter of nomenclature, was that the standard roller chain designation be changed from "Universal No." to "Manufacturer's Standard No." This was adopted.

Sleeve Mounting for Generators

The report of the Electrical Equipment Division dealt with four items, viz., a sleeve type of starting motor mounting, cable terminals for ignition distributors, generators, meters and switches, non-magnetic magneto shims and flexible disk magneto couplings. There had been some criticism of the proposal to add another mounting to those already standardized by the Society, but it was pointed out that the machining operation for a flange mounting on the flywheel housing of a unit power plant was often a very difficult matter. The mounting recommended is already in practical use. Mr. Broege wanted to know whether the relation of the new mounting to the engine was the same as that of the corresponding flange mounting and was told in reply that it would be quite possible to use a new starting motor (that is, one designed for sleeve mounting) on an engine designed for the flange mounting, using the same flywheel and a suitably designed adapter. The proposed mounting was adopted by the committee. This mounting is to be used only for outboard mesh installations, as it is not considered a suitable type for inboard constructions. The mounting consists of a cylindrical portion of the gearshift housing sliding into a bored hole in the bell-housing, the length of which is about two-thirds the diameter of the bore. The motor is locked in position by a screw through the bell housing entering a tapered

hole in the cylindrical portion of the gearshift housing.

The next subject dealt with in the report, that of cable terminals, was referred back. In regard to non-magnetic magneto shims, which subject was taken up last year, the Division now recommended that when it is desired to use a non-magnetic shim with magnetos mounted on cast iron pads, the shims shall be ½ in. thick, and high strength bronze bolts shall be used. The thickness of the shim is to be added to the dimension given in the mounting drawing for the distance from the face of the mounting pad to the center of the magneto shaft. It is suggested that a grid construction be used for the shims. This recommendation was adopted.

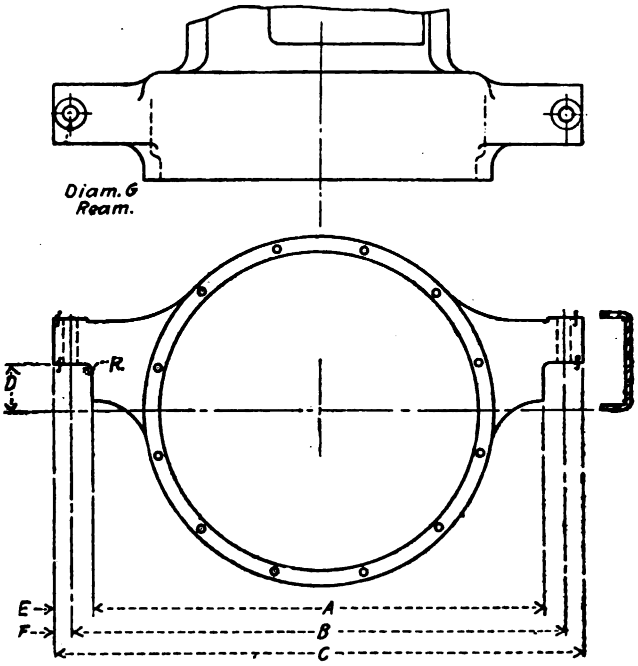
Dimensions are also recommended for flexible disk type magneto couplings, as follows: Outside diameter of disks, 2¾ in.; inside diameter of disks, 1 in.; diameter of bolt circle, 2 in.; thickness of disks, ¼ in.; number of ¼ in. bolts equally spaced, 4. These recommendations are complementary to the driving shaft and coupling dimensions printed in the S. A. E. Handbook, Vol. I on pages 36 and 36xa. This recommendation was also adopted.

Engine Support Arms

W. A. Frederick read the report of the Engine Division, which made recomendations regarding standard engine support arms in two sizes, the large size for the No. 1 S. A. E. flywheel housing and the small size for Nos. 2, 3, and 4 S. A. E. flywheel housings. It was pointed out that further standardization to include the front rocker bearing is being considered by the Division. The standards recommended correspond to the dimensions of the engine support arms on the Class B and Class AA Army trucks, respectively.

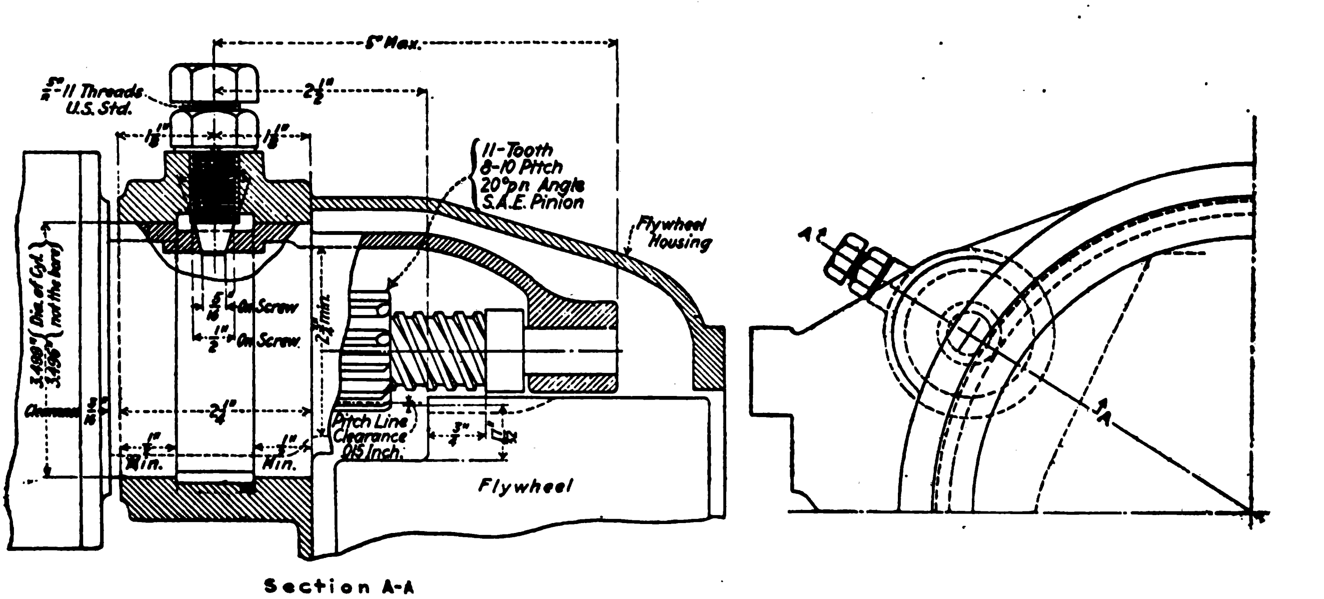
A letter from A. L. Riker was read in which objection was made to the adoption of the proposed standard. Mr. Riker said that the mounting suggested would not permit of supporting the engine direct on the main frame but called for the use of a sub-frame and its adoption therefore would favor sub-frame mounting. Replying to Mr. Riker's criticism, Mr. Frederick pointed out that the support was intended for both passenger cars and trucks. It had been found entirely impossible to standardize support arms for mounting engines directly on the main frame as the height of the engine relative to the frame varied considerably and so did the widths of frames. The arms could be used for mounting the engine on a sub-frame, or if main frame mounting was preferred, engine support brackets would have to be used. The report was adopted as presentd.

F. P. Gilligan read the report of the Iron and Steel Division which contained a suggestion for a new steel castings standard. The Society already has a standard for the composition of steel castings and the adoption of the new specification would amount to a revision of the old standard. The recommendation was made with the desire of correlating the several existing steel casting specifications which differ but slightly from each other. The A. S. T. M. specification has already been practically adopted by the Ordnance Department, the Navy and the Steel Founders Society of America. The recommendation was to the effect that the carbon in steel castings might vary as required in view of the physical properties demanded, but that the phosphorus and sulphur contents should not exceed 0.05 per cent each. There was a footnote attached to this specification reading as follows: "In view of the abnormal difficulty in obtaining materials in time of war, the rejection limits for sulphur in all steels and for phosphorus in acid steel shall be raised to 0.01 per cent above the values given in these specifications. This shall be effective during the period of the war and until otherwise ordered by the Society." The report also contained notes and instructions referring to the material specified, but it was not intended that these should form part of the standard itself.



Engine rear support arms

S. A. E. Flywheel Housing	A	B	C	D	E	F	G	R
No. 1	23½	26¾	28¾	2	2⅝	1	0.750	7/16
Nos. 2, 3 and 4	23⅛	24½	25¾	2½	1 5/16	⅝	0.625	⅝



Sleeve mounting of generators

The suggestion to permit a higher percentage of phosphorus and sulphur in steel castings elicited considerable discussion, automobile engineers uniformly holding to the opinion that an additional amount of sulphur would be very objectionable, whereas the steel men present claimed that it had never been proven that sulphur had the deleterious effect on steel which it was generally imagined to have. Mr. Reese said that the matter of sulphur in steel was not so much dependent upon war conditions as upon fuel conditions. Natural gas and coal low in sulphur had practically disappeared and we could not look forward to a reduction in the sulphur content permissible. The manufacturers of steel felt that the conditions had not improved in the least. The Navy even allowed up to 0.08 per cent sulphur in steel castings.

Steel Castings Report Referred Back

In the discussion it was pointed out that the majority of steel castings used in the automotive industries were now made in the electric furnace and that there was no difficulty in keeping down the percentage of sulphur and phosphorus in this process. For steel castings made by the open-hearth process 0.06 per cent would be a very fair limit. After an extended discussion and in view of the fact that the American Society for Testing Materials will probably take up the matter at its meeting in March, the subject was referred back to the Division for further consideration.

E. H. Ehrman presented the report of the Miscellaneous Division, which comprised two items, namely, nuts for machine screws and aeronautic spark plug dimensions. Some opposition was made to the adoption of the recommendation for nuts for machine screws in a letter from former Standards Manager W. M. Hanks, who is now connected with the Navy in the capacity of aeronautical engineer. Mr. Hanks' objection was that these nuts, while in general corresponding to the S. A. E. standard hexagon nuts for aeronautic work, did not absolutely agree therewith and that this would lead to confusion. Mr. Hanks considered the adoption of this new standard an unnecessary multiplication of nut standards. In reply to this letter, Mr. Ehrman explained that there was a great difference between the nuts for machine screws here considered, which were generally manufactured by punching, and the S. A. E. standard nuts for aeronautical work which were produced from bar stock. There would not be the least interference between the two, and, in fact, the nuts for machine screws covered by the suggested standard were already being manufactured and the standard had the support of all of the machine screw makers of the country. One important difference between the nuts for machine screws and the S. A. E. standard nuts for aeronautic work was that the tolerance in the former was so great as to render them entirely unsuitable for aeronautical work. The table of dimensions recommended gave only the outside dimensions, and Mr. Ehrman stated that this standard would not be affected by any action that might be taken by the Commission for the Standardization of Screw Threads. Mr. Howard made the suggestion that the long diameter of the square and hexagon should be given in the table, but Mr. Ehrman thought it preferable that a table of long diameters of squares and hexagons should be published somewhere else in the S. A. E. Handbook. This part of the report was adopted.

Standard Nuts for Machine Screws

Thread Diameter No.	Thread Diameter Decimal	Short Diameter	Nominal Thickness
0†	0.060	[illegible]	[illegible]
1†	0.073	5/32	[illegible]
2	0.086	3/16	[illegible]
3	0.099	7/32‡	[illegible]‡
4	0.112	1/4	[illegible]
5	0.125	[illegible]‡	[illegible]‡
6	0.138	5/16	0.101
*			
8	0.164	11/32	1/8
*			
10	0.190	3/8	5/32
12	0.216	7/16	3/16
14	0.242	1/2	7/32
*			
18	0.294	[illegible]	[illegible]
20	0.320	[illegible]	[illegible]
*			
24	0.372	11/16	5/16
*			
30	0.450	[illegible]	3/8

*Intermediate sizes are special—7, 9, 16, 22, 26, 28. Their dimensions are the same as for—6, 8, 14, 20, 24, 24.

†Made from bar stock only.

‡Unless made from bar stock, No. 3 and 5 will be made the same dimensions as No. 2 and 4 respectively.

Table gives all stock sizes for square and hexagon machine screw nuts of brass, iron and steel.

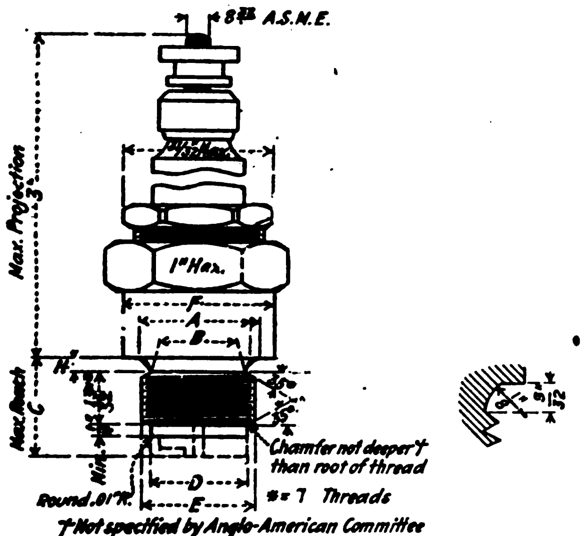
Aeronautic Spark Plug

A few changes were made in a dimension drawing of the aeronautic spark plug submitted. The aeronautic spark plug had been standardized already and the present recommendations are in the nature of a revision and an extension of the former standard. If adopted, the S. A. E. aeronautic spark plug will be brought into harmony with the international standard, and spark plugs of American origin will be applicable to British engines, for instance. In the design submitted slip terminals were shown for plugs for both stationary engines and rotary engines. Some objection to the design of the slip terminal was made by Mr. Crane, and as a result this part of the recommendation was referred back to the committee. The rest was adopted.

W. M. Newkirk read the report of the springs division which embodied quite a number of items, some of them intended for action by the Standards Committee at the meeting and others merely to indicate progress made. The first item had reference to leaf points. Two drawings were shown in the report, one of them showing leaf points which had been used in the past but now practically obsolete, and the other showing leaf points which are in common use to-day. It was decided by the Division, just before the meeting, to withdraw the first drawing and recommend the inclusion of only the latter in the records of the Society.

Leaf points Nos. 2, 3 and 4 are suitable for rolled tapered leafs and leaf points Nos. 4 and 5 are suitable for full thickness leafs. Rebound clips are to be used in all cases.

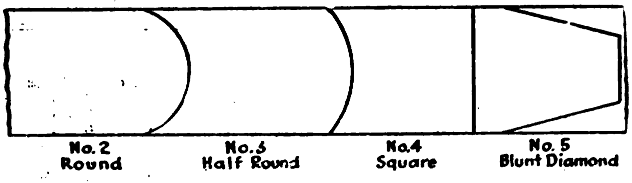
The present 3/16 in. value for angular variation of the eye center line is considered too close for practical vehicle spring



	A	B	C	D	E	F	H	
INCHES	.728 .709	.6339 .625	5/8	.625	.708 .703	31/32	3/32	MAX. NOM. MIN.
MM.	18.5 18.0				17.97 17.85			MAX. MIN.

DIAMETERS	Spark Plug Thread MM.	Spark Plug Thread INCHES		Tapped Hole M.M.	Tapped Hole INCHES	
OUTSIDE (FULL)	17.975 17.850	.70768 .70275	(.708) (.703)	18.312 18.187	.72095 .71603	(.721) (.716)
PITCH (EFFECTIVE)	17.001 16.876	.66933 .66441	(.669) (.664)	17.176 17.051	.67622 .67124	(.676) (.671)
ROOT (CORE)	15.864 15.739	.62457 .61964	(.625) (.620)	16.201 16.076	.63783 .63291	(.638) (.633)

Aeronautic spark plug



New leaf points

tests, and the Division recommends that this be specified as ⅜ in. both ways for commercial vehicles, as shown in the accompanying drawing. The tolerances now specified for eye bushings and bolts are considered too close for practical application, and it is recommended that they be opened up to within commercial limits as follows: Bushed eyes—plus 0.001, minus 0.003; bolts for bushed eyes—minus 0.005, minus 0.008; unbushed eyes—plus 0.001, minus, 0.004; ground bolts for unbushed eyes—minus 0.006, minus 0.009; bolts of hot rolled stocks (not ground) for unbushed eyes—diameter minus 0.004, for maximum so as to use standard reamers.

An attempt was made to refer the recommendation regarding tolerances for spring parallelism back to the committee, but the motion was lost.

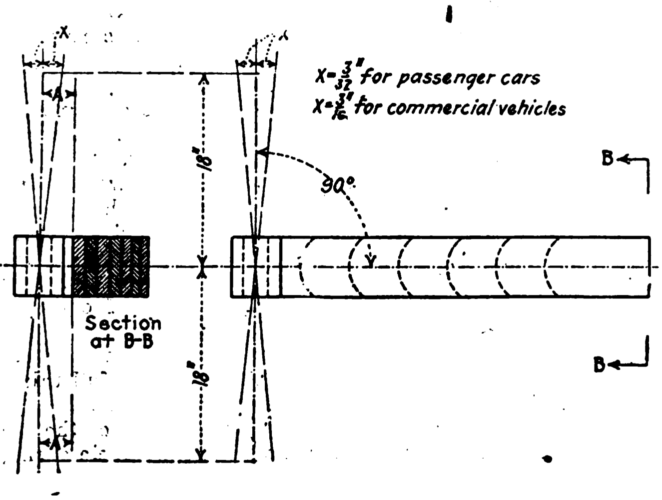
The Division also recommended that a paragraph in the S. A. E. Handbook reading, "The second leaf should not be wrapped around the eyes of passenger car springs," should be omitted. The effect of this is to broaden the provision of double wrapping, making it applicable to all kinds of springs.

In connection with the width of spring ends it was recommended that the tolerance be changed to 0.005 in. for passenger cars and 0.010 in. for commercial vehicles. In connection with frame brackets, the passage in the Handbook relating to this is to be extended to read: "the distance between the ears of bracket hoods should be 0.010 in. greater than the finished width of the spring eyes, with a minus tolerance of 0 and a plus tolerance of 0.005 in. for passenger cars. For commercial vehicles the minus tolerance should be 0 and the plus tolerance 0.010 in." A note is to be added to an item on rebound slips, spacers and bolts in the Handbook to the effect that "clearance between the rebound clip bolts (or spacer tubes if used) and spring plates shall not exceed 3/32 in. for passenger cars and 3/16 in. for commercial vehicles."

Recommended Spring Sizes

Two tables were given in the report, of spring widths and lengths, eye and clip diameters, for passenger cars and commercial vehicles respectively. It was stated in the report that these tables had been carefully reviewed and were in close accord with current practice. In the tables as originally formulated a definite spring width was given for each weight of passenger car and each capacity of commercial vehicle, but the Division in making its report revised these figures so as to give a certain leeway to the designer. The tables in the revised form are reproduced herewith.

All other matters in the report, including spring clips for passenger cars, spring bolts for passenger cars, spring bolts for commercial vehicles, spring pins for commercial vehicles



Passenger Car Springs

Shipping Weight of Car in Lbs.	Location	Approx. Load per Spring (With Passengers), Lbs.	Recommended Spring Length, In.	Spring Width, Inches	Eye Diameter (See Notes)	Spring Clip Diameter, Inches (Alloy Steel)
Under 2500	Front		38	1¾	[illegible]	½
	Rear		52	1¾–2	[illegible]	7/16
2500 to 3000	Front		40	1¾–2	[illegible]	9/16
	Rear		54	2	[illegible]	9/16
3000 to 3600	Front		40	2	[illegible]	[illegible]
	Rear		56	2 –2¼	[illegible]	[illegible]
3600 to 4200	Front		42	2 –2¼	[illegible]	[illegible]
	Rear		58	2¼–2½	[illegible]	11/16

The third sentence of the notes in the data sheet should be omitted and the following note added: "Heat-treated alloy steel spring clips shall be used in all cases.

Commercial Vehicle Springs

Capacity, Tons	Location	Spring Width (Inches)	Min. Length of Spring, Inches	Eye Diam. (See Notes)	Spring Clip Diam. (Alloy Steel): Spring Set on Axle	Spring Clip Diam. (Alloy Steel): Spring Underslung
¾	Front	2 –2½	40	¾	[illegible]	¾
	Rear	2 –2½	50	[illegible]	[illegible]	[illegible]
1	Front	2 –2½	40	[illegible]	[illegible]	[illegible]
	Rear	2¼–2¾	50	1	[illegible]	[illegible]
1½	Front	2¼–2¾	42	¾	[illegible]	[illegible]
	Rear	2½–3	54	1	[illegible]	1
2	Front	2¼–2½	42	¾	[illegible]	⅞
	Rear	3	54	1⅛	[illegible]	1
3½	Front	2½–3	44	⅞	[illegible]	1
	Rear	3 –4	56	1¼	1	1⅛
5	Front	3	44	⅞	⅞	1
	Rear	4 or 5	56	1¼ or flat end	1	1⅛
7	Front	3	46	1	1	1⅛
	Rear	5	58	1¼ or flat end	1⅛	1¼

The column "Capacity, Tons," is intended only to indicate the general truck capacities on which the corresponding usual spring sizes are used. The above table applies to all types of drives.

Heat-treated alloy steel spring clips shall be used in all cases.

and methods of greasing and oiling spring bolts were not in a form to be acted upon. With the exception of these items the report was accepted by the committee.

Quite an extensive report was made by the Tire and Rim Division, which was read by C. B. Whittelsey. According to this report, it was considered desirable to establish a definite S. A. E. standard list of solid tire sizes toward which all manufacturers could work. It was felt that such a list would also be of material value to the wheel builders as represented by the Automotive Wood Wheel Manufacturers Association. The new list contains the following sizes (together with the equivalent metric sizes): 32x3½, 36x3½, 32x4, 36x4, 36x5, 40x5, 36x6, 40x6, 36x7, 40x7, 36x8, 36x10, 40x10, 40x12 and 40x14.

Solid Tire Cross Section

Some work has also been done on solid tire sections. The first intention was to standardize the sections and contours for solid tires, but as this would tend to limit design the Division recommended that the minimum total cross sectional area of rubber on standard bands for commercial vehicles be as shown in the accompanying table, which is in accord with the schedule worked out and adopted by the Solid Tire Division of the War Service Committee of the Rubber Industry. These areas include the hard and soft rubber used in solid tires.

The recommended minimum cross sectional areas for different widths of solid tires are as follows: 3½ in., 6.75 sq. in.; 4 in., 7.75 sq. in.; 5 in., 10.75 sq. in.; 6 in., 13.75 sq. in.; 7 in., 16.75 sq. in.; 8 in., 19.75 sq. in.; 10 in., 25.75 sq. in.; 12 in., 31.75 sq. in.; 14 in., 37.75 sq. in.

Another recommendation concerned industrial truck tires. Investigation showed that there was little uniformity in the present practice, and after a careful consideration the Division recommended sizes of industrial truck tires and wheels as given in the table on page 311.

Wood Felloe Dimensions—Pneumatic Tire Rims

At a previous meeting the Society adopted dimensions for 6. 7 and 8 in. rims. To complete this specification, dimensions for 3½, 4 and 4½ in. rims were recommended as follows

Industrial Truck Tires

Tire Dimensions		Wheel Dimensions	
Nominal Diameter, In.	Sectional Widths, In.	Wheel Diameter, In.	Widths of Felloes, In.
10	3½	6	2¾
10	5	6	4¼
16	3½	12	2¾
16	5	12	4¼
20	3½	16	2¾
20	5	16	4¼
24	3½	20	2¾
28	3½	24	2¾

"Wheel diameters shall be 4 in. less than the nominal tire diameters. The height of the finished tire is to be 2 in. for all sizes. The width of the wheel felloe is to be in accordance with the present S. A. E. standard truck tire practice and the rim diameter tolerances will be plus 0.005, minus zero." The acceptance of this recommendation will make all the former or present S. A. E. standards for industrial truck tire sizes null and void.

(these felloe band dimensions conforming with those adopted by the Automotive Wood Wheel Manufacturers Association):

Nominal Tire and Rim Size	Width	Depth
30x3½	1¼	1¼ (+1/16, −0)
32x3½	1¼	1¼ (+1/16, −0)
33x4	1½	1¼ (+1/16, −0)
34x4½	*2 †2¼	1¼ (+1/16, −0)

*Width of felloes for rims with special sections.
†Width of felloes for demountable rims on cold-rolled bands.

Two regular tire sizes for motorcycle wheels were recommended, viz., 26x2¼ and 28x3, and one oversize, 29x3½. Specifications are also given for the dimensions and location of the valve hole in automobile rims.

Nominal Tire Size		Oversize Tire		Tire Seat, Diameter of Rim		Type of Rim
In.	Mm.	In.	Mm.	In.	Mm.	
26x2¼	60/535	None	None	21	535	BB
28x3	75/560	29x3½	90/560	22	560	CC

It has been found that the present specification with regard to edges of felloe bands, which call for a 1/16 in. radius on the outside edges and 3/16 in. on the inside edges of the bands are not acceptable to the steel mills, and the Division therefore recommended that the radius of all edges be changed to 3/32 in.

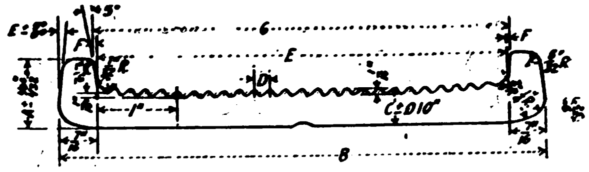
In connection with allowable tolerances for felloe bands the Division recommended that the wording be changed as follows: "Band circumferences after application to wood wheels and circumferences of steel wheels." On account of the difficulty of inspecting circumferences with a tape to the present close tolerances, the Division recommended that the tolerances for "band circumferences before application" be changed to prevailing commercial tolerances of plus 1/32 minus 1/16 in.

Base Bands for Solid Tires

A proposed standard for base bands for solid tires was also submitted. These dimensions conform to the recommended series of solid tire sizes and are in accordance with the base bands recommended and adopted by the War Service Committee of the Rubber Industry. The recommended bands relate to corrugated milled sections and it is optional with tire manufacturers to use either milled corrugated or dovetail facings, as the same general dimensions apply to bands with either facing.

The sections of tires and base bands as recommended for solid tires for trucks are also to apply to industrial truck wheels, and it is recommended that the S. A. E. adopt standard 3½ and 5 in. pressed-on channel sections for industrial truck wheels.

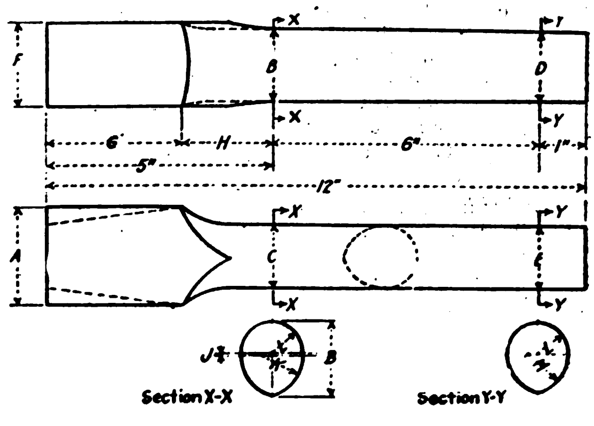
There was some rather animated discussion in connection with parts of this report. Thus, J. E. Hale objected to that



Base Band Size	A	B	Limits of B	C	Corrugations No.	D	E	G	F
3½	¾	4¼	±1/32	11/32	18	0.191	3 7/16	3 9/16	1/16
4	25/32	4 11/16	±1/32	⅜	20	0.196	3 59/64	4 1/16	3/32
5	27/32	5⅝	±1/32	7/16	26	0.189	4 59/64	5 1/16	3/32
6	27/32	6⅝	±1/32	7/16	32	0 185	5 59/64	6 1/16	3/32
7	27/32	7⅝	±1/32	7/16	36	0.192	6 59/64	7 1/16	3/32
8	⅞	8⅝	±3/64	7/16	40	0 196	7 27/32	8	5/64
10	⅞	10⅝	±3/64	7/16	50	0.196	9 27/32	10	5/64
12	⅞	12⅝	±3/64	7/16	60	0.197	11 27/32	12	5/64
14	⅞	14⅝	±3/64	7/16	70	0.197	13 27/32	14	5/64

part of the recommendation regarding base bands for solid tires which says that it is optional with tire manufacturers to use either mill corrugated or dovetail facings. Mr. Hale said that this would make a dual standard, which would be objectionable. He recommended the adoption of the corrugated facing as standard and said that it was the recommendation of the War Service Committee of the Rubber Industry that this should be the ultimate standard. Mr. Hale received no support on this recommendation, however, and another recommendation made by him, to modify the radii at the corners of the bands, also just failed of adoption when submitted to a rising vote. From another source a recommendation was made that, since there were some objections to the adoption of the base bands recommended, the whole matter should be returned to the Division for further consideration, but this was strenuously objected to by members of the Division and was voted down. A motion to refer the recommendation regarding wood spokes for passenger car wheels back to the Division was also lost, and the whole report of the Tire and Rim Division was adopted.

The last item in the report of the Tire and Rim Division related to wood spokes for passenger car wheels. The dimensions for these spokes are given in the table below.



Wood spokes—passenger car wheels

Nominal Spoke Size	A	B	C	D	E	F	G	H	L	J	K	M
1¼	See	1 13/16	1 3/16	1 13/16	1 3/16	1⅝	2¼	2¼	[illegible]	[illegible]	[illegible]	[illegible]
1⅜	Note	1¼	1¼	1 [illegible]	1¼	1⅝	2¼	2¼	[illegible]	[illegible]	[illegible]	[illegible]
1½	Below	1⅜	1⅜	1 3/16	1⅜	1⅞	3	2	[illegible]	[illegible]	[illegible]	[illegible]
1⅝		1 13/16	1 13/16	1⅝	1 13/16	2⅛	3	2	[illegible]	[illegible]	1⅛	1 1/16

Notes.—Sizes for A for each nominal size spoke are: 2, 2⅛, 2¼, 2⅜, 2½, 2⅝, 2¾, 2⅞ and 3.

Spoke numbers may be obtained by combining nominal size whole numbers; numerator of nominal size fraction; denominator of nominal size fraction; and number indicating number of eighths of an inch dimension A is over 2 inches. Thus: A 1½-inch spoke when A is equal to 2⅞ inches would be 1127.

All dimensions are for green sizes.

Principles of the Wheeled Farm Tractor*

Factors Determining the Maximum Traction Obtainable — Results of Experiments to Ascertain Rolling Resistance — Operating Efficiency and the Most Suitable Size of Machine

By Edward R. Hewitt
Consulting Engineer, International Motor Co.

THE hydrocarbon engine has in recent years placed us in possession of a light source of power for the purposes of farm traction. It is easily controlled and operated by one man. This has given the farm tractor problem quite a different position from that which it occupied when steam was the only method of propulsion. Although it was possible to make a one-man steam machine, this was not usually done, and the steam plant always had so many disadvantages in starting, use of water, leaking connections, etc., that its extended use was not to be expected.

Given a light source of power occupying comparatively small space, a tractor can take almost any form and yet do some work. While there is certainly vast latitude in design, and many different forms accomplish the purpose equally well, the fundamental principles governing the problem lay down certain postulates which must be followed if we are to reach any reasonable degree of engineering efficiency. It is to the study of these principles that I wish to draw attention, as their neglect has caused tremendous financial losses to both the manufacturers and the public. I will take up the problems, beginning, as we may say, from the ground and giving the results I have reached from my personal observation.

Friction of Wheel Upon Ground

A series of laboratory tests on full-sized wheels, which checked very well with work on the machine in the open, resulted in the following conclusions:

(1) The maximum drawbar pull is a definite function of the weight per inch of width. Weights used varied from 10 to 200 lb. per in.; the ratio of maximum possible drawbar pull to total weight on the wheel was constant for that range. This was found to be true whether the ground was wet or dry.

(2) On sandy ground the drawbar pull available with a smooth metal wheel is about 30 per cent of the weight on the wheel.

(3) On damp, sandy ground the maximum drawbar pull is greater, being about 43 per cent of the weight, and under some conditions even slightly higher.

(4) Cleats increase the maximum drawbar pull only insofar as the soil resists shearing; that is, the cleat carries a section of the top soil and slides it against the soil below the edge of the cleat. Experiments indicated that this was practically independent of the depth of the cleat, depending solely on the shearing strength of the soil at the depth of the cleat edge. In some cases the shallower cleat pulled more than the deeper cleat because the roots in the sod were not cut off and advantage was taken of their shearing strength.

Action of Cleats

In some cases subsoil may be more tenacious than the top, but this is unusual. It might be supposed that when the top is sheared from the subsoil, the soil at the back of the wheel would support it if the section were deep to a greater extent than if it were shallow. This does not appear to be the case because of the lifting action of the back of the wheel which tends to eliminate the support. This is particularly noticeable on hills when the wheel is stressed to the limit. It was found that a cleat inclined forward at an angle would improve this condition somewhat. In going uphill the cleat enters the soil almost horizontally, acting like a step and tending to lift the weight off the wheel. On leaving, the cleat stands almost vertical and causes less friction and loss of power. An inclination of about 30 deg. was found to be the most satisfactory on a 6-ft. wheel. This arrangement tends to self-clean to a great extent. Setting the cleats at an angle of 30 deg. to the axis of the wheel also helps this cleaning effect by a slipping action. The shearing strength of the soils I tested appeared to vary from 5 lb. per in. of width in dry molding sand to 75 lb. in loam or sod. No doubt, tough sod or gumbo may prove even stronger than this.

From these facts it becomes evident that weight is the only means of obtaining a tractive effort of 40 per cent of the weight of the machine under bad conditions in dry ground or sand, as cleats will be of little use. Wheels 72 in. wide would give an added pull due to the use of cleats of only 360 lb. for loose ground. Weight is therefore practically the sole reliance for traction in sand or very dry loose ground. In sod or damp ground 72-in. wheels would ordinarily give 4000 to 5000 lb. pull from the cleats alone, and the light machine with only sufficient weight to hold the cleats down would show good results.

Certain observations in operating a tractor led me to believe that the rolling losses were greater than I had anticipated, and I began a study to determine the laws governing the subject.

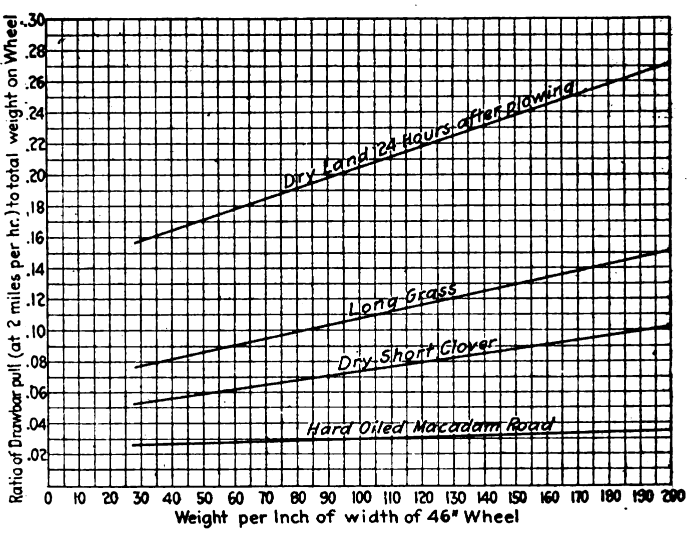


Fig. 1—Relation between weight per inch of wheel width and the ratio of drawbar pull to weight

*Read at the annual meeting of the Society of Automotive Engineers.

I took a watering cart having 46-in. wheels with 8-in. flat tires, and removed the tank, leaving only the stripped chassis. This was towed by a motor truck over several kinds of ground, and the drawbar pull was measured by spring scales. After this I replaced the body and filled it successively with various amounts of water to increase the load per inch of width on the wheels. Four types of ground surface were tested: (a) hard macadam road; (b) dry short clover; (c) sod long grass (gravelly loam); (d) dry plowed land, such as would ordinarily be harrowed, plowed 24 hours previously.

The drawbar pull was found to increase rapidly with the weight per inch of width on a regular curve on all but the hard macadam road, where the increase was only slight. This was to be expected, as the increase in pull is due to the work done in crushing the ground surface, or, in effect, continually pulling the wheel uphill. The limits selected for the tests were those under which a tractor can be built. The curve, Fig. 1, shows the ratio of the drawbar pull required for propulsion to weight plotted against wheel width in inches. The speed used was about 2 miles per hr. I could notice no marked difference in the pull from 1 to 3 miles. On some previous experiments I had observed that the rolling friction of wheels of various sizes varies inversely as their diameter, and I believe that this fact can be used with the chart as a basis for design. It would certainly be valuable to have these observations extended further to furnish a more certain basis for calculation. I have yet to see any precise data on this subject.

The value of these facts is obvious. If a tractor has too great weight per inch of width of wheel and gets on soft ground, as it must do in harrowing, etc., the power consumed in rolling friction becomes a large percentage of the total developed and the drawbar pull is proportionately decreased. There is every advantage in increasing the surface and reducing the weight. Tractors with a weight of over 200 lb. per in. of width of wheels that are even 6 ft. in diameter become very inefficient on soft ground. It is here that the "caterpillar" shows to best advantage, and if it were not for its complication and high maintenance cost, it might prove somewhat better than the wheel for many purposes. When properly proportioned, however, the wheeled machine can be made to give a very high efficiency, as I will show later on, and since wheels can be made to last the life of the machine without expense or renewal, their design is worthy of very careful study.

Weight on Wheels

Considering a four-wheel machine, with the rear wheels as drivers, it is evident that no matter what form of mechanism is used to apply the power to the wheels, the maximum drawbar pull multiplied by its lever arm ($P \times a$) cannot exceed the weight on the front wheels multiplied by a lever arm equal to the distance from the center of the front to the center of the rear wheel ($W \times b$), Fig. 2. The maximum pull which can be applied will be only that required to lift the front weight off the ground. If the machine is on a hill, this weight will be reduced as the cosine of the grade angle. In other words, when we apply power to the rear wheels we are in effect transferring part of the weight of the machine from the front to the rear wheels.

From the preceding curves it is easily seen that the increase in the weight on the rear wheels would increase the weight per inch, and so increase the rolling friction. In the first machine I designed this was very marked, as I increased the weight on the rear wheels 3500 lb. by applying full engine power, and increased the rolling friction from 20 to 25 per cent on plowed ground. The machine, therefore, did not show the drawbar pull it should from power developed by the engine. It took me several months to find the cause of the losses, and I was not absolutely certain until I had actually brake-tested the machine on the rear wheels under full power and found that the mechanical losses from the engine to the ground were only 16 per cent and did not increase materially with the lower gear ratios or increased power. Besides these serious frictional losses, very few machines in this country are proportioned in such a way that the full engine power can be applied on the low gear on any reasonable hill and not raise the front of the tractor off the ground. This interferes with the steering, and in many cases the tractor will turn over if the operator does not shut off the power. This is dangerous, and the full power of the tractor is not available. The utmost care should be exercised in having the weight on the front exactly right for the work it is desired to perform, and any failure here is inexcusable.

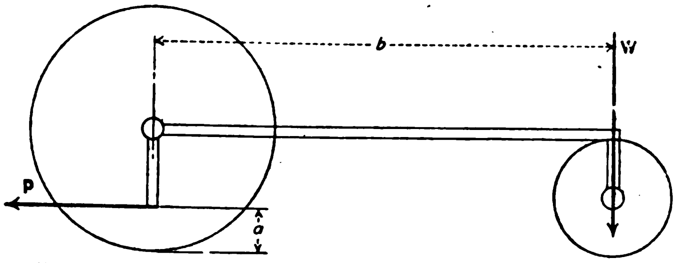


Fig. 2—Diagram of the relation between the maximum drawbar pull developed by a tractor and the weight on the wheels

If we consider a machine driving from the front wheels, the reverse is true, and the application of power decreases the weight on the drivers and reduces the possible drawbar pull which can be delivered with a given weight of tractor. This type is therefore inefficient and will eventually be abandoned. The rear drive type can be proportioned so that nearly all the weight of the front can be carried by the rear wheels when the full engine power is applied, leaving only enough weight for proper steering. This form will then develop the greatest possible pull for a given total weight.

Over-All Efficiency

By using anti-friction bearings, good lubrication and cut gears of good design, it is possible to reduce the frictional losses from the engine to the rim of the rear wheels to less than 16 per cent of the total power developed. I found on brake test of one machine that the losses with a gear reduction of 172:1 on third speed were not materially greater than the losses at 52:1 on the direct drive, where they proved to be 12.5 per cent. This is understood when we consider that we are only interposing two additional pairs of gears, the gears being well oiled and of ample size. As these gears are running in oil when the tractor is operating on the direct drive, they have under these conditions the friction of the oil in the box, which is very considerable, gearbox-oil friction with heavy oil being about 3 hp., and about 1½ hp. with light oil. To the mechanical losses must be added the rolling friction on the ground. As seen above, this may vary from 8 to 20 per cent with properly proportioned wheels.

In testing the engine on the brake I used a vacuum gage on the inlet pipe and noted the suction at various loads at the governed speed. When the engine was put on the tractor again I used this gage, which gave me the actual horsepower of the engine within a very small error, as the engine in both cases was operating at the same governed speed. A speedometer was employed that gave the feet of advance per minute of the tractor on each gear. A spring dynamometer was applied to the drawbar, giving the reading in pounds. It was a simple matter to multiply the pounds pull by the feet of advance per minute, get the delivered horsepower and compare it with the actual engine power. It was found that on good sod with short grass the efficiency of the machine was about 75 per cent, i. e., the drawbar horsepower divided by the engine horsepower was 0.75. On plowed ground, harrowing or cross-plowing, it was about 65 per cent, and never fell below that figure. When we consider the low efficiency of touring cars and trucks this seems a very satisfactory result on soft ground, and one which the engineer would scarcely expect to exceed.

The internal-combustion engine of conventional type has one serious drawback: if it is overloaded it stops at once, unless it is operating at a speed such that it is beyond its

maximum torque point, and slowing down allows the torque to increase. In this case the normal load of the engine can be slightly increased at the expense of the speed. These being operating conditions, it is evident that on a tractor the engine must be regularly operated below full load, or a specially hard pull on the plows or a slight hill will cause it to stop or necessitate a change of gears. It is therefore the usual practice to gear tractors in such a way that the engine is operated only at a small percentage of full load, say 40 or 50 per cent. This provides the safety factor for overloads and for defective oiling and cooling, as the overloads may prove to be of short duration. The curves, Fig. 3, taken as an average of tests made during several years in my own laboratory of a number of good engines, show the best fuel economy at various percentages of full load, all tests being made at the constant speed of 1000 r.p.m. The lower curve shows the best fuel economy I have yet obtained when operating conditions were at their best. The curve marked 1 may be taken to represent ordinary practice in commercial tractors. As we cannot operate continuously at full load and best economy, it is interesting to see just how far below this point we can go before the increase in fuel becomes very marked. It will be noted that we should not go below 60 per cent on an ordinary engine, while on the best ones under good conditions a fuel economy of 0.66 lb. per hp.-hr. can be obtained at 50 per cent load. Tractor engines should not be used below this point over long periods. Another point to be noted is the absolute necessity of having the engine oiled and cooled so that it can run all the time at 50 per cent to full load if we are to secure good fuel economy. A tractor, however, should work at certain specified speeds for best results on the tools used, and the pull of these tools will vary as much as 100 per cent in the same field, not to mention hills and variations of rolling resistance.

How, then, are we to get good fuel economy with two changes of gears? In my original machine I had three speeds. The high speed was reversed for road use and could not be used in the field, leaving only two speeds for actual work. I have been obliged to adopt four speeds so as to have three available speeds for field work. These are respectively 1, 2 and 3 miles per hr. at 1000 revolutions of the engine. The latter is governed to 1200 r.p.m. In this way it can be used under the proper load conditions all the time for best economy.

Suction Gage as Load Indicator

I used a suction gage on the inlet pipe as an indicator of the engine load, and have this marked so that the driver knows that it should not read over 8 in. of mercury suction, which is 50 per cent load. This point was selected as the minimum load under which the engine will operate economically. If the suction rises above this point,

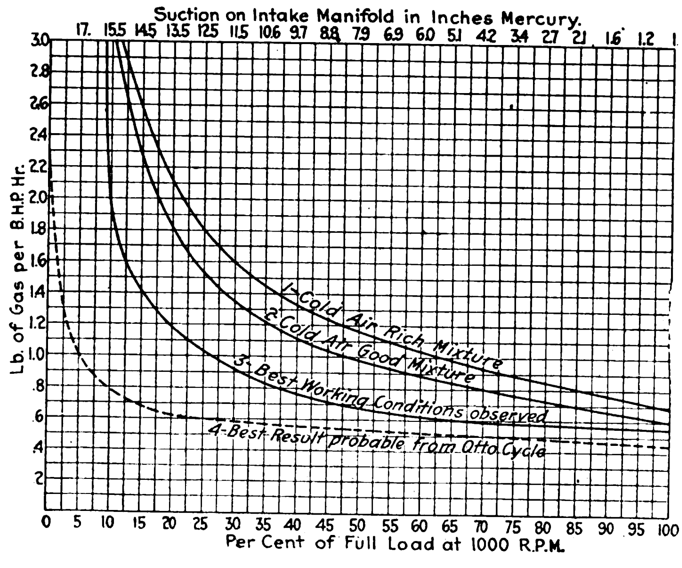


Fig. 3—Fuel economy at various percentages of load averaged from a number of tests

the driver should shift to a higher gear and load up the engine further. This is just the opposite of touring car practice, where we shift gears because the engine is overloaded and needs relief. On the tractor the heavier the load the better the fuel economy will be and the better the financial result, provided the engine is able to stand this load. We must build engines capable of holding their full power, and a cooling system that will keep them within reasonable ranges of temperature under all conditions, if we are to secure economical operation.

The size of the machine is a subject of supreme importance, and I am in the unfortunate position of being obliged to differ with the general opinion that the small tractor is the future economical unit.

The expense of operating may be divided into the three main headings of operator's wages, fuel and oil, and maintenance charges.

Considerations Affecting Size

The driver on the small machine is paid as much as on the large. The maintenance charges for actual repairs on the larger machine, if properly constructed, are not materially greater than on the small machine. The only difference here will be in the interest and depreciation items. The cost of fuel and oil will prove to be the main difference in expense. This, however, is much lower per acre on the large unit than on the small; therefore, the operating expense per acre on the large machine will be less than on the small machine, primarily because the driver's wages will prove to be at least one-third of the whole cost.

The evident answer to the question of how large the machine should be made is: as large as one man can operate easily and as large as can be run on the roads and pass through gateways and over bridges. I consider that a width of 9 ft. over all on the wheels is the outside limit in practice, and a total operating weight of 14,000 to 16,000 lb. With this weight eight plows can readily be operated, plowing at the rate of 2.8 acres per hr. This would seem to be about the practical limit for a one-man machine. The two-plow machine, on the same basis, would do 0.7 acre per hr. These figures are for the regular progress of the machine over the ground, making no allowance for delays and turns. In factory practice, with automatic machinery, it is found difficult to get more than 80 per cent of the best possible output of the machinery, and this is true when all the oiling and repairing are done outside of working hours and the operators have skilled superintendence.

How much lower ought we to expect the percentage of time in operation to be on a tractor subject to delays for oiling, filling and adjustments, not only of the machine, but of the plows and tools, stopping for corners and turns, shifting gears, etc.? An output of 60 per cent of the theoretical would be very good indeed, and I fear that it often proves to be very much lower. If we take 50 per cent of 7 acres for a day's work we get 3½ acres on an average, and this is more than is usually obtained over any long period with the two-plow machine.

Limit of One-Man Tractor

At the present time there are no eight-bottom tractor plows on the market which can be worked satisfactorily from the tractor by one man. I have made a set for my machine which works fairly well, but it will be some years before these devices can be perfected. Four-bottom plows are now to be had which with a few changes can be made to work fairly well from the tractor. It is probable that at the present time, taking into consideration all the facts of economy, first cost and ease of operation, the four-plow machine is the best suited to build. This is especially true when we consider that it is possible to design a four-plow machine with substantially no side draft and operated with the tractor wheels of ample size running on the unplowed ground.

I have just had the opportunity of getting figures from three of the best standard makes of machines working in Orange County, New York, on difficult land. They were operated for a whole season by a township committee. The

machines have averaged about an acre a day each during the season. The same money invested in horses would have done more and a larger variety of work. The cost per acre has been much greater than with horses, and the three machines all need rebuilding at considerable expense. With a capacity of 20 to 30 acres a day, we have a good chance to get 10 or 15 acres regularly. In my view, it is not the first cost of the whole outfit that will be the deciding factor, but the investment per acre worked per year. If the large and more expensive machine will do the work more cheaply, and at the same time show a lower investment per acre, it will be the one to survive in the long run. Small machines are advertised to pull mowing machines, reapers, cultivators, etc. It seems rather a step backward to be pulling these machines by a means costing at the lowest estimate from $5 to $8 a day to operate, when we can do it with horses at not over $4 to $4.50; or to be running a thresher and silo cutter with a machine costing between $900 and $1,500, when we can do the same work with a stationary engine costing between $200 and $300; while the tractor could be plowing and doing expensive work on the farm. My view is that the small tractor is rarely needed at all for the small farm. On any farm up to 100 acres the work can be done with horses more cheaply and better, especially if the farmer uses the right crop rotation and carries enough live stock. The small tractor would only be a source of expense, as he would certainly have to keep horses as well. The tractor should have at least 200 acres to cover a year, and better still, 500 or 1000. On this large output a skilled man can be employed and the machine properly worked. The tractor and farm tools that the farmer will have available for some years to come are certain to be the kind of machinery that should not be placed in the hands of the untrained.

In closing I would like to add a word as to what can be expected in the future as to the maintenance and durability of good tractors.

A motor-truck designing experience of twelve years has taught me that a well-made, properly designed gearbox and clutch will last from five to ten years with no repairs, and I see no reason why we should not expect even better results on tractors if we proportion the loads properly, especially as the tractor will not operate more than 120 days a year. The wheels on my machine show no wear after two years' work, and I am sure they will last the life of the machine, with the possible renewal of cleats every four or five years. The frame, riveting and steering-gear can be made absolutely durable. The two places in which we will have excessive wear are on the final drive to the rear wheels and on the engine. The main drive to the wheels is not durable on any machines I have seen. On my own it has lasted two years and requires renewal. It will be replaced with a drive of better proportion and materials, and better protection from dirt; I hope to get four years out of it at least. This can no doubt be further improved. On the engine the main source of wear is the dust in the cylinders. Even with a fine muslin dust filter 8 sq. ft. in area the pistons and rings were badly worn in 100 days' running. A perfect air cleaner is an absolute necessity for tractors. Those I have seen advertised thus far are all of types which will not really remove the finest particles of dust, which do the actual damage to the engine, and they cannot eliminate the trouble. If we succeed in protecting the engine from dirt, there is no reason why we cannot get ten years' service out of it with a regular overhaul every year or two. I know of motor-truck engines in operation to-day which have been in constant use for over ten years, and I firmly believe we shall make a tractor in the near future with a very low maintenance cost and a very low operating cost per acre. I believe we may hope to plow for about 60 cents per acre, on good land, this including all charges, as against $3 to $4.50 with horses. If this is accomplished, the tractor engineer will have done his bit toward solving the food problem.

Sidelights on Oil Refinery Practice*

A Discussion of Four Possible Methods of Increasing the Supply of Fuels Available for Use in Present Types of Automotive Engines

By E. W. Dean
Bureau of Mines

THE several most important ways in which the petroleum refining industry can increase the output of gasoline from a given quantity of crude oil may be listed as follows:†

(1) Universal adoption of a high "endpoint" or upper volatility limit for gasoline
(2) General use of more efficient distillation methods and equipment
(3) Recovery of gasoline now lost in refinery operations
(4) Wider use of cracking processes

There are considerable differences in the grades of gasoline marketed throughout the country by different refineries and sometimes at different times by the same refinery. A notable point of variation is the upper volatility limit, or "endpoint." In the days when gasoline was simply a by-product of the refining industry, the endpoint figure was approximately 150 deg. Cent. (302 deg. Fahr.). This type of gasoline is now practically extinct, and the so-called "high-test" engine fuel now marketed in relatively small quantities has an endpoint of approximately 175 deg. Cent. (347 deg. Fahr.). The usual grades of gasoline are represented by endpoint figures between the limits of 200 deg. Cent. (392 deg. Fahr.) and 230 deg. Cent. (446 deg. Fahr.).

The fact that gasoline of as high endpoint as 230 deg. Cent. (446 deg. Fahr.) is being used in tremendous quantity and with satisfactory results renders it desirable to consider the possible increase in engine fuel supply if this upper volatility limit were universally maintained.‡ The Bureau cannot at present go on record as either advocating or op-

*Read at the annual meeting of the Society of Automotive Engineers. Published by permission of the Director of the Bureau of Mines.

†One other possibility might be mentioned: the refining of crude petroleum now marketed as fuel oil without removing its naphtha content. The Bureau has not, however, succeeded in uncovering statistical evidence indicating that developments in this line could augment production by a maximum of more than 3 to 5 per cent of the quantity of gasoline now refined.

‡In this connection it is interesting to note the probable increase that would result if the endpoint universally adopted were sufficiently high to include the fractions of petroleum now marketed as kerosene. Bureau of Mines refinery statistics for the calendar year 1917 show that about 20 per cent of the crude petroleum refined was marketed as gasoline, and about 11 per cent as kerosene. If, therefore, the endpoint selected were high enough to include both of these fractions, instead of stopping with a figure representative of the "heavy" engine gasolines of to-day, the resulting increase in supply would be 55 per cent, instead of 15 to 20 per cent. Wherefore, it appears that even the long-sought kerosene consuming engine is not going to keep the automotive industry on "easy street" for many years.

posing such a standard, but is simply discussing what might be accomplished in the way of increased gasoline production if it were adopted. The present estimate, based on miscellaneous data at hand, is that from 15 to 20 per cent more gasoline would be available if a universal endpoint equivalent to that of the "heaviest" grade at present marketed in quantity should be maintained.

The possibility of such a standard is, incidentally, dependent upon either a considerably increased production of casinghead gasoline or the development of engines that can utilize liquid fuel having smaller properties of volatile constituents than the types now marketed. The high endpoint gasoline now marketed is almost invariably of the blended casinghead type.

The distillation methods employed by petroleum refineries do not operate with the same degree of efficiency that is attained in some other industries. Certain percentages of hydrocarbons boiling below the accepted upper temperature limit for gasoline are always present in kerosene or fuel oil. This does not necessarily discredit the technical ability of refiners, many of whom are maintaining as high a degree of distillation efficiency as is profitable under present commercial conditions. There is no doubt, however, as to the possibility of augmenting the gasoline supply through an increase in the average distillation efficiency of refineries, and it is important to estimate the order of magnitude of the probable gain.

Here again exact data are lacking, and reliance has been placed on miscellaneous indirect evidence. The probability seems to be that efficiency in gasoline recovery varies in different refineries between the limits of 75 and 95 per cent. The latter figure is probably about the maximum that can be economically attained, and the average is undoubtedly not lower than half way between the limits. It is, therefore, improbable that the nation's supply of gasoline will be increased more than about 10 per cent through advances in the technique of large scale petroleum distillation.

Recovery of Gasoline Lost at Present

Bureau of Mines refinery statistics for 1917 and for the first seven months of 1918§ show that an average of about 4 per cent of the crude oil treated was lost in the course of refinery operations. Part of this loss was, of course, inevitable, but part represented gasoline that escaped with refinery gases. Recovery of this gasoline could have been effected by the use of methods and equipment similar to those employed for the production of casinghead gasoline. Such processes are already successfully operating, and there is no reason to doubt that the extraction of gasoline from refinery gases will eventually become a general practice.

Assuming that half of refinery losses are preventable in this way, it appears that gasoline amounting to about 2 per cent of the crude oil refined and about 10 per cent of the gasoline produced could be added to the supply of motor fuel.

The wider use of cracking processes is without doubt the most promising means by which refiners can increase their output of gasoline from a given amount of crude petroleum.

In a paper presented before this Society about a year ago,|| the author ventured to state an opinion to the effect that if cracking processes were employed to the full extent of their applicability, the total production of gasoline from the quantity of crude oil now produced might be doubled. This statement is one that indicates considerable optimism for the future of the cracking art, and the Bureau has been agreeably surprised at its failure to arouse controversy. To prevent any future misinterpretation, it is perhaps best to make clear the fact that this statement implies a possibility, the commercial feasibility of which is yet to be demonstrated.

The future of cracking processes may be affected by the development of unfavorable conditions of various sorts. Two in particular deserve mention in the present connection.

Up to date, the development of the art of cracking has been far from complete, in spite of the considerable attention that has been given to this line of technical operation. Only one process, that of Burton, is to-day a real commercial factor in the production of motor fuel, and this is representative of a type that seems to involve certain inherent limitations in applicability. If the cracking reaction is to be applied to the extent necessary for a doubled gasoline production, other types of processes must be put into successful commercial operation, or the present apparent limitations of the class in which the Burton process belongs must be obviated. The Bureau of Mines is optimistic regarding the future commercial success of several other processes, but believes it is only fair to state that such success is not known to have been attained, as yet, in any large measure.

A second development that may restrict cracking operations is the existence of an unfavorable ratio between the market prices of gasoline and fuel oil. The production of cracked gasoline necessitates the consumption of fuel oil, and, if the demand for the latter commodity exceeds the supply, its price is bound to rise and the margin of profit of cracking processes wiped out. It is an open question as to whether or not the consumption of fuel oil can ever be reduced sufficiently to permit doubling the production of gasoline by the use of cracking processes. The Bureau of Mines cannot venture any prediction in this line, except that the price of gasoline is likely to exceed the present level before cracking processes will be employed to the extent indicated.

Summary

The estimates included in the present series apparently indicate that the refiner may be able to augment his production of gasoline from a given amount of crude petroleum by from 35 to 40 per cent, exclusive of the gains possible through wider application of the cracking reaction. Some of the possibilities, however, overlap each other, and a more probable summation estimate is 25 to 30 per cent. The Bureau believes that, if commercial developments are favorable, the wider use of cracking processes may permit of further increases up to a possible additional 100 per cent. No prediction, however, is ventured as to what part of this figure will actually be attained.

It may be mentioned, also, that the development of engines capable of utilizing the combined gasoline and kerosene fractions of crude petroleum would not be likely to alter the limit of maximum increase, but would materially hasten the day when it would be attained, and would, in considerable degree, help to keep the price of liquid fuel from ascending to painfully high altitudes.

The present paper may have produced the impression that the Bureau of Mines is not enthusiastic over the advantages to be gained by the development of a kerosene-consuming internal-combustion engine. Such is not the case, but it must be emphasized that this is not the only line along which the automotive industry must work.

In preparing the present paper, the author has made extensive use of statistical information collected by H. F. Mason of the Bureau of Mines. The evidence upon which estimates are based has been reviewed with H. H. Hill, J. P. Smootz and E. E. Lyder of the chemical staff of the Bureau of Mines, Petroleum Division, and the figures given have been agreed upon as most probable.

A RATHER dismal picture of the immediate outlook for the French automobile industry is painted by Charles Faroux in *La Vie Automobile*, which after more than four years' suspension has just resumed publication. Mr. Faroux says that the automobile factories have no stock under way, it is very difficult for them to obtain their raw materials, the labor situation presents problems of a most disquieting nature, and a terrible competition has to be faced not only from foreign countries but in France itself. By the latter statement Mr. Faroux makes reference to the tens of thousands of passenger cars which have been in use by the army and which are to be disposed of at public auction. He makes the suggestion that these army vehicles should be overhauled by their manufacturers and that the difference between the price realized on them at public auction and the sum demanded by the war department should be divided between the State and maker.

§Senate Document No. 280, Sixty-fifth Congress, second session Letter from the Director of the Bureau of Mines, entitled "Production of Crude Oil," Sept. 24, 1918.

||E. W. Dean, "Fuel for Automotive Apparatus," *Journal of the Society of Automotive Engineers*, vol. 2, No. 1 (January, 1918), pages 47 to 53.

Possible Effect of Aircraft Experience on Automobile Practice

Three Leading Engineers Give Their Views

Howard Marmon says: *Order of importance of desirable features is entirely different in automobile and aircraft engines and main effect of aircraft experience will be improvement of shop practice.*

O. E. Hunt says: *Aircraft experience has increased respect for good metallurgical practice, giving the manufacturers a new conception of the value of high grade workmanship and of the small margin of cost over the ordinary.*

Henry M. Crane says: *There will be a continual beneficial interchange of information between the two lines of engineering, but their practices will diverge rather than approach.*

Plane and Automobile Engines Compared*

By Howard C. Marmon

IN physical construction the four-stroke cycle airplane and the automobile engine are identical. From the delivery of the fuel to the carbureter to the delivery of the power generated at the crankshaft end, the processes are the same. An automobile engine could be made to fly an airplane, and an airplane engine or a replica of it on a reduced scale to bring the power within usable limit could be made to operate an automobile. A long series of disappointments has emphasized to all of us the fact that any aggregation of parts assembled to obtain a mechanical result is a series of compromises, and the relative importance of the objectives governs the nature of the compromise.

Controlling Factors in Design

The major objectives that govern the compromises to be made in the design of airplane or automobile engines are roughly as follows in approximate relative importance. We are considering the airplane engines that have been developed for use in warfare. They must have

(1) Reliability
(2) Small weight per horsepower
(3) Economy in fuel and oil consumption
(4) Carburetion that permits easy starting and maximum power through a range of 30 per cent of the speed range, and idling at one-quarter maximum speed without danger of stalling. In short—no great degree of flexibility is required.
(5) Ability to deliver full power through a small speed range without excessive vibration.
(6) Complete local cylinder cooling under conditions of high mean effective pressure.
(7) Compactness.

In general, it can be assumed that the airplane engine will receive expert attention daily; it will be operated on a homogeneous highly volatile fuel and be lubricated with good oils. Relatively little regard need be given to the expense involved in fabricating any part of the engine or in the original tooling-up. Further, a comparatively small part of its life will be spent at sea level and none in a dust-laden atmosphere.

The automobile engine must have

(1) Reliability
(2) Silence
(3) Carburetion that accomplishes proper and even firing in all cylinders under varying throttle conditions, through speeds covering more than 90 per cent of the speed range of the engine. In short—great flexibility. Economy is secondary to this requirement.
(4) Ability to deliver partial or full torque through its entire range of speed without vibration.
(5) Compactness
(6) Small weight per horsepower.

Difference in Service Conditions

In general, it can be assumed that the automobile engine will receive attention at infrequent intervals and then usually at the hands of an inexpert person. It will be operated on

*Read at the annual meeting of the Society of Automotive Engineers.

fuels of low volatility and lacking in uniformity, and varying grades of lubricating oils will be used. The cost of fabricating the parts and tooling-up must be kept in mind. Further, the engine must be designed to operate at higher speeds than is customary in airplane engines. Its entire operation is likely to be near sea level and often in a dust-laden atmosphere.

Reliability has been given as a prime requisite for both types of engine. It should be remembered that an automobile which has traveled 10,000 miles has had its engine running from 300 to 500 hr. This is considerably in excess of the normal life of an airplane engine in warfare. A typical two-seated airplane loaded with all its paraphernalia for reconnaissance work and the incidental fighting would, as it left the ground, have 20 per cent of its weight represented by bare engine and 15 per cent by fuel for a 3 or 4 hr. flight. These figures represent the extreme that has been attained in lowering the power-weight ratio and in fuel economy. A typical automobile carrying five pasengers and fuel for an 8 or 10 hr. run would have, not including flywheel, clutch and starter, less than 10 per cent of its weight in engine and 3 per cent in fuel.

In obtaining the greatest power output per pound of weight, it is necessary to get the greatest power output per cubic inch of piston displacement. In the airplane engine the most successful solution has resulted from the use of a compact combustion chamber, valves of ample size, large passages in the intake manifolds, carbureters designed especially for the engine speeds contemplated, and the highest practical compression pressures, bearing in mind that a fuel of high volatility is to be used and much of the operation is to be at reduced barometric pressures.

High Compression Cannot Be Used

The automobile engine will not equal the airplane engine in power per cubic inch piston displacement, as it must be carbureted for greater flexibility and not solely for maximum torque output through a comparatively limited range of speed. Two to four carbureters, as is usual on multi-cylinder airplane engines and which add to their maximum output, would not be welcomed on the automobile.

Nor can the automobile engine use a compression pressure as high as that of the airplane engine, which means that its power for a given displacement, output and fuel economy must be lower. The high compression pressures would be impracticable at the full load and low engine speeds required of the automobile engine, but not of the airplane engine.

The lower grade fuels commonly used in automobile engines are more troublesome under high compressions than the fuels customarily used in airplanes. It should also be remembered that the higher the compression ratio it is possible to use at ground level in an airplane the better the engine functions at altitude. At an elevation of about 15,000 ft. the compression pressure is reduced about 40 per cent.

Compact combustion chambers make valves in the head necessary. Mechanically the most efficient way yet devised to actuate these valves is the overhead camshaft and the use of abrupt cams. The gear train for operating the overhead camshaft from the crankshaft is rather complex and expensive, but by using proper materials can be made very light and durable.

Reduced Weight in Cylinder Construction

The greatest weight reduction in cylinder construction seems to be obtained in the steel cylinders with welded-on jackets, usually individual. All-steel cylinders are available only for valve-in-the-head engines. Steel cylinders have a particular advantage in that it is possible to get cooling water close to the interior walls of the combustion chamber and to the valve seats. This is of considerable help in connection with high mean effective pressures and tends to reduce carbonization. Steel cylinder walls can be made so thin that they will permit the bore of the cylinder to increase 0.010 to 0.012 in. during the explosion stroke without affecting the power output.

If the steel cylinder is the lightest and lends itself readily to the most effective way of producing power for a given displacement, why should it not be adopted for automobile use? For passenger car use its comparative excessive cost is the least of the objections. *Per se*, the steel cylinder wall offers no advantages over cast iron. In European aviation practice, notably in air-cooled engines, steel cylinders have been lined with cast-iron sleeves about 1/32 in. thick. In its best development, for ease of manufacture, least amount of water weight, and the best circulating water distribution, the steel cylinder is of the individual type. Individual cylinders in a passenger automobile are not desirable because of the increased over-all length consequent upon such a design, the multiplicity of water, gas and exhaust connections and valves in the head. With steel cylinders valves in the head may be operated by push-rods from a camshaft in the crankcase, as in the Benz aviation engine, but for automobiles the problems of enclosure against dust and proper lubrication of parts present difficulties that are not easily solved.

Faults of Overhead Camshaft

An attempt to operate the valves of a passenger automobile with the overhead camshaft would not be likely to succeed commercially. Not only would its comparative complexity over other methods of valve operation producing excellent results be against it, but, what is more important, no durable way of driving an overhead camshaft and all the accessories required on an automobile has yet been devised. It seems to be fundamental that a passenger car engine must operate with a total amount of noise that is, at the most, unobtrusive.

In addition to this, the cylinder walls would have to be thickened to a point where no spring from the explosion pressures would result in that constant source of trouble to the manufacturer, piston slaps. Some of the weight advantages would diminish with this change.

One of the greatest contributions to our knowledge of engine manufacture resulting from airplane engine production is the steel cylinder, and, strangely enough, probably the greatest application of steel cylinders will be on the large truck or the tractor engine. Here the noise is less important, as is also the fore-and-aft bulk. The unusual cooling advantages offered by the steel cylinder fit it particularly for heavy duty under the unfavorable conditions often required of the truck or tractor. The small relative mass of such cylinders is conducive to their staying in place without the loosening or fracture due to the excessive vibrations often encountered in such cases from causes other than engine operation.

Design of Crankshafts and Crankcases

In the design of an airplane engine crankshaft, the need of minimum weight per horsepower will govern. A material of high specific strength will be used, and empirical data will be employed in the design to avoid periodic vibrations in the narrow speed zones in which the engine operates. In the layout of the automobile crankshaft, it must be remembered that all periodic vibrations must be avoided from the lowest speed to speeds higher than those employed in the airplane engine. This results in designing for a certain stiffness, which would enable the use of material relatively inferior but still having sufficient strength. Hence the requirement of smooth operation under a greater variety of conditions makes it imposible to meet, in the automobile engine, the low weight factors of the airplane engine.

What may be termed the "tubular" type of crankcase is the lightest on a power-weight basis and presents the greatest opportunity for heat dispersion from bearings of any crankcase design yet offered, and is widely used in airplane engines. It is split on its horizontal axis, the upper portion carries one-half the crankshaft bearings and the lower portion the other half, and the two halves are bolted together with bolts going entirely through the case. The conventional automobile design in which the upper half of the crankcase, plus whatever bridgework reinforcement the cylinders offer, carries the entire crankshaft load; the lower half, being merely an oil container, is quite appreciably heavier. It will, however, in all probability be retained for automobile work on account of its greater accessibility and the greater ease with which corrections for wear can be made.

Total bearing loads and the effect of parts that apply these bearing loads will be greater in automobile than in airplane engines, as higher engine speeds must be provided for. The forces due to reciprocation of parts become greater in proportion to the horsepower output than in the airplane engine. The factor V^2 of the MV^2 equation increases more rapidly than the factor M can be reduced.

Higher mechanical efficiencies with their correspondingly greater horsepower output per cubic inch will be obtained from the airplane engine than from the automobile engine. The easy clearances on the pistons, the ample freedom given all the bearings, the gear trains, etc., that mark the assembly of the airplane engine produce a machine that responds and is ready for the hardest duty at the moment it is first "fired." Give the automobile engine this same mechanical freedom, and one of the prime requirements of automobile engines—silence—will be so lacking that the engine would be promptly condemned.

The need for economy of fuel and oil has been emphasized. It appears that any fairly conventional water-cooled engine, with a reasonably compact combustion chamber with cylinders sufficiently well cooled locally to permit good compression pressures, can reach ½ lb. of fuel per b.hp.-hr. over the speed and power ranges required. Over equivalent ranges, with proper allowances made for reduced compression ratios, automobile engines will compare very favorably. However, the requirements of great flexibility, sudden demands for idling, quick acceleration in crowded traffic conditions, present economy problems for which airplane engine history provides no parallel.

While the steel-cylindered airplane engine has been considered principally, it is not intended that the well-known aluminum jacket engines, and the Bugatti extraordinarily clever design using all cast iron above the crankcase, which engines produce much the same results when installed in an airplane, be overlooked. They have one advantage for automobile use not possessed by the steel-cylinder engine—more complete inclosure of valve operating parts. However, an analysis of all of them will show that the objectives aimed at have necessitated compromises as do other constructions.

An Airplane Engine in an Automobile

Let us now see what happens if we take any four-, six-, eight-, or twelve-cylinder aviation engine and make a faithful replica of it on a reduced scale so that its power output fits the needs of the particular car we wish to try it in. The engine will be heavier per horsepower than its prototype; cylinder walls will be as thick; crankcase walls will be as thick, as undoubtedly foundry practice dictated the thickness of the larger one; ignition, spark plugs, float chamber and many similar parts will weigh as much per cylinder as in the larger engine. The weights in pounds per horsepower will show a considerable increase. However, when installed in the car, and the usual flywheel, clutch, starting and lighting systems, tire pump and so on are added, it will weigh from one-half to two-thirds as much as engines employed in usual practice.

A trial of the car so equipped will show some extraordinary performances in speed and hill climbing when the original start for the hill is rapid. City driving under traffic conditions or heavy pulling at low speeds will demand a new carbureter and intake system to meet these conditions. This will seriously affect the conditions that made the first impressive performance. When satisfactory control of the engine has been established, noises demand attention. A general snugging up of parts helps, but a few noises remain that it is finally decided can be corrected only by a redesign, probably of the valve operating gear. All this affects the original performance adversely. After this has been done, certain conditions of operation will require an enlargement and stiffening of the crankshaft to eliminate an annoying periodic vibration. The result is an engine not a great deal lighter or more efficient than the one originally designed for the car.

Airplane Engine a Higher Type

The airplane engine is a more expertly engineered and better manufactured development of the internal-combustion engine than the automobile engine. It is, however, developed for a set of objectives different than those demanded in an automobile, and none of its major features can be directly grafted upon the motor car. It is true that a multitude of engineering minutiæ have been developed that are applicable to the motor car, but the total result in operating performance is small.

The greatest contribution from the airplane engine to the motor car industry has come through the builder of the engines. He has shown that, given a definite set of specifications and a definite request for results, engines will leave his factory with absolute assurance as to what they can do. Some of the optimists have suspected this, but the war's aviation engine experience has proved it.

Motor cars will be improved as a result of our airplane experience, but this improvement will be apparent in the service the car gives, rather than in any radical changes in design. This will come about as a result of better manufacturing facilities, higher shop standards and more intelligent inspection.

Will Give Us Methods of Producing Light Weight Results at Moderate Expense

By O. E. Hunt

Chief Engineer, Carriage Division, Packard Motor Car Co.

IN the introductory part of his paper Mr. Hunt points out that although there is a corresponding part in an airplane for almost every part of the motor car there are such differences in the requirements made of the control system, body and transmission in the two types of machines that little learned in connection with airplanes will be applicable to automobiles. He then proceeds to discuss the subject of engines, which, of course, is a different matter.—EDITOR.

EXPERIENCE gained in reducing the weight and increasing the volumetric efficiency may help in a limited way to reduce the weight-horsepower ratio of car engines, but not nearly to the extent some engineers would have you believe, because, in spite of similarities in design, the engine requirements for airplane service are so far different from those for cars that factors that are vital in the former type of machine are of minor importance in the latter and vice versa. In an airplane engine dependability, light weight, high mean effective pressure, excellent economy, first cost, flexibility and quietness are controlling factors in about the order listed, while in the case of the car engine the relative order of importance is almost completely reversed and would read dependability, flexibility, quietness, first cost, economy, light weight and high mean effective pressure. Some may take exception to the order given for cars, particularly as regards first cost and light weight, but if you stop to think that probably over 90 per cent of our total car producion is designed to fit a definite price class you will realize that cost has a predominant place in the design councils of the industry as a whole, and that light weight is of major importance only as it results in the reduction of the total amount of material to be purchased, thus reducing the material bill. Flexibility and reasonable quietness, like dependability, have come to be expected in all cars, and no car that does not give a proper

performance in these respects can hope to endure in public favor. I must confess that in placing economy below first cost I am reflecting the buyer's attitude, as he, thanks to the manufacturer's reputation for never understanding his case, will give greater weight to a known economy of first cost than a promised economy of operation.

Airplane engine design detail that will increase dependability is immediately useful in cars provided it does not entail an abnormal increase in first cost. Airplane spark plug development is an example. There are other minor ones that I shall not attempt to list in detail here.

Little Regard to Cost

In general, light weight in airplane engines is obtained by the unusual use of light materials such as aluminum, regardless of cost, and by the reducing of all parts to the smallest section that will give a satisfactory dependability with little regard to the labor involved in so doing. Aluminum has been generally used for oil-pumps, water-pumps, cylinders, and to a greater extent in carbureters, induction pipes and electrical equipment than is common in car engines. A most significant sample of the minimum section method of obtaining lightness is the all-steel cylinder used on the Liberty and some other airplane engines. I believe that the more extensive use of aluminum in car engines is going to be stimulated by this experience provided the price of this alloy comes down to a point where, better machining quality allowed for, it can compare fairly well, in cost of the finished piece, with cast iron. There does not seem to be much cause to expect a landslide to light parts of the steel cylinder variety, as the cost of producing them by present methods is out of all proportion to the dividends they would pay in car service. Commercialization of the airplane engine will undoubtedly be along the lines of perfecting less expensive methods of manufacture for such parts. This may ultimately result in costs low enough to warrant their use in cars.

High Volumetric Efficiency

Many improvements contribute to high volumetric efficiency in airplane engines. Overhead valves are already used to a limited extent on car engines, but the overhead camshaft that is almost universal on airplane engines is practically unknown on cars outside the racing class, because of the difficulty of getting a quiet and inexpensive form of drive. Very high compression and open exhaust are barred for car use because the former militates against flexibility and the latter is too noisy. Abnormally large valves and high lift are generally frowned upon in cars because of the tendency to a lesser valve life and quietness in combination. The unusual care taken to cool valves and spark plugs in airplane engines to combine proper dependability and high efficiency usually involve structural features of the steel cylinder type that are too expensive for cars. Abnormally large intake passages and carbureters are not usable in automobile engines because of their unsatisfactory effect on flexibility. On the whole, one must proceed very cautiously with the use in cars of design "stunts" that contribute to raising the mean effective pressure in airplane engines or he may find to his sorrow that he has sacrificed results that the public insist upon as necessary to satisfactory car performance. There seems to be no immediate promise of a general increase in the average mean effective pressure of car engines based on airplane experience.

Fuel Economy

The dead load that present-day airplanes can handle satisfactorily is relatively small. The power required to give them satisfactory performance is so high that a considerable proportion of this dead load must go to supplies, leaving only a small portion for useful load or if a large useful load is desired the flight range is small. Economy of fuel is then of real importance. Good distribution, a carbureter setting as lean as will give full power over the engine speed range ordinarily used in flight, but not so lean as to accelerate valve burning, and a sensitive means of reducing the fuel flow to an amount that will give a proper mixture with the lighter air at altitude, are the design details used to accomplish it.

The distribution and mixture adjustment experience is usable on cars, but it is obvious that the high-speed lean setting would not give a proper flexibility. Oil economy is of much less importance from the weight standpoint, but it is carefully watched in airplane engines and the methods of producing a proper result in them will be useful in car design. Accommodating the oil supply to the load, which is very essential in airplane engines, has produced schemes for the interconnection of the throttle with the oil-pressure regulator that may find their way into cars of the higher grades.

Cost—Flexibility

It is a well-known fact that first cost has been largely forgotten in war airplane engine design where there was any military advantage to be gained by so doing. Such an atmosphere obviously has not tended to produce design detail that could be used in cars, where first cost is of great importance. Flexibility, or more particularly speed range at full load, is relatively unimportant in an airplane engine which operates in the upper 20 per cent of the possible range with a given propeller for at least 90 per cent of the time it is at work. Flexibility being sacrificed to economy through the remainder of the range, it is obvious that we can learn nothing in connection with this car essential from airplanes.

In airplane service the noise of the propeller and the open exhaust drown out the mechanical noises of even the least quiet engines. Until they are eliminated, and there seems to be no prospect of getting rid of the propeller noise, airplane engines can continue to rattle and "slop" in a way that would drive the average car user to distraction.

Summary

A summing up of all this evidence indicates that there is very little ground for a feeling that airplane experience will suddenly and immediately revolutionize cars. We may, market conditions being right, see an increase in the use of aluminum. If aircraft are commercialized to an extent that demands a volume production of engines, we may develop methods of making the minimum section type of lightness that will make this practice usable in cars. There may be an increased tendency to overhead valves and overhead camshafts if the mechanism involved can be made sufficiently inexpensive and quiet. There are possibilities of minor improvements in carburetion and oil control and in some other details.

I believe, however, that the most important contribution that the airplane has made to the automobile is the stimulus to the thought of the industry as a whole that has resulted from a contact with its design and manufacturing problems. Our war experience has set engineers to dreaming of ways to produce a light weight result at a moderate expense. It has taught an increased respect for good metallurgical practice as a necessary factor in successful design and manufacture. It has given the average manufacturer who engaged in airplane engine building a new conception of the value of high-grade workmanship and of the small margin of cost that, in many cases, separates it from the ordinary variety. I should say that in setting up new ideals of design and workmanship for the industry to strive toward it has given us an inspiration of far greater value than any design details could possibly yield.

[*The third paper of this series begins on the following page*]

New High Altitude Uniforms Worn by Airplane Pilots

Valve-in-Head and Aluminum Cylinder Engines Will Increase

By Henry M. Crane
Vice-President and Chief Engineer, Wright-Martin Aircraft Corporation

DURING the four and one-half years of the great war, an enormous amount of development work has been done on various types of engines suitable for use in aircraft. It is only natural, now that peace has come, to speculate as to what effect the knowledge thus gained will have on the design of motor cars.

V-type engines are those comprising two rows of cylinders. There have been a number built, also, with more than two rows of cylinders, but none of them has come into any considerable use, and in any case it is difficult to see how they would have any bearing on motor car practice. There have also been several engines having eight cylinders in a row, such as the Mercedes and Bugatti, but these do not seem to be interesting to the motor car engineers.

If we look at aviation engine design, as represented above, from a general point of view, there are several interesting features of considerable prominence that are practically standard at the present time. These features are the four-stroke cycle, the use of valves in the cylinder-heads and the use of more or less complete force-feed oiling. I do not want to be understood as saying that engines not embodying these features have no great possibilities. I have limited myself in this case to the engines that have actually proved themselves in service.

I think it is fairly obvious why the apparent standardization has taken place on the lines described. There is no question that the four-stroke cycle poppet valve engine, with valves in the head, is the lightest for its horsepower that has yet been developed into commercial use. The valve-in-the-head type, using poppet valves, has the simplicity, compactness and light weight of individual parts, which make up a light total weight. The four-stroke cycle, due to positive charging and efficient scavenging, allows very high speeds, and therefore high powers for a given size cylinder as well as excellent fuel economy. The constantly increasing speed of airplanes and the development of geared engines have made it possible to take full advantage of these characteristics.

Force-Feed Oiling Increases

The use of force-feed oiling has naturally come to the front, in view of its positive action, and because the oil circulation is of great assistance in cooling parts of the engine that would not otherwise be properly cooled.

Of course, we know that the important feature in an airplane engine is reliability of operation, together with the lightest possible weight for a given power, the weight necessarily being taken as that of the whole power plant, including all cooling accessories, fuel, oil and the necessary tanks for the length of flight required. On the other hand, long life, durability and ease of repair, while they have received a great deal of consideration, have naturally been of considerably less importance than usual, because of military considerations. Aerial warfare is more or less an informal racing proposition without any particular rules, and with the life of the pilot frequently paying for defeat. The question of first cost and the cost of maintenance, therefore, cannot be given the same consideration as in the more commercial motor car field.

It is the striving for light weight and compactness that has resulted in the various radial engines, as well as the V-type engines. It has also resulted in the development of improved forms of cylinder construction, this being a point where the greatest weight saving could be made, cast-iron cylinders due to the inherent weakness of material and methods of fabrication being extremely heavy in proportion to the work performed. The steel cylinder has become almost universal in military engines for these reasons, being formed with radiating fins in air-cooled engines and provided with suitable waterjackets in water-cooled engines.

In the water-cooled engines, two pretty definite types of construction have come to the front. The Mercedes type, in which a complete cylinder unit, including the water-jackets, valve-ports and other fittings, is made up of various parts, all of steel, in most readily machinable forms, these parts being welded together. A very large number of successful engines, including our own Liberty engine, have been constructed in this way. The second system first came into large and successful use in the Hispano-Suiza engines. In this system, the cylinder wearing surfaces are of steel, while the water-jackets, valve-ports and other parts are cast aluminum. A number of interesting modifications of the Hispano-Suiza design have recently been proposed and some of them undoubtedly will prove to be successful.

It might at this point be interesting to the members to hear that we have recently completed an engine similar to the 300-hp. Hispano-Suiza, the only difference being in the use of a steel cylinder construction, and that the weight of the two engines proved to be almost identical, the one with steel cylinders being slightly heavier dry than the one using the aluminum casting construction, but the weight with the jackets filled with water is almost identical because of the smaller amount of water carried in the steel-cylinder unit.

More Aluminum-Alloy Pistons

There has been a steadily increasing use of aluminum-alloy pistons in aviation service, partly due to the light weight, but more because of the very much improved cooling due to the high heat conductivity of this material.

Of course, crankshafts, crankcases, bearings, etc., are considerably lighter for the horsepower developed in aviation engines than in pre-war automobile designs. We must remember, however, that aircraft engines are not subjected to external shocks and vibrations to anything like the extent that automobile engines are, and, furthermore, that quietness of operation can be absolutely disregarded. If we add to these facts the point already stated, that durability, ease of manufacture and of repair have been sacrificed to a considerable extent to the saving of weight, we can reach a more just estimate as to the possible value of such improvements in future automobile designs.

A contributing factor to the lowering of the power-weight ratio has been the ability reached to maintain very high mean effective pressure in large-size cylinders. A number of very light engines are successfully developing 45 hp. per cylinder and are able to maintain this power for hours at a time. Mean effective pressures as high as 130 lb. are being maintained on cylinders having piston displacements of 140 cu. in., with compression ratios of 5.35 to 1.

There are two other things which have assisted in lightening engines, these being greatly increased power, which means that planes no longer need to be operated continuously with wide-open throttle, and that much of the flying is being done at considerable altitudes. This latter feature is being done at considerable effect on the reliability and life of all aircraft engines. Various schemes have been tried out with the view of obviating the loss of power with altitude in aircraft engines, but naturally such devices have no practical bearing on automobile work.

Another line of development which has a very direct bearing on automobile engine design was just coming to the front at the end of the war. This is the production of composite

fuels. The admixture of one part benzol with four of gasoline raises the ignition temperature of the mixture to practically that of benzol. This allows of increasing compression ratios far beyond anything that is feasible with gasoline alone. While this is of undoubted value in connection with the very high grade gasoline used for military aviation, it has a far greater interest in connection with the very much less volatile gasoline daily used in automobiles. The temperature at which gasoline ignites becomes lower and lower as less and less volatile grades are used. While we can look forward very hopefully to the effect of this new fuel development in automobile work, we must not forget that it does not solve the questions of vaporization and distribution, which are always present in using gasoline having a high boiling point.

Use of Improved Materials

Regarding the question of materials, the recent advance in aircraft engines can, I think, be attributed almost entirely to a more general knowledge of materials already in use before the war. Very much higher grade aluminum castings are required than were commercially possible several years ago. Improvement came rapidly with the increasing Government demands, but it was due to greater care and better methods rather than to any new inventions.

The same situation holds good with regard to the various steels required. In the Hispano-Suiza engine we are using steels exactly the same as we used in motor cars for the last ten years, with the exception of exhaust-valve material. The use of steel having a chromium content of 12 per cent, the so-called "stainless" steel, has, because of its non-oxidizing properties at high temperatures, been very satisfactory in exhaust valves. The Liberty engine also requires no fancy materials for its successful operation. The main thing is that information regarding the manufacture, heat-treating and testing of alloy steels is much more widely distributed than before. Personally I have learned that the fabrication of the steel to be employed is far more important than the analysis. For example, a carelessly manufactured chrome-nickel steel is a snare and a delusion. I have often felt like building one Hispano-Suiza engine using nothing but straight carbon steel throughout, provided I could get such steel fabricated with the care used in making alloy steels. I have very little doubt that such an engine would stand up in direct comparison with our regular product.

There is another point of vital importance in aircraft engines, and that is the main and connecting-rod bearings, especially the latter. I think that we have learned a great deal about making babbitt-lined bearings with bronze or steel backs since the war started, but we have been able to get excellent results with the same grades of babbitt and bronze as were used before the war, improvements being made in the method of fabrication. We have run our 300-hp. engine for hours at a time, taking from 75 to 85 hp. out of it per crankpin. Each of these bearings is about 2½ in. long, disregarding fillets, and 2⅛ in. in diameter. These engines, when run at sea level, preignite practically all the time, the best power being obtained in this manner.

Heavy Babbitt-Lined Bearing Used

We have come to the use of a rather heavy bronze back babbitt-lined bearing for this work, with sufficient oil circulation not only for lubrication but for cooling also. The smaller Hispano-Suiza engine, as well as all the engines that I have ever designed, had very energetic circulation, being far beyond immediate lubrication requirements. When the 300-hp. type was being developed the oil consumption ran very high in the early samples, and there was a suggestion from the other side to remedy this by reducing the oil flow through the crankshaft. We believed this to be a mistake, and that no such action would be necessary with proper cylinder and piston design, and this proved to be the case. With the best that we can do, in lubrication and cooling, however, unless there is a 100 per cent bond between babbitt and bronze, the bearings will not stand up, the babbitt cracking and flaking off after longer or shorter periods of operation. From our own experience we have concluded that all efforts to hold the babbitt mechanically, as by the use of holes, dovetails or screw threads, for example, accomplish no good purpose, the trouble with most of them being that they are more or less local, and also that they make rapid variations from point to point in the cross-section of the babbitt. The screw-thread system possibly has not these defects, but it has two others; first—the difficulty of getting absolute cleanliness, and second—the probability of entraining air when pouring the babbitt. After all is said and done, the one sure method consists of absolute cleanliness. If the bronze is unoxidized and the tinning is maintained in an absolutely unoxidized condition until the babbitt is poured, nothing else is required to make a thoroughly satisfactory job.

We must not overlook in this discussion the question of ignition. With detailed improvements in engine construction, higher and higher compressions have been successfully used and necessarily higher and higher explosion temperatures. In modern aviation engines, spark plugs which will run successfully in automobiles for thousands of miles without attention fail in 5 min. of full-load operation. The spark plug is a study in itself, being a beautiful compromise between running so cold that it will become fouled with oil and running so hot that it will cause preignition, or that its insulating properties will break down, causing delayed ignition or misfiring. Tremendous advances have been made in the quality of insulating material and in the detailed design of plugs, which will undoubtedly have a tendency to improve the product for automobile uses.

The effect of steady high-speed running with accompanying shocks and vibration on magnetos, especially of the eight and twelve-cylinder types, has forced a very great improvement in detail manufacture in this line. It is unbelievable that it will not have its effect on subsequent commercial manufacture. I think this is equally true of the battery ignition systems, which have come into successful use on aircraft engines during the war.

Because of the very high operating pressures and temperatures, valve or piston leakage in aircraft engines becomes a most serious matter. No new inventions in piston rings have been required to meet this condition, but simply a higher grade of fabrication on already standard lines.

In the accessory field, the design of radiators has been given a new impetus. In many motor cars the radiator, due to different features of design, is larger than is absolutely necessary and the most efficient types of cores have not been required.

Radical Changes in Design Unlikely

Looking back over the facts brought to your attention in this paper, I feel certain you will agree with me that there is no reason to expect any radical change in automobile design, due to aircraft engine development. Nearly every feature of design that I have described has been used in motor cars. For instance, an eight-cylinder V-type engined car was actually produced by E. R. Hewitt in 1908, following the idea first put into service in the Antoinette aviation engine. I do expect to see an increase in the number of valve-in-the-head engines, due in part to the general efficiency of this arrangement, but more especially to the fact that this construction lends itself extremely well to the separable cylinder head, which is coming into continually greater and greater use. We have already seen a number of successful engines with cast-aluminum block-cylinder construction and this development may be expected to continue.

I have purposely based my consideration of this subject on the commercial use of motor cars for passenger and freight service. In racing cars, of course, the effect of aviation engine progress is bound to be extremely marked, as the service required is very similar in the two cases. In commercial motor car work, however, the percentage of the total loaded weight which can be saved by detail lightening of the engine is not very great, and this saving is apt, as I have pointed out, to be at the expense of durability and ease of construction and repair.

Furthermore, in my opinion the motor car engine should be designed to develop its best pulling characteristics at considerably lower speeds than does the aircraft engine, which will undoubtedly mean very much lower compression ratios and lower mean effective pressures.

The Liberty Aircraft Engine*

A Chronological History of the Development of the Liberty Engine, with Sidelights on Incidents and Military Requirements That Affected Its Design

By J. G. Vincent
Vice-President in Charge of Engineering, Packard Motor Car Co.

UP to the time the armistice was signed, the Government maintained a strict censorship over details of its war equipment, and for this reason very little was known about the details of the Liberty aircraft engine outside of military circles. Since the signing of the armistice this censorship has been lifted, and very complete detail information covering this engine has been published. The cuts and data already published are quite accurate, and hence it seems unnecessary to give a detailed description in this paper.

It was decided to divide this paper into two parts, covering, first, the historical side of the Liberty aircraft engine; and second, a discussion of its features, explaining how these features worked out in actual practice, and what changes in the construction would appear to be desirable after extensive experience with thousands of these engines on the test stand, at the test flying fields, at the schools and on the battle front.

The historical side of this development is, in my opinion, one of the very best arguments for reasonable preparedness, and I don't think that, as an engineer, I would be doing my full duty to this Society or to our country unless I gave my brother engineers as complete a picture as may be possible of the difficulties encountered due to lack of preparedness in our Air Service when war was declared on April 6, 1917.

I urge all members of the Society to give this matter careful thought and do everything in their power to further the development of military aeronautics in this country, as we may not be so fortunate the next time in having allies to stand between us and the enemy while we spend a year laying the fundamental basis for an Air Service, as was the case in the recent emergency.

I will endeavor to set forth clearly just what happened in extensive use of the engine. It may well be that all engineers will not agree with me in some of my conclusions, but I will endeavor to be entirely unprejudiced, and my statements will be based on what I believe to be the consensus of opinion of the many experts with whom I was associated in the Engineering Division of the Bureau of Aircraft Production at the time the armistice was signed.

Aircraft Situation When We Entered War

To understand why certain moves were made it is necessary to have a clear picture of the aircraft situation as it existed in this country when we entered the war. We were totally unprepared. The Government had no adequate engineering organization, no production organization, and no samples or drawings of engines, airplanes, instruments or armament of any value for military operations on the battle front; neither did it have any definite information regarding designs being used by our allies. We had to start from absolutely nothing. Realizing the seriousness of the situation, General Squier immediately arranged a number of very important moves, and realizing that the obtaining of proper equipment was very largely a commercial matter, he gathered around him a small group of men of undoubted engineering and business ability. Among these were Howard E. Coffin, Edward A. Deeds and S. D. Waldon. These men, together with General Squier and a few others, began immediately to operate as an Aircraft Production Board.

One of the first moves of this Board was to arrange to send a commission abroad to study airplane designs, make recommendations covering machines to be copied, and put into production, and send information about such machines to America at the earliest possible moment. Major R. C. Boling headed this commission, and took with him Captain Clark, an airplane engineering expert, and Howard C. Marmon, an engine expert. Captain Clark had been head of the very small airplane engineering organization which existed as a part of the Signal Corps at the beginning of the war, and he was chosen because he was as well posted on this subject as any other man in America. Howard C. Marmon was chosen as he had had a long experience on automobile engines and was a highly-trained all-round engineer. He resigned his position with the Nordyke & Marmon Co. to take up this work, at the personal request of General Squier, and he was commissioned as a Captain in the Reserve Corps after he had been in Europe for some time. This commission left for Europe about June 15, 1917. While these preliminary moves were being made in this country, our allies, realizing our state of unpreparedness, had sent a Technical Commission to this country to act in an advisory capacity so that we might get something started along the right line with the least possible delay.

Allied Technical Commission Came Over

A combined group of French and English experts visited Detroit on May 26, 1917. I conducted them through the Aircraft Engine Experimental Department of the Packard Company, and explained the development work that had been carried on in there for two years. They seemed to be very much pleased with the quality of the work and the general details of design of the Packard aircraft engine, and stated that it would no doubt be a very fine engine for certain kinds of work, but that its power-weight ratio was too great to make it of any real value in an up-to-date military airplane. The engine would develop about 235 hp., and without water or radiator weighed a little under 3½ lb. per hp. We had a very thorough discussion of the aircraft situation, and the commission gave us many valuable hints in connection with the latest developments in Europe. I realized that there was not a single firm in the United States working on aircraft engines that would be of any real value on the fighting line.

I read later that there were at that time about thirty-seven different kinds of aircraft engines being manufactured or experimented upon in England and some forty-six different kinds in France.

This multiplicity of design not only made for high price and low production, but also caused great complication in the field, as it was next to impossible to keep on hand proper repair parts for all types of engines.

I discussed the situation with the president of the Packard Motor Car Co., who appreciated the need for a standardized line of aircraft engines, and suggested that we communicate with Mr. Coffin. I left Detroit for Washington on May 27, in company with R. D. Chapin of the Hudson company. We had a conference with Messrs. Coffin, Deeds and Waldon. I pointed out the absolute impossibility of obtaining a large production of aircraft engines in this country if the various factories were left alone to go their own way in the designing

*Read at the annual meeting of the Society of Automotive Engineers.

of aircraft engines. I told them that if it was going to be necessary for the automobile industry to build a large number of aircraft engines they must be furnished with a proper standardized design, so that they would not have to waste any time in experimental work. I pointed out the fact that the Packard engine was too low powered and too heavy, but that this could easily be remedied by increasing the piston displacement and lowering the factor of safety. I explained that this engine had been designed to weigh under 4 lb. per hp. and run for the longest possible time without overhaul, and that it was the result of specifications put up to me by the Government about two years before, but that since then aircraft development had been rapid, with the result that conditions were entirely changed. I pointed out that the French and English commission had stated to me that a fighting airplane must be equipped with an engine of the lightest possible weight per horsepower, which meant that it must be designed with the lowest possible factor of safety that would run satisfactorily for a reasonable length of time.

Designing the First Engine

After discussing the matter at some length, Mr. Deeds suggested that he would like to have me meet E. J. Hall. On May 29, Mr. Deeds, Mr. Hall and I got together, just before noon, at the New Willard Hotel, and went carefully into the situation so that we might make a joint report on the aircraft engine situation in this country promptly. By mid-afternoon Mr. Hall and I were ourselves laying down two views of a proposed eight-cylinder aircraft engine.

To get started promptly, we called Mr. Zimmerschied, who was then running the Society's Washington office, and asked him to get us a draftsman and some drafting materials. He could not locate a draftsman, but sent over his own drafting instruments. We purchased drafting tables and supplies, and soon were busy. I laid out a transverse section, and Mr. Hall a longitudinal one. We were very well posted on all engines manufactured in the United States and also a great many of the foreign makes, but we, of course, also wanted the latest information on British and French engines. We appealed to Major Souther of the Signal Corps and he immediately put Charles King on the job of rounding up this information for us.

That evening Mr. Deeds called a session at the New Willard, at which members of the French commission were present. By this time Mr. Hall and I had specific questions that we wanted to ask, and they were answered quite fully by the French officials. The next morning Mr. Zimmerschied turned one of his volunteer helpers over to us, Mr. Schoonmaker of Pittsburgh. Like Mr. Hall and myself, Mr. Schoonmaker had done no drafting work for a number of years, but nevertheless he did not hesitate to take off his coat and go to work. I turned the drawing that I was making over to Mr. Schoonmaker, and proceeded to dictate a report to the Aircraft Production Board, which Mr. Hall and I had agreed on the night before. I reproduce this report below, as I believe it clearly sets forth our understanding of the situation at that time:

First Report to Aircraft Production Board

At your request we have made a careful study of the aircraft engine situation, and hasten to submit our report:

To get this report in your hands promptly, we have condensed it as much as possible, and have covered the essentials only. In view of the fact that there are a number of good engines for training machines available, we have disregarded this type of engine, and we have confined our attention strictly to the high efficiency, low weight per horsepower type, such as is necessary at the front.

In order that any engines that are built by this country may be of any value when received at the front, it is, of course absolutely necessary that their efficiency be brought up to, or a little beyond, the best now available in Europe. The French and English Commissions have enabled us to obtain this information by answering our questions very clearly and completely. From information obtained from these gentlemen and from other sources, we believe that the Lorraine-Dietrich is the coming engine in Europe. This engine has not been built in large quantities as yet, but some thirty have been constructed and carefully tested out at sea level, and also at about 6000 ft. elevation.

The important facts about this engine are as follows: Eight cylinders, 120 mm. bore by 170 mm. stroke; cylinders made of steel with water jackets welded on. Engine is direct-driven and develops 250 hp. at 1500 r.p.m. and 270 hp. at 1700 r.p.m. The weight of the bare engine is 240 kg., or approximately 528 lb., while the weight of the engine complete, with radiator and water, is 305 kg., or 671 lb. There seems to be a reasonable doubt regarding the exact weight of the bare engine, as, while the French Commission gave us the figure of 528 lb., information from other sources indicates a weight of 552 lb. Probably some intermediate figure is more nearly correct, but in any event the engine gives a horsepower for approximately 2 lb. of weight when figured at its maximum output of 270 hp.

After obtaining this information and considering the matter very carefully, we next investigated the manner of testing such an engine, as we knew that an engine of this type could not be run at full power for long periods of time without developing serious trouble. Here again the French Commission gave us valuable information. They stated that in using an engine of this type it is only run at full power for short periods of time, while climbing or fighting, and that at all other times it is run at speeds 200 to 300 r.p.m. slower. In view of the fact that the engine is built to run under these conditions it is, of course, necessary to test it under a similar condition, and they stated when trying out a new model of engine it is their practice to mount a propeller which will just hold the engine down to maximum speed under full throttle. The engine is then run for 50 hr. in periods of 6 to 8 hr. each, but the engine is not run up to full speed for more than a total of 10 hr. during this entire period, nor is it run more than 30 min. at any single time under this condition. The other 40 hr. running is under throttled condition, turning the same propeller at 200 to 300 r.p.m. less than maximum speed.

This information is of the utmost importance, as it enables us to reduce all factors of safety and makes possible the light weight per horsepower now being obtained in Europe. After obtaining this information, we immediately laid down a proposed engine, which we believe can be produced promptly in large quantities in this country. Built carefully out of proper materials, this engine will have approximately the following characteristics and be as good, or a little better, than the Lorraine-Dietrich, which is not as yet really available abroad. In laying down this engine we have, without reserve, selected the best possible practice from both Europe and America. Practically all features of this engine have been absolutely proved out in America by experimental work and manufacturing experience in the Hall-Scott and Packard plants, and we are, therefore, willing to stake our reputations on this design unhesitatingly; providing we are allowed to see that our designs and specifications are absolutely followed.

The engine is to be of the eight-cylinder type, with cylinders set at an included angle of 45 deg. The cylinders are of the individual type, made out of steel forgings, with jackets welded on. The bore is 5 in. and the stroke 7 in., giving a piston displacement of 1100 cu. in. The crankshaft is of the five-bearing type, with all main bearings 2⅜ in. in diameter and all crankpin bearings 2¼ in. in diameter. The connecting rods are of the I-beam straddle type. This engine is of the direct-driven type with a maximum speed of 1700 r.p.m. This engine will have a maximum output of 275 hp. at 1700 r.p.m. It will weigh 525 to 550 lb., but we feel very sure of the lower figure. It will have a gasoline economy of 0.50 lb. of fuel per hp.-hr. or better; it will have an oil economy of 0.04 lb. of oil per hp.-hr. or better. Complete with water and radiator, this engine will not weigh more than 675 lb., if a properly constructed radiator is used and placed high above the engine. To obtain the above mentioned weights, it will be necessary to use the fixed type of propeller hub, which has been thoroughly proved out by Hall-Scott practice. It will also be necessary, as mentioned above, to use the very best material, workmanship and heat-treatment.

Complete detail and assembly drawings, as well as parts lists and material specifications, can be completed at the Packard factory under our direction in less than four weeks. We believe that a sample engine can also be completed in approximately six weeks, if money is used without stint. As soon as the drawings, specifications and a sample engine have been finished, complete information would, of course, be available, so that any high-grade manufacturer could either make parts for this engine or manufacture it complete.

In laying down this design, we have had in mind the extreme importance of interchangeability, as a well laid comprehensive program, which has for its base interchangeability of important parts, such as cylinders, will speed up output and reduce ultimate cost to an astonishing extent. Europe is suffering right now from lack of uniformity of design, but it is too late for them to change their plan. We

however, can take a leaf out of their book and start right.

In the design which we have laid down, the cylinder, for instance, can be used to make four, six, eight and twelve-cylinder engines. As this is the most intricate part to make, immense facilities could be provided to produce them in large quantities for the use of many concerns who could manufacture the rest of the engine. Nearly all small parts, and numerous large and important ones, would also be interchangeable. This would not only speed up production, but would be of the utmost importance in connection with repairs and replacements. A full line of engines made according to this plan would line up about as folows:

Type	Rated hp.	Maximum hp.	Weight, lb.	Weight per hp., lb.
4	110	135	3[illegible]5	2.7
6	165	205	400	2.8
8	225	275	535	1.9
12	335	410	710	1.7

Respectfully submitted,
(Signed) J. G. VINCENT.
(Signed) E. J. HALL.

The above report was finished on the afternoon of May 31, and we had at that time gotten the cross-section and longitudinal section drawings fairly well blocked out. About 3 p. m., Mr. Waldon telephoned Mr. Hall and me to bring our report and drawings over to General Squier's office, in the Army and Navy Building. When we arrived we were promptly shown in the conference room, where a joint conference of the Army and Navy and Aircraft Production Boards was in session, with Mr. Coffin in the chair. Mr. Coffin called for our report, and we asked Mr. Waldon to read it.

Actual Layout Work Started

After the report was read we were asked to explain the drawings, which we did as quickly and clearly as possible. We, of course, explained that these drawings were only intended to show the general idea, and that we would, however, get layouts made quickly if our suggestions met with favor. We were immediately requested to go ahead with all possible haste and make good layouts. We wired to Detroit for two good layout men, and they arrived about noon Friday, June 1. Messrs. Hall, Schoonmaker and I kept right ahead with our layouts, on which we were determining construction features. This allowed good layout men to go right ahead with finished layouts of settled construction. We all worked right straight through until Monday afternoon, June 4. By that time the layout men had finished good, accurate layouts of the longitudinal section, transverse section, rear elevation and camshaft assembly views of the eight-cylinder engine.

About the middle of the afternoon of June 4, Mr. Hall and I were again requested to go before the joint committee of the Army and Navy, with the Aircraft Production Board, to make a further report. We exhibited the finished drawings and went somewhat more into detail than had been possible at the previous meeting. After we had explained the drawings we left the conference with Mr. Deeds, who was just leaving for Dayton. Mr. Deeds told us that it had been decided that we should build ten sample engines, five of the eight-cylinder size and five of the twelve-cylinder, and asked us to "go to it" and produce the first sample eight-cylinder engine at the earliest possible moment. He told us he had promised that we would finish the first sample eight-cylinder engine in seven weeks from that date. We immediately sent the layout men home to Detroit with instructions to complete the detail drawings of the long-time parts, such as cylinders and crankcase, immediately.

Mr. Hall went to Indianapolis that night and I went to New York, where I met Mr. Macauley the next morning and explained to him just what had taken place. Mr. Macauley and I returned to Washington on the morning of June 6, and immediately went into conference with Messrs. Deeds, Waldon and Hall. Mr. Deeds explained to Mr. Macauley the great advantage of standardizing a line of U. S. A. engines, and after a little thought Mr. Macauley not only agreed to this very radical step, but also to the loan of my services to the Government for a period of three months so that I might follow up the engineering work which had been started.

Mr. Deeds explained to Mr. Macauley that money had been appropriated to cover the cost of this development, but that he realized that to make good on the deliveries which he had promised I must have the ability to order things quickly through commercial channels, with which I was well acquainted. To this end he requested Mr. Macauley to arrange for the Packard Motor Car Co. to "finance the job," so to speak, or, in other words, to buy and pay for anything which I requested for the work, with the understanding that the Packard company would render an accounting, and be reimbursed by the Government. Mr. Macauley agreed to do as requested, stating that this work would be put ahead of anything in the factory, and that I would have the "right of way," not only as to the services of my well-trained experimental organization, but the factory facilities also. This was the day on which the "U. S. standardized aircraft engine" idea was really settled.

Originally It Was the U. S. A. Engine

As a matter of interest, I will state that Mr. Hall and I designated this line of engines as the U. S. A. standardized line, but a little later I believe Admiral Taylor "dubbed" it the "Liberty" engine in one of the Aircraft Board meetings, and this name took so well that we were forced to adopt it, and change all our titles on the drawings.

Mr. Hall and I left Washington Thursday noon, June 7, for Detroit, where we arrived on Friday morning. We went to the Packard factory and looked over the work on detail drawings which had been started. We found that O. E. Hunt had taken very prompt action, and already secured billets of steel from Cleveland out of which to make cylinders for the first engines. Mr. Hall spent the day going over various matters with me, and left on the night boat for Cleveland to make arrangements to get crankshaft forgings for the first engine. These forgings, completely heat-treated, were produced in three days, Mr. Hall having given permission to "dig out" his dies.

I, of course, realized that to get the first engine quickly we must have detail drawings almost immediately, and I therefore called for volunteers from the various drafting departments of the Packard organization to work Saturday afternoon and Sunday. Every man volunteered, with the result that we had a very large force working Saturday afternoon and Sunday, and during this day and a half approximately 86 per cent of the detail drawings were finished on vellum, from which blueprints could be made. In other words, on the morning of June 11 I was enabled to get blueprints of 86 per cent of the parts, and I immediately began calling on various automobile and accessory manufacturers to rush through enough parts for a first sample eight-cylinder engine.

The crankcase upper and lower halves were, of course, long-time parts, and these drawings could not be finished in a day and a half. We did, however, succeed in getting them nearly enough completed by Wednesday, June 13, to enable us to take off preliminary prints. These preliminary prints enabled us to start pattern work and also a wood model of the engine. Vellum drawings of the upper and lower halves were finished on Friday, June 15, and good blueprints were put in the hands of the experimental pattern shop.

In the meantime, the pattern shop had been working night and day on the wood model, which they succeeded in finishing and shipping to Dr. Stratton at the Bureau of Standards, on Saturday. By this time the vellum drawings on all the major parts, except those contained in the oil-pump assembly, had been completed, and enough parts for a sample engine ordered from various factories.

Assembling an Engineering Organization

While all this work was going on during the week ended June 16 the Aircraft Production Board was furnishing engineering offices at the Bureau of Standards, Washington, where space had been arranged for by Dr. Stratton. I left Detroit on Sunday, June 17, with a complete engineering organization, which had been drawn from various automobile factories, including the Cadillac, Dodge and Packard. Engineers were also sent from the Pierce-Arrow plant, and

they met us at Washington. I arrived in Washington on Monday morning and immediately set to work getting settled in our new quarters at the Bureau of Standards.

In order to "put over" a job of this magnitude in a short time a tremendous amount of work must be accomplished quickly through the co-operation of a great many people who are peculiarly fitted by their training to do their particular part without detailed supervision. At this stage the design was practically settled and the work of building samples was well under way. Everybody connected with the job continued to put forth his very best efforts, with the result that our first sample Liberty engine was delivered to the Bureau of Standards, Washington, on July 3, 1917. Additional samples of the eight-cylinder, also samples of the twelve-cylinder, followed quickly, and the first sample twelve-cylinder Liberty finished its first official 50-hr. run at 1.30 a. m., Aug. 25, 1917, having gone through this 50-hr. run in an elapsed time of only about 55 hr., thus breaking all records for tests of this kind. It is usual to run such tests in periods of 5 hr. each, two runs being made each day. In other words, it usually takes five or more days to complete such a test. This 50-hr. test was made under the supervision of Government Inspector Lynn Reynolds, and after finishing his very complete report of the test, he wrote the following foreword:

The appended report is a survey of the main phases of the 50-hr. endurance test, maximum power curve calibration on electric dynamometer, and inspection of dismantled parts of U. S. A. twelve-cylinder aircraft engine No. 1, which were made under the supervision of the Equipment Division, Signal Corps, at the Packard factory, Detroit, Mich., Aug. 22 to 25, 1917.

A consideration of the data collected, we believe, will show that the fundamental construction is such that very satisfactory service with a long life and a high order of efficiency will be given by this power plant, and that the design has passed from the experimental stage into the field of proven engines.

The First Engine Completed

All the Government officials who had been following this job carefully realized that while no doubt a great deal of detail work remained to be done, this test conclusively proved that we had an engine design capable of being produced in large quantities in this country, and that it would compare favorably with the best designs that had been developed in Europe. Acting on this belief, all possible haste was made in cleaning up the drawings, and a complete set of drawings of both the eight and twelve-cylinder designs were turned over to Lieutenant Emmons, who was in charge of Engine Production, about Oct. 1, 1917. It was, of course, understood that many detail changes would have to be made in these drawings during the early stage of manufacture.

After careful consideration of reports from abroad it was decided to put the twelve-cylinder engine into production and hold the eight-cylinder back, as all demands from abroad called for around 400 hp. The first "production" twelve-cylinder engine was delivered at McCook Field, Dayton, Ohio, on Thanksgiving Day, 1917, but it should be borne in mind that this engine was only partially made from production tools. In fact, the first several hundred engines were made more or less by hand to get out a reasonable quantity at the earliest possible date, and thus permit extensive tryouts under actual flying conditions.

During the time that this work was going on, Captains Clark and Marmon returned from Europe, and after going over the Liberty engine carefully in light of what they had learned, agreed that we had been very wise in developing the Liberty engine, because, in their opinion, an engine of 400 hp. was essential for types of machines that it had been decided we should manufacture, and they stated that no proved 400-hp. engine existed in Europe.

Spurred on by this encouraging information, every one concerned put forth his best efforts to get into quantity quality production at the earliest possible date. From this point on the facts are pretty generally known. As soon as the necessary samples could be shipped to Europe they were carefully tried out under actual flying conditions by our allies. First England, and then France and Italy accepted the engine and began to negotiate for the purchase of these twelve-cylinder Liberty engines for installation in their planes. Unfortunately, our own plane production was considerably delayed, not so much on account of the plane itself, but because of the fact that we did not have in this country the necessary instruments and armament to equip the planes. In other words, the design of the De Haviland Four could have been finally settled in November or December, 1917, had information been available as regards all the instruments and armaments, but this information did not become available until late in March, 1918. As soon as this information was available the De Haviland Four design was quickly cleaned up, and I believe that a real record was made in getting it into production after that time.

What the Tests Revealed

As soon as these planes became available they were extensively tested both in this country and abroad, with the result that numerous minor faults were developed, which had to be corrected. The extensive test work of the Liberty-De Haviland combination also developed several shortcomings in the Liberty engine, which had to be corrected after production was fairly well under way in one plant. In this connection, however, it is interesting to note that the correction of none of these difficulties involved any radical change in the basic design.

It is now a well-known fact that the De Haviland plane equipped with the Liberty Twelve did wonderful work at the front, and that it was considered the best all-round plane available at the time the armistice was signed. It is also a significant fact that England, France and Italy were taking deliveries of these engines just as fast as they could get them, and installing them in their various types of observation, two-seated fighting, day bombing and night bombing machines.

The fact that no tried 400-hp. engine existed in Europe was one good reason for developing the Liberty engine, but other equally good reasons existed. The engines developed by our allies had been built under extreme pressure. There were so many different kinds that none of them were made in any great quantities. Probably the two best foreign engines at that time were the Rolls-Royce and the Hispano-Suiza. According to information received at that time, the Rolls-Royce developed about 350 to 375 hp. and was recognized as probably the best large engine available for our allies. It was, however, developed for European manufacture in small quantities, and was composed of a great many intricate parts, which would be very hard to manufacture in quantity under American production conditions. For example, many of the important forgings would have to be made much better than it had been our practice in this country. The Liberty engine was designed to be as reliable as Rolls-Royce, develop a little more power, be a little lighter per horsepower and cost about one-half as much. These aims have all been accomplished.

The Hispano-Suiza was a smaller engine, and as it was already in production in this country, and continued to be produced in increasing quantities, it need not be considered in this discussion.

Lorraine-Dietrich Held Up As Model

The Lorraine-Dietrich eight-cylinder engine, which it will be remembered was held up to Mr. Hall and me as the coming aircraft engine in Europe, did not come through the experimental stage as fast as had been anticipated. While Captains Clark and Marmon were in Europe they examined both eight and twelve-cylinder models of this engine, but upon their return stated that it had not yet gone into quantity production, and as nearly as they could determine these engines were still in the experimental stage. Our Government had for months a standing order to ship one of the twelve-cylinder Lorraine-Dietrich engines to us, but it was never received. It is obvious, therefore, that it would have been a great mistake to have depended on putting either of these Lorraine-Dietrich engines into production in the United States.

The only other Allied engine that looked at all interesting was the Bugatti, and arrangements were made to bring a sample of this engine to America, so that it might be put into

production. As was to be expected, it had to be entirely redesigned for American methods of manufacture, with the result that it was just getting into production when the armistice was signed. This engine was designed for a special type of service and can never be as light per horsepower as the Liberty. It may, however, have distinct military value for certain kinds of work.

A Standardized Line of Engines

To sum up what has been accomplished by the designing of the standardized Liberty aircraft engine, I will state that this development made it possible for the United States to produce large quantities of 400 to 420-hp. reliable light-weight aircraft engines. Handling of the maintenances problem was greatly facilitated, with but one set of repair parts for the vast number of engines manufactured.

I am not in possession of exact information regarding production, but I know that the first production engine was delivered to the Government in less than six months from the date that Mr. Hall and I turned in our original recommendation, and within a year from the date our recommendation was made some five or six large companies were in quantity production, and the output was increasing steadily day by day.

Had the war gone on for a few more months, we would have also been producing the 280 to 300-hp. Liberty Eight in large quantities for single-seated fighting or chasse machines. To take care of the maintenance work on these eight-cylinder engines, it would have been necessary to put into stock only some twelve additional parts, as the eight-cylinder parts are interchangeable with the twelve-cylinder, except as to a few special parts such as the crankcase, crankshaft and the like.

An important advantage of the standardized line of engines, which is ordinarily overlooked, is the matter of installation in planes. To be a good job, all airplanes must be designed around the engine and equipment. Every different type of engine presents many new installation difficulties. We have worked out a standard form of installation for the standardized line of Liberty engines, so that we could give a plane designer definite information as to the engine tachometer, the gasoline system, the oil system, cooling system, the spark throttle and altitude control system, and many other details too numerous to mention.

Standardization and Reliability

I have talked with many experts who have been sent over by our Allies, and all who have had practical experience at the front state emphatically that the most important thing about a military airplane is to have it reliable, and they, therefore, agree with me that it is very important to have all the systems standardized as outlined above so that the troubles may be worked out of them. They have stated to me that it has never been possible to work out good standardized systems abroad, on account of the fact that they have had so many different kinds of engines to install. Due to this fact, most of their installations have been more or less of a makeshift, and a very large percentage of their failures have been due to failures of some part of these systems, rather than to the engine or plane proper.

I hope that I have made the matter of standardization clear, as I consider it of the utmost importance, but I do not want to be understood as advocating that the Government use only one or two kinds of engines during peace time. The standardized Liberty aircraft engine was designed to meet an actual emergency, and I believe that everybody who is familiar with the facts will agree that it was a very wise move. On the other hand, it would greatly retard development if the Government did not give careful and unprejudiced consideration to all designs submitted during peace times. If there is to be any real progress in the development of aircraft engines, airplanes or airplane equipment, however, it must be brought about by the co-operation of engineers and proper officials of our Government.

At the present time the Engineering Division of the Bureau of Aircraft Production and the Technical Section of the Department of Military Aeronautics are being merged into one peace-time organization, which will probably be known as the Technical Section of the Department of Military Aeronautics. This reorganization is being carried out under the direction of Col. T. H. Bane, of the Air Service, whom I personally know to be well fitted for the job, on account of his long training in the army, his knowledge of military aeronautics and his thorough broad-mindedness and impartiality.

The Technical Section of the Department of Military Aeronautics is a mammoth bureau of information, having on file at the present time a complete record of the present state of the art, not only in this country, but in all important foreign countries as well. In addition to serving as a bureau of information, this section, through its officers, acts in an advisory capacity to engineers, as critic of designs or sample machines, and last, but not least, as an experimental organization to test out all designs which are submitted. By co-operating with this department, all engineers may secure exactly the same data and advice, and be sure that their equipment will be tested in an unbiased, as well as in a standardized, way. In other words, all engineers will have exactly the same chance, and may be posted beforehand as to just what tests their equipment will have to pass through.

Much Depends on Proper Support

If the Department of Military Aeronautics is given proper support, as it must be if we are to remain prepared in our air service, the Government will be in a position to go into production quickly in any emergency, because the Technical Section will have a complete record of all tests, and will, therefore, be in a position to select the best equipment of each kind; and, furthermore, it will be in possession of the necessary drawings, specifications, etc., so that in such emergency there would be no necessity for an experimental stage.

In closing this chapter of my paper I want to urge all engineers who are interested in aeronautics to co-operate with the Technical Section of the Department of Military Aeronautics and work for the maintenance of a permanent technical department, in connection with our Air Service, so that we may never again be caught in the pitiful condition that existed in the early part of 1917.

[*The concluding part of Mr. Vincent's paper, in which are given reasons for features of the design, will be printed in next week's issue.*—EDITOR.]

Vineyard Tractors Needed in France

AMERICAN CONSUL PAUL H. CRAM, of Cette, states in a recent report that owing to the shortage of labor and horses, there exists in that district, as in all parts of France, an excellent market for farm tractors. However, it should be noted that wine-growing is by far the chief branch of agriculture carried on in that region.

In a communication to the "Académie d'Agriculture" dated Dec. 12, 1917, Mr. Ringelmann, director of the "Station d'Essais de Machines de Paris," explained the importance of the market which French, Algerian and Tunisian vineyards offered to farm tractors. The extent of the vineyards which may be cultivated mechanically is estimated at 640,000 hectares (1,581,468 acres). Mr. Ringelmann stated that at that time (in 1917) no tractors had been constructed specially adapted for use in the vineyards.

The labor to be performed in the vineyards consists of plowing to a depth of 4 to 6 in. and scarifying to a depth of 2 in. According to Mr. Ringelmann, the maximum width of a tractor should not exceed 1 meter (39.36 in.). The tractor, together with the plow or cultivator, should be able to turn around within a distance of 3 meters (9.84 ft.) at a maximum. The weight should not exceed 2400 lb. Furthermore, the tractors should be so constructed that they may be utilized for the application of sulphate and sulphur to the vineyards. In order to make use of these tractors for hoeing and weeding purposes, it would be necessary to install an appliance which would permit a modification of the distance between the wheels in order to correspond with the space between the lines of vines. The outer side of the tires of the wheels should pass at about 8 in. from the axis of the line of vines to be weeded.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. X[illegible] Thursday, February 6, 1919 No. 6

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142.

Cable Address - - - - - - - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES

United States and Mexico	One Year,	$3.00
Canada	One Year,	5.00
Foreign Countries	One Year,	6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS

Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

The New York Show

FROM an automobile-commercial standpoint, the war came to an end at an opportune time. Had it lasted only two months longer the manufacture of automobiles for the general market would have been entirely stopped and the succession of annual shows in this city, which has been continuous since 1900, would have been broken.

It had already been decided by the National Automobile Chamber of Commerce to abandon the show this winter, but the signing of the armistice on November 11 made it possible to hold it, although the date had to be set one month later than usual. While there is thus no break in the continuity of the annual exhibitions, there has been a change in management, the show this year being conducted by the New York automobile dealers' organization instead of the National Automobile Chamber of Commerce. This change, however, will hardly be apparent to the attending public. In former years the manufacturers staged the show and the dealers from a considerable eastern territory were on hand to take care of customers from their localities. This year the New York dealer will be the exhibitor, but no doubt factory representatives will be in attendance to look after those seeking agencies. Many agency connections have been broken during the past year, partly because of the demands of the war upon the manpower of the country and partly because the manufacturers, being kept busy with war work, were unable to deliver cars. Consequently, it is to be presumed that now, when the manufacturers are again in position to devote all their efforts to the production of cars, there will be a greater demand for "territory" than there has been for years back.

It would be futile to look for striking technical innovations at the show. Up to the time the armistice was signed automobile manufacturers were looking forward to a complete stoppage of car manufacture for an indefinite period, and the minds of their engineers naturally were concentrated on problems connected with the work that was to occupy them during this period. There has not been time enough since to create anything new and put it in shape for production, hence what we are seeing at the show are the same models that were exhibited last winter. The few exceptions do not invalidate this statement.

Special Show Chassis Scarce

It is probably due to the haste with which the exhibits had to be prepared that finely finished chassis and special bodies are less conspicuous than at previous shows. The preparation of such show models demands a great deal of time and also involves a good deal of expense. A local dealer, of course, cannot go to the same expense in preparing show samples as can a manufacturer. The fact that the New York show this year follows the Chicago show, and that without interval so as to preclude the transfer of exhibits from one show to the other, may have had its effect. On the whole, the New York show this year is a plain business show at which practically none but stock models are shown. The war, moreover, has left its imprint on the show, in that not a few of the makers, in accordance with the recommendations of the Commercial Economy Board, have reduced the number of different models manufactured by them. Thus the cloverleaf and so-called sport models, which never sold in the same numbers as the standard runabout and touring car models, are less conspicuous than at former shows.

As to the success of the show, it is still too early to speak with assurance. On the opening night the attendance was good, though there was not the same jam as in previous years. However, it has always been the custom to swell the opening attendance by artificial means, and it would be unwise to take this as a criterion of public interest. As usual when the show is held in Madison Square Garden, it has a fine setting, and weather conditions at the opening also were very propitious.

Powering of Cars

AN engineer in a recent letter regretted that there are no settled standards for powering passenger cars. Most other features of design have been brought down to a well-defined basis, but nobody seems to be able to say what should be the horsepower of a car of given weight and load carrying capacity. This is the more remarkable since extension acceleration tests have been carried out in recent years. Our correspondent remarks that if there were some generally accepted standard for the amount of power that must be provided in cars of definite weight, we would not have the present great differences in the ability and liveliness of cars, for which there seems to be absolutely no warrant.

We do not believe that a uniform rule for powering passenger cars will ever be adopted. A great many drivers strongly favor "high ability"—a car capable of rapid acceleration, that responds almost instantly to the throttle. However, this quality in automobiles is rather expensive to the owner. It means the provision of an engine of great piston displacement with its attendant low fuel efficiency. Not only does an over-powered car burn more fuel per mile of travel, but its tire consumption also will be materially greater, owing to the heavy strain on the tires due to rapid acceleration.

There are many purchasers who are not aware of these uneconomical features of the super-powered car and there are others who do not mind them because they appreciate the operating qualities of such a machine. On the other hand, the war has taught most people to economize, and the maker at least knows that in order to minimize the fuel consumption the piston displacement must be kept down. Striking an average will not meet the case. There are a sufficient number of people who want a lively car regardless of cost to afford a good market for a machine of this type and there are many more who are looking for an economical car.

The designer, therefore, should first select the class of customers which he wants to supply and then power his car accordingly.

Aviation Influence

IT it remarkable that three of the most prominent engineers in our aircraft program should agree so closely in their comments on the influence of airplane engines on the design of power plants for automobiles as they did in their papers presented before the winter meeting of the Society of Automotive Engineers.

These papers, which were probably prepared independently, showed a unanimity of thought which is very rare when future practice is discussed. The matter was commented on by President Kettering from the platform and also by a great many in the audience.

Yet, are there not a good many thoughts on this subject which were not brought out? There is no doubt that engines for passenger car and truck work are going to remain much as they are, and there is no chance of airplane engine practice revolutionizing the modern gasoline engine. Nevertheless, this subject presents so many angles that it is not right to dismiss it with generalities.

Surely the experiences with the airplane type of valve have taught some valuable lessons! We must have learned something from the use of heavy section aluminum pistons, steel cylinders, pressure oiling and the general application of light-weight design which will have its influence in improvng the performance of the high duty, high-speed type of engine. Further and more detailed discussion of this subject should bring to light many matters relating principally to detail refinement but which have a marked influence on general performance.

Makers' Attitude Towards Standardization

LIKE every other movement of importance in the world's progress, engineering standardization has met with a good deal of opposition. While, on the one hand, it is being hailed as a great boon to the industry and encouraged in every way, on the other hand faults are being found continually and the work is impeded as much as possible.

It is now quite clear that standardization is a great help to the organization of large industries. Where the products of one branch of the industry have to be used by another branch and fitted to its products, standardization eliminates many difficulties. If the parts are made to certain outside dimensions with definite tolerances, not only can the purchaser be sure that they will fit when received, but in case one source of supply fails the parts can be obtained from another and used without any change in the design of the machine.

But when standardization is attempted of what may be designated the "internals" of a part, the resentment of the manufacturer is likely to be aroused. When the parts have to fit only other parts that are made in his own plant his engineering department can handle the matter alone without outside help. The situation would be a very simple one if all factories specialized to the same degree, for probably no one would force himself upon the manufacturer insisting on giving him help on what are recognized to be his own problems. But this is far from being the case. Where one manufacturer produces almost every part of a complete car, another turns out only bearing bushings or similar parts. Consequently, their respective interests are entirely different and this often explains their different attitude toward standardization.

During the early years of automobile standardization many manufacturers looked upon the movement with a great deal of suspicion, and especially were they afraid that some competitor might "put something over" on them by getting standards adopted that were right in line with his methods and designs. Very little or nothing of this sort has ever occurred, however.

Latest News of the

Manly Will Head S. A. E., 1919-1920

Society Has Had Successful Season—Increasing Membership at Rate of 1,000 Per Year—Finances in Excellent Condition

NEW YORK, Feb. 5—The annual professional section of the Society of Automotive Engineers opened to-day with an attendance which crowded the seating capacity of the auditorium of the Engineering Societies Building. Tractors, war and commercial, and an automobile engine symposium filled the day's program with the exception of a short time devoted to the business of the society, during which the new officers were announced and the financial and membership matters were shown to be in flourishing condition. The assets of the society are now $79,000.

Charles M. Manly of the Curtiss Aeroplane & Motor Corp. will head the S. A. E. for the 1919-1920 term. B. B. Bachman, chief engineer of the Autocar Co., will be first vice-president. The other officers are: Second vice-presidents, E. H. Belden, E. A. Sperry, T. B. Funk, John J. Armory and L. S. Kielholtz, representing, respectively, the motor car, aviation, tractor, marine and stationary engine fields. The following have been elected as councillors for 2 years: E. A. DeWaters, David Fergusson, E. A. Johnston, and for 1 year Charles S. Crawford and J. B. Whitbeck. The treasurer is C. B. Whittelsey.

Membership in the society is now increasing at the rate of 1000 per year. On Jan. 1 the society had a membership of 3866. The financial returns and earnings were greater last year than ever before in spite of the war, and the outlook is excellent for a greatly increased membership and a successful year in every way.

Short but significant discussions are developing as a result of the program laid down for the professional sessions. A symposium on the probable effect of airplane engine design on automobile practice was awaited with interest by the society, this being rendered by H. M. Crane, Howard Marmon and O. E. Hunt. These men, all having had extended experience in the manufacture of airplanes during the war, were in remarkable alignment as regards their opinions.

It is their unanimous opinion that the real influence will be in the introduction of better manufacturing methods in automobile practice due to the education of handling finer materials and through closer limits on a production basis. All are agreed that greater noise and decreased flexibility of the airplane engine make it impossible as a motor car powerplant.

Considerable surprise was expressed by some of the members in regard to the poor economy secured in the British tractor tests where some of the tractors used as much as 8 gal. per acre pulling a four-bottom plow. This was brought out by Edward R. Hewitt in digesting his paper on the "Principles of the Wheeled Farm Tractor." According to Mr. Hewitt's figures the best results secured were 2½ gal. per acre and the average was 5½ gal. Another comment made was on the poor acreage plowed in the English tests. It was cited by one member that in Texas he had been able to average 7 acres per day, plowing 280 acres in 40 days with a three-bottom machine.

President C. F. Kettering pointed out that even with the tractor of admittedly poor construction the farmer cannot afford to dispense with it, as he is able to have his silo full of feed that would otherwise not be there. The season is short in which definite work is to be done on the farm and the ability of the tractor to handle it is one of the best reasons for its success.

C. M. MANLY

Newly elected President of the S. A. E.

Mr. Manly is one of the pioneers of the airplane industry, having been associated with Professor Langley in the latter's historic experiments on mechanical flight during the early part of the present century. He is also the inventor of a hydraulic transmission for motor vehicles and occupies the position of consulting and chief inspection engineer of the Curtiss Aeroplane Corporation.

Lieut.-Col. H. W. Alden in presenting his paper on "Tanks" gave some interesting sidelights on the real purposes of these fighting machines, telling that the work for which they are most valuable is the elimination of machine gun nests. Moving pictures showing the 40-ton Mark VIII machine in action were given.

Morse Abroad for Willys-Overland

NEW YORK, Feb. 5—Elliot C. Morse, chief of the Willys-Overland Export Co., sailed to-day for England to look into export and import conditions in that country and throughout Europe. He will be away until May 1. Mr. Morse was in charge of Willys-Overland Co. interests in Washington during the war, and has now taken over the supervision of the foreign business of the company.

$29,940,780 General Motors Surplus

NEW YORK, Feb. 5—The financial statement of the General Motors Corp. and its subsidiary companies, including five months' operation of Chevrolet for the twelve months ending Sept. 30, 1918, shows total assets of the corporation to the amount of $208,252,477. After paying all expenses, taxes, bonds, etc., a surplus of $29,940,780 remains. Gross sales for 1918 amount to $39,254,396 and gross earnings to $10,568,245.

As compared with the year ending Dec. 31, 1917, there is an increase of total assets amounting to $74,462,753, and an increase of gross sales of $4,433,870.

No Price Reduction for Six Months Is General Feeling

NEW YORK, Feb. 3—Judging from the attitude of the manufacturers of the cars exhibited at the show, it is quite certain that there will be no general reduction in car prices for at least six months. There have been only two or three instances of price drops in the last week. Almost without exception guarantees are being given against reductions. In some cases these guarantees are qualified to the extent that if there is a drop within the period of the guarantee the dealer will receive a refund of the difference in price. Those who are not so bold as to actually guarantee the price "assure" the dealers and the public that cars will not be cheaper.

July 1 seems to be the date generally fixed for the period of the guarantee, a very small minority being for 3, 5, 7 and 8 months.

Automotive Industries

Labor Situation Has Passed Crisis

Detroit Believes Surplus Will Now Gradually Work Off —Not Serious Now

DETROIT, Jan. 29—Manufacturers now believe that the labor situation in Detroit has passed its crisis and from now on the surplus of labor will gradually grow less. Many plants which have been running on skeleton crews are resuming operations on their old time scale. Two of the biggest Detroit companies, the American Car and Foundry Co. and the Lincoln Motors Co., will close down temporarily in a few days, however, releasing 6,000 men, but in spite of this setback, labor officials are optimistic.

That the unemployment situation is at its peak and that there will be no acute suffering unless unforeseen developments occur is the opinion of leading factory officials who met Tuesday, Jan. 28, in conference at the Board of Commerce. Figures presented at this meeting estimate that there are approximately 35,000 men out of work. The temporary closing of the two big plants will send these figures to 41,000, but from then on they will recede.

The situation is not as serious as the figures would indicate. Reports show that savings in the banks of Detroit are not only increasing month by month, but are increasing in a cumulative ratio, showing that money is not being withdrawn for current expenses as it would be in a serious unemployment situation. Another optimistic report from the unemployment standpoint was that one-half of the 5000 employees of the American Car and Foundry Co. are intending to "go back home," having been attracted to Detroit by high wages.

Manufacturers are getting large orders and receiving raw material which will shortly enable them to increase the number of their employees. Delay in the settlement of war contracts by the Government and a belief of business men that prices will come down, a belief which is not justified according to industrial leaders, are the two obstacles to the period of great prosperity. Action on Government contracts is expected shortly, while business men in general are beginning to realize that prices are going to stay up.

Soldiers returning to Detroit are not furnishing as serious a problem as was expected. Figures show that between 13,000 and 15,000 service men have returned to the city. Of these only 2750 have applied for employment at the Government office. Of these over 70 per cent have been placed. Of the thousands who have not applied for employment, the great majority have probably gone back to their old places.

To keep in constant touch with the situation, a combined committee of the Board of Commerce and the Employers' Association and other civic groups will be appointed.

Government to Use All Machines in Service

DETROIT, Feb. 4—Col. Edwin F. George, chief of the motors branch of the Purchase, Storage and Traffic Department of the army, Washington, today said that the Government had completed plans for the utilization of every car, truck and tractor now in service, and that in no event would machines be placed on public sale. Colonel George explained that the War Department will first decide on the number of machines required for the permanent army organization. The remaining trucks will be turned over to the Post Office Department, the Department of the Interior and other Government departments. What trucks then remain will be placed at the disposal of each State for agricultural, National Guard and other purposes.

Sale of Supplies Overseas Authorized

WASHINGTON, Feb. 4—An order issued to-day by General Peyton C. March authorizes the commanding generals of the American Expeditionary Forces to sell any war supplies, including motor trucks, passenger automobiles and motorcycles, to concerns, individuals or nations that were allied with the United States. These are to be sold by auction or by sealed bids when no longer needed for the Army. Reports of sales are to be made monthly. No materials or supplies are to be sold for less than their invoice price, including cost of inspection and transportation. Some restrictions in sales are made on guns and railways and immovable property.

Commerce Motor Car Official Dead

DETROIT, Feb. 4—George J. Kellogg, for eight years secretary and treasurer of the Commerce Motor Car Co., died Sunday at Grace Hospital, following an operation. He was an official of the Commerce company from its incorporation.

82,436 Overlands in 1918

TOLEDO, Feb. 4—The Willys-Overland Co. turned out 82,436 cars in 1918, as compared with 140,002 the year before. In addition, the company completed 42 per cent of its war orders, totaling $80,000,000.

Validating Bill Is Passed

Senate Approves Measure to Relieve Contractors—Several Amendments

WASHINGTON, Jan. 31—The bill to provide for payment of informal contracts has been passed by the Senate. It will now go to conference and then probably be reported to the House.

The bill passed is the one drawn up by the War Industries Board and advocated by the United States Chamber of Commerce, the Motor & Accessories Manufacturers' Association and other industries, although the bill as originally approved by these bodies did not contain the numerous amendments that have since been added.

The act authorizes the Secretary of War to waive non-compliance with the law in the matter of the irregularly made contracts. It creates a commission composed of three members, representing the War Department, Department of Justice and a third the business interests of the country. Concerns or individuals who are dissatisfied with the decision of the Secretary of War can appeal to the commission.

A provision authorizes the Secretary of War to secure satisfactory evidence that subcontractors will be properly paid before making payments to prime contractors. Reports of all operations under this act must be filed with Congress before the first Monday in December of each year. Following is the complete bill:

(*Continued on page 339*)

Additional Aero Banquet Guests

NEW YORK, Feb. 5—Coming with Lieutenant Fonck as representatives of the French Government at the Aero banquet on Feb. 19 are Sub-Lt. Charles Nungesser and M. Esnault Peltrio, one of the foremost French engineers and president of the Airplane Manufacturers and Industries in France. He will discuss the development and possibilities of the airplane for commercial uses.

Westcott Has a Lighter Six

SPRINGFIELD, OHIO, Feb. 2—The Westcott Motor Car Co. is working on a new model, a lighter six, and it is hoped that it will be ready in time for the Atlantic City Show the latter part of this month. The new car does not differ radically from the heavier six, which is now going through, but is more or less a small edition of it. No price has as yet been set, and it is not expected that this detail will be made public till the car gets

into production. The salient features include a Continental 3¼ x 4½-in. six-cylinder engine, automatic thermostatic water regulation, Fedders radiator, Delco ignition, Borg & Beck clutch, Brown-Lipe gearset, Hotchkiss drive, Timken axles and a Stewart vacuum fuel feed system. Grease cups have been entirely eliminated from the car, and every part requiring lubrication is supplied with oil fed by wicks. The tire equipment is 33 x 4 both front and rear, and the standard finish on the body and wheels is green.

—

Freight Rates to United Kingdom

WASHINGTON, Jan. 30—The United States Shipping Board has made public to-day the following rates of freight from the United States North Atlantic ports to Liverpool, London, Manchester, Hull, Avonmouth, Bristol, Cardiff, Glasgow, Leith and Belfast on a list of commodities which included:

Agricultural tractors $1 per 100 lbs. or 50 cents per cu. ft.

Auto trucks, $1 per 100 lbs. or 50 cents per cu. ft.

Ball bearings, $1 per 100 lbs.

Gas engines as parts of agricultural tractors or not as parts of agricultural tractors, $1 per 100 lbs. or 50 cents per cu. ft.

Other automotive products or materials not enumerated take a rate of $1 per 100 lbs. or 50 cents per cu. ft., ship's option:

—

Simplify Import List

WASHINGTON, Jan. 30—Individual import licenses will no longer be required for the importation into the United States from the United Kingdom, France, Italy, and Belgium and their European and Mediterranean African possessions and protectorates of any automotive commodities except the following: Naxos emery, naxos emery ore, ferro-manganese, spiegeleisen, nitrates, tin, tin ore and tin concentrates, or metals containing over 5 per cent tin.

It was also announced by the Board that all commodities imported into Alaska, Guam, Hawaii, Tutila, Porto Rico, the Virgin Islands, the Canal Zone, and the Philippine Islands may now be transshipped to destinations other than the United States.

All such relaxation of import restrictions, it was stated, will expedite import shipments and will tend to restore the entire import trade to normal conditions.

Thompson Elected Head of M. A. M. A.

President of Steel Products Succeeds Stiger—Broadwell First Vice-President

CHICAGO, Feb. 3—Charles E. Thompson, president of the Steel Products Co., Cleveland, was elected president of the Motor and Accessory Manufacturers' Association at a meeting of the Board of Directors Thursday afternoon, Jan. 30. He succeeds C. W. Stiger, Chicago, president of the Stromberg Motor Devices Co. The directors chosen were: E. P. Hammond, president of the Gemmer Mfg. Co., St. Louis, and G. W. Yeoman of the Continental Motors Co., Detroit. Other officers elected included: first vice-president, E. A. Broadwell, vice-president Fisk Rubber Co.; second vice-president, Christian Girl, president Standard Parts Co.; third vice-president, W. O. Rutherford, vice-president B. F. Goodrich Co.; treasurer, L. M. Wainwright, president Diamond Chain Co; secretary and assistant treasurer, T. J. Wetzel, Precision Castings Co.; manager, L. M. Bradley, and assistant manager, L. M. Heminway.

The afternoon meeting was a business session at which the retiring president delivered an address.

The evening session constituted chiefly the banquet in the gold room of the Congress Hotel and was attended by about 400 members.

—

Lieut. Fonck to Represent France at Aero Banquet

NEW YORK, Feb. 1—It is understood that Lieut. René Fonck, the leading French ace, who is also the premier ace of the world, will represent France at the Aero Club of America banquet on Feb. 19. At the request of the Foreign Service Committee of the club, he has been granted permission by the French Government to represent it, and is preparing to come to the United States at once.

—

$1,096,114,908 Spent for Air Service

WASHINGTON, Feb. 1—Total disbursements by the Bureau of Aircraft Production and the Division of Military Aeronautics amounted to $691,503,165 to Dec. 1, 1918, and outstanding obligations incurred to that date and not paid were $404,611,742, according to a statement of military appropriations filed with Congress yesterday. These expenditures allow a remaining $463,532,925 as the balance of appropriations not required.

According to the same report the Ordnance Department disbursed $25,771,-912.91 for armored motor cars to Dec. 1, 1918, with outstanding obligations for the same product totaling $79,584,252.82. Appropriations of $406,640,000 allowed for armored motor cars by the acts of July 9 and Nov. 4, 1918, were untouched.

Below is the statement of the Division of Military Aeronautics and the Bureau of Aircraft Production.

—

Detroit-Pittsburgh Airplane Express Route Advocated

DETROIT, Jan. 31—Automobile and other automotive industrial companies are asked to guarantee sufficient business to permit the establishment of an airplane express route between Detroit and Pittsburgh this spring. The Detroit and Pittsburgh Boards of Commerce have endorsed a plan submitted by Lieutenant B. Vernon, Flying Field, Philadelphia, for the immediate establishment of such a line, providing sufficient business can be secured. Lieutenant Vernon proposes to operate two planes, one to fly from Detroit to Pittsburgh and the other from Pittsburgh to Detroit, stopping at all intermediate cities. Discounting time required to make principal stops, a machine leaving Detroit at 10.30 a. m. will reach Pittsburgh at 3.30 p. m.

The proposed air express company will carry express for $1.78 a pound, subject to a 40 per cent discount if a satisfactory amount is sent at one time.

—

Le Pere Planes at Bolling Field

WASHINGTON, Jan. 30—Two of the latest type American-made scout planes, the Le Pere, have arrived at Bolling Field for test flights. These are the first two planes of this particular model made in the United States and were designed for use of American aviators at the front. It was stated at Bolling Field last night that these planes are equipped with the latest mechanical devices, having a balanced elevator and great speed.

The airplanes are camouflaged green, blue and white, and have 12-cylinder Liberty engines. The planes, it was stated, weigh approximately 3500 lbs., with a wing spread of 24 ft. They can climb 22,000 ft. and attain a speed rate of 135 m. p. h.

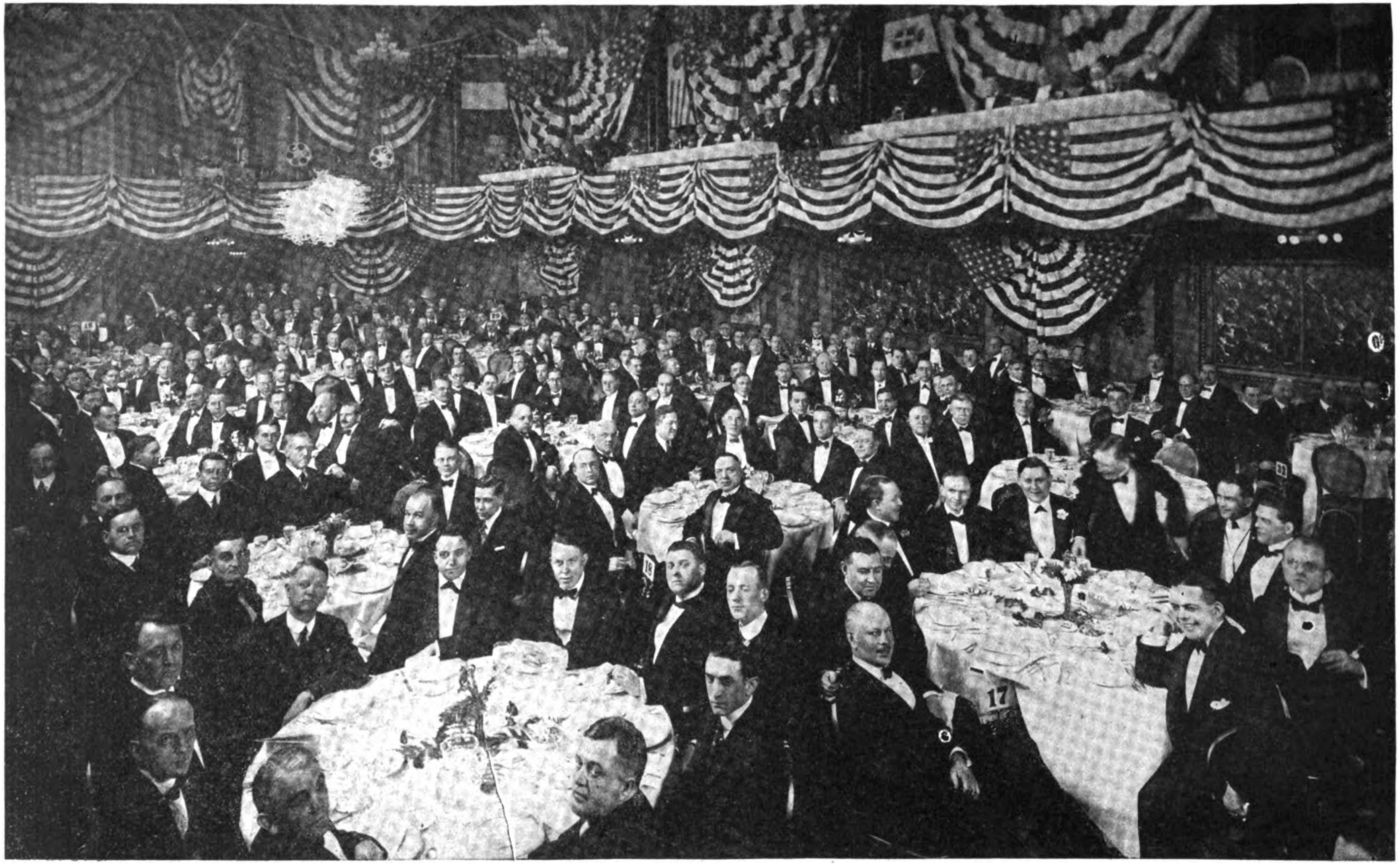
—

Hawkins Reported in Combine

NEW YORK, Feb. 6—A great consolidation of passenger car, truck, tractor and parts makers to be headed by Norval A. Hawkins, former sales manager of the Ford Motor Co., will shortly be completed, according to persistent reports. New York financiers are said to be behind the deal which it is understood is practically completed now.

DIVISION OF MILITARY AERONAUTICS					
Air Service, military, acts July 9, Nov. 4, 1918	$184,304,758.00	$53,254,806.40	$46,050,000.00	$23,467,026.42	$61,532,925.18
Aviation stations, seacoast defense, act July 8, 1918...	8,000 000.00	....	....	8,000,000.00	....
Totals..........	$192,304,758.00	$53,254,806.40	$46,050,000.00	$31,467,026.42	$61,532,925.18
BUREAU OF AIRCRAFT PRODUCTION					
Air Service (Production), act July 9, 1918	$760,000,000.00	$34,490,492.11	$225,251,843.63	$100,257,664.26	$400,000,000.00
Increase for Aviation Signal Corps, act July 24, 1917..	640,000,000.00	522,161,120.38	117,838,879.62	....	....
Signal Service of the Army, acts May 12, June 15, Oct. 6, 1917	99,067,766.00	81,596,746.98	15,471,019.02	....	2,000,000.00
Totals..........	$1,499,067,766.00	$638,248,359.47	$358,561,742.27	$100,257,664.26	$402,000,000.00

Annual Banquet of the M. A. M. A. During the Chicago Show



—Photo Kaufman & Fabry

More than 400 members of the Motor and Accessory Manufacturers' Association and guests attended the annual banquet of the association held during the Chicago show

Big Drop in Automotive Exports for Calendar Year 1918

Figures Maintained for Fiscal Year Ending June 30, but a Net Loss of Over $15,000,000 Incurred in Last Six Months

Totals by Months, 1918

December	1,703	$2,203,027	896	$2,636,689	$2,191,511
November	2,226	2,576,622	974	2,709,362	2,166,719
1917					
December	6,442	$5,380,702	807	$1,592,881	$4,952,615

Totals by Calendar Years

	Cars	Value	Trucks	Value	Parts
1918	36,936	$36,278,292	10,308	$26,814,952	$33,607,050
1917	65,576	51,872,905	14,479	36,755,236	31,624,963
Loss or gain in 1918	—28,820	—$15,594,613	-4,171	—$9,940,284	+$1,982,087

WASHINGTON, Jan. 31—When considering the matter of exports it is advisable to remember that the Government fiscal year ends on June 30 in each year and that for this reason it frequently happens that misunderstandings arise in connection with figures covering the Government year and those relating to the calendar year.

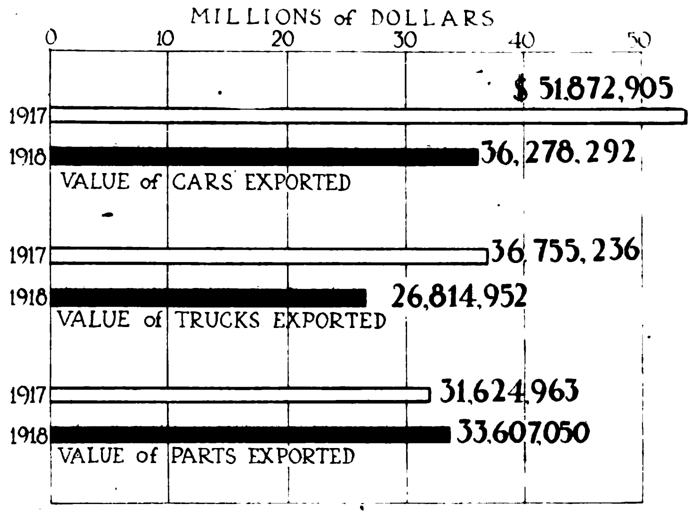
In the table herewith the totals are those of the calendar year, the figures for the fiscal year 1918 having been published in AUTOMOTIVE INDUSTRIES of Aug. 8. A comparison of these two sets of figures is of interest, especially at this time of reconstruction and consequent partial derangement of manufacturing programs.

Turning to the totals covering the fiscal year ending June 30, 1918, and segregating those referring to cars, trucks and parts, it is found that our total exports for the Government year were valued at $110,106,505 for 1918 and $118,377,047 for 1917, showing a drop in 1918 of $8,270,542.

Taking calendar year totals on similar items, as shown in table herewith, the values are $96,700,294 for 1918 and $120,253,104 for 1917, an apparent gross falling off of $23,552,810, or, deducting the fiscal year drop, a net loss of $15,282,268 on the year ending Dec. 31, 1918.

However, this is hardly an accurate way of determining the position, for it assumes that our export figures ran 50-50 during the first six months of 1918, a period common to both methods of computing the year's totals. It is quite conceivable that the loss occurred during the last six months of 1917, a period included in the 1918 fiscal year. At the same time there are regrettable indica-

Chart illustrating the drop in exports of cars and trucks and the slight gain in parts as between the calendar years 1917 and 1918



Exports of Automotive Equipment for Twelve Months Ending December, 1918

	Month of December				Twelve Months Ending December			
	1918		1917		1918		1917	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	......	....	1	$17,250	48	$607,255	140	$1,100,207
Airplane parts	......	$424,784	......	870,924	......	14,670,269	......	5,505,565
Commercial cars	896	2,636,689	807	1,592,881	10,308	26,814,952	14,479	36,755,236
Motorcycles	481	114,405	1,284	293,325	9,212	2,169,385	14,320	3,035.032
Passenger cars	1,703	2,203,027	6,442	5,380,702	36,936	36,278,292	65,756	51,872,905
Parts, not including engines and tires	......	2,191,511	......	4,952,615	......	33,607,050	......	31,624,963
Total (trucks, cars and parts value only)	......	$7,031,227	......	$11,925,698	......	$96,700,294	......	$120,253,104
ENGINES								
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas	1,777	$332,112	7,667	$943,196	30,813	$4,188,675	36,768	$4,223,095
Marine, gas	499	250,127	921	511,426	5,483	2,790,833	10,334	2,427,058
Stationary, gas	1,222	219,670	3,856	398,292	26,608	3,332,131	27,610	3,237,647
Tractor, gas	1,734	1,355,338	1,226	1,482,746	23,424	24,402,949	14,031	16,521,444
Total value	......	$2,157,247	......	$3,335,660	......	$34,714,588	......	$26,409,244

	EXPORTS BY COUNTRIES DECEMBER, 1918				TWELVE MONTHS ENDING DECEMBER, 1918			
	Passenger Cars		Trucks		Passenger Cars		Trucks	
	No.	Value	No.	Value	No.	Value	No.	Value
Argentina	163	$152,698	2	$844	1,628	$1,673,137	45	$40,707
Australia	254	239,375	......	....	3,826	3,271,317	......	....
British India	8	11,420	......	....	72	70,254	......	....
British South Africa	129	136,909	......	....	1,205	1,070,570	......	....
Canada	55	75,588	97	143,329	8,542	7,140,776	1,596	2,035,464
Chile	129	263.788	......	....	1,734	2,315,386	......	....
Cuba	121	208,797	50	87,382	1,909	2,638,001	557	1,109,368
Denmark	27	48,643	......	....	98	159,516	......	....
Dutch East Indies	194	273,863	......	....	1,260	1,567,760	......	....
France	4	15,890	370	1,706,184	1,003	1,134,818	3,356	12,920,029
Mexico	87	108,637	......	....	1.916	1,538,893	......	....
New Zealand	63	71,878	......	....	1,418	1,228.864	......	....
Norway	......	....	......	....	198	430,514	......	....
Philippine Islands	50	46,031	......	....	1,690	1,462,571	......	....
Russia in Asia	......	....	......	....	3	11.734	15	18,200
Russia in Europe	......	....	......	....	10	8,325	2	5,454
Spain	47	67.946	......	....	808	1,042,789	......	....
United Kingdom	1	1.000	10	19,361	423	1,082,347	2,264	6.671,230
Uruguay	......	....	......	....	1,351	799,787	......	....
Other Countries	371	480,564	367	679,589	7,842	7,630,927	2,473	4,014,500
Totals	1,703	$2.203.027	896	$2,636,689	36,936	$36.278.292	10,308	$26,814.952

tions that our export trade in cars and trucks has been on the down-grade for some months.

This apparent fact should not be accepted as an indication that our export business is leaving us permanently. It is rather a sign that circumstances and conditions quite outside of the automotive industry are not propitious for the time being. We are handicapped in our foreign trade at the present time by the state of national unrest existing in practically every country in the world, we find it hard to sell cars and trucks to countries which have no gasoline and but few available tires, and our difficulties do not end here.

The process of reconstruction on an improved ante-war basis is the big subject which is occupying the majority of our best customer countries to-day, and until commercial relations can assume a condition more nearly approaching normal it is too much to expect that our automotive export business will start in breaking records, as in 1916-17 and the earlier part of 1918.

Decrease in Canadian Motor Imports and Exports

WASHINGTON, Feb. 3—During the year 1917 there were in Canada eleven automobile manufacturers, twenty automobile accessory manufacturers and 497 repairshops, according to a report made by the United States Consul General at Ottawa. The capital invested in these industries was divided as follows: $28,192,858 in automobile manufacture, $3,155,893 in accessory manufacture and $4,431,926 in repairshops, making a total investment of $35,780,677.

Materials to the value of $35,585,820 were used in the manufacture of automobiles, $3,788,308 in accessories and $1,961,773 in repairs. The value of automobiles produced was $54,466,273, of accessories $6,495,868 and of repairs $5,091,066, making a total for the year of $66,053,207. The number of different types of cars produced, classified according to purposes, were: Touring cars, 80,544; runabouts, 5502; closed cars, 1231; club roadsters, 561; trucks, 117, and unclassified, 1721, or a total of 89,676.

The number of automobiles exported during the 12 months ended October, 1918, was 8044, valued at $3,692,524, against 9349, valued at $4,504,772 during the preceding 12 months. The value of automobile parts exported during the same periods was $1,202,055 and $1,523,678 respectively. Imports of motor cars during the six months ended September, 1918, amounted to 5689, valued at $5,018,941, and parts to $3,511,077, compared with 11,171 automobiles, valued at $7,870,377, and parts at $3,698,140, imported during the six months ended September, 1917.

The following table shows the number of employees on a wage basis in each class and the amount paid them:

Industry	Males	Females	Wages
Automobile plants..	4852	164	$4,862,779
Accessory plants...	1405	122	1,198,596
Repairshops	1508	34	1,200,958
Totals............	7765	320	$7,262,333

December Exports from New York

Parts Show Gain for Month, but Exports of Both Cars and Trucks Have Dropped

NEW YORK, Jan. 31—Exports of cars, trucks and parts from this port for December, 1918, represented in value approximately 50 per cent of the total car, truck and parts exported from all United States ports during that month. This proportion is rather under the mark, as New York is usually credited with around 60 per cent of the country's exports.

The increases shown in car and truck export figures for November were not maintained during December, the former dropping in number from 806 to 740, but showing a slight gain in value, the figures being $1,003,416 and $1,020,126 respectively. Four hundred and thirty trucks, valued at $1,564,293, were exported in December, as against 549, valued at $1,733,489 in November. On the other hand, parts have shown a gain, the December figures being $898,513, as compared with November's $593,414.

December's list of buying countries is somewhat restricted, as compared with those of the previous month, no shipments having been made to over a dozen which figured in the November table. When considering exports from New York to such places as Australia, New Zealand, Japan, etc., it should be noted that many shipments are made to these and other Oriental countries from Pacific ports. For example, Australia shipped 140 passenger cars from New York during December, but she also shipped 114 from other United States ports.

To Relax Export and Import Restrictions

WASHINGTON, Feb. 3—Further relaxation of restrictions and simplified procedure will be made shortly by the War Trade Board for the benefit of American exporters and importers. The method by which exporters were forced to procure individual export licenses during the war will be abolished as quickly as possible and a general license permitting the export of specified commodities to specified destinations will be issued instead wherever possible. This policy will be specifically applied to export shipments to the United Kingdom, France, Italy or Japan and their colonies, possessions and protectorates, Belgium and the Belgian Congo, Canada and Newfoundland.

New and Simplified Import License

WASHINGTON, Jan. 25—A new general import license, to be known as PBF No. 31, has been issued by the War Trade Board to cover all shipments of unrestricted commodities in transit through the United States where shipment from abroad is made after Jan. 21, 1919. This license does not relieve shipments of commodities in transit of the necessity of complying with whatever regulations are in operation and cover such shipments at the time.

AUTOMOBILE, TRUCK AND PARTS EXPORTS FROM NEW YORK FOR DECEMBER

	Cars		Trucks		Parts
	No.	Value	No.	Value	Value
Argentina	42	$32,885	2	$844	$257,051
Australia	140	134,489	..	......	28,157
Barbadoes	..	......	1	2,792	2,779
Bolivia	1	2,320	8	24,516	1,711
Brazil	14	14,460	..	......	991
British Guiana	3	3,170	..	......	2,318
British India	7	9,920	1	2,118	29,051
British South Africa	100	108,416	1	2,279	27,701
British West Africa	12	10,169	2	3,037	9,111
British West Indies	3	1,967	..	......	2,754
Canary Islands	..	......	..	......	600
Chile	112	245,900	23	26,158	67,030
Costa Rica	..	......	..	......	1,024
Cuba	22	54,097	25	32,274	55,063
Danish West Indies	1	1,741	..	......	650
Denmark	27	48,648	..	......	811
Dutch East Indies	46	41,317	20	42,785	36,784
Dutch Guiana	..	......	..	......	376
Dutch West Indies	..	......	..	......	243
Ecuador	..	......	..	......	520
England	1	1,000	10	19,361	135,174
France	4	15,890	295	1,330,690	126,503
French Africa	22	8,611	1	1,912	15,485
French West Indies	4	4,900	..	......	3,088
Guatemala	..	......	..	......	886
Haiti	9	8,588	..	......	848
Honduras	..	......	..	......	228
Hongkong	4	2,800	..	......	360
Iceland	4	3,779	..	......	......
Jamaica	..	......	..	......	10,460
Japan	1	1,600	5	6,436	236
Mexico	15	24,150	5	4,176	7,314
Newfoundland	18	25,407	4	1,998	256
New Zealand	..	......	1	2,296	1,814
Nicaragua	..	......	..	......	490
Norway	..	......	5	16,800	2,533
Panama	2	2,500	..	......	3,300
Peru	57	105,673	14	35,816	9,779
Portuguese Africa	..	......	..	......	381
Russia in Europe	..	......	..	......	127
Salvador	6	9,000	..	......	1,041
Santo Domingo	9	7,393	..	......	14,122
Siam	..	......	..	......	1,053
Spain	45	63,118	2	1,805	7,947
Straits Settlements	..	......	4	6,200	18,178
Trinidad	..	......	..	......	2,505
Venezuela	10	13,223	..	......	6,445
Totals	740	$1,020,126	430	$1,564,293	$898,513

More Than 400 Gather at S.A.E. Home-Coming Supper

CHICAGO, Jan. 30—Four hundred representatives of the various automotive industries outlined their activities for the reconstruction period in connection with the home-coming supper and afternoon technical session of the Society of Automotive Engineers at the Hotel Morrison to-day. While most engineers realize the pace throughout the automotive world will be much faster in the coming years, there is a feeling of optimism that whatever conditions prevail the engineers of the country will shape the destinies of their respective industries in the same satisfactory manner as was done throughout the war period. President Kettering stated that as a result of war work we have on hand a tremendous amount of technical information, all or some of which will undoubtedly be used by engineers and designers in the motor car, truck, tractor and airplane field.

Besides President Kettering, the speakers of the evening included George W. Smith, assistant chief engineer Nash Motors Co. and chairman of the Midwest Section, S. A. E.; H. H. Merrick, president Chicago Association of Commerce; Col. Chauncey Baker, Quartermaster Department, Motor Transport Section; William B. Stout, United Aircraft Engineering Corps, New York. E. E. Peake, executive secretary National Automobile Dealers' Association, acted as toastmaster. The afternoon session was given entirely to reading and discussion of technical papers, the severity of which, however, was relieved by Capt. Mark Smith, U. S. M. C., who told of his experiences at Chateau-Thierry.

Stewart-Warner Earns $1,504,664

CHICAGO, Feb. 5—The Stewart-Warner Speedometer Corp. showed net profits for the year ending Dec. 31, 1918, of $1,594,664 after Federal income, excess profits and war profits taxes were deducted. As compared with $1,860,774 for 1917, this is a loss of $365,110. After dividends were paid, a surplus of $994,664 remained, as compared with $1,260,774 for 1917. Net profits for 1918 are equal to 15.94 per cent on capital stock, which was recently raised from a 6 to an 8 per cent per annum basis.

The comparative statement for 1918 and 1917 follows:

	1918	1917
Profit and income, after deducting expenses, depreciation, etc.	$2,002,646	$2,234,824
Provision for taxes	407,982	374,050
Net profit	$1,594,664	$1,860,774
Dividends	600,000	600,000
Surplus	994,664	$1,260,774
Previous Surplus	5,456,216	4,195,442
Total Surplus	$6,450,880	$5,456,216

Indict 13 Pan-Officers

CHICAGO, Feb. 1—Indictments against thirteen officers and directors of the Pan Motor Co., St. Cloud, were returned today by the Federal Court, charging the use of mails to defraud. The indictment alleges a stock-promoting scheme.

The concern is incorporated under the laws of Delaware and the men indicted are: Samuel C. Pandolfo, St. Cloud, president; Norman A. Street, promoter, Chicago; George Heitman, Chicago; H. S. Wigle, Spokane, Wash.; John Barritt, St. Cloud; Charles D. Schwab, St. Cloud; Fred Shilpin, St. Cloud; Charles Bunnell, St. Cloud; George E. Hanson, St. Cloud; Charles F. Ladner, St. Cloud; Peter R. Thielman, St. Cloud; Hugh Evans, St. Cloud, and H. C. Erwing, Jr., St. Cloud.

The indictment charges that approximately $5,500,000, including $250,000 in Liberty Bonds, was accepted from 50,000 working people throughout the country.

A recent financial statement issued by the company, the indictment asserts, claims that the company had a surplus of $2,500,000, although it never was on a production basis. The surplus, it is charged, was created by capitalizing intangible assets.

National Show Managers' Association Re-elects Officers

CHICAGO, Feb. 4—At the annual meeting of the National Association of Automobile Show Managers last week all the officers of the organization were reelected, as follows: President, E. E. Peake, Kansas City; vice-president, Bart J. Ruddle, Milwaukee; secretary-treasurer, Ray W. Sherman, Motor World, New York.

No Automobiles for Sale by Army

WASHINGTON, Feb. 4—Further official denial of the rumors that the army is selling passenger automobiles was made here to-day by the War Department. A public statement given to the press denies that dealers or others have purchased any cars from the army, and adds that second-hand dealers who advertise that they have cars for sale purchased from the government are not telling the truth. Following is the announcement:

"There are persistent rumors all over the country to the effect that the War Department is disposing of a large number of automobiles by auction or private sale at reduced prices and in many cases to brokers. At the present time there are available no passenger automobiles for sale. New cars will be turned back through the original manufacturer in every case where practicable.

"It has been noted that a number of second-hand dealers have advertised from time to time quantities of new or nearly new material which they claim to have purchased from the War Department. These cases have been investigated, and in every instance so far, material advertised has not been property of the dealer and the Government had no intention of selling him this property. In this connection it should be distinctly understood that it is not the policy of the War Department to sell property to anyone for speculative purposes."

Jordan Prices Drop

CLEVELAND, Feb. 3—The Jordan Motor Car Co. has reduced the price of five of the company's six models as follows:

Model	New Price	Old Price
Touring car	$2,475	$2,775
Four-passenger sport model	2,475	2,775
Sedan	3,500	3,750
Four-passenger brougham	3,500	3,750
Town car	3,500	3,750
Limousine	3,750	3,750

Rickenbacker, American Ace, Honored at Banquet

NEW YORK CITY, Feb. 4—Captain E. V. Rickenbacker, America's ace of aces, shared plaudits with his mother last night when the nation officially welcomed the former racing driver at a banquet given in his honor by the Contest Board of the American Automobile Association and allied motoring and aviation organizations at the Waldorf-Astoria. Seven hundred of the big men in motoring and aviation gathered to do honor to the man who had brought down twenty-six Huns. Secretary of War Baker, Chief, Bureau Aircraft Production. Major-General Menoher, Congressman Ireland, ex-Congressman Bourke Cochrane and others voiced the welcome of the victorious flyer's admirers. Cablegrams were read from General Pershing and others who had known Rick in service and on the speedways. Through Rick his friends presented his mother with a pair of platinum wings set with diamonds and sapphires in honor of her eagle son.

Studebaker Branch Management Changes

NEW YORK, Feb. 3—F. R. Bump, who has been manager of the Studebaker branch for many years, has resigned, and Ira C. Jones has taken up his duties. Mr. Jones was formerly the owner and proprietor of a wholesale jewelry business in New York. He has brought F. L. Sholes into the organization to be retail manager, and F. W. Beinecke, who will be in charge of service. Mr. Sholes was formerly the factory sales manager of the specialty department of the American Can Co. and Mr. Beinecke was in charge of the rolling stock of the Texas company.

More Ford Tractor Plants

DETROIT, Feb. 3—The Ford Motor Car Co. is planning a period of expansion. The completion of the $7,000,000 tractor factory here is followed by the statement of Mr. Ford that he is preparing to build a tractor factory on the Hudson River, another in Ontario and another plant will be built and transported bodily to Mexico.

Bethlehem Motors Building Tractors

ALLENTOWN, PA., Feb. 3—The Bethlehem Motors Co. is now building a tractor in addition to its line of trucks. It is hoped to have an exhibition model ready in time to be at the Kansas City Tractor Show.

New Overland Price Is "Mystery"

DETROIT, Feb. 3—The price of the new light Overland four to be placed on the market May 1 by the Willys-Overland Co., Toledo, has become one of the main topics of discussion in automotive circles. Since the chassis was introduced at the January show last year the trade has been waiting for the new machine and a price announcement. From the Toledo factory comes word that the price will not be made public until the cars are in the hands of the distributers.

Rick's Record Is 100% Perfect

No Damaged Planes Despite 26 Victories—69 Planes to Credit of Squadron 94

NEW YORK, Feb. 1—Eddie Rickenbacker, former racing star, returned on the Adriatic as Captain Rickenbacker, American ace, with 26 Hun planes to his credit in the short period of 7 months that he was on the American front in France. He comes home with more planes than any other aviator in the American service, his closest rival being the late Raoul Lufberry, shot down in France some months ago, who had 18 to his credit. Captain Rickenbacker left his squadron, the Ninety-fourth, of which he was commander, the day after Christmas, and is proceeding to Washington on military orders. His was the leading American squadron, with 69 Hun planes as its share. It is not known whether he will remain permanently in this country or not.

His squadron, whose work began at Chateau-Thierry in July and continued until the armistice Nov. 11, was selected to accompany the army of occupation to Coblenz, a coveted honor for any squadron.

Captain Rickenbacker, or Eddie or Rick, as we still prefer to call him, had a truly meteoric career in the war. He was ordered to the front as an aviator on April 14, 1918, and got his first Hun on April 29. It was from that date up to November that he won the highest honor that could come to an American aviator. He chalked up more victories than any of our flyers in the Lafayette squadron, which had over three years' experience in France. He proved himself as fearless a fighter against the Boche as he was a racing driver on our speedways. In flying, however, he was more fortunate. He had machines, a Nieuport and a Spad, that he could not break up. In his old racing days on Indianapolis and other speedways he ran the wheels off his cars, burned out bearings and put himself out of the winning. In aviation his record has been 100 per cent perfect. He has never crashed a single machine. In training he never once broke up a plane, nor even a wing or a tail.

He brought down 18 Boche planes on his Spad fighter and never crashed or broke his machine. He never had to have a new rudder or elevator put on. Even the 220-hp. Hispano-Suiza engine lasted him for 120 hours, although the average life of these engines in fighting service was 9 hours.

Once Rick was caught in a dog fight. That is what the show was called when eight or ten Boches attacked three or four Allied planes. Rick had been out nearly the limit of the two hours and fifteen minutes for which his Nieuport carried gasoline supply when the dog fight started. He finished the scrap, getting one Hun, and then made for across the front line trenches and home. Before he reached the lines his engine oil was exhausted, the bearings seized, and he was just able to glide across No Man's Land and make a forced landing between rows of barbed wire in an open field. But his pilotship was so expert that even here he did not crash his machine. He tore the tail skid off, but did not crush the landing gear. It was necessary to take the wings off before the plane could be removed to the squadron.

Rick is accompanied by two aces from his squadron. One is Major Meissner of Brooklyn, with 8 victories to his credit, and the other is Capt. Douglas Campbell of Mount Hamilton, Col., who brought down 7 Boches. Both are reporting to aviation headquarters at Washington with Captain Rickenbacker.

Rick left him famous Ninety-fourth at Coblenz in charge of Reed Chambers, who, before going to the war, was the Cadillac agent at Memphis. He is now Captain Chambers, with 7 victories on the official record.

Some of Rick's other fighting "94's" had previous connections with the motor industry, and some were boys fresh from college. Samuel Kayes, with four Boche victims, was the Ford agent at Columbus, Miss. He is still with the squadron at Coblenz.

Wierd Cook, Anderson, Ind., was one of the college graduates, a mere lad from school. Yet he had 6 victories when Nov. 11 ended the show.

Joe Dawson, Denver, Col., no relation to the old race driver, was another fighting member of the 94th, and got 6 Boches.

The squadron, although officially made up of twenty-five planes, was in service with twenty-four and about twenty pilots. They all flew Spads, type XIII, fitted with Hispano-Suiza engines. The Spad is France's best single-seater scout fighter, and has a flying speed of 135 m.p.h., with a driving speed as high as 300 m.p.h. All American fighting scouts used the Spad the last few months. Previous to that many of them used Nieuport Scouts, also French machines, with a rotary air-cooled engine. These were not so recent a creation as the Spad.

—

NEW YORK, Feb. 3—Captain Eddie Rickenbacker, America's Ace of Aces, and former racing driver, if he does not change his mind, is out of motor racing for good. While his future is quite unsettled, and he is only home on official orders to report to headquarters in Washington, he has a strong desire to spend the remainder of his days in aircraft service. Indications that his service to his country will not be concluded with his return to America are apparent in the announcement by Director of Publicity Wilson of the Liberty Loan Bureau of the Treasury Department, that for the next month Rickenbacker will pilot a plane doing stunts in Ohio cities to promote the Fifth Liberty Loan.

His ambitions are not to remain a pilot, but may follow either of two directions: First, to continue with the army or Government in aircraft work, or, second, to go into the commercial end, either in engineering or other work.

Michigan and Ohio Car Production

63,246 Passenger Cars Built in January, With Factories Running Below Normal

DETROIT, Jan. 31—Production figures given out by the leading automobile companies of Michigan and Ohio show that approximately 63,246 passenger cars were made during January, notwithstanding the fact that a majority of the concerns were running below normal production and some were not in production at all. The figures are fairly accurate and show that the delay attendant on reconstruction work will very likely curtail the 1919 car output 33 1/3 per cent.

Had normal conditions prevailed, the number of cars made in this district in 1919 would have exceeded the 3,000,000 mark, and may even have a total of 3,500,000, automobile manufacturers contend. Delay in contract settlement and in shifting the big plants from a war to a peacetime basis will cut the estimated production to approximately 2,000,000 machines, unless the trade demands necessitate the adoption of an over-time schedule by the larger plants.

Thirty-two manufacturers submitted production figures. Oldsmobile and Chevrolet figures were not available. The Packard, White, Jackson and King companies are not in production. The King people will start making cars this month. The White and Jackson companies may both produce a passenger car this year.

Ford production is now 1300 cars a day, which is more than half below normal. This company will be hitting the 3000 mark by the middle of March. The production tabulation follows:

Car	Daily Production
Buick	100
Briscoe	30
Cadillac	55
Chalmers	30
Chevrolet	
Columbia	8
Dodge	300
Dort	40
Ford	1300
Harroun	4
Hudson	30
Essex	38
Hupp	10
King	0
Liberty	15
Maxwell	150
Oakland	160
Oldsmobile	
Overland	320
Packard	0
Paige	50
Reo	100
Saxon	10
Scripps-Booth	20
Olympian	4
Jordan	5
Winton	5
Grant	25
White	0
Monroe	25
Paterson	4
Jackson	0
Total	2838

—

New Illinois Super-Drive Tractor

BLOOMINGTON, ILL., Feb. 3—The Illinois Tractor Co. is building a new tractor to be known as the Illinois Super-Drive. It will be exhibited for the first time at the Kansas City Tractor Show.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. .... .02 -.03
- Phosphoric (85%).. .35 -.39
- Sulphuric (60%), lb. .008

Aluminum:
- Ingot, lb. .... .30 -.33
- Sheets (18 gage or more), lb. .... .42
- Antimony, lb...... .07½-.07¾

Burlap:
- 8 oz., yd.......... .10½
- 10½ oz., yd......... .16⅛

Copper:
- Elec., lb. .... .18¾-.23
- Lake, lb............ .21

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.62
- Egypt, combed, sq. yd. 1.30
- Egypt, carded, sq. yd. 1.27
- Peelers, combed, sq. yd. .97
- Peelers carded, sq. yd. .95-1.05

Fibre (⅛ in sheet base), lb. .... .50

Graphite:
- Ceylon, lb. .... .09 -.22
- Madagascar, lb. .. .10 -.15
- Mexico, lb. .... .03¾

Lead, lb. .... .0475-.0525

Leather:
- Hides, lb. .... .18 -.35¼

Nickel, lb. .... .40

Oil:
- Gasoline:
  - Auto. gal. .... .24½
  - 68 to 70 gal...... .30½
- Lard:
  - Prime City, gal..1.90-2.00
  - Ex. No. 1, gal...1.10
- Linseed, gal. 1.45-1.48
- gal. 1.10-1.12
- Petroleum (crude):
  - Kansas, bbl. 2.25
  - Pennsylv'a. bbl..4.00
- Menhaden (Dark).

Rubber:
- Ceylon:
  - First latex pale crepe, lb. ...... .56
  - Brown, crepe, thin, clear, lb. .... .50
  - Smoked, ribbed sheets, lb........ .54
- Para:
  - Up River, fine, lb. .58½
  - Up River, coarse, lb. .... .34
  - Island, fine, lb... .49

Shellac (orange), lb. .70 -.72

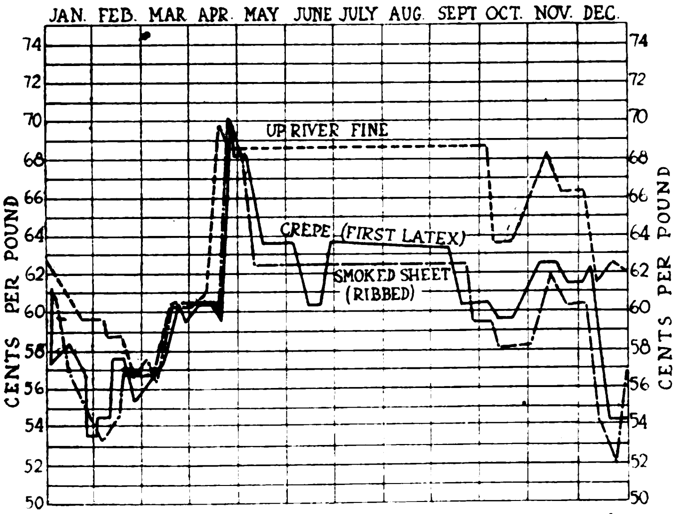
Spelter .... .07

Steel:
- Angle beams and channels, lb. ..... .03
- Automobile sheet (see sp. table.)
- Cold rol'ed, lb. ..... .0625
- Hot rolled, lb....... .039

Tin .... .71 -.72

Tungsten, lb. 1.50-.2.10

Waste (cotton), lb... .12¾-.17



Price fluctuations of Up River Fine, First Latex Crepe and Smoked Sheet crude rubber during 1918. *Government control, which limited shipments, affected prices throughout most of the year*

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock.................	$5.95	$5.85
Automobile body stock, deep stamping.	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock.................	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping..............	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Black Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.
- Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close Feb. 1

	Bid	Asked	Net Ch'ge
Auto Body Company.........	6⅛	8½	..
Briscoe Motor Car, com....	10½	..	½
Briscoe Motor Car, pfd......	40	55	..
Chandler Motor Car........	107¾	108¾	+5¾
Chevrolet Motor Car	149	151	..
Cole Motor Car Co..........	90	105	..
Continental Motors, com....	7½	8	+½
Continental Motors, pfd......	94	97	..
Edmunds & Jones, com.....	15	20	—4
Edmund & Jones, pfd.......	75	90	..
Electric Storage Bat........	50	53	..
Federal Motor Truck........	31	34	—1
Fisher Body Co., com........	40	43	+3½
Fisher Body Co., pfd........	90	92	—2½
Ford Motor of Canada......	255	265	+5
General Motors, com.......	124⅜	125⅜	—⅝
General Motors, pfd.........	83	85	+½
Hupp Motor Car, com.......	5½	6½	..
Hupp Motor Car, pfd........	89½	..	..
Kelsey Wheel Co., com......	30	36	—⅛
Kelsey Wheel Co., pfd......	88	95	+2
Manhatten Electric S., com.	..	48	..
Maxwell Motor, com.........	29½	30½	+3
Maxwell Motor, 1st, pfd....	52½	53½	+1
Maxwell Motor, 2nd. pfd....	21½	22½	+2
McCord Mfg., com..........	32	35	..
McCord Mfg., pfd...........	93	96	..
Mitchell Motor Co...........	24	30	..
Motor Products Corp.........	..	40	..
Nash Motors Co., com......	170	200	+10
Nash Motors Co., pfd.......	93	97	—½
National Motor Co..........	6	10	..
Packard Motor Car, com....	116	123	+1
Packard Motor Car, pfd.....	99	103	—1
Paige-Detroit Motor, com...	23½	24½	+½
Paige-Detroit Motor, pfd...	8¾	9¾	..
Peerless Motor Truck.......	18	21	..
Pierce-Arrow Mot. Car, com.	40	41	+¼
Pierce-Arrow Mot. Car, pfd.	101	104	—¾
Premier Motor Corp., com..	5	..	..
Premier Motor Corp., pfd..	..	75	..
Prudden Wheel Company...	16	17	+½
Reo Motor Car Co..........	21½	22½	+¼
Republic M. Truck, com....	37½	40	—½
Republic M. Truck, pfd....	87	90	..
Saxon Motor Car, com......	8	10	+1¾
Scripps-Booth Corp.	21	25	..
*Stewart Warner Spd. Corp..	83¼	85¼	—3¼
Stromberg Carburetor Co...	39	41	+6
Studebaker Corp., com......	50¼	51¼	+1⅛
Studebaker Corp., pfd......	92	95	—½
Stutz Motor Car Co.........	48	49	—1
United Motors Corp.........	35⅜	37⅜	+1⅜
White Motor Co.............	46⅜	47⅜	+1⅝
*Willys-Overland, com......	24¼	25¼	+¼
Willys-Overland, pfd........	87¾	88	—½
RUBBER STOCKS			
Ajax Rubber Co.............	70	70¾	+¾
Firestone T. & R., com......	140	145	—5
Firestone T. & R., pfd......	95½	100	..
Fisk Rubber Co., com.......	88	90	—1
Fisk Rubber, 1st pfd.......	97	100	..
Fisk Rubber, 2nd pfd.......	85	90	..
Fisk Rubber, 1st pfd. conv..	100	105	..
Goodrich, B. F., com........	61	61¼	+3
Goodrich, B. F., pfd.........	102½	103	+½
Goodyear T. & R., com......	247	252	+17
Goodyear T. & R., 1st pfd...	103	105	—1
*Goodyear T. & R., 2nd pfd..	104	105½	+1
Kelly Springfield, com......	77	78	+7
Kelly Springfield, 1st pfd....	91	98	+1
Lee Tire & Rubber Co......	23	23½	+1¾
Marathon Tire & Rubber	..	55	..
Miller Rubber Co., com.....	160	165	+18
Miller Rubber Co., pfd......	96	98	..
Rubber Products Co........	114	118	..
Portage Rubber Co., com....	155	160	+10
Swinehart T. & R. Co.......	50	60	..
U. S. Rubber Co., com......	75½	76	+1
*U. S. Rubber Co., pfd......	109¼	110	+¼

*Ex Dividend.

Continental Motors Has Surplus of $555,030 Over 1917

DETROIT, Feb. 1—A comparison of the financial statements of the Continental Motors Corp. for 1917 and 1918 shows that the company's surplus for 1918, in spite of war conditions, is $555,030 over 1917. The company has completed its war contracts and has closed down for ten days to take inventory. It is now running at 80 per cent capacity, amounting to 180,000 cars a year, with 5000 men employed.

The following is the comparative financial statement of the two years:

CONTINENTAL MOTORS STATEMENT

Assets	1918	1917
Property account	$7,395,722	$7,201,808
Investments at cost	31,756	6,756
Deposit with trustee for retir'm't of pfd. stock	1,243	——
Inventories	6,022,357	5,068,956
Accounts and notes receivable—less reserve	1,840 596	1,428,092
Liberty Loan bonds	210,996	——
Thrift stamps	1,229	——
Cash in banks and on hand	172,818	369,421
Deferred charges to future operations	48,552	42,879
	$15,725,270	$14,117,912
Liabilities		
Capital stock	$10,448,070	$10,720,070
Notes payable	850,000	1,025,000
Accounts payable	1,828,945	855,179
Accrued payrolls, taxes, int., etc.	1,042,645	517,083
Surplus	1,555,610	1,000 580
	$15,725,270	$14,117,912

After deducting canceled army contracts, the company's books Oct. 31 last showed orders amounting to $19,781,000. In the fiscal year 494 stockholders were added, making the total 3961.

The profits for the year were $3,045,545. After deducting the amount reserved for federal excess profits and income taxes, $515,000; depreciation provisions, $524,508, and the interest on borrowed money amounting to $66,253, there remained a balance or net profit for the year of $1,939,785.

The company's financial statement shows $75,000 was added to land investment, principally by purchase of 33 acres adjoining its Muskegon plant, giving that plant 50 acres. Inventory was increased about $950,000, much of which represents material bought for government work. In the fiscal year dividends amounting to $238,281 were paid on preferred stock and $1,401,066 on common. Allowing for dividends and reserves, a balance of $1,555,610 remained in surplus, an increase of more than $500,000 over 1917.

The income statement shows a balance of $1,939,785 for net profits after allowing $1,105,760 for interest and depreciation charges, reserves and federal income and excess profit taxes, federal taxes being estimated at $515,000.

Richardson Heads Studebaker Foreign Sales

NEW YORK, Feb. 5—D. B. Richardson, who was manager for the Studebaker Corp. in South America, with headquarters in Buenos Aires, has taken charge of Studebaker foreign sales. His headquarters will be in South Bend.

Moline Plow Co. Makes Report Covering 15 Months

MOLINE, ILL., Jan. 31—Net profits equivalent to 9.14 per cent per annum on the common stock are disclosed in the report of the Moline Plow Co. for the 15 months ending Oct. 31. This is arrived at after providing for dividends on the first and second preferred stocks and after charging all operating expenses, including depreciation allowance and interest on borrowed money. The profit and loss surplus as of Oct. 31, 1918, stands at $2,717,512.

ASSETS

	1918 (15 months)	1917 (12 months)
Real estate, etc.	$8,409,154	$7,168,940
Stock in treasury	....	13,800
Sundry investments	429,150	53,073
Inventories	17,970,585	11,297,144
Cash	946,394	1,038,771
Cash, investments, inventories, etc., in Europe	1,465,879	2,647,450
Receivables, domestic	4,921,782	6,681,391
Other assets	481,358	255,077
	$34,624,802	$28,975,646

LIABILITIES

	1918 (15 months)	1917 (12 months)
Capital stock	$19,000,000	$19,000,000
Seven per cent serial gold notes	6,000,000	....
Bills payable	4,754,000	6,680,000
Accounts payable	690,706	1,088,454
Wages and sundries	176,873	....
Customers' deposits	378,783	198,327
Accrued charges	657,950	180,383
Reserves	478,979	380,999
Surplus	2,717,512	1,447,646
	$34,624,302	$28,975,646

Bill to Validate Contracts Is Passed

(*Continued from page* 331)

AN ACT

To provide relief where formal contracts have not been made in the manner required by law.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That whenever during the war emergency and prior to Nov. 12, 1918, any individual, firm, company, corporation, or foreign Government has made an agreement with the Secretary of War, or with any officer or agent acting under his authority, or with any agency of the Government authorized to procure for the War Department, for the production, manufacture, sale, acquisition or control of equipment, materials or supplies, or for services, or for facilities, or other purposes connected with the prosecution of the war, and such agreement was reduced to the form of a contract or accepted procurement order and executed or signed on behalf of the Government, but the agreement did not comply with statutory requirements, in every such case the Secretary of War is authorized and directed to waive, on behalf of the Government, such noncompliance: Provided, That he finds such waiver is not inconsistent with the public interest, and in this event the said agreement shall have the same validity and effect it would have had if such statutory requirement had been complied with: And provided further, That such waiver shall not validate such contract or procurement order in so far as any claim for unearned profits may be involved.

That whenever, prior to said Nov. 12, 1918, any individual, firm, company, corporation, or foreign Government has made any agreement, oral or written, express or implied, with, or has received any order or request, oral or written, from the Secretary of War, or any officer, agent, or agency as aforesaid, for any of the purposes aforesaid, and the same has not been reduced to contract form, or when the Secretary of War has not waived such noncompliance, but such individual, firm, company, corporation, or foreign Government has in good faith made expenditures, incurred obligations, acquired or furnished facilities, equipment, materials, or supplies, or rendered services, in reliance on such agreement, order, or request, in every such case the Secretary of War is authorized and directed, on behalf of the Government, to enter into such contract with such individual, firm, company, corporation, or foreign Government as will, under all the circumstances, fairly and equitably compensate him or it for the expenditures made, obligations incurred, equipment, materials, or supplies furnished or acquired, or services rendered, as aforesaid: Provided, That in no event shall such contract provide for compensation on terms more favorable than the terms, if any, for which the aforesaid agreement, order, or request may have provided.

That whenever, prior to said November twelfth, nineteen hundred and eighteen, the War Department, through its officers or agents, has taken possession of any land, or whenever the holder or owner of any land has removed from or removed any improvements from such land at the order or request of the War Department and no valid contract has been made with respect thereto, then the Secretary of War, if he finds that the public interest does not require the possession or occupancy of such land by the Government, is authorized to make compensation to the owner or holder thereof for the fair value of such improvements so removed and the expense incurred by such owner in removing therefrom or for the fair value of the use of such land of which the War Department has taken actual possession and for any expense or loss incurred by the owner or holder by reason of such possession.

Sec. 2. That a commission is hereby created and established, to be known as the War Contracts Appeals Commission (hereinafter referred to as the commission), which shall be composed of three members, who shall be appointed by the President, by and with the advice and consent of the Senate, and shall continue in office for one year from the date of this Act. One member of the commission shall represent the War Department, one member shall represent the Department of Justice, and one member shall represent the business interests of the country. None of the members of the commission shall be interested in any order, contract, or agreement within the purview of this Act or have any interest in any firm or corporation having such orders, contracts, or agreements. Each member of the commission shall receive a salary of $7500 a year, payable in the same manner as the salaries of judges of the courts of the United States. The commission shall choose a chairman from its own membership and may appoint a secretary, who shall receive a salary not exceeding $5000 a year, to be determined by the commission and payable in the same manner as the salaries of the members of the commission.

That there is hereby appropriated, for the purpose of defraying the reasonable expenses of the commission, including the payment of salaries herein authorized, out of any money in the Treasury of the United States not otherwise appropriated, available immediately and until expended, the sum of $50,000.

That within thirty days of the date when the Secretary of War offers any contract or compensation as provided in this Act or refuses to offer such contract or compensation, the party to whom said contract or compensation is tendered or refused, or the Government by a duly authorized officer from the Department of Justice may file with the chairman of the commission a notice of appeal: Provided, however, That if the representative of the Department of Justice agrees with the action of the War Department there shall be no appeal by the Government, but settlement can be made at once. If the Secretary of War shall refuse to waive noncompliance with statutory requirements in respect to any agreement within the purview of the first paragraph of section one of this Act or upon the expiration of sixty days from the date of the taking effect of this Act shall have failed to waive such noncompliance, the contractor named in any such agreement may, within thirty days after such refusal or after the expiration of such sixty days file with the chairman of said commission a notice of appeal. In all cases where an appeal is taken hereunder the commission shall proceed to examine and review the facts and circumstances

of the case and make its award or finding thereon according to the justice and equity thereof. Upon giving receipt in full of all demands against the United States arising out of the transaction by reason of which the award is made, the appellant shall be entitled to receive the amount of any award so made, and the proper officer of the United States is hereby authorized and directed to pay the same, but if the appellant is dissatisfied with the amount so awarded he shall be paid seventy-five per centum of the amount awarded and shall be entitled to sue the United States in the Court of Claims to recover such further sum as added to said seventy-five per centum shall make up such amount as will be fair and just compensation as provied in this Act, and the Court of Claims is hereby given jurisdiction to hear said suit and render judgment therein.

That whenever the Secretary of War and the contractor shall fail to agree in the matter of the adjustment or settlement, or as to the interpretation or application of the terms, of any contract which has been made for any of the purposes set forth in this Act, and in the execution of which there has been compliance with statutory requirements, or compliance has been waived as herein provided, the contractor or the Government by a duly authorized officer from the Department of Justice may give notice to the Secretary of War of intention to appeal to the commission, and provided notice of appeal is filed with the chairman of the commission within thirty days: Provided, however, That if the representative of the Department of Justice agrees with the action of the War Department there shall be no appeal by the Government but settlement can be made at once. On an appeal being taken the commission shall thereupon proceed to determine the questions at issue as set forth in said notice of appeal; and the contractor shall be entitled either to receive the whole amount of such award as may be made as in full of his claim on the questions submitted or seventy-five per centum of the same and sue the United States in the Court of Claims for any remainder, all as provided next above as to agreements otherwise within the purview of this Act.

That in executing the duties and powers conferred by this Act the commission may make its own rules and regulations and may hear and determine issues informally. It shall be the duty of the Secretary of War to furnish to the commission such evidence, documents, or papers pertaining to transactions as to which notice of appeal has been filed as the commission may request. The commission is authorized in its discretion to appoint an examiner in any region or district when such region is within the United States where in its judgment the taking of additional testimony is necessary to the determination of any case. Such examiner shall be a resident of the region or district for which he is appointed, and shall not have any interest, directly or indirectly, in any contract or transaction coming before him or receive any compensation save and except such per diem compensation and expenses as shall be fixed by the commission. Whenever the commission shall refer to any such examiner any claim presented hereunder, the examiner shall proceed, under the direction of the commission, to hear the parties, take the proofs, and return the same to the commission with his recommendations thereon as promptly as possible: Provided, That in no case shall any award either by the Secretary of War, the commission, or the Court of Claims include prospective or possible profits on any part of the contract beyond the goods and supplies delivered to and accepted by the United States and a remuneration, which may include a reasonable profit, for expenditures and obligations or liabilities necessarily incurred in performing or preparing to perform said contract or order; Provided further, That the foregoing proviso shall not apply to any contract executed in compliance with all statutory requirements.

Sec. 3. That nothing in this Act contained shall be held to validate any such contract unless the officer who was at the time of the making of such contract the chief of the division or bureau, as the case may be, in which said contract was negotiated, or in the event that such officer was not responsible for the making of such contract, then the officer in such division or bureau who was so responsible, together with the officer who signed said contract, shall each severally make and subscribe to an affidavit in writing, giving the definite terms of such contract, the name or names within his knowledge, of any such officer or officers who took part in the negotiation or making of the same, and stating whether or not within his knowledge any officer aiding in such making was interested, directly or indirectly, in said contract, and in addition subscribing to an oath to be appended to said affidavit in substantially the following form and tenor:

"I, ————, Chief of the Division or Bureau (naming it) in which the contract hereinbefore mentioned was negotiated, at the time of negotiation thereof, and the officer in the Division or Bureau (naming it) responsible for the making of the contract hereinbefore mentioned, and I, ————, the officer who actually signed said contract, do hereby each severally swear that I am not and was not at the time of the making of said contract directly or indirectly interested in said contract."

That in respect to any such contract as to which any one of said officers can not take the foregoing oath, or after diligent search or inquiry by the contractor can not be found, or is at the time actually engaged in foreign service, or refuses to take said oath, then upon such facts and the fact required in the oath of such officer, appearing by an affidavit of the contractor, or of one of its partners, chief officers, or chief agents acting in its behalf, the Secretary of War shall promptly report such contract to the War Contracts Appeals Commission, and furnish to said commission such evidence, documents, and papers pertaining to the transaction as may be within his control, and such commission may request, and original jurisdiction is hereby vested in, said commission to hear and determine said claim with the powers and upon the procedure hereinbefore described in this Act. Said commission shall make its award or finding thereon, and deny said claim or grant it in whole or in part, according to the justice and equity thereof, and the award or finding shall have the same force and effect, and create the same rights as if made under the provisions of section three of this Act. And it shall be the further duty of said commission in hearing, investigating, and determining such claim to find and determine whether any of such officers is or was at the time of the making of said contract directly or indirectly interested in said contract.

Sec. 4. That nothing in this Act contained shall be construed to validate any agreement, contract, or order procured by fraud or to relieve any officer or agent of the Government from prosecution under the penal statutes of the United States for any fraud, criminal conduct, illegality, or irregularity in connection with any of the agreements or orders referred to herein or the execution or signing thereof. In all proceedings hereunder witnesses may be compelled to attend, appear, and testify, and produce books, papers and letters, or other documents; and the claim that any such testimony or evidence may tend to criminate the person giving the same shall not excuse such witness from testifying, but such evidence or testimony shall not be used against such person in the trial of any criminal proceeding.

Sec. 5. That no settlement of any claim arising under the provisions of this Act shall bar the United States Government through any of its duly authorized agencies, or any committee of Congress hereafter duly appointed, from the right of review of such settlement, nor the right of recovery of any money paid by the Government to any party under any settlement entered into, or payment made under the provisions of this Act, if the Government has been defrauded, and the right of recovery in all such cases shall extend to the executors, administrators, heirs, and assigns, or any party or parties: And provided further, That nothing in this Act shall be construed to relieve any officer or agent of the United States from criminal prosecution under the provisions of any statutes of the United States for any fraud or criminal conduct: And provided further, That this Act shall in no way relieve or excuse any officer or his agent from such criminal prosecution because of any irregularity or illegality in the manner of the execution of such agreement: and Provided further, That the names of such contractors and the amounts of such partial or final settlements shall be filed with the Clerk of the House for the information of Congress and printed in the Congressional Record, or as a public document, within ten days after such confirmation.

Sec. 6. That whenever, under the provisions of this Act, the Secretary of War shall make an award to any prime contractor who shall have sublet any part of said contract for material, equipment, or supplies to any other person, firm, or corporation who has in good faith made expenditures, incurred obligations, rendered service, or furnished material, equipment, or supplies to any prime contractor, with the knowledge and approval of any agent of the Secretary of War duly authorized thereunto, the Secretary of War shall apportion the amount of said award justly due to each of the subcontractors of said prime contractors. Before payment of said award the Secretary of War shall require any prime contractor to present satisfactory evidence of having paid said subcontractors or of the consent of said subcontractors to look for their compensation to said prime contractor only; and in the case of the failure of said prime contractor to present such evidence or such consent, the Secretary of War shall pay directly to said subcontractors the amount found to be due under said award; and in case of the insolvency of any prime contractor the subcontractor of said prime contractor shall have a lien upon the funds arising from said award prior and superior to the lien of any general creditors of said prime contractor.

Sec. 7. That the Secretary of the Interior be, and hereby is, authorized and directed to ascertain and determine the amount or amounts of money heretofore invested or contracted to be invested and obligations incurred by any and all persons and investors for producing or for the purpose of producing or preparing for producing, within the United States, to supply the urgent, published, and evident needs of the Nation during the war, any ores, metals, minerals, or mineral substances mentioned and enumerated in an Act of Congress approved October fifth, nineteen hundred and eighteen (public, numbered two hundred and twenty), entitled "An Act to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of those ores, metals, and minerals which have formerly been largely imported, or of which there is or may be an inadequate supply"; the production of which by any claimant or claimants was requested, or demanded, by personal solicitation of, or personal inducement to, such claimant or claimants made by the War Industries Board, the Shipping Board, or the Department of the Interior.

And that said Secretary ascertain, determine, adjust, liquidate, and out of the moneys provided and appropriated by said Act pay to the parties entitled thereto the amount of such loss and damages as he, the said Secretary, shall find and determine have been sustained and suffered or are likely to be sustained and suffered, by reason of having made such investments for said purposes or having produced surplus stocks of such materials; and that in each case he shall make such determination, provision, settlement, advancement, or final payment, and by agreement with owners and claimants make such other adjustment, or take such other action as he shall find and determine to be just, equitable, reasonable, and expedient; and that he make such provisions as he may deem necessary, advisable, and reasonable to prevent further losses pending final decision, settlement, and disposition in any case or cases; that the payments herein authorized be made to the claimant or claimants the said Secretary shall find to be morally, equitably, and justly entitled thereto; that in ascertaining and determining the losses and damages sustained or to be sustained, and the adjustments, settlements, payments, and provisions to be made, the said Secretary shall consider the prices and conditions existing at the time of each investment and the prices and conditions existing prior to the war, as well as those existing at the time of such determination, adjustment, and settlement, together with all of the circumstances and conditions of each case; that the final determination, decision, provision, disposition, and action of said Secretary in each case shall be conclusive and final; that all payments shall be made and all expenses incurred by the Secretary paid from the funds and appropriations provided and appropriated by said Act of October fifth, nineteen hundred and eighteen (public, numbered two hundred and twenty), and that said funds and appropriations shall continue to be available for said purposes until such time as the said Secretary shall have fully exercised the authority hereby granted and performed and completed the duties hereby provided and imposed: Provided, however, That said Secretary shall consider, approve, and dispose of only such claims as shall be made hereunder and filed with the Department of the Interior within three months from and after the approval of this Act.

That a report of all operations under this section, including receipts and disbursements, shall be made to Congress on or before the first Monday in December of each year.

That nothing in this section shall be construed to confer jurisdiction upon any court to entertain a suit against the United States.

Amend the title so as to read: "An Act to provide relief in cases of contracts connected with the prosecution of the war, and for other purposes."

Passed the House of Representatives January 9, 1919.

Attest: SOUTH TRIMBLE,
Clerk.

Passed the Senate with amendments January 28 (calendar day, January 30), 1919.

Attest: JAMES M. BAKER,
Secretary.

WASHINGTON, Feb. 1—The following contracts were placed by the Motors Division, Quartermaster Department:

Dodge Bros., Detroit, motor equipment. Set of equipment to accompany each order motors A-45 and motors A-46, at $75.17 each.
Dodge Bros., Detroit, crating and box. Box and crate for export at $53 each, as per P. S. and T. Bulletin No. 22.
Dodge Bros., Detroit, substitute equipment. Substitute for 500 sets of equipment for Dodge delivery wagons, as per attached list.
Dodge Bros., Detroit, price determined. Price on 1000 sets extra equipment in original contract now determined at $75.17 per set.
Ford Motor Co., Detroit. War tax changed to $14.07 instead of $14.51 as originally specified.

—

WASHINGTON, Feb. 1—Following is a list of contracts made by the Bureau of Aircraft Production:

Dayton Engineering Laboratories Co., Dayton, 3 No. 8245 Delco Liberty "12" generator assemblies, $94.05.
Dayton Engineering Laboratories Co., Dayton, 1 Liberty "12" rotor brush and spring, Delco system, $0.25.
Dayton Engineering Laboratories Co., Dayton, 100 distributor brush and spring assembly No. 12712, for Delco system on Liberty "12," $3.25.

Contracts

Dayton Engineering Laboratories Co., Dayton, 4 distributor brush and spring assembly No. 13712, for Delco system, Liberty "12," $0.13.
Dayton Engineering Laboratories Co., Dayton, 1 Delco generator, No. 8245, Delco system on Liberty engine and 1 voltage regulator No. 8542, Delco system, on Liberty engine, $36.05.
Dayton Engineering Laboratories Co., Dayton, 1 Delco switch No. 8408 and 2 distributor assemblies with coils. 12229; Delco system on Liberty "12," $70.95.
Dayton Engineering Laboratories Co., Dayton, 6 No. 12602 armature assemblies, Delco system on Liberty "12"; 6 No. 12616 field-coil assemblies, Delco system on Liberty "12," $63.42.
Splitdorf Electric Co., Newark, 100 magneto parts, $1,430.
Dayton Engineering Laboratories Co., Dayton, 12 distributor brushes No. 13712 (Delco on Liberty "12"), $0.39.
Dayton Engineering Laboratories Co., Dayton, 14 items Delco parts Liberty "12," $40.44.
Dayton Engineering Laboratories Co., Dayton, 4 items of Delco parts on Liberty "12," $92.54.
Dayton Engineering Laboratories Co., Dayton, 70 ignition switches No. 8408 Delco (Liberty "12"), $367.50.
Dayton Engineering Laboratories Co., Dayton, 25 breaker arm assemblies No. 12890 (Delco system on Liberty "12"), 25 distributor cams No. 12751 (Delco system on Liberty "12"), $29.50.
Nordyke & Marmon Co., Indianapolis, 100 No. 12515 crankshaft assemblies Liberty "12," $19,789.20.

—

WASHINGTON, Feb. 3—The following orders have been placed by the Motors Division, Quartermaster Department:

B. F. Goodrich Co., Akron, 797 casings and tubes, $11,491 29.

Peerless Motor Car Co., Cleveland, 1 lot spare parts, $19,923.74.

A. J. Detlaf Co., Detroit, 350 clutch assemblies $29,250.

Standard Motor Truck Co., Detroit, 225 standard 3½ chassis, 225 extra bodies, $695.-250.

Kelly-Springfield Tire Co., Cleveland, 100 casings and 1,050 tires, $30,362.

Troy Wagon Works, Troy, Ohio, 350 No 212 trailers, $372,750.

Kelly-Springfield Tire Co., Cleveland, 2,560 solid-pressed tires, $102,144.

Trailmobile Co., Cincinnati, storage agreement entered into provides that contractor receive as compensation 25 cents per day for each article stored, payable upon final delivery f. o. b. Cincinnati. Ordnance Nos. 12308 and 2226 ME.

Great Britain to Continue War-Time Restrictions on Automobile Apparatus

(*Continued from page* 290)

from the Board of Trade is permission to import a couple of chassis to be used for exhibition purposes only. These must not be sold under penalty of a severe fine. Most of the importers have already taken advantage of this ruling and are importing show or exhibition chassis. The same is true of commercial trucks, and will undoubtedly apply to farm tractors.

The importers are having a harder load to carry now than during the war. War orders have stopped and their men are returning from the army and are demanding their old jobs and efforts are being made to take all of them back. The repair work is increasing and the demand for spares is four times what it was in December. This assures good business for the repairshops, but the returning sales organizations have not a bright future for immediate employment.

But the importers have yet another load on their shoulders. Many of them have held together their entire dealer organizations throughout the British Isles. It is nothing short of wonderful how this has been done. One large importer, with nearly 150, has not lost a single dealer in four years. They have all had war work and those who went to war had their business carried on by others. Some of them have become manufacturers of no mean stature. One case in point is a Liverpool dealer who during the war has had 1000 employees and had two or three manufacturing plants. He has been manufacturing airplane wings as well as other parts.

Now that the war is over, these dealers are anxious to get back into business. Their war trade has ceased and repair work is now their only source of revenue excepting the sale of used cars. Every day the importers are literally besieged by these dealers, and they in turn are getting more inquiries than they have received for four years regarding post-war models, car prices, possible dates of delivery, etc.

The recent decision announced by the Board of Trade to continue the total prohibition order on imports is very disquieting to this army of dealers, who feel that as business men who built up legitimate businesses before the war and took their part during the war, that now they are not being fairly treated, and not given that business co-operation which they feel the Government owes them.

While these dealers are marking time the dealer handling British cars is little better off. His factory has been on war munitions since 1914, and has no cars on hand. All he has regarding post-war models in most instances are assurance of deliveries in August and September and in some cases October. Few of the British factories have as yet quoted prices, and but a small percentage of them have issued specifications of post-war models. There are exceptions, notably concerns that have been building cars during the war for army use, and one or two others who have post-war models ready and hope to make deliveries in April or May.

As to the attitude of the new Parliament on the importation of automobiles in the next year, nothing definite is known, but the decision of the Board of Trade is so explicit that there is no room for doubt. The Board of Trade ruling was made after the new Cabinet was formed, and Sir Albert Stanley, the president, is an appointee of the present Cabinet. In view of this, it can only be interpreted as the ruling of the new Cabinet, and as such will stand for some months at least.

There were elected to the new Parliament not fewer than a round dozen of members from the British manufacture. These twelve in nearly every case can be looked upon as protectionists. These members in nearly every case are connected with nearly all of the largest makers. This situation argues for a possible continuation of the restriction of imports. These makers have a strong case. They have been out of production for four years. Some have not been permitted to develop post-war models, and it is almost a certainty that the Government will protect these manufacturers until they can get back on their feet and get into production.

What will take place when the restrictions are removed and perhaps a duty imposed no one can tell. It is certain that free trade will not come back so far as motor cars are concerned. With twelve protectionists in Parliament from the automobile industry, and from the manufacturers generally of higher priced cars of small production, there is not good prospects for a continuation of free imports of automobiles into the British Isles.

No objection can possibly be raised to any protectionist policy on the part of Great Britain. France has her import duty of 70 per cent, America has her 45½ and 30 per cent custom duties and the British maker has every right to ask for a share in the same kind of protection. It is not against an import duty that the British importer has ground for complaint, but against an unknown period of continued total prohibition.

Capt. Westmoreland Returns to States

NEW YORK, Feb. 3—Captain H. E. Westmoreland, who has been adjutant of the Air Service Replacement Concentration Barracks No. 3 at St. Maxient, France, for the past eighteen months, is back in the United States. He was for a number of years Southwestern manager for the McQuay-Norris Mfg. Co., St. Louis, with headquarters in Dallas. His future plans are not yet determined.

—

W. B. Wood, for 17 years Detroit manager for Fairbanks, Morse & Co., has joined the sales force of the Commerce Motor Car Co., Detroit, to represent it in western territory.

—

Fred I. Tone, formerly with the Marion Co., Indianapolis, and Willys-Overland Co., Toledo, is now chief engineer of the United States Ball Bearing Mfg. Co., Chicago.

—

Ray A. Long is back at his old post as chief engineer for the Columbia Motors Co., Detroit. While in government service, from which he was just discharged, he helped develop the Militor Four-Wheel Drive truck.

—

J. M. Case, former sales and advertising manager of the United Motors Co., Grand Rapids, has become advertising manager of the Garfield Motor Truck Co. of Lima.

—

G. B. Rickenbaugh, who has been connected with the Irving National Bank for the past two years, was recently elected vice-president and general manager of the Scott Corp., which has general offices in Paris and London, with the main office in Aeolian Hall, New York.

—

Herb Flint, Detroit, former distributer of Hupp motor cars in Michigan, is now Western sales manager of the Abbott-Downing Truck & Body Co. of Concord, N. H.

—

C. L. Fox has been made sales manager of the Saxon Motor Car Co., Detroit. He has been with the company since its incorporation.

—

E. S. Gellatly, for several years vice-president of the Indian Refining Co., New York, also in charge of its Havoline oil advertising, severed his connection with that company on Jan. 15 to go with the Illinois Zinc Co., New York, where he will be in charge of the formation and organization of a new department.

—

Elbert Warford, who has been in the aviation service, has returned to his former position as advertising manager of the Seattle branch of the B. F. Goodrich Rubber Co.

—

Elmer Sperry to Address S. A. E.

CLEVELAND, Feb. 3—Elmer Sperry, inventor of the gyroscope, will address the March meeting of the Detroit Section Society of Automotive Engineers.

Men of the Industry

Changes in Personnel and Position

Don T. Hastings, M. E., has been appointed manager of the Chicago office of Rex W. Wadman, Technical Advertising Specialist, and is in charge of all the business of the concern in the Middle West.

—

Charles A. Mayne, formerly of the Firestone Tire & Rubber Co., Akron, who was connected with the Republic Motor Truck Co. of Alma for the last few months, has gone to South America, where he will represent that company.

—

L. E. Colgrove, former Grand Rapids distributer of Hudson cars, has returned from the army and is now selling Cadillac machines for the Becker Sales Co. of that city.

—

J. P. O'Brien has been appointed district manager in Chicago of the central territory of the Anderson Electric Car Co. He has been associated with the company for the past six years.

—

C. Haines Wilson, treasurer and general manager of the C. R. Wilson Body Co., Detroit, recently left for a six weeks' trip to Pasadena, Cal.

—

W. H. Luhrs, general manager and member of the Board of Directors of the General Aluminum & Brass Mfg. Co., Detroit, has severed his connections with that company.

—

L. E. Lyons, for the past six years sales engineer of the axle division of the Sheldon Axle & Spring Co., has resigned to become associated with the B. F. Everitt Co., Detroit.

—

Fred E. Dean has become associated with the Allied Metal Sales Corp., New York, as Western sales manager, with headquarters in Detroit.

—

Frank R. Ryan has been added to the sales force of the Chicago office of the Roller-Smith Co., New York. Previously he was connected with the testing department of the Commonwealth Edison Co. and the Krehbiel Co., consulting engineers, Chicago. For the past six months he has been in the signal corps. He succeeds Charles H. Nicholson, who since his return from service is in charge of the company's Detroit office.

—

F. A. Haines has been promoted from factory manager to general manager at Dodge Bros., Detroit. A. Z. Mitchell, his former assistant, succeeded him as factory manager.

Barney Oldfield Becomes Tire Maker

CHICAGO, Jan. 31—Barney Oldfield, the veteran racing driver, has branched out into the industry as the head of a new tire concern known as the Oldfield Tire Co. He says this definitely marks his retirement from racing.

—

J. H. Kelly, formerly production manager of the Hudson Motor Car Co., Detroit, is now general manager of the Cole Motor Car Co., Indianapolis.

—

Lieut. D. W. Bay has returned to his former position as sales engineer, Hyatt Roller Bearing Co., Detroit, in charge of Illinois, Wisconsin and the Northwest, with offices at 2715 South Michigan Avenue, Chicago. For the past 15 months he has been in the Motors Division, Department of Production, Quartermaster Corps.

—

William K. Swift, Philadelphia, has become associated with the sales department of the Bound Brook Oil-less Bearing Co., Bound Brook, N. J.

—

Harry H. Hawke, formerly connected with the De Luxe Automobile Co., St. Louis, has been made general sales manager of the Traffic Motor Truck Corp.

—

Walter Wilmot, former manager of the Detroit Automobile show, is now manager of the Minneapolis automotive show, which opens Feb. 15.

—

J. H. W. Mackie, who resigned as sales manager of the Saxon Motor Corp., is now general manager of the Payne Motor Car Co., Minneapolis.

—

Major John L. Bender has joined the Anderson Forge & Machine Co., Detroit, as sales manager. For the past 15 months he has been the military member of the Priority Committee of the War Industry Board at Washington.

—

Ford Enters Tire Field

DETROIT, Feb. 3—Henry Ford is now making rubber tires for his cars. The Ford Motor Co. has built and is operating a small tire factory producing on a small scale. Only a few tires have been made to date, but plans call for extensive manufacture.

—

Advertising Manager Dies at Desk

BOSTON, Feb. 4—George Burkle, advertising manager of Gray & Davis, Inc., died of heart failure at his desk on Friday, Jan. 31.

—

Lansing Automotive Leader Dead

LANSING, Jan. 30—Harry E. Bradner, general manager of the Auto Body Co. since that corporation was started in 1901, and later president of the concern until a few weeks ago, died of pneumonia last week. He was also vice-president of the Duplex Truck Co., the Gier Pressed Steel Co. and the Auto Wheel Co., all of Lansing. The Auto Body Co. was started with a capital stock of $20,000, which recently was increased to $2,000,000.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Studebaker Additions Will Increase Working Population

SOUTH BEND, Feb. 3—At a dinner tendered him by the South Bend Chamber of Commerce, Jan. 30, A. R. Erskine, president of the Studebaker Corp., stated that within a few months Studebaker cars will be built completely in South Bend, as well as in Detroit, the production totaling 500 complete cars per day, when the extension plans are in operation.

The factory additions caused by the Government contracts which were under way when the armistice was signed, in which shells, tractors and other munitions were to be produced, will form the beginning of the extension, which will cover 61 acres, and provide 4,000,000 sq. ft. of floor space, requiring from 7000 to 12,000 employees. The new equipment includes everything from a foundry to the final car assembling.

The whole plan, however, hinges on the housing question, for this expansion will mean doubling the present working population of the city, and the Chamber of Commerce last night started on plans for providing homes for these people. Housing facilities for 10,000 men and 2000 women will have to be provided, one-half of whom will be at work by Dec. 1 of this year and the other half six months later.

No Drop in Packard Prices

DETROIT, Jan. 30—The Packard Motor Car Co. is extensively advertising the fact that there will be no change in Packard prices. The company states that as there was no rise in Packard prices during the war period, there is consequently no leeway for reduction at this time.

300 Dodges Turned Out a Day

DETROIT, Jan. 31—Dodge Brothers are turning out 300 machines a day. A portion of the plant is still engaged in war work. The Dodge car, being one of the standard makes chosen by the army, is being still purchased by the government. The company is also working on parts orders for the repair and maintenance of its machines in federal service. There are 10,000 men on the payroll. When at full capacity 18,000 men are employed.

Maxwell Now at Daily Rate of 150

DETROIT, Jan. 31—The Maxwell Motor Car Co. is producing 150 cars daily, and expects to increase this output materially in the immediate future.

Dort Production Normal Again

FLINT, MICH., Jan. 30—The Dort Motor Car Co. has about finished government work and is back at normal car production. The plant is turning out 40 cars daily, and its 1919 production schedule calls for 15,000 machines. The next three or four weeks will see the last government job completed. This winds up over $3,000,000 of war contract work which called for the manufacture of "AA" trucks, trailers, truck "C" bodies and cutting boards.

Salvaged Scrap Saves $3,000,000

AKRON, Feb. 1—An indication of the conservation methods of the Goodyear Tire & Rubber Co. may be gained from the fact that the by-products during the year salvaged scrap and waste material to the amount of $3,000,000.

Curtiss Advertising Department at Garden City

BUFFALO, Feb. 1—The advertising department of the Curtiss Aeroplane & Motor Co. has been moved from the Buffalo plant to Garden City, L. I.

Amazon Rubber Co. Issues Extra Dividend

AKRON, OHIO, Jan. 31—The Amazon Rubber Co., which held its annual meeting Saturday, showed an increase in business during 1918 of 85 per cent over 1917. An extra dividend of 12½ per cent was issued. Officers for the coming year were elected as follows: President, Albert Kroehle; vice-president, J. A. Burger; treasurer and general manager, L. J. Schott; secretary and general superintendent, L. F. Smith.

Grant Reduces Price $130

CLEVELAND, Feb. 1—The Grant Motor Car Corp. this week issues a new schedule of prices for Grant-Six cars, to take immediate effect. The new prices reveal a reduction of $130 on each machine, as follows:

Model	New Price	Old Price
Grant-Six touring car....	$1,120	$1,242
3-passenger roadster.....	1,120	1,242
3-passenger coupé........	1,625	1,755
All weather sedan.......	1,645	1,775
Demountable sedan......	1,400	1,530

The Grant corporation guaranteed its dealers against a price decrease up to May 1.

Ward LaFrance Drops Prices

ELMIRA, Feb. 3—The Ward LaFrance Truck Co. has reduced the price of its 2-ton truck $150 and of its 3½-ton truck $175.

	New Price	Old Price
2-ton truck........	$3,350	$3,500
3½-ton truck......	3,750	3,925

Acme Truck Scheduled for 1400 in 1919

CADILLAC, Jan. 30—The Acme Motor Truck Co. is producing approximately four trucks daily. The production schedule for this year calls for the manufacture of 1400 trucks. The 1919 machine embodies no radical design changes, but has been improved upon in a number of minor respects. The company is anticipating no price reduction, and is guaranteeing its distributers against a cut.

Changes in Executive Force of Pennsylvania Rubber

JEANNETTE, Jan. 31—At a special meeting of the Board of Directors of the Pennsylvania Rubber Co. on Jan. 27, George W. Daum was elected second vice-president in charge of production, and A. H. Price was elected second vice-president in charge of sales. James Q. Goudie, formerly sales director in charge of the Middle West district, who represented the company in Washington regarding its Government business, was elected general sales director, in charge of branch sales, with headquarters at Detroit.

New Aultman-Taylor Tractor Model

MANSFIELD, OHIO, Feb. 3—The Aultman & Taylor Machinery Co. is building a new model tractor to be known as the 22-45. This will supersede the former models 18-36 and 22-50. Plans are being made to get this model on the market in a very short time.

No Price Reduction in Saxons

DETROIT, Jan. 31—The Saxon Motor Car Corp. has assured its dealers that it will protect them against a reduction in the price of its cars. Prices will positively not drop before June 1. In case the company finds it necessary to cut prices, the new contract which Saxon purchasers sign calls for an appropriate refund.

Government Airplane Factory for Fisher Body Corp.

DETROIT, Feb. 3—Fisher Body Corp. is now endeavoring to lease or purchase the airplane factory adjoining its plant, built by the Government for aircraft production. Federal officials are now in the city. An inventory and survey of the plant is under way, and the matter will probably come to a head in the course of a few days.

Paterson to Increase Production

FLINT, MICH., Jan. 30—The W. A. Paterson Co., makers of Paterson 6-cylinder cars, will increase daily production about April 1. This company is now running 20 cars per week and is preparing to deal more extensively in the foreign market. The new 1919 car varies but slightly from the 1918 model. The company does not plan a price reduction, and is guaranteeing to give distributers 60 days' notice if such a course is decided upon.

Allen Motors Resuming Pre-War Production

FOSTORIA, OHIO, Jan. 31—The Allen Motor Co. is fast getting back to prewar production.

Grant to Make 12,000 Cars

CLEVELAND, Jan. 30—The Grant Motor Car Corp. plans the production of 12,000 cars during the coming year. Twenty-five machines are being turned out daily, but plans for increased production are already in effect.

Calendar

ENGINEERING

S. A. E. Meetings

March 5 — Minneapolis Section, S. A. E.—Hotel Radisson. "Tractor Service and Sales."

April 2—Minneapolis Section, S. A. E. — Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Feb. 1-15—New York. Automobile Dealers' Assn. Charles A. Stewart, Manager, Hotel Woodward, Broadway and 55th St.

Feb. 6-15—San Francisco, Cal. Third Annual Pacific Automobile Show, Motor Car Dealers' Assn. of San Francisco, Exposition Auditorium. G. A. Wahlgreen, Manager.

Feb. 10 - 15 — Rochester, N. Y. Rochester Automobile Trades Assn., Exposition Park. George C. Donahue, Manager.

Feb. 12-15—Defiance, O. Second Annual Show under auspices of Defiance Automobile Dealers' Assn.

Feb. 15-22—Newark, N. J. N. J. Auto Exhibition Co. Calude Holgate, Manager.

Feb. 15-22 — Cleveland, Ohio. Cleveland Auto Show Co. Fred H. Caley, Manager.

Feb. 15-22—Minneapolis, Minn. Minneapolis Auto Trade Assn. Walter B. Wilmot, Manager.

Feb. 15-22—Albany, N. Y., Albany Automobile Dealers' Assn. State Armory.

Feb. 16-22—Waco, Tex. Henry B. Marks, Manager.

Feb. 17-22—St. Louis. St. Louis Auto Mnfrs. & Dealers' Assn. Robert E. Lee, Manager.

Feb. 17 - 22 — Louisville, Ky. Louisville Auto Dealers' Assn.

Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.

Feb. 17-22 — Pittsfield, Mass. Pittsfield Automobile Dealers' Assn., State Armory. James J. Callahan. Manager.

Feb. 17-22 — Passenger Cars; Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. J. L. Elliott, Manager.

Feb. 17-22—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.

Feb. 17-22—Seattle, Wash. Cars. Motor Car Dealers' Assn., State Armory. A. G. Schaeffer, Manager.

Feb. 18-22—Baltimore, Md. Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland, Fifth Regiment Armory, H. M. Lucius, General Manager.

Feb. 18-22 — Oklahoma City, Okla. Automotive Show. R. H. Braun, Manager.

Feb. 19-22 — Evansville, Ind. Cars, Evansville Automobile Dealers' Assn. Coliseum.

Feb. 22-Mar. 1—Hartford, Conn. Hartford Automobile Dealers' Assn., Inc., Broad Street Armory. Ben. F. Smith, Manager.

Feb. 22-Mar. 1—Atlantic City, N. J. Auto Trades Assn. of Atlantic City.

Feb. 22-Mar. 1—New Castle. Pa., Lawrence County Association of Automobile and Accessory Dealers.

Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.

Feb. 24-Mar. 1—Burlington, Ia. Second Annual.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 24-Mar. 1 — Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.

Feb. 24-Mar. 1—Portland, Ore. Ninth Annual Dealers' Motor Car Assn., Automobile Palace. M. O. Wilkins, Manager.

Feb. 25-Mar. 1 — Erie, Pa., United States Garage.

Feb. 26-Mar. 1—Mason City, Ia. Fifth Annual. Mason City Auto Show Assn.

Feb. 26-Mar. 1—Madison, Wis. Seventh Annual. Automobile Dealers' Division of Madison Assn. of Commerce. Union Transfer Bldg.

Feb. 26-Mar. 1 — Quincy, Ill. Cars. Quincy Automobile Trade Assn. Armory.

Feb. — Wheeling, W. Va. Automobile show at Market Auditorium.

March 1-15—New York Aeronautical Exhibition. Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.

March — Scranton. Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica. N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March—Philadelphia. Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

Mar. 3-5—Quincy Ill. Trucks and Tractors. Armory.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

Mar. 3-8 — Muskegon, Mich. Third Annual, Armory, Muskegon Lodge No. 274, B P. O. E. John C. Fowler and George M. Friant, Managers.

Mar. 3-8—Scranton, Pa. Ninth Annual, 13th Regiment Armory, Scranton Automobile Assn. Hugh B. Andrews. Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

Mar. 5-8—Lancaster, Pa. Automobile Trade Assn., Rowe Motor Co.'s Bldg. R. W. Shreiner. Manager.

Mar. 8-15 — New Brunswick, N. J. Armory, New Brunswick Motor Trade Assn. William Kuehle, Manager.

March 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley. Show Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gardner, Manager.

March 10-15 — Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn. Auditorium. Clark G. Powell Manager.

March 12-19—St. Joseph, Mo. Sixth Annual. St. Joseph Automobile Dealers' Assn.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Passenger cars only. Chester I. Campbell. manager.

March 15-22—Harrisburg. Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton. Manager.

March 17-22 — Great Falls. Mont.—Montana Automobile Distributors' Assn.

March 19-22—Norfolk. Neb. Norfolk Automobile Show Assn.

March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell. Manager.

March 22-29. Passenger Cars: April 1-5. Trucks—Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C Kirkham, Manager.

Mar. 24-29 —Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.

Mar. 24-29—New Orleans, La. Henry B. Marks, Manager

Mar. 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock. Manager.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman. Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

TRACTOR SHOWS

Feb. 15-22—Minneapolis, Minn.

Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show. Wichita Tractor and Thresher Club. Forum.

Feb. 24-March 1—Kansas City. Mo. Fourth Annual Tractor Show. Sweeney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

RACES

Mar. 15—Santa Monica, Cal. Speedway.

May 17—Uniontown, Pa., probably 112½ miles.

July 5—Cincinnati, O., Speedway.

CONVENTIONS

Feb. 19—New York. 13th annual banquet of Aero Club of America, Waldorf-Astoria

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

Feb. 25-28 — Ninth American Good Roads Congress and 16th Annual Convention of the American Road Builders' Assn. Hotel McAlpin, New York.

Apr. 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

Buda Has Three New Tractor Engines

HARVEY, ILL., Feb. 1—The Buda Co. will exhibit at the Kansas City tractor show, to be held from Feb. 24 to March 1, three new types of heavy duty tractor engines. These will be of the same general design as the 4¼ x 5½ in. engine which made a 103-hour non-stop run at the Salina tractor demonstration last summer. They have been developed and tested during the past year.

The largest of the new models is a 4-cylinder, 5 x 6½ in. bore and stroke engine having a piston displacement of 510.5 cu. in. Another, also a 4-cylinder engine, has a bore and stroke of 4½ x 6 in. They are block cast, with removable heads and full pressure lubrication.

It is stated that these engines are especially suited for multiple plow work in new soil, on large acreage and in the heaviest kind of duty, using low grade or heavy fuels.

Jackson May Quit Passenger Car Field

JACKSON, Feb. 1—The Jackson Automobile Co. will not place a passenger car on the market this year. While the company is still undecided on its future policy and will make no formal statement at this time, it is understood that it proposes hereafter to devote its entire time to the production of trucks. The company is just winding up a large government shell contract.

New Die Casting Co. for Milwaukee

MILWAUKEE, Feb. 3—The Wisconsin Die Casting Co. has been incorporated here with a capital stock of $25,000 to engage in the general die casting business. The incorporators include Gustave R. Hurz, Julius O. Roehl, attorney, and Fred H. Koch.

Lewis Steel Products Co. Changes Hands

TOLEDO, Jan. 30—The controlling interest in the Lewis Steel Products Co. has been purchased by a group of Detroit and Cleveland parts manufacturers. Additions to the plant will be started at once and a new plant will be erected later. George L. Lewis, president and founder, has disposed of all his interest in the concern, and A. R. Clas, for nine years with the Falls Motor Corp., of Sheboygan, has taken over the management. It is understood that Mr. Lewis will organize another company to manufacture automobile parts.

AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Vol. XL
Number 7

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, FEBRUARY 13, 1919

Fifteen cents a copy
Three dollars a year

Champion Dependable Spark Plugs

Wins Out in Government's Severe Shock Test

At the factory of the Chalmers Motor Car Company, of Detroit, Michigan, the United States Government was conducting a most exacting ignition test on the Holt-Caterpillar Tractors, used in war-work for hauling cannons, caissons, etc.

With motor at high speed under heavy load, the spark plugs at sizzling heat were doused with a bucketful of cold water.

This most severe test had not the slightest adverse effect, the operation of the motor continued perfectly, not a spark plug "missed" even temporarily.

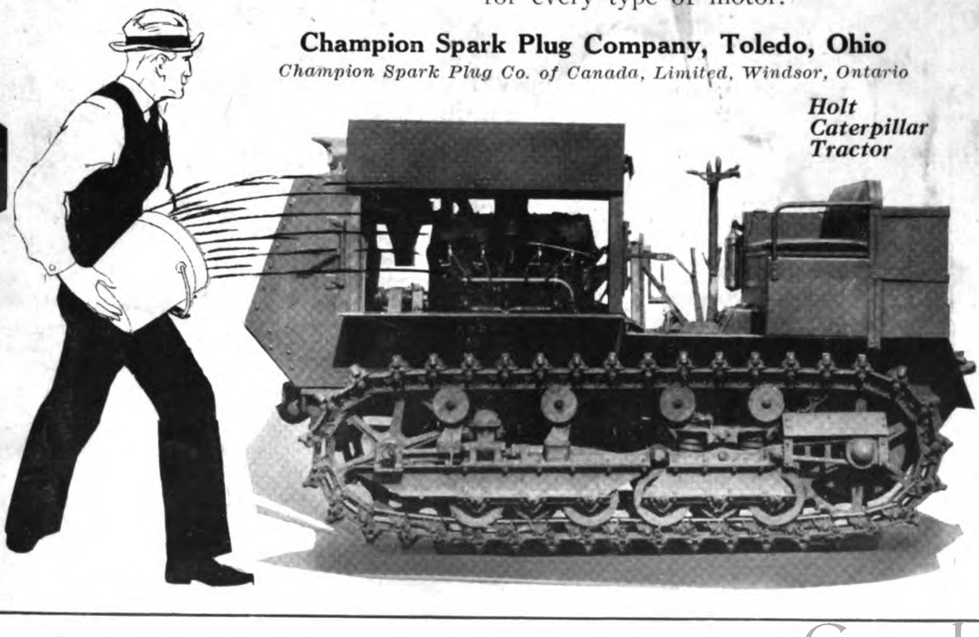
Every motor car owner has, in this test, irrefutable proof of the hardiness and efficiency of Champion Spark Plugs.

Every Champion Spark Plug dealer has, in this test, additional proof of the wisdom of recommending the Champion Spark Plugs especially designed for every type of motor.

Champion Spark Plug Company, Toledo, Ohio

Champion Spark Plug Co. of Canada, Limited, Windsor, Ontario

JAS43, ⅞—18. Price $1.00
Champion Heavy Duty



AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, FEBRUARY 13, 1919—CHICAGO No. 7

European Expansion Under War Pressure

Post-War Models Not Ready—Electric Starting and Lighting Universal—Huge Factory Enlargement

Part I

By David Beecroft

LONDON, Jan. 21—Two months have not been sufficient for European automobile manufacturers to get converted from war to a peace program. That time has not been long enough for many to decide on what their peace program shall be. For more than 4 years they have worked on a war program only. Their peace organizations have been completely disrupted. With many, their manufacturing organizations have been disrupted as compared with 1914. Some have been very largely without engineering organizations since that date. Others have lost many from their organizations who were heads of departments in 1914. The peace manufacturing momentum ceased to exist long ago.

Factories were placed under government control in most instances and were largely prevented from going ahead with post-war activities. Many of the British factories were expressly forbidden from utilizing any of their engineers in the development of post-war models.

Few Completely Converted

There were a few factories that were turned entirely from automobile manufacture to aircraft. A case in point is that of the Sunbeam, whose automobiles have been manufactured during the war and used as officers' cars; but these have not been built in the Sunbeam factory, but in other British factories, while the Sunbeam company has had to devote its energies almost exclusively to the development and production of engines for aircraft uses.

Industry Not Ready for Peace

What is true of this factory is true of many others to a very great extent, and the miraculous would have happened if these factories had been able in a month or 6 weeks to turn from peace into war and get on a development basis. In every factory, and in practically every industry, the general comment is that it was relatively easy to move from peace into war in 1914 and 1915, but it is a herculean task to transform the greatly increased factory capacities from war into peace.

It is true of Great Britain, France and Italy that up until Armistice day they had not contemplated an early peace and were going ahead on the basis of at least one more year of war, and perhaps 18 months.

There was no slowing up of development, while many factories had been doubled, tripled, quadrupled, and in some cases increased tenfold in manufacturing capacity; the work of expansion was not completed.

New buildings were going up on every hand.

Some factories had additions under operation which would give a 25 per cent further increase in capacity. This increase was all based on a war program. Peace did not enter into it.

Suddenly, on Nov. 11, this came to an unexpected end. In the short space of one hour the entire program was changed. The active belligerent stage of war was over, and these industries for the first time since 1914 thought of peace. For the first time they were face to face with the stupendous problem of passing from the stage of war activity into a peace program.

Up to that time many had not given it any consideration. It is true the leaders of these industries had been analyzing the situation, but help was scarce and demand for production so high and Government insistence on a 100 per cent war program so intense that nothing active had been done in 80 per cent of the cases.

Some Factories Favored

There are exceptions to this condition. Some of the factories received more favorable treatment from the Government. The exact reason for this is not known. During the war a few of them were able to work along their previous lines. For example, the Vauxhall company in England was manufacturing its cars for war use during the entire period and so is in a preferred position to talk deliveries, specify dates and quote prices. It has even been able to develop a post-war model which has passed through the development stage and is ready for production.

In Italy, Fiat has been manufacturing both passenger cars and trucks in tremendous quantities during the war and has also been developing post-war models and has on hand great volumes of material with which to push these into production. Fiat's post-war models have been tested out for many months. They are in production, and a program for world-trade is moving ahead.

In France, Renault, which has had an amazing increase in manufacturing capacity, has been permitted to go ahead in the development of post-war models and has these well developed and almost ready for production.

In England, Crosseley has been devoting a large percentage of its factory to the production of a light high-speed van for the Royal Air Force, the chassis being a development of the pre-war model. Its manufacturing organization on this model has not been molested, but very greatly increased, so that its capacity of fifty cars a month before the war has been increased to 250 per month now, and it is into production on a program of 3000 cars per year of its 25-30-hp. type, and is getting ready for a program of 7000 additional on its new 15-hp. model, which is a development of the war and is counted as one of Great Britain's post-war models.

20% Will Have Big Start

With many other companies the conditions are similar, and at least 20 per cent of the industry in Great Britain, France and Italy is going to have a big start over the remaining 80 per cent in the question of production and getting back into the market.

From a canvass of over forty firms manufacturing automobiles in England, the conclusion is that very few are ready to quote chassis specifications, delivery dates. or prices. They are all working on post-war models. It would be impossible to make deliveries before October or November, and, owing to the uncertainty of the material market, the quoting of prices was out of the question.

Several stated they were endeavoring to produce as good and cheap a car as it was possible to produce. Others frankly stated that their post-war prices on continued models were 50 to 75 per cent higher than 1914 prices, due to increased cost of labor, higher cost of materials, and to this might be added the expense these organizations must face in rebuilding their entire factory scheme for automobile production.

There will not be a comprehensive display of post-war models in Europe until the Olympia Exposition, which is scheduled to take place in London in November, and even at that time several of the post-war models will only be in a semi-completed stage of development.

No Low-Priced Models

France is holding in March her great industrial fair at Lyons, where most of the French and Italian manufacturers, as well as some of the British and American, will exhibit. In a few cases there will be post-war models exhibited by such firms as Fiat, Renault, Crossley, Vauxhall, Austin, Argyle, Peugeot, and one or two others.

The majority of the remaining firms will show models that are continuations of pre-war types. The Lyons Fair is not merely an automobile exhibit, but an industrial exhibit of all French industries, and marks France's initial step in her efforts to get into industry. The world will have to wait until November to get a correct measure of what Europe is going to build in the way of post-war models.

It is possible at present to outline in a general way what is coming through in the post-war model field. *One thing is certain, namely, that there is not going to be a landslide movement into the low-priced cars selling at* $1,000 *or thereabouts and which models will serve as rivals for the American car in that field.*

For the present Great Britain has almost deserted the cheap car field. There is no tendency as yet for new models that will compete with the cheap American car. In France, Renault, with a new production job which is expected to sell at about $1,000, looks like the most aggressive factor in American competition. Fiat is a close second, although its price is not yet definite.

British Cars High Priced

The majority of the British factories still incline to the high-priced automobile. As an example of this, Daimler will sell as its cheapest model a 30-hp. six-cylinder car at $4,500. This same model formerly sold at approximately $3,800. Napier will market a six-cylinder car at $5,000. One of the Vauxhall models lists at $5,900, and the other at a little less. Austin has a new model, a real post-war type, which will sell at approximately $2,000. Rover has a model which before the war sold at $1,750 and is now listed at over $2,000.

Very few announcements of prices have been made in the smaller field. The 10-hp. four-cylinder Singer is listed at $1,375, and a Belsize at $2,100 which formerly sold at approximately $1,500. The B.S.A. small car which was brought out by the Birmingham Small Arms Co., as the adaptation of the Ford in England but on an expensive design basis, has been discontinued, and this large concern apparently gone out of what might be interpreted as the low-car field.

In France the Citrogen company, a new organization, which previous to the war was a large manufacturer of gears, but which during the war grew to be one of the greatest factories in Paris, is planning to go into a cheap car production, but has nothing definite as yet.

All Europe is going into the equipment of post-war models with electric starting and lighting as standard. There will not be a single exception to this, even in the cheapest cars. Every concern has decided on this policy, and accessory manufacturers are under way in the production of generators, starting motors and batteries.

The question of standardizing on these parts has already been taken up in Great Britain by the Institution of Automobile Engineers; committees have been formed for starting battery standardization, and the sentiment is that plate dimensions will be standardized. The sentiment is to work as close as possible to American standards.

With electric starting motors outside dimensions only are going to be standardized at present. The committee having this work in hand is making good progress.

The committee having the standardization work of electric generators in charge has not started on this job as yet.

Starting motors are going to be mounted in practically the same way as in America, and in the majority of cases will drive by pinion into a ring of teeth on the flywheel. Already some of the large manufacturers have developed motor drives for this use.

Value-in-Head Design Increases

With regard to the generator, manufacturers are not so agreed. In the final post-war models they undoubtedly will be incorporated in the engine very similar to the American practice, but for the present not a few are going to be mounted on the front arms of the crankcase and driven by belt. Belt-drive will undoubtedly disappear as the development of the models crystallize. The case seems a parallel with the introduction of the magneto years ago in America when our early models were chain-driven.

There is every promise of considerable movement throughout England, France and Italy toward the valve-in-head design of engine. This may not appear in the first post-war models, but is receiving considerable attention by the leading engineers. The fuel question is so acute in all European countries that the increase of fuel efficiency is certain to have a very definite effect on engine design.

The reading of a paper in January by L. H. Pomeroy, Vauxhall engineer, on experiments with valve-in-head designs and its reception by the majority of the engineers in the country is an indication of what can be expected. The new four-cylinder Vauxhall with a horsepower rating of 30-98 is of this type, and is looked upon as one of the finest performing cars in Europe. Its cylinder dimensions are 98 by 150 mm. In Italy, while the valve-in-the-head design has not actually appeared, it was frankly admitted that it is under serious consideration. The same is true in France.

Aluminum Alloy Development

As suggested by Mr. Pomeroy in his address on valve-in-the-head design, one of the strong reasons for it being favored is the fact that it is much easier to mount the engine accessories, such as starting motor, generator, etc., with a valve-in-the-head design than with a T-head or L-head design. His experiments with valve-in-the-head design also established the point that with valves in this position diameter is not so great a factor and that intake gas velocities can be increased very greatly without any deterrent effect on the efficiency of the engine.

The use of detachable cylinder heads is under way and is destined to make considerable progress. It has attractions because of its manufacturing possibilities and also because of the fuel situation.

Great Britain has made wonderful strides in the development of aluminum-copper alloys for piston manufacture. This work has been pioneered by the aircraft development. The National Physical Testing Laboratory at Teddington, a suburb of London, has been working on this subject during the entire period of the war and has made great development. The aluminum alloy piston has come into general use and due recognition has been taken of its effect on the thermal characteristics of the engine.

Special Steels Developed

The development of a special grade of automobile steels was aggressively taken up by the British automobile makers and the steel manufacturers over 18 months ago. For a period of 11 months they concentrated on the development of twenty steels which were approved some months ago as standard automobile steels, and the steel manufacturers started production on them last fall. These had been adopted as standard steels by the Engineering Standards Committee, which is the national organization that finally decides on standards in all industries.

Once a specification or design is approved by this committee it is immediately accepted by all the manufacturers as a standard and is so considered in their complete manufacturing program. The sentiment was freely expressed that American steel specifications did not measure up to the requirements of the British manufacturer, and the new adopted list of steels is a result of the manufacturer's effort to put an automobile on as high a standard as possible.

This suggests the fact that there is throughout England no sentiment in favor of dropping from her high standard of material and workmanship that existed previous to the war. Her factories have learned great lessons in production. They have been filled with the best machinery, and some of the factories state they are doing machine costs lower than in America, yet notwithstanding this they are going to maintain their reputation for the very highest grade of workmanship and are going beyond pre-war standards in the use of high-grade materials.

No Decrease in Quality

The lessons of production have not blinded them to the desirability for a high-grade product. Good workmanship and the necessity for it have increased in Europe because of the war. All war products have to be made on a high standard of accuracy. The consequent aim was to produce the product that would give the best results. The production of the very best grade of ammunition permeated every factory and every home in England and France. Its objective of accuracy has impressed its lesson on the entire nation. At the same time the possibilities of production have been realized and appreciated. Production methods are going ahead, but there is going to be every precaution taken to prevent the sacrifice of quality for a little gain in production.

It was impossible during December when the Italian and French factories were visited, and during January when the British factories were visited, to gage correctly the possibilities of increased production in these factories on post-war models. Many of the companies had not ceased their war activities. Some of them will not be through with Government orders on aircraft engines for another 6 months.

Most of them have ceased the manufacture of shells, but several were still going on and expected to continue for several months on the building of airplanes of large bombing types, and on parts of aircraft engines and other lines of munitions.

It was unreasonable to look for production systems in factories that since the start of the war had been under Government control and were continuing on Government contracts. Much of the new machinery installed was installed especially for war work, and there was not to be seen a good deal of the multiple spindle type of machine

that is so generally used in America for production methods on automobile parts.

You looked in vain for progressive assembly systems, even with those companies that have been manufacturing cars for war uses. It was a little disappointing not to find well worked out progressive assembly systems in such factories. They are distinctly behind America in this respect.

There were three exceptions: Ford at Manchester has an assembly system as good as anything in the Ford factories in America. The large British truck manufacturer, the Associated Equipment Co., has a well worked out progressive assembly system in the form of what might be designated a traveling sidewalk which carries not only the chassis under assembly but the workers as well, so that the workers move along with the chassis or parts they are working upon.

Renault had perhaps the best example of progressive assembly on the continent in his aviation assembly room, where each engine is carried through assembly on a moving stand which is a conventional type mounted on wheels which travel in a U-track in the floor.

Little Progressive Assembly

In all of the other factories no effort had been brought into actual operation by way of progressive assembly. It was unreasonable to expect any such thing excepting in those factories that had been engaged on car production during the war. It must be remembered that America's great steps in production methods have been made since 1914 and that the majority of the European manufacturers have had little opportunity since then to come to America and study our methods.

In some of the accessories factories excellent manufacturing methods have been adopted. This is particularly true in some of the British magneto factories that have been developed under Government pressure during the war and which represent some of the most modern factories in existence. Everything modern has been installed. The lighting has been brought right to the side of the head of the worker where glare in the eye is impossible and where the greatest illumination possible on the work is obtained.

The workbenches and tables have been laid out with special regard for the work. Small assembly trays are in use with separate compartment to contain all of the parts used in the assembly of any part of the magneto. Where the condensers are being assembled there are glass sides to the working tables, so that there can be no possible interference by the wind or other agents in the speed of the work. Suitable foot rests are provided for the workers, whether women or men. The same applies to chairs. It would be almost impossible to conceive of any improvement that might be added in some of these factories.

Too Much Littering Up

There are some of the other factories where the fundamentals of production have not been studied and applied as they should. Not sufficient attention has been made to the clean-desk idea in assembly. You would see assembly benches where the parts are piled promiscuously along the center of the benches without regard to the rows of workers on the sides. Mental confusion can only follow such practices. Not a few of the manufacturers were aware of the handicap of such methods, but seemed to feel that under the stress of war they had not the available energy to revamp a system.

In some of the largest aircraft factories—and this criticism might apply to most of the factories, in the automobile, truck and aircraft industries—there is a lack of benches or racks, or crates, call them what you will, to carry the raw material or partly finished material awaiting at the different machines; and other racks to receive the material after it had been worked upon by the machine. There was too much throwing of parts on the floor or putting them in very inefficient boxes.

There was a general realization that throwing anything on the floor is inefficient. It was realized, too, that special racks for crankshafts, camshafts and all parts in the process of construction were desirable, but that the enormous pressure of expansion during the war had made it difficult to get into this aspect of production as many had desired to do. It must not be inferred that there were not in many factories very complete equipments in the way of racks and benches.

Electric Industrial Trucks Used

The use of industrial electric trucks is general in several factories, and in the majority of the others the factory managers had been endeavoring for nearly a year to get such, but were unable to do so. Fiat received its first half dozen of such trucks from American in December. They had been on order for more than a year. Several of the French factories had been trying to get such for months but without avail.

In the absence of these trucks there has sprung up a very general use of overhead trolleys for moving material and also the use of the miniature trolley system along the factory aisles. Very narrow gage steel rails are laid in the concrete flooring and hand trucks in trains of two or three are pushed along these tracks.

Where factory development has been enormously great, as in the case of Renault, which before the war had 4500 workers and now has 23,000, the use of motor vehicles to transport material from one building to another and into and through the buildings as well, has been developed. Renault employs a small passenger chassis fitted with very small diameter wheels with solid tires. These are driven by girls, who operate the vehicle only, the loading and unloading being done by men. These vehicles are very efficient in transporting from building to building, as well as in some of the larger departments.

Factories Greatly Enlarged

Nothing is more impressive to the visitor of Europe than the new factories. When contrasted with the factories that existed in 1912, you get an immediate conception of what the war has meant to France, England and Italy. You get a new realization of what is conveyed by the oft-used phrase "a war of mechanics." The mechanical devices before the war have to a very large extent been the products of the automobile and motor truck manufacturer.

Renault is a typical example in France of this. The factory has grown out of all pre-war proportions. It has grown beyond the conceptions of the Renault organization of 2 years ago. None of the manufacturers in 1914 or 1915 had any conception of what 1918 would accomplish. As a result many of the factories are not as organized and symetrically laid out as might be expected. Renault, for example, increasing more than five-fold, has spread all over the lot, so to speak, and while the organization in the different buildings is generally good, there is naturally a manufacturing loss because of the number of different buildings and the location of them. Because of the variety of manufacture it was also impossible to build up under war pressure any broad scheme of factory layout. Because of this there will be much rearrangement taking place during the present year.

(To Be Continued)

S. A. E. Discusses Truck Subjects

1—Pneumatic Tires for Trucks

B. B. Bachman

2—Summary of Truck Engineering

Cornelius T. Myers

3—Keeping 40,000 Army Trucks Running

G. E. Randles

NEW YORK, Feb. 11.—Three papers covering truck subjects were presented last night at a meeting held at the Automobile Club of America, under the auspices of the Metropolitan Section, Society of Automotive Engineers. Cornelius T. Myers, consulting engineer, Avenel, N. J., presented a general summary of truck engineering development; B. B. Bachman gave a paper on pneumatic tires on trucks, and G. E. Randles, until recently director, Division of Maintenance, Motor Transport Corps, told of some of the problems in keeping 40,000 army motor trucks in operation.

Mr. Bachman reached some important conclusions in the field of the pneumatic tire for the motor truck. He gave it as his opinion that for vehicles up to 1500 lb. capacity pneumatic tires only are proper. From 2000 to 3000 lb. inclusive there is a strongly marked tendency toward pneumatics which it is believed will develop continuously. On the 2 and 2½-ton trucks they are just making an appearance, and are still in the experimental stage, while on the larger size there is practically no evidence apparent that the heavy pneumatics will be used.

The reasons given for these conclusions are taken up definitely in Mr. Bachman's paper, which is digested herewith. The subject is one of intense importance because of the growing use of motor trucks for long-distance carrying. Furthermore, as the use of pneumatic tires is a factor in the decrease of gasoline consumption, and also lessens the depreciation of roads, it is a matter of extreme importance at the present time, when both the fuel and road prolems are being given as close as possible study both independently and as co-related matters.

Room for Detail Improvement

Cornelius T. Myers covered a broad field in his paper, this being in many ways a result of his varied experiences, including that in the design of the Class B truck. Mr. Myers stated frequently that while we have fairly satisfactory development along many lines of truck construction there is a great necessity for detail improvement. Digesting his remarks, they covered the following points:

One of the phases of truck design which has not been given all the attention which it deserves is that of accessibility. In a very large number of instances the question of cost of construction vs. accessibility comes up, and the decision is not always in favor of the accessible method of construction. Mr. Myers made a plea for simplicity, stating that this not only resulted in fewer parts but also in more accessibility. He mentioned a certain concern in this city which is a large buyer of motor trucks which makes a practice of removing from the trucks several parts which in their opinion are superfluous and selling them to other users of the same make of truck.

Comfort for the driver is a highly essential matter in truck design, particularly when it is remembered that trucks are operated for much longer spaces of time than passenger cars; and furthermore, they must be out in all sorts of inclement weather. The driver is compelled, during his attention to his duties, to exert a tremendous amount of nervous energy, and for the general safety of the other occupants of the streets, and for the general good of the apparatus handled, as much should be done as possible to relieve the driver of mental strains.

Mr. Myers touched for a moment on the gain in speed possible with the use of giant pneumatics. The further use of these, he predicted, would result in more attention on the part of designers to the layout of the brake and steering. The speed proposition, however, is a matter of extreme importance when it is realized that for real efficiency it is necessary to keep the trucks moving. The faster the average speed the better paying is the truck. The average speed in taking into consideration the entire period over which the trucks operate is not only governed by the time it spends on the road but also what is lost by waiting or by overhauling.

Transportation Cost Should Come First

According to the author, the cost of transportation by truck should be put first and the cost of the truck next. That is, in laying out a truck transportation system the first cost of the truck should be figured not as standing alone but as being only part of the entire problem of determining exactly what truck transportation is costing the owner of the vehicle or fleet of vehicles. This is a broad gaged method of calculating the value of the truck or fleet of trucks to the owner, but one which is forgotten frequently by the truck purchaser.

In the design of a truck it is very often possible to combine units so that there are parts with double and triple functions. This results in a reduction in weight and increase in simplicity, and often because of the combination of functions a designer is enabled to allow a greater factor of safety and still have finally a lighter part.

In taking up details of construction, Mr. Myers pointed out several directions in which future improvements in truck construction are necessary. Better cooling systems are required, and it is particularly necessary to look into the design of radiators, to see if they cannot be lightened, as a great amount of weight over the front axle results in making the truck hard to steer. Spring suspensions can also be improved. The use of longer springs is increasing, but lubrication of the spring eyes is often faulty; in fact, he stated many spring breakages are directly traceable to the neglect of oiling the spring eyes. This causes the bearing at this point to seize, giving an action which overstresses the main leaf, allowing it to break.

Hearty approval is being given the use of oil fittings instead of grease, but one of the criticisms offered on this method of lubrication is that the oil fittings, in many cases, admit dirt and water. They are also very frequently of

such construction that they are apt to be knocked off and broken.

The magazine system of oiling the spring brackets, as utilized on the Class B truck, was explained in detail, and was shown to have worked out generally satisfactory except at one minor point, which is readily corrected. This is in the use of too loose a fit of the wick, in the case of the front springs. When this wick is too loose the oil rapidly siphons from the reservoir, thus emptying it, and necessitates the renewal of the wick, giving it a tighter fit.

As an example of the real influence of this method of oil lubrication on ease of spring suspension Mr. Myers mentioned a truck utilized in transporting berries on the Pacific Coast. He stated that in this work the trucks using the magazine oiled suspension were allowed an increased rate per crate owing to the easier suspension, which prevented injury to the delicate berries.

There are other points on the chassis which should be lubricated in some way more closely, like the spring brackets, just described. These are such inaccessible points as the brake rocker mechanism, and so forth, which are seldom touched, but which would probably be lubricated more consistently were it necessary to renew the supply in the reservoir but once in 2 or 3 months.

Axles are generally good, according to Mr. Myers, but it would be well to look further into the matter of unsprung weight and see if more cannot be done in this respect. The paper concluded by pointing out that the time has now come to build for future development and permanent business. Mr. Myers cited the appeal for higher standards of quality voiced by an article by H. M. Swetland, president of the Class Journal Company, in an article in AUTOMOTIVE INDUSTRIES for January 23.

Keeping Army Trucks in Operation

Systematized maintenance in the army had reached a high state of development when the armistice was signed. This is made evident by the report given by Mr. Randles on keeping 40,000 army motor trucks in operation.

Obviously, keeping in repair 40,000 trucks, motorcycles, and any other motor equipment coming under the care of the Motor Transport Corps meant processing, standardization and quantity-production methods. The maintenance division of the corps adopted methods based on the experience of the foremost manufacturers of motor vehicles in the country. Motor experts were called on to give the results of their experience, and their advice adapted to that of army men who had observed motor transportation on the Mexican border. These men brought together the best practices, eliminated the faulty, and kept those that had stood the test. They picked the best standards and established definite limits to work to. Accuracy was adapted to production. A system of thorough inspection of every part was established and the final test made practically error-proof.

In the standardized repairshops the vehicle receives a complete rebuilding in all of its parts, including engine, transmission, body, upholstery, electrical apparatus, etc., and when finished, barring hidden flaws in some of the parts not replaced, it has at least the original capacity, and in many cases is capable of greater length of service than when new. The work, from the time the vehicle reaches the dead line until it passes through its process of rebuilding, is on the progressive system. In fact, in this plan modern manufacturing methods are applied to repair work, which results in low cost, large production, and the use of unskilled or specialized labor.

The schedule and routing department from the time a truck or other motor vehicle arrives in the storage yard, or "dead line" of a mechanical repairshop, keeps a record of it. As soon as it is assigned a position in the storage yard the arrival is noted in the production and schedule office and a record is made of the truck make, manufacturer's number, job number, and United States truck number. It is then surveyed and inspected by the survey board, which reports on the condition of the truck and recommends either rebuilding or salvage.

This report, approved by the shop commander, is the basis of the repair instructions. An identification memorandum is issued by the production department to the battery repairshop, advising that the truck is on the "dead line."

This shop removes the battery from the trucks, puts it in A-1 shape, holding it until the overhauled truck is ready for test. When the chassis-bay foreman has space for another job the production department assigns the truck to a vacant stall in the chassis bay. All these stalls are numbered consecutively, and the truck is tagged with its stall number.

A memorandum is then sent to all the departments, bearing truck made, manufacturer's number, job number, United States truck number and stall number. Every department then has full data on any unit which may come to it, identified only by its staff number.

As the various units are removed they are tagged with the stall number and placed on trailers in the center aisle of the bay. These trailers are picked up by tractors and taken to the distributing point in the main aisle, whence they are moved to their respective shops to be overhauled. The engine, transmission and driveshaft, rear axle, brake, front axle and steering column all go into the general overhaul and machine shop. Each part is tagged with a metal tag bearing the stall number. Parts coming from repair are inspected before being sent back to the stall. New parts are also inspected. After the engine, transmission and other units are put together in the sub-assembly and final assembly departments they are returned by trailer and tractor to the stall from which they originally came. The truck is put together again by the same gang that tore it down.

Organization of Division of Maintenance

The final test is thorough and intended to check repairs. It is given by a separate department and a group of men who had nothing to do with the actual repairing. The tested and approved truck goes back into service as good as new, and probably in better condition than 95 per cent of the trucks repaired in civil life.

The maintenance division of the Motor Transport Corps is organized for overhauling and rebuilding motor equipment in the United States and to supply parts, tools and personnel of mechanical repair units for overseas service. Maintenance repairs in the field are made by service park units which are mobile, or semi-mobile, and consist of 35 men with equipment. These units can be taken into the field, close behind the lines, where repairs can be made as the emergency demands.

Mechanical repairshops for overhauling in the United States are standard in size, eqquipment and personnel. Each is housed in a building of thoroughly modern, fireproof, concrete construction, so planned that considerable extensions can be made without disturbing the original floor arrangement. The original unit is 497 feet square, providing space to carry on 120 truck overhaul jobs at one time.

Within this enclosure is assembled equipment for completely rebuilding any style of motor vehicle. The men are so organized in all departments that the work is understudied all the way through; they are equipped with hand tool kits which are just as much a part of their equipment as a rifle is for an infantryman. The tool kits have been standardized for various classes of work and give each man the necessary tools for the job to which he is assigned and more or less confine his activities so that he will work as instructed.

Pneumatic Tires on Trucks

The most pertinent questions that arise in connection with determining the feasibility of the use of pneumatic tires are probably these:

(1) On what sizes of trucks can they be used?
(2) In what class of service?
(3) On what kinds of roads?
(4) What advantages are obtained?
(5) What disadvantages become evident?
(6) Will it be necessary to radically modify truck construction to use pneumatic tires most economically?

An analysis of data contained in AUTOMOTIVE INDUSTRIES, Jan. 16, 1919, shows that on trucks ranging from 1000 lb. to 5 tons' capacity the maker's equipment for tires is as given in the accompanying table:

Capacity Tons	No. of Models	Solid Only	Pneumatic Only	Optional
½	14	0	13	1
¾	18	3	14	1
1	64	41	8	15
1¼ to 1½	71	59	1	11
2 to 2½	128	118	2	8
3 to 3½	81	80	0	1
5	63	62	0	0

It must, of course, be recognized that this does not give an indication of the cars which have had their equipment changed by the owner after purchase, and probably does not give an indication of the cases where pneumatic equipment has been furnished at the customer's request. Conversely, if a sufficiently large demand had arisen, the manufacturer would undoubtedly have recognized the fact by listing as optional equipment.

The Field of the Pneumatic Tire

Viewing the figures with these facts in mind, it would seem to be safe to say that for vehicles up to 1500-lb. capacity pneumatic tires only are proper. From 2000 to 3000 lb. inclusive there is a strongly marked tendency toward pneumatics, and on 2- to 2½-ton trucks they are just making an appearance, while on the larger sizes there is practically no evidence apparent from this source. We have all seen large trucks of 3, 4 and possbly 5 tons' capacity with pneumatic equipment, and the fact that makers are not listing them would indicate that the proposition is still in the experimental stage.

The advantages claimed for the pneumatic tire are numerous. Some of these claims are so obviously correct as to need practically no discussion; others are open to considerable question. Also, as with every matter of this sort, the answer is not to be obtained from any one factor in the problem, but after the bearing which each factor has upon all the others has been given consideration.

The claims of advantage which are made may be listed as follows:

(1) Reduction in mechanical repairs.
(2) Increase in permissible speed.
(3) Decrease in gasoline consumption.
(4) Decrease in oil consumption.
(5) Less fatigue for men.
(6) Lessened depreciation of roads.
(7) Greater tractive ability.

The reduction of mechanical troubles can be accepted as a fact almost without comment. One point to be considered, however, is that while the net trouble is reduced, it is apt to change in character. With solid tire equipment, due to the shocks on the portions of the chassis which are not spring borne, the greater amount of difficulty is caused by the wear and looseness developed by this action. The small amount of resiliency in the wheels causes sharp blows to rack and twist the chassis structure, whereas the pneumatic tire absorbs a larger proportion of these shocks, and thus reinforces the spring action in relieving the chassis. There is, however, a reverse side to this, caused by the greater speeds which in spite of the generally larger sized wheels result in higher engine speeds. This sets up mechanical vibrations, which in conjunction with other trouble engendered by high engine speeds, raises the proportion of trouble in this part of the mechanism. However, as stated before, the total amount of trouble is decreased, and this becomes more apparent when placed in proportion with the car mileage.

Runs to test fuel economy were made with different loads; in the case of the solid tire one run was made with a considerable overload, which was not duplicated on the pneumatic tires. The results obtained are tabulated below:

Test No.	Weight Empty Lb.	Load Lb.	Total Weight Lb.	Ton Miles Per Gal.	Total Time in High Gear Per Cent
1*	4,500	525	5,025	30.33	89.1
2*	4,500	2,350	6,850	32.45	77.7
3*	4,500	4,175	8,675	36.35	62.7
4*	4,500	5,900	10.400	42.00	57.1
5†	4,500	680	5.180	28.20	81.3
6†	......4.500	2,000	6,500	32.10	74.6
7†	......4.500	3,580	8.080	31.96	62.1
8‡	4,500	550	5.050	24.40	88.2
9‡	4,500	3,480	7,980	27.40	63.0

*Solid tires.
†Pneumatic tires and the same axle reduction.
‡Pneumatic tires and a changed axle reduction to compensate for the greater wheel size.

The tests were made as carefully as possible and are, to say the least, disconcerting in the results shown. It is possible and, in fact, very probable, that these results are due to the form of the tires, which were not of the conventional cross-section and were designed to operate at considerably lower inflation pressures than normal.

General observations lead me to believe that the performance with regard to gasoline consumption will vary according to the road conditions. On very good roads there will be little or no difference, while on bumpy roads the pneumatic tire will show up the better.

Objections to Pneumatic Tires

The objections to pneumatic tires are not so numerous, but need careful consideration lest we be carried away with the idea that their use offers a solution for all troubles with no problems of their own needing attention. These objections are in my opinion:

(1) High initial cost compared with solid tires.
(2) The need of carrying emergency equipment.
(3) The difficulty attendant on making road changes due to weight and high inflation pressures required.
(4) Reduction of the high gear ability and limitation of the total ability due to larger diameter of wheels.
(5) Limitations imposed on the size of brakes due to the small size of wheels.

A material increase in tire mileage must be obtained to bring the cost per mile down to within a reasonable comparison with solid tires. Fortunately, this seems perfectly possible, at least up to 2 tons' capacity. On the group of cars which has been used before in this article for illustration, the grand average of reported mileage to date is 14,000 miles. One make of tire has averaged 19,000 miles, and of all the tires none has given less than 6000 or 7000 miles.

The weights are roughly as follows for an inflated tire and demountable rim: 38 by 7-in., 152 lb.; 40 by 8-in., 213 lb.; 44 by 10-in., 400 lb. These figures represent weights that require quite a bit of handling.

Inflation Pressures Recommended

Inflation pressures recommended are: 5-in. section, 80 lb.; 6-in., 90 lb.; 7-in., 100 lb.; 8-in., 110 lb.; 9-in., 120 lb.; 10-in., 130 lb., and 12-in., 140 lb. It is impracticable to consider hand pumping for any but the 5-in. size, and a mechanical pump to do the job is quite a piece of apparatus, and to be installed correctly adds another considerable item of expense which must be taken into consideration.

By referring to the table, it will be seen that the driving wheel diameters are increased as follows:

Capacity, Tons	Old Diameter In.	New Diameter In.	Increase in Diameter Per Cent
1..............	34	35	3
1¼ to 1½......	34	36	6
2 to 2½......	36	40	11
3 to 3½......	36	44	22½
5..............	36	44	22½

On the smaller sizes the change is not so great and will probably work no material hardship except in cases where the brake equipment is on the transmission. With the larger sizes the difference is so great as to make it extremely doubtful whether there is sufficient flexibility in any well-designed truck to permit successful application.

Capacity, Tons	Solid Front, In.	Solid Rear, In.	Pneumatic Front, In.	Pneumatic Rear, In.	Increased Cost Pneumatic Over Solid, Per Cent	Increased Cost Pneumatic Over Solid, Including Extra Tires, Per Cent
1	34×3½	34×4	35×5	35×5	80	125
1¼ to 1½	34×3½	34×5	35×5	36×6	93	184
1¼ to 1½	36×3½	36×5	35×5	36×6	77	165
2 to 2½	36×4	36×7	36×6	40×8	110	216
3 to 3½	36×5	36×5 dual	36×6	44×10	87	180
5	36×6	36×6 dual	38×7	44×10	60	140

N.A.C.C. Truck Convention A Success

Few Surplus War Trucks in America—Prospects Not Bright for Exports to Europe—Truck Registration by Speed and Weight—More Standardization Needed—Standard Warranty Needs Revising

NEW YORK, Feb. 11—Representatives of over seventy-five motor truck makers attended the truck convention held to-day by the National Automobile Chamber of Commerce, the convention being one of the best held in some time by the chamber. Subjects relating to increased use of motor trucks and improved systems of handling them were discussed. The convention covered a wide range of subjects and turned the meeting into a kind of house-cleaning day on many matters relating to trucks.

A new system of registering motor trucks on a basis of speed and weight was recommended by George H. Graham. A similar system was recommended for all horse vehicles.

Col. Fred Glover intimated that there will be very few surplus war trucks and that most of our war trucks in Europe will be disposed of on the other side of the Atlantic.

The complete elimination of the truck warranty by manufacturers and the sale of trucks on their merits and reputation was recommended by E. J. Herbig.

David Beecroft in reviewing possiblities of foreign trade in trucks showed that prospects are not bright for such trade at present due to the large surplus of war trucks owned by our Allies.

David C. Fenner asked for standardization of more truck parts and emphasized the necessity of such in throttle and spark levers as well as with gearshift and brake levers.

E. J. Mehren favored a federal system of highways to supplement state systems and the necessity of a great educational campaign on highway improvement and the better use of highways.

James I. Blakslee advocated a better national system of transportation by closer correlation of the post office, the highways and the motor truck.

A committee of truck men was appointed to discuss with a committee of the tire makers what truck tire sizes should be eliminated.

Few War Trucks for Sale

Col. Fred Glover of the Quartermaster's Department U. S. Army, in discussing the probability of disposing of any surplus war trucks which might be on hand after the determination of the size of the U. S. A. standing army in this country, was of the opinion that none of the U. S. A. war trucks now abroad would ever be returned to this country but would be sold abroad, together with the large stock of spares for such vehicles already shipped overseas.

In answer to a question as to whether the public auction of 325 trucks owned by the United States Spruce Production Corps in Portland, Ore., on Feb. 15 is an indication of the government's policy regarding the disposition of surplus trucks, he stated that the War Department had no jurisdiction over the trucks being auctioned off in Portland. Those vehicles were under the direct supervision of the Spruce Corps and not of the War Department.

He expressed it as his opinion that the various government departments would consume a large number of the motor trucks now on hand. No definite statement as to the possible number of such surplus trucks can be made at this time on account of the impossibility of knowing the needs of our army of occupation abroad and of our standing army at home.

There are fewer than 100 motor trucks owned by foreign governments now in this country which might be auctioned off. It is the intention of the government to cause the least possible disarrangement of the truck industry, and that all of the military trucks would be consumed by the various governmental departments if these had sufficient work for them to do.

There are enough spare parts on hand for these vehicles to prevent breaking up any second hand trucks to repair others of the same make and capacity.

S. M. Williams, president of the Highways Industries Association, brought out the fact that the Post Office bill which passed the Senate last week provides that any surplus military trucks be turned over to the various states for road building work and that the state governments pay for these vehicles in the same ratio as they share in the construction of federal aid highways. A large number of truck makers had objected to this plan on the ground that such disposition of surplus war trucks would cut off a possible market for new trucks. Colonel Glover stated that the motor truck industry could not expect to get back to a peace basis without some readjustment to make up for the large number of military trucks sold during the war.

A National Highway System

That a successful system of national highways must be built, laid out and maintained exclusively by federal funds; that the maintenance and control of such a system of highways must be vested in a Highway Commission and not in an obscure office of a governmental department, and that a great educational campaign must be conducted to convince 100,000,000 people of the new development in highway transportation were the three cardinal topics discussed by Edward J. Mehren, representative of the Highways Industries Association.

The various states cannot be expected to spend their highway appropriations except for the greatest benefit of those states. The national system of highways would have to be built with the view to serving the country as a whole irrespective of the economic advantages of such a route to the particular states which it crossed. He emphasized the fact that the national system should be carried on in addition to the federal aid road construction and that these latter roads would act as feeders to the main truck line. He further urged the increased use of federal aid funds as an incentive to the establishment of competent highway departments or commissions in those states which are now backward in road development.

A Federal Highway Commission, according to Mr. Mehren, is the only logical manner of supervising the building of a national system of roadways, since the various states could not be expected to maintain such a road to the same degree as would be the case if the government had the work in charge.

Highway transportation has developed more in the last 10

years than the railroads did from 1830 to 1880, a period of 50 years. The great majority of the present voters were brought up under conditions which existed before the beginning of this new era of highway transportation by motor vehicles and must be educated along new lines before the realization of the great road building program can be accomplished.

Register by Speed and Weight

A new method of state registration of motor trucks based on speed and weight was advocated by George H. Graham, chairman of the Motor Truck Committee of the N. A. C. C. and presiding officer at the convention. There should be some fundamental systems of registration and the two cardinal principles in such a system are speed and weight. The suggested method of determining trucks license fees based on speed and weight would eliminate the present discrepancies which vary from $5 to $125 for a truck of the same speed and capacity in various states. Connecticut has the $125 fee for a 5-ton truck and Massachusetts has $25 for a similar truck. Other states further west have a $5 fee for the same capacity vehicle. No action of the convention was taken on the suggestion.

The proposed rates for pneumatic tired trucks was 25 cents per horsepower plus 25 cents per 100 lb. of the gross weight of the truck and load.

For trucks with two or more solid tires the corresponding rates would be 25 and 35 cents.

For trucks with iron or steel tires the rates would be 25 and 50 cents.

Horse vehicles should pay their share of taxation for road maintenance by a tax of $3 for wagons under 1000 lb. capacity, and for wagons over 1000 lb. $3 plus 50 cents additional for every 100 lb. above the 1000 lb. limit.

Small Export Trade

The possibility of truck export trade with Europe, analyzed by David Beecroft, Directing Editor of AUTOMOTIVE INDUSTRIES, who has recently returned from a three-month investigation of conditions in Europe, showed that prospects are not specially bright at present, due to the large war production of England, Italy and France and the number of new and used war trucks that will be turned back into industry as soon as peace is finally settled.

The British manufacturers are much perplexed over this situation. To-day there is no such thing as exporting trucks to Great Britain because the order of total restriction against imports is in force and is likely to remain in force for some time to come.

There are in England 20,000 new war trucks that can be turned into the channels of industry. In addition there are available nearly 50,000 used war trucks, most of which will be repaired or rebuilt before being put into industry. Added to this are 10,000 ambulances not needed in the war work and 12,000 light delivery vehicles, which give a grand total of nearly 90,000 vehicles.

The truck production of Great Britain for 1919 has been estimated at 20,000 trucks of all capacities, so that in view of this figure the magnitude of the war trucks that can be returned to industry becomes apparent.

The production of British truck companies varies from the largest factory with a capacity of 125 trucks per week to others having a capacity of but a few. There are, among the leading makers, two with a capacity of 25 per week each, and others with capacities of 18, seven, six, five and four per week.

Italy had a very large production of trucks during the war, Fiat alone selling upwards of 50,000 to the Allies. Fiat's maximum production reached 170 per day and for months its production approached 75 per day. In Italy such other firms as Spa and Lancia have been building trucks in quantities during the war. France, England and America purchased large quantities of Fiat trucks.

Great Britain has passed a bill appropriating $130,000,000 for road improvement, which augurs well for an increased use of motor trucks. It will be impossible to expend this sum in a year, but it will be expended as rapidly as possible.

There has been a big increase in electric trucks in London during the war due to the scarcity of gasoline and the cheapness of electric current. Before the war there were 250 electrics in London and now there are 2000. The manufacture of electric trucks is being started in England by one firm that aims at an early capacity of 60 vehicles per month.

The use of steam trucks has increased very largely in England, partly due to the adoption of solid rubber tires on these in 1915. Now the steam trucks burning coal travel as rapidly through the streets of London as gasoline types. In the war zone are hundreds of steam trucks used in road building and salvaging. The use of coke as a truck fuel has been under development of late. The fuel cost for steam truck approximates 50 per cent of the cost of gasoline types.

Urge Elimination of Truck Warranty

Entire elimination of the standard warranty covering material and workmanship in trucks was recommended by E. J. Herbig, sales manager of the Service Motor Truck Co. The warranty was necessary in the early days of the industry but not to-day with the developed trucks. To-day the standard warranty is really an indication that something is going to happen to the truck.

This view was concurred in by David S. Ludlum, president of the Autocar Co. It is not expected that any such radical action will be taken, but Mr. Herbig recommended an immediate revision of the warranty in order to make it more considerate of the owner and yet not work any sacrifice on the maker.

The warranty should cover tires and truck equipment. The warranty should be rewritten to cover trucks specifically, and since the governor is such a factor in truck operation it should be written into the warranty that tampering with the governor and operating the truck without the governor cancels the warranty.

In handling spare parts Mr. Herbig had some suggestions to offer the truck maker, such as: The dealer should have the opportunity of returning obsolete parts within one year and should be paid the price for them that he originally paid the factory. The dealer should be required to carry a stock of spares sufficient to take care of the trucks in the territory. In returning defective parts the dealer should tag them showing the name of the truck owner, serial number of the truck and date of the fracture. Dealers should be given discounts on spares in accordance as they carry adequate supplies for the trucks in use. There should be a better standardization of the names of truck parts so as to avoid confusion that follows where dealers use different names for the same parts.

In connection with the standard service policy for trucks it was recommended that the dealer be impressed with the evil of idle trucks due to any cause. An idle truck is the poorest kind of advertisement.

More Standardization Needed

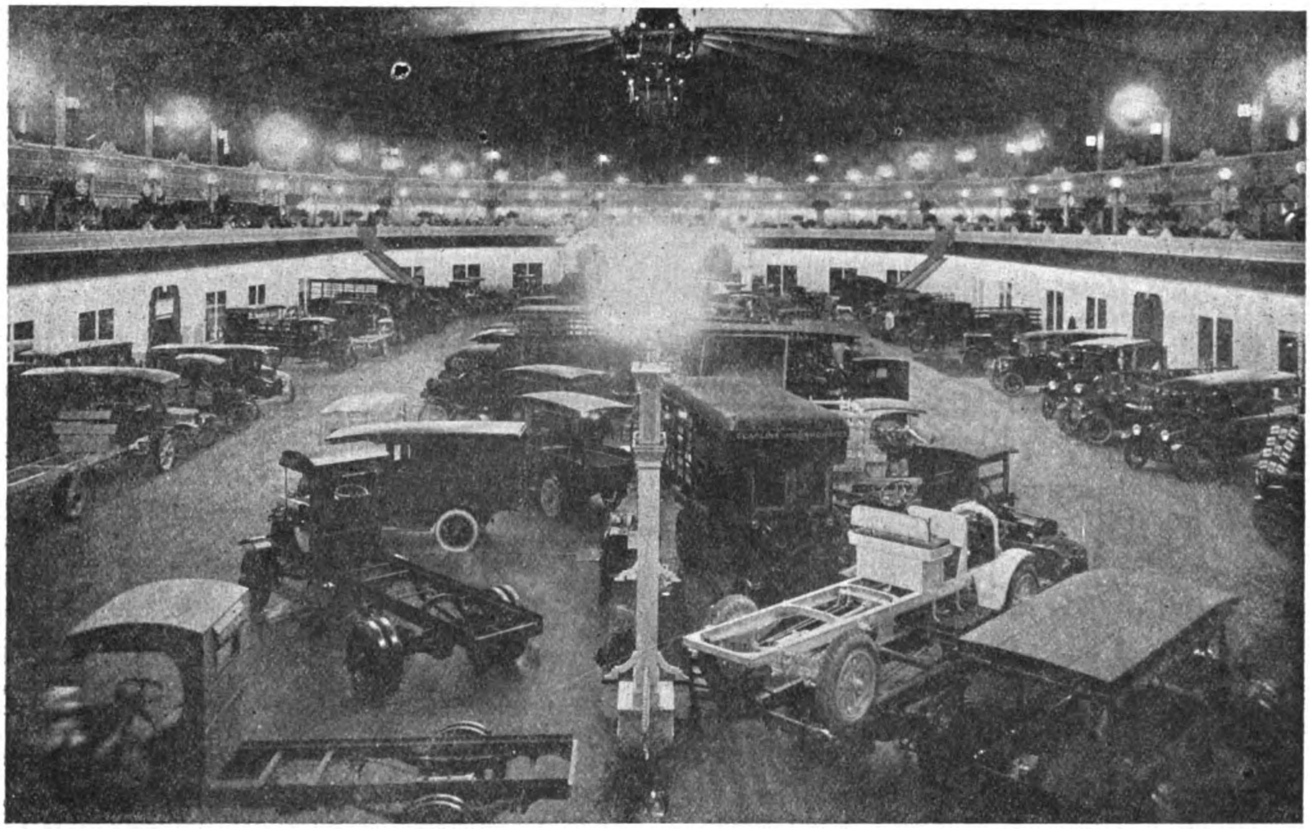
That truck manufacturers have never given sufficient consideration to standardizing the position and manipulation of spark, throttle, gearshift and emergency brake levers is the opinion of David C. Fenner of the International Motor Co.

A standard gate or location of the gearshift positions in relation to the driver's seat is highly important. If the S. A. E. standards which already apply to these features are not commercial, manufacturers should apply for a revision. If, on the other hand, these are among the details of motor truck design which are quite likely to be changed by further development, it would not seem wise to attempt their standardization at present.

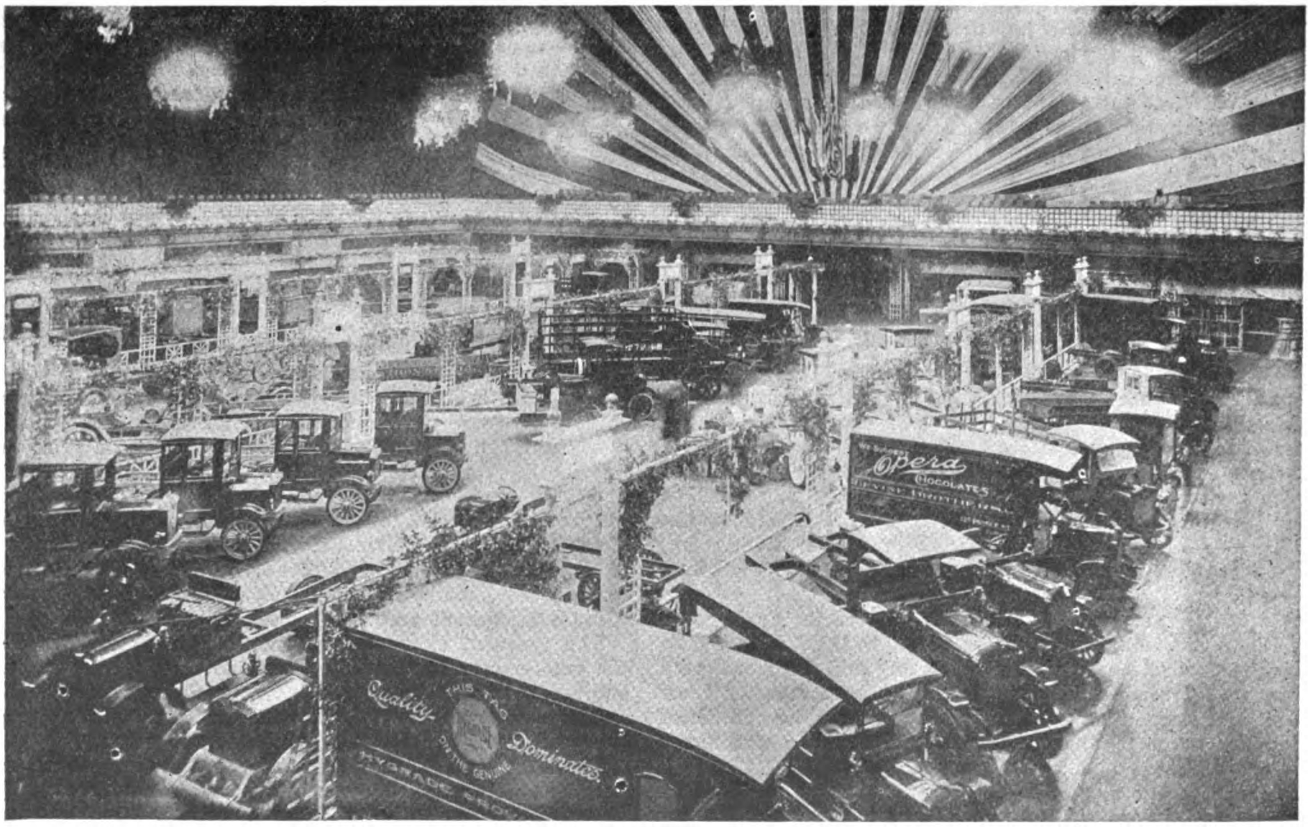
The types of chassis standardized for army work during the war emergency contain details of design selected by the engineers, who volunteered for this work, as representing the average practice of the times with the extraordinary requirements of army service kept constantly in mind.

The fact that these engineers considered it necessary to develop special types for army work does not necessarily indicate that these types will prove practical and economical for average commercial service, and as this is the problem of the immediate future, it is the basis on which we must consider the advisability of further standardization.

Two Views of the New York Motor Truck Show



Madison Square Garden with its exhibit spaces filled with commercial vehicles for the second week of the show



View of the 69th Regiment Armory part of the Commercial Vehicle show

Engineering Refinement Evident at Truck Show

Better Driver Protection—Oil Chassis Lubrication—Pneumatics for Lighter Types Among Developments

NEW YORK, Feb. 10—The motor truck show, which opened here to-day at Madison Square Garden and the 69th Regiment Armory, has 144 vehicles on the floor, some of which are new models and 22 of which were not shown at Chicago. The trucks show a refinement of detail which parallels what has been found in the passenger car industry. There is little or nothing of a radical nature, but minor refinements are plentiful, particularly as regards chassis lubrication and in the better protection of the driver.

Tractors Shown for First Time

Tractors were on the floor for the first time at a New York show. Four makes were represented, Fordson, Maxim, National and Emerson-Brantingham. These attracted such a great amount of interest that doubtless the farm tractor is going to be present at future truck exhibitions. There was no attempt made to segregate the tractors and make a tractor section of the exhibit, but these were put along with the motor trucks.

In a great number of exhibits, special bodies were shown, which made it apparent that one of the effects of the war and the experiences in the Motor Transport and other corps is to produce bodies which are more carefully designed for the specific task they have to perform. The bodies are of all styles, even including the public service type, such as a pay-as-you-enter bus, fire-engine, ambulances, hearses, and so forth, and there are also a number of new designs of convertible side stake and side panel types. One of these has interior shelving for assisting in efficiently handling small package work.

Five Makes of Converters

There are five makes of converters for turning passenger cars into trucks, and three makes of trailers. A number of the accessory makers retained their booths from the passenger car show, but altered materially the nature of the product contained in them so as to make them directly applicable to trucks.

There are a few new models on the floor, such as the Fulton 3 to 4-ton tractor and trailer, a new 1-ton Columbia, a new 5-ton Acme and a 2-ton Shaw. The new 3-ton Rowe is one of the up-to-date higher speed types, being capable of running at 30 m.p.h., and is mounted on pneumatic tires. It is equipped with a Herschell-Spillman eight-cylinder engine, and the rear axle is worm driven. The newer makes are all assembled types and a number of them use the Continental truck motor, this being evidenced by its employment in the Columbia, Acme, Shaw and other types which have not been previously exhibited.

One could not fail to be impressed with the fact that the use of pneumatic tires is increasing rapidly in the lighter capacity vehicles. Up to 2½ tons this is a matter of common usage, and it is even predicted by some of those exhibiting that the utilization of pneumatics for even heavier capacities is going to come in on a larger scale than was expected. This has come about very largely through the demand for higher speed in connection with long haul work. It is necessary to maintain a good average rate if long distance truck haulage is to be made a paying proposition, and the use of pneumatics is counted on to make high speeds possible without undue strain on the vehicle. This is an important consideration at the present time, when maintenance of roads and conservation of fuel are in everyone's mind.

Oil lubrication has supplanted grease on a great many of the trucks, the new Columbia, for instance, having entirely gone over to oil for all the chassis bearings. It is a noticeable feature that many of the manufacturers of trucks, in the same way as those who make passenger cars, seem to believe that it is necessary to make the oil cup as large as the grease cup which it replaces.

This is not only untrue, but it is positively harmful, because the larger oilers more readily admit dirt and water than the smaller type. It is always necessary to fill oil cups anyway, as they are not able, as a rule, to retain the lubricant, nor to act as a reservoir. Therefore, unless some reservoir system is used at the bearing, a few drops injected into a small oil opening is just as satisfactory as an over-supply in a cup which is too large.

Heavy Radiators the Rule

It is noticeable that many of our trucks are very heavily loaded over the front axle. The cause of this is a heavier radiator than perhaps could be constructed if particular attention were paid to the lightness of this unit. None of the radiators on the trucks seem to be designed on the basis of lightness, but it is very well possible that a reduction in weight at this particular point might make steering easier and lighten the stresses on the steering parts.

Better cushions, deeper springs under the seats, more enclosed cab protection and improved control layout are among the features which are found in the new trucks. This attention to the comfort of the driver is recognized as contributing materially to the possibility of securing better performance from the truck. In other words, a tired driver is not a good driver. He cannot take care of the vehicle in his charge if he is weary, due to the handling of badly laid out controls and uncomfortable from his exposure to the elements.

—

ACCORDING to the Government reports, the exports of tungsten ore from the Federated Malay States for the year 1917 amounted to 761.31 long tons, as against 515.47 tons in 1916. In 1913 the production of tungsten ore in these States was only 225.06 tons, so that the output has more than trebled since the outbreak of the war. The export figures for 1917 do not accurately represent the production of tungsten ore, some of the ore included in the above figures having been sent to the Federated Malay States for treatment and re-exported.

FUEL

HOW CAN CRUDE OUTPUT BE INCREASED? HOW CAN WE INCREASE THE GASOLINE YIELD?

Greater Co-operation Between Refiner and Automotive Engineer Needed—Mexican Oil May Not Be as Plentiful or as Useful as Generally Thought—Three Possible Substitute Fuels Are Benzol, Alcohol and Shale Distillate

Improved Design of Automotive Apparatus Can Have Important Bearing on Future Consumption of Fuel—Crankcase Dilution Serious

ONE of the most vital phases of the winter meeting of the Society of Automotive Engineers, held in New York, was the discussion of the fuel situation. The lesson derived from the meeting is that the time has arrived for co-operation between the refining and automotive manufacturing industries. We are now drawing on our reserve stock of crude petroleum and the curve of consumption has crossed the curve of production. With this condition, predictions are freely made by petroleum experts that gasoline prices are due for a sharp rise unless present conditions, either as regards fuel or consumption, are changed.

From the papers presented by Joseph E. Pogue of the United States Fuel Administration, who gave an interpretation of the engine-fuel situation, and Dr. E. W. Dean of the Bureau of Mines, who spoke on sidelights on oil refinery practice, it was quite evident that new petroleum discoveries and new distillation methods, while augmenting our supply, are not keeping pace with the increase in demand due to the more extended use of automotive apparatus.

It was pointed out by the authors of these papers that the matter is not solely one for the petroleum expert to solve. The low thermal efficiency of the internal combustion engine is one of the greatest causes for the excessive use of fuel. Automobile engines operating under very small throttle openings, as a rule, are not more than 8 to 10 per cent thermally efficient. In other words, from 8 to 10 cents' worth of propulsion is secured for a dollar's worth of fuel. If the thermal efficiency could be materially raised the available supply of fuel would go a long way further.

At the present time we are getting about 20 per cent gasoline from crude. This factor, like the supply of crude petroleum, is a variable figure and is directly dependent upon the sort of crude and the methods used in distillation.

As yet, the cracking methods have only been of minor assistance, but scientists are optimistic regarding the possibility of further increasing the output by extending the cracking processes and making them available for cracking not only the more volatile of the fuel oils, but also in handling the kerosene content.

The papers presented on the Mexican field showed that while there is a considerable supply of fuel to be obtained from this source, the mythical tales of fabulous deposits of petroleum do not seem to have any real basis in fact. There are many difficulties in the way of using any great quantity of the Mexican crude for some time to come, and it is very probable, according to Mr. Pogue, that the Mexican supply may be very largely utilized in taking care of the needs of the merchant marine and navy of Great Britain and the United States.

Very little discussion took place on the fuel situation among the members of the Society. This was due to the length of the program, which precluded the possibility of any extensive discussion.

Regarding the substitute fuels it was pointed out that there are only three which at the present time have any importance at all. These are benzol, alcohol and shale oil distillate. Benzol can be sold at a competitive price with gasoline, but it cannot be produced in quantities sufficient to be a material factor in the situation. Alcohol and shale oil can-

not, under the present circumstances, be made to sell at the price now obtained for gasoline. For this reason there has been no great stimulant to the development of the two latter products, although much development work has been done.

In surveying the fuel situation one is impressed by the big factor in fuel conservation that improved design is going to become. The higher thermal efficiency secured in aircraft engines has shown that there are possibilities along this line which have never, so far as known, been reached in automobile or truck practice.

Now that the tractor field is about to open up on a very large scale and since the tractor is going to be a heavy consumer of fuel, due to the fact that it is operating under heavy load conditions at all times, the matter of engine design becomes of the highest importance.

The descending volatility is increasing crankcase dilution to a marked extent, making it necessary to frequently renew the lubricating oils, thus adding to the expense of operation. Co-operation between the engineer and the refiner is necessary to solve these problems.

An Interpretation of the Engine-Fuel Situation

By Joseph E. Pogue

U. S. Fuel Administration

THE principal factors in the engine-fuel situation are the demand for liquid fuel and the adaptability of the internal-combustion engine, on the one hand, and the supply of crude petroleum, the gasoline-producing capacity of this material, and the substitute fuels in sight, on the other. Out of the interplay of these factors will come developments, focussed in the price of engine fuel, that will determine the future of the automotive industry.[1]

The Demand for Motor Fuel

The demand for engine fuel has been increasing over the past few years at an imposing rate. The nature of this expansion is shown graphically in Fig. 1. The construction program of automotive manufacturers, moreover, affords no prospect of let-up in the pressure of fuel requirement; on the contrary, the injection into the situation of a notable development in the capacity for truck production introduces an element that bids fair to overshadow even the tremendous automobile demand, while the item of tractor manufacture looms ahead with a fuel significance scarcely second in importance. If these matters be projected into the future unabated, it is evident that the supply of engine fuel will need to be doubled every few years. The automotive industry is young and vigorous, and its continued expansion will place an unexampled burden upon the engine-fuel resources of the country.

Adaptability of Motor Type

The automotive engine has developed and become standardized in its main features on the basis of cheap and volatile gasoline. Its improvement has for the most part followed the direction of convenience and performance, with secondary consideration to fuel economy. This trend has been sustained to the present time by the existence of a highly stimulated oil production, providing gasoline capacity in excess of gasoline demand. So long as this condition obtained there was no need for the automotive industry to concern itself with considerations of fuel supply, but now, with the gasoline capacity of the country beginning to give indications of strain, while the gasoline demand is just fairly getting launched, the question arises whether the exigencies of the future will allow the engine type continued freedom of development in luxury directions, or will force adaptations to meet the exactions of the fuel situation.

Automotive apparatus is mechanically responsive to changing requirements, but its adaptation to new conditions is retarded by the time required to perfect mechanical developments and the counter advantage to be gained from quantity production and standardization, with their antagonism to change. So far-reaching and insistent, indeed, are the claims in favor of holding fast to established standards that departures can be made only at great cost and in response to powerful reasons. Anticipatory action becomes peculiarly difficult in the face of these circumstances. Recognizing the strength of the opposition to changes in engine-type and seeking to force the fuel supply into channels fitting the established standards, we may examine the fuel supply with a view to determining if present engine standards can be advantageously maintained, and, if not, along what lines changes are likely to be made.

Supply of Engine Fuel

The engine fuel in dominant use in the United States is gasoline, a mixture of volatile liquids won from crude pe-

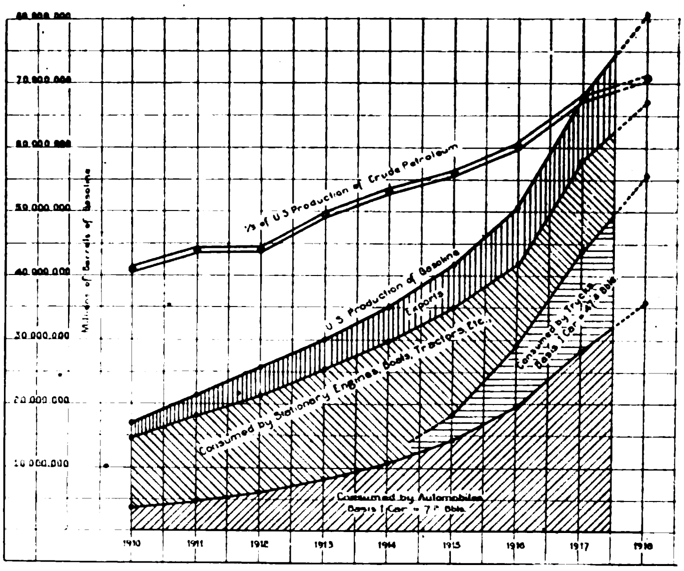


Fig. 1—The gasoline situation

This composite chart is drawn from data as follows: Crude production from U. S. Geological Survey; gasoline production from U. S. Fuel Administration and U. S. Bureau of Mines; automobile and truck consumption based on registration compiled by National Automobile Chamber of Commerce, and consumption factors worked out by War Industries Board (see manuscript report by M. J. Gillen on Regulation of Uses of Motor Cars, Gasoline, Rubber Tires and Rubber. Nov. 4, 1918). This chart is not exact in final detail, but is an interpretation of data approximately correct.

[1]The validity of the conclusions presented in this paper depends upon the correctness of the writer's diagnosis in respect to four basic points: The domestic supply of crude petroleum, the significance of Mexican petroleum, the significance of cracking, and the adaptability of the automotive apparatus. An independent check upon these points, which will serve to substantiate, modify or controvert the present argument, will be afforded by the other papers presented at the Fuel Session of the Annual Meeting of the Society, as well as by a study of the references given at the end of the paper.

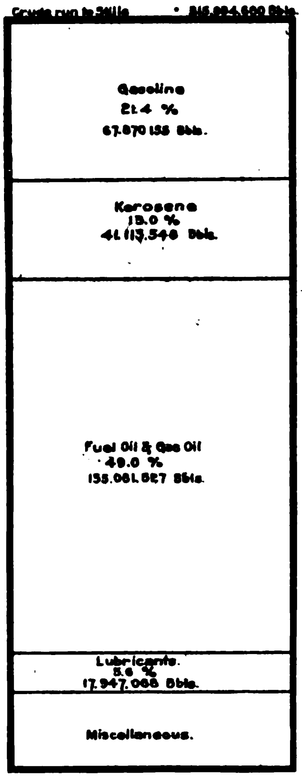


Fig. 2—Gasoline and its joint products. Data from U. S. Fuel Administration

troleum by a process of distillation.[2] Kerosene, fuel oil, lubricants and various by-products are produced at the same time, and bear an intimate relation to gasoline, both as to production and price. The relative output of these products in 1917 is shown in Fig. 2. The quantity of gasoline that the country is capable of producing depends upon the supply of crude petroleum and the gasoline capacity of this material.

Supply of Crude Petroleum

The supply of crude petroleum for years to come depends upon the unmined reserve and the rate at which it may be won. The reserve in the United States was inventoried by the U. S. Geological Survey in 1908, in 1915, and again in 1918, with results shown in Fig. 3. The significant aspects of the results are two: The small size of the reserve, approximating 6,000,000,000 bbl. in 1918 (our annual production is over one-third billion), and the fact that in the past ten years, in spite of an exceedingly aggressive campaign of oil exploration, the decrease in the reserve has exceeded the addition to the reserve through new discoveries. Those, therefore, who count upon new discoveries to materially affect the basic situation overlook the fact that for ten years already discoveries have been failing to do so.

At the same time the production of crude petroleum has been steadily mounting to its present enormous figure. This growth in output, shown in Fig. 3, has been sustained, not primarily by the discovery of new oil fields, but largely by the cumulative tapping of an increasing number of rich spots in inventoried territory. There is obviously a limit to an output supported by such a train of circumstances; there are strong engineering and economic reasons for believing that the output of crude petroleum in the United States is nearing its maximum and that the country will soon pass into a period of slowing and more costly production.

Gasoline Factor

The output of gasoline approximates[3] the supply of crude petroleum multiplied by its commercial gasoline factor,[4] which at the present time is about 20 per cent. This factor, like the supply of crude petroleum, is itself a variable figure depending upon the proportion of the crude supply subjected to refining, the natural gasoline content of this quantity, and the extent to which means are used for forcing the gasoline yield above the natural gasoline content. Obviously, so long as the natural gasoline is not fully extracted from the available crude, there is scant economic room for the development of roundabout, i.e., more intricate, more costly means for producing gasoline. This was the situation that prevailed in the United States until recently; this is why natural-gas gasoline, cracked gasoline and low-volatile gasoline are all recent commercial developments.

The proportion of the crude supply subjected to refining in respect to gasoline has been steadily increasing until the quantity so employed now approximates 95 per cent of the total.[5] Thus practically the whole output has now come to be requisitioned for gasoline production. This is to say that the readiest means for increasing the supply of gasoline, i.e., refining a progressively larger percentage of the crude produced, has been virtually forced to its limit; the "gasoline slack" within the crude production has been taken up. Thus the most potent circumstance that has thus far enabled the demand for gasoline to increase without a concomitant increase in price is no longer in existence (see Fig. 1). Further expansion in gasoline output will lie through a more difficult avenue than that of merely increasing refinery capacity.

Gasoline Content of Crude Varies Widely

While dependent primarily upon the quantity of crude refined, the output of gasoline is at the same time a function of the average composition of the various crudes that go to make up the total supply. Since crude petroleum varies in its natural-gasoline content[6] from about 2½ per cent in the case of heavy asphaltic oils to 25 per cent or so for light paraffine oils, it is evident that the gasoline supply will be strongly influenced according to the dominance of the one or other type of oil. As the high-gasoline crudes were the first to be exploited in this country, the unmined supply of petroleum has been selectively reduced in gasoline capacity,[7] so that the crude production of the future will show a lower natural-gasoline factor than the crude supply of the past. While this matter cannot be expressed quantitatively, in very rough terms it may be noted that the high-gasoline crudes are about half exhausted, while the low-gasoline crudes, originally of about equal magnitude, are only about a third used up. In other words, the country's gasoline capacity is being drawn upon more rapidly, and hence exhausted more quickly, than is indicated by the condition of the crude supply viewed alone. This tendency was of no immediate consequence so long as it could be compensated by merely refining a greater proportion of the output of crude; but now, since practically all of the domestic crude is used for gasoline extraction, a decline in gasoline content can be offset only by shoving crude production to a higher figure than would otherwise be necessary, or else through a still greater use of means for wresting an unnatural percentage of gasoline from the crude obtainable.

Means of Increasing Yield of Gasoline

The means for producing more gasoline than may be obtained by subjecting the total supply of crude to straight refining are: (1) increasing refinery efficiency, (2) blending high-volatile natural-gas gasoline with low-volatile refinery gasoline, (3) increasing the use of cracking in refinery practice, and (4) lowering the volatility of gasoline. All four means are increasingly in use. For the sake of brevity, the first two may be passed over with the comment that, while important, they have quantitative limitations which prevent them from broadly affecting the situation. This is not true of the second two, the limitations of which are of a different order.

Cracking is a process attachable to straight refining, by means of which low-priced distillates such as kerosene and fuel oil are re-run under more rigorous conditions and partly converted into gasoline. Obviously, cracked gasoline costs more to produce than natural gasoline, because of a greater consumption of capital, labor, material and fuel, and is commercially possible only after gasoline requirements have approached the quantity produceable by straight refining, and as long as there is a certain difference in market value between the raw materials used and the product turned out. The first condition has recently been attained, and there is already economic room for cracking; the second condition, if the prices of kerosene and fuel oil rise, can be maintained

[2]A small proportion of the supply is extracted from natural gas, but this does not largely affect the general situation.

[3]Because of the subordinate item of gasoline produced from natural gas, the relation is not an exact equality.

[4]The commercial gasoline factor is here used to represent the percentage of gasoline obtained from the crude consumed; the natural gasoline factor is the percentage of gasoline contained in the crude consumed. The first has increased until it has overtaken the second. (See Fig. 1.) The terms are used in a general sense.

[5]A much smaller proportion, of course, is subjected to complete refining with the production of the whole range of petroleum products.

[6]This term is used in a practical, rather than a strictly scientific, sense.

[7]The gasoline content of crude oil has been known to decrease even during the life of a given pool, which is a tendency in the same direction as that occasioned by selective extraction in respect to separate pools and fields.

only by a proportionate increase in the price of gasoline. The prospective growth in the use of the Diesel engine, especially for marine service, with its high fuel economy in the consumption of heavy petroleum distillates, may be expected to lessen the advantage that at the present moment accrues to cracking. Although the price of fuel oil is limited by the price of coal, the advantages of oil over coal for marine service are so marked that fuel oil can probably rise to $5 to $10 per bbl. before reaching its limit. Another no less potent factor bearing unfavorably upon the aid that the automotive industry may expect from cracking is the circumstance that the cost of cracking becomes greater as the percentage of gasoline demanded of a given quantity of raw material increases. This means, so to speak, that a little cracking may spread rather rapidly to all the crude refined, but much cracking will involve a step-up to a higher level of costs. In addition, the retarding influence that private control of patents will exert upon a widespread use of cracking processes should not be left out of account. Opposed to these unfavorable economic aspects of cracking, which offer relief only upon a basis of higher prices, is the matter of advance in cracking technology toward increased efficiency and lowered costs. Progress of this kind is undoubtedly in store, but advances under this head must work within the broad economic restrictions laid down above, and can scarcely be counted on to more than temper the price advances competent to maintain the requisite increase in cracking output. On the whole, then, there are reasons to believe that cracking, while of great importance at present, will under expanding use develop toxic properties, so to speak, which will limit its field of operations, if not ultimately remove it largely from the scene of action.

Lowering the Volatility

The fourth means for enlarging the output of gasoline independently of the production of crude is through lowering the volatility of the product. The less specialized the engine fuel in respect to volatility, the more can be produced from a given quantity of crude by the processes of refining in general use (see Fig. 2). By a change in character, the supply of "gasoline" can be enlarged, slowly or rapidly at will, without material refinery changes, until it is two to three times the present figure, even with no increase in the output of crude. Since the materials requisitioned in such a change are the basis of kerosene and fuel oil, which can be replaced almost entirely by coal and its products, the transition may be made without a basic disturbance of the country's economic fabric and without setting up counter forces tending to turn back the tide, as would be the case in an over-dependence upon cracking. The practical limit to this enlargement, however, is set by what the standardized automotive engine will accept in the way of fuel; which is to say that this avenue of advance is wholly in the hands of the automotive industry. The progress of gasoline in this direction has already gone about as far as practicable under existing standards of mechanical equipment; if the fuel current finds an unbreakable dam at this point, the whole pressure of advance will be thrown back into the channels already reviewed. Inasmuch, however, as the past few years have seen the volatility of gasoline steadily decreasing, in spite of laws and the desires of the automotive industry and the public to the contrary, while engine design has already been forced to respond to this circumstance with superficial adaptations, it is apparent that the channels of crude production, cracking, etc., have already demonstrated their incapacity unaided to accommodate the rising flood of gasoline demand. If these mainstays of the automotive industry are failing to meet the issue now, it is hazardous to count upon complete relief in this quarter when the pressure focussing there is rapidly increasing.

We have seen, so far as the petroleum situation in the United States is concerned, that an increasing supply of gasoline of present grade can be maintained into the future only through a growing use of cracking processes, involving material increases in the cost of production. But there are large oil deposits in Mexico which are believed by many to be capable of sustaining a North American supply of crude sufficient for all demands, even in the face of a slowing domestic output. What bearing does this factor have upon the engine fuel situation?

The Bearing of Mexico Upon the Situation

The oil-producing capacity of Mexico is certainly great, but the size of the underground reserve that will have to sustain production is largely an unknown quantity. The geological occurrence of Mexican petroleum is widely different from that of oil in the United States, and is of such a nature that the unmined supply cannot be readily inventoried. The output of Mexico to date has come largely from two wells of prodigious capacity, which have been held in check, but one of these wells is recently reported to have gone to salt water. There are, in addition, political difficulties in the way of the exploitation of Mexican petroleum, because of which the output will have to go in part to Great Britain, whose subjects hold extensive interests in the Mexican fields, and to other foreign countries. Mexican deposits are also involved in a large and growing fuel-oil demand in respect to the merchant marines and navies of Great Britain and the United States, which alone will tend to exhaust them rapidly.

Of even greater significance to the engine-fuel situation, however, than the quantity of crude that Mexico may be expected to contribute to the domestic supply, is the natural gasoline factor of this contribution. Unfortunately the natural gasoline content of Mexican petroleum is low, so that the more the domestic supply of crude is supplemented by imports from Mexico, the more the natural-gasoline factor of the entire crude supply is reduced, the more must cracking methods be called upon to sustain the production of gasoline. Thus, not only is the future of Mexican production a subject upon which adequate information is wanting, but, with the most optimistic assumption in that respect, the character of the supply is such as to be capable of sustaining an output of gasoline only upon a higher level of production costs* than now prevails. Thus Mexico, instead of offer-

*This may not be strictly true of gasoline produced in Mexico itself as a by-product of fuel oil for a period following the establishment of large "topping plants" and in event of sustained production in that country of crudes containing appreciable quantities of gasoline; but imported gasoline can scarcely be counted on in quantities large enough, or sufficiently soon, to materially affect the situation in the United States.

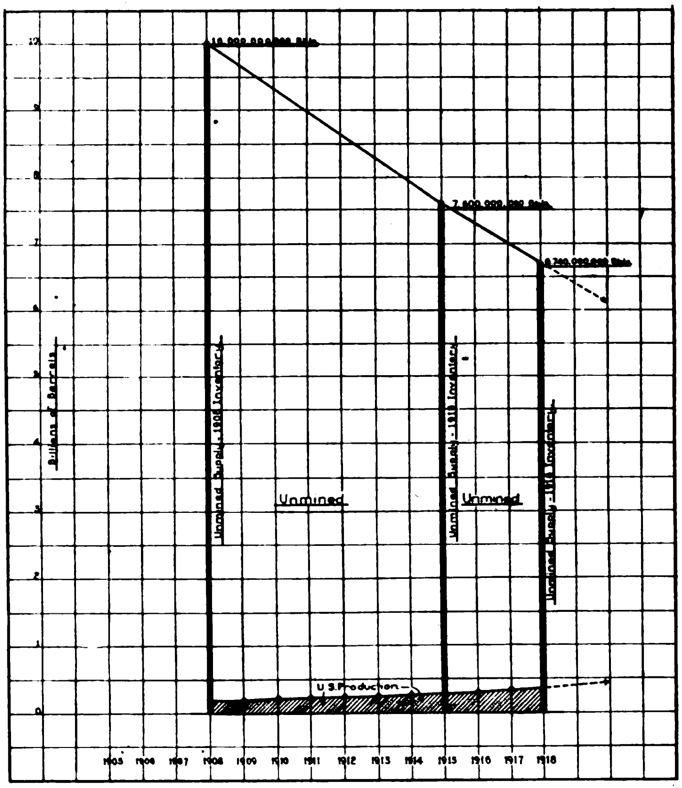


Fig. 3—The domestic crude petroleum situation. Data from U. S. Geological Survey

ing a solution to the engine-fuel problem, promises only to accentuate the issue, especially as the sudden leap in production that is impending from this source will lend a strong color of assurance to the situation.

The statements thus far made in respect to Mexico may, without substantial qualification, be extended to include the oil fields of Central America as well which will probably turn out to be heavy producers. As to South America, rather extensive explorations in most of the countries have failed to locate oil deposits of sufficient magnitude to bear materially upon the situation in the United States.

The Significance of Substitute Motor Fuels

The petroleum industry is so firmly established and produces such a range of products other than gasoline, that no engine fuel of non-petroleum origin need be counted on as capable of displacing gasoline.[9] Substitute fuels are to be regarded as supplementary resources, capable of affecting the situation broadly only as petroleum relinquishes the field through exhaustion.

There are three substitute engine fuels in sight—benzol, alcohol and shale-oil distillate. Benzol is now ready to compete with gasoline in a small way; alcohol and shale-oil distillate will be ready to compete only on a higher level of prices. As to resource capacity, benzol is a by-product of coal, and the quantity produced is dependent upon the coal subjected to by-product recovery; benzol will be manufactured in constantly increasing quantity, but the total supply can never fill more than a small part of the engine-fuel requirement. Alcohol and shale-oil distillate, on the contrary, are main products made from raw materials of almost unlimited availability; they may be produced to fill any need, however great, willing to pay the price. Whether shale-oil distillate or alcohol will eventually become the more important engine fuel cannot wholly be foreseen; but since shale-oil is similar to crude petroleum and can be made to yield an analogous range of products, a shale-oil industry is certain to supplement and eventually to succeed the petroleum industry, and hence shale-oil distillate is bound to become eventually a prominent motor fuel.[10] Alcohol on the other hand, is not so tied up with joint products, and its career as an engine fuel will be determined almost entirely by relative economy and its acceptability to engines evolving on the basis of oil fuel. If the engine type broadens so as to fit the petroleum resource, it will at the same time be prepared to receive the aid that benzol, shale-oil and alcohol may be called upon to render.

On the whole, then, there is nothing in the substitute engine fuel situation that would dictate to the automotive industry a policy differing from that determinable upon the basis of the petroleum issue. The substitute fuels remove any physical limit as to the quantity of engine fuel that may be produced; they offer greater assistance to the situation if present standards are less rigorously adhered to and automotive apparatus becomes adapted to a less volatile fuel than gasoline; they set the bounds to which the price of engine fuel of petroleum origin can advance—a very rough approximation of this figure being relatively 50 to 60 cents per gallon—suggesting, therefore, to the automotive industry an increase in thermal efficiency competent to offset the advance in price which the substitute fuels will permit and the petroleum situation will occasion.

Future Developments

The foregoing analysis of the resources and technology underlying the prospective supply of engine fuel indicates that the continued growth of the automotive demand will soon force either an extraordinary dependence upon cracking, with concomitant increases in production costs, or else a change in the character of the fuel so as to include more and more of the material now going on the market in the form of kerosene and fuel oil. The first adjustment is limited by the physical capacity of cracking, which is largely an unknown quantity, and the extent to which fuel costs can rise without involving curtailment in the growth of the automotive industry. The second solution is dependent upon the extent to which automotive apparatus may be adapted to consume a fuel less volatile than gasoline. Running through each solution, and serving to contribute to each, is the extent to which the thermal efficiency or fuel economy of the automotive apparatus may be increased. The more rigorously the present standards of low economy and specialized requirements are adhered to by the automotive industry, the greater the weight that will fall upon cracking, the greater and more sudden the inevitable rise in fuel price and the graver the danger of of an industrial reverse.

The fuel resources in sight indicate that a normal balance between supply and demand will eventually be reached, irrespective of the policy of the automotive industry, but the adjustment will result in a basis of price and character different from that now prevailing. The danger in the situation is not that of a permanent breakdown in fuel supply through exhaustion, but of a period of enforced readjustment to new conditions of fuel supply, which may come so suddenly as to catch the automotive industry unprepared and in consequence impose a serious handicap upon its prosperity, if it does not precipitate industrial disaster.

Situation Critical

The situation is serious, indeed critical, not only because the period of readjustment is apparently almost upon us (see Fig. 1), but because there are many aspects of the situation that tend to hide the real issues and to lend a false sense of security to those armed with an excess of optimism. American economic experience affords no parallel to the present engine-fuel situation; as demand in the past has almost invariably conditioned supply in American economic practice, it is an easy assumption that this will continue to hold in unabated vigor. New discoveries of oil pools are constantly coming into prominence. While the outlook for oil production never before appeared brighter, one easily overlooks the fact that each new pool, in proportion to its magnitude, adds to the unstability of the engine-fuel structure. At this very moment of writing, gasoline is piling up in storage and it is quite possible that before the winter is over the price will decline slightly. This may readily be accepted as controverting the whole argument of the paper, if the circumstance is not recognized as an inevitable reaction to a coincidence of season and post-war industrial readjustment. Upon all this come widely heralded announcements of new fuels, with extravagant claims and secret formulas, boldly promising at one stroke an easy solution of one of the most complicated industrial problems this country faces to-day. There are indeed specious arguments for sustaining conclusions quite the reverse of those arrived at here. While one series of circumstances is operating cumulatively to render the engine fuel situation more and more unstable, another set is serving to hide the real issue.

There is scant hope, at this late date, that the automotive demand will be brought into stable adjustment with the engine-fuel supply with results wholly conducive to the prosperity of the automotive field, but such difficulties as lie in store may be tempered if the industry as a whole recognizes its responsibility in this matter and acts accordingly. The exigencies of the fuel situation now urge, but shortly will demand, that the automotive industry work toward greater fuel economy and at the same time adapt its mechanical equipment to handle a less specialized fuel than gasoline. The first can be accomplished in some degree through car design, but in the main must depend upon engine changes in favor of greater thermal efficiency. The second can be accomplished either through the development of equipment not dependent upon fuel of high volatility, so as to permit the supply of "gasoline" to expand easily, or else by inducing the engine-fuel supply to bifurcate into gasoline at present grade reserved for passenger cars, and heavier distillates to be drawn upon by trucks, tractors, etc., fitted with semi-Diesel or other type of engine suited to such fuel. Apart from the disadvantage of greater costs involved in the production and distribution of two specialized fuels in the place of a single product, and the practical difficulty of unloading the problem

[9] Gasoline can be sold cheaper than any competitor, because of the possibility of shifting part of its cost of production to the joint products.

[10] It should be remembered, however, that many years must elapse before a shale-oil industry can become established and grow to significant proportions.

on the heavy-traction section of the automotive industry, the second expedient would in reality mean merely the turning over of the raw materials of cracking to a counter demand and would leave the gasoline problem still in acute need of attention. So the economics of the situation, the dictates of resources limitations and human needs, point to an automotive engine evolved into a type fitted to gain not only higher efficiency from the fuel consumed but greater economy in respect to the activities involved in the production and distribution of the fuel. The answer then is: Greater thermal efficiency in the engine and means for gasifying liquid fuel without requiring that it first be converted by a costly manufacturing process into a highly volatile product difficult to store and to transport.

Summary

1—The automotive industry is working without due regard to the engine-fuel situation.

2—This situation is an integral part of the automotive situation and should not be left out of account.

3—Owing to the pressure of automotive demand, the supply of engine fuel is in course of change, both in respect to character and price, with danger of precipitant alterations; there arises in consequence a fuel problem which cannot be adequately solved without the active participation of the automotive industry.

4—An analysis of the problem is as follows:

(a) The domestic production of crude petroleum is nearing its maximum.

(b) The natural gasoline content of this supply is lessening.

(c) Mexico offers no relief competent to solve the issue.

(d) Substitute fuels need not enter into present consideration.

(e) The supply of engine fuel can be maintained only through an extraordinary dependence upon cracking or through changes in engine type.

(f) Cracking cannot meet the issue at a favorable price.

(g) The burden, therefore, falls upon the automotive engine, which must consequently so adapt itself as to gain higher thermal efficiency, and to use less specialized (less volatile) fuel.

5—The automotive industry should therefore at once, as an emergency measure, take steps to shape its development in the direction of increased fuel economy and less specialized requirements as to fuel, establishing for this purpose centralized machinery to study the problem in full detail; should keep the industry informed of every development in the situation; should coordinate research and design in the competing units of the industry; and should conduct basic lines of research not now adequately encompassed by individual agencies.

The Unmined Supply of Petroleum in the United States*

Estimates of Quantity Still in the Ground Vary from 5,763,000,000 to 24,500,000,000 Bbl.

By David White

Chief Geologist, U. S. Geological Survey

THE justification of an estimate so highly speculative as must be that of the petroleum resources in the ground in the United States lies in the widening angle between the flattening curve of production and the rising curve of consumption. The standards of living, the industrial power, and the prosperity of the country are to so great a degree dependent upon our oil supply, and the question of the adequacy and duration of this supply so directly concerns, at the present moment, the individual citizen, as well as the public in general, that an estimate, even if it but a scientific guess, based, with careful study, experience and judgment, on the best information available, is imperatively necessary.

In response to the growing interest of the public four estimates of the oil resources of the United States have been made. In 1908 Dr. David T. Day,† then in charge of petroleum statistics in the U. S. Geological Survey, calculated the total amount of oil originally available in the ground as ranging somewhere between a minimum of 10,000,000,000 and a maximum of 24,500,000,000 bbl. In 1915 Dr. Ralph Arnold‡ placed the original supply of oil at 9,098,557,000 bbl., of which he believed 5,763,100,000 bbl. remained in the ground at the end of 1914. The third estimate was made by the geologists of the oil and gas section of the Geological Survey for the use of the Secretary of the Interior in responding to a Senate resolution of Jan. 5, 1916, and was published in Senate Document 310, Sixty-fourth Congress, first session, Feb. 2, 1916. According to this estimate the reserve of oil available at the end of 1915 was 7,629,000,000 bbl. In the spring of 1917 the producing or possibly productive area in the Western closely reconsidered with marked conservatism by the same geologists, each studying the regions with which he had field acquaintance, with the result that the total oil available in the ground at that time was estimated at 6,182,000,000 bbl.

In the preparation of estimates in the U. S. Geological Survey consideration has been given to the general character of the geologic formations—stratigraphy, geologic history, structure—the number, thickness, continuity and pore space of sands, the curves of production, the gas pressure, the water relations, and the results of drilling in near-by or geologically similar regions. A large part of the producing or possibily productive area in the Western States has been examined and mapped by the oil and gas geologists of the Survey or is now under examination. Typical areas in the Central, Gulf and Eastern States have also been studied. Nevertheless, the criteria upon which estimates can be based vary in every degree of inadequacy in the different regions, and the quality of the results, therefore, varies with the extent and character of the data available and with the personal equation of the estimators. Necessarily the estimates for areas not yet tested, especially those remote from the producing fields, are based upon theoretical conditions, carefully considered. For most of the areas estimates were first formulated by the geologists who had studied the areas. Later, these estimates were discussed in conferences.

(*Continued on page 376*)

*Paper presented at the annual meeting of the S. A. E.—Published by permission of the Director of the U. S. Geological Survey.

†U. S. Geological Survey Bulletin 394, pp. 30-50, 1909.

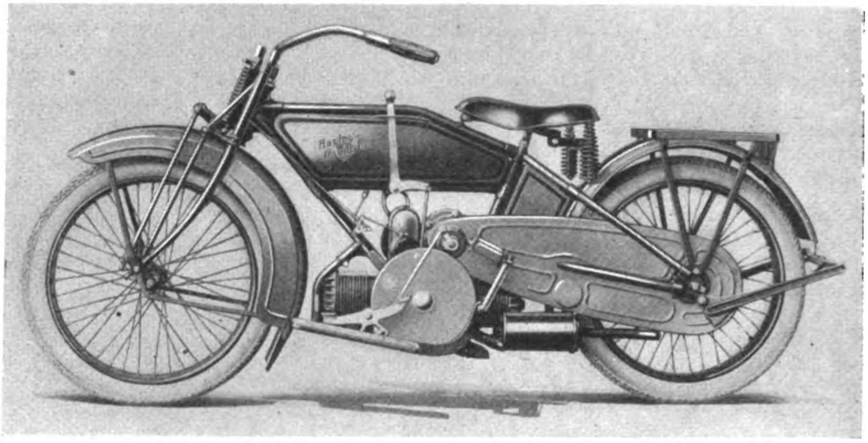
‡*Economic Geology*, vol. 10, No. 8, pp. 695-712, December, 1915.

Harley-Davidson Co. Brings Out Sport Model

An Entirely New Design, Having a Two-Cylinder Opposed Engine, Multiple-Disc Clutch and Three-Speed Transmission Combined in a Unit Power Plant, Single-Chain, Inclosed Drive—A Solo Roadster of 257 Lb. Weight

AFTER having for more than a decade built motorcycles with single and two-cylinder V engines, the Harley-Davidson Co. of Milwaukee has brought out a new model fitted with a two-cylinder opposed engine. This is an entirely new design, and the cylinder displacement is considerably smaller than that of the previous Harley-Davidson twin machines, being only 35.6 cu. in. as compared with 61. The machine is known as a sport model, and is classed as a moderate weight type.

Quite a departure from conventional practice is the use of a unit power plant, which does away with the short chain drive from the engine to the transmission, formerly used by most makers of motorcycles, affording a number of forward speeds.



Harley-Davidson sport model, left side

The elimination of this chain, together with the inclosure of the final drive, insures complete protection from mud and dust of all parts of the driving mechanism, and should add greatly to the life of the machine. A first reduction in speed from the engine to the transmission is obtained by means of helical spur gears, which are inclosed and run in a bath of oil. This type of gear is used on account of its noiselessness. Lubrication of the final drive chain is secured by leading the breather pipe into the chain case, so that the oil-laden air from the crankcase is directed onto the chain.

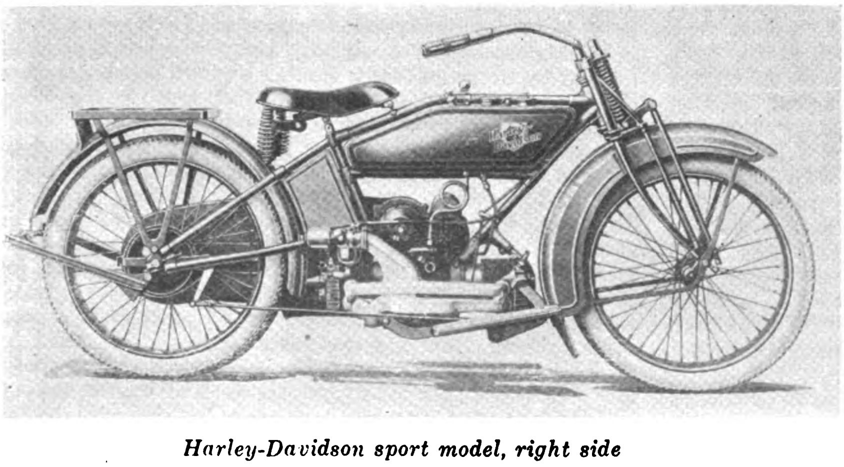
The new Harley-Davidson sport model is designed as a solo roadster for cross country work. It weighs 257 lb., and the manufacturers lay emphasis on the point that it is not a light weight machine in the sense that this term has been usually applied. A speed of 50 miles per hour can be maintained on good roads, and the engine is said to be so flexible that it will admit of throttling down to a pace which obliges the rider to use his feet to steady the machine. For power and hill climbing ability the machine is said to be the equal of any standard twin cylinder.

From an operating standpoint one of the important features of the sport model is its low center of gravity, which is due partly to the use of 26 in. wheels and partly to the type of engine fitted. The saddle position is low and well forward, and the machine is claimed to handle well in mud and sand.

The engine is of the well known two-cylinder opposed type, with cranks set at 180 deg. It has a bore of 2¾ in. and a stroke of 3 in., giving a piston displacement of 35.64 cu. in. While the rating is 6 hp., it is stated that it will develop considerably more than this.

Crankshaft Carries Balance Weights

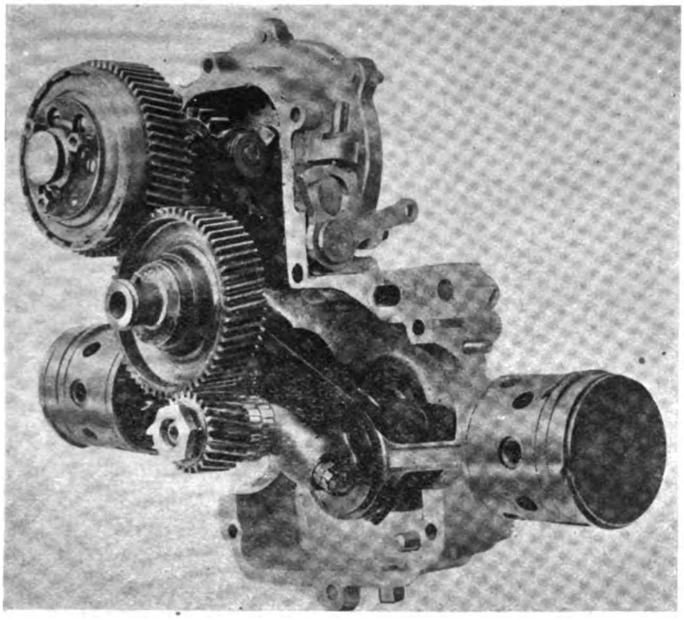
Following previous Harley-Davidson practice, roller bearings are used in the engine, both main and crank pin bearings being of this type. These bearings are made by the Harley-Davidson Co. itself. Notwithstanding the fact that a two-cylinder crankshaft with opposite throws has a very good inherent balance, balance weights are attached to the two short crank arms, so that the engine should operate with very little vibration. The method of attaching these balance weights to the crank arms is of interest, and is shown in one of the illustrations.



Harley-Davidson sport model, right side

An outside flywheel is used, and is built up of pressed steel discs, which are inclosed in a neat guard, so that the wheel will not throw any water, sand or mud onto the rider's clothing.

The valves are located at the side of the cylinders, one above the other, but not in the same vertical plane, the object in thus staggering them being to permit of operating both sets of valves from a single, horizontal camshaft. All valve ports have a clear diameter of 1¼ in. The plugs over the valves are provided with cooling fins. Only two cams are required for operating all four valves, one intake cam and one ex-



Assembly of power plant parts, showing especially the pistons, clutch and helical gearing

haust cam. The valves are actuated through the intermediary of a simple tappet lever without rollers. Cams and tappet levers operate in a bath of oil. Valve stem guides are screwed in place. All valves may be ground into their seats without removing the cylinders from the engine or the engine from the frames. It is also possible to decarbonize the engines without any great trouble, as the cylinders can be removed without taking the entire engine out of the frame.

In the design of the new engine account has been taken of the constantly deteriorating quality of motor fuel. A combination cast inlet and exhaust manifold is used, which extends between the valve ports of both cylinders and is fastened to them by means of a stud and nut at each end, a gasket insuring a gas pipe joint. That part of the intake pipe in which condensation is most likely to occur is heated by a by-pass from the exhaust pipe, to such a degree that "loading" is said to be entirely prevented. The use of this form of combination manifold does away with a good many joints and greatly simplifies the construction. A standard ¾-in. Schebler carbureter is fitted, and is provided with a cylindrical dust baffle. The latter is an air-filtering device which prevents road dust and sand from reaching the inside of the engine through the carbureter air valve.

Ignition is by a high tension magneto mounted on top of the crank case. Metric spark plugs are used, and are so located that they can be easily gotten at, yet so that their operation is not likely to be interfered with by splashing mud and water. Priming cocks are screwed into the cylinder walls close to the spark plugs, so that the gas formed by the priming charge will be in the vicinity of the plug and be sure to be fired.

Lubrication of the entire power plant is effected automatically by means of a plunger pump with rotary valve. This pump may be adjusted to feed more or less oil by lengthening or shortening the stroke of its plunger. A bull's-eye makes it possible to watch the oil feed. For emergency use a hand pump is provided.

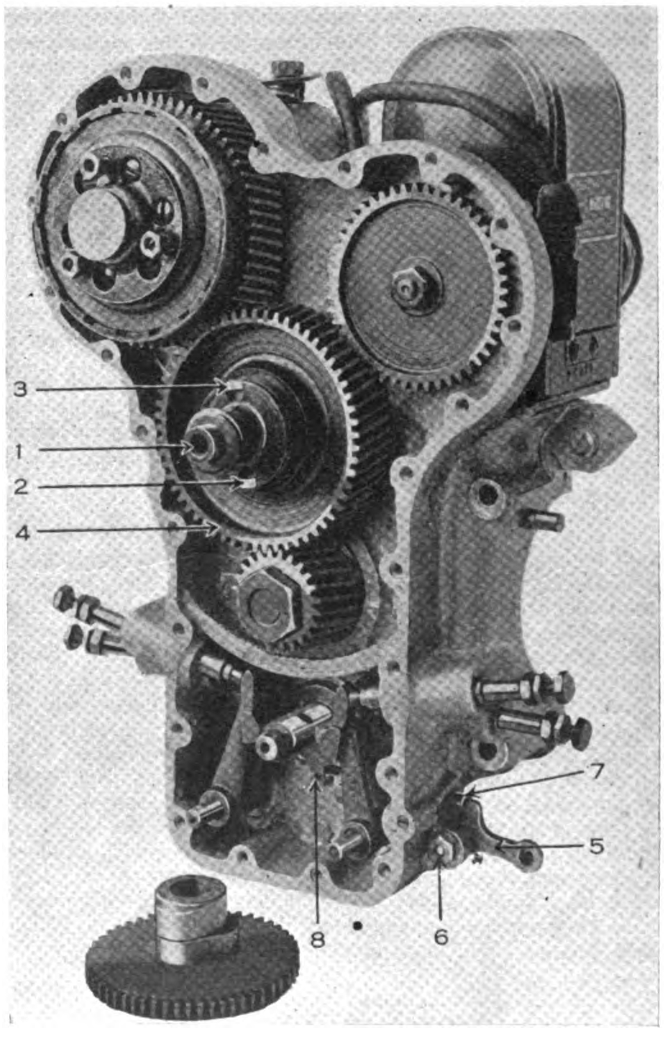
Lubrication System

The oil pump delivers the oil into the case inclosing the helical driving gears, where it serves to lubricate these gears, the bearings and the disc clutch. From this casing the oil overflows into the crank case of the engine, where it lubricates the main and crank pin bearings, the wrist pin bearings and the cylinder walls. As the transmission is located on top of the crank case, and is formed with an open base, so that there is direct communication between the crank case and the gear case, lubrication of the transmission gears is effected by the spray from the revolving crankshaft. The drive chain, transmitting the power from the transmission to the driving wheel, also receives its lubricant from this single source. It is carried to it in the form of a mist through the crank case breather valve, which discharges into the chain case. Ports are drilled in the secondary gear hub, and in the stud upon which it revolves, so that the secondary gear is made to serve as a crank case breather valve. This farther simplifies the construction. The breather pipe leads from the top of the driving gear case direct to the driving chain case.

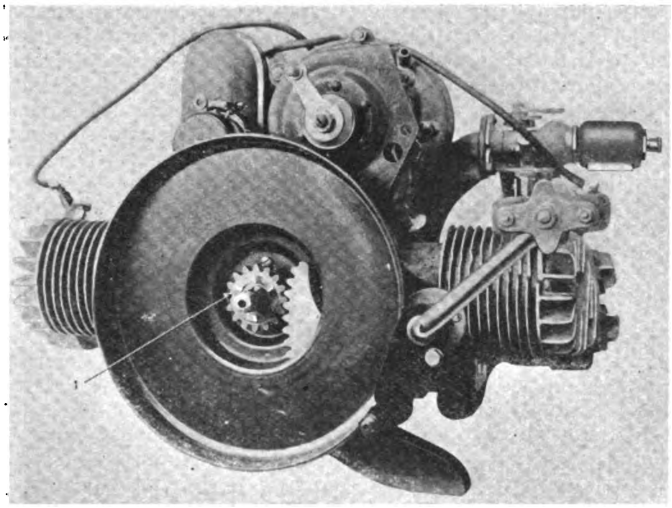
Multiple Disc-in-Oil Clutch

An innovation for the Harley-Davidson Co. is the use of a multiple disc-in-oil clutch. Owing to the fact that the clutch is located in the driving gear housing, in which there is a constant supply of oil, the use of this type of clutch does not call for any additional attention. In the earlier experimental models, a plain steel disc type of clutch was used, but this has now been replaced by a design in which one set of discs is provided with what is referred to as composition inserts. There are 13 discs in the clutch, made of saw steel carefully tempered. If adjustment of the clutch is ever called for this can be readily attended to. The clutch is controlled by a pedal convenient to the left foot of the driver.

The arrangement of the transmission is substantially the same as that of the three-speed sliding transmission used on the Standard Harley-Davidson twin motorcycle, which has already been described in AUTOMOTIVE INDUSTRIES. On the high gear a reduction of 5:1 is obtained; on the intermediate gear, 8.33:1, and on the low gear, 13.87:1. One of the



Unit power plant with gear cover removed. Valve operating mechanism at the bottom of the figure



Unit power plant with flywheel removed, showing starter gearing

greatest improvements over previous models is the elimination of the intermediate chain drive. The one remaining chain is completely inclosed, and is therefore protected against excessive wear due to dust, sand and mud getting into its links, as well as against rust. The chain being at all times kept clear and well supplied with oil, wear is very slight and adjustment is required only at long intervals. This adjustment, moreover, can be made without disturbing the chain guard. The hubs and brakes are of Harley-Davidson manufacture. Large hubs with substantial flanges, cones and ball races are used. The brake is of the contracting band type, and is claimed to hold the machine in either direction. Its drum is 7 in. in diameter and has a brake band of 1 in. width acting upon it.

The frame is of the double bar thrust type, and when the unit power plant is in place it forms a keystone construction. Seamless, high carbon steel tubing 1⅛ in. in diameter and of Nos. 12 and 16 gage is used for the frame. The steering head bearings are of the same design as those on the larger Harley-Davidson model, although slightly smaller in size. To facilitate the installation of the power plant in the frame by one man, a small shelf is provided on which the power plant can be rested just before the clamping bolts are slipped into place.

Although the center of gravity of the machine is very low, the road clearance is 5½ in. The manufacturers point out that this is equivalent to a greater road clearance with a machine of long wheel base.

Fork of Caster Type

The fork is of the trailer or caster type; it is made of round, seamless steel tubing, and features the Harley-Davidson double stem extension fork side principle. Side play and wheel shake are prevented by the balancing rocker arms. The main cushion spring is a large, resilient coil, which is placed outside the steel tube or cylinder which carries the recoil or balancing spring.

The starter is made up as a unit with the engine, and is on the left side of the machine. It turns over the engine at sufficient speed to start it readily, and may be operated with the gear shift lever in any position provided the clutch is disengaged. The starter is protected by a substantial steel shoe from mud, sand and water thrown up from the road.

One-inch tubular steel double-stem handlebars, with handlebar stems and steering bars proper made in one piece, eliminate brazed joints at top of the stems. The grip control mechanism is entirely inclosed within the handlebars. The system used is the Harley-Davidson double-acting wire control.

The tires are 26 x 3 in., which is very liberal equipment for the weight of this machine. Rims are standard CC type steel rims. A regular motorcycle saddle is fitted, and is mounted on the Harley-Davidson Ful-Floteing seatpost. The luggage carrier affords an 8 x 14 in. carrying space.

Five-inch mudguards are furnished and a large, substantial splasher flap is fitted to the front one. The rear mudguard has a removable rear section to permit ready removal of the wheel in case of tire trouble.

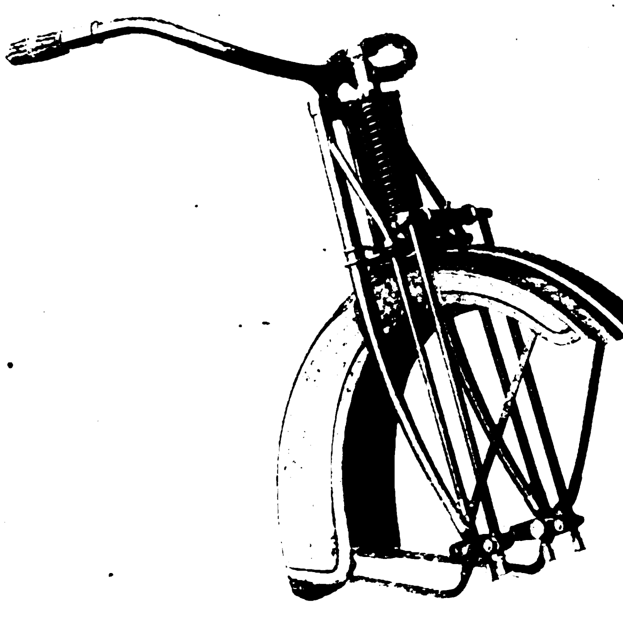
Gasoline and oil tanks follow very closely the lines of the tanks on the larger Harley-Davidson model, and have no exposed seam and no sharp corners. On the new model, however, the tanks are made up as one complete unit. The gasoline tank holds 3 gal. The oil tank holds 2 quarts, or enough for 400 or 500 miles under ordinary conditions.

A large muffler silences the exhaust so it is hardly noticeable. A tail pipe directs the exhaust gases away from the machine. A cutout is provided which may be readily operated by the foot without the rider taking his eyes off the road.

Acetylene as Motor Fuel

NOT much has been heard in late years regarding the use of acetylene as fuel in internal combustion engines, after experiments during the early part of the century had yielded no commercial results. Quite recently, however, references to the use of this fuel are again being met with in the European technical press, which may be a result of the gasoline famine in some countries consequent upon war conditions. Thus the *Tecknisk Ukeblad* reports that a motor transport service, running exclusively on carbide, has been maintained throughout the summer on a route 116 km. long between Kristiansand and Aaseral. Also a trial trip has just taken place with a 52 hp. motorboat, "Falken," driven by a six-cylinder Thornycroft petroleum motor, adapted to carbide by being fitted with a special vaporizer and air-mixing valve. The carbide containers, three in number, are situated on deck with pipes leading to the engine below. The Swiss Acetylene Society recently published the results of precise measurements on the gas consumption of acetylene engines. The measurements were made on a 30 hp. truck engine, and the output determined by an electric dynamometer. The engine under test made the same speed of revolution at all loads. The results were as follows:

Brake hp.	Total consumption cu. ft. atmosphere	Specific gas consumption: cu. ft. per hp. atmosphere
10.5	136	13.1
17.0	177	10.3
22.8	238	9.9
27.2	252	9.2



Front fork, handle bar and wheel guard

The FORVM

In Defense of the Bristol Fighter

By S. W. SYMONS, Lt. R. A. F.

AS a constant reader of AUTOMOTIVE INDUSTRIES and a pilot who has spent considerable time on Bristol Fighters, I cannot permit the many statements which have been printed in the American press, belittling the performance of the Bristol Fighter, to go unchallenged.

I do not blame the American press for these statements; I know full well that they emanate from official sources and that is the obvious reason for their inaccuracy.

The reported obsolescence of the Bristol Fighter might in itself pass unnoticed. You are well aware that the Bristol has been in use at the Front for the better part of two years, a long period for any machine to remain up-to-date under war conditions, and a new "Super" Bristol has been under way for several months past, though it may now never see the light of day. However, it is the statements which belittle the performance of the Bristol which I wish to criticise, and particularly those comparisons, on a purely fighting basis, between the Bristol and D.H.4. (itself obsolete) which are misleading and in many cases inaccurate.

In comparing the Bristol Fighter with the D.H.4. (or D.H.9. which has superseded it) it should be borne in mind that the D.H.4. is an armed bomber and is not intended to fight unless forced to, while the Bristol is purely a fighter and only used for bombing incidentally, though, due to its ability to take care of itself in a scrap, it has been used very successfully on "lone" photography and reconnaissance "shows" and even for trench "straffing," where usually only the lightest machines are used.

The D.H.4. and Bristol machines frequently work together. It is no uncommon thing to see a squadron of D.H.4. machines start on a bombing "show" escorted by Bristol Fighters, and if there is any fighting to be done, it is left most religiously to the Bristols.

With an expert fighting pilot and observer the D.H.4. can give an excellent account of itself in a scrap, but again, not being a fighting machine, neither pilot nor observer is picked for his fighting qualities, and even the most expert would be at a disadvantage owing to the D.H.4. having such poor stunting qualities, so essential for fighting. The Bristol, on the other hand, is designed primarily for fighting and both pilot and observer are given a special training in gunnery and fighting practice, and, of vital importance, the pilot must qualify as a "stunt artist" before going overseas. In stunting capacity the Bristol is only excelled by some of the small and fast scouts.

In regard to actual work in France, I can only say that the Bristol Fighter was feared by the Huns as much, if not more, than any other British machine and they had no two-seater to touch it in performance. I have known personally of many occasions when a single Bristol has been set upon by six or more Hun scouts and got away with it, with at least one Hun sent "west." It is a peculiarity of the Bristol, due largely to the rear gun, that the Huns will not attack a single machine unless they outnumber it at least four to one. In more recent scraps, where large formations have been employed, I have known of several cases where formations of six to twelve Bristols have run into the famous circus, numbering anything from 25 to 50 Albatross and Fokker scouts, and again come out best. My own squadron one morning brought down thirteen Huns in a 2-hr. "dog fight" without the loss of a single machine. A pal of mine, in another Bristol squadron, started out with a formation of twelve and came back with a bag of 15 Huns and no losses. A flying officer in my squadron went to France in January, 1918, had his first scrap late in February and between that time and September, had—officially—destroyed 34 Hun planes, had been decorated three times, and risen to the rank of Major; these are but a few Bristol records; they could be multiplied by the hundreds.

To turn in detail to some of the statements and criticisms in the American press, statements which the press cannot be held responsible for since, as before noted, they presumably come from official sources.

In your issue for Sept. 26, 1918, page 548, the types of engines used in the Bristol are listed, and a statement of performance is given.

The engines listed are the 190 Rolls, 150 and 200 Hispano, and the 200 B.H.P. As a matter of fact the only engine used to any great extent is the Rolls, the use of the other types being practically negligible, and the 190 Rolls was superseded in December, 1917, by the 264 Rolls (sometimes known as the 275). This engine is really a highly improved 190, but the 40 per cent increase in power had a marvellous effect on the performance of the plane. Apparently this information had not been given out in the States in time for publication in the issue of Sept. 26 of AUTOMOTIVE INDUSTRIES. In other respects the report is sufficiently accurate, except that the front gun carries 500 rounds instead of 88.

As regards the failures experienced in the early part of 1918, noted in your issue of Sept. 5, page 404, which apparently damned the machine in the eyes of Americans, these were undoubtedly serious, though luckily very few. They were due entirely to slight changes in wing construction, made by the manufacturers and changed as soon as the results came to light. All existing machines were also modified so that a repetition was made impossible. When it is considered that Bristols have been dived at over 300 m.p.h. (I myself have been in a dive at over 230 m.p.h.) any rough handling in pulling out, or a slight reduction in wing strength, is bound to result in failure, yet Bristols are constructed so that pilots handle them as though it were not possible to break them and you can do things with a Bristol which would make a D.H.4. collapse.

The real reason the Bristol was washed out in the U. S. A. is that the Liberty engine did not suit it. It was too heavy and too powerful and it is a pity that this reason was not frankly stated, though it was obviously due to the mysterious workings of the official mind.

In conclusion I cannot but admire the frankness with which the American press has reviewed the airplane situation and admitted the many deplorable mistakes, mistakes which have now happily been completely cleared up and cannot now affect the winning of the war.

Recovery of Manganese from Slag

A GERMAN patent, No. 307,393, of March 7, 1916, describes means for recovering manganese from low-percentage manganese-carrying blast-furnace slag. In an electrical furnace a sump-bath of iron, or clippings and turnings, is melted without access of air, and into this the blast-furnace slag of basic proportion of 1 to 0.8 is put, and the bath raised to the highest temperature possible. When fusion has taken place, as much lime is added as the fluidity of the bath will permit. A better reduction of the manganese is thereby effected, due to the increased basic qualities of the slag. The sulphur and manganese compound of the blast-furnace slag is broken up, and the sulphur carried over to the final slag. To the whole molten bath a reducing agent is then added in the form of small pieces of coke, whereupon the reduction of the manganese and oxygen compounds takes place according to the equation $MnO + C = Mn + CO$. The reduction is greatly facilitated by the use of lime and coke, prepared in the electrical furnace, where, under the action of the electric arc, calcium carbide is formed, which substance serves as the carrier of the carbon required. The molten iron takes up the reduced manganese, forming a ferro-alloy. Manganese is used as an alloy in steel and hardens the latter.

Social Surroundings Have Important Bearing on All Labor Questions

Comfort and Home Life of the Worker Will Modify Extent and Acuteness of Unrest and Migration

By Harry Tipper

FOLLOWING our last week's article, giving some particulars as to the condition of labor in the automotive field in this country, it is necessary to consider the general figures of the case not only, but also the prospects of difficulty with organized labor in this field during the period.

It is to be observed that since the armistice was declared there have been a number of strikes among skilled workers in several industries and in many localities, asking either for higher wages or for shorter hours, and apparently aimed at the prospective reductions in labor prices which are likely to occur and adopted as a means of strengthening the position of the organized labor bodies under the circumstances. These strikes have not become acute, and in most cases they have been settled very promptly. They indicate rather the beginning of the post-war period of unrest, which will be accentuated in proportion to the difficulties met in redistributing the labor to take care of the present industrial requirement.

It is obvious that in Europe the organized labor bodies are determined upon carrying out the very radical socialistic program which they have adopted during the war period and which has been expressed in the platforms emanating from their conferences. It is significant to note that the trouble from general strikes in Great Britain is more widespread and covers a larger number of industries than at almost any other previous time. It is also evident that the strikers present a much more determined front and a much more complete and effective organization than they have been able to show at any other period.

Political Demands of Organized Labor

It is not likely that we shall be troubled in this country with the severe conflict between labor and capital which is occurring in Great Britain, but the example of the European countries and the presence of a considerable body of radical opinion among the labor organizations would suggest that some severe labor unrest will occur based upon the desires of the organized bodies of labor for a larger control politically and industrially at the present time when public opinion is sufficiently fluid.

The platforms of the organized labor conferences in various states continue to exhibit demands which are mainly political and which are radically socialistic in their point of view. It is to be noted that the demands made on these platforms have extended themselves politically very much further than any labor organization permitted before the war began. In several of these adopted resolutions of various state conferences of the labor federations the demand for the government ownership of public utilities has been extended, so that the demand now takes in the ownership and distribution of coal, food products and of other important matters. The only difference, therefore, between the situation in Great Britain and the situation in this country lies in the relative weakness of the labor organization, which prevents their passing to the extreme measures that are being adopted on the other side.

The power and influence of organized labor have been greatly extended during the war, until this body, variously estimated as comprising from 14 to 20 per cent of the total supply of labor in the country, has exercised an influence so far beyond the boundaries of its own organization, in the last few months, that in many industries its effect is as great as though it comprised 80 or 90 per cent of the total labor instead of a minority. It is this increase in political influence which makes it impossible to predict with safety the demands of labor and its willingness to accept the process of readjustment without a more or less severe conflict. The necessity for redistribution of skilled labor from one part of the country to another and from one type of work to another, with the necessary period of unemployment, is in itself a cause for social unrest and discontent. People do not move readily from their homes unless the necessity is severe, neither do they accept a change in their economic condition which involves the acceptance of less pay until necessity compels them to do so.

Question of Wages Is Minor

In the meantime the enforced idleness and the comparative sacrifice taken together with the ceaseless activities of the radicals are calculated to lead to unrest and to lay the foundation for further difficulties between the organized bodies of labor and the industrial owner. It is probable that idleness and the social causes of discontent are at all times more important in their bearing upon labor troubles than the question of wages *per se*. The question of housing, the character of the surroundings and the bearing of this on comfortable home life are always important, and at no time of greater importance than at the present.

At South Bend, Ind., this week the Studebaker Corporation presented to the citizens of South Bend their plans for the addition of new factories which would require 12,000 workers besides those already employed. At the lowest estimation this means an addition of 40,000 people to the population of a city whose present population is around 75,000. It was interesting to note that the great concern of the Studebaker Corporation in presenting this matter was the question of the provision of proper houses, schools, churches and the accompanying public improvements in order that the workmen could be secured and induced to remain.

The relations between the Studebaker Corporation and its employees are evidently very friendly, and the plans which the company have in mind indicate that they expect

to make developments in profit sharing, etc., which will increase this amiable contact. The corporation recognizes nevertheless that nothing which it can do in the way of organization developments, in giving the worker a share in the responsibility for the enterprise, can be effective unless the social surroundings are at least reasonably comfortable.

Large bodies of skilled and unskilled laborers were moved during the war period into specific locations in order that the urgent requirements of the war could be met. The Government did a great deal of work in housing these workers and the immediate problem was solved.

In the redistribution of labor from the concentrated necessities of the war to the development of peaceful occupation these social surroundings will have a great bearing upon the labor unrest, both as to its extent and acuteness. Thousands of workers will not move back to their old places, and cities which have not been faced with a large amount of unemployment because of the cancellation of war contracts will be faced with an unemployment problem due to the migration of workers, either from war industries or from the demobilization, who have decided not to go back either to their old life or to their old occupation.

The general unemployment figures show an increased number of skilled and unskilled workers who are idle, and this idleness will automatically breed labor trouble, discontent and unrest, and may lead to some disorder. In this respect the automotive field is interested not only in its own labor problem but in the general labor conditions throughout the whole country, because the stability of labor in this particular industry and the relations between employer and labor will be directly affected by the surrounding conditions in other industries in the immediate localities or general territory.

All things considered, this is the proper time for every manufacturer who desires to stabilize his labor and to meet the return to peaceful production with a minimum of trouble to begin the development of those organization plans which may be necessary to establish the proper basis of confidence between the employer and his employee. This point cannot be emphasized too strongly. The platforms of the state labor conferences show that the political influence and the desire for control are extending the demands of the labor organization and leading directly toward experimental and socialistic legislation and further conflict industrially. The unfortunate difficulties in the way of a rapid readjustment will add to the force of these demands the idleness and the social unrest which always accompany any large necessities of that kind.

Changes May Invite Disaster

It is becoming clearer all the time, from the progress of conditions in the older countries, that the growth of labor organizations to the point of control will so seriously change the political and industrial aspect as to invite disaster. It is a question whether in the older countries the matter can be solved without an experimental period of socialistic government. The tendency in this direction has gone so far and the movement has acquired such momentum that such a conclusion is inevitable.

In this country the strength of organized labor is not sufficient, neither is the movement in this direction of such proportions that experimental legislation need be considered inevitable. It is still possible to solve the problem without seriously changing our fundamental practices in the governmental, industrial and social relations, but this depends entirely upon the action of the manufacturer and how far he is willing to go in taking the worker into discussions which establish the conditions of his work, the extent to which he is prepared to share the profits of the business with the worker and the distance he expects to travel in the analysis of the fundamental requirements of this proposition.

The present situation is not satisfactory either to the worker or to the manufacturer. The worker will disregard the mandate of his own executive council when there is any local advantage to be gained thereby just as readily as he will disregard the necessities of the manufacturer. The present labor organization is incapable of offering more than a temporary settlement. No organization of manufacturers can do more. The manufacturer must decide whether he will bargain collectively, inside his own organization with his own workers, or whether he will bargain collectively with the outside organized labor body. He must decide whether he will fight for control against the constantly increasing political power of organized labor and the constant tendency toward more radical demands, or whether he will gather together with his own workers in a group unified in purpose so that it can fight for its own place in the industrial world.

The practical considerations of the effect of these things upon the amount of production per man and upon the other economic items is beside the question at the moment because the whole fabric of industry is threatened with severe political readjustments unless the matter is solved or at least the basis of solution is made.

Political Power Not Understood

Even now the manufacturer does not realize the industrial significance of the present attempt in some quarters, backed by many of the labor organizations, to put the railroads under Government ownership. Even now the increase in political power of organized labor is not properly understood. It is a question whether any manufacturer realizes the extent to which the professional classes and the salaried classes of employees are in sympathy with some experiments in Government ownership and other socialistic tendencies. There is no sympathy among the large body of citizens of this country for the industrial aristocracy controlled exclusively by a few private individuals and passing no share of the responsibility to the worker. There is a great desire among the large body of citizens for an orderly solution of these industrial problems of labor which will avoid the acute difficulties in which the older countries find themselves, which will prevent us from rushing into experimental legislation of a bureaucratic nature and which will at the same time give the worker some share in the responsibility for the conditions of his own work and some share in the common object of the industrial organization of which he is a part.

Socially, politically and industrially we are in a period of change, and the industrial so intimately affects the social and political that all these changes will react one upon the other, and the action of the manufacturer in dealing with the labor problem in the next few years may govern the tendency of our political development and the conditions of our social existence.

THE first batch of airplanes ceded by the British Government to Chile has reached Valparaiso. It will form the nucleus of the new Chilean Air Service, which, as a start, will consist of 14 seaplanes and 50 airplanes, all machines originally built for the British air services. Major Huston, of the British Flying Corps, is to act as chief instructor of the new force and Engineer-Lieutenant Solano is to be the technical head of the naval section of the service. The first Chilean naval base will be the island of Omiriguina, almost in the middle of Talcahuano Bay.

Over 1200 at S. A. E. Victory Dinner

NEW YORK, Feb. 7—That the automotive future holds even greater opportunities and presents engineering problems of more import than the past was the theme of the Victory dinner held by the Society of Automotive Engineers last night and attended by more than 1200 members and guests of the society. Speakers included C. F. Kettering, president of the S. A. E.; Charles M. Manly, president-elect of the S. A. E.; Alfred N. Reeves, general manager of the N. A. C. C.; John N. Willys and George F. Houston of the Wright-Martin Aircraft Corp. Job E. Hedges was toastmaster.

Discussing aeronautics, George F. Houston briefly presented a problem that is probably of as great importance to the automotive industry as any at this time, the present and future of aviation. The past, he declared, referring to the war, was a testimonial to the engineering and productive skill of the American automotive industry, the present—"the less said the better"—but the future, he is certain, will find the airplane and the airship firmly established and accepted in an important niche in the commercial world.

War Has Developed Co-operation

The engineer, said C. F. Kettering, urging wide co-operation, who closes the door of his research department "shuts out more valuable information than he keeps in." The war, he said, has developed co-operation between automotive engineers to the highest degree, and that co-operation must be continued to insure solution of the huge problems before us.

Capital must recognize its obligations to labor, and labor in turn must recognize its debt to capital, said John N. Willys, who told of his plan to divide the profits of his various companies with the workers "above a just and reasonable wage compensation." The Ford plan, he said, not only provided the workers with greater remuneration, but increased their incentive and consequently their productive output, and he stated frankly that if the clock could be turned back he would follow the Ford plan in less than 24 hours after its inauguration.

Alfred Reeves, discussing the past year and the general governmental attitude toward the industry, and the future of the automobile, said that the industry is now recognized as vital and important, and chiefly utilitarian.

Others at the speakers' table included: H. R. Sutphen, president of the National Association of Engine & Boat Manufacturers; F. H. Russell, president of the Aircraft Manufacturers' Association; Camillo Cerruti, chief, Italian Military Mission in the United States; C. W. Stiger; Capt. E. C. Hugh, British War Mission; Capt. George Sykes, British War Mission; C. E. Thompson, president of the Motor and Accessory Manufacturers' Association, and Col. A. O. Seaman, Motor Transport Corps.

Annual Dinner of the Society of Automotive Engineers, Feb. 6, 1919

S. A. E. Annual Meeting Concludes

Three-Day Meeting Well Attended—Papers Centered Around War Accomplishments and the Fuel Situation—Dinner Attendance a Record One

NEW YORK, Feb. 8—One of the most valuable meetings ever held by the Society of Automotive Engineers came to a close yesterday. The three-day session embodied a program covering the vital developments in all phases of automotive activity. The high spots were undoubtedly the discussion of the influence of aeronautic practice on future motor car design and the symposium on the fuel situation, which occupied the attention of the members during an entire forenoon.

Higher standards of manufacture are sure to result from the lessons gained in airplane work. It was predicted by the three engineers—H. M. Crane, O. E. Hunt and Howard Marmon—that in the future we will see much greater co-operation among engineers as a result of the general discussion in laying out the Liberty engine and other airplane developments during the war. While it is true that the automobile and automotive industry has always been distinguished for the great amount of co-operation existing between even competing concerns, the war has carried that co-operation to a far greater extent, and it seems certain that the engineers who got together on airplane development, as well as on other phases of war work, will continue to co-operate in the future.

Seriousness of Fuel Situation Emphasized

The seriousness of the fuel situation was brought forcibly to the attention of the membership during the meeting, and it seems certain that out of the discussion will come a Fuel Division of the Society which will take care of this development and co-ordinate the efforts of the engineering profession and the refining industry. This matter is discussed more fully elsewhere in this issue.

It is regrettable that there was not time at the meeting for discussions. There were a great number of papers which were well chosen and dealt with vital questions, but they could not be discussed because of lack of time. Surely a great many thoughts must have been suggested by the reading of these papers, but they could not be given expression. It would seem that in the future it would be better to have either shorter or fewer papers in order to permit the membership at large to make comments or ask questions.

Sessions Well Attended

The attendance was excellent, keeping the auditorium of the Engineering Societies Building practically filled at all times. It was distinctly noticeable that the crowd was a shifting one, specialists from each of the different fields attending the meeting which most interested them. The broad nature of the work of the Society was brought out more strongly in this way than ever.

One of the features of the arrangement of the program was the grouping of the subjects so that it permitted of the attendance of those interested in any topic at the particular meeting which most concerned them. In this way the topics were covered thoroughly at a single session, and had there been opportunity for discussion it is quite certain that it would have been highly important because the leaders of the respective fields were in attendance at each of the sessions.

The final feature of the S. A. E. program was the banquet held at the Hotel Astor. This was attended by 1300 members and guests, and was one of the greatest affairs of the kind that the Society has ever held. The demand for seats was so great that although the largest banquet hall in the city was utilized, there were many who could not secure accommodations. President C. F. Kettering closed his highly successful year by introducing the toastmaster, Job E. Hedges, who presided on this occasion. Among the other speakers were Al Reeves of the N. A. C. C.; the new president-elect, C. M. Manly, and John N. Willys.

Kettering's Novel Theory

One of the most interesting phases of the professional session was the presentation of an entirely novel theory on what really happens within the cylinder of an internal combustion engine. C. F. Kettering spoke of the formation of secondary products within the cylinder, these being very often of a detonating nature causing knocks which have hitherto been classified as pre-ignition knocks. While Mr. Kettering did not present any scientific proof regarding his theory, he stated that he had reason to believe that some of the secondary compounds formed were acetylene gases. Mr. Kettering illustrated his address in his inimitable way by comparing the molecules in a given quantity of fuel with the potatoes in a bushel basket. He said that if the potatoes were all put in an oven for a sufficient length of time to cook, those of average size, the little ones, would be burned, while the large ones would be raw. This, he said, is what happens to a fuel with a number of constituents of different boiling points. The result is that some of them are submitted within the cylinder to temperatures which cause cracking, thus giving rise to the hydrocarbon secondary compounds which may be of a detonating nature, causing sudden high pressures to be reached, giving momentary but acute bearing stresses.

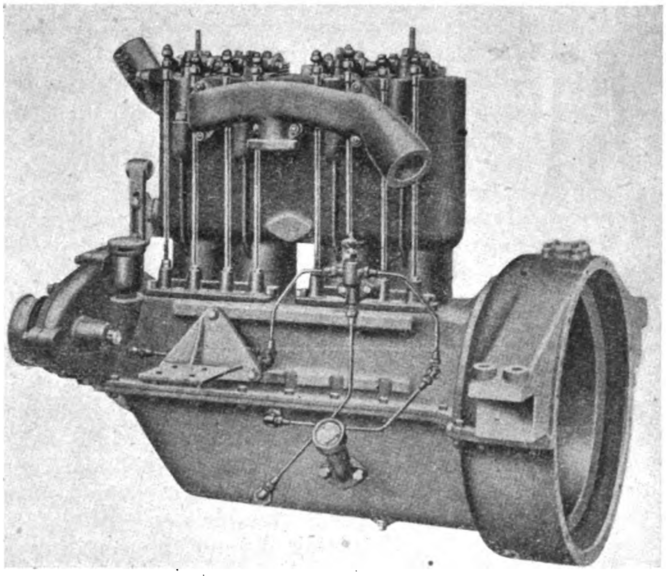
Membership Manifests Keen Interest

Throughout the entire session, the influence of Past-President Kettering's brilliant wit and effective graphic method of presentation made itself felt in creating a keen interest in what are more or less abstruse subjects, even to those who follow engineering practice. An instance of this was where Mr. Kettering showed the lack of value of chemical formulas as pertaining to the hydrocarbon series, where the same hydrogen contents and, in fact, the same contents of other elements, produced entirely dissimilar compounds because of the different arrangement of the atoms.

The program was well balanced, including a discussion of airplanes, tractors, motor trucks, motor boats, as well as automobiles and the fundamental problems which are equally applicable to all. On the tractor paper there was some discussion regarding economy, showing a surprising difference between the results obtained by British users and those in the United States. It was shown that on the other side where official tests had been conducted the fuel economy was much less than that experienced in the United States.

Gray Victory Four-Cylinder Engine

To Be Made in a Passenger Car Type with Aluminum Base and Bell Housing and in a Truck and Tractor Type in An All Cast Iron Construction



Gray Victory engine, left side

A FOUR-CYLINDER block cast engine of 3½ in. bore by 5 in. stroke has been put in production by the Gray Motor Co., Detroit, Mich. It is of the valve-in-head type, and is intended both for passenger cars and for trucks and tractors. Special emphasis is laid by the manufacturers on the provisions made in the engine for vaporizing the fuel, and high efficiency and great economy are claimed with the present grade of gasoline.

All four cylinders are cast in a block, together with the upper half of the crankcase. As the cylinder heads are separate from the cylinder block, it is possible to completely machine the compression spaces, and thus insure uniform compression in all cylinders. The cylinder bores are ground to size, and the cylinders are offset from the crankshaft axis to reduce the mean side thrust of the pistons against the cylinder walls. Inlet and exhaust passages are cored in the cylinder head, and there are two hot spots which are claimed to insure thorough vaporization of the fuel, and consequent complete combustion. A McKim gasket is placed between the cylinder block and head, and the head is held in place by means of heat-treated cap screws fitted with lock washers. The bottom half of the crankcase is made of cast iron for truck and tractor engines, and of aluminum for passenger car engines.

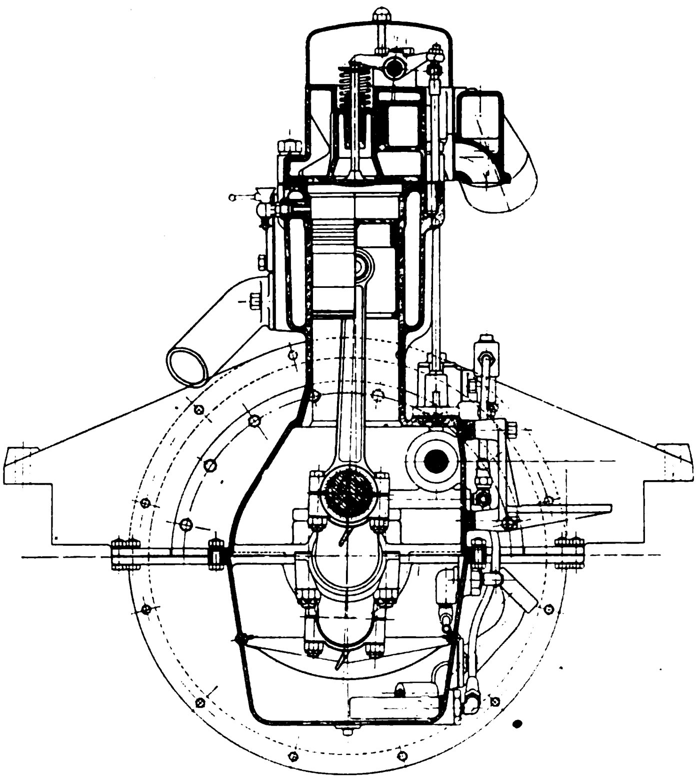
Both sets of valves are interchangeable, and in order to permit of making them of large sizes, the cylinders are counter-bored from the top end. The effective diameter of each valve is 1 21/32 in. The valves have carbon steel stems and cast iron heads, the latter of 2¼ in. outside diameter. The pistons are of conventional design, of cast iron, and are provided with three diagonally split expansion rings each. The connecting-rods are I-section drop forgings and measure 9¼ in. between centers. The crank pin bearings are 1¾ in. in diameter, by 2 in. long, and are made of die cast babbitt. Bearing caps are held in position by nickel steel bolts with castle nuts and cotter pins.

The crankshaft is made of 0.40-0.50 per cent carbon steel, heat treated and ground. It is supported in three die cast babbitt bushings, all 2 in. in diameter, and of the following lengths: (front to rear) 2¾ in., 2 in. 3⅝ in. The bearing caps are made of malleable iron, and are held to the cylinder block by means of heat treated studs fitted with castle nuts and cotter pins. Laminated shims are placed between the caps and the upper half of the bearing.

Bearing Dimensions

A three bearing cam shaft is used, made from low carbon steel, carbonized and ground. This shaft is 1 1/16 in. in diameter, and has its bearings directly on the cast iron of the cylinder block. The dimensions of the bearings are as follows: (front to rear): 1 13/16 x 2½ in., 1¾ x 2 in., and 1 11/16 x 2 in. For driving the camshaft, use is made of helical toothed gears, cut with 10 pitch teeth of ⅞ in. face. The pinion on the crankshaft and the magneto driving gear are of steel, while the gear on the camshaft is made of cast iron. The timing gears are inclosed by a malleable iron cover, the hub on which for the crankshaft is turned off cylindrically to form the third point of support for the engine. This cover is held in place rigidly by means of cap screws, lock washers and dowel pins.

Oil is fed to the three main crankshaft bearings under pressure by means of a plunger pump operated from an eccentric on the camshaft. The plunger of this pump, instead of moving in a horizontal plane, has an up and down motion. In addition to supplying oil to the main crankshaft bearings, oil is delivered from this pump to the timing gears, and to the connecting-rod splash troughs. All other interior parts, including the camshaft bearings, pistons, connecting-rod bearings and cylinders, are lubricated by splash. Oil is drawn from the main oil base through a fine mesh screen. The base will hold 5 quarts of oil, and is provided with a positive dial



Cross section through cylinder

indicator showing the oil level. As a precautionary measure, when the gage shows "empty," there is still a certain amount of oil in the base.

The engine is designed to take a standard 1 inch carbureter. Either a horizontal or a vertical outlet carbureter can be used, the vertical outlet type going on the left hand side, and fastening to the inlet manifold, while the horizontal outlet type is placed on the right hand side, and connects directly to the cylinder block. With the horizontal type carbureter the intake passage leads through the space between cylinders Nos. 2 and 3.

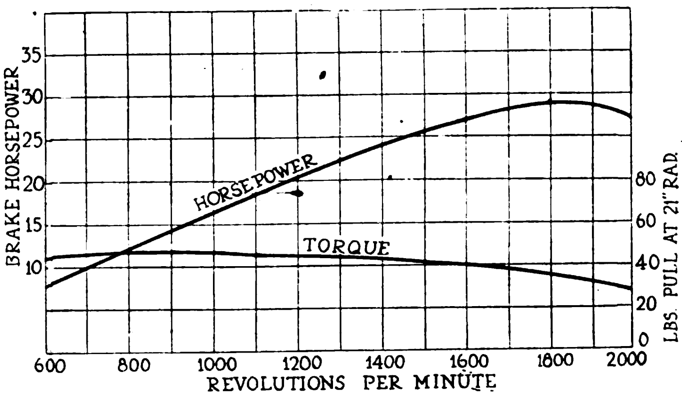
The flywheel is secured to an integral flange of the crankshaft by means of six heat-treated bolts. It is regularly furnished to accommodate standard clutches used in connection with the No. 3 S. A. E. bell housing.

Provision for Electrical Equipment

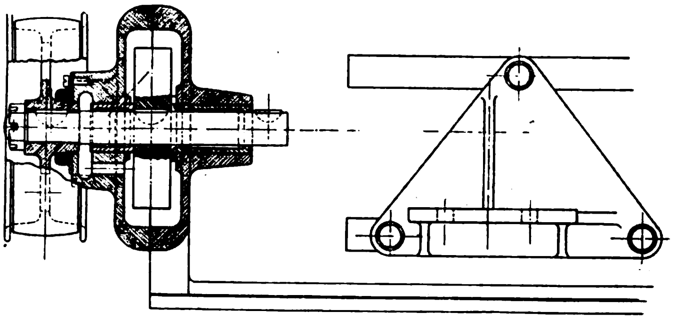
Provision is made for fitting a complete electrical equipment. A starting motor flange is provided on the detachable bell housing, which is of the No. 3 S. A. E. size. An ignition generator or plain lighting generator, a magneto or both can be mounted on the detachable magneto or generator bracket, and can be driven by a standard two bearing magneto shaft and coupling. A bell housing of cast iron is furnished for truck and tractor work, and of aluminum for passenger car work.

The cooling system is designed for thermo-siphon circulation, and the water connections are made appropriately large, the inlet being 2 in. in diameter, and the outlet 2¼ in. A malleable iron adjustable fan bracket is provided. A drop forged steel, quadruple jaw, roller handle crank is furnished with the engine.

The piston displacement of this engine is 192.4 cu. in. and its N. A. C. C. rating is 19.6 hp., while on the dynamometer the engine shows 34.6 hp. A horsepower and torque curve chart is shown herewith. The engine complete with cast iron base and bell housing weighs 495 lb.



Horsepower and torque curves

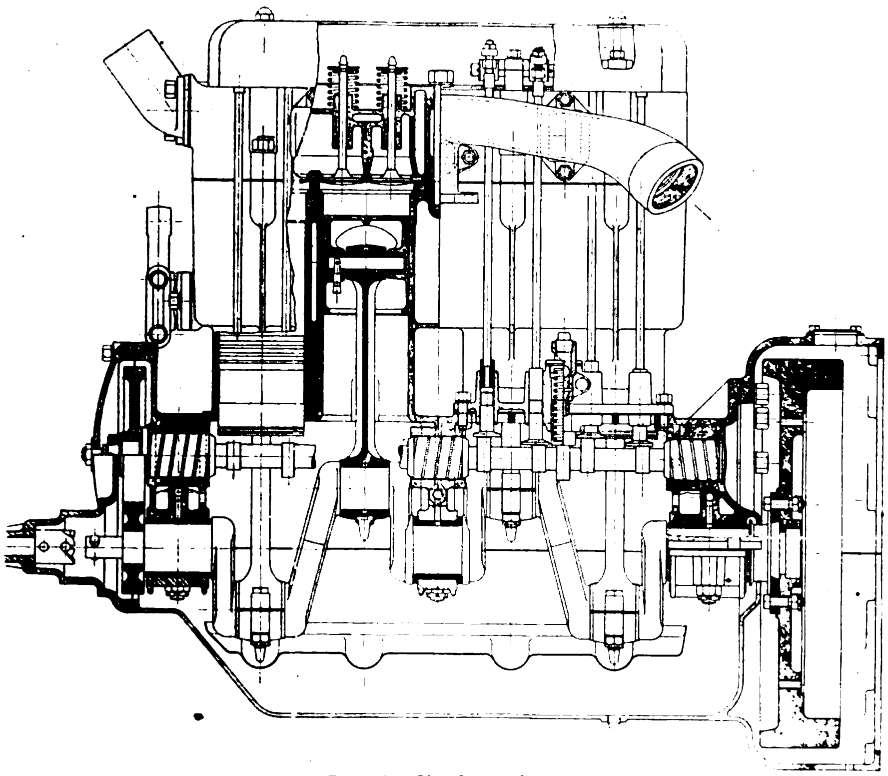


Fan and magneto drive and magneto bracket

Preferential Tariff for Belgium Proposed

AUTOMOBILE travel in Belgium is still full of difficulties. Roads in the devastated area are in terrible condition, being full of holes and most destructive of springs and the general mechanism of the car. Gasoline is only obtainable in a few localities, and its cost is from $1.50 to $2.60 per gal. Tires are rare, a 36-in. casing costing from $100 to $120.

The Belgian Society of Automobile Manufacturers has already held a meeting, at which a committee was elected and new members admitted. Messrs. Gregoire, Deconinck and Dejong were elected as delegates to attend the conference of recognized Syndicates of Automobile Manufacturers at Paris next month. This conference, which will be attended by delegates from England, France, America and Belgium, will consider the advisability of recommending a preferential tariff for Belgian automobile manufacturers who existed before the war, and whose capital is entirely of Belgian origin. The proposal is being made by the British Society of Motor Manufacturers and Traders.



Longitudinal section

Detroit Demands Gasoline Meters

DETROIT, Feb. 10—An ordinance adopted by the common council of Highland Park, a suburb of this city, requires the installation of a meter in every gasoline station showing the consumers how much fuel they are actually receiving.

6140 Motor Vehicles in Switzerland

BERNE, Jan. 5—According to statistics of the Automobile Club of Switzerland, at the end of 1917 there were 6140 motor vehicles in Switzerland, of which 4934 were touring cars and 1206 motor lorries. There were 15 firms in the Helvetic confederation, and these had produced 2565 of the total number, the remaining 3575 representing 43 foreign makes. Fiat was the foreign firm with the largest number of vehicles in Switzerland, 283 touring cars and 15 lorries. Of the foreign nations supplying vehicles France came first, Germany second, America third, Italy fourth and Belgium fifth. British cars were not listed separately.

Douglas' Automatic Airplane Ignition Interrupter

A Safety Device Stopping the Engine Instantly When Propeller Breaks or Other Serious Breakage Occurs

BREAKAGE of airplane propellers in flight, or of other important parts, resulting in a seriously unbalanced condition of the power plant, often proves fatal to the pilot. An instrument designed to prevent such results, known as the interrupter, has been invented by Theodore Douglas, president of the Duplex Engine Governor Co., Inc., Brooklyn, N. Y. It was developed under the auspices of the National Advisory Committee for Aeronautics.

The function of the instrument is to automatically interrupt engine ignition, thereby stopping power development, in the event of the propeller breaking, etc. In non-war flying the danger of such breakage is fortunately not serious, though it is always present. Under war conditions, on the other hand, such breakages, accidental or from gun-fire, are very frequent and in a large percentage of cases end fatally.

The tendency of a tractor plane, in the event of its propeller breaking, is to go into a dive, and of a pusher plane to go into a tail-stall. Under such conditions either type of machine is apt to pass into a spin as a result of the unbroken propeller blade tending to swing the machine around a neutral axis. The resulting intense vibration is apt to break a gasoline line, and the continued exhaust of the engine into the gasoline-charged atmosphere may cause a fire. Sometimes the most perfect mental and physical co-ordination on the part of the pilot fails to prevent this, since the brain and hand can seldom act quickly enough, as many thoroughly understood accidents of this nature attest. This manual limitation will be better realized when it is considered that the time of one engine revolution assuming full throttle varies from one twenty-third to one twenty-seventh of a second.

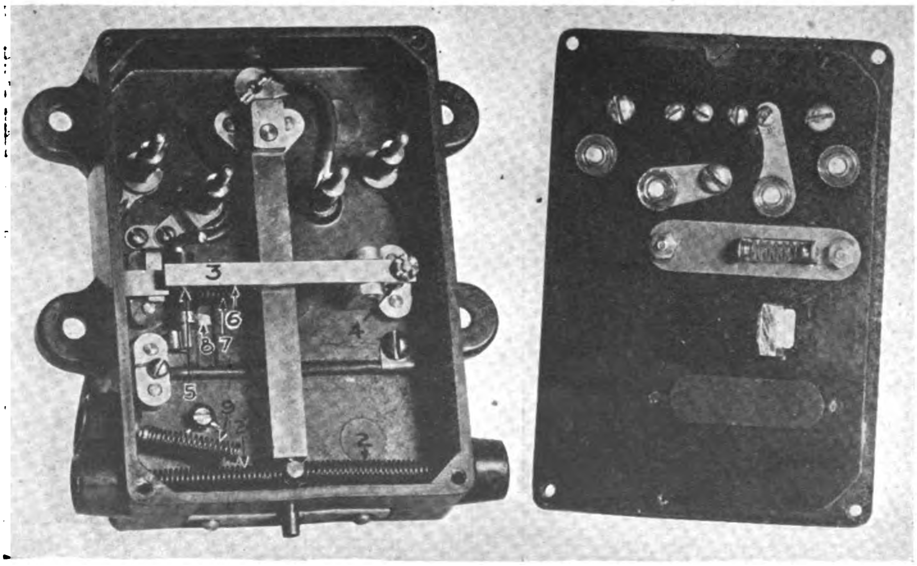
The interrupter supplements the action of the pilot in such instances, and through practically instantaneous action interrupts the power development, thereby confining the danger to the initial breakage. The instrument is thought to be particularly desirable on twin-engine machines, as such an accident happening to one engine would cause the good engine to tend to suddenly swing the machine around and probably into a spin. On such machines the interrupter may be so installed as to instantly cut out both engines, thus maintaining an approximately normal flying position. The pilot then has the alternative of making a landing with dead engines, or of switching off his damaged engine and continuing his flight with his good engine at reduced speed.

The Design

The instrument consists essentially of a suitably pivoted metal bar, so mounted as to swing in a plane transverse to the axis of rotation of the propeller. By means of tension springs 2-2, the free movement of this bar is confined, under normal airplane operating conditions, to a very limited arc in its plane of movement. The amplitude of this movement is determined by the weight of the bar, the intensity and frequency of the transverse vibrations of the engine, and the opposing strength of the springs confining it. The extended end of the trigger 3 is constantly pressed toward the floor of the instrument by the compression spring 4, and is designed to engage the latch 5. On the under side of the trigger 3 there is an inclined surface 6, by which the trigger is raised. A ball-pointed hardened steel screw is fitted into the bar directly beneath the trigger, and is designed to engage an inclined surface and thus to lift the trigger when the swing of the bar is sufficient. When the trigger is lifted the latch 5, held under tension by spring 7, is released and moves out of engagement with the trigger. Cam 8 serves for resetting the latch by rotating it back into position by means of the push button 10 from the outside of the instrument.

The compression spring 9, presenting an unbalanced force, is designed to prevent the bar from disengaging latch 5 as a result of cylinder misses coinciding with bad vibration periods of the engine, etc., thus increasing the amplitude of the swing of the bar through synchronism, or from lateral shocks to which the plane may be subjected in landing. An intense oscillating shock transverse to the axis of the engine, such as an unbalanced engine-propeller torque reaction resulting from the breaking of a propeller at speed, are the kinds of shock intended to operate the instrument, and to which it is claimed to immediately respond. Under such conditions the bar will swing through its full amplitude, raise the trigger, which releases the latch, and thus interrupt the ignition by grounding the magnetos. From the interrupter terminals 11 and 12, wires are connected to the grounding terminals of the magnetos, and from the terminal 13 of the interrupter a wire is connected to the engine ground. On the disengagement of latch 5 a triple contact is made between the interrupter terminals 11, 12 and 13.

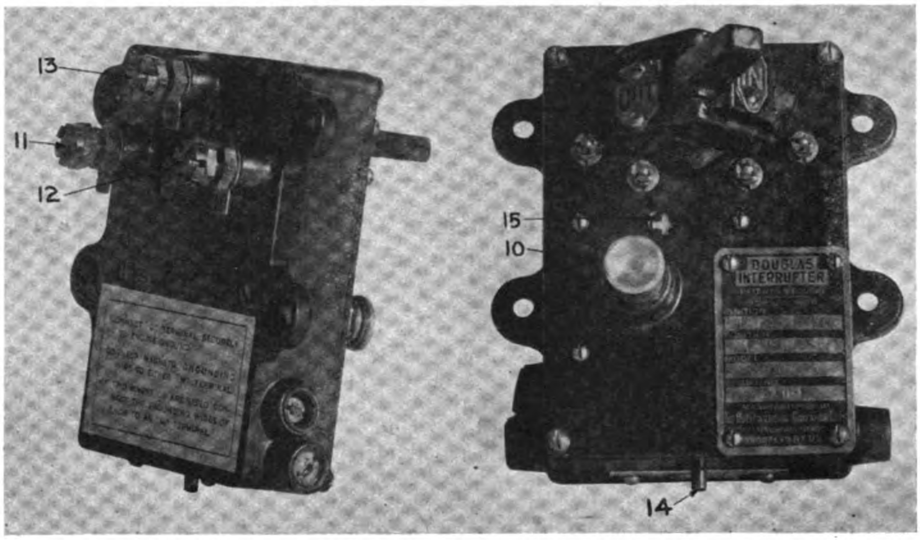
Provision is made to enable the pilot to make a rapid test of the operation of the interrupter before each flight. The handle 14, which projects through a slot in the end of the instrument, is pushed gently to the left until the red spot 15 of the tell-tale,



The interrupter with cover removed

which bears a luminous cross for night flying, appears. Before the engine stops the instrument may be reset by pressing down on the button 10 until the red spot of the tell-tale disappears. Should the engine not stop it would indicate that either the interrupter switch is in the wrong position or that its wiring system, etc., is defective.

A manually operated switch is provided with each instrument by which the interrupter may be thrown into and out of the grounding circuit as desired.



The interrupter complete, front and rear views

Types of Interrupters

Interrupters are furnished of two general types, maker and breaker instruments, and in several models to best suit various engine and airplane conditions.

Maker-instruments, such as the one just described, are intended for magneto ignition engines, in which case there is no flow of current through the instrument, except at the moment of interrupting the ignition.

Breaker-instruments are intended for Liberty engines, using the Delco system, where the current flows constantly through the instrument, and where two separate circuits are provided, because of the double distributer system used on these engines. The interruption of the ignition results from opening these circuits.

Different Models

The interrupter is manufactured in five models, adapting it to the two general ignition systems employed—magneto and battery—and to different engine locations, on the fuselage and in the wings. All instruments are provided with shunting switches. When the engine is located in the wings the interrupter is mounted on a weather-proof casing attached to an engine-bearer, and the shunting switch is located on the instrument board.

The weight of any of the instruments is under ten ounces.

According to the manufacturers, various tests of the interrupter made by the Navy Department have shown in general the following results:

(a) As nearly as it has been possible to determine, the instrument will operate within one complete revolution of the engine following the propeller breakage, or within a time interval of one twenty-third of a second.

(b) It may be depended upon to do this every time that such a breakage occurs, as shown by tests in the air and on the ground.

(c) It will not interfere with the efficiency of the ignition system nor has it caused complications therein of any kind.

(d) The electrical resistance of the interrupter on Liberty engines has been determined by a representative of the Delco company as being less than 0.05 ohm, so the loss of potential in the primary circuit due to it is negligible.

Materials Used for Interrupter

Following are some particulars of materials employed in the construction of the interrupter. The latches and triggers are of hardened steel, heavily silver plated to minimize electrical resistance, to afford better contacts, and to prevent corrosion. Other contact parts are of hard brass, silver or nickel plated. All of the springs employed are of phosphor-bronze.

The electrical connections between the instrument base and its cover are by means of substantial screws which act not only as binding posts, but as attachment members holding the cover in place. These are all protected by castellated nuts and cotter pins. Molded Bakelite insulating parts are used. Owing to the extended development and tests involved the instrument did not get into quantity production until December, 1918.

German Giant Airplanes

A FIVE-ENGINED German bomber was brought down near Talmas on Aug. 10, but unfortunately, owing to the explosion of one of its bombs, the machine was damaged beyond hope of reconstruction. Some of its components have been recovered, and of these, the principal item of interest is the gear box, which is used for all five engines, each of which is a 300-hp. Maybach of the standard 6-cylinder vertical type.

The power plants are arranged as follows: In the nose of the machine is one engine driving a tractor screw. On each side of the fuselage, supported by the wings, is a long pair of engine bearers carrying two engines apiece, which drive tractor and pusher screws. The use of the gear box and driving shafts necessitates the employment of a fly-wheel on the engine, to which is added the female portion of a flexible coupling of the type already described. Whereas the gear box in the 4-engined giant is of a somewhat crude type, employing external driving shafts between the gear box and the engine, in the 5-engined machine the gear box design is considerably improved. The casing consists of a massive aluminum casting provided with four feet, which are bolted to the engine bearers.

Two kinds of gear boxes are employed in these "giants." These differ only in over-all dimensions and the length of the propeller shaft. The larger type is used for the pusher screw in order to obviate the necessity of cutting a slice out of the trailing edge of the main planes. All the gear boxes were very badly damaged except one of the longer type, but it would appear that the shorter design is very similar in appearance. In each case the gear reduction is 21:41. Plain spur pinions are used having a pitch of 22 mm. and a width across the teeth of 75 mm. The diameter of the smaller of the driving pinions is 162.5 mm., and that of the larger pinion 282 mm.

The overall dimensions of the long gear box are as follows: Length, 1025 mm.; breadth, 675 mm.; height, 535 mm. The driving pinion runs on two large diameter roller bearings carried in gun-metal housings supported in the inner end of the gear box. This part is split vertically, and united by the usual transverse bolts. The usual oil-thrower rings of helical type are fitted. At its outer end the pinion shaft terminates in a ring of serrations which engage with serrations provided in the male portion of the flexible coupling, these two parts being held together with bolts and clamping plates.

Truck and Tractor Engine Governors*

Function of the Governor—Various Types Employed, Their Advantages and Disadvantages—Points on Governor and Throttle Design

By R. B. Shoop
Mechanical Engineer, Minneapolis

THE function of a governor is to hold the speed of an engine between predetermined limits under all conditions of operation, from no load to full load.

The history of governors is very closely related to that of the steam engine, and our present day governors are very largely adaptations or improvements of the steam engine governor. James Watt discovered the necessity of some means to regulate the speed of his ponderous, slow moving engine and used the centrifugal type, as shown in Fig. 1.

Tradition has it that the first governor was the result of a boy's desire to play. The old engines had a cord attached to the throttle valve and a boy was employed to watch the speed of the engine and pull the cord when more steam was required. One day this boy yielded to his desire to play and tied two apples to the cord. The scheme worked and the present day governor was born, and some of the present governors, in action, closely resemble that "two-apple" governor.

Classification of Governors

Engine governors can be divided into three classes, as follows:

1—Hit and miss.
2—Throttling.
3—Ignition timing.

In practice, the third class is largely manual in operation, except where mechanical means are provided in the magneto to vary the time of the explosion. This class can be omitted from our discussion.

The hit and miss type is now obsolete in truck and tractor work. This type of governor acted on a pawl or "pick blade," which in turn held the exhaust valve open or the fuel valve closed, allowing a charge of pure air to enter the cylinder, instead of a charge of gas. The throttling governor is now universally used, as modern design has improved the economy of this type to such an extent that the better regulation more than offsets the possible saving in fuel and does away with the trappy devices and irregular explosions of the hit and miss governor.

Both the hit and miss and the throttling mechanical governor may be of one or the other of three types or a combination of two of them, viz.:

1—Centrifugal.
2—Inertia.
3—Pendulum.

The first two will be treated later. The pendulum governor is described by its name and is used largely on the hit and miss type.

Electro-Magnetic Type

The past year has brought us a new type, which we are all watching with deep interest, the electric governor. This device combines the governor, ignition, lighting and starting generator, coil and box, distributor and controller. The direct current generator is a 4 pole shunt wound type. The housing is mounted on trunnion bearings, which allow the generator to turn through an arc of 30 deg. The trunnion bearing shaft is brought through the generator housing and a lever is placed on the outer end. This lever is connected to the throttle valve. The revolving armature produces a magnetic drag on the field frame and causes it to rock on its axis. When the controller is placed in any given position the corresponding speed will be maintained, for if the engine speeds up due to decrease in load, the magnetic drag of the armature on the field is increased, causing the field frame to turn in the direction of armature rotation and close the throttle. If the load is increased the magnetic drag is decreased, allowing the field frame to be turned by a spring, to which is attached a piston operating in a dashpot to prevent too rapid a movement of the arm controlling the throttle valve. A hand wheel on the control box indicates the speed at which the governor holds the engine. The speed range is from 400 to 1650 r.p.m., but the manufacturer will supply the proper speed ratio to hold the engine at any required speed. A starting motor can be used with this device.

Factors Affecting Design

There are a number of variable factors entering into the design of a governor: The work the engine is required to perform, allowable speed variation between no load and full load, size and type of intake control valve, flywheel inertia, vertical or horizontal arrangement, speed, the manufacturing and inspection facilities, and unfortunately, in some cases lack of sufficient space.

If an engine is to do such work as threshing and plowing where there is a sharp rise in the power curve, the weights, springs, rise of governor collar, etc., should be greater than on light work. The weights should be balanced and the springs calibrated so that there is no binding or unequal pressure of moving parts. All moving parts should be inclosed in an oil tight, dust-proof case and should run in an oil bath or vapor. Ball bearings should be used on the principal parts and especially for taking thrust. Some manufacturers even mount the throttle valve on ball bearings.

The main fault of governors, aside from inability to see the approaching hill or the extra bundles thrown into the separator, is the "hunting." This is due to the fact that where there is a change in load, the governor makes an effort to take care of it. The force necessary to start the parts moving is greater than that required to keep them moving, so the throttle overruns its position. This speeds or retards the motor and the reverse action is necessary to maintain an equilibrium. Larger weights with proper springs, proper fitting, balanced throttle valve and anti-friction bearings will all help to overcome this defect.

Mounting of Governor Valve

The best way to mount a governor valve, when separate from the governor proper, is in a cage, as shown in Figs. 6 and 7. This allows a proper correlation of parts without depending on the carbureter and also allows a change in carbureter without disturbing the governor parts.

The governor should be set to run the engine at maximum speed, with the carbureter valve open. The retarding should be done with the carbureter control valve or governor speed controlling device. It is unfortunate that corporal punishment has been revoked in most states, as this should be the penalty for the chap who monkeys with the governor.

In a centrifugal governor, the so-called Watt or flyball type, Fig. 1, we have two or more weights revolving about the center spindle and connected to a sliding sleeve, which is in turn connected to the throttle valve by means of a bell

*Read at the January meeting of the Minneapolis Section of the S. A. E.

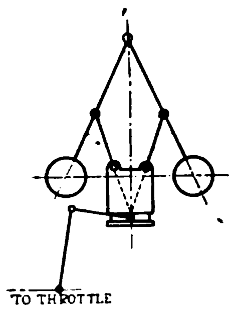


Fig. 1

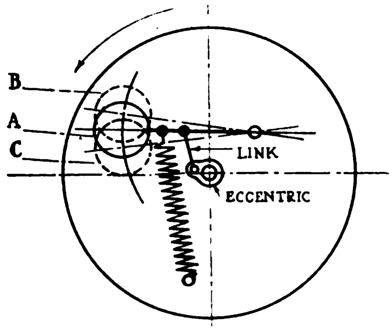


Fig. 2

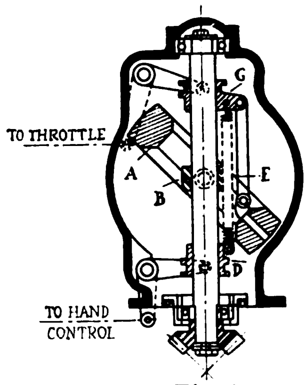


Fig. 3

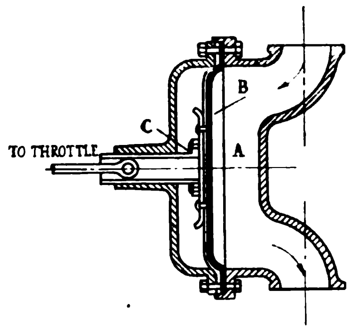


Fig. 4

crank or lever. The proper resistance to the centrifugal force of the balls is maintained by a loaded sleeve, or by springs. The loaded sleeve may be weighted by metal or actuated by a single spring mounted on the spindle or by double springs attached directly to the weights.

One type that is seldom, if ever, used on trucks and tractors is the inertia governor, the reason for its non-use being the difficulty encountered in properly mounting it in the limited space allowed and in balancing its revolving parts.

In a governor of this type the scope of action is a plane perpendicular to the axis of the shaft and the inertia of the weight *A* will make the governor more prompt in its action. If the governor is moving in the direction indicated by the arrow and the load is removed the motor speeds up. The inertia of the weights will hold it back and it will move to position *B*. If the load is suddenly applied, the inertia of *A* will cause it to surge forward to position *B*. This type of governon does not have the "hunting" tendency of the purely centrifugal type.

Adaptation of Marine Type

The ring governor, Fig. 3, was developed by one of the automobile companies and is an adaptation from marine steam engine practice. This is a centrifugal governor, in which the balls are replaced by a metal ring *A* pivoted to the collar *B*, which is mounted on and driven by the spindle. The ring *A* is connected to sliding collar *C*, which actuates the bell crank connected to the throttle by link *E*. There is a lower sliding collar *D* to which is attached the hand control linkage. This is attached to the upper collar *C* by means of a spring. This gives both automatic and manual control and is one form of speed regulator.

The hydraulic governor, Fig. 4, has been successfully used on at least one popular line of trucks. The device is interposed between the pump and motor. It consists of a water chamber *A*, with diaphragm *B* connected to plunger *C* which is attached to the throttle linkage. There is a speed and pressure constant for each motor speed and the diaphragm assumes the proper position for each speed, thus regulating the throttle valve.

Fig. 5 shows an intake governor, or a governor operated by the speed of incoming gases. The floating disk or piston *A*, which is calibrated for a velocity and butterfly friction, by means of side clearance and vertical holes, moves up and down according to the air speed and operates the butterfly *B* through the series of links. The moving parts are made of aluminum for lightness. This governor is interposed between the carbureter and the manifold of the engine.

Among other types of governors are the transmission governor, which regulates the engine speed from the top shaft of the transmission, and the road wheel governor, which is driven from the front wheel by a flexible shaft the same as a speedometer.

An investigation of governors is not complete without study of governor valves. The governor may be attached to the butterfly valve of the carbureter, but a separate valve cage is much better. This allows governor action unhampered by the extra linkage of the manual control. The governor should be set with the engine operating at maximum speed when the carbureter butterfly is wide open. The hand control is attached to the carbureter butterfly and is used for slowing down the engine.

Governor Valve

Fig. 6 shows a widely used type of governor valve. The butterfly is set at 60 deg., but may be set at 90 deg. with the axis, but the working arc is greater with more liability for "hunting," as the valve has to travel further from full closed to any desired area of opening. If the butterfly stem is placed in the center of the valve the pressure of incoming gases on the advancing side is greater than on the opposite side and imposes a greater load on the governor and linkage. This makes for uneven action, and the stem is often offset to

(*Continued on page* 392)

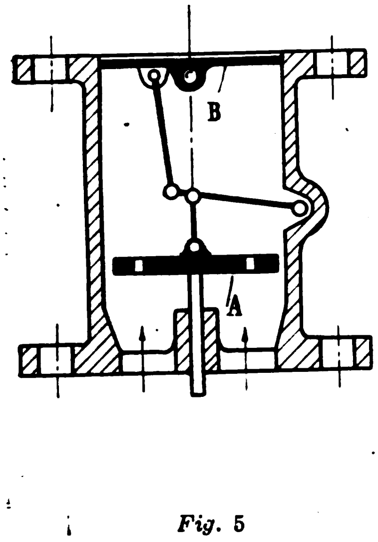


Fig. 5

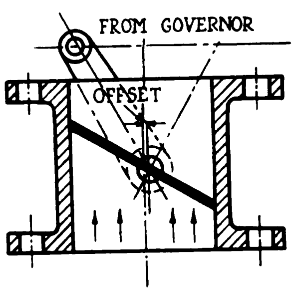


Fig. 6

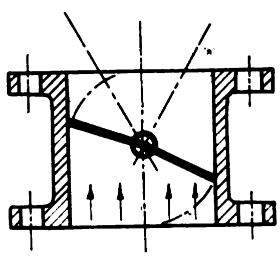


Fig. 7

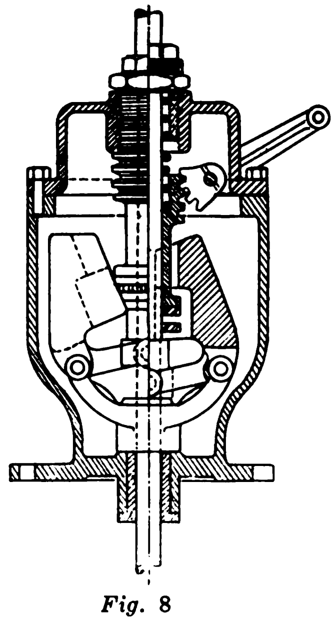


Fig. 8

The Unmined Supply of Petroleum in the United States

(*Continued from page* 361)

Further recent geologic investigations in the field and the study of the results of testing and exploration, especially in the Rock Mountains and Gulf States, have furnished the basis for a more reliable recalculation of the estimates for a number of the regions. The conclusion reached is that the available oil in the ground at the end of 1918 approximates 6,740,000,000 bbl.

Available Oil Remaining in Ground, as Estimated by the U. S. Geological Survey (Bbl. of 42 Gal.)

Oil Fields	Marketed Production in 1917	Marketed Production in 1918 (Preliminary Estimate)	Total Marketed Production to End of 1918	Available Oil Left in Ground, January, 1919	Present Average Gasoline Extraction, Per Cent
Appalachian ...	24,932,205	25,300,000	1,221,737,000	550,000,000	28.0
Lima, Indiana..	3,670,293	3,100,000	448,404,000	40,000,000	28.0
Illinois	15,776,860	13,300,000	298,159,000	175,000,000	22.0
Mid-Continent..	144,043,596	139,600,000	990,573,000	1,725,000,000	24.0
North Texas ...	10,900,646	15,600,000	78,971,000	400,000,000	33.0
North Louisiana.	8,561,963	13,000,000	90,902,000	100,000,000	28.0
Gulf	24,342,879	21,700,000	303,954,000	750,000,000	01.5
Wyoming	8,978,680	12,370,000	39,793,000	400,000,000	40-50
California	93,877,549	101,300,000	1,114,000,000	2,250,000,000	12.0
Alaska, Colorado, Michigan, Montana, etc.	230,930	230,000	10,651,000	350,000,000	....
Total........	335,315,601	345,500,000	4,598,144,000	6,740,000,000	....

The new estimates, combined according to the commercial fields, are given in the accompanying table, in which for comparison and information are shown the marketed production for 1917 and the estimated output for 1918, as compiled by John D. Northrop, of the Geological Survey, in charge of statistics of petroleum and natural gas, and the approximate total production of petroleum in the United States to the end of 1918, also based on Geological Survey records. For the immediate convenience of the reader there is also included the percentages of average gasoline recovery from the oils of the different fields at the present time. For the later data the writer is indebted to Chester A. Naramore, of the Bureau of Mines, in which bureau the returns of gasoline recovery from the oil runs are compiled. The general characteristics of the various crude oils in the different fields are too well known to require discussion in this paper, and their especial qualities will be fully considered in those to follow. It will, however, be noted that the reserves of the heavy oils of California and the Gulf Coast are estimated at about 3,000,000,000 bbl. Probably such low-gasoline oils comprise more than one-half of the total reserves.

Later Estimates More Reliable

Those who have followed the history of petroleum in America and understand how much of our present-day oil-field development has taken place since Day made his estimates in 1908 and even since Arnold calculated the reserves in 1915 will appreciate the great advantages, mainly in the form of results of exploration and records of production, enjoyed by those who make computations now. However, with these circumstances in mind, we may, nevertheless, for comparison, compensate and bring to date the earlier estimates by deducting subsequent production to the end of 1918. The available oil in the ground at present would be according to these estimates, as follows:

Day (estimate in 1908), 5,402,000,000 to 19,902,000,000 bbl.

Arnold (estimate in 1915), 4,500,000,000 bbl.

Geological Survey (estimate in 1916), 6,647,000,000 bbl.

Geological survey (estimate in January, 1919), 6,740,000,000 bbl.

The recent estimate by the Geological Survey, as given above, and as differentiated by fields in the accompanying table, differs from that of 1916 mainly in a more conservative view as to prospects in Montana and recoveries along the Gulf Coast and in a more optimistic attitude toward Kansas and the States of little or no present production. As compared with the very conservative estimate formulated in the Geological Survey in 1917 they represent greater confidence in Wyoming, north Texas and Alaska and several of the minor States. In general, they are to be regarded as conservative, and there is little probability that the actual yield will fall short of the calculated amounts. They are, however, likely to be again revised in the near future, as the modes of occurrence of oil and gas in different regions become more fully understood, as exploration proceeds, and as the areas offering possibilities of oil discoveries are examined more in detail.

The reports of production of petroleum in the United States, as compiled by the Division of Mineral Resources of the Geological Survey, show that since 1858 approximately 4,598,000,000 bbl. of petroleum has been taken from the ground. This is more than two-thirds as much as the amount which, according to the latest estimate by the Geological Survey, remains available, and exceeds what would now be left according to Arnold. Further, the oil companies are now taking out over one-third of a billion barrels a year.

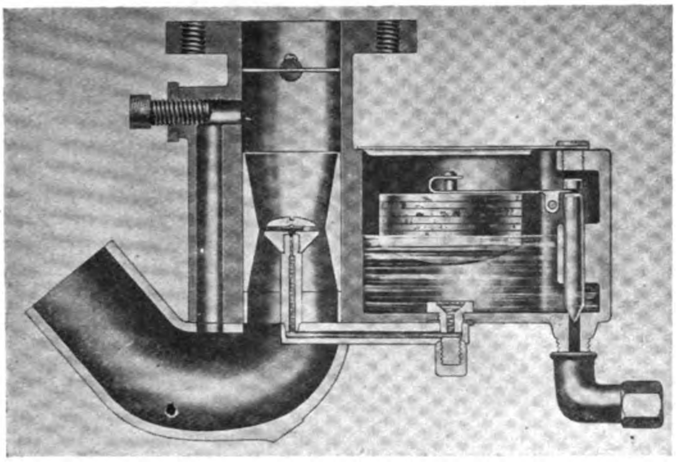
Relation of Production and Consumption

The situation as to petroleum production and the importance of the remaining oil resources of the United States are both graphically indicated by the curves in the accompanying figure. The most significant features here shown are the steep ascent of the consumption curve and the flattening, in 1918, of the curve of actual production in spite of the vigorous efforts of the oil companies to increase their war-time output even at the expense of their proved reserves. To fill the gap between our actual domestic production and the requirements of domestic consumption it has been necessary to reduce the oil in storage to the extent of 27,000,000 bbl. and to supplement this with a net importation of 31,000,000 bbl., chiefly from Mexico. The deficiency of our current production during 1918 has, therefore, amounted to 58,000,000 bbl., nearly half of which has been withdrawn from storage. That is to say, this country has to the extent of 27,000,000 bbl. of storage oil been "living on its hump," which is now reduced to about 123,000,000 bbl.

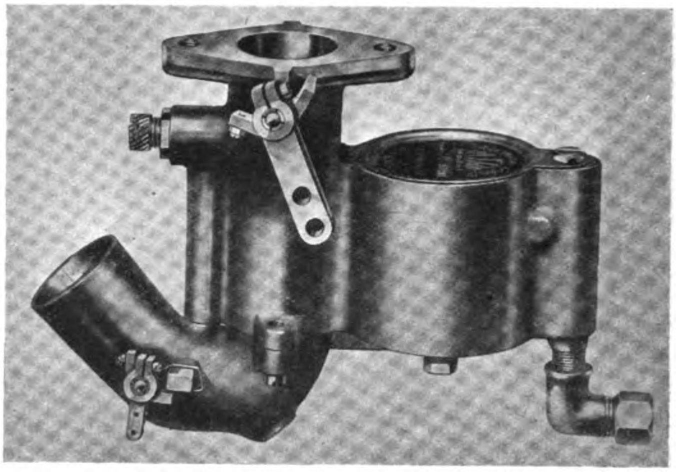
According to general expectations, barring disaster or shortage of supply, or much higher prices which might result from such shortage, the consumption curve is destined during the next year, and probably longer, to continue its present general trend beyond the 400,000,000-bbl. mark, which it nearly reached (397,000,000 bbl.) in 1918. On the other hand, whether the domestic production can be increased in volume to correspond to the consumption remains to be seen. Glenn pools and Cushings may await discovery, but the strike of a Glenn pool such as produced the bulge in the storage curve for 1907 and 1908, or of new Healdtons and Cushings, such as were largely responsible for the production swell of 1914-15, will make a less conspicuous wave in the greatly expanded and diffused production of to-day. Texas, the Osage country and Wyoming will furnish notable contributios, but so many fields are now running down that it will require numerous successive strikes of large magnitude to send the production curve so high that oil will go into storage without considerably increased importations. On the whole, even with prices stimulating the driller to greater efforts, it seems unlikely that the domestic production of petroleum can at best gain appreciably on the reasonably expected increase in consumption. It seems more probable that, unless consumption is restrained by high costs, the gap between consumption and production will continue to widen. In any event, this gap must be filled with oil from other sources. Further exhaustion of stocks in 1919 is a certainty that can be successfully minimized only by still larger importations.

The situation demands not only the prevention of waste, but the most economical and efficient use of our oil. Also, it warns operators to consider more thoughtfully and promptly the acquisition of foreign oil reserves. Mexico, to which the American public looks with optimistically hopeful eyes, probably contains less oil—perhaps very much

(*Continued on page* 385)



Sectional view through the Sunderman carbureter showing the floating venturi, mushroom jet and air bypass



The new Sunderman carbureter, showing throttle valve, choke valve, air bypass and gasoline connections

New Sunderman Carbureter Uses Floating Venturi

Employs Mushroom Jet and Air Bypass for Regulating Depression at Nozzle

THE Sunderman Corp., Newburgh, N. Y., has brought out a new carbureter which it is marketing under the name of the Nitro. It is a plain tube type, employing a floating venturi and a mushroom nozzle for compensating the ratio of air to gasoline. The nozzle is also relied upon to produce an atomizing effect so that the fuel is reduced to a fine fog before it is mixed with the air.

The floating venturi slides in the jet passage and is concentric with the jet. At idling speeds the float of the venturi is at the jet, while at high speeds it is considerably above the jet, as shown in the diagrammatic illustration herewith. When the venturi rests upon its seat at idling speeds, a very small air passage results which greatly increases the air velocity at the jet, increasing the suction and producing the relatively rich mixture required for idling.

Moderation of the suction on the jet is secured by an adjusting screw which controls an air bypass. This adjustment reduces the suction on the nozzle at lower speeds and consequently reduces the flow of fuel and at the same time prevents the venturi from rising too rapidly. When the throttle is open and the vacuum increased the venturi commences to rise on the air screen and draw away from the nozzle. This opens up the air passage around the nozzle, due to the tapered walls of the venturi, and compensates for correct ratios of air and gasoline. At higher speeds the venturi rises above the air passage, as shown in the diagrammatic illustration. This blocks the passage and puts it out of action, causing all the air to flow through the main passage.

It is claimed that this increases the volumetric efficiency of the engine by giving the maximum air passage. The venturi is a true streamline shape and consequently is designed to give practically no resistance to the free inflow of air while increasing the velocity at its narrow throat. The venturi at all times automatically centers itself on the air screen around the nozzle. It has ample clearance in the carbureter barrel for freedom of motion.

The mushroom nozzle has a calibrated hole drilled in the end of the jet tube to a size suitable for the particular requirements of the engine upon which the carbureter is installed. The jet feeds into the mushroom head and out through four small holes, spreading the gasoline by capillary action. Due to this spreading action it is claimed that the fuel is spread in a thin film to all sides of the under surface of the slot. Here the ascending air picks it off at right angles to its path. The Sunderman Corp. is preparing to turn out this new carbureter for regular equipment by car and truck manufacturers, and will also produce an aluminum model for Ford replacement.

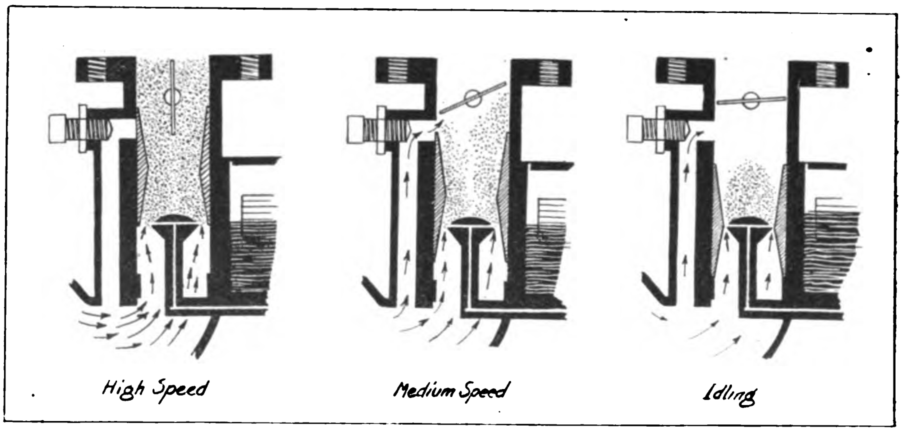


Diagram showing the relationship of the jet, venturi and air bypass in the new Sunderman carbureter at various throttle positions

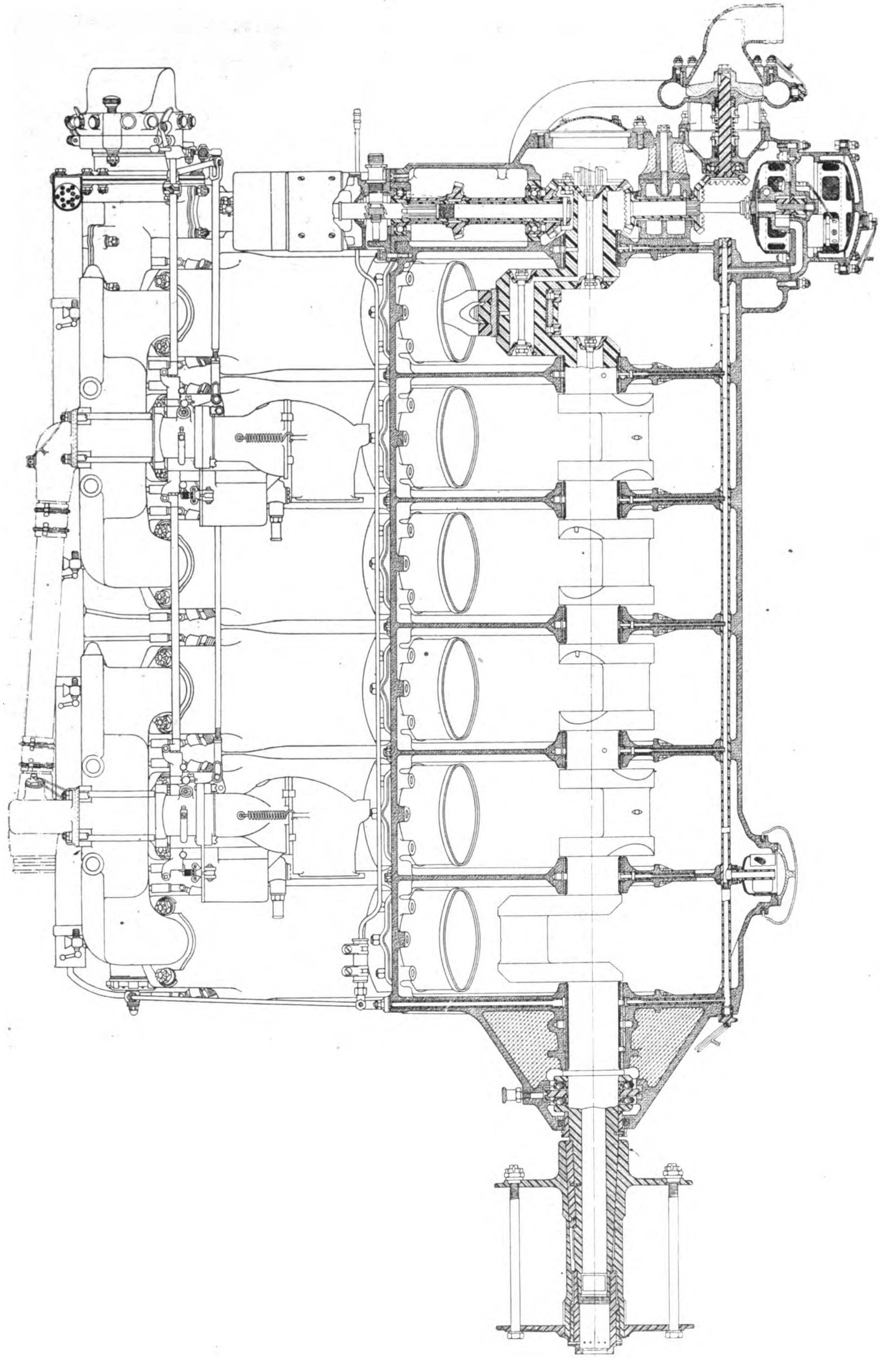


Fig. 1—Longitudinal sectional elevation of Liberty engine

The Liberty Aircraft Engine*

Part II

A Discussion of Various Features of Design, with Reasons for Their Adoption —Performance of Planes Equipped with the Engine

By J. G. Vincent

FIG. 1 clearly indicates the general construction of the conventional type of seven-bearing crankshaft. This type was selected on account of comparatively large bore and stroke of the engine, which made it practically impossible to consider any less number of bearings. No counterweights were considered, because the engine is of the direct-drive type, and not intended to run over 1800 r.p.m. At this speed the main bearing pressures, due to centrifugal force, are not excessive. All main bearings, except the front one, are of the same length, which, of course, results in the bearing pressures being highest on the center bearing. Conservative designs would have dictated a longer center bearing, but as this would have lengthened the engine and added some weight, we decided against it, as calculations and experience indicated that it was not absolutely necessary. Although this center bearing actually showed more wear in service than any of the others, it was never a source of trouble, as the wear was not excessive. From my experience with these engines, I would make the same decision again under the same circumstances, but would lengthen the bearing about 50 per cent, if I were designing an engine for commercial aviation. In this connection I will also state that for a commercial aviation engine I would make all main bearing shells ¼ in. thick, instead of 3/16 in., as is the case in the Liberty.

The crankshaft main bearing journals are all 2⅝ in. in diameter and the crankpins 2⅜ in. The crankshaft cheeks, as originally designed, were the weakest point, and when we began to get into quantity production, small variations in material and heat-treatment occasionally resulted in a broken shaft; sometimes within a few hours and sometimes after from 50 to 100 hr. use. It was, of course, impossible to make the cheek any thicker, and it was, therefore, decided to widen them.

So far as I am aware, no crankshafts of the revised design were ever broken, with the exception of the occasional shaft that contained a flaw, and these usually let go before the engine had passed its manufacturer's test. It is my belief that the crankshaft as strengthened is an entirely practical and satisfactory design for this type and power of engine.

Connecting-Rods

The design of connecting-rods and connecting-rod big end bearings, as originally specified, were on the light side, and while the connecting-rods themselves would stand up indefinitely, if made out of the best material with the best heat-treatment, the least variation would result in trouble. It was, therefore, decided to thicken all sections about 1/32 in., and while this added weight to the engine, it made a thoroughly practical manufacturing proposition.

One of the sources of trouble with the original design was sharp corners under the connecting-rod bolt heads, and this was generously filleted in the redesign. The trouble with the connecting-rod bearings was that they were too thin, with the result that they went out of shape under heavy load, and the continual distortion would crack the babbitt. These bearings would not burn out nor break, but the babbitt would simply disintegrate, with the result that when the engine was taken down after 50-hr. use, the bearings would be in bad shape, and would all have to be replaced. This trouble was entirely overcome by increasing the thickness so that the thinnest portion under the straddle-rod forks is 9/32 in. thick.

The connecting-rods and connecting-rod big end bearings, as finally proved out and standardized, gave a uniformly satisfactory result, and I would not know how to improve them if called upon to do so at this time. We carried out a great many experiments at McCook Field with various kinds of V-type connecting-rods, including the so-called "Marine type," such as is used on the 300-hp. Hispano-Suiza, and the so-called "articulated type," such as is used on the Rolls-Royce. Both of these types can be made perfectly satisfactory, but we could not determine that they were any better than the so-called "straddle-rod type," as standardized for use on the Liberty. The connecting-rod piston-pin bushing, with its splash lubrication, proved entirely satisfactory, which seems to indicate that there is no necessity for carrying pressure oil to the piston pin.

The connecting-rod length to stroke ratio is 1.71 to 1. This proved satisfactory, but I would not recommend designing an aircraft engine with any lower ratio.

Pistons

The die-cast aluminum-alloy piston design, as originally laid down, proved very satisfactory, and was never changed. This piston design was originally dictated by Mr. Hall's experience, as he had proved by extensive experimental work the value of a very thick head and tapered piston wall increasing in thickness toward the top, in order to be as thick back of the piston rings as through the head. The purpose of this thick piston head and tapered wall is, of course, to provide for the proper transfer of heat from the piston head to the cylinder wall.

The piston pin is of the floating type, held in position by aluminum washers pressed into the piston at each side. This construction proved to be very satisfactory and prevented the usual trouble of cotter-pins and set screws dropping into the crankcase.

We had a little trouble at first with the pistons scoring, because they were too soft to work satisfactorily against the steel cylinder. This trouble was quickly cured by making the pistons harder and watching the heat treatment of the cylinders to get them of a uniform hardness, though still machinable.

The crowned head high compression piston gives a compression ratio of 5.4 to 1. The low-compression piston is flat on top but has the same bearing length as the high-compression type. The low-compression piston was used for all navy engines, as they work at comparatively low altitude, and the high-compression for all army engines, as they were intended for use principally at high altitude.

Propeller Hub

As originally designed, the propeller hub was intended to be put on the crankshaft permanently, as it was feared that a detachable hub would give trouble in an engine of so large power. This design, however, was contrary to foreign practice, and so much pressure was brought to bear in favor of the detachable hub that the design was changed before the engine was ordered into production.

*Paper read at the annual meeting of the S. A. E.

Fig. 1 shows the propeller hub as finally designed, including the propeller hub key running clear out to the rear end. The taper is 1 to 12. The propeller hub key as originally put into production was short, and did not extend within 1 in. of the rear end. This construction gave trouble, in that the hub would freeze on the shaft, making it hard to remove and impossible to replace without filing and lapping.

This trouble was largely overcome, and a practical result obtained by extending the key clear to the rear end of the hub and grinding the shaft and hub so that all the draw came at the rear end. By this I mean that the tapers were made so that they did not exactly match, and the front end of the shaft would be perhaps 0.001 in. loose with the rear end drawn up tight. This simply insured that the hub would be absolutely tight at its big or driving end.

The offset hub, as shown in Fig. 1, was really an afterthought to allow room for shutters in front of the radiator, but it proved more satisfactory than the conventional type, due, it is believed, to the reinforcing of the rear flange by the hub extension. The diameters of the propeller hub flanges and bolt circle, as well as the thickness of the propeller hub, proved entirely adequate for the horsepower output of the engine.

Crankcase

As shown in the illustrations, the crankcase is of the deep box-section type; the upper and lower halves being lapped together and firmly anchored to each other by numerous bolts around the flanges, as well as long through bolts on each side of all main bearings. The design of the individual steel cylinders made it possible to extend them down into the crankcase, thus greatly increasing the possible depth and strength of the crankcase, and at the same time making it possible to reduce the included angle between the two rows of cylinders to 45 deg. As clearly indicated, the main bearings are carried between the upper and lower halves. In my opinion, the design of this crankcase had a great deal to do with the satisfactory operation of the Liberty engine, and I know that no other type could be designed anywhere near as light and still stand up.

After the Liberty engine had been in production for some months a well-known English engine expert came to America, and in going over the design of the Liberty engine with me he asked where we got our information as to the design of the crankcase. After I explained its advantages he told me that they were just then beginning to realize the value of the box-section type of crankcase in England, and that experiments carried out recently had proved to them that this type with the bearings carried between halves is a very great improvement over any other design which they had used. The engine-bed flange design, including the number of bolts, form of ribbing, etc., has proved entirely satisfactory.

Cylinders

The individual cylinder design was, of course, originally selected on account of the necessity for a seven-bearing crankshaft, but while the design was being laid down it was recognized that the individual design was right for several other reasons. This design made it possible to machine pilots to extend into the crankcase, thus increasing the depth of the crankcase and making it possible to narrow up the angle without weakening the crankcase too much at the center or having the cylinder flanges overlap. The steel cylinders were selected for this make for more simple machining and easier application of the steel water-jacket. This design also makes for easy assembling and dismantling of the engine, and therefore facilitates manufacture as well as maintenance. It is very convenient to be able to remove a damaged cylinder quickly without disturbing the remainder of the engine and without removing it from the 'plane. In my opinion, the steel cylinder is the lightest that can be designed, and its construction provides for the best possible valve cooling. In spite of the fact that the Liberty valve is 2½ in. in diameter in the clear, it cools very satisfactorily, and I have seen any number of engines taken down after 100 hr. flying with the valves still in good, serviceable condition. Owing to the shape of the steel water-jacket around the spark plug, considerable difficulty was experienced in producing this stamping, but dies were finally devised which produced a perfect result with the minimum of scrap.

Manufacture of Hollow Forgings

One of the big manufacturing problems in connection with the steel cylinder was to secure hollow forgings of the proper material, which would provide for the minimum removal of material in machining. This job was submitted to two different companies, the Ford Motor Co., Detroit, and the J. G. Brill Co., Philadelphia. Both worked out a thoroughly satisfactory and economical forging. The Ford company worked out a process to make this forging from steel tubing, while the J. G. Brill Co. used a process to make the forgings from billets. One of the difficulties in producing this forging was the fact that its flange is located several inches from the lower end. It is my belief that both companies finally used the same process to produce this flange, consisting of an upsetting operation, with the bore properly reinforced by a pilot.

The valve port cages are machined from separate forgings and welded on, the camshaft housing support bosses being machined as an integral part of these ports. The design is such as to provide for water-cooling for almost the entire length of the exhaust valve stem guide. Proper welding on of the steel jackets proved to be simply a matter of practice to get a good job, and girls were used largely for performing this operation. The only trouble that I have ever heard of in connection with these cylinders was an occasional leak in the water-jackets, which usually occurred at the top of the jacket. This trouble would not occur frequently enough to be of any great importance, but we carried on extensive experimental work, in an endeavor to find out what caused it, and came to the conclusion that it was caused by the flexing of the jacket, due to slight distortion of the cylinder head, under the force of the explosion. If this is a correct deduction there are two ways the trouble could be cured, one being to put a positive tie between the valve ports, and the other to thicken the cylinder head, say 1/16 in.

Camshaft Housing

The camshaft and housing assembly, as well as the valve rocker arms, are clearly shown in Fig. 2. This construction proved to be very satisfactory, as it is positive in operation, practically never gives trouble, is quite easy to assemble and disassemble, and throws very little oil. This is the only type of valve operating mechanism that has given real satisfaction in connection with V-type engines having steel cylinders and exposed valve springs. It is, of course, a much simpler problem to work out a valve-operating mechanism for cast-in-block engines like the Hispano-Suiza, where the entire valve mechanism is covered, and therefore oil-tight.

The arrangement of the driving gears is very clearly indicated in Fig. 1. This arrangement of gearing proved very satisfactory after we had overcome the initial troubles due to bad design, such as lack of proper fillets, metal being cut down too thin under the teeth, etc. During the early manufacture there was a tendency to make these gears too hard.

Some trouble was experienced with the meshing of the bevel gears in the early stages of manufacture, due to the expansion of the crankcase and crankshaft under heat. This trouble was finally overcome by working out the proper clearances and then shimming to that clearance.

The recent Mercedes engines contained a very great improvement, however, at this point. The bevel gear is splined on the crankshaft with a sliding fit, and a separate thrust is provided to locate the gear and determine its mesh. This does away with all variations due to expansion and contraction, and is therefore a great improvement.

Before we had extensive experience with these engines it was predicted that we would have a great deal of trouble from breakage due to crankshaft vibration. I know that the Rolls-Royce company did have serious trouble of this kind, and were forced to put in a compensating spring drive on the crankshaft gear. I believe that we would have had the same trouble with the Liberty had the cylinders been placed at an angle of 60 deg., but due to the 45-deg. angle the periodic vibration seems to be broken up to a marked degree.

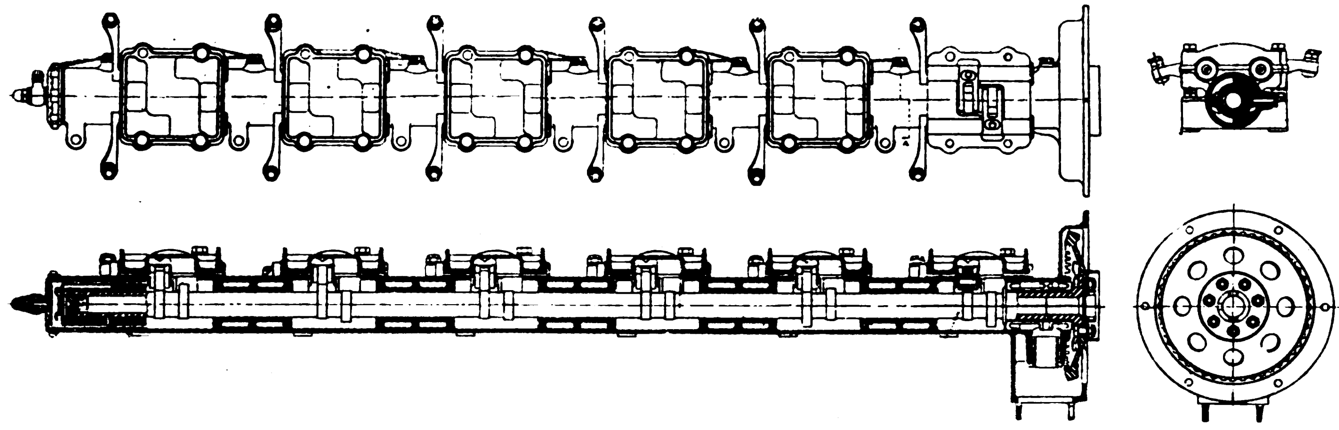


Fig. 2—Plan and vertical section through cam housing

This could, of course, only be proved by building a sample 60-deg. Liberty, but I firmly believe that the 45 deg. allowed us to get by at this point with the simple, light construction.

Lubrication

The double-deck oil pump and pressed-in oil manifolds are shown in Fig. 1. The crankcase is of the dry type, all oil being returned to an outside tank, cooled, and then pumped to the bearings under pressure.

As originally designed, the so-called scupper type of oiling system was provided for the connecting-rod big end bearings. With this system the crank cheeks are not drilled, but part of the oil which works out of the ends of the main bearings is caught by scuppers or scoops and conducted into the large drilled hole through the crank-pin. This system has some very desirable features, among which are simplicity and superior oil economy, and under ordinary conditions it works extremely well, but unfortunately it has one serious drawback. Due to the fact that the large holes through the crank-pins are open, all the oil drains out when the engine is stopped, except in those crank-pins which are near the bottom. This does not make much difference in warm weather, as the oil will quickly flow to the ends of the main bearings, and be caught by the scuppers, when the engine is started, but under cold weather conditions trouble results, and bearings are liable to be burned out, particularly if the throttle is opened quickly after starting. Since this scupper feed oil system had been criticized by foreign engineers, we wasted no time in changing over to the full pressure feed system as soon as the first trouble showed up. Comparatively few engines were manufactured with the scupper feed, and so far as possible all light crankshaft scupper fed engines were kept in this country.

Full Pressure Substituted for Scupper System

After adopting the full pressure feed system no further lubrication trouble was encountered, with the exception of over-oiling of the cylinder and fouling of plugs at high altitudes. This trouble was very largely overcome by drilling a hole in the by-pass valve of such a size as to lower the oil pressure to about 3 to 7 lb. under idling conditions, and still provide 30 to 40 lb. of oil pressure under full load. This device was entirely satisfactory, with the exception that it varied somewhat with different kinds of oil.

At the time the armistice was signed we were experimenting in the air with various kinds of devices inter-connected with the throttle to control the oil pressure positively. This is a comparatively easy thing to design, but we wanted to accomplish the result without making any changes in the basic parts of the Liberty engine. Although this device never got into production, I feel that the principle of positively controlling the oil pressure is correct and should be a part of any aircraft engine design.

Cooling System

The construction of the water pump is clearly shown in Fig. 1. One of the important features of this pump is the automatic spring take-up of the two stuffing boxes, one of which seals the oil in the engine and the other the water in the pump. This construction proved very satisfactory. From an installation point of view, the water-pump is located in a rather bad place, and experience seems to indicate that the best practical place to locate the water-pump is at the bottom of the crankcase near the rear end, in a vertical position, as on the Hispano-Suiza aircraft engine. Nothing which ever has to be got at should be located on the rear end of an aircraft engine, as it is often desirable to locate the engine just in front of a permanent bulkhead. To have located the water-pump as suggested in the Liberty engine it would, of course, have been necessary to have a different arrangement of the oil-pump. The Hispano-Suiza oil-pump is a very satisfactory arrangement, but I prefer that the oil-pump be located so that it can be got at from the bottom or one side of the crankcase, without disturbing the water-pump or any other accessory.

Rumors of Overheating Troubles

Many rumors have been circulated that the Liberty engine is hard to cool, but this is not and never was a fact. We did have two difficulties in connection with cooling the Liberty engine, one being the difficulty which we had in obtaining good tubular radiators, and the other the difficulty involved in working a 400-hp. radiator into the design of a plane which had originally been laid out for 240 hp. We were handicapped by not knowing just how much radiation to provide, as there is a great deal of difference in cooling an engine on the ground and cooling it at 10,000 or 15,000 ft.

We finally adopted the British practice on radiators, as follows: All radiators to be of the tubular type with the ratio between the inside diameter of the tube and its length 1 to 12 desired, and from 1 to 10 to 1 to 14 permissible; the size of the radiator to be determined by the horsepower output on the climb, 0.7 sq. ft. of wetted surface per hp. output being the desired figure. The area of the wetted surface is determined by calculating the outside surface of the tubes, nothing being deducted for the short space taken up at each end by solder:

$$\frac{\pi d l n}{144p} = 0.7$$

Where d = outside diameter of tube in inches
l = length of the tube in inches
n = the number of tubes
p = horsepower on the climb.

This formula has been extensively used, and a radiator designed in accordance with it will give perfect satisfaction on any well-designed aircraft engine, providing the radiator is well made, properly located, and the air flow through it is not badly choked by obstructions.

For military work, shutters must be provided in front of the radiator, so that the pilot can close off the cold air and regulate the temperatures at high altitudes, particularly in cold weather when gliding.

In Fig. 1 the arrangement of the ignition generator is shown, as well as the ignition heads of the Liberty generator type of ignition. The small 10-amp.-hr. battery used in connection with this system can be located in any convenient place about the plane, and the double ignition switch is, of

course, located at a convenient point on the instrument board.

At the time the Liberty engine was designed, so far as we knew, no reliable light-weight twelve-cylinder magnetos were in existence, and we did not want to follow the foreign practice of using four six-cylinder magnetos, not only on account of the weight of the magnetos but also on account of the weight and complications of the necessary drives. Mr. Hall and I have both had extensive experience with the generator type of ignition on aviation engines, and knowing that a light-weight reliable outfit could be secured, we deliberately incorporated it in the design, although we anticipated that we would meet with stubborn resistance from people who had not had experience with this type of ignition. The design, as originally laid down for this engine, proved to be exceedingly satisfactory, and very few changes were made during the early experimental stages.

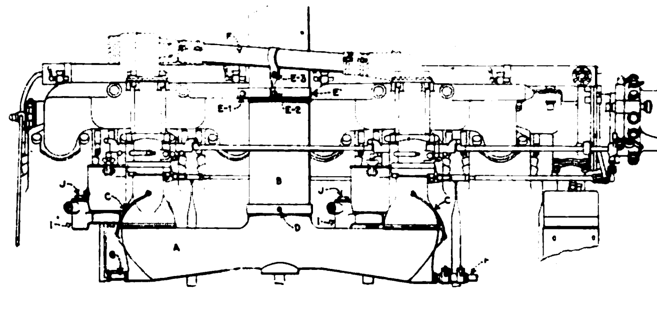


Fig. 4—Longitudinal elevation showing revised carbureter arrangement

Ignition Distributor Head

As indicated in the drawings, an ignition distributor head, complete with coil, is located at the rear end of each camshaft housing; each one of these heads is so cross wired as to make it possible to secure ignition in twelve cylinders on either head. thus providing a complete double system.

One of the very desirable features of the Liberty engine which is directly traceable to its ignition, is the easy starting, it being necessary to pull the engine over only very slowly to start it.

My experience would indicate that with a large-bore engine it is much better to start it by pulling it over slowly than on the spark with the starting magneto or vibrator. I believe this is due to the fact that to start on the spark it is necessary to have the mixture just right and on the rich side, and where several attempts are made to start from the spark, excess gasoline often accumulates in the cylinders and cuts the oil off the pistons, due to the large clearances. This is apt to result in scored cylinders.

I think the principal objection to the Liberty ignition system is the location of the ignition heads. They were, of course, placed in their present position to obtain simplicity and light weight, but in some installations they are in the way of a permanent bulkhead, and would be better located if placed at the side. It would, of course, add something to the weight to place them anywhere else, and this is a factor which would have to be taken into consideration. Since the Liberty engine was designed, some very excellent twelve-cylinder magnetos have been developed, and it is entirely possible that in laying out a new design at the present time a magneto installation might be provided which would be just as light and just as reliable as the generator type used on the Liberty. This is a matter which would have to be proved by actual design and exhaustive experimental work.

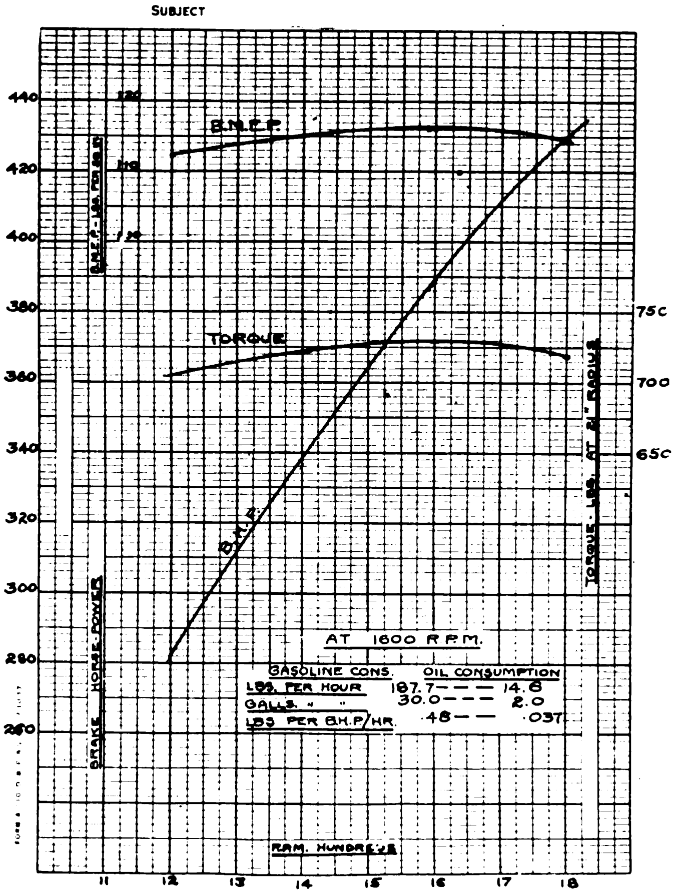


Fig. 3—Performance curves of well worked in twelve-cylinder Liberty engine

Carburetion

At the time the Liberty engine was designed, the only proved-out aircraft carbureter available in this country was the old-style single venturi Zenith, and, although we knew that this carbureter would not be entirely satisfactory, we had to specify it until such time as we could get definite information on something better.

Fig. 1 illustrates the arrangement of the Zenith carbureter, the intake header and water outlet arrangements. It will be noted that four intake headers are used, each serving three cylinders. It will also be noted that hot water is taken out of the top of the cylinders into water-jackets on top of the intake headers and piped from there to the radiator inlet. This arrangement of intake header proved very satisfactory, and resulted in very good distribution at all altitudes. It will be noted that the throttle valves in the carbureter were arranged fore and aft, instead of crosswise, to prevent interfering with the distribution under throttled conditions. This arrangement proved very satisfactory. The altitude adjustment originally provided on these carbureters had very little effect on the mixture, and was, therefore, unsatisfactory.

No strainers were provided in the original carbureter design, as it was thought that a strainer could be provided in a more accessible place. Experience proved this idea to be wrong, as small particles from the rubber hose connections would work into the carbureter and block the jets. This was particularly annoying, as the carbureters are located in an inaccessible place, and it was a considerable job to remove the jets and clean them out.

It will be noted from the drawings that individual air scoops were fitted to each carbureter, and that no provision was made for carrying these intakes outside the bonnet. Although these scoops were drained overboard the drain was only effective with the plane level or climbing, and a flooding carbureter on the glide would spill gasoline over the engine. If backfire occurred after this had happened, the plane might be set on fire. As soon as the engines were received overseas where they had had experience with fires, various modifications were promptly made to reduce the fire hazard, before the planes were flown, and we were requested to change the design as quickly as possible, to overcome this trouble.

While making a change to reduce the fire hazard, we decided to also alter the altitude control and provide screens at the carbureter and beyond all hose connections. Figs. 4 and 5 show the revised construction, which it was intended

should be in all production Jan. 1, 1919. The change in the altitude adjustment consisted simply in some rearrangements of the passages, and the construction, as finally worked out, was so simple as to make it possible to make this change in the field. To provide for a screen, a small aluminum casting *I*, Fig. 4, was provided, and arranged so that it would screw on to the old carbureter. This casting was provided with a nipple to receive the gasoline hose connection, and the screen was easily removable by taking off the nut *J*.

Fire Hazards Reduced

To prevent the possibility of fire, the individual air intakes were removed from the carbureter, as well as their retaining springs, and a single long intake *A* was provided and held on by spring bails *C*. This intake was machined at its center to receive a large single intake pipe *B* extending up through the center of the engine and out through the bonnet. The top end of this pipe was cut off at an angle of 25 deg. A dowel *D* engaged a slot in the intake pipe *B* and prevented it from turning. A clamp band *E* and *E* was arranged to anchor the intake pipe *B* to suitable cap screws already existing in the intake headers. The fragmentary plan view, Fig. 5, shows this rearrangement and the way it is necessary to bend the water outlet pipe to permit the installation of the new intake pipe *B*. The intake header *A* is provided with nipples *G* at each end, so that overflow pipes may be attached and carried outside the fuselage. It is obvious that this provides for the complete draining away of all stray gasoline, whether the plane is climbing, diving or flying level. This new arrangement of altitude control, carbureter screen and intake pipe has been extensively tested out in the air, and has proved to be exceedingly satisfactory.

The revised altitude control was worked out first and went into production in the early summer of 1918, and it is my understanding that all engines were equipped with this improved altitude control before being used at the front. Vague rumors to the effect that the Liberty engine has excessive gasoline consumption have been pretty generally circulated, and this, of course, if true, would be serious. It is obvious that all other things being equal, the gasoline consumption of the engine will be in proportion to the horsepower developed. All well-known aircraft engines at the present time have about the same gasoline consumption per horsepower hour. This runs from 0.48 to 0.56 lb. per b.hp.-hr., depending on conditions. In this respect the Liberty engine is no better, and no worse, than other well-known designs.

Gasoline Consumption

Running wide open near sea level, the Liberty engine will develop 400 to 420 hp. and granting that it develops the average, that is, 410 hp., and that the average service conditions maintain, it will probably have a gasoline consumption of 0.52 lb. per b.hp.-hr. Under these conditions it would burn 213.2 lb., or approximately 35½ gal. per hr. The same engine flying wide open at 15,000 ft. would be developing approximately 295 hp. and if the altitude adjustment was properly used, the gasoline consumption would be reduced in approximately the same ratio. This would bring the consumption down to 153 lb., or roughly 25½ gal. per hr. As a matter of fact, however, the general practice is to throttle down, except for short periods of time when it is desired to obtain maximum speed. Where a plane is capable of making 120 miles per hr. at 15,000 ft. altitude, it is good practice to throttle down to between 90 and 100 miles, thus enormously reducing the horsepower and gasoline consumption per hour, without seriously affecting the distance traveled. We know from practice that with a Liberty twelve mounted in a DeHaviland Four or Nine plane, we can average about 100 miles per hr. in cross-country flying at 15,000 ft. on 20 to 22 gal. of gasoline per hr. Throttling down still more, will further reduce the gasoline consumption, and it is possible to fly a DeHaviland Liberty-equipped plane at about 75 miles per hr. on 17 gal. of gasoline per hr.

Fig. 3 gives absolutely accurate data as to gasoline and oil consumption of Liberty engines running wide open at 1600 r.p.m. near sea level.

Radical Carbureter Design Evolved

A rather radical carbureter design, which was worked out for the Liberty twelve, while only used experimentally, gave some very promising results. Fig. 6 shows this experimental carbureter and intake header arrangement, and Fig. 7 is a fragmentary plan view showing the same arrangement. Fig. 8 is a diagrammatic sectional drawing showing the principal parts of the experimental carbureter. It will be noted that two carbureters are shown, as in the standard Liberty, but they are what might be called an inverted type. Without going into detail as to the construction of this carbureter, it will be noted that the double venturi arrangement, which has been highly developed during the war, makes this construction possible. The reason for this is clearly shown in Fig. 8. It will be noted that this type of carbureter cannot flood into the engine, as would be the case in the ordinary type of carbureter turned upside down. In Fig. 8, *D* is the needle-valve float, *Y* the drain compartment connected to an overflow pipe, *K* the altitude valve, *F* the jet, *N* the compensator well, *M* the compensator feed holes, *I* the compensator, *L* the idling mixture passage, *O* the passage to the secondary choke, and *P* the secondary choke. This arrangement is very desirable for airplane use, as it provides short separate intakes from each carbureter that project directly out through the bonnet and make fire from backfire impossible. Another important advantage of this arrangement is the matter of accessibility, as the carbureters are right up on top of the engine, where all connections and adjustments can easily be gotten at, and it leaves the *V* between the cylinders absolutely clear for machine-gun installation.

It is obvious that this type of carbureter requires a different kind of intake header, and as designed for the experimental job there were rights and lefts, as shown by *A* and *B*. This construction made it necessary to change the water outlet headers, and provide a separate outlet manifold *R* for each line of cylinders. On account of the gas impinging against the bottom of the header in this construction it is necessary to place the water-jackets on the bottom of the intake headers, and to get hot water into these jackets a connection was made at the rear end through the water outlet manifold *R* by the pipe *N* and hose *P*-6. The jackets were connected at the center by the nipples *M* and hose *P*-7. At the front end the jackets were connected to the water manifold *R* by the nipple *M*, hose *P*-1 and pipe *O*. This pipe *O* was arranged to extend inside and then turn forward with the flow to form an ejector and thereby induce some of the hot water to flow through the jackets. This construction worked out very satisfactorily, and the intake header seemed

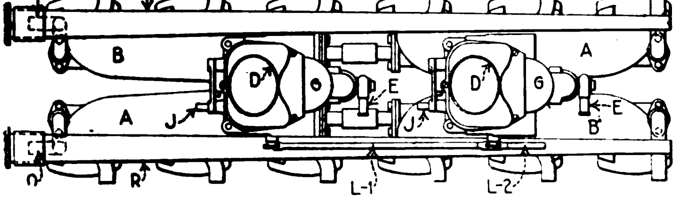


Fig. 5—Plan view of revised intake header arrangement

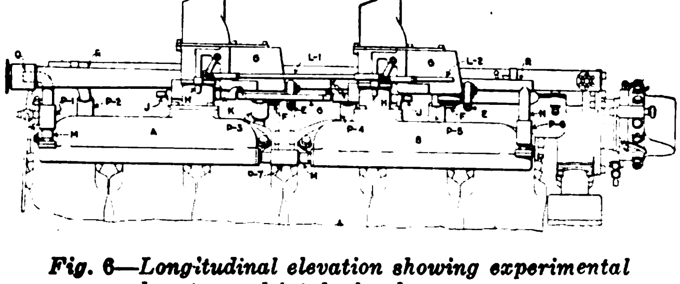


Fig. 6—Longitudinal elevation showing experimental carbureter and intake header arrangement

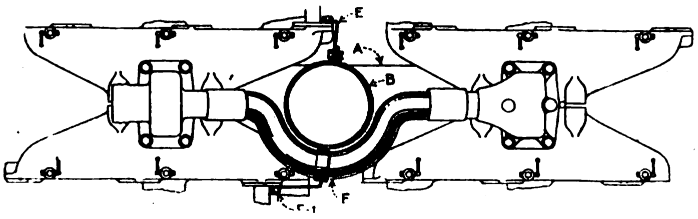


Fig. 7—Fragmentary plan view showing experimental carbureter and intake header arrangement

to keep just as hot as in the standard Liberty construction.

As stated above, this whole inverted carbureter arrangement was treated as a purely experimental proposition, as it was recognized that it would be impossible to put it into production owing to the fact that absolutely new carbureters would require new tooling up as well as many other small parts. I believe, however, that all those who have tested this arrangement believe it to be the best possible installation for the Liberty engine. This carbureter arrangement has every advantage of all such arrangements that I know of, that is, that it does not provide for gravity feed.

Angle Between Cylinders

The Liberty engine has been criticised on account of its cylinders having been set in an inclined angle of 45 deg. All experts in engine design know that a six-cylinder engine is perfectly balanced. Two six-cylinder engines hooked to the same crankshaft are also perfectly balanced at any angle, except as to impulse frequency. Before designing the Liberty engine I had experimented extensively with various angles of cylinders, and knew that the 45-deg. arrangement would not be noticeable, so far as lack of smooth running was concerned, and that it had distinct advantages, not only in that it reduced head resistance, but also that it reduced synchronous vibration of the crankshaft due to the breaking up of the evenly spaced impulses.

The cover over the oil pump in the Liberty engine is held on by a spring bail, which, while readily detachable, cannot jar loose and come off. This is a well-known mechanical device which has been used for years for exactly similar purposes. This little device, however, has been the subject of widely circulated criticism, and I do not know how much it has cost the Government to investigate persistent criticisms on this device sent in by irresponsible people.

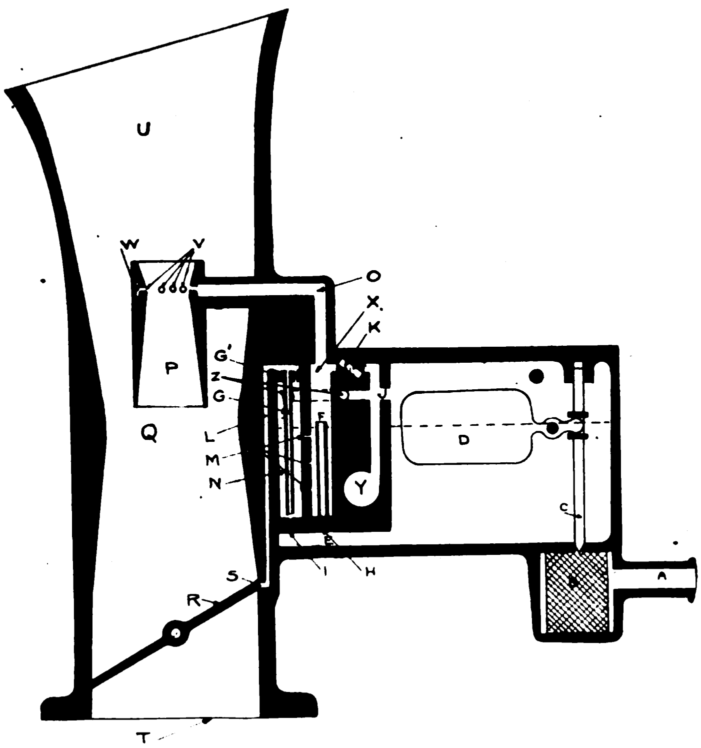


Fig. 8—Sectional diagram of experimental carbureter

Weight Per Horsepower

I believe that it is pretty generally known that the Liberty engine weighs approximately 2 lb. per hp. By using still better materials, making the engine considerably harder to manufacture, and lowering the factor of safety, which is pretty high, it would be possible to bring the weight down to about 1.8 lb. per hp. This would greatly increase production troubles, would require more skilled mechanics to keep it in working order, and would, therefore, in my opinion, be an inadvisable move.

I believe that one of the outstanding features of the Liberty engine, as it is now being manufactured, is its reliability. I have flown the Liberty engine thousands of miles cross-country and have yet to make a forced landing. This reliability has, of course, been developed by extensive experimental work in the air and close attention to details of manufacture and inspection.

Reports have been promiscuously circulated that while the Liberty engine has been proved to be good for large bombing machines it cannot be used in a small, fast fighting or chasse machine. It was never intended that the Liberty twelve should be put in a small, single-seated chasse machine, and that is the reason the Liberty eight was developed. It was our original plan to put the Liberty eight into production and use it for just such small machines, but when our program was finally made up, based on advice from abroad, it did not include a single-seated chasse machine, and for that reason the eight cylinder was not put into production at the time. Some four or five months ago it was decided that we should develop a single-seated chasse machine in this country, and the Liberty eight was promptly brought out and ordered into production. Airplane designers generally agreed that the Liberty eight-cylinder engine, developing as it does 300 hp. and weighing approximately 600 lb., will make a very satisfactory powerplant for a plane of this type.

Air Performance

Owing to the fact that the performance of an airplane must be measured in the air, it is a rather involved matter to make a full flight test, requiring, as it does, a number of special instruments, a well qualified pilot, and proper technical experts to make the necessary corrections for temperature, air density, etc., after the readings have been secured. When we first started making full-flight tests in this country we did not have the proper equipment, and a number of tests were made and reported which were not on a comparative basis with similar tests of allied planes made in Europe. Quite naturally, this has led to a misunderstanding, and it has been claimed that the DeHaviland-Four plane equipped with the Liberty engine, is not as good as allied planes equipped with engines of much less horsepower.

To throw some light on this subject I am giving below a few comparative figures covering foreign planes. They give average performance of three well-known planes, namely: the French Salsom 270 hp., English DH-4, using the Siddeley 240-hp. engine, and the Italian Pomilio E, using the Fiat 240-hp. The USDH-4 is, of course, equipped with the Liberty twelve. The figures on allied planes were secured from official technical reports from abroad and figures on the USDH-4 were taken from tests made by the Technical Section of the Department of Military Aeronautics and the Engineering Division of the Bureau of Aircraft Production.

OBSERVATION PLANE

	Average Foreign	DH-4
Power, hp.	266.6	400
Speed at sea level, miles per hr.	116.8	128
Climb to 10,000 ft.	9¼ min.	7½ min.
Ceiling, ft.	20,267	21,000
Endurance (Cruising)	3½ hr.	4⅓ hr.

DAY BOMBER

Power, hp.	266.6	400
Speed at sea level, miles per hr.	110.5	118
Climb to 10,000 ft.	11¼ min.	11 min.
Ceiling, ft.	16,000	17,500
Endurance (Cruising)	3½ hr.	4 hr.
Bomb load	423 lb.	223 lb.

RADIUS OF ACTION, MILES

British DH-9	256
British DH-4	244
Breguet	151
USDH-4	310

In the above comparison it will be noted that the USDH-4 equipped with the Liberty twelve shows up well in all cases except the load of bombs carried as a day bomber. This machine was originally designed for a 240-hp. engine, and when equipped with a slightly heavier 400-hp. Liberty, plus the necessary gasoline for a larger engine, its carrying capacity is naturally cut down. It was to take care of this work that the USD-9-A was being put into production just as the armistice was signed. This machine has 500 sq. ft. of surface and carries 500 lb. of bombs with practically the same performance as the USDH-4. In addition to the USD-9-A, the following planes were being put into production at the time the armistice was signed:

VE-7 advanced training machine, equipped with 150-hp. Hispano-Suiza.

Le Pere two-seated fighting machine, equipped with the Liberty-twelve.

Glenn Martin day or night bombing machine, equipped with two Liberty-twelves.

U. S. Bristol fighting machine, equipped with the Liberty-eight.

Many other new types of planes were in the experimental state, including several designs of single-seated fighting machines around the 300-hp. Hispano and Liberty eight.

The Unmined Supply of Petroleum in the United States

(*Continued from page* 376)

less—than remains in the ground in the United States.

How long the commercial production of natural petroleum will continue in this country is a question whose answer is no less speculative than the quantitative estimates. After the production peak is passed, be it one year or seven, the annual output of natural oil will decline gradually for a long time. Oil wells will be producing at least 75 years hence. The pools cannot all be so soon discovered; the oil cannot immediately be gotten out of the ground. The discovery of deep sands is likely to give new life to many old or even abandoned fields. Pools will be found after prolonged search and repeated wildcatting in old as well as new regions, and this is probably especially true of the Gulf Coast, where, unless geologic discovery and consequent new methods of search, come to the aid of the driller, it may be 75 years before some of the productive salt domes are revealed.

The most significant feature of the prospect, however, is the probability that, although an estimated two-thirds of our reserve is still in the ground, with an annual drain of one-third of a billion barrels, the peak of production will soon be passed—possibly within three years. The date when the peak will be reached is a matter of individual opinion, in which predictions have wide range. There are many well-informed geologists and engineers who believe the peak in the production of natural petroleum in this country will be reached by 1921 and who present impressive evidence that it may come even before 1920.

Development of Oil Shale

In her deposit of oil shale the United States has an anchor to windward. Oil shale is a richly bituminous shale, some of it approaching cannel in character, interbedded, like coal, in series of shales, sandstones and limestones. The most extensive and valuable deposits known in America if not in the whole world are in northeastern Colorado, northeastern Utah and southwestern Wyoming, mainly in what is known as the Uinta Basin. Rich beds of oil shale also occur in very limited areas in northeastern Nevada. Minor deposits, more conveniently located but for the most part leaner and less promising, are found in the Mississippi Valley and the Appalachian States. D. E. Winchester* and A. R. Schultz, of the Geological Survey, have estimated that there are in Colorado, Utah, Wyoming and Nevada deposits of oil shale in thicknesses of 3 ft. or more, and capable of yielding 25 gal. or more of oil per ton, sufficient to produce at least 75,000,000,000 bbl. of oil.

The oil is generated through the destructive distillation of the shale, and its character and composition depend largely on the processes employed. Rough dry or steam distillation tests produce distillates — essentially heavy petroleums — carrying both paraffin and asphalt with considerable nitrogen and yielding gasoline in an average of about 12 per cent. These rough tests indicate that the gasoline obtainable by distillation of these shales, even by simple methods, far exceeds in amount all the petroleum yet produced in the United States and may equal the remaining natural oil.

*U. S. Geological Survey Bulletin No. 641-F. 1917; Bulletin No. 691-B. 1918.

Shale Oil Production Still Experimental

The production of oil from these shales is still in the experimental stage, in which various methods are being tested. Much doubtless depends on the processes devised and adopted. It is possible that initial commercial success may be determined as much by a study of methods and of the possible by-products and their values as by a further advance in oil prices. The technologic problems connected with the utilization of the oil shales are worthy of research by the best hydrocarbon engineers and chemists.

Shale oil is the most natural, satisfactory and ample substitute for petroleum, and it is likely to come into the market as the production curve of the natural oil glides downward beyond the peak, if not sooner. It must be borne in mind, however, that in spite of the probable very rapid growth of the shale-oil industry beginning with the day that shale oil is produced profitably on a commercial scale, it will require several years to construct and put into operation the enormous plants necessary to treat the millions of tons of shale which must be distilled in order to offset the waning production of natural oil, or fill a part of the gap between the production and consumption of petroleum in the United States.

Prevention of Dust on Concrete Floors

IN an article in the *Schweizerische Bauzeitung*, Albert Meyers gives the following method for attaining the above object. It consists in the use of a potash-water glass solution at 40 deg. Baumé in three to four parts of water. The solution is applied with a brush, after the floor has been thoroughly scoured with water and then allowed to dry. After the solution is applied the floor is rubbed over with a wet cloth, and the whole operation repeated. In this way it should be possible to harden the concrete surface considerably and thus prevent dust formation.

Life of Self-Luminous Preparations

MEASUREMENTS carried out by Meitner, extending over a period of seven years, show for six preparations an average life value of 1.905 years, which agree well with the results of other investigators. Measurements effected on an eleven-year-old mesothorium preparation showed the half-value period for mesothorium to be 6.7 years instead of 5.5, which figure had been assumed previously. For thorium, the half-value period was calculated indirectly at 2.37 x 1.10 years.—*Elektrotechnik und Maschinenbau.*

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, February 13, 1919 No. 7

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142.

Cable Address - - - Autoland, New York
Long Distance Telephone - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - One Year, $3.00
Canada - - - One Year, 5.00
Foreign Countries - - - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Machine Tools at the Show

NOT the least interesting feature of the New York show was the machine tool section in the basement of the Garden. Three complete exhibits of metal working machines were installed, besides a number of exhibits of miscellaneous shop equipment.

The machine tool industry has been engaged to full capacity on equipment for war work production during the past two years. Like certain contingents of our Army, it has been mustered out, and it is now looking for peace-time outlets. And there is probably no branch of industry that offers better chances to the toolmakers than that of automotive equipment. Take, for instance, the tractor branch. Aside from munitions, this has been one of the fastest growing industries in the country during the past two years, having doubled its output each year. The tractor industry has reached the stage where large scale production is about to begin, and this will mean the purchase of a vast amount of shop equipment.

In the automobile and truck industry, while we cannot expect the same rapid growth as in the younger tractor industry, there are also excellent chances for the sale of shop equipment. It is the consensus of opinion among engineers and shop men that the next few years will see progress chiefly in production methods. Automobile design has reached a very high degree of development, and no very striking or radical changes are likely to occur. But with stability in design that firm stands the best chance of success which can produce at the lowest cost. It is on the improvement of production methods that the automobile makers will largely concentrate their efforts during the immediate future, and this will favorably affect the demand for machine tools and other shop equipment.

Tractor Results

ONE of the most striking facts brought out at the S. A. E. session was in relation to the high fuel consumption observed in the British tractor trials. Some four-bottom tractors are said to have used as much as 8 gal. of fuel to the acre. The average consumption as given in one of the papers presented at the meeting was a little over 5 gal.

This is so high in comparison to what we have been getting that it shows the possibility of wide variations. Results in this country seem to indicate that the kerosene consumption per acre may be readily held down to 2 gal. under normal conditions.

When comparing the cost of operating tractor-drawn and horse-drawn farm implements the comparison should not be made solely on the per hour or per mile basis, but should include also a consideration of the element of speed and the fact that the tractor can be utilized to do the work at the time it is required. There is a "best time" for each job to be done on a farm and the tractor is capable of performing these jobs so much faster than horse-drawn implements that each can be performed at its proper time.

As Mr. Kettering pointed out at the S. A. E. meeting, even if the tractor as a whole is a bad mechanical proposition, the farmer cannot afford to throw it out. The filled silo and the bigger farm yield are a direct result of the ability to use the tractor in the short working season. There will be a better return than with horse farming, even if all the rest of the year has to be spent in tuning up the tractor.

ELECTRIC starting and lighting equipment was almost unknown in Europe previous to the war. It will be next to impossible, however, to sell post-war models there without a complete electrical system. European electrical firms have had little opportunity during the war to develop such equipment and our manufacturers certainly should not miss the opportunity offered them of getting their products taken up abroad. Some of the largest foreign firms, like Fiat and De Dion, have developed their own starting and lighting sets, no doubt because the home market did not offer any suitable equipment.

S. A. E. Fuel Division Needed

A FUEL division is needed in the Society of Automotive Engineers. One could not come away from the winter meeting of the organization without that thought in mind. We have motor car, truck, tractor, airplane and motorboat divisions, but no division to look after automotive interests as regards the fundamental necessity for all the other divisions—fuel.

There should be a vice-president of the fuel division in the same way as there is a vice-president for the other divisions of the organization. He would be able to look after the work which must be done during the next 3 years in meeting the greatest problem which confronts the automotive industry to-day. The problem is a part of two industries, the refineries on one side and the factories which make apparatus using internal combustion engines on the other.

No point of contact has hitherto existed between these industries, and nobody offers a more logical meeting point than the S. A. E. It is a problem that neither industry can solve alone, and it cannot be solved at once. There doubtless must be a transition period where we are changing from one fuel to another. Perhaps certain phases of design must be altered in order to meet the characteristics of the fuel that the refiners would evolve. Perhaps it will be necessary to alter compressions, manifold arrangements, lubricating systems or other details. All these matters would have to be taken into consideration before reaching a conclusion.

It is no simple problem and it cannot be dismissed with the thought that it is only necessary arbitrarily to fix a gravity below that now in use to greatly augment the supply. From the fuel maker's standpoint that would probably settle the problem for a while to come, but from the standpoint of the automotive maker and user the problem would be far from solved.

The car owner wants to be able to start his car on a cold morning. He does not want to have to change the lubricating oil every 3 days as is necessary on some of the farm tractors burning kerosene. Even with the present gasoline the amount of gasoline that enters the crankcase is so large that the life of bearings is seriously menaced if the owner does not take the necessary precautions in regard to changing the lubricant.

Even with the increased gravity of the fuel the question would only be solved from the refiner's standpoint for a relatively short space of time, because the use of automotive apparatus is increasing so rapidly that the problem would soon overtake us again.

The matter is brought squarely back to the engineer and technician in the necessity of producing engines that are more thermally efficient. The average automobile running about the streets with partially closed throttle is getting about 5 per cent of propulsive value out of the engine. The best thermal efficiency in the present type of automobile engine under advantageous circumstances is somewhere around 20 per cent. It does not require any mathematics to prove that this is very wasteful. It would be in the province of the fuel division of the S. A. E. to follow through the development work that is necessary in raising the efficiency of our engines.

Doubling the thermal efficiency of the internal combustion engine is equivalent to doubling the supply of fuel. A car that is now getting 20 miles to the gallon of fuel would get 40 if the thermal efficiency of its engine were raised from the probable figure of 15 per cent up to the possible of 30 per cent. It is easy to realize what a vast increase in our fuel resources would result from an improvement of this nature.

Similarly the ramifications of the problem even reach the building of good roads. It has been found that the consumption of a car going over bad roads can double and even triple that of a car going over the improved roads. Such wide differences in fuel figures have been found in districts where poor roads exist and in those that have the good hard surface roads that, neglecting the matter of time, the roads would be a true economic saving from the fuel standpoint alone.

All of this would be under the control of the vice-president of the fuel division or of the committee having this phase of the work in charge. There is no more vital work that can be undertaken than this. Every branch of the automotive industry is based solely and only upon the internal combustion engine. The internal combustion engine cannot exist without a suitable economical fuel. The present fuel will have to advance radically in price within the next 3 years under present conditions of its use. Now is the time to start work, before we have a real crisis.

Latest News of the

Airplane Show Space Allotted

Fourteen Makers of Planes and Engines and 32 Makers of Accessories Now Listed

NEW YORK, Feb. 11—Plans for the forthcoming aeronautical exposition to be staged by the Manufacturers' Aircraft Association in Madison Square Garden March 1-15 are rapidly assuming shape. At the present time fourteen manufacturers of complete airplanes and engines have been allotted space and thirty-three manufacturers of accessories of various kinds have signified their intention of exhibiting. These exhibits, of course, are in addition to those that will be made by the different army and navy departments. Following is the list of exhibitors to date:

Airplanes and Engines

Dayton Wright Airplane Co., Dayton.
Curtiss Aeroplane & Motor Corp., Buffalo.
L. W. F. Engineering Corp., College Point, L. I.
Wright Martin Aircraft Corp., New Brunswick.
Aeromarine Plane & Motor Co., New York.
Thomas Morse Aircraft Corp., Ithaca.
Burgess Company, Marblehead.
Gallaudet Aircraft Corp., East Greenwich, R. I.
B. F. Sturtevant Co., Jamaica Plain, Boston.
Packard Motor Car Co., Detroit.
Lawrence Aero Engine Corp.
Gio Ansaldo Co.
Cantilever Aero Co., New York.
L. Sperry Aircraft Co., New York.

Accessories

Empire Art Metal Co.; Arthur Johnson Mfg. Co.; Dodge Mfg. Co.; Valentine & Co.; Zenith Carbureter Co.; Wellington, Sears & Co.; John A. Roebling's Sons Co.; Eastman Kodak Co.; Motor Compressor Co.; Gold Light Mfg. Co.; Livingston Radiator Co.
American Balsa Co.; Jones Motrola Co.; Champion Ignition Co.; Dayton Eng. Lab. Co.; Ajax Auto & Sheet Metal Co.; Stone Propeller Co.; Splitdorf Electrical Co.; National Cash Register Co.; Jamestown Propeller Co.
American Propeller & Mfg. Co.; Hartzell Walnut Propeller Co.; Dayton Wire Wheel Co.; Lukenheimer Co.; General Ordnance Co.
Society of Automobile Engineers; Gardner-Moffat Co., Inc.; Torrington Co.; Goodyear Tire & Rubber Co.; Simms Magneto Co.; Triplex Safety Glass Corp.; Radium Dial Co.

More Men Hired Than Laid Off In Detroit

DETROIT, Feb. 6—The crisis in the labor situation in Detroit has passed. This week more men were hired than were laid off. Over 1000 men have been given employment, while those losing jobs numbered less than 800.

More men were made idle last week than during any other week in recent years. The American Car & Foundry Co. laid off 6000, Lincoln Motor Co. 500, while the Chalmers Motor Co. laid off its entire night shift due to completion of large Government contracts.

There are at present about 35,000 men idle in Detroit. The soldier situation seems to be taking care of itself. Eighty per cent of the men in uniform who registered with the U. S. Employment Office have been placed at work. A feature of the labor situation of late is a noticeable exodus of foreigners. In many local plants foreigners without full citizenship papers are being laid off and their jobs given to soldiers.

Contract Bill Before House

WASHINGTON, Feb. 11—The long pending bill for validation and settlement of informal war contracts aggregating $3,000,000,000, in which automotive manufacturers are interested to the extent of more than $300,000,000, was agreed upon to-day by the Conference Committee and was placed before the House for final action. The Senate passed the bill last week.

The agreement reached by the Senate and House conferees eliminates the section providing for an appeals commission, and also the McKellar amendment, which would have required War Department officials settling the contracts to make affidavits that they were not connected with any firm or had no personal interest in the contracts under settlement. Otherwise the bill is substantially the same as that passed by the Senate and published in AUTOMOTIVE INDUSTRIES last week.

Under the conference agreement, informal contracts, which include those not legally executed, are legalized so that they may be settled. Government officials will make the settlement and if dissatisfied, contractors may appeal to the Federal Court of Claims.

Herschell-Spillman Reorganized

NORTH TONAWANDA, N. Y., Feb. 12—The Herschell-Spillman Co. has been reincorporated under laws of Massachusetts with a capitalization of $1,750,000 and has taken over all the assets and property of the old company. Plans for extending the plant and increasing production are under consideration. B. W. Birdsall is president and general manager of the new company and associated with him are: Vice-president and chief engineer, E. O. Spillman; treasurer, Thomas C. Perkins; assistant treasurer and secretary, M. J. Tovell. The directors are T. J. Wilson, chairman; E. O. Spillman, Guy White, F. R. Switzer, Thomas C. Perkins and B. W. Birdsall.

Army Bill Abolishes M. T. C.

Pooling Inefficient and Standardization Lost Under New Bill—Operation and Maintenance Scattered

WASHINGTON, Feb. 12—The Army Appropriation Bill providing for 28,579 officers and 509,909 enlisted men, appropriating $1,117,289,488.56, orders the repeal of the Overman Act under which the Motor Transport Corps, Tank Corps and Aviation Corps were created for the emergency, and by its provisions abolishes the Motor Transport Corps and Tank Corps completely.

The aviation departments, both military and production, are recommended for continuation. The bill provides for the purchase, operation and maintenance of motor trucks and other motor vehicles by each individual army corps, such as the Engineers, Quartermaster, Ordnance and Signal Corps, and thereby reverts back to that condition which existed prior to the war, when the motor transport was not pooled and when each division purchased different types and sizes of vehicles, creating waste, confusion, extravagance and inefficiency, which finally resulted in the creation of a Motor Transport Corps for the purpose of pooling motor vehicles under one body.

Hearings of the House Military Affairs Committee which prompted this act have not been made public, and consequently causes are not available for publication at present.

It is thought in official circles here that either a vital omission was made accidentally on the part of the House Military Affairs Committee in thus scattering the purchase, operation and maintenance of motor vehicles throughout the army or that possibly some influence has brought

(*Continued on page* 395)

Naval Aviation Approved

WASHINGTON, Feb. 12—The House of Representatives yesterday passed the big Naval Appropriation Bill which includes appropriations for $25,000,000. This sum is for producing, constructing and operating and maintaining aircraft, aircraft stations, aircraft fields and experimental work. No more than $300,000 can be disbursed for drafting, inspection and messenger service for aircraft stations. No part of this appropriation can be expended for the maintenance of more than six heavier-than-air stations on the coasts of continental United States.

Automotive Industries

War Revenue Bill Passes

Measure Taxing Automotive Products Now Goes Before Congress for Approval

WASHINGTON, Feb. 7—The 1919 revenue bill, taxing passenger cars, motor trucks, tires, accessories, parts, truck express and taxicabs, among its numerous provisions, was agreed upon yesterday by the conferees and now comes before Congress for approval. It is anticipated that the bill will be passed promptly as it stands.

The provisions include a tax of 3 per cent on motor trucks, trailers and the equipment, including tires, tubes and other parts; 5 per cent on passenger cars and all other automobiles, including equipment, excepting on tractors, which are not taxed, and 5 per cent on tires, inner tubes, parts and accessories made for automobiles and sold to any person other than an automobile manufacturer. The floor tax on parts originally included is now eliminated. A tax of 1 cent for each 10 cents is assessed on tickets of admission and applies to automobile or parts shows held during the year.

Taxicabs, which includes all automobiles that carry passengers for hire, will pay a tax of $10 with a seating capacity of 7 or less and $20 for those machines with a capacity for more than 7 persons.

The tax of 3 per cent on motor truck haulage where it competes with rail or water transportation of freight remains in the bill, and in addition there is included a tax of 1 cent for each 20 cents paid for motor truck express where it competes with rail or water express, and 8 per cent of the transportation fee for carrying of passengers by motor truck, passenger car or motorcycle when it is in competition with rail or water carriers.

Following are excerpts from the bill, including those provisions most important to the automotive industries:

Sec. 800—That there shall be levied, assessed, collected and paid in lieu of the taxes imposed by section 700 of the Revenue Act of 1917:

(1) A tax of 1 cent for each 10 cents or fraction thereof of the amount paid for admission to any place on or after such date, including admission by season ticket or subscription, to be paid by the person paying for such admission.

Sec. 900. That there shall be levied, assessed, collected and paid upon the following articles sold or leased by the manufacturer, producer, or importer, a tax equivalent to the following percentage of the price paid for which so sold or leased:

(1) Automobile trucks and automobile wagons, including tires, inner tubes, parts and accessories therefor, sold on or in connection therewith or with the sale thereof, 3 per centum;

(2) Other automobiles and motorcycles, including tires, inner tubes, parts and accessories therefor, sold on or in connection therewith or with the sale thereof, except tractors, 5 per centum;

(3) Tires, inner tubes, parts or accessories for any article enumerated in sub-division (1) or (") sold to any person other than a manufacturer or producer of any of the articles enumerated in sub-division (I) or ("), 5 per centum.

Sec. 1000. That on and after July 1, 1918, in lieu of the tax imposed by the first subdivision of section 407 of the Revenue Act of 1916:

(II) Persons carrying on the business of operating or renting passenger automobiles for hire shall pay $10 for each such automobile having a seating capacity of more than 2 and not more than 7, and $20 for each such automobile having a seating capacity of more than 7.

Sec. 500—That from and after April 1, 1919, there shall be levied, assessed, collected and paid in lieu of the taxes imposed by section 500 of the Revenue Act of 1917:

(*Continued on page* 390)

Provisions in the Revenue Bill

Three per cent tax on motor trucks and trailers.
Five per cent tax on passenger cars.
Five per cent tax on tires, parts, accessories and inner tubes.
Ten per cent tax on shows.
Ten dollars annual tax on taxicabs seating 7 or less.
Twenty dollars annual tax on taxicabs carrying more than 7 persons.
Three per cent of transport cost for freight by truck in competition with rail or water.
Five per cent of transport cost for express by truck or passenger car in competition with rail or water.
Eight per cent of transport fee for carrying passengers by truck, passenger car or motorcycle in competition with rail or water.

Continue Rebating Duty on Tractors Valued Under $1,400

OTTAWA, Feb. 10—The Canadian Government has decided to renew the Order-in-Council passed on Feb. 7, last year, rebating the duty on tractors valued at $1,400 and under. These tractors, while practically coming in free, are not on the free list, the duty simply being remitted. The order will be renewed for an indefinite period.

Since duty on tractors of the value specified was removed, over 10,000 of that variety entered the Dominion, and the amount of duty rebated approximated over $2,000,000 for the fiscal year 1916-17. Only about 2000 of all kinds of tractors entered the Dominion previously.

Jobbers Not Guilty of Restraint

21 Members of Automotive Equipment Assn. Freed from Charges

NEW YORK, Feb. 11—The twenty-one members of the Automotive Equipment Association, formerly the National Association of Automobile Accessory Jobbers, and about half as many corporations, have been freed from all charges of monopoly and restraint of trade under the Sherman Law by the jury in the United States District Court for the Southern District of New York. Indications now are that the association will go forward into a successful future. Its growth and activity have been somewhat restricted during the year and a half that the trial has been pending.

The Sherman Law charge has caused the association to be a mysterious quantity in the trade since the finding of the indictment, Aug. 30, 1917. Prospective members have hesitated to join, not knowing what the status of the organization would be.

Judge Hand, in charging the jury, touched on most of the operative resolutions of the association, and stated that of themselves they were not restraint of trade, and that they meant little unless there were some ulterior intent proven.

The association successfully contended that it is not a price-fixing organization and has no monopolistic ambitions. Realizing, however, that some of its motives have been misconstrued, the organization now proposes to give a more definite understanding of its ideals with the object of continuing the trade betterment work it has been doing since its beginning.

The defense used only three witnesses, ex-Presidents Sidney F. Beech, T. M. Brooks and Charles E. Feath, each of whom explained the trade work the association has attempted to perform. Chief among the witnesses for the prosecution were syndicate catalog men, purchasing agencies and others who have had differences with the association's members.

Olds Building 100 Cars Daily

LANSING, Feb. 10—The Olds Motor Works is rapidly swinging into full production with 100 cars and 40 trucks daily. Passenger car production will be run up to 150 machines within 60 days and the daily truck output is being increased.

Rubber Imports 45% of Jan., 1918

Quantity Is Less Than for Same Month in Last Four Years

NEW YORK, Feb. 11—Importations of crude rubber into the United States during January, 1919, amounted to 7235 tons, as against 16,084 tons for January, 1918, and 11,292 tons for December last. This is also less than the imports for any one month during the past year except September and November, during which there were heavy restrictions on raw rubber importation. The present low import figure may be due to the fact that shipping space at the present time is limited for commercial products.

The following statistics for the month of January for four years have been compiled by the Rubber Association of America:

	1916 Tons	1917 Tons	1918 Tons	1919 Tons
January....	9,162	12,788	16,084	7,235

Labor Surplus Grows

WASHINGTON, Feb. 10—The surplus of labor in the United States is increasing rapidly, according to the U. S. Employment Service of the Department of Labor. Twenty-six states reported a surplus for the week ended Jan. 25, which is an increase of 19 states since Dec. 21.

More than 210,000 workers were unemployed according to reports received last week, while the current week shows a total of 265,000. The number of cities reporting surpluses has increased from 44 to 50 per cent. The number of cities reporting shortages decreased 1 per cent.

Cleveland, with 65,000 surplus, an increase of 10,000 for the week; Detroit, 33,000, as against 20,000 three weeks ago, and Buffalo, with 17,000 surplus, are the three cities reporting the largest surpluses. Akron reports 1500, Dayton 8000 and Toledo 9000 surplus. Reports of surplus workers are also received from California, New York, New England and through the Middle West. Slight shortages are reported from the South.

The total labor shortage of the 18 cities reporting shortages aggregates but 15,000.

The belt of unemployment, beginning in Illinois, extends east through Indiana, Ohio, along the lakes to Buffalo, up into and through Massachusetts; then south along the Atlantic seaboard to Florida and back toward Illinois through Tennessee and Virginia, skipping almost completely the State of Kentucky.

Two New Nash Models

KENOSHA, WIS., Feb. 10—The Nash Motors Co. has added two models to its line. These are a four-passenger model and a two-passenger roadster. It is expected that first deliveries will be made early in May. The four-passenger model has four doors and is built on a chassis with 121-in. wheelbase, the body having the popular beveled edge. Fenders and running gear are black with nickel plated trimmings. Stock equipment includes wire wheels equipped with cord tires.

War Revenue Bill Passes

(*Continued from page* 389)

(a) A tax equivalent to 3 per centum of the amount paid for the transportation on or after such date, by rail or water or by any form of mechanical motor power when in competition with carriers by rail or water, of property by freight transported from one point in the United States to another; and a like tax on the amount paid for such transportation which the United States or property transported from a point without the United States to a point within the United States;

(b) A tax of 1 cent for each 20 cents or fraction thereof of the amount paid to any person for the transportation on or after such date by rail or water or by any form of mechanical motor power when in competition with express by rail or water of any package, parcel or shipment by express, transported from one point in the United States to another; and a like tax on the amounts paid for such transportation within the United States of property transported from a point without the United States to a point within the United States;

(c) A tax equivalent to 8 per centum of the amount paid for the transportation on or after such date of persons by rail or water or by any form of mechanical motor power on a regular established line when in competition with carriers by rail or water from one point in the United States to another or to any point in Canada or Mexico where the ticket or order therefor is sold or issued in the United States, not including the amount paid for commutation or season tickets for trips less than 30 miles or for transportation the fare for which does not exceed 42 cents: provided that where such water transportation lines are in competition between American ports with foreign water transportation lines from adjacent foreign ports, the tax imposed under this subdivision of amounts paid for water transportation between American ports shall not exceed the amount of the transportation tax to which such foreign water transportation lines are subjected by their government corresponding to this tax.

Edmunds & Jones Corp. Has $737,319 Surplus

DETROIT, Feb. 11——For the year ending Dec. 31, the balance sheet of the Edmunds & Jones Corp. and its subsidiaries shows a surplus of $737,319, a decrease of $33,721 over 1917. Comparative figures for the two years follow:

Assets	1918	1917
Real estate, plants, machinery, etc., less reserves	$839,899	$833,083
Patents	1	1
Liberty bonds and other investments	92,619	21,200
Cash on hand and in banks	110,828	47,535
Accounts receivable	208,759	414,228
Inventories	677,834	852,814
Deferred charges	43,451	27,451
	$1,973,392	$2,196,312
Liabilities		
Accounts payable	$331,381	$421,699
Preferred stock	897,500	916,000
Reserve for income and war taxes	6,699	87,573
Uninvested balance of reserve for redemption of preferred stock	492	......
Surplus — Representing value of 40,000 shares common stock without par value, subject to payment of dividends on preferred stock	737,319	771,040
	$1,973,392	$2,196,312

The annual directors' meeting and the election of officers for the year will take place in about 10 days.

G.M.C. 1918 Surplus $29,940,780

$18,432,388 Increase Over 1917—The Net Profits Were $19,376,782

PONTIAC, Feb. 10—According to the balance sheet of the General Motors Corp. and subsidiary companies, including five months' operation of Chevrolet, for the 12 months ending Sept. 30, 1918, as compared with that for the 12 months ending Dec. 31, 1917, there is an increase of $18,432,388 in the company's surplus for 1918. The complete statement for the two years is as follows:

Assets	Sept. 30, 1918	Dec. 31, 1917
Real estate, plants, equipment, etc.	$76,144,354	$38,657,835
Good will	......	11,697,503
Patents, agreements, etc.	245,300	274,100
Investments in allied companies	9,158,730	2,030,273
Cash	23,335,327	18,865,645
Marketable securities	......	1,255,000
Liberty bonds	10,804,273	......
Notes and accounts receivable	23,483,734	13,595,538
Inventories	63,864,702	46,559,394
Deferred expenses	1,216,057	854,435
	$208,252,477	$133,789,724

Liabilities	Sept. 30, 1918	Dec. 31, 1917
Preferred stock	$19,684,300	$19,676,800
Common stock	105,996,400	76,873,300
Subsidiary companies' stock and surplus not owned by G. M. Corp.	1,732,339	1,399,583
Accounts and bills payable	13,252,659	10,665,718
Taxes, payroll, etc.	6,253,431	4,858,326
Preferred dividend payable	196,843	196,768
Reserve for depreciation, federal taxes, contingencies, etc.	31,195,725	8,610,936
Surplus	29,940,780	11,508,392
	$208,252,477	$133,789,724

Net profits, after expenses, taxes, depreciation, etc., were deducted, amounted to $35,718,459. After Federal taxes and other expenditures were made, the remaining net profit was $19,376,782. The amount held for outside shareholders was $332,756, the General Motors proportion being $19,044,026. Preferred dividends amounted to $885,769 and undivided profits to $18,158,257. The profit and loss surplus on Jan. 1, 1918, was $11,508,392, with the addition of $8,065,083 through the acquisition of Chevrolet assets on May 2, 1918. With the undivided profits of $18,158,257, the total was $37,731,732. Deducting the common dividend of $7,790,952, the profit and loss surplus amounted to $29,940,700.

New York Branch for Beckley-Ralston

CHICAGO, Feb. 11—The Beckley-Ralston Co. will shortly open a New York branch at 238-240 West Fifty-fourth Street. The branch is to be headed by James A. Abeles, who has resigned as vice-president and general manager of the Motor Car Equipment Co., New York, and disposed of his interests in that company to take up the new work.

Ford Must Distribute $19,000,000, But May Build Smelting Plant

Michigan Supreme Court Affirms Former Ruling for Distribution to Stockholders—Reverses Decision in Favor of Ford Expansion—Ford-Dodge Case Settles Three Important Points in Michigan Law

LANSING, Feb. 8—The Michigan Supreme Court Friday decided the famous legal action between John and Horace Dodge on one hand and Henry Ford and the Ford Motor Co. on the other. The decision is split, but Mr. Ford carries off the lion's share of the legal score, getting two points to the Dodges' one.

Special dividends, amounting to $19,000,000 were ordered paid to Ford stockholders by Judge Hosmer in the Wayne County Court, and this decree was affirmed. The higher court held that Mr. Ford was arbitrarily usurping the powers of the majority of stockholders, and was in substance making the rights and privileges of the other stockholders incidental to his altruistic plan to let the public have the benefit of company profits in a lower price for automobiles.

Decrees of the Wayne County Courts stopping expansion of the business of the Ford Motor Co. in its extensive smelting plant at River Rouge were overruled. In addition the court sustained the contention of Mr. Ford that the laws of Michigan, when they stop organization of a corporation for over $50,000,000, mean for organization purposes only.

Capital investments, such as the profits, borrowed money, are not controlled by the law limiting capitalization, according to the Supreme Court.

The Court assessed one-third of the cost of the case to Mr. Ford and two-thirds to Dodge Brothers.

The opinion was written by Justice Russell C. Ostrander. It consists of 20,000 words, and quotes at length from the briefs submitted by the attorneys on both sides, from the testimony, from newspaper interviews accredited to Mr. Ford and from letters which passed between the parties at litigation before the actual litigation began.

The case is of great importance to the State at large. It decides three important and perplexing points in Michigan law. These points were the backbone of the case. They are:

1—The rights of minority stockholders in a Michigan corporation.

2—The question whether an automobile company is going beyond the power granted it in the general manufacturing charter by the state, when it engages in the smelting of iron ore for automobile parts.

3—It interprets the meaning of "capital" in the Michigan law which puts a limit of $50,000,000 on a corporation's capitalization.

As to the first point, the court holds that the board of directors of a company must conduct the affairs of the company with the primary object to make money for the stockholders. When, however, the directors, dominated by the majority of the stockholders, apparently operate the corporation for purposes other than making money for the stockholders, they can be and ought to be stopped. They are entitled to retain a reasonable surplus, but when they try to take the profits belonging to the minority stockholders and put them to some other use, they are violating the rights of the minority and the courts can stop them.

Expansion of the business as proposed by Mr. Ford in his smelting plant, however, must not be considered as "some other use," for that expansion is held to be good business.

On the rights of Dodge brothers as stockholders, Justice Ostrander writes:

"It is the contention of the plaintiff (Dodge Brothers) that the apparent effect of the plan (the profit sharing plan with the public) is intended to be continued, and that it is deliberately proposed, not of record, and not by official corporate declaration, but nevertheless proposed, to continue the corporation henceforth as a semi-eleemosynary institution and not as a business institution. In support of this contention they point to the attitude and expressions of Henry Ford.

"Henry Ford is the dominant motor company. No plan of operation could be adopted unless he consented and no board of directors can be elected whom he does not favor. One of the directors of the company has no stock. One share was assigned to him to qualify him for the position, but it is not plain that he owns it.

"The records and especially the testimony of Mr. Ford convince that he has to some extent the attitude toward shareholders of one who has dispensed and distributed to them large gains and that they should be content to take what he chooses to give. His testimony creates the impression, also, that he thinks the Ford Motor Co. has made too much money, has had too large profits and that although large profits might still be earned, a sharing of them with the public, by reducing the price of the output of the company, ought to be undertaken.

"We have no doubt that certain sentimental, philanthropic and altruistic motives creditable to Mr. Ford had large influence in determining the policies to be pursued by the Ford Motor Co., the policy herein referred to.

"There should be no confusion (of which there is evidence) of the duties which Mr. Ford conceives that he and the stockholders owe to the general public and the duties which in law he and his co-directors owe to protesting minority stockholders.

"A business corporation is organized and carried on primarily for the profit of the stockholders. The powers of the directors are to be employed for that end. As we have pointed out, and the proposition does not require argument to sustain it, it is not within the lawful powers of a board of directors to shape and conduct the affairs of a corporation for the merely incidental benefit of shareholders and for the primary purpose of benefiting others, and no one will contend that if the avowed purpose of the defendant directors was to sacrifice the interest of the shareholders, it would not be the duty of the courts to interfere."

That section of the opinion which relates to the smelting works and in which Mr. Ford's plan for that are approved, does not lay down the flat law that an automobile manufacturing concern may go the limit from the transition of the varied raw material into the finished product, but it certainly leans that way. The court, however, notes that there must be special cases where such an argument could be stopped.

Claims Board Created to Settle War Contracts

WASHINGTON, Feb. 10—A War Department Claims Board has been created by the Secretary of War to supervise and co-ordinate the work of the various War Department agencies engaged in the settlement of claims resulting from the termination of contracts or other procurement obligations made necessary by the suspension of hostilities, and to authorize and approve such settlements. Through special representatives of the board, sitting with the various bureau boards of contract adjustment, the adjustments of the bureaus are subject to its scrutiny and approval. Adjustments involving matters of policy and of particular difficulty and importance are brought before the full board for decision.

The members of the War Department Claims Board are: President, Benedict Crowell, Assistant Secretary of War and Director of Munitions; G. H. Dorr, Assistant Director of Munitions; Brig.-Gen. George W. Burr, Assistant Director of Purchase, Storage and Traffic; Brig.-Gen. Herbert M. Lord, Director of Finance; Lieut.-Col. Herbert H. Lehman, Assistant to the Director of Purchase, Storage and Traffic.

Special members of the board are: W. H. Davis, for Ordnance Department contracts and obligations; Col. C. A. McKenny, for contracts and obligations of the Purchase and Storage Division; Major H. L. Goodhart, for contracts and obligations of the Chemical Warfare Service, Medical Corps and Signal Corps. Other special members may be appointed by the president of the board when necessary in connection with other procurement bureaus or agencies of the War Department.

Civilian Fliers Require Permits

WASHINGTON, Feb. 10—Civilians will not be permitted to make flights in the Army airplanes, despite the cessation of war activities, without authority from the Secretary of War, according to orders issued to-day by Major General William L. Kenly, Division of Military Aeronautics.

Hartford Automotive Parts Combines Two Companies

HARTFORD, Feb. 10—Negotiations have been consummated for the consolidation of the Hartford Auto Parts Co. and the Kinsler-Bennett Co., both manufacturers of universal joints and drives. The new company has been incorporated under the name of Hartford Automotive Parts Co., with a capital of $1,500,000. To provide additional manufacturing facilities it has purchased the plant formerly occupied by Billings & Spencer Co., and has taken possession. No change in management is contemplated other than a consolidation of the personnel of those identified with the former companies, and the association of Hollister, White & Co., bankers of Boston, who have a financial interest in the new company. James M. Carney, formerly of the Hartford Auto Parts Co., becomes chairman of the board of the new company, and the following are the officers: President, J. McA. Johnson; vice-president, F. R. Switzer; treasurer, H. A. Bigelow; assistant treasurer, T. C. Hudson. The directors include the above and H. A. Allen of the City Bank & Trust Co., and Shires Morris, president of Hart & Hegeman Co.

To Build a New Truck

NEWARK, OHIO., Feb. 11—The American Motor Truck Co., a new corporation, is making and will place a new truck on the market within sixty days. The new machine will be made in two sizes, a 1½-ton and a 2-ton machine. Later, a 3½- and a 5-ton truck will be produced, but not before the first of next year. The company will produce 300 trucks this year, the majority of which have already been sold. About a year ago this company purchased the assets of the Blair Motor Truck Co., but it will not make the truck manufactured by the Blair people in the past. Since incorporation, the American Motor Truck Co. has been running 20 hours daily on two-men tanks for the Government. This contract was recently cancelled and the company is now busy tearing out Government machinery and equipping the plant throughout for truck work. The officers of the new concern are: President, J. D. Potter; vice-president and production manager, E. B. Alspach; secretary and treasurer, H. S. McCoy; chief engineer, C. H. Doty, superintendent, H. E. Cavendish.

Henry Vice-President of Maxim Munitions

NEW YORK, Feb. 12—H. H. Henry has been made vice-president and general manager of the Maxim Munitions Corp., 120 Broadway. He was formerly president of the Dart Motor Truck Co., Waterloo, and came East only a few days ago to direct the work of merchandising Maxim tractors along the Atlantic seaboard and abroad.

Trippensee Buys Wolverine Plant

DETROIT, Feb. 11—The Trippensee Mfg. Co., makers of automobile bodies, has bought the plant of the Wolverine Mfg. Co. The property covers 6½ acres with 250,000 ft. floor space with two railroad sidings. The company has already taken possession and it is understood they will commence production at once on closed body work, providing employment for 1600 men.

Harroun Plans for 1919

DETROIT, Feb. 10—The Harroun Motors Corp. is back to 100 per cent peace time production and plans during February to turn out 200 cars, then 500 and gradually increase the number during the spring and summer until the maximum output is reached. The plant is able to make 250 engines and assemble an equal number of cars per day, double shift. The Harroun plant finished its manufacture of shells for the Government on Jan. 31.

Harroun activity for the Government in November showed that 90 per cent of the plant was devoted to shells, 5 per cent to class B truck engines and 3 per cent to Fordson tractors. The whole plant was working on 10,000 tractor shoes, the creeping caterpillar type of walking shoe used as a tread on the wheels of the Government 6-ton tractors. Production of these tractor shoes was about 700 a day. Of the contract for 10,000 cylinder water heads for Fordson tractors, 5000 were turned out on an average of over 100 per day. Notwithstanding Government work, the Harroun plant was able to make 2400 cars from parts on hand.

This concern desires to manufacture its car complete in its own plant as far as possible, and is seeking a body plant, a transmission plant, a universal joint plant and an axle plant, which, when combined with the present plant, will include all the major units necessary for the manufacture of Harroun cars.

Reliance Reorganizes Directorate and Personnel

APPLETON, Feb. 10—The Reliance Motor Truck Co. has reorganized its directorate and official personnel. John M. Balliet, Appleton, has been elected president and general manager, succeeding Ira L. Miller, Racine, who has retired. M. Weyenberg succeeds Mr. Balliet as vice-president. T. F. Purtell, secretary, also has resigned and is succeeded by A. G. Brusewitz, who has been county highway commissioner at Appleton. August Brandt is an additional director. Its new $75,000 plant has been placed in full operation and is manufacturing trucks as well as the former Piggins internal spur-gear drive rear axle for trucks.

Truck and Tractor Engine Governors

(*Continued from page* 375)

equalize this pressure. This offset is governed by the size, angle and gas velocity, but is generally about 1/32 in.

Fig. 7 shows a particular type of disk brought out by one of the large engine manufacturers and serves the same object as offsetting the butterfly stem. The angle on the right is 17 deg. and the left is 25 deg.

There are other types, such as piston valves, gate valves, plates, grids, etc. The piston valve may be balanced but the other types impose more or less extra load on the governor, due to the force of incoming gases. The butterfly valve seems to have the call, as it is serviceable, easily manufactured and installed.

We have now considered some of the elements of a governor. Fig. 8 shows one of the most recent tractor governor designs. This is a very compact, efficient governor, equipped with a simple speed changing device and a spindle spring instead of the double springs frequently used. The governor works through a circular rack and pinion instead of the typical sliding collar.

Fig. 9 shows a complete governor and governor valve installation, as used by one of the largest tractor manufacturers. The weight yoke is bolted directly to the camshaft and the weights operate the spindle *O*, which actuates the governor arm *E*. The casing *F* is bolted to the motor housing and all parts are lubricated from the crankcase. The speed changing device is shown at *J*. The manual control is shown at *W* and is spring mounted.

Commerce Back in Commercial Work

DETROIT, MICH., Feb. 11—The Commerce Truck Co. is winding up its war contract work and is now running approximately 50 per cent on commercial production. Uncompleted Government contracts call for 300 war trucks, but these will be completed within 30 days. This company is now running 15 commercial trucks daily.

Roamer to Make 2000 in 1919

KALAMAZOO, Feb. 11—The Barley Motor Car Co. has been running normal capacity for thirty days, and expects to increase its production 200 per cent within the next months. Four machines are turned out daily. The 1919 production schedule calls for 2000 machines.

Seymour Buys Eisemann

BROOKLYN, N. Y., Feb. 12—The Eisemann Magneto Co. has been sold by the Alien Property Custodian to the Seymour Mfg. Co., Seymour, Conn. This company has been a factor in the brass casting field. It acquires 1500 of the 2000 shares in the Eisemann company, the remaining 500 being retained by R. Kny, president of the Eisemann company. Though nothing definite has been made public regarding the plans of the Seymour company, it is understood that the Eisemann business will be continued.

Airplane Show for Chicago

CHICAGO, Feb. 11—Chicago will hold its first airplane show at the Coliseum, March 29 to April 5. Louis Disbrow is the promoter. He and George W. Browne, Wisconsin distributer for Willys-Overland and distributer in Wisconsin and Illinois for Curtiss, have formed the International Airplane Exposition Co., and may put on similar shows elsewhere. Four Curtiss planes are promised for exhibition. Bart J. Ruddle of Milwaukee, will manage the show.

Mile Record for De Palma

NEW YORK, Feb. 12—Ralph De Palma is reported to have set up a new record for a straight-away mile on Daytona Beach, covering the distance in 24.02 seconds, which is at the rate of 148.875 m.p.h. The kilometer is reported to have been covered in 15.86 seconds. The Contest Board of the American Automobile Association officially observed the trails, but has not yet received confirmation of the time.

Moon Motor Car President Dies

ST. LOUIS, Feb. 12—Joseph W. Moon, president of the Moon Motor Car Co., died last night after a year's illness from hardening of the arteries. He was born in Brown County, Ohio, 66 years ago. In 1882, he came to St. Louis, and, with his brother, J. C. Moon, organized Moon Bros. Carriage Co. Ten years later he formed the Joseph C. Moon Buggy Co., of which he was head. At the time of his death he was also vice-president of the Scheler Implement Co.

197 Exhibitors for Kansas City

Sixty-six Tractors, 131 Accessories Take Space for National Tractor Show

KANSAS CITY, Feb. 10—Arrangements for the National Tractor Show to be held here during the week of Feb. 24 to March 1 are rapidly taking shape, and it is expected that the exhibition will draw a record attendance.

At this time 66 manufacturers of tractors and 131 manufacturers of accessories of various kinds have signed up for space. The following is a partial list of tractor and accessory exhibitors:

Tractors at Kansas City

Acme Harvesting Machine Co.........Peoria
Acme Harvesting Co............Kansas City
Advance Rumely Thresher Co...Kansas City
Advance Rumely Thresher Co.......LaPorte
Allis-Chalmers Mfg. Co...........Milwaukee
Aultman-Taylor Machinery Co.....Mansfield
Aultman-Taylor Machinery Co..Kansas City
Avery Co. ....Peoria
Automotive Corporation......Ft. Wayne, Ind.
Bethlehem Motors Co.............Allentown
Bull Tractor Co..................Minneapolis
J. I. Case Plow Works................Racine
J. I. Case T. M. Co.............Kansas City
Bentley Sales Co................Kansas City
J. I. Case T. M. Co....................Racine
Cleveland Tractor Co..............Cleveland
Coleman Tractor Co............Kansas City
Craig Tractor Co....................Cleveland
Culto Tractor Co.......................Detroit
Dayton Dick Co........................Quincy
Dart Truck & Tractor Co...........Waterloo
Dougherty Motor Co., H. A......Kansas City
P. J. Downes Motor Co........Kansas City
Electric Wheel Co....................Quincy
Emerson-Brantingham Imp. Co.....Rockford
Emerson-Brantingham Imp. Co.Kansas City
Farm Tractor Sales Co.............Kansas City
The Frick Co...............Waynesboro, Pa.
General Motors Co..............Kansas City
Gray Tractor Co..................Minneapolis
Hart-Parr Tractor Co..........Charles City
Henry Ford & Son..................Dearborn
Holt Mfg. Co...........................Peoria
Howard Motors Co.............Kansas City
Huber Mfg. Co.........................Marion
Illinois Silo & Tractor Co.......Bloomington
International Harvester Co............Chicago
Janesville Machine Co..............Janesville
John Deere Plow Co...................Moline
John Deere Plow Co..............Kansas City
John Lauson Mfg. Co..........New Holstein
Kansas City Hay Press Co......Kansas City
Kansas Moline Plow Co..........Kansas City
Kauffman-Parrett Co............Kansas City
Kinnard & Sons Mfg. Co.........Minneapolis
LaCrosse Tractor Co..................LaCrosse
Liberty Tractor Co.................Minneapolis
Minneapolis Steel & Mach. Co...Minneapolis
Moline Plow Co.........................Moline
National Tractor Co............Cedar Rapids
Nilson Tractor Co..................Minneapolis
G. T. O'Maley Tractor Sales Co..Kansas City
Parrett Tractor Co....................Chicago
Port Huron Engine & Thresher Co. Port Huron
Rock Island Implement Co.......Kansas City
Rock Island Plow Co........Rock Island, Ill.
The Russell Co.....................Massillon
E. G. Staude Mfg. Co............Minneapolis
E. G. Staude Mfg. Co............Kansas City
Simplex Spreader Co............Kansas City
Trite Tractor Co...................Minneapolis
Turner Mfg. Co......Port Washington, Wis.
Velie Motors Corporation.............Moline
Wallis Tractor Co....................LaCrosse
Wichita Tractor Co...................Wichita
Wisconsin Farm Tractor Sales Co., Madison

Accessories

B. F. Avery & Sons Plow Co....Kansas City
LaCrosse Plow Co..................LaCrosse
Oliver Chilled Plow Co..........South Bend
Parlin & Orendorff Plow Co..........Canton
Roderick Lean Mfg. Co............Mansfield
South Bend Chilled Plow Co.....South Bend
The Vulcan Plow Co..............Evansville
Columbian Steel Tank Co.......Kansas City
C. A. S. Engineering Co..............Detroit
Link Belt Co...........................Chicago
McCord Mfg. Co........................Detroit
Modine Mfg. Co.........................Racine
Oakes Co. ....Indianapolis
Perfex Radiator Co.....................Racine
Vacuum Oil Co.........................Chicago
Gurney Ball Bearing Co............Jamestown
Hyatt Roller Bearing Co.............Chicago
Lumen Bearing Co......................Buffalo
S. K. F. Administrative Co., Inc...New York
Timken Roller Bearing Co..............Canton
Standard Parts Co.....................Cleveland
U. S. Ball Bearing Mfg. Co..........Chicago
Buda Co.................................Harvey
Climax Engineering Co...............Clinton
Hercules Motor Co......................Canton
Toro Motor Co......................Minneapolis
Traction Engine Co.................Boyne City
H. J. Walker Co.....................Cleveland
Waukesha Motor Co..................Waukesha
American Manganese Steel Co.......Chicago
Balso Oil Co................Council Bluffs, Ia.
Bates Oil Co...................Council Bluffs
Bosch Magneto Co.................New York
Byrne Kingston Co.....................Kokomo
Carnegie Steel Co...................Pittsburgh
Champion Spark Plug Co.............Toledo
Diamond Chain Co................Indianapolis
Double Seal Ring Co.............Kansas City
Eisemann Magneto Co...............Brooklyn
The Fulton Co........................Knoxville
K. W. Ignition Co....................Cleveland
Indiana Silo Co..................Kansas City
McQuay-Norris Mfg. Co............St. Louis
Monarch Mfg. Co................Council Bluffs
Mutual Oil Co....................Kansas City
National Refining Co............Kansas City
Norma Co. of America..............New York
R. D. Nuttall Co.....................Pittsburgh
Remy Electric Co.......................Chicago
Splitdorf Electrical Co...............Chicago
Standard Oil Co..............................
Sinclair Refining Co............Kansas City
Tide Water Oil Co....................New York
U. S. Graphite Co.....................Saginaw
Willard Storage Battery Co........Cleveland
Geuder, Paeschke & Frey Co.....Milwaukee
H. R. Mosler Co...........Mt. Vernon, N. Y.
Agrimotor Magazine ....Chicago
Automotive Export Corporation....New York
Clarke Publishing Co..................Madison
The Capper Publications.............Topeka
The Chilton Co....................Philadelphia
The Farm Implement News..........Chicago
Implement & Tractor Trade Journal, Kansas City
National Farm Power..................Chicago
Sweeney Automobile & Tractor School, Kansas City
Parlin & Orendorff Plow Co.....Kansas City
Fafnir Bearing Co..................New Britain
American Pulley Co...............Philadelphia
Crew Levick Co....................Philadelphia
Journal of Agriculture...............St. Louis
Grand DeTour Plow Co............Dixon, Ill.
Farm Machinery, Farm Power......St. Louis
Madison Kipp Lubricator Co.......Madison
Universal Lug Co.....................Cicero, Ill.
Baldwin Chain & Mfg. Co..Worcester, Mass.
Beaver Motor Co.................Kansas City
Stowe Supply Co.................Kansas City
Farm & Fireside.....................New York
Joseph Dixon Crucible Co..........New York
W. W. Coates Co.................Kansas City
Oklahoma Farmer Stockman ......Okla. City
Gill Mfg. Co..........................Chicago
Acheson Oil-Dag..................Kansas City
Merchant Evans Co...............Philadelphia
Standard Steel Castings Co.........Clearing
Anderson Forge & Machinery Co.....Detroit
Mechanical Belt Co..................St. Joseph
Wood Brothers Thresher Co......Des Moines
American Fruit Grower................Chicago
The Moto Meter Co..................New York
Foote Bros. Gear & Mchy Co.........Chicago
American Bronze Corporation...Berwyn, Pa.
Dorr Miller Differential Sales Co...New York
Curtis Publishing Co...............Philadelphia
Hillard Clutch Co......................Elmira
Fedders Mfg. Co........................Buffalo
H. C. Doman Co......................Oshkosh
Hathaway Motor Co...............Kansas City
Rolly Carburetor Co....................Detroit
Rahe Automobile School.........Kansas City
The Morgan Corporation, Mfrs.........Chicago
Ajax Auto & Aero Sheet Metal Co..New York
The Sweeney Automobile & Tractor School, Kansas City
Galion Iron Works & Mfg. Co..........Galion
Shelby Truck & Tractor Co..........Shelby
McCord & Co............................Chicago
Tractor & Trailer......................New York
Howard Motor Co..................Kansas City
Tri State Motor Co................Kansas City
Power Farming Press. St.........St. Joseph
C. A. Kessler ....St. Joseph
G. T. O'Maley......................Kansas City
Towers & Sullivan...................Rome, Ga.
Illinois Form-A-Truck Co............Chicago
Rhodes Implement Co..............Kansas City
Society of Automotive Engineers..New York
Bailor Plow Mfg. Co..................Atchison
Mutual Oil Company..............Kansas City
P. & O. Plow Co.:..................Kansas City
Electric Storage Battery Co. of Phila., St. Louis
Taylor Wharton Iron & Steel Co.....Chicago
Indian Refining Co.................Kansas City
Scientific Farming ....Minneapolis
Stromberg Motor Devices..............Chicago
Stover Mfg. Co......................Kansas City
Townsend Mfg. Co...................Janesville
T. E. Bissell Co.......................Lockport
Implement Age ....Springfield
H. D. Lee Mercantile Co........Kansas City

83 French Makers at Lyons Fair

Every Important Maker on List—Little American Representation

PARIS, Jan. 20—Automobile and accessory manufacturers to exhibit at the Lyons samples fair during the first fortnight of March will number eighty-three, according to the final list just published. All these firms will be in one building. The Lyons fair will thus constitute the first automobile show in France since the war.

The list comprises practically every automobile manufacturer of importance in France, including a certain number of newcomers who, before the war, were only indirectly connected with the automobile industry.

There is very little American representation. Goodrich and the United States Rubber Co. will be at the show, and the French agent of the Overland has secured space. Ford does not appear on the official list, but it is believed that its French representative has also reserved space.

It is expected that a number of new cars will be presented at the Lyons fair. The time for preparation is short, but motor men are all working hard to send new types to this exhibition. Where the actual cars cannot be shown, representatives will be on hand to supply information and issue particulars. The fair is open to all but enemy nations.

U. S. Provided 80 Per Cent of Allied Petroleum Requirements

WASHINGTON, Feb. 8—"If you don't keep up your petroleum system we shall lose the war." This cablegram from Marshal Foch, and a later one reading "Highest command informs that position has become so serious that change in military operations will have to be contemplated unless increased deliveries of gasoline at front are made possible," were given out to-day by the United States Fuel Administration as the real causes for the gasoline-less Sundays of the fall of 1918. The gasoline shortage in France, it is said, was so serious that complete alterations of the campaign would have been necessary had it not been for the timely shipments by the United States, which provided 80 per cent of the Allied requirements of petroleum products during the war.

N. A. D. A. New St. Louis Address

ST. LOUIS, Feb. 10—The address of the National Automobile Dealers' Association is now 5124 Locust Street. Business Manager Harry G. Moock moved to his new location Friday.

$2,000,000 Asked for Air Mail Service by Assistant Postmaster General

30 Successful Air Mail Routes in Italy, France, Great Britain, Greece, Denmark, Germany, Spain and Austria—Suggests Boston-Atlanta, New York-San Francisco, Key West-Havana Lines

WASHINGTON, Feb. 10—A request for $2,000,000 for the development and extension of air mail routes in the United States was made by Otto Praeger, Second Assistant Postmaster General, in a letter to Congress. The letter, written as an argument in favor of the $850,500 appropriation for air mail contained in the post office bill now before the Senate, stated that 30 airplane mail routes have already been established and successfully operated in Italy, France, Great Britain, Greece, Denmark, Austria, Norway, Spain and Germany, and that many more are contemplated in those countries.

The first route established in the United States between Washington and New York, states the letter, cost $75,165 to operate in the past year as against a revenue of $60,653. The cost as estimated includes a bookkeeping charge of 6 per cent interest on the investment and 33 1/3 per cent depreciation. It was considered an excellent showing in view of the fact that it was the first experiment, and that the route was short and not between two points of high industrial contact. The route was established, says the letter, "not as a typical commercial line, but to solve the problems that had to be met on a daily dependable schedule."

An appropriation of $2,000,000, it was stated, would allow for the establishment of routes between Boston and Atlanta, New York and San Francisco, Key West and Havana, and other points between these cities by means of feeder lines. The War Department planes, and especially those of the De Haviland type, says the post office, are unsuited for mail work. New planes are needed. This accounts for the large sum asked.

Following is the complete statement:

Memorandum on Aerial Mail Service

January 30, 1919.

The Aerial Mail Service was inaugurated May 15, 1918, and during the first six months of its existence its operations covered 68,892 miles, at a cost of $75,165.94, including 6 per cent on investment and 33⅓ per cent for depreciation. In that period it carried between Washington and New York 7452½ pounds of aeroplane mail. The revenue derived was $60,653.28. The net deficit, not taking into account the 6 per cent interest on investment, was $8,969.08. In addition to the aeroplane mail carried there was dispatched between Washington, Philadelphia, and New York in the six months' period a total of 31,926½ pounds of first-class mail, aggregating 3,667,040 letters. This mail was advanced in dispatch from 6 to 16 hours, which many times made up for the small deficit in operation of this service. This ordinary mail was letter mail from distant States, which was carried in addition to the aeroplane mail. Thus the ordinary mail put on the planes at Washington was usually mail from the South Atlantic Coast States and the Gulf States, distributed to carriers by the Railway Mail Service before reaching Washington, and by reason of aeroplane dispatch was delivered in New York on the same afternoon instead of the following morning.

The Washington-New York route was established not as a typical commercial line, but to solve the problems that had to be met to establish a daily dependable schedule. The flying record made on the New York-Washington line has never been equaled in the history of aviation, and its operation by civilian fliers of the Post Office Department has far exceeded its operation while under military control, the civilian fliers having a record of but 7 forced landings in 100 consecutive flights and only 2 failures in that time on account of fog or storm conditions. The mail has been carried in blinding rain and hail, on fog-bound days with visibility of not over half a mile, and in the face of gales. Only two winter gales were strong enough to prevent the aeroplanes from completing their journey. On Thursday, January 23, the mail was brought south as far as Silverside, Del., in the face of a 65-mile gale at an altitude of a few thousand feet.

The fastest time of flight carrying the mail from College Park to Belmont Park, N. Y., a distance of 218 miles, was 1 hour and 30 minutes, and the slowest time for a continuous flight was 4 hours and 56 minutes. The average time is 2 hours and 40 minutes. The common experience of the users of aeroplane mail is that a letter posted in the down-town stations in Washington as late at 10.50 a. m., and leaving the aviation field at 11.30 a. m., is usually delivered between 4 and 4.30 in the afternoon, which is ample time before close of business.

Extension of Service

The greater the distance between the points on an aerial mail route the greater is the service rendered to commerce and the greater is the patronage of the line. A mail service leaving New York at 6 in the morning and arriving in Chicago before 3 o'clock in the afternoon, in time to connect with carrier deliveries, will advance the mail between the two cities by 16 hours over any train dispatch that can be made after the departure of the Twentieth Century Limited from New York at 2.45 p. m. The department desires to establish this line immediately and extend it west to the foot of the Rockies during the coming fiscal year, with the view of reaching the seaports of Seattle and San Francisco, if Congress authorizes the appropriation necessary. The air mail time between New York and San Francisco will be less than 40 hours. It is desired that this transcontinental trunk line shall be tapped by lines from Minneapolis, St. Paul, St. Louis, Kansas City and other points, and ultimately by a line from Boston, via Albany, Buffalo and Detroit, to Chicago.

A north and south trunk line from Boston to Atlanta should likewise be established, with an ultimate extension from Boston to Montreal, Canada, and from Atlanta, via Key West, to Habana. Based on the accurate cost accounting kept in the operation of the Washington-New York air mail line, the cost of an east and west trunk line from New York as far west as Omaha and a north and south trunk line from Boston to Atlanta has been carefully estimated at $1,600,000. To this should be added $400,000 for several essential feeders that would connect up Detroit, Minneapolis and St. Paul, St. Louis, Kansas City and other points, and would admit of an extension as far west as Salt Lake City, this extension, however, dependent upon the extent to which the Government equipment can be transformed into strong and safe mail-carrying machines.

For this reason it would be very desirable to obtain an appropriation of $2,000,000 for the ensuing fiscal year.

Equipment

The Post Office Department has made a sincere effort to comply with the general and natural sentiment that the war planes left over at the conclusion of hostilities should be utilized in carrying the mails. The attempt at once developed that the DH-4's, of which more than 1000 are said to be available, are too lightly built for commercial work. They were produced in immense haste for light war purposes, to rise from a prepared field, drop a certain number of bombs, fire machine-gun ammunition, and return to a prepared aerodrome empty. When required to make forced landings because of engine trouble they crumple up in a majority of cases, frequently crippling or killing the pilot. The single casualty and the single case of serious physical injury sustained in the operation of the aerial mail service in this country, covering 93,463 miles of operation, were sustained in the persistent and conscientious effort made by the Post Office Department to utilize the DH-4 for cross-country commercial work. Single-motor planes must be expected to occasionally develop engine trouble, which necessitates a forced landing for readjustments. These forced landings must be frequently made over fields that are soft from rain or with holes, gulleys, or small obstructions that will turn a plane upon its back while coming to a stop on the ground. Whenever this occurs to a strong commercial machine, such as is used on the New York-Washington run, the damage is usually slight and the delay not serious.

However, when a DH turns turtle in such landings, it generally sustains more serious injury. In a majority of the cases it fairly crumples up, resulting in bad spills or injury for the pilots. This is the result of the light construction of the planes, which makes them unavailable except possibly for the special war purposes for which they were designed.

There are also in this country, which might be available for mail service, a number of twin-motor Handley-Pages. These planes are of a slow type, with an average speed loaded of from 70 to 90 miles, according to the characteristics of the individual plane. It requires the two engines to keep it in the air with a load, the result being that with one engine getting out of order the twin-motored Handley-Page of the type that was built in this country will come to the ground, although the other engine is intact and operating under full power.

Just as the war was coming to a close certain American manufacturers created twin-motor planes which surpassed anything in that line on the battle front. These planes have sufficient speed to make better than fast railroad time against the severest wind-storms; also they can continue on their course in the air with a load against head winds with one engine operating. They can be built strong enough for commercial purposes and will prove satisfactory mail machines.

In the expenditure of any appropriation made by Congress it would be the policy of the Post Office Department first to use such of the De Haviland machines as can be rebuilt and strengthened with reasonable cost. A rebuilt plane of this character has been completed and is undergoing tests to ascertain whether it will be a dependable and safe machine. The services of some of the best aeronautical engineers of the country generously have been placed at the command of the Post Office Department to assist in solving the problem of making the surplus war planes suitable for commercial cross-country work. Should all these efforts fail to develop out of the war material a practical mail-carrying machine, it would be the purpose of the Post Office Department to call upon manufacturers for designs and bids for a commercial twin-motor machine of reasonable cost for carrying the mails. It is believed that with readjusted conditions in the aircraft industry with the cessation of war orders it will be possible to obtain such machines for considerably less than $20,000 by utilizing surplus parts and engines which the War Department has put at the disposal of the Post Office Department.

Army Co-operation

It has always been the policy of the Post Office Department to seek the fullest co-operation with the Army and Navy Departments in their training programs, so that the military personnel and equipment used in military training might incidentally render a civic function in carrying the mails. The Post Office Department has offered to take details of Army fliers and Army mechanics and to utilize war equipment in carrying the mails to such an extent as the military authorities may deem the practice gained by its personnel in the mail service of training value. In this co-operation the Post Office Department has pointed out that the maintenance of mail schedules must be the prime consideration, and that this can be obtained only through placing the men detailed to the Post Office Department under the direction and control of the Postmaster General during the period of such detail. The service can be operated from the standpoint of maintaining mail schedules more efficiently by the Post Office Department. Likewise

the service can be operated at a much less cost to the Government by the Post Office Department than it can be operated by a military branch, notwithstanding the higher wages paid to civilian aviators and mechanics, for the reason that it is the policy in the military branches to be more lavish with men and materials than obtains in civilian operations.

The extent of the expansion of the aerial mail program in this country will naturally depend upon the amount of co-operation that the military authorities may finally determine would be of value in their air training program. This factor, however, is a matter of uncertainty, and it is therefore desirable that Congress should make an appropriation of at least $2,000,000 that a substantial aerial mail service may be inaugurated, independent of the final determination of the military authorities as to the value and the extent of utilizing the aerial mail service as an adjunct to their training program. If this is not done it is probable that this country at the end of a year will find itself as far behind in the commercial development of aviation as it found itself in military aviation upon entry into the recent war.

OTTO PRAEGER,
Second Assistant Postmaster General.

—

Italy's Truck Exports Decline in 1918

NEW YORK, Feb. 10—Italian motor vehicle exports showed a falling off for the first six months of 1918, compared with the corresponding period of the two preceding years. From Jan. 1 to June 30, 1918, there were exported a total of 2356 trucks and touring cars, having a total value of approximately $7,000,000, compared with a total of 4148 vehicles in 1917 and 2731 in 1916. The number of touring cars exported during the first six months of 1918 was 728, this constituting a record, for the figures of the two preceding years were 244 and 569 respectively. The decrease was on the trucks, which dropped from the high figure of 3904 for the first half of 1917 to 1628 for the first half of the past year.

Italian imports of motor vehicles were very low during the first half of 1918, the value being about $75,000 for 92 touring cars and one truck. For the corresponding period of 1916 the figures were 178 trucks and nine touring cars. The following are the detailed returns, as issued by the Ministry of Finance:

AUTOMOBILE EXPORTS FROM ITALY

Six months ending June 30, 1918

	Trucks		Cars		Total	
Yr.	No.	Value	No.	Value	No.	Value
1916	2162	$4,791,056	569	$977,720	2731	$5,768,776
1917	3904	9,937,462	244	623,946	4148	10,561,408
1918	1628	3,898,080	728	1,836,160	2356	5,734,240

AUTOMOBILE IMPORTS INTO ITALY

Six months ending June 30, 1918

	Trucks		Cars		Total	
Yr.	No.	Value	No.	Value	No.	Value
1916	9	$14,840	178	$289,828	187	$304,668
1917	10	5,600	59	85,920	69	91,520
1918	1	4,000	92	56,112	93	60,112

—

Hawthorne, Hamilton & DeLoss Merged

BRIDGEPORT, Feb. 7—The Hawthorne Mfg. Co. and the Hamilton & DeLoss Co. have been consolidated under the style Hawthorne Mfg. Co. The Hawthorne company was a maker of spot lamps and other automobile lights, and the Hamilton company's business was sheet metal products.

"Working Condition Service" Created

To Look After Health and Safety and Promulgate Labor Standards

WASHINGTON, Feb. 8—The Department of Labor has created a Working Conditions Service to investigate working conditions, determine standards and adopt regulations for the maintenance of such standards. The service will co-operate with State authorities. In order to properly function the service has been divided into three groups—health, safety and relations between the groups necessary to production. These will be known as the:

Division of Industrial Hygiene and Medicine.
Division of Labor Administration.
Division of Safety Engineering.

The Division of Industrial Hygiene and Medicine program proposes:

To make studies of working conditions in their relation to health to determine hazardous processes and methods;

To formulate sanitary codes and regulations to meet health hazards in the various industries;

To formulate standards of medical practice in industries, to co-operate in the betterment of medical service in industries and industrial centers;

To determine standards of physiological requirements of various occupations;

To determine methods for proper placement of workers;

To secure statistical data of industrial morbidity;

To promote facilities for the education and training of physicians and sanitarians for industries;

To assist industries in obtaining physicians and other technicians for industrial service;

To disseminate information concerning measures necessary to safeguard workers against industrial health hazards, and to secure co-operation of all elements, governmental and private, in furtherance of the industrial health program.

The Division of Labor Administration includes in its program:

Studies of employment systems and labor management policies, such as methods of hiring, selecting, inducting, and assigning employees to their duties, in order to determine causes of labor turnover and to avoid unnecessary rotation of labor.

Assisting industrial managers in studying their individual employment problems and advising them as to the best methods of hiring and selecting employees, reducing absenteeism and irregular employment, handling grievances, eliminating friction, and stimulating morale among the employees.

Establishing a national information center on employment and labor administration policies for the use of industrial managers, educational institutions and others, and distributing information.

Formulating standard policies of labor administration, and with the aid of a committee representing all interests affected, promulgating these standard policies to the country and urging their adoption by the industrial managers.

Acting as counselor or consultant on employment methods and policies, and assisting industries to put into operation the standard practices that are recommended.

Promoting facilities for training of labor administrators and assisting industries in obtaining such trained men for their plants.

The Division of Safety Engineering will include:

A study of the hazards of different industries and the determination of safety standards and codes to overcome such;

The encouragement of experiments on safety appliances and practices and the exchange of ideas concerning the same among industries specially interested;

In establishments where exceptional hazards are an integral part of industry, such as mines and explosive plants, the encouragement of co-ordinated plans by safety and medical supervisors to care for the victims in emergencies.

The standardization of record cards, survey forms, filing systems, charts and analytical procedure and presentation to enable safety engineers to have uniform systems for the collection and interpretation of data on plant hazards and injuries; the systematic elimination of the more serious hazards; the protection afforded the workers and like facts which justify the retention of safety work in plant management.

—

Army Bill Abolishes M. T. C.

(*Continued from page* 388)

about this arrangement, probably by suggestion to the committee.

It is known that none of the army officers connected with the Motor Transport Corps testified with regard to the functions or importance of that corps to the committee. Amazement at the provisions of the bill is displayed, and particularly so because of the proof that motor transport must be pooled in this country from the experiences of France and Great Britain. The bill as it now stands, allowing each corps to operate and maintain its own trucks and other vehicles means a complete cessation of the standardization plan and a renewal of the original system whereby hundreds of types of trucks were operated and necessitated the maintenance of great stores of parts for maintenance and repair.

One of the first lessons that came out of the war was that idle trucks were a frequent result of the operation of trucks under different corps. There was no correlation of work. One corps cannot use the trucks of another corps.

An effort will be made, it is understood here, to present this matter properly before Congress and urge an amendment which will make an appropriation for the Motor Transport Corps and take the purchase, operation and maintenance of trucks from the other divisions, or pooling under the motor division. That either this step or the pooling of all the motor vehicles under the Quartermaster Department in one division is vitally important to the army, is the statement made by many army officers.

The army bill provides $4,000,000 for the Signal Corps, $10,000,000 for military air service, $449,000,000 for the Quartermaster Department and $3,000,000 for the Ordnance Department, and specifically states that these funds, in addition to the purchase of other supplies for each of these departments, are also for the "purchase, hire, operation, maintenance and repair of motor propelleld vehicles" by each of these respecttive departments.

Five hundred thousand dollars is also provided for the Ordnance Department for the purchase, manufacture and maintenance of armored motor cars. The sums appropriated are to remain available until December 31, 1920.

The legislative section of the bill provides for the repeal of the Overman act, an "act to authorize the President to co-ordinate and consolidate executive bureaus, agencies and offices in the interest of economy and more efficient concentration of the Government."

It authorizes the President to continue any such corps as he shall deem necessary, but since motor-vehicle appropriations have been made directly to each specific army corps, completely ignoring the Motor Transport Corps, that division could be continued only as a body without functions.

Furthermore, the statutes specifically state that the head of one department cannot disburse funds which have been appropriated in the name of another department, and even though the President might see fit to continue the Motor Transport Corps as such, it would be left without functions or funds, under the present provisions of the army bill.

One amendment which has been suggested and may be proposed for the army bill provides that all motor cars, trucks, trailers, motorcycles, and bicycles shall be under the Motor Transport Corps as regards engineering, purchase, operation and maintenance except armored cars and tractors and tanks, which will remain under the Ordnance Department.

It also specifies that all appropriations for motor cars, trucks, trailers, motorcycles and bicycles should be placed at the disposal of one department, and further that the special bodies required by each army division such as the ambulance for the Medical Corps, and pigeon carriers for the Signal Corps are to be designed by the respective departments to fit the standard chassis as specified by the Motor Transport Corps.

American vs. German Exports

U. S. A. the Leader in Each of the Five Years Preceding the World War

	1909	1910	1911	1912	1913
Value of Germany's total exports of passenger cars	$4,066,000	$6,931,000	$10,099,000	$15,483,000	$16,897,000
Value of U. S. A.'s total exports of passenger cars	5,387,021	9,548,700	12,965,049	21,550,189	24,275,793
Value of German passenger cars exported to U. S. A.	193,580	368,219	297,153	259,313	261,168
Value of U. S. A. passenger cars exported to Germany	136,966	265,218	209,663	226,227	764,389

NEW YORK, Feb. 7—German commercial efficiency has been lauded to such an extent in the past that it may be a surprise to many to learn that during the five years preceding the war the United States not only exported cars to a greater value in each individual year, but sold to Germany passenger cars of a total value of $1,602,463 as against Germany's sales to the United States of cars valued at a total of $1,379,433 during the five years. A table giving Germany's and the U. S. A.'s passenger car exports by principal countries is published herewith.

A study of this table reveals the fact that certain countries, notably Russia, have been large importers of German cars. The geographical location of these countries is probably one reason for supporting the German industry, but another is that Germany has in the past given careful study to the requirements of each individual foreign customer and has not only furnished products which measure up to the local (and often arbitrary) standards, but has given the long credits customary. We, on the other hand, have furnished standard cars and, in the great majority of cases, have insisted that payment for them be made in accordance with the practice current in this country.

In 1913 Germany's total passenger car exports were valued at $16,897,000, as against the U. S. total of $24,275,793. Since 1913-14 Germany's export trade may be indicated by a zero sign, whereas in 1917 our exports of passenger cars alone were valued at $48,612,632, a high-water mark more than double our figure for 1913. In 1918 our car export figures receded a little, but were well maintained in view of the shortage of ocean transport, a gasoline famine which was practically world-wide and an almost universal lack of tires owing to restrictions affecting the supply of crude rubber.

Germany has ceased to be a competitor for the world's automotive markets for the time being, but England, France and Italy are making strong bids for trade with post-war models and prices which will be lower in all probability.

Value of Passenger Cars Exported by Germany and the U. S. A. for Five Years Before the War

Exported to	By	1909	1910	1911	1912	1913
Argentina	Germany	$76,000	$247,000	$589,000	$1,480,000	$1,228,000
	U. S. A.	81,614	174,677	423,193	860,350	1,181,735
Austria-Hungary	Germany	746,000	1,086,000	1,211,000	1,699,000	1,720,000
	U. S. A.	36,978	26,178	27,911	78,748	91,781
Australia	Germany	23,000	67,000	117,000	177,000	159,000
	U. S. A.	81,426	268,274	874,112	2,260,320	1,896,990
Belgium	Germany	132,000	474,000	293,000	818,000	769,000
	U. S. A.	46,340	147,375	241,269	140,585	85,679
Brazil	Germany	34,000	298,000	640,000	1,586,000	857,000
	U. S. A.	26,892	267,687	225,083	662,883	1,035,247
British South Africa	Germany	55,000	89,000	63,000	45,000	159,000
	U. S. A.	22,152	61,185	126,734	306,606	1,157,895
Bulgaria	Germany	16,000	5,000	8,000	100,000	75,000
	U. S. A.	......	1,890	6,350	19,716	11,457
Cuba	Germany	16,000	5,000	18,000	15,000	189,000
	U. S. A.	140,160	187,392	208,960	234,569	242,686
Denmark	Germany	140,000	252,000	376,000	363,000	625,000
	U. S. A.	29,967	46,024	40,021	41,976	77,149
Dutch East Indies	Germany	55,000	126,000	217,000	293,000	219,000
	U. S. A.	40,836	21,768	34,252	70,055	198,378
Finland	Germany	17,000	61,000	225,000	256,000	306,000
	U. S. A.	......	......	12,049	26,203	53,568
France	Germany	431,000	651,000	672,000	836,000	869,000
	U. S. A.	643,692	771,869	473,122	469,721	615,486
Italy	Germany	175,000	131,000	221,000	419,000	665,000
	U. S. A.	240,516	333,193	188,405	193,037	280,961
Mexico	Germany	52,000	119,000	243,000	58,000	142,000
	U. S. A.	282,462	459,077	614,160	418,599	423,123
Netherlands	Germany	210,000	406,000	431,000	694,000	724,000
	U. S. A.	53,965	76,957	50,796	78,363	94,163
Norway	Germany	71,000	50,000	60,000	103,000	168,000
	U. S. A.	8,079	20,669	13,808	66,897	66,689
Portugal	Germany	25,000	57,000	74,000	131,000	215,000
	U. S. A.	3,041	11,429	23,966	14,752	58,931
Roumania	Germany	93,000	94,000	154,000	555,000	214,000
	U. S. A.	......	......	31,806	22,543	30,337
Russia	Germany	583,000	1,098,000	1,823,000	2,540,000	4,232,000
	U. S. A.	78,409	107,310	139,487	254,047	484,913
Siam	Germany	36,000	44,000	23,000	44,000	52,000
	U. S. A.	......	6,407	6,540	8,933	35,934
Spain	Germany	61,000	61,000	90,000	175,000	347,000
	U. S. A.	9,061	18,330	54,599	116,202	127,621
Sweden	Germany	54,000	90,000	173,000	337,000	436,000
	U. S. A.	44,585	55,118	62,005	127,729	235,918
United Kingdom	Germany	523,000	857,000	1,316,000	1,737,000	1,215,000
	U. S. A.	1,680,154	2,415,593	2,273,222	4,454,430	2,907,427
Uruguay	Germany	......	8,000	120,000	181,000	172,000
	U. S. A.	5,657	23,666	147,142	235,097	273,253

German Truck Train Organization

Run on Fuel Substitutes and Steel Rims—Gasoline Reserved for Air Force

By W. F. Bradley

PARIS, Jan. 20—Two types of automobile truck trains exist in the German army. These are known as Army columns and Division columns. An Army column, or truck train, consists of 18 trucks of 4 ton capacity, one of which is a traveling workshop. The effective tonnage is thus about 60. Attached to this train are two passenger cars, one or two motorcycles and a trailer kitchen. This organization is practically the same as that adopted by the French. The staff of an army truck train comprises a captain and a lieutenant, one sergeant-major, four or five non-commissioned officers and 51 men.

The Divisional truck trains comprise ten trucks of 4 ton capacity, one of which is a workshop, and this train has a practical tonnage capacity of 30 tons. There is also one passenger car, one motorcycle and one kitchen trailer. The staff of such a truck train consists of an officer, a sergeant-major, four to five non-commissioned officers and 30 men. The Divisional truck trains are made use of for all kinds of transportation required by the division.

Early in the war the German army made use of some special types of meat-carrying trucks. These, however, were abandoned later, and two or three ordinary trucks from the train were given this work.

The Army columns or trains were designed to supplement the Divisional trains, and were employed especially for carrying munitions from the rear to the dumps or batteries. Repairs were handled in the German army by repairshops, usually one for each army.

The real rubber shortage in the German army made itself felt in 1916. Up to this time all cars and trucks had been run on rubber tires. Suddenly rubber disappeared from the trucks and steel rims or wood blocks, sometimes surrounded by a steel rim, were made use of everywhere. At the same time every automobile unit was give only one truck equipped with rubber tires. This vehicle was used for carrying delicate objects and also as a break-down truck.

With either wood or steel tires it was impossible to obtain sufficient adherence to tow other vehicles. Pneumatic tires were only used on light cars and ambulances operating in the advance zone. All vehicles on the lines of communication or in the zone of the rear were equipped with various types of steel tires. Many of these had coil springs interposed between the outer rim and the wheel.

It is interesting to note that the German army employed "Continental" and "Oberspree" tires almost exclusively. A

certain number of Michelin tires were in use until 1917. It is not known whether these were requisitioned in the invaded districts of France or whether they were made in moulds stolen in France. In any case, the fact that these tires were available until 1917 indicates that rigid economy was effected in their use.

For a long time before the end of the war the automobile service of the German army was altogether deprived of gasoline, this fuel being reserved for the air service. During practically the whole of the war trucks and passenger cars were run on benzol or on a mixture of benzol and alcohol. During one particular period, in 1916, the fuel employed consisted of 40 per cent benzol and 60 per cent alcohol. As neither engines nor carbureters had been built for this fuel results were very unsatisfactory, and it was not long before the percentage of alcohol was reduced.

It is stated that the German army was never totally out of fuel, but at all times the service was restricted because of shortage. As in the case of the French army since 1917, all German automobile units had a ration supply of fuel. When this supply was exhausted the cars remained in the garage, in some cases for two or three months.

Foreign Trade Opportunities

WASHINGTON, Feb. 8—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has inquiries for the agencies of automobiles and tractors. Full information regarding each of the following can be secured by addressing the Bureau of Foreign and Domestic Commerce and referring to the foreign trade opportunity number.

A man in Norway desires to purchase an agency for the sale of automobiles and accessories. Foreign Trade Opportunity No. 28120.

An agency is desired by a man in France for passenger cars. Correspondence should be in French. No. 28121.

An agency for passenger cars, oils and greases is desired by a man in France. Correspondence should be in French. No. 28125.

Requests for an agency for passenger cars, bicycles and tool supplies has been received from a man in France. Correspondence may be in English. No. 28127.

A company in Sweden desires an automobile supplies and accessories agency. Correspondence may be in English. No. 28130.

A firm in Spain desires to secure the sole agency and to act as purchaser of farm tractors for the Balearic Islands. Quotation should be made f.o.b. New York, cash against documents. Correspondence may be in English. No. 28126.

A business man in Spain desires an agency for automobiles, tractors, petroleum and gasoline. Correspondence should be in Spanish. References have been filed. No. 28134.

A business man in France desires an agency for automobiles and tractors. Correspondence in English. No. 28155.

A business man in France desires an agency for passenger cars, tractors, trucks, petroleum, gasoline and heavy oils for Morocco. Correspondence should be in English. References have been filed. No. 28141.

A man in Algeria desires an agency for motor cars. References have been filed. Payment against documents or confirmed credit. No. 28150.

A business man in France desires an agency for passenger cars and tractors. Correspondence in English. No references have been filed. No. 28155.

A commercial agent in France desires a farm tractor agency. Correspondence in French. No. 28137.

An agency is desired in France for farm tractors. Terms, cash on delivery to France. Correspondence in French or Spanish. No. 28143.

Australia Expects Big Developments in Automotive Business

Activities Have Been Curtailed by After-War Conditions and Heavy Taxation, but Revival Is Imminent—Expected Reaction in Favor of European Cars—No Shortage of American Products

SYDNEY, N. S. W., Jan. 3—There are several circumstances which in combination have had the effect of slowing down the automotive business in Australian cities for some time past. In the first place, the country has been suffering from a severe drought which has practically ruined the wheat crop. Fires have caused a lot of damage to farms and cattle in Northern Queensland, and the general effect has been detrimental to the sale of automotive products.

A second reason for business slackness lies in the fact that last season's wheat has not yet been shipped, and the farms do not expect to get a remunerative price for it. The Government has paid about 84 cents a bushel for it so far, but there is a shortage of buyers. A third reason is the passing of a compulsory act by the Government in connection with the seventh war loan.

A bill known as the wartime profit tax has apparently hit the automotive dealers pretty hard, as it is retroactive for the three years of war which had elapsed before it became law, and thus a trader is taxed to the extent of 50 per cent of his profits over and above 10 per cent of his capital. As this affects profits made up to three years before, profits which have already been distributed in dividends or diverted to the extension of business, the tax is proving onerous to many. In fact, the effort to meet it has tied up operating capital to a considerable extent.

Armistice Affects Prices

Prices of commodities generally started to drop on the signing of the armistice, and the country has not as yet succeeded in reconstructing itself on a pre-war commercial basis.

There are fairly good stocks of the various popular types of American cars throughout Australia—Buick, Chevrolet, Dodge, Hupmobile, Overland, etc., but apparently stocks of other makes are somewhat depleted. The used car market is very flat, owing to the popular belief that prices will drop. It is not anticipated that this state of things will be anything but temporary.

There has been a sufficient supply of tires, although at times the selection of makes has been limited. On the whole, the local rubber factories are able to take care of the demand, and the situation has been improved by importers having cars shipped complete with tires instead of minus tires as before.

There is an ample supply of spare parts for both cars and trucks in the various cities throughout Australia. Occasionally there have been difficulties in shipping these from the United States factories, but in such cases parts have been made locally.

Very successful demonstrations of farm tractors have been held from time to time, and it is anticipated that this branch of the business will develop rapidly as soon as the initial difficulties of arranging distribution are overcome. Unit power and lighting plants are fast finding their way into the country, and the business is generally handled by the electrical supply firms, of which there are many throughout the Commonwealth.

Gasoline Plentiful but High

Gasoline is plentiful, but expensive. The price averages 75 cents an American gallon in the cities. There is also an ample supply of lubricating oil.

One of the reasons why there has been no increase in the price of cars brought about by shortage of supply is that a large percentage of the dealers here find it necessary to dispose of their stocks as quickly as possible in order to get their cash in again and thus keep their total operating capital at the lowest practicable amount. This condition of temporarily tied-up finance is mainly the result of conditions outside the automotive trade, the strain of war taxation and abnormal trading conditions generally.

There is every indication that there will be a big demand for European cars just as soon as any are available. It is not yet known here what European manufacturers may have to offer in the shape of post-war models, but Australians are naturally a British people and therefore are favorably disposed to any British product. Nevertheless it is early to predict what the future may hold in the automobile line, and it is quite obvious that the British or other European manufacturer will have to go a long way to beat the American car builder or to dispossess him of the trade he now holds. There seems to be a reaction in favor of first-class magneto ignition as compared with ignition of battery type.

In conclusion, there is no doubt whatever but that the European car builders are planning extensive and energetically conducted selling campaigns on their after-war products throughout Australia, and it is natural to expect that under the circumstances they will meet with a fair measure of success. Therefore the American car builder must look to his laurels and intensify his sales methods to retain his trade here.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. .... .02 -.03
- Phosphoric (85%).. .35 -.39
- Sulphuric (60%), lb. .008

Aluminum:
- Ingot, lb........... .30 -.33
- Sheets (18 gage or more), lb. .... .42
- Antimony, lb...... .07¼-.07½

Burlap:
- 8 oz., yd.......... .10½
- 10½ oz., yd........ .16½

Copper:
- Elec., lb. .... .18 -.18½
- Lake, lb. .... .21

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.50
- Egypt, combed, sq. yd. 1.25
- Egypt, carded, sq. yd. 1.15
- Peelers, combed, sq. yd. 1.10
- Peelers carded, sq. yd. 1.00

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
- Ceylon, lb. .... .09 -.22
- Madagascar, lb. .. .10 -.15
- Mexico, lb. ...... .03¾

Lead, lb. .... .4474-.0525

Leather:
- Hides, lb. .... .18 -.35¼

Nickel, lb. .... .40

Oil:
- Gasoline:
  - Auto. gal. 24½
  - 68 to 70 gal...... .30½
- Lard:
  - Prime City, gal..1.90-2.00
  - Ex. No. 1, gal...1.10
- Linseed, gal. 1.45-1.48
- Petroleum (crude):
  - Kansas, bbl. 2.25
  - Pennsylv'a, bbl..4.00
- Manhaden (dark), gal. 1.05-1.06

Rubber:
- Ceylon:
  - First latex pale crepe, lb. ..... .57½-.58
  - Brown, crepe, thin, clear, lb. ...... .52
  - Smoked, ribbed sheets, lb. .... .56½-.57
- Para:
  - Up River, fine, lb. .59 -.59½
  - Up River, coarse, lb. .... .34 -.35
- Island, fine, lb........ .49

Shellac (orange), lb. .64

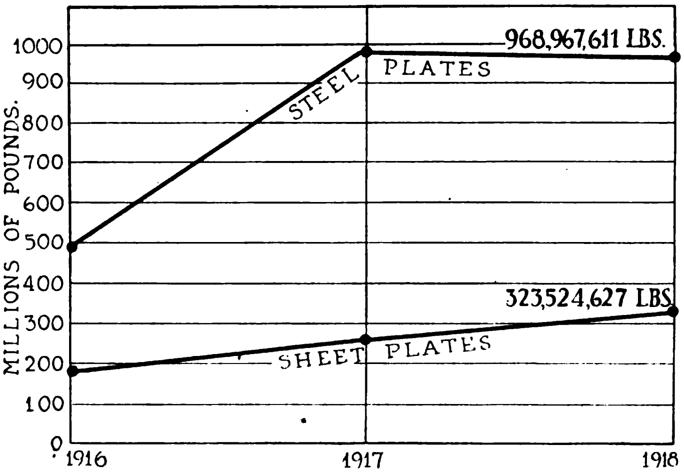
Spelter .... .07½-.07¾

Steel:
- Angle beams and channels, lb. ..... .03
- Automobile sheet (see sp. table.)
- Cold rolled, lb.... .0625
- Hot rolled, lb...... .039

Tin .... .71 -.72

Tungsten, lb.........1.50-2.10

Waste (cotton), lb... .12¾-.17



Exports of steel plates and sheets for 10 months of 1916-17-18. In 1918 Canada and Japan were our best customers. The United Kingdom and France took a very small proportion

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock................	$5.95	$5.85
Automobile body stock, deep stamping.	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock...............	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping...............	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.
- Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close Feb. 8

	Bid	Asked	Net Ch'ge
Auto Body Company........	6½	8½	..
Briscoe Motor Car, com.....	10	..	— ½
Briscoe Motor Car, pfd......	35	50	—5
Chandler Motor Car........	112⅛	114⅛	+4⅝
Chevrolet Motor Car........	154	156	+5
Cole Motor Car.............	90	105	..
Continental Motors, com....	7½	8	..
Continental Motors, pfd....	95	99	+1
Edmunds & Jones, com.....	15	20	..
Edmunds & Jones, pfd.....	75	90	..
Electric Storage Bat........	50	55	..
Federal Motor Truck.......	30	34	—1
Fisher Body Co., com.......	42½	43	+2½
Fisher Body Co., pfd........	90	92	..
Ford Motor of Canada......	265	275	+10
General Motors, com........	130½	131½	+6⅛
General Motors, pfd........	83⅞	85⅞	+ ⅞
Hupp Motor Car, com......	6¼	7	+ ¾
Hupp Motor Car, pfd.......	90	..	+ ½
Kelsey Wheel Co., com.....	28	36	—2
Kelsey Wheel Co., pfd......	88	95	..
Manhattan Electric S., com.	..	48	..
Maxwell Motor, com.......	30⅜	31⅜	+ ⅛
Maxwell Motor, 1st pfd.....	53½	54½	+1
Maxwell Motor, 2nd pfd....	21½	22½	..
McCord Mfg., com..........	32	35	..
McCord Mfg., pfd...........	93	96	..
Mitchell Motor Co...........	24	30	..

	Bid	Asked	Net Ch'ge
Motor Products Corp........	..	40	..
Nash Motors Co., com......	170	200	..
Nash Motors Co., pfd.......	93	97	..
National Motor Co..........	6	10	..
Packard Motor Car, com....	116	122	..
Packard Motor Car, pfd....	99	103	..
Paige-Detroit Motor, com...	24½	25½	+1
Paige-Detroit Motor, pfd...	8¾	9¾	..
Peerless Motor Truck......	18	21	..
Pierce-Arrow Mot. Car, com.	39	40	—2
Pierce-Arrow Mot. Car, pfd.	102	..	+1
Premier Motor Corp., com..	5	..	..
Premier Motor Corp., pfd...	..	75	..
Prudden Wheel Company...	15	17	+1
Reo Motor Car Co..........	21½	22½	..
*Republic M. Truck, com...	35½	37½	—2
Republic M. Truck, pfd.....	87	90	..
Saxon Motor Car, com......	7½	9½	+ ½
Scripps-Booth Corp.........	21	25	..
*Stewart Warner Spd. Corp.	83¾	85¾	+ ½
Stromberg Carburetor Co...	40	43	+1
Studebaker Corp., com......	50½	51½	+ ¼
Studebaker Corp., pfd......	92	95	..
Stutz Motor Car Co.........	42¼	43¼	—5¾
United Motors Corp........	38	40	+2⅝
White Motor Co............	47	48	+ ⅝
*Willys-Overland, com.....	24¼	25¼	..
Willys-Overland, pfd........	88	88½	+ ¼

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.............	70	70¾	..
Firestone T. & R., com.....	140	145	..
Firestone T. & R., pfd......	95½	100	..
Fisk Rubber Co., com......	87	89	—1
Fisk Rubber, 1st pfd........	97	100	..
Fisk Rubber, 2nd pfd.......	85	90	..
Fisk Rubber, 1st pfd. conv..	100	105	..
Goodrich, B. F., com........	61	61¼	..
Goodrich, B. F., pfd.........	102½	103	..
Goodyear T. & R., com......	240	250	—7
Goodyear T. & R., 1st pfd..	103½	105	+ ½
*Goodyear T. & R., 2nd pfd.	103½	105	— ½
Kelly Springfield, com......	77	78	..
Kelly Springfield, 1st pfd....	91	98	..
Lee Tire & Rubber Co......	23	23½	..
Marathon Tire & Rubber...	..	55	..
Miller Rubber Co., com.....	160	165	..
Miller Rubber oC., pfd......	96	98	..
Rubber Products Co........	114	118	..
Portage Rubber Co., com...	155	160	..
Swinehart T. & R. Co......	50	60	..
U. S. Rubber Co., com......	75½	76	..
*U. S. Rubber Co., pfd......	109¼	110	..

*Ex Dividend.

Men of the Industry

Changes in Personnel and Position

R. T. Hodgkins, general sales manager of the Cleveland Tractor Co., was elected a director of that company at a recent meeting of the stockholders and at the directors' meeting following he was chosen vice-president.

Horace N. Trumbull, who was advertising manager for the S K F Ball Bearing Co., Hartford, before he entered the service, has been discharged and has become advertising manager of the Wellman-Seaver-Morgan Co., Cleveland.

W. M. Jones has been appointed eastern sales representative of the Torbensen Axle Co., Cleveland.

E. D. Rogers has joined the staff of the Anderson Motor Co., Rock Hill, S. C., as southwestern district sales manager, with headquarters at Dallas.

A. C. Olfs, formerly eastern representative of the Titanium Bronze Co., has been appointed Michigan representative for the Stewart Mfg. Corp., Chicago, with headquarters in Detroit.

L. B. Cravath has been elected vice-president of the Hessian Tiller & Tractor Corp., Buffalo. He joined the organization as sales manager. He was later made general manager and has recently been chosen a director.

Robert E. Page, for four years assistant foreign sales manager for Dodge Brothers, has joined the staff of the Commerce Motor Car Co. He will look after the Canadian Commerce Truck business.

J. J. Tobias is in charge of the new Detroit branch of the Moto Meter Co., Inc., 2019 Dime Bank Building.

C. H. Williams, formerly manager of the Chicago branch of the Goodyear Tire & Rubber Co., Akron, has been appointed manager of the far eastern division, which covers the Philippines, China, Japan, Java, Siam, India and Eastern Russia.

C. L. Diers, formerly in charge of the Indianapolis branch of the Goodrich Tire & Rubber Co., Akron, is now in charge of the European division, covering Europe, Asiatic Russia and the northern coast of Africa.

W. A. Westlake has been appointed eastern sales manager of the truck tire department of the McGraw Tire & Rubber Co., New York.

W. R. Vogeler, for the past six years export manager of the King Motor Car Co., New York, has been appointed general manager to take the place of E. A. Scheu, who has been made general sales manager.

Bartsch Takes Up Sales and Advertising Reins for Bosch

NEW YORK, Feb. 10—Alfred H. Bartsch has returned to the American Bosch Magneto Co. after an absence of a little more than a year. Effective immediately he takes up the duties of advertising manager, which he surrendered just before this country entered the war, and, in addition, has been appointed the company's general sales manager. Prior to the time he left the old Bosch company, which has since been reorganized, Bartsch was for more than seven years its advertising manager. He left that position to become affiliated with the McLain, Hadden, Simpers Co. advertising agency, and for about a year has made his headquarters in Philadelphia. Henceforth his headquarters will be in New York.

C. J. P. Lucas, Chicago, for the past eight years with the *Automobile Trade Journal*, has resigned, and about April 1 will leave for South America to make a survey of the South American market with a view to establishing a house in Buenos Ayres for carrying an American car, truck and tractor and lines of supplies for Argentina, Paraguay, Uruguay, Brazil and Chile.

Judson M. Sells, until recently general manager of the Northern Steamship Co., has joined the sales force of the Commerce Motor Car Co. in the Buffalo territory.

Harry Moler, Grand Rapids, has quit the theatrical business to sell Willys-Knight and Overland cars.

Honor Blocker has been appointed advertising manager of the Republic Rubber Corp., Youngstown.

F. S. Wright, who has been for many years sales manager of the New York branch of the Valvoline Oil Co., has resigned his position to become connected with the James B. Berry's Sons Co., Inc., Oil City, Pa., as sales manager of this company's New York branch.

F. H. McFarlin has joined the sales department of the Erie Specialty Co., Erie.

Frank Mossberg Joins Rice Leaders

ATTLEBORO, MASS., Feb. 10—The Frank Mossberg Co. has become a member of the Rice Leaders of the World Association.

A. R. Redburn has been appointed sales manager of the truck department of Walden W. Shaw Livery Co., Chicago.

Gustave Huette, Sheboygan, Wis., founder of the Falls Motors Corp., Sheboygan Falls, and for many years president of the company, has disposed of his final interest and retired from all connection with the concern.

R. G. Hayssen, secretary and treasurer of the Sterling Motor Truck Co., Milwaukee, was elevated to the presidency at the annual meeting of the stockholders. He succeeds Victor L. Brown, who has retired from active business. E. M. Sternberg was elected vice-president and Frank Luick secretary and treasurer. The company will devote most of its energy until March 1 to the completion of its government contracts and will then shift to peace business.

E. H. Ruck has been appointed chief engineer of the Automotive Corp., Fort Wayne, and will have charge of all engineering and production. He was formerly with the White Co., and until a few weeks ago was chief engineer of the Cleveland Tractor Co., Cleveland.

George K. O'Donnell has been elected vice-president in charge of the sales of the Coe-Stapley Mfg. Corp., with headquarters in New York City. The New York offices of the company have recently been moved from 135 Broadway to 136 Liberty Street.

John Walter Hertzler has been elected secretary and treasurer of the Pressed & Welded Steel Products Co., Long Island City. He was formerly assistant manager of the Bearings Co. of America, Lancaster, Pa.

J. H. Cooper, formerly vice-president of the Endurance Tire & Rubber Co., has joined the sales force of the Walker Mfg. Co., Racine, as eastern sales manager.

W. B. Stout, formerly of the Packard Motor Car Co., has been appointed sales and advertising manager of the United Aircraft Engineering Corp., New York.

J. J. Buzzell has been appointed advertising manager of the Hyatt Roller Bearing Co., Detroit, to succeed W. E. Biggers, who recently resigned.

J. W. Lever is now district manager of the Denby Motor Truck Co., Detroit. His territory is Oklahoma and Texas.

Capt. Charles Smith, Engineers, U. S. A., who is connected with the Commerce Motor Car Co., has returned from overseas.

A. E. Creeger, identified since its organization with the Nash Motors Co., Kenosha, as special traveling representative, has resigned to become associated with the Ohio Nash Co., in charge of truck sales.

J. I. Case Passes Resolution to Re-employ Returning Men

RACINE, Feb. 7—At a meeting of the Board of Directors of the J. I. Case Plow Works, the following resolution was unanimously adopted:

"Resolved, That all employees of the J. I. Case Plow Works, who left their positions for military service, at home or abroad, will be given re-employment at a compensation at least equal to what they were receiving when they left their positions, provided that such employee desires to return and makes application and reports for duty within thirty days after honorable discharge."

The same policy will be followed by the Wallis Tractor Co.

Briscoe After Foreign Business

JACKSON, Feb. 7—Although running at 50 per cent capacity, the Briscoe Motor Corp. is now producing thirty cars daily. The company plans increasing production constantly until the daily average is between sixty and seventy machines. The 1919 schedule calls for 15,000 cars. This company has established an export office at New York and is preparing to engage extensively in foreign trade.

New G. M. C. Plant at Flint

FLINT, Feb. 8—The General Motors Corp. is to establish a new frame plant here. It will be on a spur line of the Michigan Central Railroad. Such a plant has been contemplated for some time.

Auto Body Co. Speeding Production

LANSING, Feb. 8—The Auto Body Co. has completed a definite schedule of production, which will keep the plant busy for three months. The company is now employing 400 men. Six weeks ago less than 100 men were employed.

Packard Still Filling Government Orders

DETROIT, Feb. 7—No new Packard passenger cars will be ready for distributers before early summer. This company, which was working 100 per cent on Liberty engines and Packard army trucks, is obliged to reorganize completely its plant before passenger car production can be resumed. War contracts are being wound up. The last of the Liberty engines are about to be run through, but there is still a large number of trucks to be made.

No New Columbia Models

DETROIT, Feb. 7—There will be no change in the car models of the Columbia Motors Co. Three models will be produced: The touring at $1,600; the five-passenger Bevel Edge Sport, $1,745, and the sedan, $2,445. The sport model is a new one, having been brought out during the past summer. There will be no cut in prices. The Columbia Co. expects to be in full production by Feb. 15. Its contracts for government trucks, trailers and truck parts are about complete. The company is producing 8 passenger cars daily.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

"Red Star" Bodies in New Building

PHILADELPHIA, Feb. 7—The Lowry Top and Body Co., manufacturer of automobile tops and bodies, specialist for long distance hauling concerns, using bodies from two to six tons and upwards, has moved from 33d and Walnut streets to its new factory at Gaul and Adams streets, in the Kensington district. The company's new quarters allow 70,000 sq. ft. for manufacturing purposes. There are painting, trimming and mill departments on the first floor, and the body-building department proper on the second.

The company is about to produce its newly patented "Red Star" bodies. The patent covers a non-leakable roof, the top construction known as "outside structural member," the general underconstruction and the tail-gate. The patent is especially for the large, covered type of car for intercity hauling. The outside structural member used is of the "waffle-iron" bracing type, of 2-in. oak and is calculated to withstand high pressure both from within and without the top. The raised panel frames prevent accidents to goods within the car, no matter how hard a blow the top may receive. A complete line of these bodies will be carried.

Goodrich Sales Total $123,400,000

AKRON, Feb. 7—The annual report of the B. F. Goodrich Co., made public Saturday, shows net sales amounting to $123,400,000 and net profits $15,500,000, not deducting federal income or excess taxes but after deducting for maintenance, depreciation, bad and doubtful debts. For the year ended Dec. 31, 1917, the net sales of the company amounted to $87,155,072 and the net profits $10,544,677. The directors have authorized a 3½ per cent dividend on preferred stock, half payable April 1 and the rest July 1. They also declared a 1 per cent quarterly dividend on common, payable May 15.

Pierce Governor Erects Addition

ANDERSON, Feb. 7—The Pierce Governor Co. has just completed a two-story brick annex to its factory, giving it an additional 5,000 sq. ft. of floor space. The new building will be used for storing raw material and finished parts. The tool making and pattern making departments will also be moved into it.

Atterbury Doubles Capital

BUFFALO, Feb. 7—The Atterbury Motor Car Co. has increased its capital from $250,000 to $500,000.

Nelson Motor Truck Co. Incorporates

SAGINAW, Feb. 7—The Nelson Motor Truck Co., maker of the Jumbo truck, this week changed from a co-partnership to an incorporation, with a capitalization of $500,000. The officers of the company are: President and general manager, H. B. Nelson; vice-president, J. J. Nelson; secretary and treasurer, C. J. Nelson. The company is making a truck a day, but anticipates producing 1200 machines this year. A new factory addition is under construction and plans for building a complete new plant are being considered for next year.

Telecator in New York Office

NEW YORK, Feb. 7—Herbert H. Scott, president of the Scott Corp., Chicago, manufacturer of the Telecator, an instrument for locating faults in car and truck engines, has opened an office in Aeolian Hall, New York, as a base for Eastern business. This office will be in charge of Guy Rickenbaugh. The Telecator is the invention of Mr. Scott, and is made in two models, one for attachment to the dash where it also acts as a lock for the car, and the other a portable instrument for use in garages. The total output of the company so far has been supplied to the Government.

Monroe Plant to House Moline Engines

PONTIAC, Feb. 8—The plant and property of the Monroe Motor Co., which was sold recently for $75,000 to the Wilson Foundry & Machine Co., will be used for the production and assembly of engines for the Moline Tractor Co. All Moline engine parts will be made either in the present Wilson plant or in the new plant. About 500 men will be employed. First deliveries will be made in April.

General Motors Buys in Canada

DETROIT, Feb. 10—The General Motors Corp. has purchased a 37-acre factory site in Windsor, Ont. General Motors officials will make no statement regarding the proposed Canadian activities of their organization.

Defiance Plant Quits War Work

DEFIANCE, Feb. 7—The Defiance Machine Works, which has been on a 100 per cent war basis, has voluntarily discontinued its contract for the manufacture of big guns for the Government. It is intended to save the Government further expense in operating this plant and enable the management to readjust the factory for handling peace-time business.

Overland Speeding Up Production

TOLEDO, Feb. 10—The Willys-Overland Co. has increased its daily production for February to 400 cars. During January the plant's daily average was 320 finished jobs. Odds and ends of war work are being cleaned up and reconstruction is about complete. The company is now operating at two-thirds capacity. It will be July at least before full production of 600 cars daily will be obtained.

Canadian Chalmers to Make 2000 Cars

WINDSOR, ONT., Feb. 8—The Chalmers Motor Co. of Canada, Ltd., will produce 2000 cars this year. The company, which is turning out 10 cars daily, contemplates no price reduction, and is guaranteeing its dealers against such a move.

Canadian Maxwell Plans 6000 This Year

WINDSOR, ONT., Feb. 8—Approximately 6000 cars will be made by the Maxwell Motor Co. of Canada, Ltd., during 1919. The 1919 Canadian Maxwell has a different style top than the 1918 model, demountable rims instead of wheels, a Johnson carbureter with vacuum feed and a gasoline tank on the rear. The company anticipates no price reduction and is protecting its dealers. It is producing 25 cars daily, but will increase the output in June.

Annual Meeting of Detroit Steel Products Co.

DETROIT, Feb. 10—The Detroit Steel Products Co., at its annual meeting, elected the following officers: President, John G. Rumney; vice-president and general manager, Victor F. Dewey; secretary, H. F. Wardwell; treasurer, E. R. Ailes; assistant general manager, Mason P. Rumney; production manager, A. L. Baldwin.

B. R. & L. Co. Changes Officers

CLEVELAND, Feb. 10—The Baker R. & L. Co., makers of Rauch & Lang electrics, Owen Magnetic gasoline cars and B. R. & L. Electric industrial trucks and tractors, has made several changes among its administrative staff. C. L. F. Wieber has resigned as president and is now acting as chairman of the board. Fred R. White, previously vice-president and in charge of production, is now president. E. J. Bartlett, previously manager of the commercial department, is now vice-president and general manager. R. M. Owen and D. C. Durland remain as vice-presidents of the company. Robert C. Norton remains as treasurer, but for some time has been in France as a major of artillery. His active duties are being performed by W. P. Southward, assistant treasurer. F. W. Treadway remains secretary and counsel of the company.

The company, which is now running about ten cars daily, expects to increase its production of industrial trucks and custom bodies and to continue its other products on the present scale. Manufacture of 4000 cars is contemplated in 1919. The largest production increase will be in the body department and in industrial trucks.

20,000 Sq. Ft. for Ahlberg Bearings

CHICAGO, Feb. 10—Owing to the government ban on building operations during the war, the Ahlberg Bearing Co. had to wait until this time to commence work on its new plant at 29th Street and Calumet Avenue. Operations have already been started and it is expected that the new factory will be ready for occupancy the latter part of February. The new building will be two stories, of steel and reinforced concrete, with a floor space of about 20,000 sq. ft. The lighting has been so designed that every part of the building will be available for the handling of the remaking process. Provisions have been made for a hardening plant also. The first floor will contain the salesroom, stock room and shop. The executive and general offices will occupy the second floor, and a garage will be erected in the rear.

General Motors to Build for Scripps-Booth

DETROIT, Feb. 10—The General Motors Corp., which recently gained control of the Scripps-Booth Corp., will establish that company in a new $1,500,000 factory building as soon as a suitable site can be obtained. The proposed plant will have a capacity of 25,000 cars annually. In the present establishment the Scripps-Booth organization is cramped for room. Unlike most other automobile concerns, this company was not seriously affected by the sudden ending of the war inasmuch as it was not engaged very extensively in Government work.

The company is making twenty cars daily, but in February it expects to boost production to thirty cars. While 5500 machines were built last year, the 1919 schedule calls for the manufacture of 10,000. The 1919 Scripps-Booth models are the same as last year, with the exception of several small changes in detail and in color.

Gier Steel Profit $427,903

LANSING, Mich., Feb. 10—The newly elected Board of Directors of the Gier Pressed Steel Co. held its election following the annual meeting of the company, Wednesday, Jan. 22, and named B. S. Gier, president and general manager; W. H. Newbrough, vice-president, and D. F. Edwards, secretary and treasurer. W. K. Prudden was elected chairman of the board. The new board is composed of the officers and H. F. Harper, Edward Ver Linden and Arthur D. Baker. The annual financial statement shows an operating profit of $427,903.03, or 55 per cent of the outstanding stock. This is double that of 1917. The estimated Federal tax on this year's operations is $290,000, or 68 per cent of the total profit. The surplus on Dec. 31, 1917, plus the net income for operations makes a total of $638,200.82. Out of this comes the estimated Federal tax, leaving $347,200.82. From this is deducted $156,250, the stock dividend declared Jan. 15, 1918, and the cash dividend of 5 per cent or $39,062.50 of Dec. 13, 1918, leaving an extended total of $151,888.32.

Dividends Declared

Grant Motor Car Corp., Cleveland, 1 per cent, common, payable March 1 to stockholders of record Feb. 18; 1¾ per cent, preferred, payable Feb. 1 to stockholders of record Jan. 20.

Reorganize United Brass & Aluminum

PORT HURON, Feb. 10—The United Brass & Aluminum Mfg. Co. has been reorganized with the following officers: President, Jacob Goldman; vice-president, H. S. Grant; secretary and treasurer, Shirley Stewart, and Albert Ryan general manager. This concern was formerly the William O. Lee Co. The plant has been extended and is now making brass bushing for the Packard, Northway Motors Co. and a number of other automotive concerns.

Boring Tractor's New Plant

ROCKFORD, Feb. 10—The Boring Tractor Corp. has purchased six acres of land and will erect a new plant on this tract. The tracks of three railroads are located close to the new site, giving excellent transportation facilities. It is hoped to have the first unit of the new series of buildings ready by May 1. Reinforced concrete will be utilized in the construction.

Melling Forge Co. Elects New Officers

LANSING, Feb. 10—The Melling Forge Co. at its annual meeting elected the following officers: President, J. B. Simon; vice-president and general manager, George Melling; secretary and treasurer, J. B. Whitney. The company was organized in March, 1917. During the year machinery and equipment have been doubled and the working force increased 150 per cent. Ninety-five per cent of the output of this plant has been Government work, but contracts with the Olds Motor Works and the American Car and Foundry Co. have already been placed for 1919.

Grant Motors Gains $450,000 in Year

CLEVELAND, Feb. 10—The net earnings of the Grant Motor Car Corp. for the year ended Dec. 31 were in excess of $450,000, after paying the preferred dividends, which left a balance of more than 20 per cent on common stock.

Chevrolet Will Expand

DETROIT, Feb. 10—The Chevrolet Motor Co. plans to expand its factory at Toledo to a $4,000,000 or $5,000,000 plant within two years, according to T. W. Warner of the Toledo-Chevrolet Motor Co. Additional property of approximately five acres has been purchased for new buildings. The plant has been employing 1200 men, and it is expected that from 3000 to 4000 will be employed when the new additions are complete.

U. S. Pressed Steel Co. Enlarges Plant

YPSILANTI, Feb. 10—The U. S. Pressed Steel Co. has greatly enlarged its plant here. It has installed the conveyer system, and is now making steel products for tractor concerns. Among its contracts are seats for Fordson and Samson tractors.

Calendar

ENGINEERING

S. A. E. Meetings

March 5 — Minneapolis Section, S. A. E.—Hotel Radisson. "Tractor Service and Sales."

April 2—Minneapolis Section, S. A. E. — Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Feb. 6-15—San Francisco, Cal. Third Annual Pacific Automobile Show, Motor Car Dealers' Assn. of San Francisco, Exposition Auditorium. G. A. Wahlgreen, Manager.

Feb. 10-15 — Rochester, N. Y. Rochester Automobile Trades Assn., Exposition Park. George C. Donahue, Manager.

Feb. 12-15—Defiance, O. Second Annual Show under auspices of Defiance Automobile Dealers' Assn.

Feb. 15-22—Newark, N. J. N. J. Auto Exhibition Co. Calude Holgate, Manager.

Feb. 15-22 — Cleveland, Ohio. Cleveland Auto Show Co. Fred H. Caley, Manager.

Feb. 15-22—Minneapolis, Minn. Minneapolis Auto Trade Assn. Walter B. Wilmot, Manager.

Feb. 15-22—Albany, N. Y., Albany Automobile Dealers' Assn. State Armory.

Feb. 16-22—Waco, Tex. Henry B. Marks, Manager.

Feb. 17-22—St. Louis. St. Louis Auto Mnfrs. & Dealers' Assn. Robert E. Lee, Manager.

Feb. 17-22 — Louisville, Ky. Louisville Auto Dealers' Assn.

Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.

Feb. 17-22 — Pittsfield, Mass. Pittsfield Automobile Dealers' Assn., State Armory. James J. Callahan, Manager.

Feb. 17-22 — Passenger Cars; Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. J. L. Elliott, Manager.

Feb. 17-22—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.

Feb. 17-22—Seattle, Wash. Cars, Motor Car Dealers' Assn., State Armory. A. G. Schaeffer, Manager.

Feb. 18-22—Baltimore, Md. Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland, Fifth Regiment Armory. H. M. Lucius, General Manager.

Feb. 18-22— Oklahoma City, Okla. Automotive Show. R. H. Haun, Manager.

Feb. 18-22—Wichita, Kan.

Feb. 19-22 — Evansville, Ind. Cars, Evansville Automobile Dealers' Assn. Coliseum.

Feb. 22-March 1 — Hartford, Conn. Hartford Automobile Dealers' Assn., Inc., Broad Street Armory. Ben F. Smith, Manager.

Feb. 22-March 1—Atlantic City, N. J. Auto Trades Assn. of Atlantic City.

Feb. 22-March 1—New Castle, Pa., Lawrence County Association of Automobile and Accessory Dealers.

Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.

Feb. 24-March 1—Burlington, Ia. Second Annual.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 24-March 1—Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.

Feb. 24-March 1—Springfield, O.

Feb. 24-March 1—Portland, Ore. Ninth Annual Dealers' Motor Car Assn., Automobile Palace. M. O. Wilkins, Manager.

Feb. 24-March 1—Duluth, Minn.

Feb. 25-March 1 — Erie, Pa., United States Garage.

Feb. 26-March 1—Mason City, Ia. Fifth Annual, Mason City Auto Show Assn.

Feb. 26-March 1—Madison, Wis. Seventh Annual, Automobile Dealers' Division of Madison Assn. of Commerce, Union Transfer Bldg.

Feb. 26-March 1—Quincy, Ill. Cars, Quincy Automobile Trade Assn. Armory.

Feb. —Wheeling, W. Va. Automobile Show at Market Auditorium.

March 1-15—New York Aeronautical Exhibition, Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

March 3-5—Quincy, Ill. Trucks and Tractors. Armory.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

March 3-8 — Muskegon, Mich. Third Annual, Armory, Muskegon Lodge No. 274, B. P. O. E. John C. Fowler and George M. Friant, Managers.

March 3-8—Scranton, Pa. Ninth Annual, 13th Regiment Armory, Scranton Automobile Assn. Hugh B. Andrews, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

March 5-8—Lancaster, Pa. Automobile Trade Assn., Rowe Motor Co.'s Bldg. R. W. Shreiner, Manager.

March 8-15 — New Brunswick, N. J. Armory, New Brunswick Motor Trade Assn. William Kuehle, Manager.

March 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gradner, Manager.

March 10-15 — Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn., Auditorium. Clark G. Powell, Manager.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Passenger cars only. Chester I. Campbell, Manager.

March 15-22—Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.

March 17 - 22 — Great Falls, Mont. Montana Automobile Distributors' Assn.

March 19-22—St. Joseph, Mo. St. Joseph Automobile Show Assn., Auditorium. John Albus, Manager.

March 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.

March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 22-29—Passenger Cars. April 1-5—Trucks, Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkman, Manager.

March 24-29—Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.

March 24-29—New Orleans, La. Henry B. Marks, Manager.

March 24-29—Utica, N. Y. Utica Motor Dealers' Assn.

March 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

April 13-19—Bristol, Tenn. Cars, trucks, tractors, airplanes and accessories. Bristol Chamber of Commerce.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

TRACTOR SHOWS

Feb. 15-22—Minneapolis, Minn.

Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show, Wichita Tractor and Threshing Club. Forum.

Feb. 24-March 1—Kansas City, Mo. Fourth Annual Tractor Show. Sweeney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

RACES

March 15—Santa Monica, Cal. Speedway.

May 17—Uniontown, Pa., probably 112½ miles.

July 5—Cincinnati, O., Speedway.

CONVENTIONS

Feb. 19—New York, 13th annual banquet of Aero Club of America, Waldorf-Astoria.

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

Feb. 25-28 — Ninth American Good Roads Congress and 16th Annual Convention of the American Road Builders' Assn. Hotel McAlpin, New York.

April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

Improvements in New Mitchell

CHICAGO, Feb. 8—The new Victory model Mitchell on exhibition for the first time at the showrooms on Michigan Avenue has been entirely remodeled. The body lines have been improved by a bevel edge, while upholstery, top and other appointments are superior to the pre-war light six. A thermostat now controls the temperature of water, intake gases and air. The new car has a 120-in. wheelbase, using tires 34 x 4, and powered with a 3¼ x 5-in. engine. Some of the major improvements consist of a deeper frame, stronger rear axle, better brake layout and ball-bearing steering gear. The new crankshaft shows 35 per cent increased tensile strength. The long cantilever springs of last year have been retained. The new model sells for $1,475 f.o.b. Racine, and comes in a five-passenger touring and three-passenger roadster, both at the same price. The standard finish is green with black hood and fenders.

New Manufacturers' Representative

CHICAGO, Feb. 10—The Miller-Cave Corp. has opened offices in the People's Gas Building, Chicago, for service to manufacturers as sales representative to the automotive industry.

Franklin A. Miller, president and general manager, was with the Stromberg Carbureter Co. for several years in the sales department and later as advertising manager. For the past four years he has been connected with the western advertising department of the Cosmopolitan. Robert R. Cave, vice-president, has recently returned from the Government service as a divisional procurement officer. C. E. Sedweek, secretary and treasurer, has also just returned from a captaincy in the Army Transport Division.

Wright-Martin Turns Out Combination Liberty-Hispano-Suiza

NEW BRUNSWICK, Feb. 10—About 2000 workmen are still employed by the Wright-Martin Aircraft Corp. on a Government airplane engine contract, which will be completed in about a month. It has developed an airplane motor combination of Liberty-Hispano-Suiza, and has a four- and six-cylinder engine completed.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 8

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, FEBRUARY 20, 1919

Fifteen cents a copy
Three dollars a year

Entered as second-class matter Jan. 2, 1903, at the post office at New York, N. Y., under the Act of March 3, 1879.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, FEBRUARY 20, 1919—CHICAGO No. 8

European Expansion Under War Pressure

Manufacturers Unprepared for Peace Conversion—Merchandising Organizations Disrupted—Government Financing and Designing Ended with Armistice—Knowledge of Production, But Without Design and Finance

PART II

By David Beecroft

LONDON, England, Jan. 21—It is not surprising that after 4½ years of war many of the British and Continental manufacturers find themselves unprepared for quick conversion onto a peace basis. Some of these factory organizations resemble a person who has unexpectedly been knocked down by a vehicle whose approach was not noticed. While in this predicament the first impulse is for help and protection. So with these factories; not having the future clearly mapped out and having during the war suffered a complete destruction of its entire merchandising organization, the first impulse is a negative as contrasted with a positive course.

The reason for this is quite fundamental.

One manufacturing magnate has said that successful business is made up of four cardinal activities: a—designing, b—production, c—financing, d—merchandising. The correct proportioning and synchronizing of these four is the essential of success. With the British makers during 4 to 5 years of war only one of these four has received attention, namely, production. But not so with designing. The Government has looked after that; at least it has been done by some one outside of the factory in which the job was manufactured and the factory owner has had all the finance handled for him. The Government has handled it. He has never had to give scarcely a moment's consideration to it. So with merchandising. The Government has been the only customer, and selling and production have become as inactive as designing and financing the job.

Thus has the British manufacturer largely, under war, gone through a spoon-feeding production. He has seen his factory double, triple, quadruple and in some cases, increase tenfold. He has seen unheard of increases in production and he has for four to five years watched almost the complete disintegration of his selling organization both at home and abroad.

Thus we see these manufacturers to-day having to take up three activities which from four to five years have been crippled by the Government. It is not to be wondered that after the thunderbolt at noonday of November 11 a period of indecision

should set in and that with Christmas days ahead that indecision should prolong itself, with elections aiding in this delay.

This may explain why five post-war models are ready, why five post-war model prices had been set and why plans for the future are not crystallized as many might expect. But while picking up the three activities of design, finance and merchandising, which had remained dormant during the war, is a task of no mean magnitude, the British maker is confronted with other problems that are giving him perhaps greater concern. To-day he finds himself at the forks in the road. To his right lies the new highway for increased production, which looms into new importance because of the large modern factories filled with modern machinery that he finds himself in possession of as a result of the war.

To the left is the long trodden and more familiar road of low production and high price of the article coupled with wide variation in design, multiplicity of models and old design developed as a result of low production methods.

Which course to select is a problem of marked stature to the maker, who is yet hedged round with the smoke of battle and the never-ending demand of daily increasing production of munitions of war.

Must Change Manufacture Radically

To decide as to which fork in the road to take is made harder by the withdrawal of the strong arm of the Government. From now on the factory must carry along all four activities, design, production, finance and merchandising. Many factories had not sufficiently weighed each of the four. Some are weak-hearted. They want to go into quantity production but are weak-kneed. They are afraid they cannot merchandise them. Their old selling prices are gone. New ones had to be built up and 4 years of war has entirely eliminated the merchandising factor and it will be hard to rebuild.

Design for quantity production is a stumbling block to many. From 4 to 5 years their engineers in some cases had been on special war work, and they had not followed very closely what has been done. It is not surprising when thus halting at the fork in the road and in the throes of such a mental chaos that positive action should seem slow, if not naturally wanting and that the negative action should seem to dominate with not a few concerns.

To enter whole-heartedly into quantity production called for a radical change in British motor car manufacturing methods. It calls for a complete discontinuance of the old method of pre-war days—those days of Olympia expositions when the maker took to Olympia his new model to see how it caught the public eye and to see how many orders he could get, how much deposit money he could bring home and so, when the show was over, completely revise and design the job and start manufacturing. That was a sure-game policy. There was no losing on it. But that was not quantity production. It did not contain a single fundamental of quantity production.

Bold Program Needed

A few of these same sure-game managers are in charge of factories. True the factories are new. True they are modern factories. True the Ministry of Munitions has had production in them, but this does not insure a quantity production program in car manufacturing.

Quantity production calls for a bolder program than the average British manufacturer has attempted in the past. It calls for a complete reversal of attack. It presupposes a mental change as well as changes in manufacturing processes.

The question of the moment is can the British maker convert himself to the new quantity program?

British Factories Ideally Equipped

Notwithstanding the handicaps which the British manufacturer is under because of the war, he has the advantage of greatly increased factors. These invariably are of the very last word in modern construction, and are permanent, as everything of the kind is in Great Britain. Buildings are invariably brick, generally of the one-story type with saw-tooth roof construction, and have very large rooms. Everything necessary in the way of good lighting, good arrangement of machinery, central heating, forced ventilation, canteens at which the great majority of employees can get cheap noon-day meals, Red Cross facilities, with resident doctor and corps of nurses, auditoriums for entertainments, technical libraries, educational classes, in fact everything that could be asked for in connection with British factories exists.

While many of these additions are recent, not a few of them were made about the middle of the war, so that the companies have been using these factories at capacity for two years, and in some cases longer.

Rolls-Royce is a typical example of British factory expansion under the war. This factory has been required to manufacture only aircraft engines. Before the war it had 3000 employees and on Nov. 11 it had 8000. The factory covered 11 acres. The new buildings were erected on an orderly basis, and were filled with the finest machinery possible to obtain. When the armistice was signed the company was producing upward of 80 aircraft engines per week, mostly of the Eagle and Falcon models. It had started production on the large Condor twelve-cylinder type with cylinders 6½ by 7½.

Such a firm had little opportunity of making any progress on its post-war models because of Government control, and it will be engaged on aircraft work for some months to come. Its post-war program consists largely of carrying on its pre-war model, the 40-50-hp. six-cylinder chassis. There are many rumors of a small six-cylinder chassis of 15.9 hp., but these could not be confirmed.

Increased Organization Nearly 1000 Per Cent

One of the companies to make perhaps unprecedented progress during the war is Austin of Birmingham, which previous to July, 1914, had 2500 employees, but now has 22,000, or had this number on armistice day. The factory buildings are situated well in the country in Northfield, which is a suburb of Birmingham. This company during the war has had a variety of activities. It delivered 2000 airplanes, 2000 motor trucks, 350 armored cars, 650 guns, 750 touring cars, 148 ambulances, but by far its greatest reputation was made in its shell manufacture. In this work it reduced the price of the 9.5-in. shell from approximately $62.50 to $31. In other words, it cut it in half. The reduction in cost was of such importance that the matter was brought up in Parliament and an explanation of how it was possible to accomplish such results was made. Being located in the country it has been necessary for the Austin company to have special trains to bring its 22,000 workers from the surrounding locality. The railroads carried 10,500 of these workers to the plant in a period of 85 min. The company

has lines of motor buses which cover many of the adjacent areas.

Factory buildings cover 53 acres, and it has been necessary to feed 20,000 of the workers at the factory. This has called for a tremendous canteen organization.

Austin was one of the few companies fortunate in being able to develop its post-war model.

Maintains Technical Institute for Employees

This factory literally abounds with activities for the benefit of the workers. There is a technical society with a membership of 750 which holds regular meetings and has a technical library of over 500 volumes. The company has accommodation for 10,000 bicycles used by its employees. There is a large factory farm on which much of the produce for the canteen was grown. At a company grocery store it has been possible to supply provisions at a low price which were difficult to obtain. There is a technical institute for the education of the factory apprentices, who are given time during their working hours to take educational courses.

Another British factory which can be looked upon very largely as a war plant is the Siddeley at Coventry. On armistice day this factory was employing 5000 to 6000 workers and had 20 acres of floor space. It was delivering 150 airplane engines per week and twenty complete planes. With each of these went a 50 per cent stock of spares, which gave a considerable war output. The Siddeley factory is as modern a plant as could be found. The buildings are all of brick construction, largely one-story design, with a few multi-story buildings. Light, heating and ventilation are the best that can be found in any country. All buildings are fitted with modern machinery, much of which is American. The Siddeley company gives promise of being one of the aggressive British manufacturers in car production, and, while the company's plans are not definitely worked out, it has two thoughts primarily in mind—first, the production of a good car in quantity, and second, the merchandising of it at a low price.

Continue to Build Aircraft Engines

This company, like other British companies, has had great experience in manufacturing aircraft engines. It was one of the first to manufacture the twelve-cylinder air-cooled V-type R.A.F. which has had such wide use in the Royal Air Force. Siddeley took the drawings of this engine in December, 1914, and had the first engine made in March, 1915. In addition to manufacturing this engine, Siddeley has manufactured his own vertical six-cylinder design. It is stated that 25 per cent of all the British engines at the front were made by the Siddeley company. The Lanchester firm, one of the pioneers in Great Britain, has been engaged almost exclusively on aircraft production. It has been manufacturing the Arab Sunbeam model, an eight-cylinder design which has been produced in great quantities. In addition Lanchester has built other aircraft engines and expects to be engaged on this work for many months yet. During the war it built many of the air-cooled R.A.F. types.

The Sunbeam company was required by the Government to devote all of its attention during the war to the development and production of aircraft engines, and although the Sunbeam automobile was used as a staff car, the company was not permitted to build it in order that all of its activity might be devoted to aircraft work. Previous to 1914 the Sunbeam company had gone perhaps as far as any British concern in the development of aircraft engines, and it was because of this preliminary work that the Government practically assumed complete direction of the factory. Since the starting of the war 27 different types of aircraft engines have been developed for various uses, such as airplanes, seaplanes, blimps, dirigibles, flying boats, etc. Several of these engine types have been developed for certain types of machines, such as the flying boat for Russia. The company has 4000 workers, and has capacity for 4000 automobiles per year or approximately 80 per week. The factory has not developed as extensively as many other factories during the war largely because it has been used more as a development factory than a production one.

Vauxhall is another company that has made great development during the war, and many factory additions have taken place. The company is relatively small, with 1800 workers at the end of the war. It was largely engaged on the manufacture of Vauxhall cars throughout the war and so suffered very little disorganization. Because of this the company was able to develop its new four-cylinder valve-in-the-head car, which is one of the few British post-war models. The company does not contemplate going ahead rapidly on this model, which is designated as the 30-98 type, and plans only 50 of them for this year. It has a speed of 80 to 90 m.p.h. on the level, and travels 25 miles to the gallon at 33 m.p.h. with a four-seated body which weighs 2464 lb. The cylinders are 98 x 150 millimeters.

L. H. Pomeroy, the Vauxhall engineer, shares with many British engineers the opinion that designing an airplane engine is child's play compared with the automobile line. Many of them think that one Grand Prize road race gives them more information on engines than four years of war.

Crossley Output 250 Cars Monthly

The Crossley is a typical example of the growth under war pressure of one of the old British manufacturers. Before the war it had 500 employees, and on Nov. 11 it had 5000. Its capacity of fifty cars per week before the war has increased to 250 per week now. Before the war the old factory had 2½ acres of floor space and now it is 9 acres. In addition the company has one of the largest aircraft factories in England, which was completed about the middle of 1918. It covers 23 acres and is located in the outskirts of Manchester, or approximately 3 miles from the old factory. The erection of this factory was one of the building accomplishments of the war. In December the company was devoting one-third of its manufacturing effort in its old factory to airplane engines and two-thirds to motor cars. Two types of engines were in production, the six-cylinder Beardmore and the British air-cooled B.R. 2, a rotary type of engine. Just before the armistice the factory started on the manufacture of a third type of aircraft engine.

In the early days of the war—in fact, as far back as 1912, when the British Government organized the Royal Flying Corps, which later became the Royal Air Force—it was decided to use the Crossley chassis as the motor vehicle best suited for a good deal of the aircraft work, and when war broke out 100 of these were ready for the work. This was followed by Government orders to produce as many as possible. In the early days of the war these were produced at the rate of 30 per month and in the final days at 250 per month.

Made Tractors, Guns, Trucks, Airplane Engines

Renault, for example, has been manufacturing his heavy tractors for moving guns; he has been manufacturing cars; he developed the small Renault tank, and was producing it at the rate of 20 per day in December; he was manufacturing large guns com-

plete; he was manufacturing motor truck types of axles and running gears for guns; he had built an entirely new aircraft factory for the manufacture of planes; and he was manufacturing different types of aircraft engines.

With all this variety of war program it was quite impossible to install modern production methods on each and all. Notwithstanding this he had in operation one of the best systems of aircraft assembly in Europe. He was assembling the small tanks on a production progressive assembly basis, using the traveling chain method.

These tanks were traveling steadily along an assembly platform and the work on them was being carried on as they progressed. The war had required the opening up of new foundries which were constantly enlarged from time to time. So it was with all the other departments of the factory. There was never any time when each had reached its state of completion. It was a constant program of expansion, with no thought of terminating it until the morning of Nov. 11.

No Halt to Expansion

The development in other French factories was on a par. The case in question is that of the Gnome company manufacturing the Gnome and LaRhone engines in Paris. This company, previous to the war, had 500 employees. In December it was working with 4,000. The entire force was on aviation engines.

The company was producing thirty-five per day and was building four models of the Gnome alone. It had been asked by the government to build 350 of the Salmson radial type engine which has been such a successful war product.

The company has two large Paris factories and had partly completed a large foundry, part of which was in operation and had just completed the building for a very large forge shop. Some of the hammers had just been moved into the building and the work of installation was just started.

In the design and layout of these new buildings there was only the thought that the government must have more engines from this company no matter what the cost or what the possibilities of using these factories should the war unexpectedly stop. The work of equipping them was going ahead in December. Besides this, great additions to the factories for machine shops and assembly rooms were in the course of erection. The factory is a fine brick structure modern to the last chapter of factory design and equipped with all the modern machinery that aircraft engine manufacture called for. The company had manufactured many of its own lathes which were in use. Long rows of American machinery were seen alongside of French, British and Italian machinery.

800 Aviation Engines a Month

The company was going ahead on a war program developing its 800 hp. twenty-cylinder radial type engine, with fixed cylinders as compared with the rotary type engine which this company has always manufactured. The fixed cylinders were arranged in four circles of five cylinders to the circle. The circles were placed one behind the other so that each group of five cylinders was working on a single throw of the crankshaft. The job is water-cooled which represented a new departure in Gnome practice. Also under development was the new 500 hp. Salmson radial engine which the company was aiding in the development of at the request of the government.

Another French firm, Lorraine-Dietrich, made amazing development during the war. Its factory area has been more than doubled and it has been producing aviation engines at the rate of 800 per month. This is one of the old French automobile concerns which very early began the development of aircraft engines and which is to-day looking into the future and preparing for the possibilities of commercial aviation. Its factory additions have been carried out on a broad practical basis rather than in a step by step piecemeal topsy-turvy way.

The factory has enormously large rooms for machine shops, assembly, etc. They compare with the largest manufacturing floors in America. The machinery is all laid out in a well organized way, but there is a lack of electric industrial trucks to facilitate in removal of the material. The company is one example of the many that have endeavored to secure such equipment during the last year or two.

This company has been carrying through a large airplane program and its final thought is indicated in the development of a twenty-four-cylinder, 1000 hp. W-type of engine that should be well suited for commercial work. There are three rows of cylinders, the center row mounted vertically, and a row at each side, inclined slightly above the horizontal. All three groups work on the one crankshaft. The company has been producing an eight-cylinder V-shape 275 hp. with cylinders mounted at 90 deg. It has also been producing a twelve-cylinder 400 hp. type with cylinders at 60 deg. and a twelve-cylinder 600 hp. type with cylinders at 60 deg. The 600 hp. type uses four calves per cylinder, whereas the others have two. The 1000 hp. type uses the same cylinders with four valves as used in the 600. The company has also been producing aviation engines of 220 and 300 hp. so that it has been in production in five different models and has the sixth under development.

Expansion Constant at Panhards

The pioneer firm of Panhard-Levassor is an example of a French maker that has had a large production on four-wheel drive tractors for artillery use and has also manufactured trucks, aviation engines, ammunition, and other lines of war products. The company developed one of its own types of aviation engines which did not develop as satisfactorily as expected and many of which are now used in motor boats. In December it was just completing its government contracts for shells. The factory was in a complete state of expansion. It was one of the few French factories located within the walls of the city placed as it is close to the wall on the South. It has just completed a large three-story foundry of brick and reinforced concrete construction. The lower floor only has been put into operation. The elevators and staircases were just being installed. Panhard has added one of the finest three-story office buildings that exists in Europe. It stands as a monument of the development of the industry under war pressure. The building is largely completed. Adjacent to it are lines of new factory buildings which are just nearing completion. These factory additions are laid out on a modern scale giving large machining rooms as well as assembly floors. A general use of underground tunnels for transportation between buildings is a recently developed feature of the factories. During the war it was necessary for Panhard to utilize every adjacent building in its factory zone. Three and four-story warehouses were converted into machine shops for manufacturing shells. Alleys and every available outside space was utilized for storage of war products. Panhard's work of expansion was really just under way.

Ricardo Engine "Made Good" in Tanks

Embodies an Unconventional Piston Design and Means for Cooling the Piston, for Preheating the Carbureter Air and for Preventing Any Unvaporized Fuel That Gets by the Piston from Getting Into the Crank Chamber

THE war has brought a new type of internal combustion engine prominently to the front in England. It is the Ricardo engine, which was used successfully in British tanks during the last year of the struggle to the number of about 3000. This engine incorporates means tending toward the more economical use of fuel as well as toward a saving in lubricating oil. The outstanding feature of the Ricardo engine is its piston design. This piston is of the double diameter type, to use a term which has become somewhat familiar in connection with two-stroke engines. But in the Ricardo piston the lower portion is of smaller diameter than the upper, and serves chiefly the purpose of a crosshead, while the upper part carries the piston rings and serves to seal the combustion chamber. The lower part of the piston works in a crosshead guide, which is a sleeve of less diameter than the cylinder and fitted into the lower end of the cylinder in such a way as to project into the crankcase. The large diameter top part of the piston is rigidly connected with the smaller diameter lower or crosshead part by a long tube cast integral with the top part. At its lower end this tube carries the crosshead sleeve, which is a sliding fit in the crosshead guide. The wrist pin is carried in the the crosshead at the bottom, the conventional type of connecting rod being used. The diameter of the tube connecting the top and bottom of the piston is little more than one-half of the cylinder diameter.

Many reasons are advanced for the adoption of this design, and results with the engine in tanks bear out practically all of these claims. The primary object is to get a piston in which the upper part with the rings is entirely free from side pressure and only takes the explosion pressure on its head.

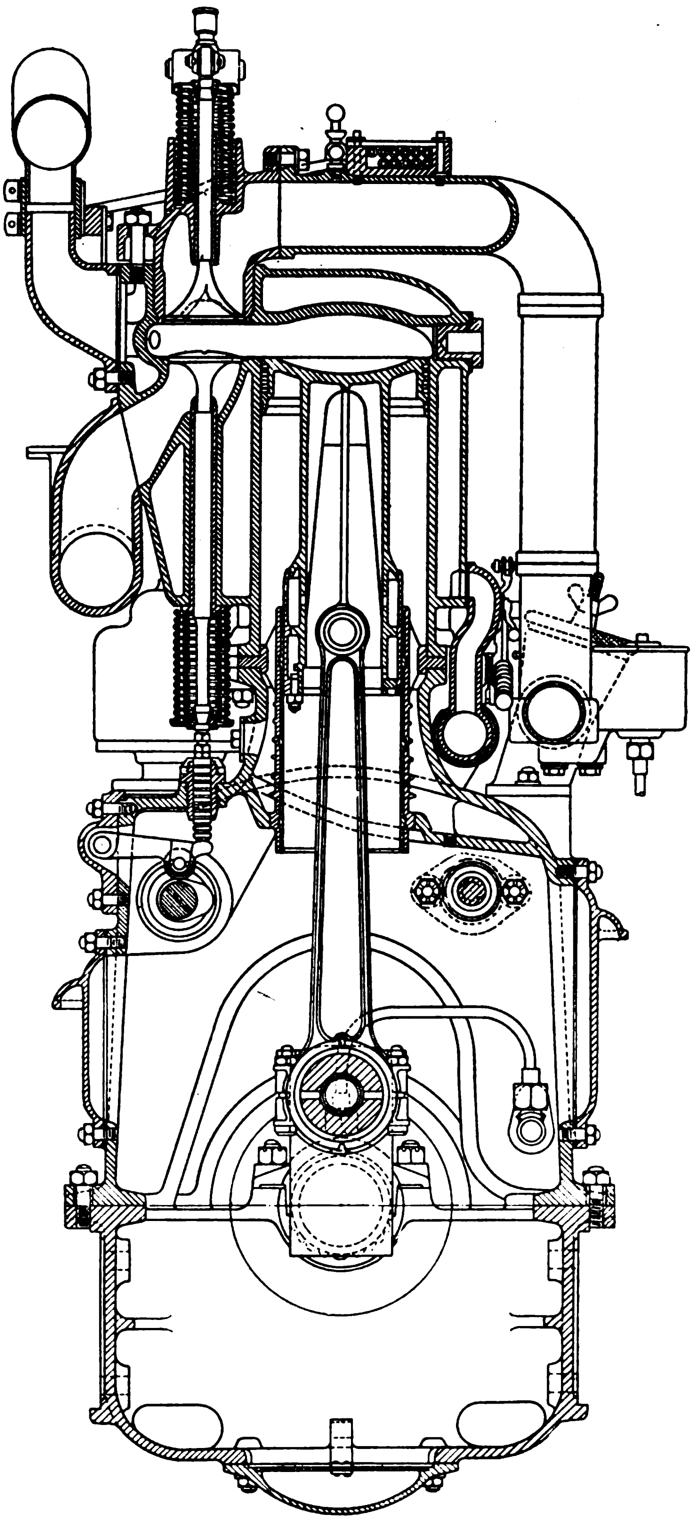
The crosshead taking the side thrust, the piston crown can be made with a relatively loose fit, as high as 0.060 in. clearance being allowed, and there is no pressure on the rings other than their own radial pressure, which is required for retaining compression.

Piston Design Insures Easy Cooling

A further object was to insure quick radiation of heat from the piston head, which is accomplished by a thick piston crown assisted by the smaller diameter downwardly extending piston tube. This obviates the necessity of relying on a piston skirt.

By securing the wrist pin in the lower or crosshead part it is far removed from the piston head, and its lubrication is proportionally simplified.

The wrist pin possesses several other advantages, due to this unusual location. The pin is short as compared with that used in the skirted piston, and the bosses carrying the ends of the pin are close up against the sides of the connecting rod. This reduces the bending moment on the rod and allows of using not only a shorter rod, but one of smaller diameter, and consequently reduces the reciprocating weight. It is possible to use a pin which floats in the top of the connecting rod and also in the crosshead bosses, which obviates any tendency to local



Cross section through the Ricardo engine, showing the unusual double-diameter piston with crosshead

wear on the pin, in that it tends to a slow rotary motion.

Among other advantages of this mounting of the wrist pin is that it is properly located with reference to the crosshead sleeve, which is the skirt of the piston. It is located approximately midway between the ends.

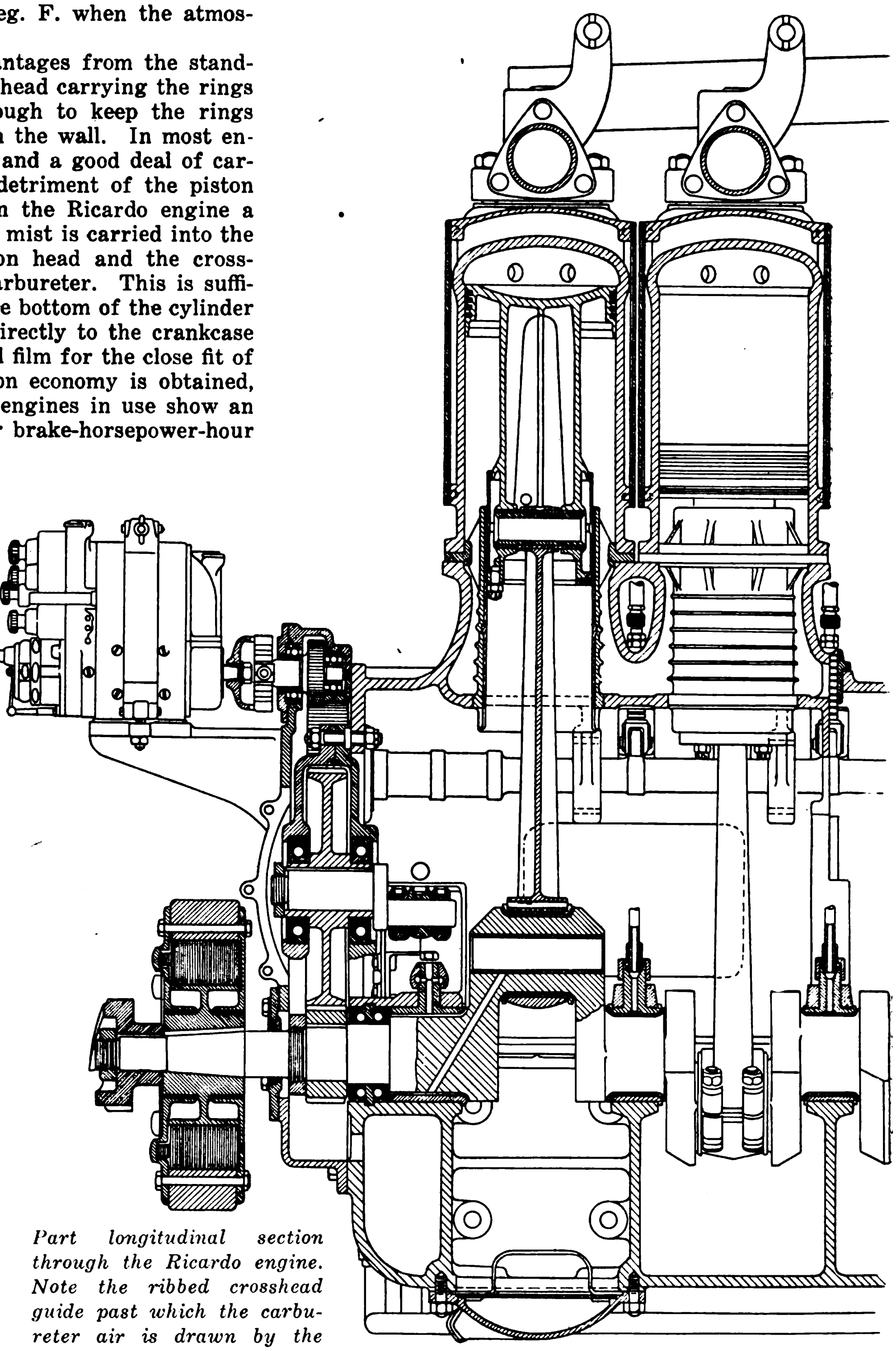
This crosshead design of piston prevents direct radiation of heat from the piston head to the crankcase, and so keeps the lubricating oil in the case cool. This is largely due to two factors: First, the heat from the piston head is largely radiated by the piston tube, and before it can reach the crankcase it has to be transmitted through the crosshead. Radiation from the piston tube is accelerated by having all the air entering the carbureter pass through the cylinder between the piston head and the crosshead. This air passes to the carbureter at as high a temperature as 150 deg. F. when the atmospheric temperature is 60 deg. F.

The crosshead piston has advantages from the standpoint of lubrication. The piston head carrying the rings requires very little oil, just enough to keep the rings working and to furnish a film on the wall. In most engines the rings get too much oil and a good deal of carbonization of oil occurs, to the detriment of the piston rings and the cylinder walls. In the Ricardo engine a small portion of the crankcase oil mist is carried into the cylinder space between the piston head and the crosshead by the air passing to the carbureter. This is sufficient for the piston crown. At the bottom of the cylinder the crosshead guide is exposed directly to the crankcase mist, and receives an adequate oil film for the close fit of the crosshead. Special lubrication economy is obtained, and the averages from the 3000 engines in use show an oil consumption of 0.012 pint per brake-horsepower-hour on new engines, which drops to 0.0075 pint per brake-horsepower-hour after use.

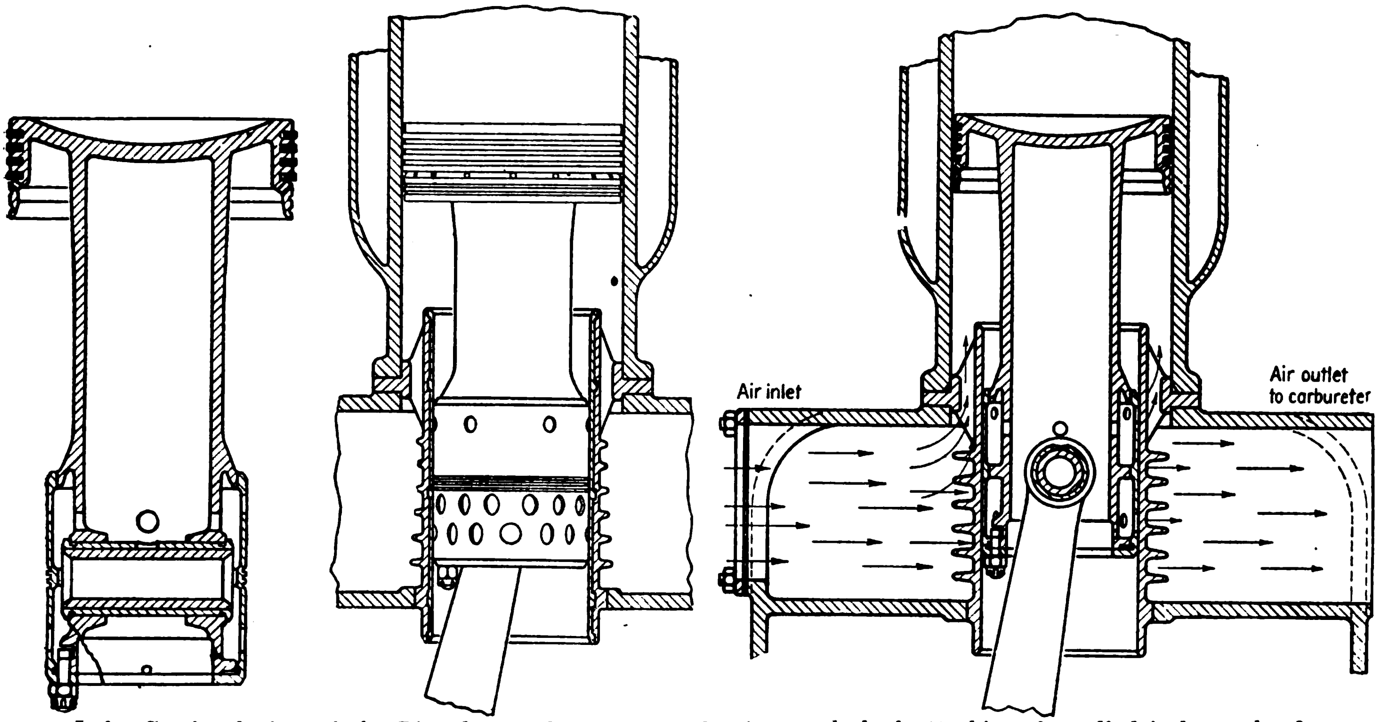
Still another advantageous feature of the Ricardo construction is that unburned fuel leaking down past the piston head does not enter the crankcase lubricant. Any heavier fuel particles that get by the piston head are picked up by the air passing to the carbureter and are again carried into the carburetion system. This factor is very desirable for using kerosene and also for gasoline in cold weather.

Not the least interesting aspect of this piston design is that it seems to furnish the missing link with aluminum alloy pistons, namely, the means of preventing piston slap when an engine is cold. The aluminum alloy piston has become universal in European aviation engines, where piston slap of a cold engine does not count. However, in passenger cars this slap must be eliminated, and it is also undesirable in the truck and the farm tractor. Ricardo designs the piston head with a loose fit, with as much as 0.060 in. clearance, but fits the crosshead as close as 0.004 in. The crosshead takes the side thrust and there is no slap.

The Ricardo engine was adopted for tank work owing to the impossibility of getting all the Daimler-Knight engines needed. The tanks originally used the 105-hp. six-cylinder Daimler-Knight, and Ricardo was asked to design his engine to give 113 hp. and to fit in the space used by the Daimler-Knight. The first design was a four-cylinder, 5⅝ by 7½ in., that gave 113 hp. at 1200 r.p.m. A six-cylinder design with the same cylinder sizes gave 170 hp. at 1200 r.p.m. To date four different sizes have been manufactured. The third model has six cylinders, 6¾ by 7½ in., and gives 255 hp. at 1200 r.p.m. Recently a twelve-cylinder job has been developed which would be interchangeable with the Liberty engine for certain uses.



Part longitudinal section through the Ricardo engine. Note the ribbed crosshead guide past which the carbureter air is drawn by the **action of the piston**



Left—Sectional view of the Ricardo crosshead piston, showing method of attaching the cylindrical crosshead. Center—The piston in place in the engine. Right—Sectional view, showing how the carbureter air is drawn past the ribbed sides of the crosshead guide

Apart from the piston design, the engines are conventional types, with single cast-iron cylinders having valves in pockets on one side, the exhausts in the bottom of the pockets and the intakes in the tops, or directly above the exhausts. Both are operated from a single camshaft within the crankcase.

Using the crosshead piston increases the engine height approximately two-thirds of the stroke, which in the case of the 7½-in. stroke engine referred to adds 5 in. to the height. There is an increase of 10 to 15 per cent in engine weight as compared with the same sized engine using a skirt piston. A cold compression of 85 lb. gage is used. The mean effective pressure in the 5⅝ by 7½-in. size is 100 lb., and in the 6¾ by 7½-in. size is 106.5 lb.

Before going into tank use each engine is given a severe test and every fifteenth engine is given a 200-hour test in four runs of 50 hours each at full load on a dynamometer. No work can be done on the engines under test between the 50 hour periods. Every engine has to run 10 minutes while tilted at an angle of 30 degrees without load, and at the end of 10 minutes must go onto full load without smoking or missing. At the end of the 200-hour tests no carbon deposits have been found on the cylinder heads, the only indication of carbon being a mahogany color.

In the design of the engine the use of alloy steels was not permitted by the Government, in order to conserve these steels for the aviation program.

The engine has a mechanical efficiency of 386 per cent when starting up and 87.5 per cent after running.

The design of the engine parts to admit of the cross-head piston, which is a two-diameter one, does not call for unusual complications, as the cross-head guide fitting into the bottom end of the cylinder accomplishes this, leaving the cylinder casting identical with that in an engine using a skirted piston. The crosshead guide is an air-cooled aluminum alloy sleeve supported by a flange which is anchored between the cylinder base and the crankcase. The lower end of the sleeve fits into a sub-top of the crankcase. In the early designs this cross-head sleeve or guide was of bronze, lined with white metal, but aluminum alloy has been found to give very excellent results. The clearance of the crosshead in its guide ranges from 0.0035 to 0.006 in.

The piston, a die casting, has the crown slightly concaved, and only carries the very thin piston rings, which have a thicker radial measurement. Below the rings the very brief piston skirt is cut back, leaving a clearance of 0.020 in. In manufacture it has to be machined on the two cylindrical surfaces.

The crosshead sleeve is a cast-iron ring or shell fitting over the lower end of the piston tube and is secured thereto by four small bolts. It is an easy push fit on the piston tube. It is supported on the piston tube by three circular bands, the middle one being on the center of the wrist pin. The sleeve can be either cast iron or a steel forging, the former serving for commercial engines.

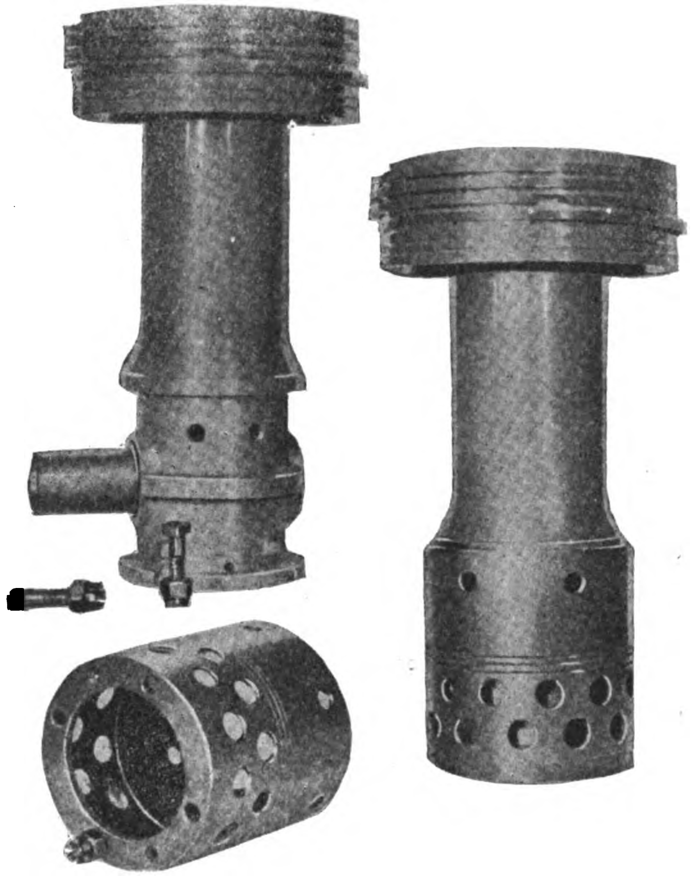
The crosshead piston permits of a short wrist pin, which is bushed in the end of the connecting rod and also in the crosshead bosses, allowing the pin to float. It is oiled by the crankcase mist, and the quantity supplied is quite independent of the throttle.

Nothing unusual is found in the valves and operating parts. They are of 3 per cent nickel steel, low carbon and case hardened. Phosphor bronze valve guides are used. There is little if any pitting of the heads. The timing is:

Inlet valve opens 20 deg. late.
Inlet valve closes 17 deg. late.
Exhaust valve opens 55 deg. early.
Exhaust valve closes 5 deg. late.

A careful masking of the inlet valves has shown very satisfactory results.

In carburetion use is made of the space between the crankcase top and the sub-top for the circulation of air around the crosshead guide. The air enters at one side and passes out to the carbureter on the other side. A portion of the air is drawn directly round the crosshead guide, and the remaining portion passes between the guide and the cylinder through slots provided for this purpose. On the upward stroke of the piston the air is drawn through these slots at a high velocity, and impinges



The Ricardo piston complete and disassembled, showing the crosshead which is bolted to the piston extension

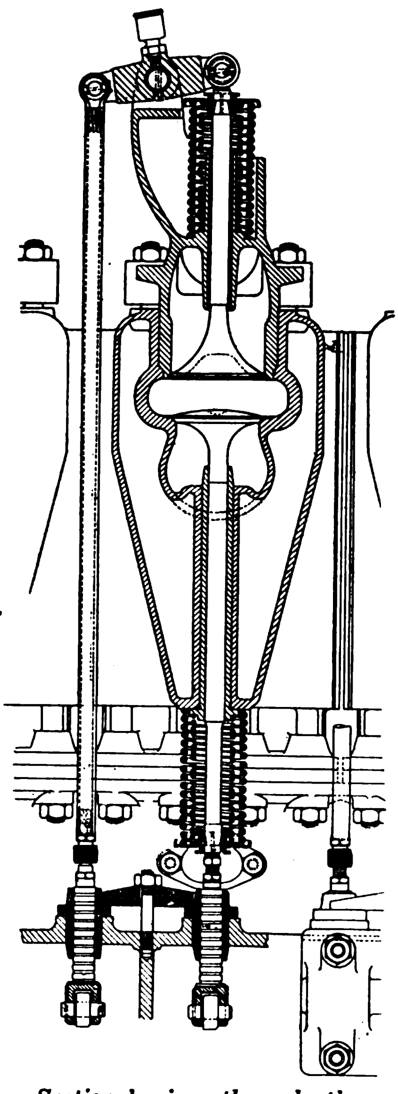
upon the crown and stem of the piston, thus effectually cooling them. On the downward stroke this heated air is discharged again into the chamber surrounding the guides, and thence into the carbureter. By this means the piston and crosshead guide are kept cool and the carbureter air is warmed.

It is found in practice that the heat abstracted from the piston and crosshead guide is just sufficient to overcome the latent heat of evaporation of the gasoline when running on full load, and rather more than sufficient on reduced loads. Tests carried out with thermometers fitted in the induction piping above and below the carbureter have shown that when running on full load with an atmospheric temperature of 60 deg. Fahr. the air, after passing round the crosshead guides and pistons, entered the carbureter at a temperature of 130 deg. Fahr.

The temperature immediately above the throttle was found to be 70 deg. Fahr., and near the top of the induction pipe, where evaporation appears to be complete, it was found to be 60 deg. Fahr., showing that the heat abstracted from the pistons and crosshead guides was just sufficient to replace that absorbed in overcoming the latent heat of the fuel, while the total drop in temperature of 70 deg. Fahr. showed that practically the whole of the fuel was evaporated before entering the cylinder. On a light load, with consequent reduced air circulation, the temperature of the air entering the carbureter rose to 150 deg. Fahr., and the temperature near the top of the induction pipe was sufficiently high to check condensation at reduced loads. The free circulation of air through the upper portion of the crankcase tends to keep the lower portion cool, so that no oil cooling is required. Further, the crankcase is not exposed to the heat radiated from or carried away by the lubricant from the inside of the piston crown.

As the upper end of the piston is to a certain extent isolated from the crankcase, special provisions had to be made to insure its lubrication. The lower portion of the stem of the piston is provided with a few small holes, and the crosshead sleeve which surrounds it is also provided with a ring of small holes so placed that these holes are uncovered above the guide at the top of each stroke. On the upward stroke of the piston air is drawn through slots provided in the flange of the crosshead guide between the guide and the cylinder, and passes at a very high velocity around the crosshead sleeve; in doing so it draws a small proportion of air and oil mist from the holes in the crosshead sleeve, which are in communication with the crank chamber through the corresponding holes drilled in the piston stem. The oil issuing from these holes in the form of a mist is picked up by the rush of air and sprayed over the cylinder walls while the piston is near the top of its stroke; the total quantity of oil drawn out in this manner is exceedingly minute, but it is sufficient for the maintenance of the piston rings. The whole operation is similar to that of a carbureter in which the slots in the crosshead guide correspond to the choke tube and the holes in the sleeve to the jets. The control of the quantity of oil delivered in this manner is governed by the area of the slots and the size or number of holes provided in the sleeve.

It will be noted that by this means the lubrication of the cylinder walls is continuous, that it is independent of the suction in the cylinder, that oil is only supplied to the cylinder walls in the quantity required by the piston rings, and that oil which has clung to the walls and become partially carbonized does not find its way back into the crankcase.



Sectional view through the valves and valve gear of the Ricardo engine

The advantages of the Ricardo piston may be summarized as follows:

(1) The lubrication is under complete control, and is independent of the suction in the cylinder; consequently the oil consumption, the tendency to carbonize both the piston and combustion chamber, and the risk of oiling up the sparking plugs are all reduced to the minimum.

(2) The piston friction is reduced to about half that which obtains with an ordinary trunk piston.

(3) Owing to the fact that the crosshead and guide are relatively cool, and that both are maintained at approximately the same temperature, a very fine running clearance can

(Continued on page 443)

Generation and Storage of Energy in Magnetos

How the Spark Energy Is Generated by the Armature Motion and Stored in the Magneto During the Short Circuit Period

By Harry F. Geist, E. E.

THE magneto generator, as used for ignition purposes, generates and stores the energy which subsequently goes into the ignition spark, during a period of operation while its winding is short-circuited. When the spark is desired, the winding is suddenly open-circuited, with the result that the stored energy is delivered in the form of an electrical spark.

Fundamentally, this stored energy, which is electromagnetic in form, is present in the combined electrical and magnetic circuits of the machine in the form of a reactive magnetic field and also in the form of a distortion of the excitation flux distribution due to this reactive flux, that is very different from what the flux distribution would be on open circuit for the same armature position, so that it naturally follows that a sudden change from the short circuit to the open circuit condition will result in a very sudden magnetic readjustment that produces the delivery of the stored energy to the ignition spark.

It is the purpose of this article to explain how the energy is generated due to armature motion and stored in the magneto on short circuit, pointing out by the aid of diagrams how the reactive flux is set up, influencing the shifting of the main or excitation flux from the magnets of the machine, and affecting current flow in the windings. The writer will endeavor to cover briefly all the important phenomena connected with the short-circuit operation of the ignition magneto.

In AUTOMOTIVE INDUSTRIES, Vol. XXXIX, page 616, in an article, "Magnetism In Magneto Generators," under Analytic Measurements, the writer gave a brief description of the physical dimensions of a low-tension magneto and of the set-up for the oscillographic test by which the oscillogram of the open circuit e.m.f., illustrated in Fig. 4 of that article, was taken. Special attention is here called to the fact that the oscillogram shows that when the armature was in the vertical position a relatively high voltage was generated.

Short Circuit Current

In Fig. 1 is now presented an oscillogram showing the current generation on short circuit for the same machine, taken under the same general testing conditions, so that in this oscillogram, just as in the oscillogram of the open-circuit e.m.f., the armature position is definitely marked.

Fig. 1, therefore, represents both a current-time and a current-armature position record of the performance of the machine on short circuit, at a speed of about 630 r.p.m., as checked directly from the 60 cycle wave represented therein.

The principal disclosures of this record are that the current wave is a very broad and flat one, indicating considerable firing range in the magneto, and that the current changes its polarity each time the armature passes the vertical position for this particular speed of operation. The current flow in amperes is also indicated on the oscillogram and the sequence of events is as shown by the arrow.

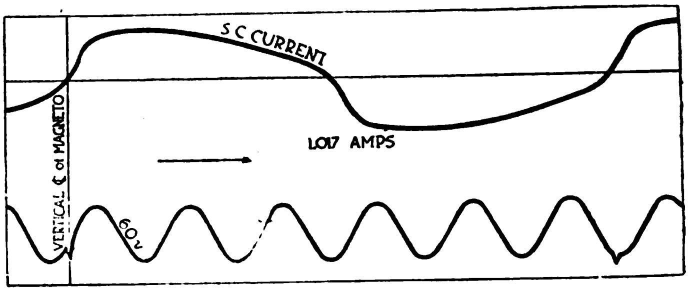
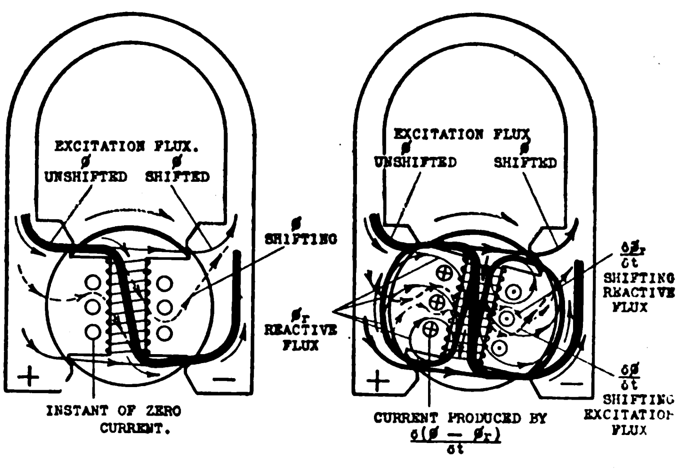


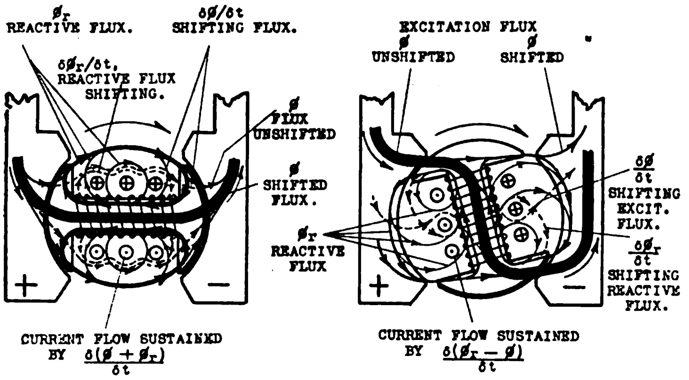
Fig. 1—Oscillogram of short circuited armature current

By comparing the short-circuit current wave with the open-circuit voltage wave, it will be seen that there is a lag between the armature position at which the short-circuit current rises to its maximum and that armature position at which the open-circuit e.m.f. rises to its maximum. It is this lag or retardation effect upon the manner in which the generating flux shift is produced on short circuit as compared with the more natural shift which takes place on open circuit, that is caused by the reactive flux set up in the magnetic circuits of the machine due to current flow in the generating winding.

The following flux distribution diagrams (Figs. 2, 3, 4 and 5) represent an attempt to show as completely as is possible how the reactive flux is set up in the machine, and its effect upon the excitation flux distribution, as well as the manner in which both the reactive and the excitation fluxes shift with respect to the winding.



Figs. 2 and 3—Showing flux distribution for two armature positions



Figs. 4 and 5—Flux distribution for two other armature positions

In these diagrams, just as in discussions of magnetic phenomena, the excitation and the reactive fluxes will be shown as separate entities, even though they do not actually exist as such, and the general plan is followed of joining these forces where they flow in the same direction through the same path, and of giving them slightly separated paths where they tend to flow in opposite directions in the same path. An endeavor has been made also to show the fluxes in about the proportions in which they exist for the different armature positions shown.

Shifting fluxes are shown in dotted lines and are given a curved effect with respect to the conductors they are shifting across. In connection with shifting fluxes, it might be pointed out here that as the armature face tips leave the pole piece tips, and as the opposite tips meet, excitation flux will shift across the winding, leaving the separating tips toward the meeting tips. For the direction of rotation shown in Figs. 2, 3, 4 and 5, this shifting excitation flux travels down on the left and up on the right-hand side of the coil, or always toward the "shifted flux" as designated.

As current increases in the winding, the reactive forces increase, the loops of reactive flux increase in number, and in so increasing, additional loops of reactive flux shift across the turns of the coil, beginning at the magnetic center, until they include the path formed by the armature core, armature faces and pole pieces. For decreasing current, these loops in dying out will decrease in the scope of their path inward toward the magnetic center of the winding and thus also will shift across the coil turns. This shifting of reactive flux has an effect similar to the shifting of the excitation flux, the effect being in proportion to its rate.

In these diagrams, a direction of rotation and a polarity of the magnets are assumed, and one face of the armature is shown heavier than the other in order that the amount of armature motion from one position to another be more easily followed.

Fig. 2 shows the armature in the vertical position, which, according to the oscillogram, Fig. 1, is the position of zero current. The conditions as represented in Fig. 2 depend upon phenomena occurring as the armature approaches the vertical position, so that Fig. 2 will not be discussed until after Fig. 5.

Position of Zero Current

As the armature passes from the vertical position to that represented in Fig. 3, the current rises toward its maximum value. This current is due to the fact that the excitation flux shifting across the coil generates an electro motive force that causes current flow in the closed circuit. While this current producing voltage is purely the result of the excitation flux shift and will vary as $\delta\phi/\delta t$ varies, it is further influenced by the fact that as the current increases in value, the reactive flux ϕ_r will increase in value correspondingly and will shift across the coil at a rate $\delta\phi_r/\delta t$. This shifting of reactive flux takes place in a general way in the opposite direction to that in which the excitation flux is shifted across the coil, so that it is evident that the current is produced by the resultant of these two shifts, which is expressed by $\delta(\phi - \phi_r)/\delta t$. Owing to the fact that the generating shift must be greater than the reactive shift which it produces, this resultant shift is expressed by the difference as shown. The current flow in the winding will be in the direction indicated by the three turns in cross section.

Attention is called in Fig. 3 to the fact that the loops of reactive flux flow in the same direction as the excitation flux at the separating armature and pole piece tips, and in an opposite direction at the meeting tips, which accounts for the fact that the excitation flux is retarded in its shifting by the reactive flux, for it will be appreciated that on open circuit, with an absence of the reactive flux, the direction of the excitation flux through the armature would be directly opposite. The diagram also shows that all the reactive loops do not interlink with all the coil turns and shows that the magnetic center, that is, the center from which all reactive loops arise and return, is at the opposite end on each side of the coil from the separating tips.

Fig. 3 shows the armature in about the position of maximum energy storage. This energy exists, as was previously mentioned, in the presence of the loops of reactive flux interlinked with the coil, and in the fact that the excitation flux is held in an unnatural path with respect to the coil by this reactive flux. The energy which is thus stored is generated by the shift of the excitation flux, produced by the motion of the armature and its consequent co-action with the pole pieces of the machine.

Position of Maximum Current Flow

As the armature passes on to a position of about 50 deg. beyond the vertical position, the current reaches its maximum value and then begins to decrease in amount, because the actual generation of energy has dropped off to a rate that is less than the amount that is being continually consumed in the copper and iron losses of the machine.

Fig. 4 shows the armature when it has about reached the horizontal position, and illustrates the phenomena taking place with the current thus decreasing in value. This figure shows practically all of the excitation flux shifted and passing directly through the armature core, but shows a stray flux still unshifted that is negligible for this position. The reactive flux loops ϕ_r will take the path as shown, and it will be noticed that these loops have a more difficult path than that of Fig. 3.

With the current decreasing, and the reactive flux decreasing likewise, there will be a shifting of the reactive flux $\delta\phi_r/\delta t$ across the coil as these loops die out toward the magnetic center of the winding. This center, it will be seen, has changed for each side of the coil to a position on the vertical center line of the machine, about as shown.

The dying out of the reactive flux and the shifting of the rest of the excitation flux are both now in the same direction with respect to the coil, so that from the instant the current begins to decrease, up to the neighborhood of the position of Fig. 4, the resultant flux shift is seen to be $\delta(\phi + \phi_r)/\delta t$. This resultant flux shift rate has a sustaining effect upon the current flow and accounts for the fact that the current decrease is very gradual. When all the excitation flux is completely shifted with

respect to the coil this resultant flux shift rate becomes $\delta\phi_r/\delta t$.

As the armature passes on toward the position of Fig. 5, the tendency is for the excitation flux to again begin to shift with respect to the coil, passing down on the left-hand side and up on the right-hand side, thus changing from the path of the unshifted to the path of the shifted excitation flux, as shown in the diagram. The reactive flux is still present and still decreasing in value, so that it is seen that the shifting of the excitation flux now opposes the shifting of the reactive flux, *i.e.* the motion of the armature is now tending to generate energy to destroy the stored energy still existing in the machine, with the result that the resultant flux shifting rate is now $\delta(\phi_r - \phi)/\delta t$. Here still the component $\delta\phi_r/\delta t$ is the greater, but $\delta\phi/\delta t$ is overcoming it at an increasing rate. In Fig. 5 it will also be noticed that the magnetic center for each side of the winding is directly opposite from where it was in Fig. 3, showing how the magnetic center of the machine changes with the armature during its rotation.

Shifting of Flux Balances Stored Energy

When the armature reaches the vertical position, as represented in Fig. 2, the shifting of the excitation flux has completely overcome the stored energy and the current has reached the zero value. This position is an instantaneous one, and the shifting flux ϕ shown is part way between the unshifted and shifted positions. Due to the fact that the current is zero, there can be no reactive flux left from the original generation of Fig. 3 or resulting from the new generating tendency of the shift explained for Fig. 5.

For the next half revolution the magnetic and electrical phenomena repeat themselves, but inasmuch as the armature and coil are inverted with respect to the field, from what they were during the half revolution discussed, the forces set in action will be of opposite polarity.

A general review of the diagrams shows that useful generation takes place from the vertical position of the armature for about 50 deg. of motion, after which the coil serves almost purely as a reservoir, this reservoir being emptied by the generating effect during the last part of the half revolution, in addition, of course, to the continual consumption of energy by the coil resistance and the iron of the machine.

During the half revolution, the resultant flux shift is seen to change from $\delta(\phi - \phi_r)/\delta t$, to $\delta(\phi + \phi_r)/\delta t$, and after the original flux shift $\delta\phi/\delta t$ has died out and the new one begins, to $\delta(\phi_r - \phi)/\delta t$, so that it is apparent that the reactive flux plays an important part through the complete half revolution.

Throughout the phenomena, the general effect of the reactive flux is to stabilize the current flow in the machine, hindering it in its generation, and retarding also its decrease. This retardation effect results, as has been shown, from both a regenerative effect upon the coil itself and from the distorting effect upon the distribution of excitation flux.

Regenerative Effect of Reactive Flux

The regenerative effect of this reactive flux upon the coil itself is what is known as the effect of inductance, while the distorting effect upon the distribution of the excitation flux is what is known as armature reaction. A third limitation to current flow, which is well known, is the resistance of the winding itself, but inasmuch as its general effect has little bearing on the wave shape of the current flow on short circuit, only a mention of it will be made at this time.

It is well known that an electromagnetic circuit, having an inductance L, in which a current i is flowing, will store energy in accordance with the following equation:

$$W_1 = \frac{L\,i^2}{2} \qquad (1)$$

In addition it is also apparent that during the armature motion from the position of Fig. 2 to that of Fig. 3 or until $\delta\phi_r/\delta t$ begins to exceed $\delta\phi/\delta t$, each line of reactive flux will hold an equal line of excitation flux in an unnatural position with respect to the coil, so that for this range of armature positions the stored energy due to armature reaction must be about equal to that stored due to inductance, or the total stored energy can be expressed by,

$$W = Li^2 \qquad (2)$$

Therefore the inductance effect and the armature reaction are both factors in the stored energy of the magneto.

The value of the current i in amperes is obtainable for any armature position directly from the oscillogram of Fig. 1, so that if the inductance in henrys of the circuit can be ascertained for different armature positions, the stored energy for any armature position is calculable in joules from the foregoing equations.

If an alternating electromotive force, of known frequency and sinusoidal in its wave shape, is impressed across the terminals of the magneto coil, with the magnets removed from the machine, and this emf. is of such a value that as small a current as can be accurately measured will flow, then for any armature position the impedance Z of the circuit is obtainable, by dividing the impressed voltage by the current flow resulting.

Impedance

It is well known that the impedance Z is equal to the square root of the sum of the squares of the reactance X and the resistance R of the coil, and since R can be easily obtained by the use of a Wheatstone Bridge, and in this case proved to be 4.02 ohms, the value X is readily obtainable from Z and R by calculation.

For a sinusoidal voltage wave form of frequency f the following law holds true,

$$L = \frac{X}{2\pi f} \qquad (3)$$

and from it the value of the inductance can be calculated for any armature position for which X is known.

A series of inductance measurements was made following the above method for different armature positions of the magneto from which the oscillogram of Fig. 1 was taken, and the results are shown in the Inductance-

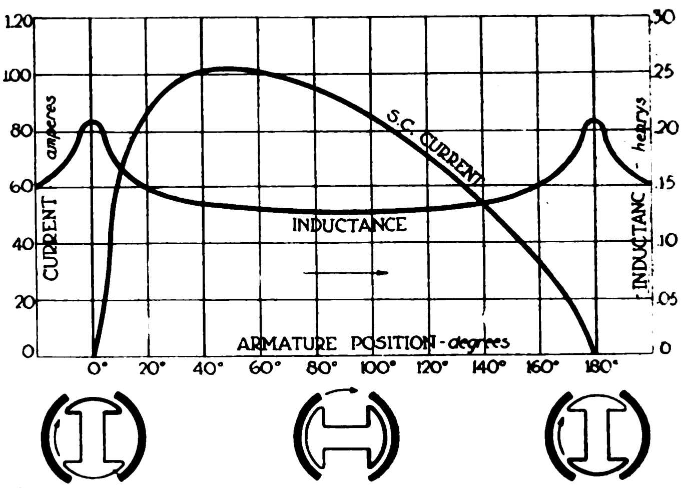


Fig. 6—Armature position-inductance curve

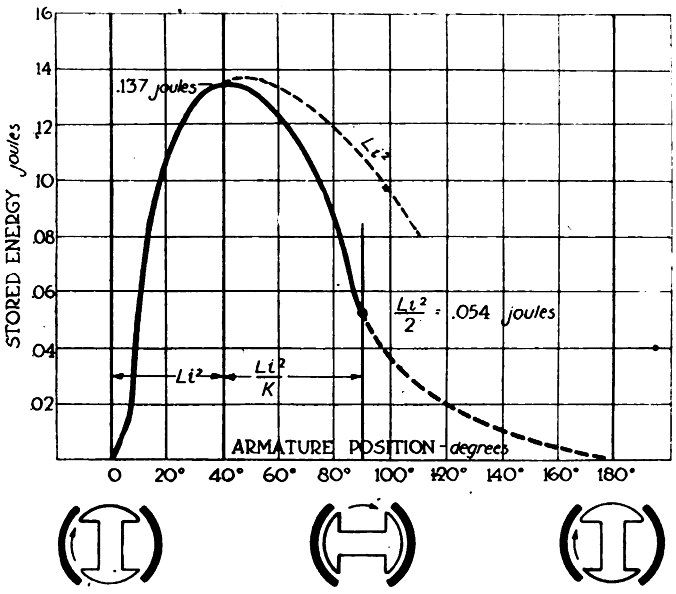


Fig. 7—Curve of stored energy

Armature Position curve of Fig. 6. The short-circuit current as reproduced from the oscillogram is also included in Fig. 6, so that from these two curves it is possible to calculate the amount of stored energy in the magneto for different armature positions.

In Fig. 6 attention is called to the fact that the inductance of the circuit is a maximum when the armature is in the vertical position. This is what would naturally be expected because for this position the reactive flux has complete iron paths through the armature core, armature faces and pole pieces, with the exception of the clearance gap between the rotor and the stator, while for the horizontal position the loops of reactive flux have a much more difficult path and the inductance will, therefore, be a minimum for that position. Thus it is seen that the inductance of the circuit varies very materially as the armature changes positions during its rotation. The resistance of the winding will, of course, be constant.

It was pointed out that the stored energy for armature positions from Fig. 2 to Fig. 3 is the sum of the effects of inductance and armature reaction, and is therefore the amount calculable from equation (2) by the use of the data represented in Fig. 6. Equation (2) holds true in this magneto for the speed at which the oscillogram was taken, from the vertical position to about 40 deg. after the vertical.

Value of Stored Energy

In Fig. 7 the calculated results are plotted and the curve shows how the stored energy increases from zero to its maximum of about 0.137 joule as the armature moves through the first 40 deg. From the 40 deg. position on to the 90 deg. or the horizontal position, the armature reaction component of the stored energy gradually dies out, so that for the horizontal position the stored energy will be due almost entirely to inductance and will be of an amount calculable from equation (1), which gives 0.054 joule.

Between the 40 deg. and 90 deg. positions, therefore, the stored energy will follow the equation,

$$W = \frac{L\,i^2}{k} \qquad (4)$$

where k is a numerical quantity varying from 1 to 2 for the included armature positions, so that the curve for the range of positions from 40 deg. to 90 deg. will have to be to some extent an approximation.

The amount of stored energy after the horizontal position for the last quarter of a revolution is of very little consequence, because the stored energy is below a useful value even before the armature reaches the horizontal position.

From Fig. 7 it is seen that the magneto under consideration has a comparatively high value of stored energy at 630 r.p.m. for about 50 deg. of motion. This range, of course, results from a constant speed of operation. In starting an engine, with the spark occurring late, say at 60 deg., the starting speed will be comparatively low, perhaps only about 200 r.p.m., so that the energy available for the spark at that position of the armature and speed will not be as high as that shown in Fig. 7. The true firing range of a magneto has to allow for low-starting speeds. However, it is evident that this magneto has ample firing range for ordinary service. It is also apparent by comparing the Stored Energy-Armature Position curve of Fig. 7 with the Current-Armature Position curve of Fig. 6, that there is a great deal of difference between the current range and the sparking range of a magneto.

Stored Energy on Short Circuit Dissipated in Heat

The question might be asked as to what becomes of the energy generated and stored in the machine on continuous short circuit, when the circuit is not interrupted to produce an ignition spark. All the energy that is generated in the machine during each half revolution of the armature is dissipated during that half revolution in the form of iron losses in the magnetic circuits and copper losses due to the resistance of the winding. At those positions of the armature where energy generation is very high, the energy generation exceeds the amount consumed, so that most of the energy is stored as previously explained, but after the generation dies out the stored energy will continue to be expended in the copper and iron losses.

During the period of generation, energy storage, and energy dissipation in copper and iron all take place simultaneously, so that a complete dispensation of the energy generated is practically impossible.

However, from the data contained in the oscillogram Fig. 1 in connection with the fact that the coil resistance R is known, it is a simple matter to determine the amount of copper loss, by the use of the following equation,

$$W_r = \int_0^t i^2 R\, \delta t \qquad (5)$$

where i varies with t as is recorded by the oscillogram, and R is 4.02 ohms. The indicated integration can be carried out by a step by step summation for small intervals of time δt covering the 0.0476 second required for the half revolution at 630 r.p.m.

Such a calculation made for this magneto shows the total copper loss for the half revolution to be 0.111 joule. Of this amount 0.08 joule was spent after the 40 deg. position from the 0.137 joule stored, so that it is evident from the difference that iron loss is also a very important consideration in this type of machine.

Energy Available for Spark

However, these calculations are secondary considerations in the phenomena that occur during the rotation of the armature, as compared with the simple, direct and fairly accurate determination that can be made of the energy available for an ignition spark for any armature position on the firing range of the magneto.

The discussion thus far has dealt principally with the phenomena occurring during one complete magnetic shift of the machine for one particular speed of operation. In

order to show how the performance of the magneto varies with the speed at which the armature revolves, the effective short-circuit current was measured by means of an electro-dynamometer for different speeds ranging from zero up to about 1400 r.p.m.

The results of this test are plotted in the form of a graph in Fig. 8, which shows how the current increases very rapidly for increases of speed until the armature attains a speed of about 300 r.p.m., after which the increase is more gradual and after 600 r.p.m. the current becomes practically constant.

As the speed increases from zero, the tendency is for the impedance voltage generated in the machine to increase with it and thus cause a higher current flow, but as the speed increases, the resulting current changes and their consequent inductive effects will set up a counter e.m.f. that also increases with the speed, so that a speed will soon be reached at which the increase in generated voltage is neutralized completely by the counter e.m.f., with the result that the current flow will then maintain a constant effective value regardless of speed increases.

From an energy standpoint, an increase in armature speed means additional mechanical energy to be transformed into electrical energy, so that there must be an increase in the electrical energy generated. Part of this increased energy is consumed in iron losses, which increase rapidly with the speed, while the rest goes into increased energy storage, giving the machine a greater storage range and being accompanied by a broadening of the current wave shape.

Increasing or decreasing the number of turns of the coil will increase or decrease the inductance of the circuit, so that such a change in the winding will result in a change in the Speed-Current characteristic of the magneto performance. As an illustration of this change, the two dotted curves are included in Fig. 8. Any other changes in the physical proportions of the magnetic circuits of the machine that will increase or decrease the inductance of the circuit, without reducing the generative ability of the magneto, are also very good methods of adjusting the Speed-Current performance, although their effects upon the wave shape of the current generated and upon the firing range of the machine will have to be taken into consideration.

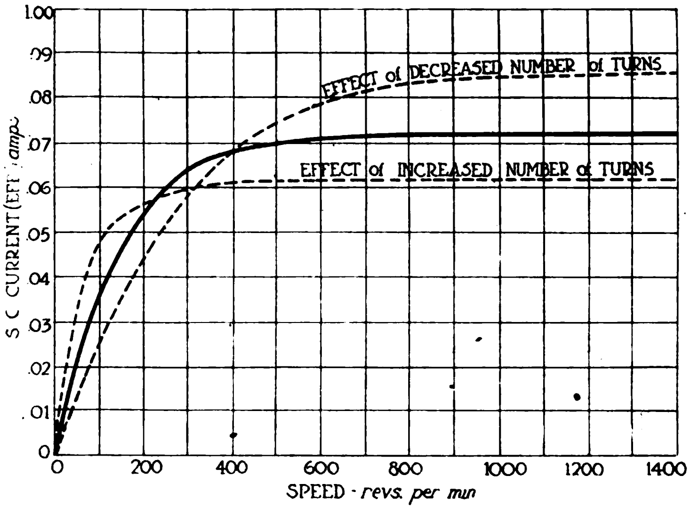


Fig. 8—Diagram showing effect of changing numbers of armature turns

While the foregoing treatise covering the generation and storage of energy in magnetos during its operation on short circuit is based upon tests and observations made upon a low-tension magneto, it must be understood that the same general laws and phenomena hold true for the generating winding of a high-tension magneto, inasmuch as the features that tend toward high generating and storage ability in a low-tension machine are also the basis of an efficient high-tension magneto.

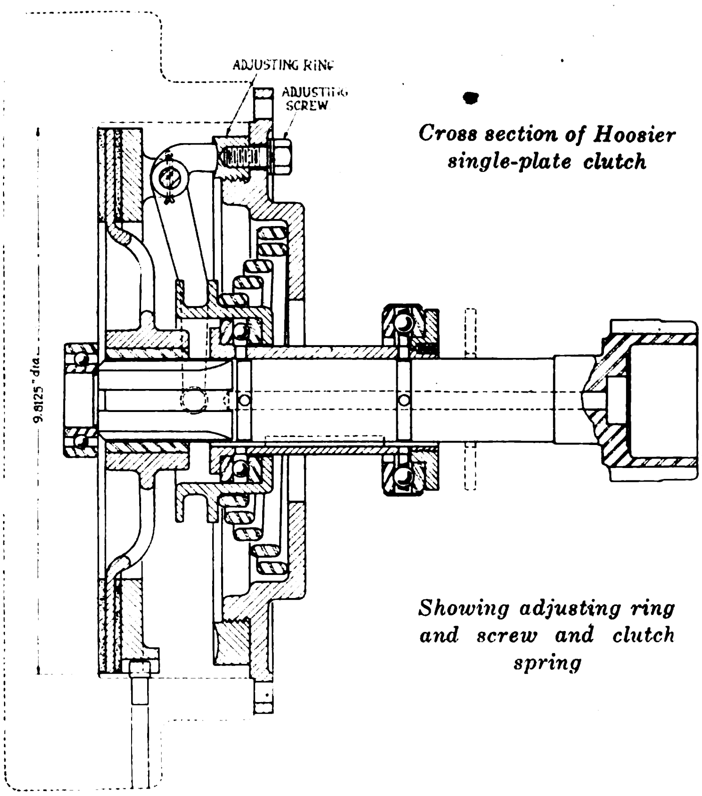
Hoosier Clutch Redesigned

THE Hoosier single-plate dry-disc clutch, manufactured by the Hoosier Auto Parts Co., Muncie, Ind., has been redesigned and improved. This clutch is of simple construction and is provided with adjusting means whereby the points of support of the clutch clamping levers are moved in the direction of clutch action. The adjustment is made by loosening the adjusting screw, which enters the adjusting ring through a 5-in. slot in the cover plate, and turning it to the right end of the slot, whereby an adjustment of 1/64 in. is obtained. If a larger adjustment is required, the screw is taken out and inserted in a tapped hole then showing in the left end of the slot. The adjusting operation may then be repeated until the desired adjustment is obtained.

Details of Adjusting Ring

The adjusting ring is threaded, there being 10 threads to the inch, and screws over a threaded flange on the cover plate; as the ring moves out horizontally from the cover plate it moves the three clamping levers toward the clutch plates and maintains them in the same relative adjustment at all times, so that the pressure against the friction discs will always be the same all around.

The adjusting ring can be moved axially at least ¼ in., and as the two friction discs have a thickness of only ¼ in. each, the adjustment is sufficient to allow for any possible wear. Hoosier clutches are made in 10-in. and 12-in. sizes to fit all standard makes of engine and transmission and are adapted for either unit power plant or for separate transmission installations. They are also interchangeable with other clutches of similar type.



Cross section of Hoosier single-plate clutch

Showing adjusting ring and screw and clutch spring

A New Windshield for Closed Bodies

Upper and Lower Parts in Inclined Planes Cutting Each Other in the Line of Vision—Greater Protection Against Rain Combined with Clear Vision Effect

By George J. Mercer

THE regulation slanting shield, set at an angle of 17 to 21 deg. from the vertical, possesses such merit that it is used on the majority of cars, but it has been found in practice that rain, when driven by the wind, will lay on the glass, even when the speed of the car is only 12 miles per hour. So the lower glass is made stationary and the joints at the side and bottom are made watertight, but assuming that the rain is coming toward the front on line *A* (Fig. 1), if the wind pressure is sufficient, the rain will be forced in the direction of the arrow and will enter the opening indicated by the line of vision. To prevent this, a rubber channel is slipped over the top edge of the lower glass, and the upper, when jammed tight against it, will form a step or offset from the glass surface and thus deflect the water, but this means that the front is closed entirely and the car is being driven through a misty glass. Of course, there are methods of minimizing this difficulty, such as wiping the glass with newspaper that contains a small quantity of kerosene, or having a wiper operated from the inside that will keep clear a space in front of the driver. Sometimes a double upper glass is used, the outer acting as a shield for the inner, but this latter will not keep condensation away. In fact, nothing is equal to a clear vision, and it does not have to be large to be effective.

At the Salon last January, Brewster & Co. exhibited an inside drive body on which the windshield, instead of being in one plane from top to bottom, was made up of two angles meeting in a point or apex at the opening, the same as the shield herein illustrated, the apex in the illustration being on the line of vision. Also, the member marked post C is continued down to the cowl to make a strong support for the roof and to withstand the impact against this member when the car is suddenly stopped and the pitch of the weight above is concentrated against the front. The Brewster body did not have to withstand such strain, as body and roof were exceptionally light; therefore, its front was formed only by the two angles. Also, the upper glass was not hinged at the top, but travelled up and down in grooves in the post and was operated by an inside handle, similar to a window regulator.

The chief advantage of this shield, however, is that the rain is deflected downward and away from the opening. Assuming that the rain is coming along line *B*, which is parallel to *A*, the line of travel when it meets the lower glass will be as indicated by arrow *B*, and if no rain can enter from below, it will be possible to open the upper glass just enough so that the rain will not enter, and a clear vision for driving is gained. Besides, no water can get into the car, except the negligible amount that may come in through the sides.

The construction of this front will present no difficulty to the body builder, though it involves a little additional work, as compared with the regular shield. The best plan will be to make this a one-piece casting of bronze, the casting to include the bottom member as well as the upright covering the lock pillar on the left side and the entire pillar on the right side. This necessitates welding in two places on the latter, at the top rail and the belt rail to the side panel. The cross member that will join the two side members together at the bottom is also a casting, in which a cored groove is cast to receive the lower glass. This cross front member is fastened

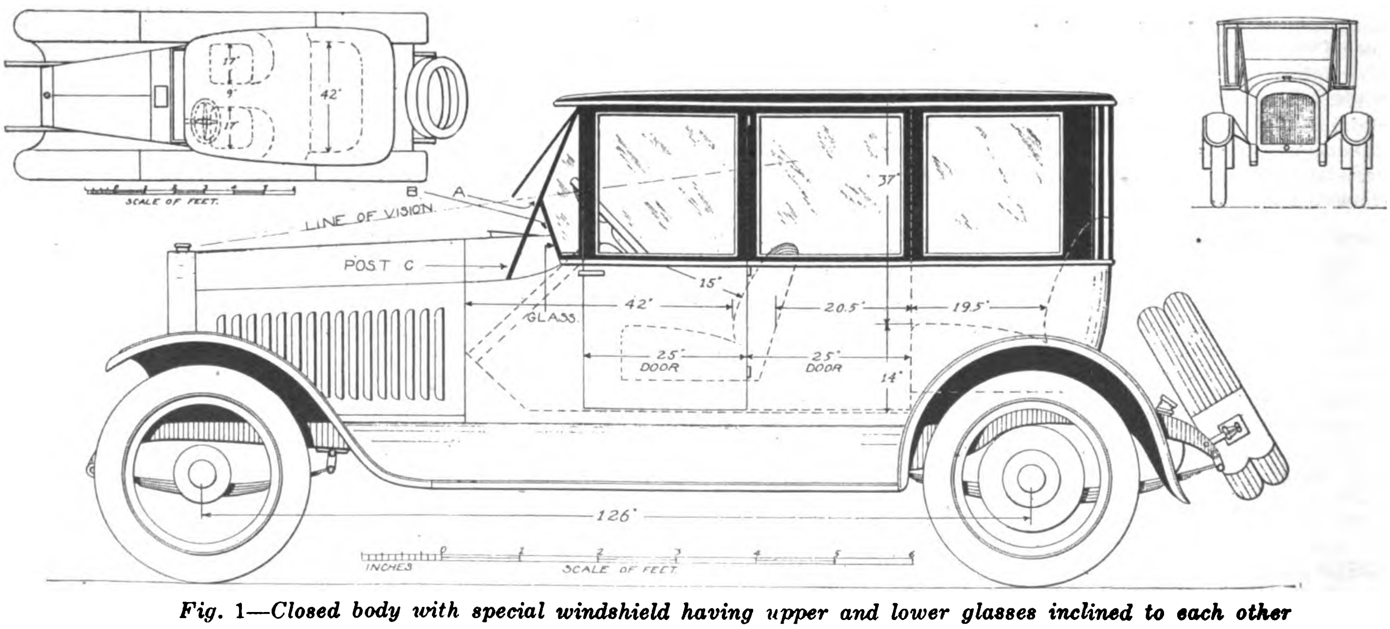


Fig. 1—Closed body with special windshield having upper and lower glasses inclined to each other

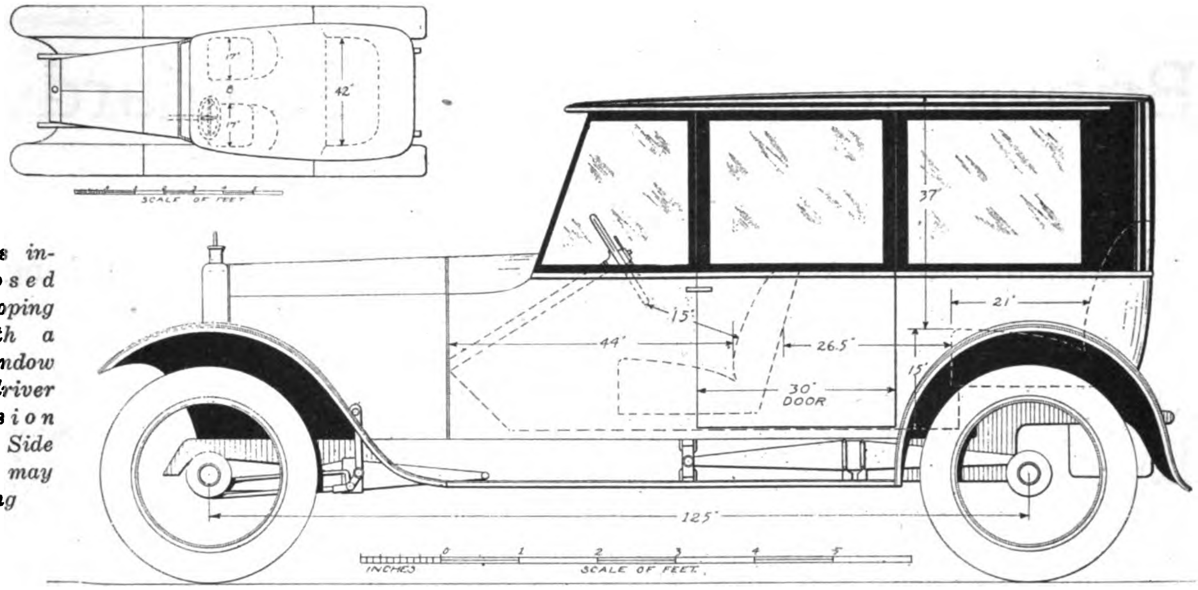


Fig. 2—In this instance the closed body has a sloping windshield with a large side window giving the driver unimpeded vision from the side. Side window may or may not be sliding

on top of the body cowl framing, and the joint is covered by the wide belt moulding, a continuation of the side belt that also covers the lap of the metal panel. This front appearance is illustrated in Fig. 1. One of the advantages of this shield is that it permits of a longer cowl line than ordinary.

With inside drive bodies the matter of vision is so complex that no single design can meet all the requirements. In connection with Fig. 1 the problem of keeping out the rain has been dealt with in such a manner that the glass may be opened when it is raining and still keep out moisture. Fig. 2 illustrates another phase of the problem of inside drive bodies. This represents a type of shield now in actual use.

The advantage of the shield shown in Fig. 2 is that the driver has an unimpeded vision from the side, which is not the case when a vertical post is placed near the front. When driving straight ahead this post is not objectionable, but when turning it is right in the line of vision. The merit of this large front glass is well understood and the reason that it is not more in use is because the slant line of the front renders it troublesome to lower and raise; besides, it must either be all the way up or all the way down, having no intermediate position. Some few make it stationary, but this is not necessary, as it can be lowered by having the front member that forms the angle glass frame extend below the hook channel about 3 in. This will always be engaged in the runway and will be sufficient guide for the up and down movement of the glass. When down the top of this front side member will wedge slightly between the bar and the lining board and keep it from rattling. This is the cheapest and most satisfactory and it works well in practice. The design, however, entails the use of central doors. By making the right front seat so it can be easily rocked forward, crowding of the rear compartment can be obviated.

Fig. 3 shows another model which can be as low, compact and light as the size of the persons using it will permit. For small people the height can be shaded down 3 in. and the length reduced considerably more than this. However, in reducing the length, care should be used that the window spaces remain of nearly equal size as this makes a better proportioned job. The single permanent line that cannot be altered is the rear line of the door. This must be kept as far back as illustrated, because the door when open is forward of the rear cut by a distance nearly equal to its own thickness, and sufficient clear space must be provided to pass the door and get back of the front seat top.

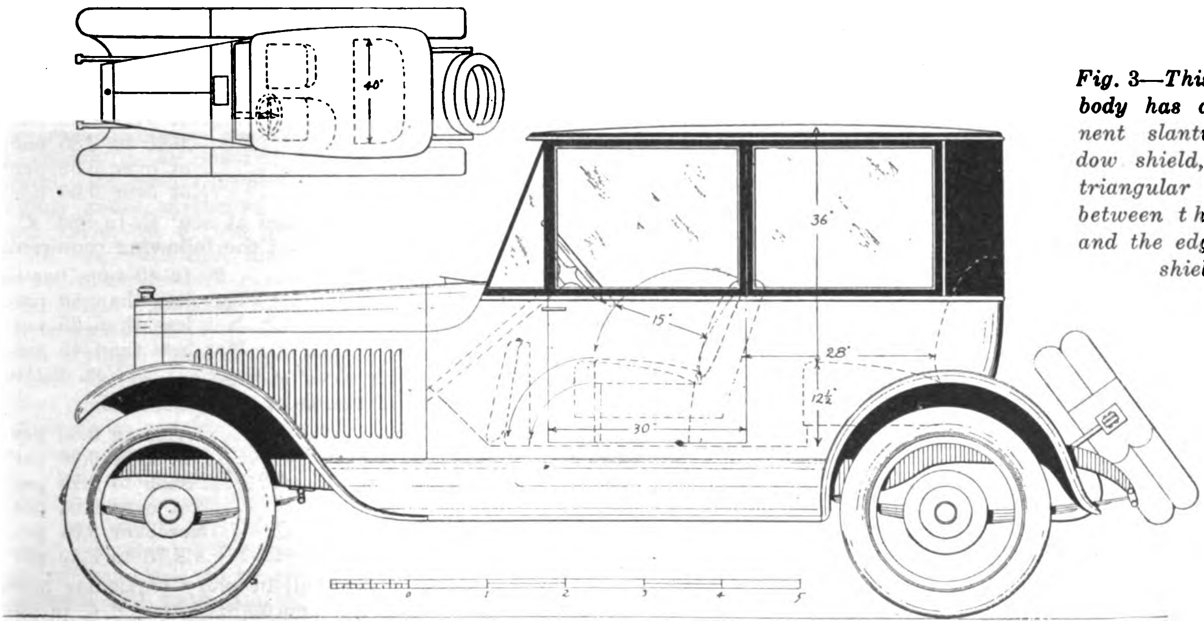


Fig. 3—This inclosed body has a permanent slanting window shield, with a triangular window between the door and the edge of the shield

British Adopt Twenty Standard Steel Specifications

Cover the Whole Range of Steels Used in Automotive Engineering—Both Chemical and Physical Properties Specified—Definitions of Terms Used

LONDON, Jan. 15—Twenty steel specifications specially written for automobile users and known as the British standard automobile steels have been adopted, and production has already started upon them. The twenty cover the complete gamut of automobile steels and represent the consensus of opinion of the steel makers, as well as the automobile makers, on what is needed for the automobile industry.

Research work was pushed ahead at a maximum pace by the steel makers, and within 11 months of the start of the research the steel makers were in production on most of the twenty grades.

The Institution of Automobile Engineers, which represented the automobile industry in this work, thinks it has a superior class of specifications to those adopted by the Society of Automotive Engineers, and looks to the S. A. E. to revise its list in accordance with the British ones.

The specifications for the British automobile steels have been agreed upon and declared standards by the British Engineering Standards Committee, which means that they are the official British standards and cannot be altered without the action of the B. E. S. C.

The specifications and tests of the British steels are:

E. S. C. 10 CARBON CASE HARDENING STEEL

Carbon	0.08 to 0.14 per cent
Silicon	Not over 0.20 per cent
Manganese	Not over 0.60 per cent
Sulphur	Not over 0.04 per cent
Phosphorus	Not over 0.04 per cent

This steel, when normalized at 900° C. to 920° C., shall pass in every particular the following check tests:

Tensile breaking strength	23 to 28 tons per sq. in.
Yield ratio	Not less than 50 per cent
Elongation	Not less than 30 per cent
Reduction of area	Not less than 50 per cent

It shall show a Brinell hardness test between Nos. 92 to 112.

E. S. C. 15 CARBON FOR CASE HARDENING STEEL

Carbon	0.12 to 0.20 per cent
Silicon	Not over 0.20 per cent
Manganese	0.65 to 1 per cent
Sulphur	Not over 0.07 per cent
Phosphorus	Not over 0.07 per cent

In check test, when normalized at 890° C. to 920° C., it shall pass in every particular the following test:

Tensile breaking strength	25 to 33 tons per sq. in.
Yield ratio	Not less than 50 per cent
Elongation	Not less than 28 per cent
Reduction of area	Not less than 50 per cent
Brinell hardness test	Nos. 103 to 143

E. S. C. 2 PER CENT NICKEL CASE HARDENING STEEL

Carbon	0.10 to 0.15 per cent
Silicon	Not over 0.30 per cent
Manganese	0.25 to 0.50 per cent
Sulphur	Not over 0.05 per cent
Phosphorus	Not over 0.05 per cent
Nickel	2 to 2.50 per cent

In check test, when normalized at 850° C. to 900° C., it shall pass in every particular the following test:

Tensile breaking strength	25 to 35 tons per sq. in.
Yield ratio	Not less than 55 per cent
Elongation	Not less than 30 per cent
Reduction of area	Not less than 55 per cent
Brinell hardness	Between Nos. 103 and 153

E. S. C. 5 PER CENT NICKEL CASE HARDENING STEEL

Carbon	Not over 0.15 per cent
Silicon	Not over 0.20 per cent
Manganese	Not over 0.40 per cent
Sulphur	Not over 0.05 per cent
Phosphorus	Not over 0.05 per cent

In check test, when normalized at 820° C. to 860° C., it must pass in every particular the following test:

Tensile breaking strength	25 to 40 tons per sq. in.
Yield ratio	Not less than 60 per cent
Elongation	Not less than 30 per cent
Reduction of area	Not less than 55 per cent
Brinell hardness test	Nos. 103 to 179

E. S. C 20 CARBON STEEL

Carbon	0.15 to 0.25 per cent
Silicon	Not over 0.25 per cent
Manganese	0.40 to 0.85 per cent
Sulphur	Not over 0.06 per cent
Phosphorus	Not over 0.06 per cent

In check test, after normalizing at 890° C. to 920° C., this steel shall in all particulars meet the following test:

Tensile breaking strength	26 to 34 tons per sq. in.
Yield ratio	Not less than 50 per cent
Elongation	Not less than 28 per cent
Reduction of area	Not less than 50 per cent
Brinell hardness	Nos. 105 to 149

E. S. C. 35 CARBON STEEL

Carbon	0.30 to 0.40 per cent
Silicon	Not over 0.30 per cent
Manganese	0.50 to 0.85 per cent
Sulphur	Not over 0.06 per cent
Phosphorus	Not over 0.06 per cent

In check test, when normalized at 850° C. to 880° C., this steel shall in all particulars meet the following requirements:

Tensile breaking strength	30 to 40 tons per sq. in.
Yield ratio	Not less than 50 per cent
Elongation	Not less than 25 per cent
Reduction of area	Not less than 45 per cent
Brinell hardness	Nos. 121 to 179

E. S. C. 3 PER CENT NICKEL STEEL

Carbon	0.25 to 0.35 per cent
Silicon	Not over 0.30 per cent
Manganese	0.35 to 0.75 per cent
Sulphur	Not over 0.04 per cent
Phosphorus	Not over 0.04 per cent
Nickel	2.75 to 3.50 per cent

In check test this steel shall in every particular meet the following requirements when normalized at 840° C. to 880° C.:

Tensile breaking strength	35 to 45 tons per sq. in.
Yield ratio	Not less than 55 per cent
Elongation	Not less than 24 per cent
Reduction of area	Not less than 45 per cent
Brinell hardness	Nos. 140 to 202

E. S. C. 1½ PER CENT NICKEL-CHROMIUM STEEL

Carbon	0.25 to 0.35 per cent
Silicon	Not over 0.30 per cent
Manganese	0.35 to 0.60 per cent
Sulphur	Not over 0.04 per cent
Phosphorus	Not over 0.04 per cent
Nickel	1.25 to 1.75 per cent
Chromium	0.75 to 1.25 per cent

In check test this steel, oil hardened at 850° C. and tempered at 600° C., shall meet the following requirements in every particular:

Tensile breaking strength	Not less than 45 tons per sq. in.
Yield ratio	Not less than 70 per cent
Elongation	Not less than 15 per cent
Reduction of area	Not less than 50 per cent
Brinell hardness	Approximately 179

E. S. C. 3 PER CENT NICKEL-CHROME STEEL

Carbon	0.20 to 0.30 per cent
Silicon	Not over 0.30 per cent
Manganese	0.35 to 0.60 per cent
Sulphur	Not over 0.04 per cent
Phosphorus	Not over 0.04 per cent
Nickel	2.75 to 3.50 per cent
Chromium	0.45 to 0.75 per cent

In check test this steel, when oil hardened at 820° C. and tempered at 600° C., shall meet the following requirements in every particular:

Tensile breaking strength	45 tons per sq. in.
Yield ratio	Not less than 75 per cent
Elongation	Not less than 15 per cent
Reduction of area	Not less than 20 per cent
Brinell hardness	Approximately 179

AIR-HARDENING NICKEL-CHROME STEEL

Carbon	0.28 to 0.36 per cent
Silicon	Not over 0.30 per cent
Manganese	0.35 to 0.60 per cent
Sulphur	Not over 0.04 per cent
Phosphorous	Not over 0.04 per cent
Nickel	3.50 to 4.50 per cent
Chromium	1.25 to 1.75 per cent

In check test this steel, air hardened at 820° C., shall meet the following requirements in every particular:

Tensile breaking strength	Not less than 100 tons per sq. in.
Yield ratio	Not less than 75 per cent
Elongation	Not less than 5 per cent
Reduction of area	Not less than 13 per cent
Brinell hardness	Approximately 418

A series of definitions with regard to different processes in steel manufacture as follows were also agreed upon:

Normalizing—Means heating a steel to a temperature exceeding its upper critical range and allowing it to cool freely in the air.

Annealing—Means reheating, followed by slow cooling. (a) It is to remove internal stresses and to induce softness. (b) It is to refine crystalline structure.

Hardening—Means heating a steel to its normalizing temperature and cooling more or less rapidly in water, oil or air.

Tempering—Means heating a steel to a temperature not exceeding its carbon change point so as to reduce hardness or increase toughness.

Cementing—Means heating a steel above its normalizing temperature in a medium which will increase the carbon content.

Core—The core of a case hardened bar is the interior portion which is substantially unaffected in composition by the cementing process.

Refining—Means reheating a steel to its normalizing temperature and is usually followed by quenching.

Tensile Breaking Strength—Means the greatest load sustained by a test piece expressed in tons per square inch of the original area of the test piece.

Yield Ratio—Means the ratio between yield stress and tensile breaking strength.

Reduction of Area—Reduction of area in per cent is the difference between the original and fractured areas expressed in percentage of the original area.

Cellon Insulating Varnishes

RECENT inquiries instigated by the German Ministry of Raw Materials have shown that both satisfactory and unsatisfactory results have been obtained in the use of cellon varnishes for insulating parts of electrical conductors and machines. This led the editor of the *Elektrotechnische Zeitschrift* to request Dr. A. Eichengrün of the Cellon Laboratory, Charlottenburg, to prepare a report on the experience he has gained, embodying his views on the causes of the troubles that have been met.

In the report it is pointed out that cellon varnishes should not be regarded as a "substitute" for oil varnishes, but that they constitute an entirely new and valuable insulating material with special properties. Cellon varnishes should be used only under particular conditions, and the choice of the correct variety is of the greatest importance. In contrast with oil varnishes that are absorbed and held by carriers such as cotton or silk coverings and require oxidizing by baking, cellon varnishes form solid coatings on bare metal by the evaporation of the liquid forming the cellon solution, no oven drying or oxidation in the air being required. Cellon varnishes are particularly suitable for insulating bare conductors, such as overhead conductors and bus-bars; sealing up cable ends; covering parts of machines, such as armature leads; forming protective coverings on wood or metal parts, such as handles, levers, hand wheels, etc.

Cellon varnishes are classified under 7 headings: (*a*) thin flowing and quick drying, to be painted on with a brush; (*b*) very thin flowing for squirting by a vaporizer; (*c*) concentrated and thick, to be applied by dipping the article to be covered; (*d*) impregnating varnishes to be absorbed by fabrics and the coverings of wires; (*e*) thick foundation varnishes to serve as a support for the cellon insulating varnishes; (*f*) thick pastes hardly suitable for electrical purposes; (*g*) cements for filling holes or forming very thick protective coverings. The layers of cellon obtained from varnishes vary from very hard and inflexible to very soft and pliable. The hardest kinds are the best insulators. In many cases the softer kinds are applied at first and then covered with a coating of a harder kind. All the varnishes adhere well to paper, fabrics and rough wood surfaces, but poorly to metal, stone, cement, etc. They are obtainable in a variety of colors. As the solution has to be made at the present time with liquids of questionable purity it is safer to use only the absolutely neutral varieties for application to copper. Hard varnishes withstand temperatures up to 200° C., but the soft ones soften at 70° C. A number of hints are given as to the choice of varnishes for particular purposes and the methods of applying them.

PREVIOUS to the war Austria did not produce any motor plows, but now this industry has been started in Bohemia and a large trade with the East, chiefly Russia, is being looked forward to. Agricultural machinery of other kinds is also to be manufactured. The prospects of these industries depend largely on the supply of iron and coal. Just now there is a great scarcity of iron, and applications for the release of that metal for the purpose of machinery export have been in most cases refused. The continual deterioration of the coal supply makes it likely that in the coming months the machine industry will also suffer from lack of fuel.

FUEL

Mexico as Source of Petroleum and Its Products*

Holds Second Place Among Petroleum Producing Countries of the World—U. S. Best Market—Development Since 1910 Has Been Tremendous

By R. De Golyer

MEXICO, with its production of approximately 67,000,000 bbl. in 1918, apparently achieved second place among the petroleum-producing nations of the world. The United States, with a marked production of some 345,000,000 bbl., was secure in first place, but it is certain that revolution-ridden Russia could not have produced enough of its normal 60,000,000 to 70,000,000 bbl. to enable it to retain second place.

This position, now gained by Mexico, will not soon be relinquished. The potential production since 1911, the year in which Mexico became an exporter of petroleum, has been far in excess of the actual production, which in the past few years has been limited by the serious tank steamer shortage resulting from the great war. With the ending of the war, the tankers are being rapidly released and many of them are going into the Mexican trade. Production for the present year is likely to be greatly in excess of that of 1918.

There are two general regions in Mexico from which petroleum has been produced—the highly important Tampico-Tuxpam region and the less explored Tehuantepec-Tabasco region. The Tampico-Tuxpam region, which includes the section of the Gulf coastal plain adjoining the ports of Tampico and Tuxpam, is the region from which practically the entire commercial production of Mexico comes at the present time.

The fields of the Tampico-Tuxpam region are divided generally into two groups—those of the Panuco River valley region and those of the southern or Tuxpam region. The fields of the Panuco River valley region, including the Panuco, Ebano-Chijol, and Topila pools, produce heavy viscous petroleum of 10 to 13 deg. Baumé gravity which are used principally in their crude state as fuel oils. The fields of the Tuxpam zone, including Potrero del Llano, Casiano-Tepetate, Cerro Azul, Los Naranjos, Alamo, and Furbero pools, produce lighter petroleums of 19 to 22 deg. Baumé gravity which are the Mexican petroleums used generally for refining purposes.

Export Trade With the United States

Approximately 69 per cent of the petroleum produced in Mexico in 1917, the last year for which detailed statistics are as yet available, was of this grade, and 31 per cent was of the heavier Panuco grade. The proportion of the lighter crude was probably even greater in the production of the past year. Of the 1917 Mexican petroleum production, some 77.6 per cent was exported. Exports for the past year show an even greater percentage and will increase as the Mexican production increases. Of the petroleum remaining in the country during 1917, the equivalent of 5.2 per cent of the total production represents fuel consumed by the Mexican railways and 1.5 per cent represents petroleum consumed principally as fuel in the industry itself. The remaining 15.5 per cent of the total production includes petroleum and products consumed in Mexico, refining losses, increase in storage, if any, etc.

The United States is the greatest single market for Mexican petroleum. In spite of limited transportation facilities during 1917 because of tanker shortage, the United States took petroleum and products from Mexico equal to 65.9 per cent of its entire production. Other nations took 11.7 per cent. The imports of crude petroleum, distillates, and various refined products from Mexico to the United States during that year were equal to more than 10 per cent of the entire production of the United States in its banner year, the one just past.

The benefits resulting from this condition are reciprocal. The United States profits by getting the petroleum, and Mexico, by the nearness of a great market where, as a result of experience acquired from the utilization of its own immense petroleum supplies, American industries are accustomed to the use of petroleum and its products to an extent not equaled in any other country of the world.

Mexican Capacity 1,000,000 Bbl. Per Day

It has been noted that the potential production of Mexico is far in excess of its actual production. It is estimated that the total capaciy of wells already completed in Mexico is more than 1,000,000 bbl. per day. In other words, if the petroleum could be taken care of, so that all the wells could be opened at once, the rate of production would be some eight to ten times the actual present rate. This potential production is slightly greater than the present actual production of the United States. The comparison is likely to mislead, however, unless it is remembered that the production of the United States is an actual proved production and can be maintained for some time by drilling up proved areas, whereas to maintain the actual production of Mexico for a year at its potential capacity would undoubtedly require the discovery of new fields.

We have been so impressed by the unprecedented size of some of the Mexican gushers and by their continued production of large quantities of petroleum over long periods of time without any appreciable decline in amount of petroleum produced daily or in field pressures that we have perhaps overestimated the total amount of petroleum to be secured from any single pool. The explanation of the great gushers seems to lie in the very great porosity of the rock in which the petroleum occurs. It collects in a network of caves and channels previously dissolved out of a bed of very thick limestone by the action of water. This condition allows the petroleum to move about very freely while still underground. Furthermore, the petroleum generally lies over water under an artesian head and as a consequence the field pressure is largely hydrostatic rather than gas pressure, which in most oil fields is the expulsive force causing the oil to flow. Effectively, the result of these conditions seems to be that in Mexico there are deposits of petroleum which can be exhausted with a single well, whereas a deposit of the same size under different conditions of occurrence would require hundreds if not thousands of wells to exhaust it. For comparative purposes it might be noted that there are two wells in Mexico, Potrero del Llano No. 4 and Juan Casiano No. 7, either of which has produced more petroleum than any single field along the Gulf Coast of the United States, while the production of the biggest fields of the Gulf Coast has come from hundreds, if not thousands, of wells, in each instance. The gusher condition in Mexico seems to indicate ease in exploiting rather than such abnormally large pools as have been inferred from the great size of the gushers encountered.

Until 1910, both the actual and potential production of

*Read at the winter meeting of the S. A. E., New York, Feb. 4-6.

Mexico were almost insignificant, in fact not great enough to supply the domestic trade of Mexico itself. Petroleum was imported from the United States and refined at the Minatitlan plant of the Mexican Eagle Oil Co. and the Tampico plant of the Waters-Pierce Oil Co. Small amounts of petroleum were produced at Furbero and in the Isthmus of Tehuantepec and refined by the Mexican Eagle Oil Co. at Minatitlan. A small amount of very heavy petroleum produced at Ebano by the Mexican Petroleum Co. was being topped in a small field plant. The distillate was sent to the Tampico refinery for further treatment and the residue made into asphalt or used as fuel on the Mexican railways. The highly important Dos Bocas and Casiano fields had been discovered, but Dos Bocas had been lost by fire and the discovery wells in the Casiano field had fallen off in production until there was some doubt whether they would be able to supply enough petroleum to run the pipe line then under construction to Tampico.

During 1910, however, the Potrero and Tanhuijo fields were discovered and Potrero No. 4, which has since produced more than 100,000,000 bbl. of petroleum, was brought in. Juan Casiano No. 7, with a record second only to that of Potrero No. 4, was completed and the discovery well in the Panuco field was brought in.

Production Far Exceeds Consumption

The potential production of Mexico thus became so great that she had petroleum far in excess of her own requirements—far in excess of the capacity of transportation systems reaching tidewater and thus making the petroleum available for export. This condition has been permanent since that time, so that to-day the developed production of Mexico is greater than can be carried to tidewater by her rapidly developing pipe-line systems or river-barging equipment. Even if the entire present production could be got to tidewater, it is doubtful whether there are enough ships available to distribute it to the world markets or whether the markets could immediately absorb it. Great fleets of tank steamers to carry Mexican petroleum have been built by the Eagle Transport Co., Ltd., (British), and the Petroleum Transport Co. (American), controlled by the Pearson and Doheny interests respectively, the foremost producers of Mexican petroleum.

The members of this Society are doubtless particularly interested in estimates of the future petroleum supply which can be expected to come from Mexico. The future of supply rather than the past is of greater interest to prospective consumers.

Estimate Production on Past Performance

Estimating petroleum reserves is under the best of conditions a somewhat uncertain business. There was the old method of calculating the oil content of a field or property from the thickness and porosity of the oil-bearing rock. The estimate so secured was modified by a safety factor of 20 to 50 per cent to cover petroleum which could not be mined, and on the resultant guess was based the best estimate as to petroleum reserves. The correctness of such a form of estimate depends largely upon a felicitous selection of the safety factor.

We do a little better now perhaps by estimating the probable production of wells to be drilled or the reserve remaining in wells already producing by comparison with the production of average wells in the same or similar fields. Such a study involves the construction of production curves, the various points on a curve being determined by plotting the amounts produced from a single well or an average well as the ordinates, with the fixed units of time in which produced, arranged consecutively, as the abscissas. Data for the construction of such a graph, to be of any value, must show the changes in the amount of unrestricted production of a given well or average well during various units of time.

We can make estimates of reserves in the Mexican fields by neither method. We have no data as to thickness or porosity of the petroleum-producing formations and consequently cannot use the volumetric method. The bulk of petroleum from Mexico has come from wells of such size that only the production from a restricted flow could be utilized. Production curves constructed on such artificially restricted data as are available under these conditions would be almost valueless. Nevertheless, we can make a rough guess as to the fields already producing in Mexico. It seems fair to assume, on the basis of past performances, that the fields already producing in Mexico indicate what one might call a blocked-out reserve of from a half billion to a billion barrels of crude petroleum.

Geologic conditions indicate that other petroleum fields of greater importance than those now known will yet be discovered in Mexico. So far as exploratory drilling is concerned, the petroleum regions have been but scratched. Not more than 1000 wells have been drilled in all of Mexico since the earliest attempt to discover petroleum. Included in this are a great number of wells drilled for exploitation purposes in fields already discovered, and a number of wells drilled in Tabasco, the Isthmus of Tehuantepec region and various outlying regions.

High Average Well Output

Remarkably few wells are being drilled in Mexico when one considers the amount of petroleum produced. According to official statistics, seventy-nine wells were drilled in 1917, and of them forty-three were productive with an estimated initial output of 235,027 bbl., and thirty-six were dry holes and abandoned. Bardone of the *Oil and Gas Journal* estimates that twenty-three wells were completed in the first half of 1918, twelve of them being producers, with an estimated initial production of 350,000 bbl. For comparative purposes, it might be noted that 1117 wells were completed in Kansas and Oklahoma in the single month of July, 1918. These successful wells have been in proved pools with the single exception of Molina No. 2, which was drilled during the latter part of 1917 and which was the discovery well of a new field.

The greatest needs of the Mexican petroleum industry at the present time are some relief from the continually increasing taxes, which are apparently designed to be confiscatory, and some degree of safety in the petroleum-producing regions in order that much needed drilling of an exploratory nature may be carried on.

The use of Mexican crude petroleum in internal-combustion engines has not yet passed beyond the experimental stage, but more and more crude petroleum is being refined for its light oil products, and this forms an increasingly important addition to the world's supply of engine fuel. The Mexican Eagle Oil Co., Ltd., has refineries at Minatitlan and Tampico and a topping plant at Tuxpam. The Waters-Pierce Oil Co. has refineries at Vera Cruz and Tampico. The Standard Oil Co. of New Jersey has a refinery at Tampico. The Texas Co. has topping plants at Port Lobos and Tampico. The Doheny interests have a topping plant at Tampico and an asphalt plant at Ebano. The Atlantic Refining Co. has a topping plant at Port Lobos.

Little Real Help from Mexico

Only the 19 to 20 deg. Baumé petroleums of the Tuxpam region are refined in quantity in Mexico. All of the refineries and topping plants run it except the Tampico plant of the Texas Co., which tops some Panuco crude, the Ebano asphalt plant, which runs Ebano crude, and the Tampico refinery of the Waters-Pierce Oil Co., which runs a very small amount of Topila crude besides much greater amounts of Tepetate-Casiano, Naranjos and Potrero crudes.

Panuco crude is used mostly for fuel purposes. It is so viscous that after the very small light oil fraction has been removed, the residue can be handled only with the greatest difficulty and by specially designed equipment. Panuco crude is imported to the United States and, after being mixed with Gulf Coast crudes, is successfully refined. One American refinery is reported to crack Panuco crude, thus securing 12 to 16 per cent of gasoline or engine fuel.

The greatest possibilities for future extended uses of Mexican petroleum seem to lie either in the further perfection and more widespread development of internal-combustion engines using very heavy oils as fuel, or in an improvement of refining methods by which heavy oils can be more easily con-

verted into lighter oil. It is likely that both methods will be utilized. In the past several years the continued development and widespread use of internal-combustion engines have created such a demand for fuel that it has been supplied only by great efforts on the part of the producer and refiner of petroleum. Fortunately for the petroleum industry, this demand has set the mark and the internal-combustion engine has not waited to be assured of a source of supply for a fixed number of years in advance.

As to the great advantage of the use of Mexican petroleum in internal-combustion engines over its use as fuel for boiler installations there can be no doubt. In this connection, one can hardly do better than quote from a recent paper by Lord Cowdray, head of the Mexican Eagle Oil Co., Ltd., and affiliated organizations:

Lord Cowdray's Opinion

"It should be stated that Mexican oil, especially refined for use in Diesel engines, is now available for motorships. It is possible that the subject of internal-combustion engines for ships has been discussed with an excess of optimism and led to expectations that have not yet been fully realized, but the most conservative observer cannot fail to be impressed by the solid progress already made in this direction, and the utility of the oil engine for moderate-sized vessels seems to be soundly established. The primary advantage is disclosed in the following figures, giving approximately the comparative consumption by main and auxiliary machinery for various types of marine propulsion.

"It will be seen that the oil engine can claim the lowest consumption; the vessel's radius is considerably increased. These are factors which will inevitably insure a great future for motorships, and the provision of fuel suplies on an ample scale will accelerate their progress."

	Lb. of fuel per hp.-hr.
Steam engine, coal-fired	1.60
Steam turbine, coal-fired	1.30
Steam engine, oil-fired	1.00
Steam turbine, oil-fired	0.82
Oil engines	0.50

Statistics covering the production of petroleum by years since the beginning of the industry have recently been made public by the Petroleum Commission of the Mexican Government. They show the past history of Mexican petroleum and indicate prospects for future increases in production better than can be done in any other manner.

Year	Bbl.	Metric tons
1901	10,345	1,544
1902	40,200	6,000
1903	75,375	11,250
1904	125,625	18,750
1905	251,250	37,500
1906	502,500	75,000
1907	1,005,000	150,000
1908	3,932,900	587,000
1909	2,713,500	405,000
1910	3,634,080	542,400
1911	12,552,798	1,873,552
1912	16,558,215	2,471,375
1913	25,696,291	3,835,267
1914	26,235,403	3,915,732
1915	32,910,508	4,912,016
1916	40,545,712	6,059,589
1917	55,292,770	8,264,266
1918 (estimated	67,000,000	10,000,000
Total	289,082,472	43,166,241

90-95% Lubricating Oil Reclaimed by Army Emergency Process

Complete Gasoline and Oil Consumption Records of Allies

240,000 gal. gasoline used per day by French army.
500 gal. gasoline used per month for airplanes—average, 1 hour per day.
.572 lb. per horsepower hour for airplane.
8 miles per gallon gasoline for staff cars—average, 190 miles per day.
6 miles per gallon gasoline for truck—average, 100 miles per day.

War-Time Necessity Brings About Peace-Time Saving of Fuel

By W. F. Bradley

DURING the month of October, 1918, the Allied armies in France consumed 34,100,000 gal. of gasoline. This was divided among the three nations as follows: France, 14,600,000 gal., England 12,000,000 gal., America 2,500,000 gal. Immediately after the signing of the armistice the gasoline consumption increased owing to the lengthening of the lines of communication. The French army, for instance, consumed 16,860,000 gal. of gasoline during the month of November.

The gasoline consumption of France has steadily increased since 1914. Official figures just issued show that the consumption of gasoline and kerosene for the last 5 years was as follows:

	Gallons
1914	178,500,000
1915	171,400,000
1916	240,000,000
1917	228,700,000
1918	365,400,000

The above figures cover the total consumption of France for both military and civilian uses. Most of the gasoline and kerosene supplied for so-called civilian purposes was used either directly or indirectly for military objects.

For the last three years, 1916, 1917, 1918, no gasoline has been sold to persons not engaged in some military work. For civilian passenger-car service the maximum

allowance of gasoline was a little less than 3 gal. per day, and this amount was only granted to persons using a car in the interests of the nation.

Toward the end of 1917, when the gasoline crisis was at its height, the French military authorities adopted a system of rationing for the army. The officer in charge of each automobile unit was supplied with a limited number of checks which enabled him to draw gasoline from one of the supply depots. In any given period he could not draw more than the quantity of gasoline indicated on his checks. In an army consuming nearly 240,000 gal. of gasoline per day this system resulted in considerable economies.

Although the gasoline shortage in France has frequently been acute, and the strictest economy had to be observed, it is declared that the army was never at any moment handicapped by a shortage of gasoline for its trucks, tanks, passenger cars, tractors, and airplanes.

Army Records of Gas Consumption

French automobile authorities have kept careful records of the gas consumption of all kinds of trucks. Possessing this data, they have found it advisable on several occasions to order a change of carbureter. These records showed, too, where any section or truck train was consuming more than similar groups.

In the aviation service the limit of gasoline and oil consumption was 0.572 lb. per horsepower hour. If this could not be obtained during the official tests the engine was refused. In the American army it was generally estimated that the average consumption of gasoline by an airplane was 500 American gal. per month. This average was based on a general service of both scout and bombing machines.

The French army authorities estimate that staff cars consume gasoline at the rate of 8 miles to the American gallon, and that these cars average 190 miles per day. The average for trucks is 6 miles to the gallon, and the mileage is estimated at 100 per day. In estimating the consumption of gas for airplane squadrons it is assumed that every engine runs for one hour each day.

Practically all the gasoline used in France during the war came from America, and was carried in either American or British tank steamers. The three most important ports at which gasoline was received were La Palice, Le Havre and Bordeaux. Dock facilities were soon found insufficient, and important extensions had to be made.

France was also short of tank wagons when war was declared, the total number at that time being only 470. This number was quickly increased to 680, then to 835. Important orders for tank wagons have been placed in England and America, with the result that France will soon possess 1500, and within a very short time will have a total of 2500 in service, for Germany is obliged to deliver 1000 tankers among the 150,000 railroad cars stipulated in the armistice agreements.

Gasoline Distributed in Cans

The final distribution of gasoline in France, in both military and civilian circles, is in cans containing 1 1/3 gal. Tank distribution by a pump and measuring instruments is practically unknown. Within a few months of the declaration of war, gasoline cans became scarce. Private owners stored cans wherever they could, for they were unable to get deliveries of gasoline if they did not present empty cans in exchange for full ones. At the front, the life of a gasoline can was very short. Because of the rapid destruction of the small cans the automobile service of the army adopted the use of the 13-gal. cans which already existed in the trade, and practically every truck carried one of these cans in reserve within special brackets built on the running board.

The American army kept its main supply of gasoline and oil at the intermediate supply depot established at Gièvras, half way up the lines of communication. This depot, which was entrusted with the task of supplying gasoline to the advance sections, had a reserve of four tanks, each tank containing 500,000 gal. of gasoline. This fuel was handled by the Quartermaster Corps, which distributed it to the Motor Transport Corps, the Air Service Engineers, artillery, and others having need of it.

Aviation Program Threatened Oil Shortage

Early in the war the development of the aviation program threatened to cause an oil shortage. One very wise precaution taken by the French Government was to monopolize all castor beans brought to France. These were delivered to the oil mills at 50 cents per pound. By reason of this measure very little castor oil got to the open market, but where a supply was obtained the usual price was from $1 to $1.50 per pound.

Early in 1916 a chemist attached to one of the States Laboratories discovered a process by which castor oil could be filtered and refined in order to render it fit for further service in aviation motors. This process was brought to the attention of the States Aviation authorities, who refused to be interested. Somewhat discouraged, the inventor brought his process to the notice of M. Meurisse, a press photographer, who for a number of years had acted as AUTOMOTIVE INDUSTRIES representative in France.

M. Meurisse, being acquainted with all the automobile manufacturers, endeavored to secure used oil from them in order to treat it by this process. Merely as a personal favor, and without any hope that the oil would be regenerated, one of the manufacturers delivered 300 gal. of used castor oil to him.

This was refined in accordance with the process invented by the chemist, returned to the factory, and used in an engine undergoing its 50-hour test at full load. Judging from the state of the engine after this test, the regenerated castor oil was equal to new.

Castor Oil Reclaimed

Aviation engine manufacturers were soon convinced that this process was to their advantage, and measures were taken to collect all used castor oil and send it to the factory created by M. Meurisse for treatment. In less than one year practically all the aviation engine manufacturers in the Paris district were sending used oil to be reclaimed.

The Gnome Co., for instance, fitted oil collectors around their engine test benchstands, so that all the oil thrown out of the exhaust could be collected.

Renault was one of the biggest users of this process. He gave orders that the base chambers of aviation engines should be emptied after two hours running under full load and that the oil thus obtained should be sent out for treatment. As the cost of this process was only 7½ cents per gallon, a real economy was effected.

The practice of using oil to destruction, previously done, was risky, for it sometimes happened that an oil was used too long and bearings were burned out in consequence. By giving orders that no oil should be used for more than two hours' steady running all danger of burned-out bearings was eliminated.

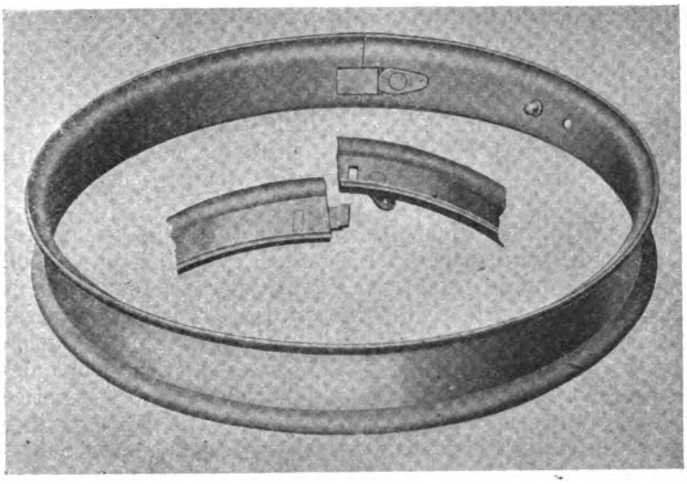
In all, about 53,700 gal. of castor oil were treated by this process during the war for the Renault Co. Other firms adopting this process were Hispano-Suiza, Clerget, Darracq, Brazier, Clément-Bayard and Mayen.

After this regenerating process had been adopted by the manufacturers the army became interested. A gen-

(*Continued on page* 450)

New Stanweld No. 76 Rim

Cam Locking Device Retained—New Design in Accord with Recently Adopted Rim Standards—Large Wedges Insure Proper Alignment of Rims



No. 76 Stanweld rim, which conforms to S. A. E. standards

A NEW standardized rim, referred to as the No. 76, has just been announced by the Standard Parts Co., Cleveland, Ohio. This rim has been designed in conformity with recently adopted rim standards and besides embodies features which are exclusive with the Standard Parts Co. One of the features for which considerable importance is claimed is that the valve stem hole is quite a distance from the split, which prevents injury to the stem when the rim is being manipulated.

No change has been made in the cam locking device, which has long been a feature of Stanweld rims. This locking device is claimed to be thoroughly efficient and easily operated, though it is exceptionally simple in construction.

The wedges holding the rim in place have a large bearing surface, which tends to keep the rims in proper alignment on the wheel and to prevent unnecessary wear of tires. Another advantage resulting from the large bearing surface of the wedges is that the annoying squeaking of rims is entirely eliminated. The wedge nuts are self contained, which simplifies the removal and application of the rims and prevents loss or misplacing of the nuts. The rims are claimed to be exceptionally light and strong.

Farm Tractors in France

ACCORDING to an article in *La Technique Modern*, the farm tractor tests held at La Verriere and Mesnil-Saint Denis (Seine et Oise) last September once again drew attention to the desirability of increasing the cultivation of the soil by means of tractors and of developing the manufacture of such tractors. This article describes the machines of French construction.

Power farming is very necessary in France, owing to the low birth-rate, the constant migration from the country to the towns, and the serious diminution of labor caused by the war. A table is given showing the results obtained in tests made before 1913 and others carried out between 1913 and 1917. The summary of these shows that the average resistance of the soil to a turning effort is as follows:

For light soils, 45 kg. per square decimeter; for average soils, 55 kg.; and for heavy soils, 70 kg. This corresponds to 6.4, 7.8 and 10 lb. per square inch. From the tabulated figures the author deduces that the share of a plow turning a furrow 0.33 x 0.18 m. (13 x 7.1 in.) in section will require a mean tractive effort on the plow of 270 kg. (594 lb.) for light soils; 330 kg. (726 lb.) for average soils; and 420 kg. (924 lb.) for heavy soils. Experience with foreign tractors, especially American, although they have given extremely valuable results in war time, has clearly shown that they are not well adapted for work upon French farms, and French tractors rationally constructed to suit the local conditions should give much better results the author says.

Benzol in Great Britain

A NATIONAL BENZOL ASSOCIATION has been formed in Great Britain to encourage the use and organize the distribution of benzol as a motor fuel and for other industrial purposes. Among the objects of the association are the following: (*a*) To interest automobile users and others in benzol as a motor fuel; (*b*) to sell and distribute motor benzol, whether wholesale or retail, and to obtain for it a fair market price; (*c*) to standardize motor benzol, and to carry on, assist and promote investigation and research with a view to its improvement. The association is to consist of motor benzol producers whose businesses are situated in the British Isles and are subscribers to the association.

Castor Beans in Central America

THE extraordinary demand in the United States a few months ago for castor oil as an engine lubricant created a great deal of interest throughout Central America, where the climate and soil are well suited to the production of castor beans, according to a trade report received here.

A considerable number of plants grow wild in a few places, notably Antigua in Guatemala. This wild production had been utilized in past years by pressing out small quantities of oil for local consumption. In Salvador, Nicaragua, and Costa Rica many planters decided to take up the cultivation of the castor bean in a systematic way, and several of them entered into contracts with importers in the United States for the year's crop.

In Nicaragua two large contracts were signed, aggregating 126,000 bushels. The total crop in that country will probably be about 200,000 bushels. The Nicaraguan crop was planted at the beginning of the rainy season, and harvest began in the early part of December. The Costa Rican farmers planted somewhat later; their fields are not yielding. The variety planted in Nicaragua was a large white seed, while in Costa Rica a medium-sized red seed was preferred.

While the demand has fallen off noticeably since the signing of the armistice, it is probable that Central America will continue to grow castor beans for export. Planters seem to think that it would pay to grow castor beans if the price were from 4 to 5 cents f.o.b. port of departure. They have learned that a close stand of castor plants kills out weeds, leaving the land in excellent condition for planting coffee, beans, corn, or rice.

ON the recommendation of the Road Board the British Government has decided to make special grants to the amount of $50,000,000 in aid of road construction work. Of this sum about $9,000,000 will be provided out of the road improvement fund and the rest drawn from the National Exchequer. In making this decision the Government was influenced by a consideration of the fact that heavy extra expenses will fall upon highway authorities in the near future in connection with work on roads and bridges, as the result of higher prices, lack of materials, shortage of labor and difficulties of transport.

Bombing Work of the British Independent Air Force

Specially Organized to Bomb German Industrial Centers — Made 142 Raids Between October, 1917, and June, 1918—Preparations for Long Distance Raids Complete When Armistice Was Signed

LONDON, Jan. 28.—If the war had continued through the summer and fall of 1919, the work of bombing aircraft squadrons on the western front would have been carried much further than it was. The extensive bombing program of the British, who took the lead in this work, was just getting into shape when the armistice came round, and the final chapters of the work will never be written.

The value of large planes for day and night bombing was not appreciated before the Handley-Page long-distance trip from London to Constantinople in July, 1917, when it made the trip to destroy a Turkish battleship, and succeeded. That trip carried conviction into the hearts of those controlling the Royal Air Force, and the reasoning was that if so much could be done with an experimental machine what might be accomplished with squadrons of perfected machines employed in day and night bombing over the manufacturing cities in the Rhine Valley.

Planned to Bomb Berlin

A comprehensive bombing program was decided upon, and in October, 1917, a few squadrons of bombers were in the zone of Nancy, which was the nearest point to the Rhine Valley from which to launch an attack. From October, 1917, to June, 1918, 142 bombing raids were carried out, 57 of which were over Germany, the remainder being over portions of France held by the Huns. This work was so successful, in spite of bad fall and winter weather, that it was decided in May, 1918, to organize a separate air force to carry out this bombing work. Accordingly, there was formed in May, 1918, what is known as the Independent Air Force, which assumed complete charge of day and night bombing, and had within its organization special pursuit or single and two-seater fighting machines to escort the bombers and fight off the Hun chaser planes that attempted destruction of the bombers.

This great bombing plane campaign was just approaching its really aggressive stages in November, and had the armistice been delayed a month there would have been squadrons of huge bombers that were built to carry the program right to Berlin. Huge machines were being rushed to completion in many British factories and some of them had been tested out only a few days before Nov. 11. One of these was a huge Handley-Page biplane fitted with four Rolls-Royce engines, two on either side of the single fuselage, and spaced between the wings. The engines on each side are mounted in tandem and carry two propellers, one tractor and one pusher. This plane carried forty passengers in its test trip over London, and it had fuel capacity to reach Berlin and return to the aerodrome in Northeastern France.

Although the Independent Air Force was just in its swaddling garments when peace came, it had from June, 1918, to Nov. 11, 1918, established a record that gives indications of what might have been expected by the autumn of 1919.

From June 6 to Nov. 10 there were dropped 550 tons of bombs in day and night bombing, 160 tons by day and 390 tons by night. Of this, 220½ tons were dropped on enemy aerodromes, the aim being to destroy as many of the enemy machines as possible so they could not be used to attack the bombers. There was a heavy destruction of Hun planes by these attacks, yet in the same period not a single British bomber was destroyed by Hun attacks on British aerodromes.

In this dropping of 330 tons of bombs on German manufacturing centers in the Rhine valley and beyond, the general plan was to bomb a great many manufacturing centers rather than attempt to completely destroy one or two centers, in order to disperse the German system of defense requiring them to provide certain protection for all of their cities rather than furnishing complete protection for a few at a time and shifting the forces as the attack shifted.

In this way the British Independent Air Force bombed over forty cities including Cologne, Coblenz, Frankfort, Heidelberg, Karlsruhe, Mainz, Mannheim, Luxemburg, Stultgart, Worms, Wiesbaden and other places.

The first great essential in this work was extending the flying radius of the machines so that they could remain 5¼ hours in the air. Many machines when they reached the aerodrome back of the front had only 3¾ hours' fuel, and it was necessary to rebuild their fuel systems to give over 5 hours' capacity.

Record Bombing In August

Many long-distance flight records were established, and from month to month during the summer of 1918 these distances were increased. The following tabulation shows how distances steadily increased from 272 in June, 1918, to 320 miles in October, 1918, in day flying. The range of night flying increased from 240 miles in June to 342 in August. Here are the figures:

	By day Distance out and back	By night Distance out and back
June	272 miles	240 miles
July	272 "	300 "
August	330 "	342 "
September	320 "	320 "
October	320 "	272 "

August was the best month for both day and night bombing, as in September and October the rains and fogs cut distances down.

The machines used in this bombing work were constantly being changed from its start in October, 1917,

up to November, 1918. The work started in 1917 with the following squadrons:

One squadron DH4, 275-hp. Rolls Royce.

One squadron FE2B, 160-hp. Beardmore.

One squadron Handley Page, 375-hp. Rolls Royce.

In spite of the very severe winter of 1917-1918, this force carried out its 142 raids between October and May, and bombed such cities as Mannheim, Mainz, Coblenz, Cologne and Stuttgart. Long-distance raids were made on Namur and Liege in Belgium.

In the summer of 1918 the force was increased by the following squadrons:

May 23—One squadron, DH9, B. H. P. engine
Aug. 9—One squadron, Handley-Page, Rolls Royce engine
Aug. 19—One squadron, Handley-Page, Rolls Royce engine
Aug. 31—One squadron, DH10, Liberty engine
Sept. 22—One squadron, Sopwith Camel

Escorts for Bombing Squadrons

A squadron was not pushed in bombing work the day it arrived at the aerodrome, but was given three weeks of final training, which it was only possible to carry out at the front.

The general scheme of bombing was that the bombing planes should proceed straight from the aerodrome to their objective, not deviating for any reason. To make this possible the squadron of Sopwith Camels was a fighting escort. These chasse machines had a normal fuel range of slightly over 2 hours, and they had to be rebuilt with fuel capacity for 5½ hours. It would have been suicidal to send the laden bombers without the protecting scouts, which scouts had to be prepared to accompany them the entire distance. This was particularly true of day bombing.

At the start the enemy was not prepared to adequately resist the British bombing program, and it was not until June, 1918, that the Hun planes were coming out in heavy squadrons to resist the British. In August it was necessary at times for bombing squadrons to fight every mile of the way from the aerodrome to the objective and back home. It was necessary to maintain formation accurately, as the Boche could cut off at his leisure every machine that had to drop behind its formation. They invariably concentrated their attacks on the rear machines, and if even a spark plug failed, necessitating a lag behind the formation, it meant a victim for the Boche. In all, 100 British planes were lost, the pilots either being shot down or the plane having to land out of control.

Railroads Vital Points

In this bombing work the British concentrated on railroad lines, stations and storehouses. After these came blast furnaces. The Boche was short of rolling stock, and destroying his railroads made the moving of food and munitions more difficult. Railroad lines are good targets at night, as are blast furnaces. The amount of destruction in blast furnaces was small per bomb that found its target, but they were good targets.

A complete intelligence department was organized to gather information and prepare maps for the work. In this way the most thorough information on all targets, such as gas factories, airplane factories, engine factories, poison-gas factories and railroads, was supplied with detail maps of each target, this work being done by day and night reconnaissance machines.

Long-distance bombing work requires the utmost determination, as a change of wind completely upsets all calculations that may have been made before starting. It requires fine judgment on the leader's part to know, if he perseveres to the objective, whether he will have sufficient fuel to carry the formation home again safely. This will be realized when it is pointed out that on several occasions the machines with only 5¼ hours' fuel supply were out for that time; in one case a formation was out for 5 hours and 30 minutes, and it only just managed to clear the front-line trenches on its homeward journey. A miscalculation of five minutes would have lost the whole formation.

Ceiling was of more importance than speed for long-distance day bombing work. It was essential that squadrons should fly as high as possible, and it soon became apparent, as already stated, that the two squadrons with the 200-hp. B. H. P. engines had not sufficient power for this long-distance work. One squadron was re-equipped with D. H. 9a machines with Liberty engines in November, before the signing of the armistice, and the second squadron had started re-equipping.

Major General H. M. Trenchard, who commanded the Independent Air Force of the R. A. F. in his detailed report on the bombing work has given many incidents which show the risks taken and the difficulties to be overcome. No more efficient general could have been selected for this work, and from the start he took hold and started building up the force along a definite plan rather than changing the schemes from week to week as conditions seemed to indicate. In his report he outlined his general policy as follows:

"It was necessary for the B. E. F., (British Expeditionary Force) to have enough aircraft to hold and beat the German aerial forces on the western front. Bombing of Germany would be a luxury until this were done, and once this were done then bombing became a necessity. That is to say, it became necessary to strike the German army in Germany and to strike at the most vital point—its source of supply.

"In using the Independent Air Force for this purpose I was faced with two alternate schemes of campaign:

"1—To attack as many of the large industrial centers as possible to reach with my machines.

"2—A sustained and continuous attack on one large center after another until each was destroyed, the industrial population having to go to other cities.

"The first plan was decided upon.

"The weather in June, July and August was extremely favorable for long-distance bombing, but in September, October, and the first week of November, it could hardly have been worse. Day after day attempts were made to reach the long-distance targets, but the wind was generally too strong. If there was no wind there was heavy rain and fog by day and dense mists by night. Frequently the nights were perfect, but dense mists covered the ground and made landing impossible and also hid the targets.

"I also recommended that the proportion of day bombing squadrons in the force should be slightly larger than that of night bombing squadrons, as I considered that, although day bombing squadrons suffer higher casualties than night bombing squadrons, at the same time, if day bombing is excluded, at least four-fifths of the value of night bombing must necessarily be wasted, owing to the fact that the enemy can then make his arrangements to work by day and live at a distance by night, and take many other similar defensive steps. Also, if the bombing had been carried out exclusively by night it would not have caused the enemy to make such a large use of his men and material in defensive measures, and therefore it would not have affected the western front to such an extent as it did. Though night bombing is

the safer, many mistakes are made at night in reaching the locality it has been decided to bomb.

Those portions of General Trenchard's report dealing with individual attacks read like chapters from fairy tales. Mannheim, the great manufacturing city where Benz cars and planes are made, was the objective of many attacks.

One formation of bombers was attacked by forty Hun fighting scouts when over the city. Two of these were shot down and three others went down out of control. It required 5 hours and 30 minutes for this trip, but so short of fuel were the fliers that they just got over the trenches on the home trip, and did not reach the aerodrome, the fight over Mannheim consuming quite some time.

Mannheim Attacked Frequently

In another Mannheim raid, in August, twelve DH4 bombers were attacked just as they reached Mannheim by fifteen Boche fighting planes. The British formation dropped to within 6000 ft. of the city and dropped all their bombs. The formation leader was shot down, and in the melee three Hun planes were shot down. Ten planes in the formation dropped their complete loads, and seven bursts on a factory were observed and four fires started. A direct hit was also made on a new factory building. Two of the formation had to land before they recrossed the German lines.

Another night two Handley-Page bombers attacked the Balische Anilin & Soda Fabrik in Mannheim and indulged in a spectacular attack, typical of night bombing. The Handley-Pages left their aerodrome at eight o'clock, and when 5000 ft. over the target one pilot shut off his engine and glided down on the factory. The searchlights at once picked him up and held him in their beams while the anti-aircraft barrage was put up. The machine continually changed its course, but could not shake off the searchlights, and the pilot was completely blinded by the glare. At this moment the second machine glided in, with its engine almost stopped, underneath the first machine, got immediately over the works, below the tops of the factory chimneys, and released its bombs right into the works. The searchlights at once turned on to this machine, freeing the first machine from their glare. This machine then turned and made straight for the works as low as the second machine, among the chimneys, and released its bombs. The searchlights were turned almost horizontally to the ground and the anti-aircraft guns were firing right across the works and factories almost horizontally. In spite of this the two machines remained at a low altitude, and swept the factories, works, guns and searchlights with machine-gun fire. On the return journey both of these machines passed through rain and thick clouds, while lightning and thunder were prevalent throughout the trip.

Direct Hits on Factories

On Sept. 7 eleven machines of one squadron, followed by ten machines of another, made an almost simultaneous attack on Mannheim, where bombs were dropped with excellent results on the Badische Anilin and Soda Fabrik. The first squadron obtained at least eight directs on the factory, but the results of the second squadron could not be observed owing to the mist and smoke. Both squadrons were attacked on the outward and return journey, and over the objective, by superior numbers of hostile aircraft.

One squadron was attacked by six hostile machines 15 miles over the lines. These were driven off. Ten hostile machines attacked about 15 miles over the lines. They were also driven off. Fifteen hostile machines then attacked over the objective. After dropping bombs the formation turned toward the hostile machines, which apparently disconcerted them, as they became scattered. On the return journey several enemy scouts kept up a running fight. One scout, attacking from in front, was driven off by the leader's observer firing over the top plane.

The other squadron was attacked at a long range 15 miles over the lines. The enemy were driven off. Fifteen hostile machines heavily attacked over the objective and followed the formation back for 70 miles. Near the lines the formation was again attacked by seven hostile machines. Over two tons of bombs were dropped at Mannheim in this raid.

On the night of Sept. 16-17 seven Handley-Page machines were missing. Five of these, detailed for Cologne and Mannheim, were probably unable to return in the face of a strong southwesterly wind, which increased after the machines had left the ground. The missing machines undoubtedly attacked various objectives well into Germany before they had to land. It was reported that one machine landed in Holland with engine trouble after having dropped its bombs on Bonn, and was interned.

Enemy Attacks Frequent

On Sept. 25 Squadron A dropped over 1½ tons of bombs on Frankfurt. They were opposed by a large number of hostile machines, two of which they destroyed. Four of our machines did not return, and in addition one observer was killed and one observer and one pilot were wounded. This was the first long-distance raid carried out by this squadron.

On the night of Oct. 21-22, machines attacked the railways at Kaiserslautern in very bad weather. Several 1650-lb. bombs were dropped, but bad visibility obscured the results. One very large fire and five smaller ones were observed, and all these fires were seen to be still burning when the town was lost sight of in the mist.

A few other examples will serve to visualize the character of this bombing work. On the night of June 29-30, Handley-Page machines were ordered to attack the chemical works at Mannheim. Owing to the weather conditions, only one machine reached the objective, on which it dropped its bombs. This machine, on the homeward journey, failed to pick up its aerodrome, and landed no less than 160 miles southwest of the aerodrome undamaged.

On July 5, 12 machines set out to attack the railway sidings at Coblenz. Shortly after starting the squadron passed over thick clouds and steered its course by compass, but the target was obscured by clouds. The leader turned, with the intention of attacking Karthaus, but as he turned the anti-aircraft barrage over Coblenz opened. Through a small hole in the clouds he could see a portion of the target, and the formation followed him and released their bombs.

On July 31, planes went out to attack Mainz. They encountered 40 hostile scouts south of Saarbrucken. Fierce fighting ensued, as a result of which four of our machines were shot down. The remaining five machines of the formation reached Saarbrucken and dropped their bombs on the station. On their way home they were again attacked by large numbers of hostile scouts, and suffered the loss of three more of their number.

On Aug. 11 a squadron attacked the station at Karlsruhe, in spite of bad weather conditions, causing a heavy explosion in the station and scoring many direct hits on the railway sidings. In the course of fighting one of our machines was brought down and three of the enemy's machines were driven down out of control.

The FORVM

An Analysis of the Hotchkiss Drive

By A. W. Happel

THE writer was very much interested in the article "Analysis of the Hotchkiss Drive" by O. M. Burkhardt, appearing in your Jan. 23 issue. Upon looking it over carefully I encountered some statements which I shall presently disprove.

Let us start with the spring loads as given for the 20,000 lb. spring supported Hotchkiss chassis when driving on low gear.

Mr. Burkhardt calculates that we have spring loads as follows:

On front springs	4,250 lb.
2 rear springs, front eyes at 6458	12,916 lb.
2 rear springs, rear eyes at 3938	7,867 lb.
Total	25,042 lb.

Now our chassis weighs only 20,000 lb. above springs and will, accordingly, due to the spring upward reaction, develop, considerable, aeronautic tendencies, if Mr. Burkhardt's figures are correct. It will be interesting, therefore, to go over this case again, using the same notations and load distribution as in the above-mentioned article.

We soon discover that the statement "$W_r'' = 15{,}750$ lb., Fig. 2," is obviously wrong, since P' applied in the upward direction and between the front and rear wheels must reduce the load on *both the front and rear* springs. Mr. Burkhardt's error is made in assuming P'' as acting on the rear spring, while it actually finds its reaction between wheel and ground.

We, therefore, derive the correct value for W_r'' from the formula.

$$W_r'' = W_r - P_r' = 15{,}000 - 1770 = 13{,}230 \text{ lb.}$$

In going over to the Hotchkiss chassis, Fig. 3, it is wrong to assume that the loads remain the same as in the previous case, in spite of shifting the point of torque reaction.

We actually have the following loads for this case:

$$P_f' = \frac{P' \times 25}{168} = \frac{5040 \times 25}{168} = 750 \text{ lb.}$$

$$P_r' = \frac{P' \times 143}{168} = \frac{5040 \times 143}{168} = 4290 \text{ lb.}$$

$$W_r'' = W_r - P_r' = 15{,}000 - 4290$$
$$W_r'' = 10{,}710 \text{ lb.}$$
$$W_f'' = W_f - P_f' = 4250 \text{ lb.}$$

Proof:

(a) Forces in upward direction:

Spring reaction W_r'' =	10,710 lb.
Spring reaction W_f'' =	4250 lb.
Torque reaction P' =	5040 lb.
	20,000 lb.

(b) Forces in downward direction:

$$W = 20{,}000 \text{ lb.}$$

We see everything is nicely balanced.

To determine the actual loads on the rear spring eyes, it is best to remember that the rear axle also must be in equilibrium; *i. e.*, we must have:

$$\Sigma M = 0$$

We have a clockwise moment of

$$T \times 20 = 126{,}000 \text{ lb.-in.}$$

A counter-clockwise moment of

$$P' \times 25 = 126{,}000 \text{ lb. -in.}$$

Any additional moments, due to frame load, must, therefore, of necessity be balanced, if a symmetric spring is used, *i. e.*, each spring eye will receive:

$$\frac{10{,}710}{4} = 2677.5 \text{ lb.}$$

We then have for the load on the rear spring front eye:

$$\frac{5040}{2} + 2677.5 = 5197.5 \text{ lb.}$$

and for the load on the rear spring rear eye we get 2677.5 lb.

The summation of vertical forces will, therefore, be:

Upward: Reaction of front springs	4250 lb.
Reaction of 2 rear springs, front eyes at 5197.5	10,395 lb.
Reaction of 2 rear spring rear eyes at 2677.5	5355 lb.
Upward total	20,000 lb.

Downward: $W = 20{,}000$.

Going over to the brakes we hear that in the case of the chassis shown in Fig. 2 the rear springs are loaded less than ordinarily when the brakes are applied. Analyzing this claim we find that, using Mr. Burkhardt's figures, we have a torque reaction of:

$$P' = \frac{180{,}000}{50} = 3600 \text{ lb., downward.}$$

Of course, the springs have to carry this additional load. Reaction P'' cannot act on the spring for even if—

$$P'' > W_r''$$

it will only lift the rear end of the chassis off the ground but cannot increase our spring load.

$$P_r' = \frac{3600 \times 118}{168} = 2530 \text{ lb.}$$

$$W_r'' = 15{,}000 + 2530 = 17{,}530 \text{ lb.}$$

i. e., considerably *more* than when driving on low gear.

The maximum spring eye load, then, for this chassis is

$$\frac{17{,}530}{4} = 4382.5$$

Front axle load

$$W_f'' = 5000 + \frac{3600 \times 50}{168} = 6070 \text{ lb.}$$

A summation of the forces for this case is then as follows:

Upward:

Reaction of front springs	6070
Reaction of rear springs	17,530
Total	23,600

Downward:

$$W = 20{,}000 \quad P' = \frac{23{,}600}{3600}$$

Turning now to the analogous Hotchkiss chassis, Mr. Burkhardt's figures again prove erroneous if the actual moments of forces are analyzed. Referring to the accompanying figure, we find:

$$P' = \frac{180{,}000}{25} = 7200 \text{ lb.}$$

$$P_r' = \frac{P' \times 193}{168} = 8270 \text{ lb.}$$

$$W_r'' = W_r - P_r' = 15{,}000 - 8270 = 6730 \text{ lb.}$$

Or, per spring eye,

$$\frac{6730}{4} = 1682.5 \text{ lb.}$$

Then, as before, load on rear spring front eye: 1682.5.
Load on rear spring, rear eye,

$$1682.5 + \frac{7200}{2} = 5282.5 \text{ lb.}$$

Load on front axle,

$$W_f'' = 5000 + \frac{7200 \times 25}{168} = 6070 \text{ lb.}$$

Summation of vertical forces for this case:

Upward: Front spring reaction	6,070 lb.
Reaction of 2 rear spring front eyes	10,565 lb.
Reaction of 2 rear spring rear eyes	3,365 lb.
Total upward forces	20,000 lb.

Downward:

$$W = 20,000.$$

We see, therefore, that there is not so great a difference in the spring loads of the two types of chassis as Mr. Burkhardt imagines, for, using his own figures, we find a deflection:

$$d_1 = 4 \times \frac{1650}{4382.5} = 1.50$$

and

$$d_2 = 4 \times \frac{1650}{5282} = 1.250$$

The above calculations do not consider moments due to location of axle relative to spring top leaf, etc., although these must be considered in a full analysis of the case as Mr. Burkhardt states.

It appears, therefore, that we have in the Hotchkiss drive not only a much simpler, less expensive and very much lighter mechanism, but also one which will show no difference in riding qualities, for we have only to increase our spring travel from 4 in. to

$$\frac{4 \times 1.50}{1.25} = 4.80 \text{ in.}$$

to be able to use the same spring rate, pounds per inch, as in the torque rod chassis.

There need not be any fear of faulty action of the brakes if they are correctly designed, and there is no excuse for not designing them so. In fact, we have the great advantage of cushioning a sudden application of the brakes or driving torque.

Spring loads can be reduced by increasing the length of the springs. The earmarks of a good Hotchkiss chassis are, therefore, adequate spring travel and long springs. A still further reduction on spring loads can be made by the use of under-slung springs—a favorite design on passenger cars.

The torque rod, on the other hand, when brakes are applied, imparts to the frame an important additional load; in our case almost two tons (3600 lb.). This is equivalent to a sudden overload of 36 per cent. It is evident, therefore, that it is much more dangerous to overload a torque rod chassis than a Hotchkiss drive chassis.

In passing it might be interesting to have the views of the advocates of torque rods on the bearing loads on the rear end of the torque rod which are extremely high and not easily taken care of.

In conclusion, I agree with Mr. Burkhardt that there is no need of hypotheses in spring design but all loads can be accurately determined by mathematical deductions.

Government Operation of Tractors Successful

GREAT BRITAIN has inaugurated a plan for Government operation of farm tractors in Yorkshire, England, whereby the machines work in units at fixed charges. Five units are operated, each comprising 10 tractors, 10 2 or 3 bottom plows, 4 cultivators, 3 or 4 binders, 2 rollers, etc. The tractors used are of two types, of 20 hp. each. Minimum charges have been established, according to the report, by the West Riding War Agricultural Committee as follows:

Plowing—Light land (3-horse work), $5.48 per acre; medium land (2-horse work), $6.69; heavy land (3-horse work), $7.91; heavy land (4-horse work), $9.13.

Cultivating—Disk or drag harrowing, $2.74 to $3.65 per acre; breaking stubble after harvest with cultivator, $3.16 to $4.87 per acre; rolling if 2 rollers are drawn, 85 cents per acre.

Harvesting—Reaping, with self-binder, field 10 acres and over, $3.65 per acre; 5 to 10 acres, $3.89 per acre; under 5 acres, $4.26 per acre; haulage of farmer's binder, $1.46.

"These charges," states the U. S. Consul transmitting the report, "in general work out at substantially below the cost of team labor on the land. While it is true that the British Government in 1917 undertook plowing operations at a minimum of $3.65 an acre, it is now known that this price involved a considerable loss. Even at a minimum charge of $5.48 per acre for plowing, the demand for tractors is greater than ever.

"Perhaps the best testimony to the usefulness of the tractor has been the part it has played in the reclamation of derelict land, of which class there has been a large proportion in the country and which the North Riding War Agricultural Committee has set to work to bring under cultivation. These lands have been widely scattered, and in two districts in particular the task was very difficult. With the aid of the tractor, however, tree roots have been stubbed up, whins cleared, gaps filled, bushes removed, and the land generally prepared. This was all done with the aid of the tractor, and many acres of useful arable land was obtained which was put into wheat.

"Some interesting information furnished by the committee illustrates the part which the tractor has played in increasing the area under cultivation in North Riding. In 1917 motor tractors were used for plowing and cultivating to a limited extent, and were regarded by the farmers as more or less of an experiment. During 1918 the committee had 103 tractors at work, an increase of nearly 70 per cent on those employed the previous year."

Decrease in Iron Ore Production

THE estimated quantity of iron ore mined in the United States in 1918 amounted to 69,712,000 gross tons, compared with 75,288,851 tons in 1917, a decrease of 7.4 per cent. The estimated shipments of ore from the mines in 1918 were 72,192,000 gross tons, valued at $246,043,000, compared with 75,573,207 tons, valued at $238,260,444 in 1917, a decrease in quantity of 4.5 per cent but an increase in value of 3.3 per cent. The average selling value of the ore per gross ton at the mines for the whole United States in 1918 was $3.41, compared with $3.15 in 1917. The stocks of iron ore at the mines apparently decreased from 10,628,908 gross tons in 1917 to 8,139,000 tons in 1918, or 23.5 per cent.

The decrease in output, which was general throughout the country, is probably to be attributed to a combination of circumstances. Industrial conditions were more or less disturbed, the supply of labor was uncertain, and transportation facilities were inadequate, but notwithstanding these handicaps the shipments from the Lake Superior district from April to October, inclusive, 1918, were over 2,500,000 tons more than those for the corresponding period of 1917. Owing to a scaling down of furnace requirements, however, in order to release vessels for carrying grain to Europe, the shipments in November and December, 1918, were nearly 4,000,000 tons less than those made in November and December, 1917. Government control of the entire steel supply, which became effective in June, 1918, undoubtedly regulated the demand for ore, and stocks at mines and lower Lake ports were somewhat reduced, so that the consumption of ore remained about the same as in 1917.

Radical Element Is Destroying Labor Organizations

Organizations Are Too Ready to Disregard Instructions or Counsel of Their Elected Leaders

By Harry Tipper

ATTENTION has been drawn in these articles to the tendency in labor organizations to withhold power from the leaders, or to disregard the instructions of the duly elected executives when such instructions appeared to be contrary to the immediate and local necessity of the branch of the organization involved. Not only is this the case, but there is an ever present tendency for the labor organization in any locality or occupation to follow the radicals, the men who are in favor of direct action.

There are many reasons for this tendency. The labor organization has been based in its traditions upon the promise of advantage to be secured by getting together for the purpose of bargaining with the employer or owner. The labor leader, who has had the responsibility of directing the action of labor in the many intricate and complicated problems with which it has to deal, seeing the danger in many of the proposals, becomes conservative and careful in his attitude. The irresponsible radical is in an excellent position to agitate against the apparent inactivity, or actual obstructionist policy of the leaders as he sees them, and promise all sorts of advantages for adopting the policies he outlines.

This leads to the sharp division which is to be observed in all labor organizations and the statements of labor leaders that we are living above a powder magazine. To the average workman the advantages of belonging to a labor organization are compassed by the actual improvements in hours and wages which are constantly insisted upon.

So soon as these advantages cease to accrue from the organization, no matter how much of value they may have accomplished in past history, the rank and file become dissatisfied and critical, and are likely to question the merit of the payment of the necessary dues. They are likely to insist upon action, and to bring sufficient pressure to bear upon the leaders to force them to some action, whether they believe it is wise or not; or they may decide to act without the regular method of decision through the appointed officers and executive committee.

Danger of Organized Labor Inside the Organization

It is in this constant anarchistic tendency within the labor organization itself that the grave danger of the organized labor movement lies. Were it possible to secure an agreement with labor by conferences with its leaders with which the general body concurred it might be possible to settle some of the problems that confront us. This might be accomplished through agreements between committees appointed by the manufacturers' groups and committees appointed by the labor organizations. This is so far from being the case, however, that it is somewhat absurd to discuss the contingency, except that there exists a general tendency to accept the labor organizations at their face value and suppose that the leaders can obligate the unions as congress can obligate the United States.

The indications of this have been visible for ten years previous to the great war, but that time of stress and emergency brought out the conditions very fully. It is significant that most of the strikes called during the war were called against the demand of the national leaders and such strikes were vigorously denounced by them.

Strikers Taking Advantage of Uncertainty of Time

At this time there is a tendency to call strikes for no other purpose than to seize upon the present uncertainty and fluidity of public opinion to gain various classes of workers without regard to the general effect upon the whole economic structure. There is a definite propaganda going out from labor circles aimed at the probable change in commodity and wage values, but in reality to forestall any action which might result in the lessening of the political power of labor, which has grown so tremendously during the war.

These facts do not keep the manufacturer from observing and taking careful count of the public desire for a different organization of industrial establishments, nor do they justify the sweeping assertion that all labor demands are without justice and should not be encouraged. They really emphasize the necessity for just action and a studious consideration of the whole problem, so that the decision may not be prejudiced by the apparent absurdity of the demands made by some labor organizations, nor stampeded by the propaganda which is issued freely by the radicals on both sides with the definite purpose of using the situation for political and individual advantage without any regard to the fundamental requirements of the case.

Satisfied Workers Want No Interference

The present situation makes clear the impossibility of securing any peaceful and harmonious arrangement between capital and labor in the mass by general agreement between the leaders, and lends force to the argument that it is necessary for the employer to solve the problem for his own establishment and his own employees. This makes it important to examine the records of those establishments which have approached and dealt with this problem by organization changes, and which have placed some of the responsibility upon the workers and instituted some form of profit sharing plan in connection therewith. Particularly is it important that the records be looked up in the endeavor to discover what has happened in those establishments during the turmoil of the past few years and present difficulties. Fortunately it is possible to find this out in conection with some cases where the plans have been worked out for a sufficient length of time to permit of a valuable comparison.

Take the case of a plant in which the method of participation was through a house of workers' representatives,

a senate body of department heads and a cabinet of the general executives. This plant has been referred to in a previous article. During the war there was a general strike in this industry, and after the labor body and employers had failed to reach an agreement the War Labor Board of the government was called in to work it out. All this time this particular plant was working full time with no absences of employees. When the Labor Board was called in the workers in this plant addressed three special communications to Washington requesting that the decisions of the board be considered not to apply to that organization, as the workers there had no intention of striking and were so well satisfied with the plan under which they were working that they did not want it upset by any decision arrived at by the adjustment board. They were not satisfied that the government had wakened to the full significance of the case. In order to further safeguard their own interests they sent a deputation to Washington to wait upon the Labor Board and make sure that they would be left alone to continue as they were.

This is only one instance of the value of a plan whereby the employers and employees get together in the individual organization and work out the necessary plans with respect to that unit, but it is very significant. The conditions were favorable to the worker. The strikers were likely to profit by the wage board's decision, and the stern necessities of the war made the bargaining power of the workers almost unassailable. There was no special attempt made in the organization we are speaking of to give their workers any special advantages or advances in wages. The regular procedure was governing this case. Every inducement which could have acted upon the workers to join the general body in this industry was involved, and only the firm belief in the merits of the plan to which they had subscribed held them to their places. The value of the plan to the owners of that concern cannot be overestimated in this one instance.

Trouble Makers Unwelcome

In another case, the men in one department of the factory asked for an increase of wages through their representative. The board of representatives considered the case and turned the request down with its reasons. After a week or two the matter was brought up again by the same workmen and the reply was that conditions had not changed and the representatives did not feel that they were able to change their previous decision. The matter was brought up a third time and the same answer was given. Then the men went out on strike, and the representatives of the rest of the workmen said, "All right, if you feel that way about it, maybe you had better get out." In two weeks they were all asking for their jobs again. The rest of the plant had gone on, and other men had been secured for the department, because the rest of the workers said, "These fellows are trouble makers. We don't want them back in this establishment."

Here again is an illustration of the worker backing the organization which has convinced him that it is dealing with him squarely, with the books open, and giving him some share in the control of his own conditions. Instances of this sort can be taken from all organizations where this problem has been dealt with from the proper standpoint—that of getting the industrial unit, the individual organization, together on the common basis of sharing the benefits and difficulties, and sharing also in the responsibility for the conditions in which they work. They should make the manufacturer pause a little before casting out plans for industrial organization which may seem to throw away his control, but which in reality give him more control than ever, because it is the solid control of an institution thoroughly organized upon a harmonious basis, where there is a team spirit which makes efficiency possible, and without which it is impossible to get any real efficiency.

A Question of Psychology

Some day the engineer and production manager and the other governing executives will know enough about the motives which govern human action to realize that efficiency is not a matter of machinery, nor is it a matter of the number of motions which must be made to complete a certain job. It is a matter of the relation of the complex mental and physical necessities to the work which it has to perform, and the social surroundings in which it must live and work. It involves a much greater degree of scientific research and development than all the mechanical arts which contribute their share to the necessities of manufacturing. It is not to be secured by the dogmatic attitude of mind which builds upon its own prejudices an unassailable logic, unassailable because there is no possibility of argument with prejudice. It cannot be secured by assuming that any particular form of organization is the correct one for these conditions merely because it was correct forty years ago.

After all, the necessity which is constantly before the manufacturer is production at greater value for less expense, more efficient work for less expenditure of man power. This means an intelligent study of the things which affect the mental and physical capacity of the man, the effect of tradition, the application of the deep seated human desires and the effect of the character of his surroundings upon his work. There are enough experiments in organization to give their practical value from a production standpoint, and they are necessary if we are to have industrial peace.

Book Review

Cost Accounting, by J. Lee Nicholson and John F. De Rohiba. Published by the Ronald Press Co., New York. Five hundred and seventy-six pages, 5½ x 8 in. Price, $6.

This is a comprehensive volume on the subject indicated by the title, by members of a firm of supervising cost accountants. The importance of cost accounting in factory operation has been brought home to a great many manufacturers in recent years who gave it little consideration previous to that time. Much effective educational work along this line has been done by the Federal Trade Commission, with a view to establishing more stable conditions in industries. Another thing that has helped to bring the subject of cost accounting prominently to the fore is the fact that a movement has been launched in various industries to standardize cost accounting methods for the particular industry.

The present volume is an extension of a previous book on the same subject by the senior author, "Cost Accounting; Theory and Practice," which was published in 1913. It has been the author's aim to classify the details of cost accounting so that the reader may get a well defined idea of the forms and records required for each separate operation, and how these forms and records fit into the general system used in any particular establishment. Every feature of cost accounting is gone into in the book and numerous forms are illustrated.

Christensen Starter on Duesenberg Engine

IN the description of the Duesenberg 800-hp. engine which appeared in the Jan. 23 issue of AUTOMOTIVE INDUSTRIES there was shown a front view of the engine which illustrated very clearly the mounting of the starter with which the engine was started while on the test stand. This is the Christensen starter, aero type.

Small Inlet Valves Satisfactory in Overhead Valve Design

British Engineer's Tests Prove High Charging Capacity—Specific Fuel Consumption Largely Independent of R. P. M. and Torque for 50 to 60% of Maximum Horsepower

Fitting Electric Starting and Lighting Units Easiest on Valve-in-Head Designs

PART I

LONDON, Jan. 15—L. H. Pomeroy, engineer of Vauxhall Motors, Ltd., recently read a paper before the Institution of Automobile Engineers here in which he analyzed a series of tests made with two engines of approximately the same size, about 3 liters (90 by 120 mm.). One was a valve-in-head design and the other an L-head with valves side by side in the valve pocket.

The paper was of unusual interest due to several facts that are deeply concerning the British automobile engineer at present. The entire European industry is landsliding to electric starting and lighting, and fitting the starting motor and electric generator on an L or T-head engine is almost impossible, according to Mr. Pomeroy, whereas it is relatively easy on a valve-in-head design.

Valve-in-head engines were not taken up in England because of the noise and the national demand for silence. Now that quiet over-head-valve designs are possible and practical the British engineer, and the French and Italian engineer as well, is taking a new interest in this design, and Mr. Pomeroy's paper took on a new international importance because of this. Italian and French engineers have openly expressed their sympathy for the overhead valve, and the next two years will record many new European designs with this valve scheme.

Test for Average Conditions

Mr. Pomeroy faced the problem in one of the most practical ways possible and carried out his tests to meet the average touring car conditions, rather than racing car or aviation engine conditions.

He used three different diameters of inlet valves on the L-head and valve-in-head engines and proved to his own satisfaction that with the valve-in-head design you can use very small-diameter valves, with high inlet gas velocity and get good horsepower and high fuel efficiency. He satisfied himself that increase in brake horsepower is not proportional to increase in inlet valve area, and that maximum brake-horsepower is largely independent of inlet gas velocity. In his opinion very much higher gas velocities can be used than are common in present-day practice.

The European designer must always keep in mind the fuel economy of his car, and here, too, Mr. Pomeroy has arrived at some interesting conclusions. Fuel consumption is not related directly to inlet gas velocity; in other words, the diameter of the valve does not materially affect the fuel consumption per horsepower hour.

Three different areas of inlet valves were used, 1.8 sq. in., 1.4 sq. in., and 0.7 sq. in. The carbureter setting in each test was not necessarily that for maximum economy, but rather to give easy starting and good road acceleration; in fact the carbureters were tuned up from the point of view of the average driver.

The two engines were practically identical in design except for valve arrangements. In both engines the compression pressures at full throttle were nearly equal in each of the corresponding tests, thus demonstrating that there is no appreciable difference in the charging effect with different valve diameters when the valve lift is kept constant.

Mr. Pomeroy discussed his experimental data under the eight following heads:

1—Inlet gas velocity and maximum brake horsepower.
2—Inlet gas velocity and brake mean effective pressure.
3—Inlet gas velocity and fuel consumption at full load.
4—Inlet gas velocity and fuel consumption at varying loads.
5—Revolution speed and brake mean effective pressure.
6—Revolution speed and fuel consumption at full load.
7—Revolution speed and fuel consumption at varying loads.
8—Fuel consumption per hour for any given brake horsepower, irrespective of engine speed.

The particulars of the two engines tested are as follows:

	Engine A	Engine B
Bore	90 mm.	90 mm.
Stroke	120 mm.	118 mm.
Compression ratio	4.8.1	4.8:1
Inlet valve dia	1.75 in.	1. $\frac{9}{16}$ in.—1. $\frac{3}{8}$ in.—1 in.
Inlet valve area	1.8 sq. in.	1.8 sq. in.
	1.4 sq. in.	1.4 sq. in.
	0.7 sq. in.	0.7 sq. in.
Exhaust valve dia	1.75 in.	1.5 in.
Exhaust valve area	1.8 sq. in.	
	1.4 sq. in.	1.75 sq. in.
	0 7 sq. in.	

Valve Timing	Engine A	Engine B
Inlet valve opens	10 degrees late	0 degrees
Inlet valve closes	47 degrees late	44 degrees late
Exhaust valve opens	65 degrees early	40 degrees early
Exhaust valve closes	17 degrees late	0 degrees

Deduction.—Increase in brake horsepower is not proportional to the increase in valve area; in other words, the small inlet valve is more useful per unit of area than the larger one. The maximum brake horsepower in the normal touring car engine is very largely independent of gas velocity through the inlet valve, and much higher velocities can be used than are common in practice at present.

Mr. Pomeroy in arriving at this deduction analyzed his experimental data as follows:

Tables I and II and Figs. 1 and 2 show the tabular and plotted values of inlet gas velocity and brake horsepower for both engines. The brake horsepowers were measured by a Froude dynamometer. The curves indicate that the brake horsepower is still rising in each engine with the 1.8 and 1.4 sq. in. area valves at the maximum revolution speed of the experiments. From other tests, however, it is known that the maximum brake horsepower shown is very nearly indeed the maximum attained, and can be regarded as such. It will be seen that in engine *A* the increase in valve area from 1.4 sq. in. to 1.8 sq. in. corresponds with an increase in maximum brake horsepower of 4, *i. e.*, from 42 to 46, some 9 per cent. The results in Table I (valve area 0.7 sq. in.) relating to engine *A* indicate a very poor power performance, and are not offered for criticism.

Expressing maximum brake horsepower in terms of valve area for engine *A* we have:

1.8 sq. in. valve...... 6.8 hp. per sq. in. of valve area
1.4 sq. in. valve...... 7.6 hp. per sq. in. of valve area
0.7 sq. in. valve...... 9.8 hp. per sq. in. of valve area

In each case the maximum brake horsepower is attained at speeds between 2200 and 2400 r.p.m. These figures show that the increase in brake horsepower is not proportional to the increase in valve area; in other words, the small valve is more useful per unit area than the large one.

With engine *B* the maximum brake horsepower is the same with both the larger sizes of valves, and is reduced by 20 per cent with the smallest valve of 0.7 sq. in. area.

Expressing brake horsepower in terms of valve area we have for engine *B:*

1.8 sq. in. valve.... 6.87 b.hp. per sq. in. of valve area
1.4 sq. in. valve.... 8.97 b.hp. per sq. in. of valve area
0.7 sq. in. valve.... 14.65 b.hp. per sq. in. of valve area

The maximum brake horsepowers are in each case attained at 2400 r.p.m.

It will be noted that the maximum brake horsepower obtained in engine *B* with 0.7 sq. in. overhead valve is almost the same as that in engine *A* with 1.4 sq. in. valve of side-by-side design, the gas velocities being 220 ft. per sec. and 450 ft. per sec. respectively.

The reasons for this rather striking result arise from considerations which will be developed later.

TABLE I
ENGINE A—FULL LOAD TESTS

Revs. per Minute	B.H.P.	Compression, Lb. per Sq. In.	ηp, Lb. per Sq. In.	M.E.P.* Calculated, Lb. per Sq. In.	Gas Vel., Ft. per Sec.	Fuel, Pints per B.H.P. per Hour
INLET VALVE AREA, 1.8 SQ. IN.						
2,400	45.5	105	80.5	94.5	167	0.75
2,200	42.2	105	81.5	......	153	0.72
2,000	39	102	82.7	94.7	139	0.75
1,800	35.4	100	83.5	......	126	0.78
1,600	31.6	99	84	94	112	0.82
1,400	27.5	96	83.4	......	98	0.87
1,200	23.5	94	83.2	91.2	84	0.92
1,000	19.3	93	82	......	70	0.98
800	14.7	91	78	85	56	1.05
INLET VALVE AREA, 1.4 SQ. IN.						
2,400	42.9	......	76	90	220	0.71
2,200	40.4	104	78	......	202	0.72
2,000	38.7	101	80	92	183	0.73
1,800	34.7	100	81.9	......	165	0.74
1,600	31.25	98	82.9	92.9	147	0.76
1,400	27.5	96	83.4	......	128	0.78
1,200	23.55	94	83.3	91.3	110	0.83
1,000	19.3	92	82.0	......	92	0.88
800	15.30	90	81	88	73	0.94
INLET VALVE AREA, 0.7 SQ. IN.						
2,400	27.5	......	45.1	......	450	1.01
2,200	27.6	85	53.25	......	412	0.92
2,000	27.5	91	58.5	......	374	0.87
1,800	26.5	95	62.5	......	337	0.84
1,600	25	98	66	......	300	0.83
1,400	23	98	70	......	262	0.85
1,200	20.5	96	73	......	225	0.89
1,000	17.3	95	73.5	......	187	0.95
800	13.7	95	72.8	......	150	1.04

*Calculated M.E.P. excludes fluid and pumping losses.

TABLE II
ENGINE B—FULL LOAD TESTS

Revs. per Minute	B.H.P.	Compression, Lb. per Sq. In.	ηp, Lb. per Sq. In.	M.E.P.* Calculated, Lb. per Sq. In.	Gas Vel., Ft. per Sec.	Fuel, Pints per B.H.P. per Hour
INLET VALVE AREA, 1.8 SQ. IN.						
2,400	49.5	101	90	104	167	0.72
2,200	46.5	104	92	......	153	0.7
2,000	42.7	105	93	105	139	0.69
1,800	38.8	105	94	......	125	0.71
1,600	34.7	105.5	94.5	104.5	112	0.74
1,400	30.4	104	94.5	......	98	0.79
1,200	25.6	102	93	101.5	84	0.85
1,000	20.4	99	89	......	70	0.94
800	15.5	95	84.5	91.5	56	1.08
INLET VALVE AREA, 1.4 SQ. IN.						
2,400	50.2	98	91	105	220	0.73
2,200	46.9	99	93	......	202	0.7
2,000	43.6	101	95	107	183	0.71
1,800	39.7	102	96.5	......	165	0.74
1,600	35.6	104	97	107	146	0.78
1,400	31.1	105	97	......	128	0.84
1,200	26	100	94.5	102.5	110	0.92
1,000	20.4	98	89	......	92	1.02
800	15.2	92.5	82.5	89.5	73	1.16
INLET VALVE AREA, 0.7 SQ. IN.						
2,400	40.2	......	73	87	450	0.76
2,200	41	......	81	......	412	0.70
2,000	40	92.5	87	99.5	374	0.69
1,800	37.9	94	91.5	......	337	0.71
1,600	34.7	98	94.5	104.5	300	0.74
1,400	30.7	98	95.5	......	262	0.78
1,200	26.5	98	94.5	102.5	225	0.84
1,000	20.8	96	91	......	187	0.93
800	15.3	95	83.5	90.5	150	1.06

*Calculated M.E.P. excludes fluid and pumping losses.

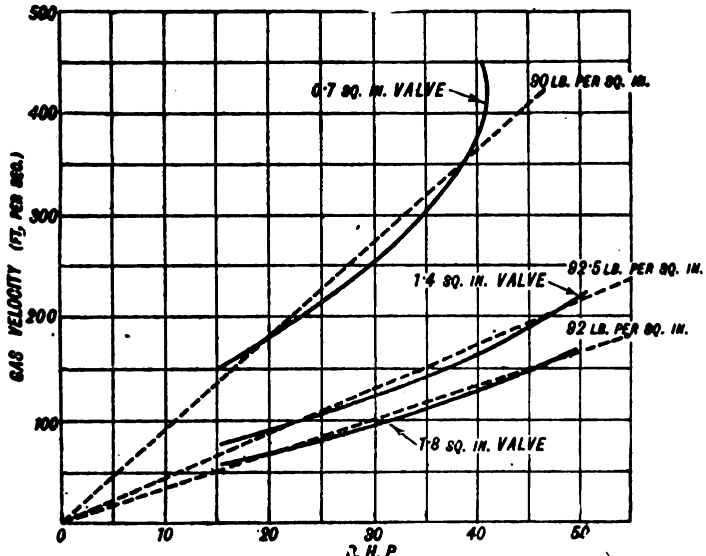


Fig. 1—Plotted values of inlet gas velocity and brake horsepower for engine A

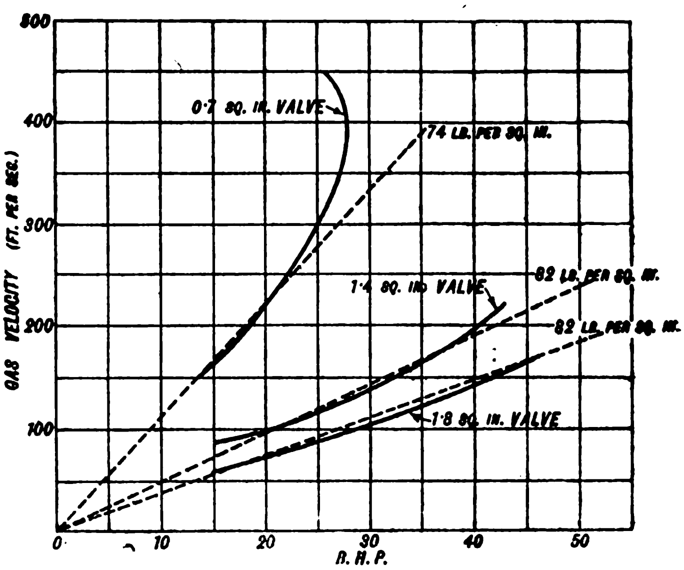


Fig. 2—Plotted values of inlet gas velocity and brake horsepower for engine B

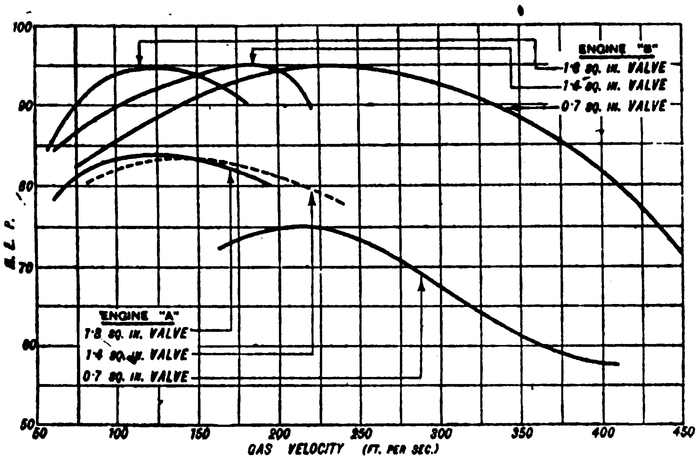


Fig. 3—Tabular and plotted values of inlet gas velocity and brake mean effective pressure for engines A and B

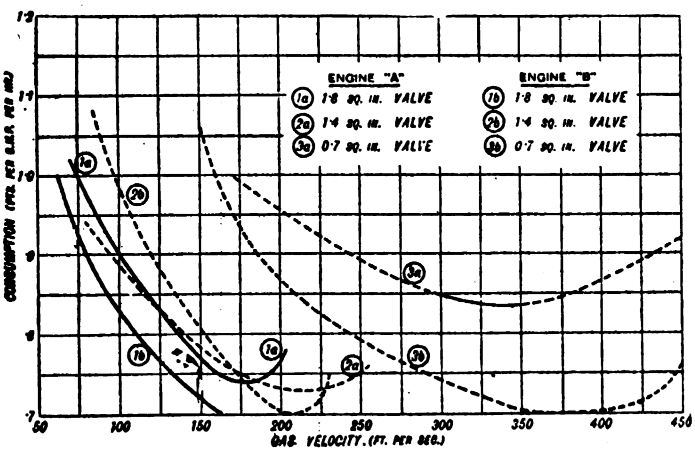


Fig. 4—Tabular and plotted values of improvement of fuel consumption

Further comparison of the maximum brake horsepowers obtained from engines *A* and *B* with valve areas of 1.8 and 1.4 sq. in. respectively show an increase of 10 per cent in maximum brake horsepower for engine *A*, but no increase for engine *B*, the increase in inlet gas velocities in each case being from 167 ft. per sec. to 220 ft. per sec.

The figures show, therefore, that in these engines the maximum brake horsepower obtained is very largely independent of the gas velocity through the inlet valve, and that for *normal touring car engines* much higher gas velocities can be used than are common practice without adversely affecting maximum brake horsepower.

Inlet Gas Velocity Has Little Effect on B.M.E.P.

Deduction—In the valve-in-head engine the effect of inlet gas velocity on brake mean effective pressure is much less than generally assumed, and B. M. E. P. of the order of 95 lbs. per sq. in. can be obtained with inlet gas velocities in the region of 300 ft. per second.

Referring to this Mr. Pomeroy said:

Tables I and II and Fig. 3 indicate the tabular and plotted values of inlet gas velocity and brake mean effective pressure for engines *A* and *B*.

To discuss these figures properly necessitates data as to the mechanical friction losses at the various speeds, so that inlet gas velocity may not be charged with a reduction in brake mean effective pressure due to mechanical friction.

The author has not been able to make such measurements, but data published on the friction losses of similar engines to those under discussion give figures which are probably near the truth.

Thus the *mechanical friction* losses (i.e., excluding pumping and fluid losses) are about as shown in Table IV.

The values of calculated mean effective pressure in Tables I and II are obtained by adding the appropriate allowance as shown above to the figures for brake mean effective pressure.

It will be seen that engine *B* is decidedly better in respect of mean effective pressure than engine *A*, but that in each case the calculated mean effective pressure is fairly steady at the various inlet gas velocities and does not fall off appreciably, i.e., more than about 5 per cent for gas velocities up to 300 ft. per second.

The author suggests that these results, particularly those obtained with engine *B*, show that the effect of inlet gas velocity on mean effective pressure is far less than is generally assumed.

The figures show also that brake mean effective pressures

TABLE III
PART LOAD TESTS

Revs. per Minute	B.H.P.	*p, lb. per Sq. In.	Gas Vel. Ft. per Sec.	Engine A Fuel, Pints per B.H.P. per Hour	Engine B Fuel, Pints per B.H.P. per Hour
VALVE AREA, 1.8 SQ. IN.					
0.8 Full load					
2,400	40	72.7	167	0.715	0.75
2,000	33.3	72.7	139	0,726	0.7
1,600	26.7	72.7	112	0.775	0.71
1,200	20	72.7	84	0.84	0.78
800	13.3	72.7	56	0.998	0.87
0.6 Full load					
2,400	30	54.5	167	0.8	0.76
2,000	25	54.5	139	0.827	0.75
1,600	20	54.5	112	0.882	0.80
1,200	15	54.5	84	0.967	0.87
800	10	54.5	56	1.17	0.98
0.4 Full load					
2,400	20	36.3	167	0.963	1.01
2,000	16.67	36.3	139	1.025	0.99
1,600	13.3	36.3	112	1.12	0.98
1,200	10	36.3	84	1.24	1.03
800	6.67	36.3	56	1.37	1.15
VALVE AREA, 1.4 SQ. IN.					
0.8 Full load					
2,400	40	72.7	220	0.715	0.74
2,000	33.3	72.7	183	0.73	0.72
1,600	26.7	72.7	147	0.765	0.74
1,200	20	72.7	110	0.84	0.79
800	13.3	72.7	73	0.066	0.85
0.6 Full load					
2,400	30	54.5	220	0.845	0.86
2,000	25	54.5	183	0.857	0.78
1,600	20	54.5	147	0.89	0.82
1,200	15	54.5	110	0.975	0.88
800	10	54.5	73	1.125	0.96
0.4 Full load					
2,400	20	36.3	220	....	....
2,000	16.67	36.3	183	1.085	1.0
1,600	13.33	36.3	147	1.138	1.03
1,200	10	36.3	110	1.245	1.10
800	6.67	36.3	73	1.4	1.23
VALVE AREA, 0.7 SQ. IN.					
0.8 Full load					
2,400	......	....	....	....	....
2,000	......	....	....	....	....
1,600	26.67	72.7	300	0.835	0.71
1,200	20	72.7	225	0.885	0.88
800	13.3	72.7	150	1.026	0.9
0.6 Full load					
2,400	......	....	....	....	....
2,000	25	54.4	374	0.9	0.88
1,600	20	54.5	300	0.909	0 83
1,200	15	54.5	225	1.01	0.89
800	10	54.5	150	1.16	1.01
0.4 Full load					
2,400	20	36.3	450	1.08	1.01
2,000	16.67	36.3	374	1.07	0.96
1,600	13.3	36.3	300	1.13	0.99
1,200	10	36.3	225	1.24	1.05
800	6.67	36.3	150	1.43	1.13

TABLE IV.

Revs. per minute	Mechanical friction per sq. in. of Piston Area
2,400	14
2,000	12
1,600	10
1,200	8
800	7

of the order of 95 lb. per sq. in. can be obtained with inlet gas velocities in the region of 300 ft. per sec.

Fuel Consumption Not Related Directly to Inlet Gas Velocity

A—Full Loads

Deduction—Improvement in fuel consumption is related to increase in engine speed rather than to increase in gas velocity as such.

Mr. Pomeroy analyzed his data:

Tables I and II and Fig. 4 indicate the tabular and plotted values of these quantities for both engines.

The characteristic feature of all the curves is that the consumption per brake horsepower per hour rapidly falls with increase in the inlet valve gas velocity, but rises again with further increase in gas velocity as the upper limit of revolution speed is reached. Further study of the curves shows that the downward path of each curve is approximately inclined to the horizontal in such a way that the improvement per cent in consumption is proportional to the increase per cent in inlet gas velocity. *In other words, the improvement in consumption is related to increase of engine speed rather than to increase of gas velocity as such.* This aspect of the case will be discussed later.

It is well known that turbulence, i.e., violent agitation of the mixture at the instant of ignition, *is essential for both power and economy;* it is usually regarded as a function of inlet gas velocity, so that it is of interest to see if any improvement in fuel consumption can be associated with increase in gas velocity. An examination of the curves in Fig. 4 shows that the same consumption in the different cases is attained with very differing values of gas velocity.

It may be said, therefore, that there is either no apparent increase in efficiency with the higher gas velocities or that there is no apparent decrease in efficiency with the lower gas velocities.

It would seem that, in considering turbulence, inlet gas velocity must be considered in its relation to revolution speed or piston speed, and that there is a certain minimum relation between the two which produces the necessary turbulence for approximately complete combustion at all speeds.

From these experiments it seems reasonable to believe that this minimum is secured with the largest valves used at the lowest speeds of the tests. It will be of great interest if the discussion reveals any experiments of this kind upon similar engines but run at lower engine speeds.

The conclusions formed by the author in considering these results are:

1. That consumption is not related directly to inlet gas velocity.
2. That sufficient turbulence is developed to produce approximately complete and rapid combustion at quite low gas velocities.
3. That the improvement in consumption with increase of inlet gas velocity shown by the curves is related to revolution speed and not to gas velocity as such.

Table III shows the consumption of each engine at varying loads and speeds for each area of inlet valve.

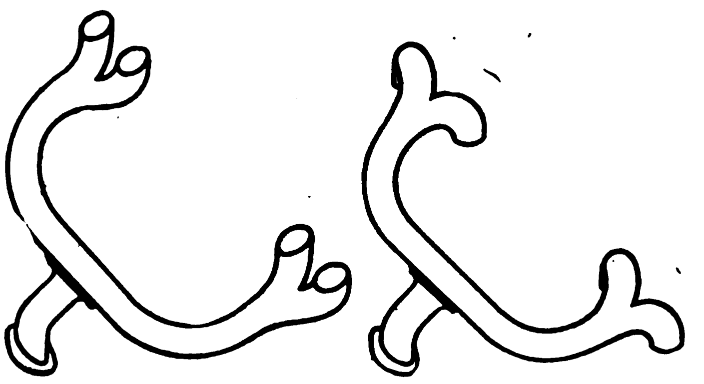
It will be seen that there is no great difference in consumption in each corresponding series of figures relating to the tests with inlet valves of 1.8 sq. in. area except at the lower speeds at 0.6 and 0.4 of full load, where engine *B* is decidedly better than engine *A*. The same remark applies to the tests with inlet valves of 1.4 sq. in. area.

Comparing the tests at 0.8, 0.6, and 0.4 full load when using each size of inlet valve, *it is evident that there is no marked effect which can be attributed to variation of inlet gas velocity.*

For example in Table V:

TABLE V.

		Inlet Valve Areas		
		1.8 sq. in.	1.4 sq. in.	0.7 sq. in.
Average consumption of engine *B* in pints per B.H.P. per hour between 800 and 2400 revs. per minute	Full load	0·82	0·86	0·83
	0:8 full load	0·78	0·78	0·76
	0:6 full load	0·82	0·85	0·88
	0:4 full load	0·94	1·06	1·02
Average gas velocity, ft. per second		111	146	300



Figs. 5 and 6—Carbureters used on each engine were similar in each case

Those who are accustomed to making measurements of fuel consumption in bulk, so to speak, will appreciate the fact that the small variations shown as between the one valve area and another are easily accounted for by errors in measurement.

The fuel consumption measurements were made by running the engine for a period required to use 0.5 pint of fuel, and as a rule the figures given are the average of three runs. The difficulties, however, of keeping the engine speed and load constant were very appreciable at the lower speeds, as these occupied much time.

The author would point out that the consumptions at full load are higher than those at 0.8 full load. This increase in consumption at full load, compared with 80 per cent of full load, occurs so frequently that it cannot be accidental. It is not in the author's opinion easily explicable, and he hopes the discussion will throw some light on the point. It does not appear to be connected with revolution speed or gas velocity, but simply arises in the process of getting the last ounce out of the engine.

In view of the small range of difference in consumption in these part-load tests it has not been thought worth while to plot the curves showing gas velocity and consumption at the various speeds and valve areas.

The general conclusion drawn from an examination of the results shows that the fuel consumption per brake horsepower per hour is not materially affected by the use of either the largest or smallest inlet valves. In other words, it is not affected by the inlet gas velocity at any prescribed number of revolutions per minute.

The author has now briefly considered the various factors in engine performance of brake horsepower, brake mean effective pressure and fuel consumption with respect to inlet gas velocity.

The experimental evidence obtained from the tests shows that within much wider limits than are usually accepted, inlet gas velocity does not appreciably affect performance either in respect of power or consumption.

The author would emphasize the fact that the range of engine speed applying to these tests is that which is more applicable to touring car engines than to racing engines. In view of his experience with the latter he would not extend the above conclusions as to the effect, or rather non-effect, of inlet gas velocity on maximum power.

So far nothing has been said about exhaust valve effects. In all the tests on engine *B* the author is quite sure that the area of the exhaust valve was such as to produce no back pressure or exhaust choking effect. This engine had, in fact, two exhaust valves. Whether both were in use or only one made not the slightest difference in any of the experiments made on this point. Only one exhaust valve was used throughout all the experiments. With regard to engine *A* there is room for doubt as to whether the exhaust was sufficiently free with the 0.7 sq. in. valve area, but for the larger sizes of inlet valve the author is confident that the exhaust valve was adequate.

The carbureters and the induction pipes used on each engine were similar in each case, and are shown diagrammatically in Figs. 5 and 6. (*To be continued*)

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, February 20, 1919 No. 8

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142.

Cable Address - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - - - - - - One Year, $3.00
Canada - - - - - - - - - - One Year, 5.00
Foreign Countries - - - - - - - - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Support for Highways Development

ROADBUILDING, at a standstill during the war because of lack of materials, now promises to outstrip all past records in the history of highway construction in this country. Appropriations already made and bills pending give assurance that an appreciation of the value of good roads has come out of the war, that the work of the various associations at Washington, the request of President Wilson and the activities of the Highways Transport Committee are bearing fruit.

That the manufacturers are interested in good roads goes without saying. The increased business that can result both to car and to truck makers from a network of highways is well recognized.

The National Automobile Chamber of Commerce, awake to the situation from its angle, has already established a representative at Washington to look after the highways developments. But the individual manufacturers at this time should also engage in every manner possible to further the work.

Advertisements, salesmen, agents, dealers and every agency should to a reasonable extent be used to promote the building of highways now while legislators and the public both seem completely "sold" on the value of "good roads everywhere."

Limit Tire Sizes Gradually

ONE of the governmental war restrictions important both to industry and to war was that limiting the sizes of tires, and the recent decision of the manufacturers to resume manufacture of all sizes demanded should be temporary only.

Undoubtedly many car makers would suffer heavy losses if suddenly forced to meet the manufacturing conditions created by the tire size limits. But the reduction of tire sizes from more than 200 of the pneumatic types to 9 and from more than 100 solids to 14 is too efficient a plan to be dropped entirely. It simplifies manufacture, labor and factory problems too well to be given up merely because of the temporary expense involved.

The best course would be one allowing a very gradual elimination of tire sizes and making the change less abrupt than that planned by the War Board, allowing the car makers to adopt the standard sizes as they change models, and giving the public sufficient time to consume those cars using tires that will eventually become obsolete.

Individual Truck Control Means Inefficiency

A REVERSION to pre-war methods of scattered purchase, operation and maintenance is threatened by the new Army Bill which has made no appropriation for the Motor Transport Corps and provides for the discontinuance of that body by the repeal of the Overman Act under which it was created. Appropriations as made for trucks are given to each individual division of the army.

This means that each department will again purchase the sizes and types of trucks it desires without regard to interdepartment standardization. There will no doubt again be hundreds of types in use and thousands of different parts in stock for maintenance and repair.

The present return to pre-war individualism of departments points to inefficiency of truck operation, increased costs in maintenance, and a breaking up of esprit de corps so essential in motor transport work.

The plan now considered and provided for by the bill means confusion, waste, extravagance and inefficiency. It means duplication of buying, operation and maintenance effort and lack of that single control that provides for comprehensive operation of truck convoys, repairshops and training schools.

The Army Bill must be amended to provide properly for the continuation of the Motor Transport Corps or it must in some other manner place all motor transport under one directing head.

Dirigibles for Commercial Flights

THE discussion of commercial possibilities of aircraft presupposes a careful differentiation between lighter-than-air types, such as dirigibles, and the heavier-than-air machines, such as airplanes. At present too many are inclined to think that because the airplane proved itself such a potent factor in war it will entirely dominate the field of commercial aircraft. The failure of the Zeppelins as war machines must not lead to the rejection of this type for commercial uses. The Zeppelin was a war failure owing to the inflammable gas it carried and because of the large target it offered to the attacking airplane. In peace both of these handicaps disappear, and the dirigible must be generally considered in analyzing the future of commercial aviation.

These are days when the enthusiast is apt to make hasty deductions regarding commercial aviation. The fact that the passenger airplane might cross the Atlantic should not be looked upon as more than a daredevil demonstration. Those who would immediately begin organizing a transatlantic mail service because of such a demonstration would be working an injury to the future of commercial aviation.

On the other hand, a war demonstration of Allied army dirigibles has been sufficient to point definitely to the possibilities of those craft for commercial uses. For transatlantic work, so far as conditions can be judged to-day, there is no possibility of comparison between the dirigible type and the airplane type. The dirigible looks like the practical vehicle for this ocean service, for at present there are dirigibles in existence in Great Britain and possibly in France, as well as in Germany, which could make a two-way ocean trip without the necessity of landing. These dirigibles have great carrying capacity. With such a positive form of aerial transportation now in existence, it seems foolhardy to attempt the uncommercial field of the airplane for such great distances.

In commercial aviation, as in any other industry that has to be built on some fundamentals, the mind must rule and not the heart. Perhaps crossing the Atlantic in an airplane appeals amazingly more to the imagination than crossing it in a dirigible, but from a financial point of view the other does not admit of comparison. To-day there is entirely too much enthusiasm for commercial aviation and too few analyses of what the requirements are before commercial aviation can be started.

What is the use of organizing large companies for commercial transportation by airplane without first having the necessary where-with-all with which to carry on such an organization? We cannot operate a railroad without the right of way, stations, telegraph lines, freight houses, and other physical equipment. An aerial transport system cannot be operated without a parallel set of physical requirements. To make it possible to fly an airplane from New York to Chicago there must be landing fields, and it would be utterly impossible to start a commercial line of aircraft transportation between the two cities without a completely perfected scheme of landing fields. Nobody knows definitely how far apart these landing fields should be, but the consensus of opinion of those who have made a close study of it abroad think that 10 to 15 miles is the maximum distance between landing grounds, and that there should be larger airdromes at other intervals. These students of commercial aviation are of the opinion that no plane should be flown more than 300 miles even in commercial use without landing. This finds a parallel in the short-run of the railroad locomotive which has been necessary in railroad operation.

In addition to the continuous chain of landing fields, there is other equipment necessary before a line of commercial aviation could be successful. The entire area must be properly marked with signals so that the aviator can follow the course by day or by night. This calls for some form of electric signals by night, not only on the course, but off it. Imagine the difficulty of an aerial pilot who found himself some night wide of his course due to high winds, and because of low clouds taken entirely out of contact with the course and the signals. It would mean almost certain destruction to the pilot and his load.

There is also need for a complete wireless system, not only on the planes, but on the landing fields, and also over much of the adjacent territory. This calls for a comprehensive course in aerial navigation and the pilot must be schooled in it as thoroughly as the sea captain of to-day.

Commercial aviation is confronted with other problems that must be solved before the work can be a success or even a warrantable business venture. Climatic conditions change very greatly in a distance of 250 miles, and a complete meteorological system is necessary, together with a

(*Continued on page* 447)

Latest News of the

Foreign Import Restrictions Continued and Increased

American Makers Must Overcome Serious Problems—Most Important Countries Have Restrictions

WASHINGTON, Feb. 18—That American manufacturers must seriously consider the existing restrictions and embargoes on the importation of automotive products in the important foreign countries of the world is evidenced more clearly daily as these restrictions become more severe.

A summary of the foreign import restrictions shows clearly the difficulties and obstacles of the American exporter. Few of the important countries are without some form of severe restrictions. A complete prohibition is in force in the United Kingdom. A duty of 70 per cent applies to lower priced cars in France, and import licenses which are required are only rarely granted. The unfavorable currency exchange conditions in Italy and the United States form a barrier to exports to that country. Likewise restrictions in the Scandinavian countries, the Netherlands, Switzerland, Australia, Canada and the British West Indies display the need for finding a solution to the problem. There are no American restrictions on the exports of automobiles or other automotive products.

Following is the latest available list of foreign import restrictions, together with a summary of the import and export situation as revealed by recent War Trade Board announcements:

UNITED KINGDOM

A prohibition in force in the United Kingdom against the importation of motor cars, chassis, motorcycles, and parts and accessories of motor cars and motorcycles (other than tires) is based on two orders of March 21 and June 27, 1916, both of which are still in effect. Rubber manufacturers, including tires, have been prohibited since May 10, 1917, and agricultural machinery, including tractors, since Feb. 23, 1917. It is to be observed that when licenses are granted for the importation of passenger motor cars they will be subject to a duty of 33⅓ per cent ad valorem. In determining the duty payable the value of tires is excluded.

FRANCE

Import licenses are still required for the importation of automobiles and motor trucks, motorcycles, and tractors into France and Algeria. When licenses are exceptionally granted for automobiles the special rate of 70 per cent ad valorem will apply to such vehicles when weighing less than 2500 kilos.

FRENCH COLONIES

The French prohibitions are not automatically extended to the French colonies, but the Government of Tunis is understood to have adopted prohibitions in practically the same form as in France.

ITALY

All goods imported into Italy from the United States require import licenses, and by reason of the unfavorable exchange conditions it is improbable that any modification will be made in the near future.

SCANDINAVIAN COUNTRIES

By reason of the special arrangements entered into between the Allied Governments and the United States and the Scandinavian countries, import licenses from the respective governments or government associations are required before the United States export licenses will be issued.

NETHERLANDS

All goods, including automobiles, must be consigned to the Netherlands Overseas Trust.

SWITZERLAND

Motor cars shipped to Switzerland require import licenses and must be consigned to the S. S. S.

AUSTRALIA

Automobiles are admitted into Australia only when each body is accompanied by two chassis. No prohibition is in force against the importation of motor trucks, farm tractors, or motorcycles.

CANADA

Automobiles for passenger use or susceptible of passenger use, when costing over $1,200 f.o.b. factory, are not admitted from the United States, Newfoundland, St. Pierre and Miquelon and the United Kingdom. All automobiles from other countries are prohibited. There is no prohibition on tractors, trucks, or motorcycles.

BRITISH WEST INDIES

There is stil in force a prohibition against the importation of motor vehicles in Trinidad, the Leeward and Windward Islands, and British Guiana. This prohibition applies also to bicycles, tricycles, and all classes of motor vehicles. It is doubtful, however, whether it would extend to tractors.

OTHER COUNTRIES

Practical difficulties prevent the shipment of automobiles or other motor vehicles to Finland and Russia. There are no restrictions against the importation of motor vehicles in the Union of South Africa or Egypt. The following countries have recently removed their restrictions against importation of motor vehicles: Belgium, British India, Straits Settlements, and Federated Malay States. There is no prohibition against the importation of automobiles into Ceylon, but the prohibitive duty of 100 per cent ad valorem is understood to be still in force.

The War Trade Board will grant licenses freely for the export of automotive products to all nations providing that the applications are otherwise in order. The board does not guarantee that the issuance of the licenses will permit the entry of the car into the foreign country. It advises all manufacturers to depend entirely upon their representatives in each country. The reason for this is chiefly that the restrictions of the different nations are changed so rapidly that the War Trade Board cannot follow them closely and does grant licenses freely only because automotive products are not on the conservation list.

Exports which have been prohibited to some nations during the war are gradually resuming. The War Trade Board expects shortly to announce that shipments can be made to Finland. It is probable that there will be an inter-Allied Committee at Helsingfors which will pass upon all imports from this country. American exporters who are interested in trading with Finland are advised to communicate with their correspondents there as soon as possible and request them to get in touch with the American Consul at Helsingfors. Trade can now be resumed by American exporters with Servia and Rumania. Export licenses will be necessary but will be granted freely under the same conditions as for other European countries. The board has received no official advice as to what import regulations may be in force in Serbia and Rumania and exporters are advised to communicate with their customers abroad before making shipments. Import restrictions to Belgium have been revised and have been eliminated as regards all automotive products. Applications for all import licenses should, if possible, be made by representatives of American firms in Belgium. Restrictions against the importation of rubber tires into Norway, Sweden, Holland, and Denmark have been lifted and licenses will now be granted freely, subject only to the condition that the proper import certificates have been issued.

Allotments of shipping space have been made by the Shipping Board for the East Coast of South American trade, which will be sufficient to take care of all of the cargo offered in the immediate future for these markets. For this reason the shipping preference procedure and priority system will no longer be necessary and manufacturers of automotive products, it is expected, will find ample space for their exports to the Southern continent.

Sub-Contractors Holding Up Contract Settlements

DETROIT, Feb. 18—Sub-contractors of war material are not making proper efforts to secure the settlement of their claims, declares J. J. Crowley, president of the Michigan section, National Association of Manufacturers of War Materials. Figures received from Washington show that the Ordnance District Board in Detroit has 276 contracts to settle, of which only 82 have been presented to the board by the contractors. Contractors declare they are delayed because their sub-contractors are negligent in making speedy returns. Of the 82 claims presented, 12 have been allowed.

Automotive Industries

France Prohibits Auto Imports

Embargo Against Automobile Imports for One Year—Importers Object

By W. F. Bradley

PARIS, Feb. 6—The importation of automobiles into France has been forbidden for about one year. Previous to this, motor vehicles were only admitted on payment of a 70 per cent duty. French automobile manufacturers, as a class, are satisfied with the present conditions, for, as they have not yet returned their factories completely to peace conditions, the prohibition of imports removes all foreign competition.

Importers, and particularly those who were established in France before the war, are very dissatisfied. At the present time there is a strong demand for all kinds of automobiles, and, as the home manufacturers cannot possibly meet this demand, the general public would not be displeased to see foreign cars brought in. The most important phase of this situation is what attitude France will adopt with regard to the importation of foreign cars. If, as many of the manufacturers request, the 70 per cent duty is maintained for a long period, very few, if any, foreign automobiles can be sold in France.

Although the cry for a 70 per cent duty is still strong, it is not heard as persistently as was the case a few months ago; probably makers are beginning to realize that they cannot erect a high tariff wall to protect themselves without other nations doing likewise. As France, before the war, was the greatest motor exporting nation in the world, and as her productive ability has enormously increased during the war, it is important that she should find outlets in foreign markets; it is hardly likely that she will get this free outlet if she protects her own market with a practically prohibitive import duty. Only one French manufacturer of any importance has loudly denounced the folly of the 70 per cent proposition. This is André Citroen, who has only recently entered the automobile industry and who, during the last few days, has issued all particulars regarding his program.

The man responsible for the present prohibition of automobile imports is M. Loucheur, Minister of Reconstruction. It is well known that pressure from all quarters has been brought to bear, but the ministry, of which M. Loucheur is the head, has persistently refused to admit any change.

The negotiations between automobile importers and the French Government were of a private nature until to-day, when, breaking away from the previous line of action, the Ford Motor Co. of France has come out with a half-page advertisement in the *New York Herald* in which the whole situation is explained in detail. The Ford Motor Co. shows that not only has M. Loucheur persistently refused to allow any foreign automobiles to be brought into France, but at the present time he will not allow Ford automobiles lying idle at the docks to go into service despite the very urgent need for supplementary transportation.

It appears that the Tardieu Commission purchased about 8500 Ford automobiles at a cost of approximately $375 each, delivery for export at American ports. About 4500 of these automobiles are new and have never seen service; they comprise 3500 that have not yet been delivered from the Ford company's works at Bordeaux, and 1000 which have been delivered and until recently were lying in automobile parks at Bordeaux and Versailles. The Ford company suggests that the French Government should release or sell back to them these 4500 cars at the price paid by the Government, plus a payment of $38, which payment could be considered either as profit or to cover cost of ocean transportation.

The Ford company proposes to sell these cars in France to customers who are in immediate and urgent need of them, such as doctors, veterinary surgeons, commercial firms, etc. In addition to paying for the automobiles at the cost and plus the profit before said, the Ford company also proposes to pay 70 per cent ad valorem duty on the above price of $375 and the purchaser would also pay 10 per cent luxury tax on the retail selling price of the vehicles. The selling price would be $1,300. It may be mentioned that this price is very high for a Ford car, but there is no doubt that the 4500 automobiles could be disposed of in France immediately on these conditions.

The Ford company points out that the following advantages would accrue to the French Government by accepting their proposal:

1—Immediate cessation of the cost of maintenance, housing, etc., 4500 cars.

2—Complete immunity from any possible loss in respect thereof.

3—Resumption on the basis of established law of commercial business amounting to a total turnover exceeding 32 million francs.

4—Receipt by the French Government of custom duty and luxury tax amounting to 8,831,250 francs.

5—Receipt by the French Government

(*Continued on page* 450)

To Make All Sizes of Tires

Makers to Abolish War Tire Limits—All Sizes Demanded to Be Made

NEW YORK, Feb. 19—The limits set on the manufacture of tires by the War Industries Board during the war will not be followed in the future, and all sizes of tires demanded by the public will be manufactured, according to an announcement by the National Automobile Chamber of Commerce, made public today.

This decision followed a meeting of tire and automobile makers in Detroit late last week. The restrictions placed on tire manufacture by the War Industries Board in an effort to conserve rubber, labor and factory facilities in the spring of 1918 called for a reduction of pneumatic tires from a range of 200 sizes and types to nine sizes and types, the reduction to be made over a period of two years. Truck tires were reduced by a similar order from over 100 types and sizes to fourteen, affecting chiefly those tires used on 1- and 2-ton trucks.

The representatives of the N. A. C. C. and the tire industry, present, agreed also that for the time being it will be most wise to continue export of tires in metric sizes only, as has been the custom. This question of shipping tires abroad marked similarly to those used in this country for domestic consumption is to come again in the near future when members of the tire industry will confer with J. Walter Drake, chairman of the tire committee of the N. A. C. C.

The decision to manufacture all sizes of tires regardless of the War Industries Board rules followed the discovery that 2,000,000 32 x 4 tires, for example, were needed with 1,000,000 for equipment of 200,000 cars in process of manufacture and 1,000,000 for maintenance. This was one of the sizes that were to be abolished. Similarly other sizes were found necessary; hence the decision to make all sizes demanded.

Hanch Sails for Europe

NEW YORK, Feb. 17—C. C. Hanch, formerly chief of the Automotive Section, War Industries Board, sailed today for Paris, where he will attend the Inter-Allied Council of Automobile Manufacturers meeting on March 5 as the representative of the National Automobile Chamber of Commerce. He will also investigate industrial and trade conditions.

Nation Awakens to Worth of Good Roads

States Appropriate Millions for Highways—Nation-Wide Acceptance of Need for Improved Roads—$200,000,000 Available for That Purpose This Year

WASHINGTON, Feb. 17—A nation-wide ambition for a complete network of good roads and highways through the country is evidenced by reports received here of State appropriations for highways, and by the popular approval that has been expressed in favor of the National Highway bills now before Congress.

It appears that, as a result of the work of the various associations, the expression of President Wilson in favor of good roads, and the activities of the Highways Transport Committee during the war, the plan for good roads has suddenly become crystallized in the minds of the entire country.

$200,000,000 Available

Reports received here indicate that all of the States are considering road appropriations, and several have already passed the necessary bills for funds covering the next few years.

Minnesota has appropriated $100,000,000, South Carolina, $40,000,000; Illinois, $60.000,000; Pennsylvania, $50,000,000; Georgia, $40,000,000; Colorado, $20,000,000, and Alabama, $10,000,000, to be used in conjunction with the funds appropriated by the 1917 Federal Road act for the development of the highways.

It is estimated that between $200,000,000 and $300,000,000 will be available for highways during 1919. The Federal Road act appropriated $5,000,000 in 1916-17, $10,000,000 in 1917-18, $15,000,000 in 1918-19, a total of $30,000,000, of which $1,487,336 has been actually paid out by the Treasury, and a total of $10,303,379 has been set aside.

827 Road Construction Projects

Eight hundred twenty-seven projects for road construction have been submitted to date, of which 760 were approved at an expenditure of $21,112,795.30 of Federal funds and $35,069,051.42 of State funds, a total of $56,171,846.72. These funds are for projects covering 7869 miles. The money actually expended to date was for ten projects of forty-four miles, which have been completed. The reason for the delay in completion of highways and for the small amount actually expended is the war, during which it was impossible to use freight cars or secure materials for highway construction.

The new Bankhead bill, which will probably be passed by Congress, and which has already been passed by the Senate, provides for $200,000,000, with $50.000 000 available at once for 1918-19, $75,000,000 in 1919-20 and $75,000,000 in 1920-21, This bill, which has been described in these columns before, is practically an amendment and continuation of the original Federal Road act of 1916. The States must provide appropriations on a dollar for dollar basis to secure their share of the National funds.

In consequence of the Bankhead bill and funds already available, there will be at least $200,000,000 to be expended in 1919 if the States comply immediately with the conditions of the Federal Road act and provide the dollar for dollar State funds.

Of the $30,000,000 originally appropriated by the Federal Road act, $20,000,000 are still available, and in addition there are $35,000,000 appropriated by States which are still available, making a total of $65,000,000.

Fifty million dollars are appropriated by the Bankhead bill for 1919, and an additional $50,000,000 will be voted by the various States, making a total of $100,000,000. Consequently there will be 165 000 000 available in 1919, and as the States usually exceed the dollar for dollar basis by 50 per cent, it is probable that the total sum available will be over $200,000,000.

The National Highways Commission bill, which was the result of the Highways Association meeting in Chicago, is to be rewritten to meet the legal requirements. This bill may be presented at this session of Congress or may be held over until the next session, depending upon the opportunities presented. It is quite certain that, even though presented at this session, it will not be considered until some future date.

Other Government departments besides the Department of Agriculture are also displaying an interest in road construction. The Department of Labor is seriously considering it as a means of employment for soldiers returning from the army camps, and is planning a slogan campaign in conjunction with the American Federation of Labor. The slogans will be advertised throughout the country intensively so that they reach every community and home.

Good Road Slogans Prepared by Department of Labor

"Build now the National, State and County Roads we need, and Prosperity will ride to every American's gate.

"Build Now Good Roads where they are needed, so that Good Times can come to every American's home without delay.

"Build Now—Money spent wisely for Good Roads will come back because the roads will bring it back.

"Build Now Good Roads and see how quickly Good Times will roll down these roads.

"Build Now—You can Notice the earmarks of Prosperity along Good Roads."—W. B. WILSON, Secretary of Labor.

N. A. C. C. Roads Committee Secretary at Washington

WASHINGTON, Feb. 17—Pyke Johnson, a former newspaper man of Denver, Col., has been made the secretary of the Roads Committee of the National Automobile Chamber of Commerce, with headquarters at the Washington office of the National Automobile Chamber of Commerce. He will compile road data and watch the development of highway legislation.

Michigan Launches Campaign for Road Amendment

LANSING, Feb. 18—A campaign to insure passage of the $50,000,000 good roads amendment, which has passed both Houses of the Legislature and will come before the voters at the April election, has been launched by the Michigan Association of Road Commissioners and Engineers. In connection with automobile clubs and good road associations throughout the State, they will conduct an intensive campaign to reach every man and woman elector with circulars and speakers.

106,930 Army Trucks in 1918

WASHINGTON, Feb. 17—One hundred and six thousand, nine hundred and thirty trucks and passenger cars were completed for the United States Army in 1918, according to a report issued by the War Department. Of this number, 89,277 were trucks, ranging from ½- to 5-ton, and 17,653 were passenger cars. Total probable production for military use for 1919 will include 28,694 trucks and passenger cars, of which 28,679 will be trucks and fifteen passenger cars.

Following is the total production for 1918, and the probable production for 1919, in sizes:

	Trucks and Passenger Cars Completed During Year 1918 for the War Department	Probable Production for 1919 for War Department
½ ton trucks....	3,454	0
¾ ton trucks....	7,260	0
¾-1 ton trucks..	2,474	0
1 ton trucks.....	16.363	6,805
1½ ton trucks...	3,095	2.268
1½ to 2 ton tr'ks	8,977	1,385
2 ton trucks.....	14.415	3.369
3 ton trucks.....	28,073	12,627
3½ ton trucks...	672	961
4 ton trucks.....	1,888	362
5 ton trucks.....	2,465	468
5½ ton trucks...	3.141	434
Passenger cars..	17,653	15
Total..........	106,930	28,694

Atterbury Capital Doubled

BUFFALO, Feb. 15—The Atterbury Motor Car Co. has increased its capital from $250,000 to $500,000 to increase production facilities.

DePalma Smashes Speed Records

Sets New Pace for 1 to 20-Mile Straightaways in Packard with Aviation Engine

DAYTONA BEACH, FLA., Feb. 18—Ralph DePalma broke all previous records for speed for distances from one to twenty miles, including those made by Burman in 1911 over the same course. Driving a Packard, equipped with a 12-cylinder, 4 x 6 aviation engine, he made his record in all instances, except that one-mile stand start, with flying starts. The engine used has a piston displacement of 904.8 cu. ft. The car was equipped with but one seat. Fuel used was gasoline seventy-nine Baume.

On Feb. 12 DePalma made a 1-mile and 1 kilometer record. On Feb. 16 and 17 he hung up records for all distances up to 20 miles, including a 1-mile standing start, formerly held by Barney Oldfield. All of these figures have been certified by the contest board of the A. A. A.

DePalma completely re-equipped his car in New York with Lynite pistons, Hartford absorbers, Goodyear tires, Willard battery and Boyce motometer.

DePalma's new records compared with former records follow:

De Palma's New Records				Old Records			
Date	Distance	Time	M. P. H.	Date	Time	M. P. H.	Driver and Car
Feb. 12, 1919	1 mile	24.02 sec.	149.8	1911	25.40 sec.	141.7	Burman, Benz
Feb. 12, 1919	1 kilometer	14.86 sec.	140.9	1911	15.88 sec.	140.8	Burman, Benz
Feb. 17, 1919	*1 mile	38.83 sec.	92.7	1910	40 53 sec.	88.8	Oldfield, Benz
Feb. 16, 1919	2 miles	49.54 sec.	145.3	1911	51.28 sec.	140.4	Burman, Benz
Feb. 16, 1919	3 miles	1:15.04 min.	143.9	....	....	....	....
Feb. 16, 1919	4 miles	1:39.77 min.	144.2	....	....	....	....
Feb. 16, 1919	5 miles	2:04.58 min.	144.2	1906	2:34 min.	116.8	Hemery, Darracq
Feb. 16, 1919	10 miles	4:09 30 min.	144.3	1909	5:14.40 min.	114.5	Bruce-Brown, Benz
Feb. 17, 1919	15 miles	6:48.55 min.	132.1	1906	10 min.	90	Lancia, Fiat
Feb. 17, 1919	20 miles	8:54.20 min.	134.7	1911	13:11.92 min.	90.9	Burman, Buick

*Standing start.

Grand Rapids Show This Week

GRAND RAPIDS, Feb. 17—The 1919 show of the Grand Rapids Automobile Business Association is being held this week, having opened to-day. It is being staged in the Klingman Building. There are fewer dealers listed in the list of exhibitors, but in spite of this more cars and trucks are on display than ever before.

Des Moines Tenth Annual Show Opens

DES MOINES, Feb. 18—The tenth annual motor show opened to-day at the local plant of the Ford Motor Co., which affords four times as much space as has been available in previous years when the show was held in the Coliseum. Iowa is flocking to the show, and as a result of last year's bumper crops is better than ever able to buy automobile goods. Sixty-four exhibitors hold space. Over 200 different models representing forty-eight makes of cars are included in the exhibit, which is the largest ever held in Iowa. Trucks and tractors are a new feature. There are thirty-five makes of trucks on display and eighteen makes of tractors.

Dayton Automobile Show March 3

DAYTON, Feb. 17—Dayton will hold its annual automobile show March 3-9. Plans for the big event are about complete. Every type of car will be exhibited at the show as well as a complete line of accessories and equipment. As airplanes and tanks are made in Dayton an effort is being made to secure one of each for the show. The exhibition hall, building No. 21 of the National Cash Register plant, provides 80,000 ft. of floor space and is 540 ft. in length. It is expected that $500,000 worth of automobiles and accessories will be on exhibition.

Shipping Board Aids Lyons Fair Exhibitors

WASHINGTON, Feb. 18—The United States Shipping Board has arranged to provide shipping space for all American exhibitors at the fourth annual Lyons Sample Fair to be held from March 1-15. The fair, endorsed by the Departments of State and Commerce, is under the patronage of the President of France. The first fair was held in 1916 with 1324 exhibitors. In 1917 there were 2593 and in 1918 3182 exhibitors. The first year's business totalled $19,000,000, while at the third fair it amounted to $150,000,000. There were 527 American exhibitors at the third fair.

The Railroad Administration will also aid exhibitors insofar as is necessary to insure quick delivery of samples to the seaboard. The charges for space at the exhibit are $110 per 20 sq. yd. Passports will be granted freely by the Department of State to all bona fide exhibitors and representatives.

Toronto Show in March

TORONTO, Feb. 17—The Ontario Automobile and Accessories Branch of the Retail Merchants' Association will hold its second annual convention on March 6-7, in Toronto. The meetings will be held in Foresters' Hall, and an exhibit of accessories and tires will be held in the basement.

General Tire & Rubber Co. Expands

AKRON, Feb. 18—The General Tire & Rubber Co. has increased its capitalization from $1,000,000 to $2,500,000.

Chandler Officials in New Company

Cleveland Automobile Co. Will Produce Low-Price Car—Production by August

CLEVELAND, Feb. 17—Officials of the Chandler Motor Car Co., this city, are interested in a new organization to build a low priced car. The new concern will be known as the Cleveland Automobile Co. and the car as the Cleveland. The company is incorporated under the laws of Delaware, with an authorized capital stock of $1,400,000. F. B. Chandler, president, and Samuel Regar, treasurer of the Chandler company, and Hornblower & Weeks New York bankers, are the leaders of the organization of the new concern, which will be identified very closely in personnel with the Chandler company. The car will be manufactured in an entirely separate factory, however, and it is expected that building will commence within 10 days on the new plant. It is proposed to be in production during the early part of the coming summer. Officials of the Cleveland company state that they have not been able to determine exactly on the price at which the new car will sell, this depending upon factory costs after getting into production. It is stated, however, that the price will be materially lower than the Chandler. It is very probable that the new product will be marketed largely through the present Chandler distributer organization.

Inventory of Army Vehicles

WASHINGTON, Feb. 15—The Motor Transport Corps is engaged in taking an inventory of every motor vehicle owned by the army and all equipment, including spare parts, machine shop parts and accessories.

Many motor vehicles had not been taken over formally by the Motor Transport Corps, having been bought and operated by the Ordnance, Quartermaster, Medical, Signal and other branches of the army, and inventories never were made.

S. A. E. Tractor Dinner Feb. 27

NEW YORK, Feb. 18—A tractor dinner will be held at the Hotel Baltimore, Kansas City, by the Society of Automotive Engineers on Thursday, Feb. 27, during the tractor show. There will be a professional session at the auditorium of the Sweeney Automobile School Thursday afternoon, when a paper on "Tractor Testing" by Prof. J. B. Davidson of the University of California and other papers on tractor engineering will be presented. Dr. Joseph E. Pogue of the U. S. Fuel Administration will discuss the fuel situation as it applies to the tractor industry, and E. R. Hewitt, consulting engineer, International Motors Co., will present a paper on the "Wheeled Farm Tractor."

Refinery Production for Eleven Months

Stocks of Gasoline and Kerosene Are Relatively Low, but Output Is Maintained

PRODUCTION

	November, 1918	October, 1918
Crude oil (bbl.)	27,411,636	29,237,767
Gasoline (gal.)	312,968,640	314,251,318

	—Stocks on Hand— Nov. 30, 1918	Oct. 31, 1918
Crude oil (bbl)	15,222,401	15,438,756
Oils purchased to be re-run (bbl.)	1,373,740	1,308,744
Gasoline (gal.)	270,072,011	250,328,329
Kerosene (gal.)	397,804,012	419,409,944
Gas and fuel (gal.)	583,777,918	596,116,351
Lubricating (gal.)	132,923,478	135,196,542
Wax (lb.)	190,953,158	195,797,590
Coke (ton)	22,005	23,905
Asphaltum (ton)	74,955	74,159
Miscellaneous (gal.)	466,887,345	457,222,127

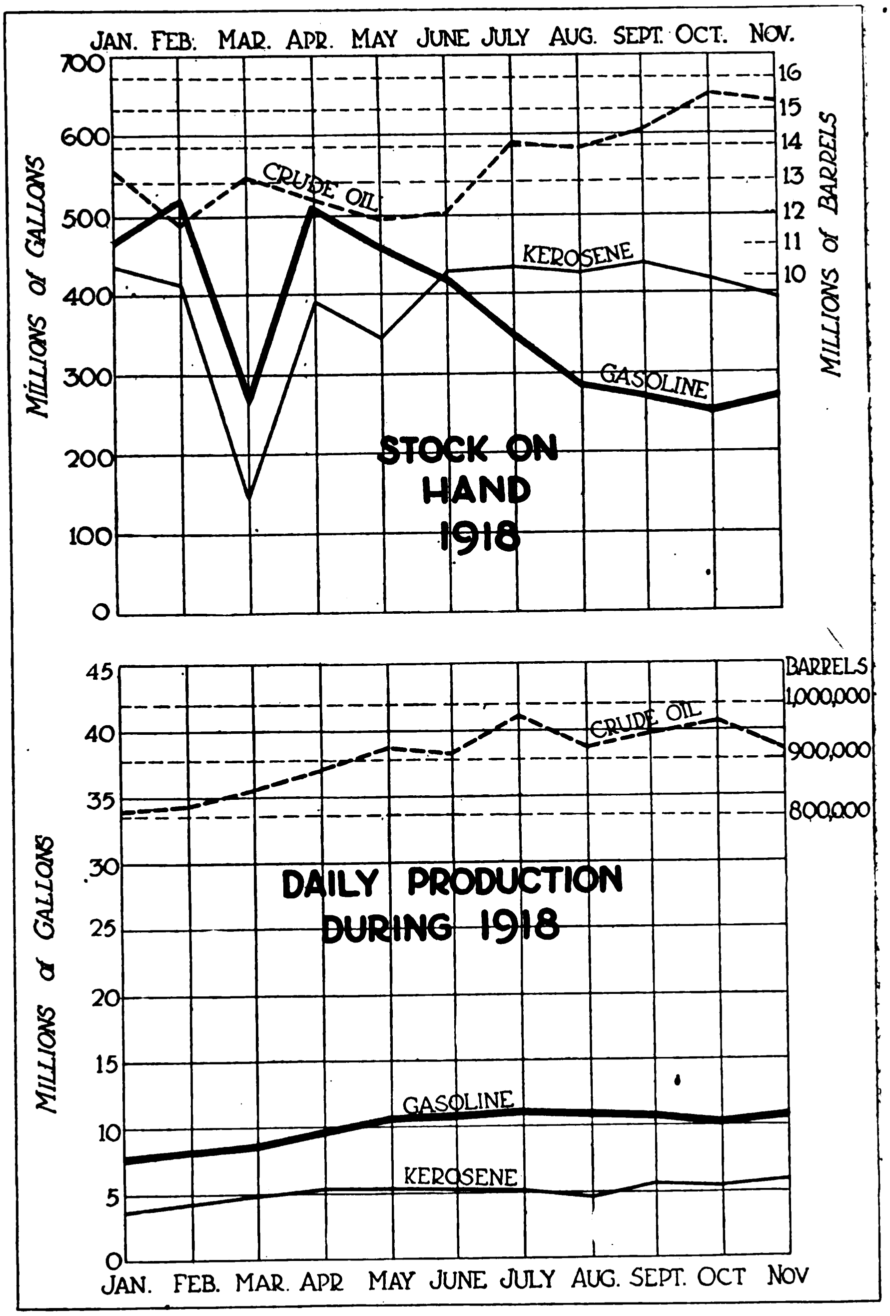
NEW YORK, Feb. 17—It is satisfactory to observe that our average daily production of gasoline, kerosene and crude oil increased steadily month by month from January to November, 1918; our total refinery output for this period also indicates that every effort is being made to produce sufficient petroleum products to keep pace with the ever-increasing demand. On the other hand, our stocks of gasoline and kerosene as of Nov. 30, 1918, are not altogether satisfactory, although in the case of the former we were on that date in a better position than in September and October. Production of crude oil is fully maintained.

At the present time it does not seem likely that our gasoline stocks will show (when figures are available) well in comparison with stocks held in January and February last. The winter has, so far, been abnormally favorable for motoring, and it may be assumed that gasoline consumption has been greater than usual. Against this is the fact that our average daily production of gasoline in January, 1918, was but 7,826,840 gal., as against 10,432,288 gal. per day average in November.

A probable decrease in the quantity of special gasoline for aircraft use may be anticipated, a circumstance which will have its effect on the general supply. During wartime our exports of aircraft gasoline have been very large, and our domestic needs have been extensive.

Our production of gas and fuel oil continues to be maintained. Much of this has been used for war purposes, and although its use in this direction may be curtailed with the coming of peace, there are a great number of oil-burning merchant vessels operating and being built, and doubtless the demand will continue. In a general way, the production of gas and fuel oil means increased production, as every trace of gasoline must be extracted from fuel oil before it is suitable for the purpose for which it is intended.

Petroleum Products Stock and Production for 1918



These charts show how we stood as regards stock and average daily production of crude oil, gasoline and kerosene during eleven months of 1918

Stutz Profits Drop

INDIANAPOLIS, Feb. 17—The Stutz Motor Car Co. of America, Inc., for the year ended Dec. 31, 1918, shows net profits of $594,047 as against $1,074,778 for 1917, a decrease of $484,731 for the past year. Gross profits decreased $462,615, from $1,107,334 in 1917 to $644,719 in 1918, and net sales decreased $946,758, a drop from $4,483,315 in 1917 to $3,536,557 in 1918. The complete balance sheet for the past three years follows:

Assets	1918	1917	1916
Plant, equipment, etc.	$2,675,854	$2,560,731	$2,431,603
Cash	167,118	252,811	74,059
Accounts Receivable	225,435	58,816	145,530
Inventory	804,857	1,148,470	577,248
Liberty Bonds	50,000	......	......
Total	$3,923,264	$4,015,829	$3,228,441

Liabilities			
Capital stock	$375,000	$375,000	$375,000
Accounts payable	358,257	317,462	356,980
Deposits on cars	30,500	35,450	17,700
Liberty bonds	12,500	......	......
Taxes, etc.	10,579	6,000	8,500
Reserves	87,162	59,491	31,329
Surplus, after payment of Federal taxes, dividends, etc.	3,049,266	3,222,425	2,439,021
Total	$3,923,264	$4,015,829	$3,228,441

—

Wheat Instead of Hession Tractor

BUFFALO, Feb. 18—The Wheat tractor is the new name for the Hession Tiller & Tractor Corp.'s four-wheel farm and road tractor, formerly known as Hession.

Post Office Department Has 1200 Army Trucks

WASHINGTON, Feb. 19—The War Department has turned over 1200 army trucks of various types and sizes to the Post Office Department for use in rural mail delivery. Announcement will be made in the near future by the post office of the routes covered by these vehicles. The trucks are turned over by the War Department in compliance with a provision in the Army Appropriation bill of 1918 which ordered all trucks delivered to the Post Office as are requisitioned.

—

Nash Pays Extra Dividend

KENOSHA, Feb. 15—In addition to the regular 7 per cent dividend on preferred, Nash Motors Co. has declared a total of $21 per share on common. An initial dividend of $6 per share on common was paid Feb. 1, and another common dividend of $10 per share is payable Feb. 15.

The Nash business for 1918 amounted to $41,000,000. This represents the production of about 21,000 cars and trucks. It is planned for 1919 to build 25,000 cars and as many trucks as conditions warrant.

—

Studebaker Dividends

Studebaker Corp., South Bend, 1 per cent, common; 1¾ per cent, preferred; payable March 1 to stockholders of record Feb. 20.

—

Hammered Piston Rings Bought by Bartlett Hayward Co.

BALTIMORE, Feb. 14—The Bartlett Hayward Co. has purchased the entire capital stock of the Hammered Piston Ring Co. of America, whose plant is located on South Eleventh Street, Newark. It contemplates keeping the Newark plant in operation, but all increases of business will be handled in one of its plants in Baltimore. The active management of the business will remain in charge of C. F. Hockley, vice-president and general manager, who will make headquarters in Newark.

—

Ricardo Engine "Made Good" in Tanks

(*Continued from page* 410)

safely be used, thus insuring silent running.

(4) Since the crosshead and guide can be profusely lubricated with clean oil, the wear is reduced to a minimum. Further, both the crosshead sleeve and its guide are small and inexpensive parts, which could in the event of wear be replaced at a very small outlay.

(5) Since the piston itself does not bear upon the cylinder walls, an ample working clearance can be allowed without any risk of noise.

(6) The wear on the cylinder walls is reduced to a minimum, since only the piston rings bear against them and there is no side thrust.

(7) The gudgeon pin being short, stiff and free to rotate, and also being placed in such a position that it receives very little heat from the piston, does not wear perceptibly. The combined wear of the gudgeon pin and bushes after a test run of 450 hours on a large six-cylinder engine at full speed, and an average of nine-tenths full power, was officially reported as being "not measurable" in any of the six pistons.

(8) The heat from the crown of the piston and from the crosshead guide is utilized to warm the air for the carbureter, and is not transferred to the crankcase.

(9) All the working parts can be lubricated without stint and without any risk of excess of oil reaching the cylinder walls; also the oil remains clean.

(10) In the event of any fuel condensing on the walls of the cylinder its subsequent passage into the crankcase can be prevented absolutely.

(11) The restricted lubrication to the cylinder walls prevents any tendency of the piston rings to become carbonized or gummed up. In practice the piston rings always remain clean and perfectly free.

(12) There is no tendency for the engine to become gummed up when cold, and it is in fact almost as free when cold as when hot, and consequently is always very easy to start.

An engine with this piston will be somewhat higher than a conventional engine, somewhat heavier and slightly more expensive to manufacture. The design should recommend itself particularly to engineers aiming at a high fuel economy or those desiring to use heavier grades of fuel, such as kerosene.

Bill Taxing Cars and Trucks Passed by Senate

WASHINGTON, Feb. 14—The new revenue bill, carrying among its provisions a tax of 5 per cent on automobiles and parts, and 3 per cent on trucks and parts, was passed by the Senate yesterday. It now goes to the President for his approval. The bill contains the provisions relative to automotive products just as they were published in AUTOMOTIVE INDUSTRIES last week.

—

Ohio Plans to Spend Millions on Roads

COLUMBUS, Feb. 18—The federal government and the state jointly will spend $15,000,000 annually during the next five years for the improvement of roads through the Buckeye State if a resolution just introduced in the house is adopted and government authorities concur. Congress is requested to appropriate $1,000,000,000 for good roads, the money to be spent during the next five years.

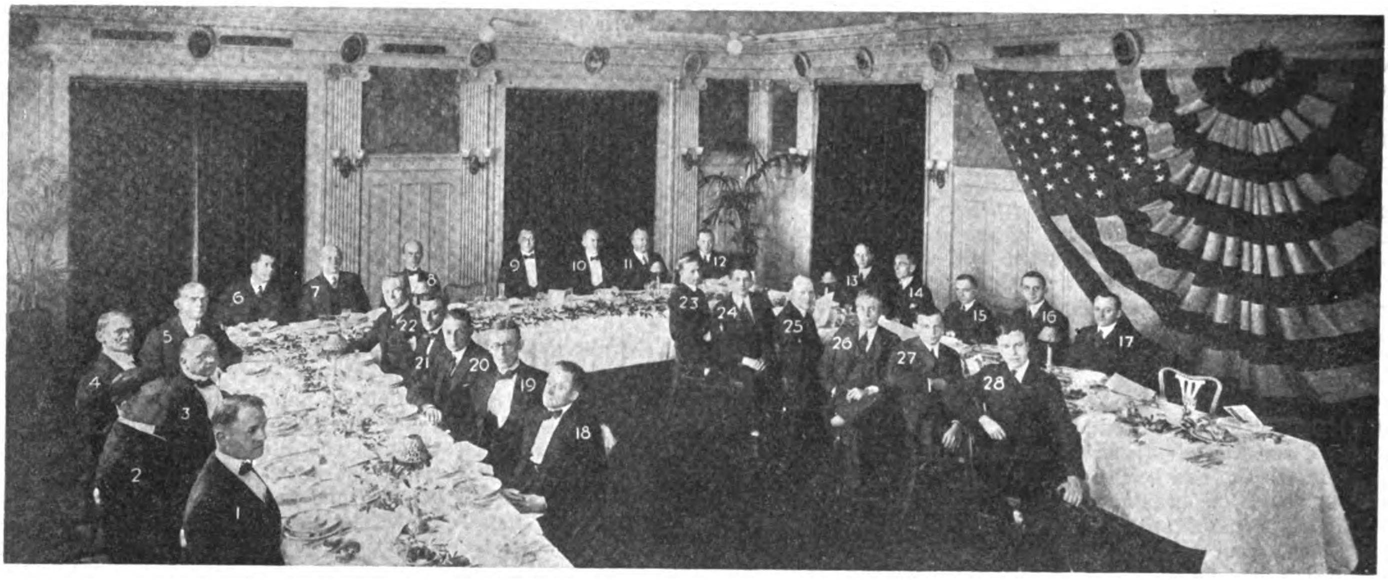
Total Output of Refineries in the United States for 1917

1917	Crude (bbl.)	Other Oils (bbl.)	Gasoline (gallons)	Kerosene (gallons)	Gas and Fuel (gallons)	Lubricating (gallons)	Wax (pounds)	Coke (tons)	Asphaltum (tons)	Miscellaneous (gallons)	Losses (bbl.)
January	24,839.772		203,618,724	137,248,370	469,596,208	60,941,062	39,558,627	44,627	49,894	27,331,019	941,924
February	23,083,433	no account	184,602,595	129,074,504	446,964,925	54 631,765	36,370,297	42,047	40,619	23,685,686	941,110
March	26,230,138	1st 6 mo.	220,523,571	159,028,978	494,855,838	64 345,221	40,868,930	48,839	52,823	26,977,334	870,380
April	25,994,938	1917	228,945,164	157,826,945	462,846,339	63,218,215	41,037,511	46,099	52,849	30,959,901	957,533
May	27,253,391		238,816,209	147,894,846	504,859,695	65,926,007	38,686,364	43,535	67,612	31,086,377	979,245
June	26,453,210		233 671,746	151,477,333	496,742,434	61,045,757	38,075,280	42,513	67,931	30,205,172	1,011,568
July	26,776,856	2,435,533	244,145 292	161,679,053	599,454 966	64,335,905	40,158,033	42,641	65,272	92,359,401	1,111,511
August	27,900,623	2,376,580	254,464,491	149,528,513	632,151,971	64,107,817	38,999,341	46,240	73,878	92,708,312	1,286,141
September	27,529,022	2 632,988	256,132,050	143,203,644	629,914,572	60 757,049	48,300,033	42,986	62,520	80,386,471	1,182,560
October	27,698,023	2,863,518	271,891,234	140,559,542	621,492,374	68,516,071	41,181,400	48,849	73,886	91,804,160	1,355,219
November	26,215,979	2,519,700	264,888,709	125,893,202	592,490,037	64,861,375	39,694,595	45,815	73,289	87,115,002	1,203,110
Total first Eleven months	289,975,385	12 828,319	2,601,699,785	1,603,414,930	5,951,369,359	692,686,244	442,930,411	494,191	680,573	614,618,835	11,840,301
December	25,155,996	2 069,351	248,846,638	123,354,046	561,954,921	61,090,596	38,269,670	45,175	58,852	87,548,408	1,233,528
Total	315,131,681	14,897,670	2,850,546,423	1,726,768,976	6,513,324,280	753,776,840	481,200,081	539,366	739,425	702,167,243	13,073,829

Total Output of Refineries in the United States for First Eleven Months of 1918

1918											
January	23,842,587	2,300,334	242,632,044	119,358,184	547,866,248	56,625,425	39,238,858	41,216	54,854	70,995,829	1,078,181
February	23,386,676	2,298,333	234,324 619	121,218,320	510,165,397	58,300,914	35,087,337	42,371	42,033	75,134,088	983,992
March	26,239,662	3,696,872	269,647,968	151,228,007	587,985 804	69,308,351	43,597,019	44,248	56,901	94,865,148	1,097,489
April	26,201,544	3 956,244	293,396,162	153,703,682	578,255,341	71,022,204	40,173,524	45,674	51,242	89,242,012	1,182,020
May	28,510,698	4,112,023	319,391,202	160,590,760	631,586,209	79,589,755	42,544,633	48,864	60,449	88,627,491	1,269,281
June	28,140,479	3,483,270	315,023 445	151,840,252	628,842,033	84,420,996	41,317,794	46,605	50,321	81,110,922	1,282,177
July	29,170,718	5,951,537	332,022,095	156,828,826	658,439 682	79,303,107	41,691,551	48,914	48,433	159,374,139	1,338,804
August	28,534,275	6 376,353	330,335,046	149,678,850	671,113,871	72,892,879	41,829,516	51,759	59,715	163,355,034	1,337,327
September	28,390,431	5,485,747	314,595,959	164,963,798	653,085,050	70 593,079	42,704,894	48,052	49,157	138,201,963	1,236,834
October	29,237,767	5,571,847	314,251 318	164,928,640	661,780,441	72,244,633	43,470,132	48,820	51,878	166,109,867	1,161,545
November	27,411,636	3,857,754	312,968,640	169,278,105	604,403 494	72,178,602	49,642,007	51,393	35,387	75,430,160	1,236,812
Total	299,066,473	47,090,314	3,278,568,498	1,663,617,424	6,733,523,570	776,477,925	461,297,265	517,916	570,370	1,202,436,653	13,204,064

Dinner of Automotive Electric Association, Hotel Astor, Feb. 11, 1919



1—E. E. Turner, Assistant Secretary.
2—G. H. Lewis, Westinghouse Electric & Mfg. Co.
3—S. L. Nicholson, Westinghouse Electric & Mfg. Co.
4—E. S. Philips, Philips-Brinton Co.
5—V. S. Beam, Westinghouse Electric & Mfg. Co.
6—B. M. Leece, Leece-Neville Co.
7—J. K. Montgomery, North-East Electric Co.
8—O. L. Harrison, Dayton Eng. Lab. Co.
9—G. B. Griffin, Westinghouse Electric & Mfg. Co.
10—J. J. Jackson, Westinghouse Electric & Mfg. Co.
11—R. W. Sutherland, Splitdorf Electric Co.
12—G. S. Cole, Leece-Neville Co.
13—A. F. Kurs, Leece-Neville Co.
14—A. L. Howland, Electric Auto-Lite Corp.
15—H. C. Branch, Leece-Neville Co.
16—O. F. Conklin, Remy Elec. Co.
17—A. H. Timmerman, Wagner Electric Mfg. Co.
18—J. C. McQuiston, Westinghouse Electric & Mfg. Co.
19—W. A. Chryst, Dayton Eng. Lab. Co.
20—J. G. Greenleaf, Gray & Davis.
21—W. B. Moses, Gray & Davis.
22—W. Gray, Gray & Davis.
23—J. M. Noble, Prest-O-Lite Co.
24—J. C. Halbleib, North-East Electric Co.
25—R. J. Nightingale, Willard Storage Battery Co.
26—T. R. Cook, Willard Storage Battery Co.
27—F. F. Dorsey, North-East Electric Co.
28—O. W. A. Oetting, Willard Storage Battery Co.

British Guiana a Market for Tractors

WASHINGTON, Feb. 14—A good market for farm tractors exists in British Guiana, according to a consular report from that country, which states that the use of tractors there has been highly satisfactory. An increased use of automobiles is also apparent, 236 having been imported in 1917 as compared with 147 in 1916.

The country has been exceedingly prosperous. Its leading industries, sugar, rice and balata, have been in great demand. Little difficulty has been experienced in financing trade, although rates of exchange were above normal.

Truck Show Called Success

NEW YORK, Feb. 17—From an advertising and prospect-gathering point of view, the exclusive commercial vehicle show staged as part two of the two-week exhibition put on in Madison Square Garden and the Sixty-ninth Regiment Armory by the New York dealers can be written down as a success. And, although the dealers did not expect to close very much actual business at the show, exhibitors report that sales have been up to expectations.

The advertising value of the show has been great, and, in the opinion of dealers, great advertising is necessary. They will have to sell this year as many trucks as were produced in the years 1916 and 1915 combined. The feeling at present is optimistic. Businesses are expanding and everywhere the call for transportation is insistent. And a big part of the success of the show will come from placing before business multitudes of sizes and varieties of individual and special transportation represented by the motor truck.

Attendance is said to have been satisfactory. At no time were the two halls over-crowded, but it was a business crowd that passed the ticket takers.

Those who exhibited tractors proclaim themselves more than satisfied with results. One firm closed wholesale territory for Maine, Vermont, Massachusetts, Connecticut and the British West Indies. Another filled a book with prospects' names and expects to close a good percentage of them.

Exports Control Committee to Dissolve

WASHINGTON, Feb. 14—Dissolution of the Exports Control Committee as early as March 1 is suggested by the chairman of that committee in a letter addressed to Secretary of War Newton D. Baker and Secretary of the Navy Daniels. This committee had control of export shipments during the war by routing, allocation and other necessary restrictions. Its plan to dissolve in the near future forecasts a complete return to normal shipping conditions.

May Ship Tires Without Special License

WASHINGTON, Feb. 14—In shipping automobiles to Denmark, Norway, Sweden and Holland, it will no longer be necessary, according to the War Trade Board, to furnish with the application for export licenses an import certificate number covering the tires on the automobile. The import certificate for an automobile, and an export license issued therefor, will include the necessary tires.

Australia-London Air Route Planned

WASHINGTON, Feb. 18—An aerial service is planned between Australia and London by private Australian business men who have formed a company under Reginald Lloyd of London with a paid-up capital of $48,665.

The purpose of the company is to explore the proposed route for landing sites, to be approximately 300 miles apart. The route is to be from Sydney or Melbourne direct to Port Darwin, in the northern territory of Australia, from which point there will be a 300-mile sea trip across to the Island of Timor in the Dutch East Indies, thence from island to island through Java and Sumatra to Singapore and Calcutta, across India to Karachi, thence to Bagdad and Port Said, from which latter point the choice of several developed aerial routes to London are available.

Next month Mr. Lloyd will lead a surveying party from Australia through the Dutch East Indies, the Malay States, India and Mesopotamia, to locate landing sites and to arrange for their lease or purchase. The organization of the present company is merely to provide for the expenses of this routing party. After the completion of this survey it is proposed to finance a company in London to operate the aerial service to Australia.

Value of War Vehicles

WASHINGTON, Feb. 15—According to a report made public to-day by the War Department, there were motor vehicles valued at $69,567,173 on hand on Nov. 1, 1918, and $79,908,070 on Jan. 1, 1919.

Air Medical Tests for Flyers

But 61 Per Cent Qualify for All Duties—Trained to Flying Experiences on Ground

WASHINGTON, Feb. 18—Of each 100 flyers accepted by the medical service of the Aviation Corps, 61 are capable of flying in altitudes over 28,000 ft., 25 are capable of flying in altitudes up to 15,000 ft. and 14 are capable of flying at 8000 ft. or less. Consequently, 61 are fitted for any air work, 25 may perform such work as bombing and 14 are limited to night bombing. These figures are the results of numerous tests made by the Air Medical Service, following the acceptance of candidates for flying duties.

The tests for altitude are made on the ground by means of a device called the "Flack-bag," which reduces the oxygen the aviator breathes so that within 25 minutes there is but 8 per cent of oxygen in the tank, creating an atmosphere equal to 28,000 ft. The weaker flyers taking this test quickly react to the limited supply of oxygen.

Other tests are also made for vision and balancing, both of which are affected by altitude. Low oxygen effects the vision. The tests given are also used to determine which men have better "night sight" for night bombing work.

Performance of stunts and low oxygen affect the internal ear, and cause the flier to lose his balance. Consequently, examinations were made of the internal ear to determine whether or not flyers are capable of withstanding low oxygen and whether they are able to perform stunts without losing their sense of balance.

All flyers are frequently examined by a re-breathing test, as it has been found that in many instances men who are capable of standing 25,000 ft. altitude at one time, are not equal to it at other periods.

In making the tests for examination of stunting ability, flyers are placed in a machine called the "Ruggles Orientator." This machine allows the cadet to acquire flying experience without leaving the ground.

It is a modification of the old-fashioned universal joint, composed of three concentric rings so pivoted together as to permit the fuselage, which is pivoted within the innermost ring through every possible evolution to be experienced in actual flying. It is practically an airplane in every respect. The cadet sits in the fuselage and by means of control stick and rudder puts himself through all the evolutions he is later to experience in the air. These evolutions stimulate the internal ear, which send the nerve impulses to the brain. Consequently, after flying day after day in this apparatus the cadet is entirely familiar with the sensations he will experience in an air flight. He is thus prepared to realize and cope with the peculiar conditions incidental to aviation.

The Air Medical Service divides its system of operation in three ways: Selection, classification and maintenance. Tests for selection are standardized. Examiners making the tests are also standardized.

A late innovation in the Air Medical Service includes what is known as the Flight Surgeon, who examines intimately the conditions in aviation accidents, and makes recommendations accordingly. For example: He finds that the cowl of an airplane provides too little play for the head, and that flyers cut their heads in crashes as a result. He recommends more room. Such recommendations have been shown to result in 10 to 30 per cent less accidents. Another recommendation instituted the use of a rubber shock absorber, used to attach the safety belt to the machine. This lessened the number of broken ribs.

Dealers Hold Tractor Agencies

No Thought of Giving Up Truck or Tractor Agencies—Minneapolis Show Huge Success

MINNEAPOLIS, Feb. 19—The rumors that dealers will give up truck and tractor agencies and handle passenger cars only in these post-war days are entirely unfounded as far as this section is concerned. Interviews with many dealers at the 1919 Northwestern Automotive and Industrial Exposition here shows them very enthusiastic over the passenger car outlook, but in no way inclined to give up truck or tractor business.

The show is a huge success. Attendance records are far in excess of all previous years. Good crops and high prices for them have resulted in a good prosperity. Farmers and dealers are here from the entire territory solely for the show.

Highway Committee's Report to Annual Convention

NEW YORK, Feb. 20—The National Highway Committee of the American Road Builders' Association has prepared an interesting report on the problem of adequate roads for presentation at the ninth annual convention. This convention will be held at the Hotel McAlpin, Feb. 25-28.

In this report reference is made to the new era of highway transportation and the necessity of providing adequately for the traffic, maintaining the road systems and connecting the interior with the seaboard in such a way as to obtain maximum results. The benefits to be derived from the establishment of a national highway system, built and maintained by the Federal Government, are also dealt with in detail. The matter of military benefit resulting from such a system is also considered. It is expected that this report will be presented at the Feb. 27th session of the convention.

Labor Standards of England Changed

Shorter Working Hours More Productive—Workers Use Spare Time Profitably

LONDON, Feb. 1—The majority of factories in Great Britain went on a 47-hr. week schedule on Jan. 1, as compared with 52- and 56-hr. formerly. During the war many of the companies worked from 6 a. m. until 6.30 p. m. There has been a good deal of opposition on the part of many British manufacturers to the 47-hr. week on the ground that the laborer would scarcely know what to do with his extra time. There was a general feeling that he would spend his time and money at the saloon, so the shorter working hour would be an evil rather than a benefit.

The case of the Ford Co. at Manchester rather disproves this. The company, formerly working on a 48-hr. week schedule, dropped to 40-hr. On this shorter schedule, which was started Jan. 1, the 1500 employees are assembling two to three chassis per day more than on the longer schedule. This is largely due to a better spirit of co-operation among the workers, the majority of whom realize the benefit of shorter hours. An investigation showed that instead of these workers spending their time at the saloon they were taking up such pastime as chicken raising and gardening. Many of the garden spaces doubled as soon as the extra spare time was allowed, and there was a great demand for lumber for building chicken coops which indicated a healthy disposition on the part of the worker. There was no increase in drunkenness. In fact, the contrary prevailed.

British manufacturers have already realized that production was very low in the early morning hours, particularly from 6 until 9 a. m., when many of the employees returned home for breakfast. There has been a good deal of opposition to starting work at 8 on the ground that it calls for an earlier breakfast than the Britisher has been accustomed to, but already the benefit of such a move is being realized, and opposition from the housewife is passing.

France is beginning to realize that the heavy noonday meal is a manufacturing error, and some factories where 1½ to 2 hours are taken off at noon so that the workers might go home for the heaviest meal of the day realize that they are losing two of the best hours of sunshine, and that after the workers return it is an hour or perhaps longer before they are back on an efficiency basis, because of the heavy meal eaten. The ½-hour luncheon is desired by the more progressive French makers, but they realize the difficulty ahead in overcoming the tradition of the French home in regard to the noonday meal.

The automobile industry in England is bound to suffer more because of the labor upheaval than it would have previ-

ous to the war. Such places as Coventry, for example, have increased their population more during the war than at any time previously, and have become trade centers as well as labor centers, and so the automobile industry has come more under labor problems than ever before.

The present working-out of the short week seems to draw attention to two factors: First, the upsetting of domestic arrangements that have been traditional; and, second, the curtailing of minor privileges which the individual has for years enjoyed. The upsetting of home routine by the earlier breakfast and the shorter meal hour has been referred to.

The curtailing of individual privileges has more to do with the factory. The tea hour or half-hour is being eliminated. The rule against smoking must be enforced, and with the shorter week it will be necessary for the worker to work at higher efficiency than ever before. Some of the factories have reduced the working temperature so as to stimulate activity. Others have insisted on medical examinations and hospital service so as to increase the usefulness of the worker. For a time the worker is going to object to many of these innovations on the ground that it is interfering with his individuality and the employer has a problem on his hands to convince him that it is for his benefit as well as the factory.

Contract Bill Again Held Up

WASHINGTON, Feb. 19—The bill providing for the payment of informal contracts which was passed by the Senate and reported to the House for approval by the Conference Committee was ordered back to the Committee by the House yesterday for the elimination of certain amendments. Only very prompt action by Congress can now secure the passage of the bill during the present session.

Michigan Copper & Brass Profits $186,507

DETROIT, Feb. 17—The balance sheet of the Michigan Copper & Brass Co. for 1918 shows net profits totaling $186,507.88 on outstanding capital stock of $991,350. After reserving $20,000 for federal taxes and paying dividends of $29,740 at 4 per cent, the company's total surplus at the beginning of the year stood at $1,570,776.91. It shows a property account on Dec. 31, 1918, of $1,407,407, of which $276,791 is in a new rod mill constructed during the war. Current assets are placed at $3,124,137 and total assets $5,033,028. Current liabilities are $2,470,901. D. M. Ireland is president and Alonzo Ewing, vice-president and general manager.

Christian Girl Back at His Desk

CLEVELAND, Feb. 19—Christian Girl, president of the Standard Parts Co., who has been South recuperating from a slight operation this fall, is again in good health, and will resume his business duties in April.

Ocean Flight Topic at Aero Dinner

Two Entries for Atlantic Flight Already In—Dinner Attended by 800 Fliers—Dirigibles Approved for Commerce

NEW YORK CITY, Feb. 19—That two entries have been registered for the transatlantic flight with the Royal Aero Club of Great Britain was announced at the thirteenth annual banquet of the Aero Club of America, held in this city tonight, and attended by upward of 800 aviation enthusiasts.

So far no other specific entries seem to have been received for the trans-ocean flight.

Capt. Edward Rickenbacker recommended that some form of memorial be erected in the cemetery at Toul, France, where many of our American aviators are buried. He also suggested that some form of memorial be erected at a suitable place in America to the memory of these aviators.

It was the general belief of practically all of the aviators present that the Atlantic would be crossed this year. The value of the dirigible as a vehicle for long distance transportation was favorably commented upon. Over a dozen American Aces, recently returned from the front, were guests at the dinner.

General Menoher, new chief of the air service, spoke favorably on commercial aviation, as follows:

"I look to see in the near future, in a matter of months only, perhaps, the command of the line of battle exercised from the air instead of from some dugout out of sight and more or less out of touch with the situation."

"As in the case of any commercial activity, there should be constant endeavor toward standardization. To adequately accomplish this there should be:

"A—A national aircraft engineering standards commission working in conjunction with our Bureau of Standards, which commission should be in touch with a similar internationl standards commission.

"B—A national aerial digest bureau, charged with the collection and publication of data which mark new advances in the development and use of aircraft and aircraft material, and the results of physical and medical research pertaining thereto.

"C—The publication of a revised, up-to-date aeronautical dictionary.

"D—The formation of aero clubs, either branches of or affiliated with a central national association, which should have a directorship consisting of representatives from the army, navy, postoffice, weather bureau, Smithsonian Institution, National Advisory Committee of Aeronautics, Aero Club of America, American Society of Aeronautical Engineers, Manufacturers' Aircraft Association, intercollegiate representation, etc."

Brazil Reduces Duty on U. S. Tires

WASHINGTON, Jan. 27—The Congress of Brazil has adopted the usual authorization for an executive decree to continue the preferential tariff treatment of some American products during 1919. The articles on which the reduction is granted will be specified in a separate decree, and will probably be similar to the list of 1918, when a reduction of 20 per cent was allowed in the duties on rubber tires, among other commodities.

38,052 Government Vehicles to Be Delivered

WASHINGTON, Feb. 15—On Jan. 9, practically two months after the signing of the armistice, there were on order and still undelivered to the Government a total of 38,052 automotive vehicles as follows:

G. M. C. 1-ton ambulances	1,834
G. M. C. standard 1-ton trucks	4,921
1½-ton standard trucks	3,090
Standard 3-, 4- and 5-ton trucks	9,068
Special 2- and 3-ton trucks	7,782
Limousines	15
Motorcycles	9,408
Standard 1½-ton trucks for domestic use	563
Standard 3-ton and heavier trucks for domestic use	1,371
	38,052

At the time of the signing of the armistice there were on order and still undelivered to the Government 138,424 automobiles and trucks; 96,952 of this number was canceled, and the balance, 41,472, was to be delivered at a future date.

Outlook Windshields to Be Exhibited at Lyons Fair

CLEVELAND, Feb. 19—Outlook windshields, made by the Outlook Co. of this city, will be exhibited at the forthcoming Lyons Fair (France) by Dutrieu & Co., Paris, distributers of the line.

Mechanical Engineers to Hold Meeting

NEW YORK, Feb. 20—Afternoon and evening meetings of the American Society of Mechanical Engineers are scheduled for Feb. 24. Subjects to be discussed are the application of electrical control to gate valves and the application to industry of the personnel work of the U. S. Army. Motion pictures and lantern slides will be shown and proceedings terminate with a buffet supper.

Fisk Reduces Common to $25 a Share

CHICOPEE FALLS, MASS., Feb. 19—At the annual meeting of the Fisk Rubber Co. to-day stockholders voted to change the par value of the common stock from $100 to $25 a share. They also authorized the reduction of the capital stock by $770,100 through the retirement of 7,701 shares of first preferred stock now held in the treasury. This stock was purchased by the company. All officers and directors were re-elected.

According to the company's financial statement for the year ended Dec. 31 last, net sales for 1918 amounted to $36,682,163. The total surplus for the year was $4,425,923, approximately $400,000 more than 1917. After deducting costs, interest on borrowed money, etc., a net surplus of $3,760,279 remained.

Mexican Bank Law Secures Credit

Bill to Develop National Banks — To Eliminate Present Foreign Cash Basis

WASHINGTON, Feb. 18—Exporters of automotive products to Mexico will benefit by the new banking system in that country planned by President Carranza in a law recently submitted to the Mexican Congress. The bill provides for development of national banks, broadening the Mexican banking system and completely revising the banking law of 1897. If passed, the bill will undoubtedly eliminate the present strictly cash basis with American manufacturers now insisted upon in their Mexican export business. The bill is particularly designed to establish a sole bank of emission and other banks for the development of specific industries, to stabilize the unsettled money market resulting from the European war, establish credits on a fair basis and promote loans at a reasonable rate of interest.

Has Few National Banks

Mexico, during the past few years, since the fall of President Diaz, has practically been without national banking institutions and has been dependent on private banking organizations whose activities are limited almost entirely to the issuance, purchase and sale of foreign exchange, and a few commercial credit transactions. As a result, commercial credits and advances on bills of lading have been made only at exhorbitant rates. Finances for import shipments have been difficult to secure. Consequently, both the exporters into Mexico and the Mexican importers have had difficulty in stabilizing their business in that country and commerce has suffered. In fact, at present American trade with Mexico has been on a cash basis with but few exceptions. American commission merchants and manufacturers' agents have had to insist on partial cash payment of the invoice value of import orders with the balance usually covered by sight drafts and documents payable at New York or the Mexican port of entry.

The Mexican Department of Finance, however, has determined to assist Mexican business men, and it is certain that under the new law the bulk of Mexican import trade will be done in the future on a credit basis. Our proximity gives us a certain advantage in competition with European manufacturers, but the latter are preparing to enter the field and extend credit, while American makers, according to the Department of Commerce, are still trying to maintain a cash basis.

Under the proposed law the following classifications of banking institutions of credit are made:

Sole bank of emission.
Mortgage banks to make loans secured by urban or rural real estate.
Banks of promotion to facilitate or encourage mining, industrial and commercial operations.
Agricultural banks to make loans for the purchase of equipment or expense of operation, to be secured by the products and crops of the farm.
Petroleum banks to make loans for equipment and operation to petroleum exploitation enterprises.

The purpose of this classification is to promote more efficient response to the needs of the different lines of production and so guarantee ready capital for the promotion of industry, commerce and agriculture. Under the new law, a minimum capitalization is specified of at least $250,000 in the case of agricultural banks, banks of deposits and banks of promotion, and $500,000 with the mortgage and petroleum banks to be contributed at once.

Dirigibles for Commercial Flights

(*Continued from page* 437)

wireless system extending over the complete area covered by the planes.

AUTOMOTIVE INDUSTRIES is one of the most enthusiastic supporters of commercial aviation, but it does not want to see the art given a body blow while in its swaddling garments, due to the over-enthusiasm of some stock promoter who is looking only toward his pocketbook, and not toward the future of this field of transportation. The exploitation of commercial aviation by a few such promoters would do an injury that could scarcely be overcome in 10 years.

These are days when the Government should be carrying on many of the activities which are fundamentals in successful aerial transportation. These fundamentals must be started long in advance of the time when planes are ready to do the work. If we had a complete, thoroughly worked out system of landing fields, wireless, signals, meteorology, aerial navigation, etc., it would be possible with present planes to carry on successful systems of mail and express handling. Without these no system can be successful. The vehicle is now as a vehicle of transportation very far in advance of the necessary systems which are needed in conjunction with it. By the time adequate measures are completed for carrying on aerial navigation, commercial types of planes will be developed on a par if not far beyond that of the system for control.

Dirigible Logical for Distance Flights

In aerial transportation over any country such as the United States there must also be carefully weighed the relative field for the airplane and the dirigible. For long distance passenger travel between New York and Chicago, the dirigible to-day seems the logical machine. With it, it would be possible to carry 300 persons with baggage, between these cities on a night journey. The trip could be made with complete safety. On the other hand, such a trip with airplanes would be accompanied with great danger until all of the necessities mentioned surrounding commercial aviation have been accomplished. Even then the safety factor with a dirigible is amazingly more attractive than that of the airplane, unless there is developed some other means of increasing the safety element.

The development of airplane pilots for commercial use is a work that must be done at once. The majority of our pilots who fought in the war have no thought of entering commercial aviation. Many of them are college men to whom the role of an aerial chauffeur has no attractions. Some of them have expressed themselves as fortunate if they never have to ride in an airplane again, but if war broke out they would volunteer at once.

With these men there is a great difference between war and commercial aviation. It will be necessary to develop commercial pilots, the same as we have engineers for our passenger and freight trains, drivers for our motor trucks and chauffeurs for our automobiles. These pilots will do the job for the weekly wage rather than for any aerial thrills. The work must be brought on to a sound business basis.

The stunt in all its forms will be eliminated, and the only requirement will be that the aerial vehicle, in whatever form it may be, will start on schedule, make its trip on schedule, arrive at its destination on schedule, irrespective of wind, rain, fog, or snow. Only when this is accomplished will aerial commercial navigation be a success.

Canada Importer of Tractor Engines

Takes 60 Per Cent of Exports —New Zealand and France Next

WASHINGTON, Feb. 17—Exports of gasoline and steam tractor engines during December, 1918, totalled 1816, of which 1734 were gasoline and 82 steam. Shipments to Canada were in excess of 60 per cent of the total number exported, that country taking 1181 gasoline and all of the steam tractor engines.

The average prices paid by the different nations vary considerably, with $1,125 per engine by England, $713 by Canada, $700 by France and but $418 by New Zealand.

Following is the list of tractor engines exported in December:

Countries	Gasoline		Steam	
	No.	Dollars	No.	Dollars
Denmark	2	6,800	..	....
France	131	91,704	..	....
Italy	45	91,550	..	....
Spain	6	7,762	..	....
England	129	145,149	..	....
Canada	1,181	842,411	82	167,556
Mexico	17	20,070	..	....
Jamaica	6	5,249	..	....
Trinidad	2	1,780	..	....
Cuba	4	8,465	..	....
Argentina	3	6,005	..	....
Bolivia	2	3,100	..	....
Peru	43	48,066	..	....
Dutch East Indies	1	4,200	..	....
Japan	1	4,500	..	....
New Zealand	148	61,927	..	....
Philippine Islands	6	1,350	..	....
French Africa ..	7	5,250	..	....
Total	1,734	1,355,338	82	167,556

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. .02 -.03
- Phosphoric (85%) .35 -.39
- Sulphuric (60%), lb. .008

Aluminum:
- Ingot, lb. .30 -.33
- Sheets (18 gage or more), lb. .42
- Antimony, lb. .07¼-.07½

Burlap:
- 8 oz., yd. .10½
- 10½ oz., yd. .16½

Copper:
- Elec., lb. .17 -.17½
- Lake, lb. .19 -.19½

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.50
- Egypt, combed, sq. yd. 1.25
- Egypt, carded, sq. yd 1.15
- Peelers, combed, sq. yd. 1.10
- Peelers, carded, sq. yd. 1.00

Fibre (⅛ in. sheet base), lb. .50

Graphite:
- Ceylon, lb. .09 -.22
- Madagascar, lb. .10 -.15
- Mexico, lb. .03¾

Lead, lb. .4474-.0525

Leather:
- Hides, lb. .18 -.34¾

Nickel, lb .40

Oil:
- Gasoline:
  - Auto, gal. .24½
  - 68 to 70 gal. .30½
- Lard:
  - Prime City, gal. 1.90-2.00
  - Ex. No. 1, gal. 1.10
- Linseed, gal. 1.45-1.48
- Petroleum (crude):
  - Kansas, bbl. 2.25
  - Pennsylv a, bbl. 4.00
- Manhaden (dark), gal. 1.05-1.06

Rubber:
- Ceylon:
  - First latex pale crepe, lb. .56
  - Brown crepe, thin, clear, lb. .49
  - Smoked, ribbed sheets, lb. .56
- Para:
  - Up River, fine, lb. .58½-.59
  - Up River, coarse, lb. .35

Island, fine, lb. .49

Shellac (orange), lb. .64

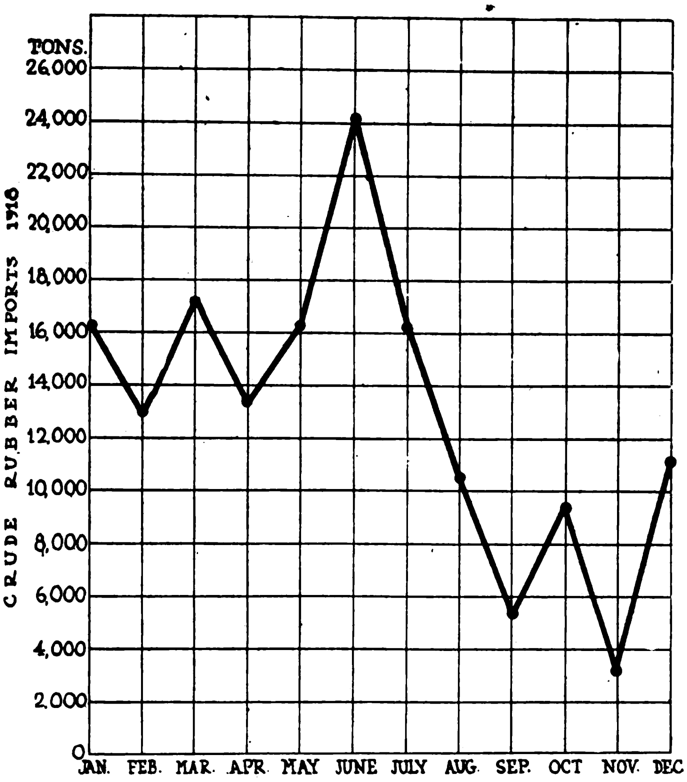
Spelter .06½-.06¾

Steel:
- Angle beams and channels, lb. .03
- Automobile sheet (see sp. table.)
- Cold rolled, lb. .0625
- Hot rolled, lb. .039

Tin .71 -.72

Tungsten, lb. 1.50-2.10

Waste (cotton), lb. .12¾-17



Fluctuations in our monthly imports of crude rubber during 1918 *were caused to some extent by Government restrictions and quantity limitations*

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.

Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

*Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close Feb. 15

	Bid	Asked	Net Ch'ge
Auto Body Company	6½	8½	..
Briscoe Motor Car com	10	..	..
Briscoe Motor Car pfd	35	50	..
Chandler Motor Car	114	116	+1⅞
Chevrolet Motor Car	164	166	+10
Cole Motor Car Co	90	105	..
*Continental Motors com	7½	8	..
Continental Motors pfd	96	..	+1
Edmunds & Jones com	15	20	..
Edmunds & Jones pfd	75	90	..
Electric Storage Bat	54	58	+4
Federal Motor Truck	30	34	..
Fisher Body Co. com	40¼	42	—2¼
Fished Body Co. pfd	90	93¾	..
Ford Motor of Canada	264	268	—1
General Motors com	130	131	— ½
General Motors pfd	82¾	84¾	—1⅛
Hupp Motor Car com	6	6¾	— ¼
Hupp Motor Car pfd	90	..	..
Kelsey Wheel Co. com	20	36	—8
Kelsey Wheel Co. pfd	91	95	+3
Manhattan Electric S. com	..	48	..
Maxwell Motor com	31⅜	32⅜	+1
Maxwell Motor 1st pfd	54½	55½	+1
Maxwell Motor 2d pfd	21½	22½	..
McCord Mfg. com	32	35	..
McCord Mfg. pfd	93	96	..
Mitchell Motor Co	24	30	..
Motor Products Corp	..	40	..
Nash Motors Co. com	175	200	+5
Nash Motors Co. pfd	93	97	..
National Motor Co	6	10	..
Packard Motor Car com	112	120	—4
Packard Motor Car pfd	99	103	..
Paige-Detroit Motor com	24½	25½	..
Paige-Detroit Motor pfd	8¾	9¾	..
Peerless Motor Truck	18	21	..
Pierce-Arrow M. Car com	39⅞	40⅞	+ ⅞
Pierce-Arrow M. Car pfd	102	..	..
Premier Motor Corp. com	5	..	..
Premier Motor Corp. pfd	..	75	..
Prudden Wheel Company	15¾	16½	+ ¾
Reo Motor Car Co	21½	22½	..
*Republic M. Truck com	35½	37½	..
Republic M. Truck pfd	87	90	..
Saxon Motor Car com	8¼	10¼	+ ¾
Scripps-Booth Corp.	21	25	..
*Stewart Warner Spd. Corp.	83	85	— ¾
Stromberg Carburetor Co.	40	43	..
Studebaker Corp. com	52½	53½	+2
Studebaker Corp. pfd	92	95	..
Stutz Motor Car Co	42½	43½	+ ¼
United Motors Corp	38½	40½	— ½
White Motor Co	49½	50½	+2½
*Willys-Overland com	24¾	25¾	+ ½
Willys-Overland pfd	88	88½	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co	71½	73	+1½
Firestone T. & R. com	140	145	..
Firestone T. & R. pfd	95½	100	..
Fisk Rubber Co. com	87	89	..
Fisk Rubber 1st pfd	102	105	+5
Fisk Rubber 2d pfd	97	100	+12
Fisk Rubber 1st pfd conv.	99	101	—1
Goodrich, B. F., com	59¼	60	—1¾
Goodrich, B. F., pfd	104¾	105	+1¾
Goodyear T. & R. com	245	249	+5
Goodyear T. & R. 1st pfd	103½	*105	..
Goodyear T. & R. 2d pfd	103½	105	..
Kelly-Springfield com	82¾	83	+5¾
Kelly-Springfield 1st pfd	93	98	+2
Lee Tire & Rubber Co	23¾	24	+ ¾
Marathon Tire & Rubber	55	70	..
Miller Rubber Co. com	178	180	+18
Miller Rubber Co. pfd	102	103	+6
Rubber Products Co	117	121	+3
Portage Rubber Co., com	162	165	+7
Swinehart T. & R. Co	95	100	+45
U. S. Rubber Co. com	75⅛	75⅝	— ⅜
*U. S. Rubber Co., pfd	109¼	110	..

*Ex Dividend.

Men of the Industry

Changes in Personnel and Position

Dedell Heads Firestone Advertising

AKRON, Feb. 17—J. R. Dedell, until recently connected with the Corday & Gross Advertising Co., Cleveland, has been appointed advertising manager of the Firestone Tire & Rubber Co., Akron.

—

Capt. Carl V. Richardson has opened an office at 1305 Monadnock Block, Chicago. He will specialize on consultations and designs of internal combustion engines, tractors and trucks. Previous to army service, he was experimental engineer with the Parrett Tractor Co. and designing engineer with the Buda Co.

—

A. A. Gloetzner has been elected vice-president of the Covert Gear Co., Inc., Detroit. He will also retain his present duties as chief engineer and manager of sales.

—

Fred B. Sides has been appointed assistant sales manager of the Hupp Motor Car Corp. He joined this company in 1915 as office manager.

—

E. J. Quirk, who has been in government service, has returned to the retail sales department of the Detroit office of the Studebaker Corp.

—

Lewis G. Harris has been appointed sales manager of the West Detroit Auto Sales Co., to succeed J. L. Cobaugh, who has resigned.

—

William H. Little has resumed his duties as general manager of the Scripps-Booth Corp. During the war he was supervisor of engine production for the army in the Chicago district.

—

A. H. Schiappacassee, for six years connected with the engineering and service departments of Dodge Brothers, has resigned to become assistant manager and research engineer of the Brisk-Blast Co., Monroe.

—

F. J. Fisher has been released from the Motor Transport Corps and has resumed his duties as secretary and treasurer of the Standard Motor Truck Co., Detroit.

—

Birkett L. Williams has been appointed sales manager of the truck department of the Grant Motor Car Corp., Cleveland.

—

Goodrich Vice-President Back From Service

AKRON, Feb. 15—Lt. Col. A. B. Jones, vice-president of the B. F. Goodrich Rubber Co., who has just returned home, left here in August to take charge of the motor transport work of the Red Cross in France, when it formed its own department to handle its supplies. In October, Colonel Jones succeeded Colonel Harvey Gibson as commissioner for France, when Colonel Gibson was made chairman of the commission for Europe.

Jacobsson Sails for Scandinavia

NEW YORK, Feb. 17—Birger Jacobsson, representing the J. B. Crockett Co., Inc., exporters, sails this week for Scandinavia on a business trip.

—

Capt. E. A. Callanan has been appointed general purchasing agent for the Cleveland Tractor Co., Cleveland. For the past 15 months he has been in charge of the production of the De Haviland battle planes at the Dayton-Wright plant, Dayton. Previous to that he was for five years assistant purchasing agent for the Willys-Overland Co., Toledo, and was later a manager in the branch department of that organization.

—

Arthur C. Brenckle, president Olympian Car Co., Milwaukee, distributer of the Olympian in Wisconsin and upper Michigan, was elected a director of the manufacturing corporation at the annual meeting held in Pontiac on Feb. 14.

—

George C. Baldwin, formerly with the Saxon Motor Car Corp., has been appointed field manager for the United Motors Service, Inc. This position includes the distribution of technical information and records, advertising and supervision of all branches and authorized distributers. Besides his connection with the Saxon corporation, Mr. Baldwin has been service manager for the Cadillac Motor Car Co. and the Studebaker Corp.

—

J. L. Hardig, formerly advertising manager of the Remy Electric Co., has been appointed assistant advertising manager of the Motor Equipment Division of the United Motors Corp., Detroit.

—

A. E. Maltby has resigned as branch manager of the Winton Co., Cleveland, effective March 1, to become vice-president and general manager of the Bigelow Willey Co., Philadelphia, distributer of Paige passenger cars and trucks. Mr. Maltby is now serving for the third term as president of the Automobile Trade Association.

—

Mason, of Mason Tire Co., Dead

CLEVELAND, Feb. 17—Daniel N. Mason, founder of the Mason Tire & Rubber Co., Kent, Ohio, and also one of the founders of the Mason Cotton Fabrics Co., died at his home here Thursday of pneumonia. He was 31 years old and leaves a widow and one child.

Coe Made Anderson Vice-President

NEW YORK, Feb. 15—Charles F. Coe has been elected vice-president and general sales manager of the Anderson Motor Co., Rock Hill, S. C. Up to within two weeks ago he was manager of the Chevrolet Motor Co. of New England, with headquarters in Boston. He assumes his new duties March 1.

—

J. Frank Keegan, formerly with Albertson & Co., Sioux City, has joined the Spencer Metal Products Co., Spencer, Ohio, as traveling representative for the Central West.

—

Lt. Fred M. Young, who has recently returned from overseas duty in the air service, has become associated with the Perfex Radiator Co., Racine, as sales engineer.

—

G. W. Williams, Jr., has resigned from the Bureau of Aircraft Production to take over the duties of advertising manager of the United Motor Service, Inc. Before entering Government service eighteen months ago he was with the advertising department of the Electric Storage Battery Co., Philadelphia, for seven years.

—

Harry E. Weiner has been appointed retail sales manager of the New York branch of the Maxwell Motor Sales Co. He will handle both Chalmers and Maxwell lines.

—

E. W. Kruste, formerly with the Four-Wheel Drive Auto Co., has been appointed a district representative of the Standard Motor Truck Co., Detroit. His territory includes Wisconsin and Minnesota.

—

Maus Made Chairman of Foreign Trade Division

CHICOPEE FALLS, MASS., Feb. 17—John B. Maus, export manager of the Fisk Rubber Co., has been appointed chairman of the Foreign Trade Division of the Springfield Associated Interests, an assocation working for the better interests of foreign trade.

—

Four Old Employees Return to Pennsylvania Rubber Co.

JEANNETTE, PA., Feb. 19—Four employees of the Pennsylvania Rubber Co., who have recently been discharged from service, have returned to their former positions. Lieut. George Blair, who has been in the Naval Aviation for the past 18 months, has resumed his position as manager of the Philadelphia branch. P. F. Armitage, in the Naval Reserve Force for the last year, has again taken up the northeastern Pennsylvania territory, with headquarters at the Philadelphia office. Milton H. Batz, who was with the company for eight years until he went into the army eight months ago, is now back on his territory in western New York State, and William E. Little, who for the past six months has been with the Motor Instruction Division, is back on his territory in central Pennsylvania.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Harley-Davidson to Expand

MILWAUKEE, Feb. 17—Enlargement of the plant of the Harley-Davidson Motor Co. is forecast by the fact that the company has engaged the Federal Engineering Co., Milwaukee, to make sketches and estimates of a proposed five-story addition, 50 x 150, at Thirty-eighth and Chestnut Streets to cost about $100,000.

National Tire & Rubber Insures Employees

EAST PALESTINE, O., Feb. 15—The National Tire & Rubber Co. has presented each of its employees with a life insurance policy paid entirely by the company, and increasing automatically as the employee's term of service increases. It provides for the payment of the full amount of the policy to the beneficiary in case of death of an employee, and in case of permanent disability the full amount of the policy will be paid in monthly installments. The policy may also be transferred and continued by the holder after leaving the employ of the company.

At the present time the addition to the National Tire & Rubber factory is going ahead rapidly, and it plans a greatly increased production next season. It is also bringing out two new brands of tires.

Pony Tractor New Concern

LAPORTE, IND., Feb. 18—Articles of incorporation have been filed by the Pony Tractor Co., with a capital stock of $100,000. The concern will manufacture, buy and sell, as well as assemble, farm tractors. The promoters are John S. Lingard, George Cummerford and M. E. Leliter, all of this city.

Mexico as Source of Petroleum and Its Products

(*Continued from page* 423)

eral order was issued that no lubricating oil should be thrown away. All the used castor oil in the squadrons was collected in barrels and sent to the Meurisse factory for treatment. In the regenerating process the loss never exceeded 10 per cent. Indeed, the refining factory could frequently work with a loss of only 5 per cent. Although castor oil was the first to be treated in this way, mineral oils were also taken and regenerated in the same way.

Details of the process are not available for publication. The oil is not only filtered but regenerated, and in doing this certain chemicals have to be used. The nature of these chemicals and the method of using them are kept secret. This system, which would never have had an opportunity of coming forth in any but a war period, has been responsible for economizing an immense quantity of oil. Previous to its adoption oil was merely filtered, and then used for some inferior purpose. The Meurisse system appears to be the only one allowing used oil to take the place of new.

Ajax Profits Less This Year

NEW YORK, Feb. 15—The Ajax Rubber Co., Inc., showed an increase in its income for the year of $960,075 over last year, but a decrease in $266,225 in its profits after the necessary deductions for taxes, dividends, etc., were made. The balance sheet for the year ending Dec. 31, 1918, as compared with that ending Dec. 31, 1917, follows:

Income Account

	1918	1917
Profits	$2,915,368	$1,955,293
Provision for Federal war profits and income taxes	1,700,000	495,000
Net income	$1,215,368	$1,460,293
Dividends	852,000	830,700
Surplus	$363,368	$629.593
Previous surplus	768,840	139,247
Total surplus	$1,132,208	$768,840
Assets		
Land, buildings, machinery, etc., less depreciation	$2,142,536	$1,862,605
Other property	17,410	....
Patents, good will, etc.	1,874,875	1,874,875
Inventories	3,917,368	5,424,827
Accounts receivable	2,165,420	2,234,585
Liberty bonds	477,838	148,000
Cash in banks and on hand	363,613	257,341
Deferred charges	112,571	118,213
Total	$11,071,634	$11,920,449
Liabilities		
Capital stock	$7,100,000	$7,100,000
Accounts payable	832,801	3,401,493
Taxes payable (Wisconsin)	75.734	....
Bonuses payable	230,889	155,114
War profits and income taxes (estimated)	1,700,000	495,000
Surplus	1,132,208	768,840
Total	$11,071,634	$11,920,449

At the directors' meeting, F. E. Dayton, formerly secretary, was elected vice-president. W. J. Jackson succeeds Mr. Dayton as secretary. Otherwise there was no change in the officers or board of directors.

France Prohibits Auto Imports

(*Continued from page* 439)

in francs, paid in France, of a sum of 8,437,500 francs, being the cost to the Government of the said vehicles paid in dollars in America.

6—Receipt by the Government by way of net profit on the transaction of a sum of 843,750 francs.

7—It is estimated that French automobile dealers established in France would make a gross profit from the sale and distribution of these automobiles of a sum of 5,850,000 francs.

8—Continuous employment would be secured for a very large number of demobilized soldiers.

9—The Ford company estimates that its costs for wages of assembly and other expenses for completing these automobiles and distributing them to dealers would amount to a sum of about 4,000,000 francs.

The Ford company claims that the refusal of the Minister of Industrial Reconstruction to allow these automobiles to go into service is resulting in:

1—A loss to the French nation of the utility of 4500 automobiles available in private ownership for immediate service in war devastated areas.

2—A loss of recovery of capital and revenue to the French Government of over 18 million francs.

3—Loss of immediate employment to many hundreds of demobilized soldiers.

4—Suspension of the resumption of commercial business, upon which the prosperity of the French people is dependent.

5—Sacrifice of the good will and commercial friendship of American allies.

This campaign of the Ford company is unprecedented; but it had to be admitted that foreign dealers established in France have been provoked by the uncompromising attitude of French manufacturers, who have used every weapon in order to shut out and discredit the foreigners. It is thought that after this attack by the Ford company the French Government cannot long delay in giving a decision. One important importer of foreign cars maintains that the greatest injustice is not the present prohibition, or the 70 per cent tax, but the continued uncertainty. Establishments have to be maintained in view of the possibility of business at some later date, but at present nobody knows whether these business relations can be re-established in a few weeks or in a few years.

French automobile manufacturers want substantial protection for one year, and after that reciprocity with a maximum import duty of 10 per cent; by this they mean that they would admit, for instance, American automobiles free of duty or with any duty not exceeding 10 per cent, providing that America did the same. They would not be interested, however, in a 30 per cent duty in America which obliged them to impose a 30 per cent duty in France.

This was the statement made to me by Louis Delage, one of the leading French manufacturers, who declared that these views were generally shared by members of the Syndicat of Automobile Manufacturers and had been submitted by them to the French Government. The French manufacturers want protection for one year in order to enable them to get their factories on to a peace basis, and to prevent their market being flooded while they are unable to meet the local demand. Reciprocity is considered to be the most satisfactory solution. It would not work equally well in every case, but, on the whole, the results should be good. A reciprocal 10 per cent duty between France and America would rather be to the advantage of America than to France, for it would allow all the cheaper grades of American cars to be sold in France while only some of the higher class French cars could be sold in America.

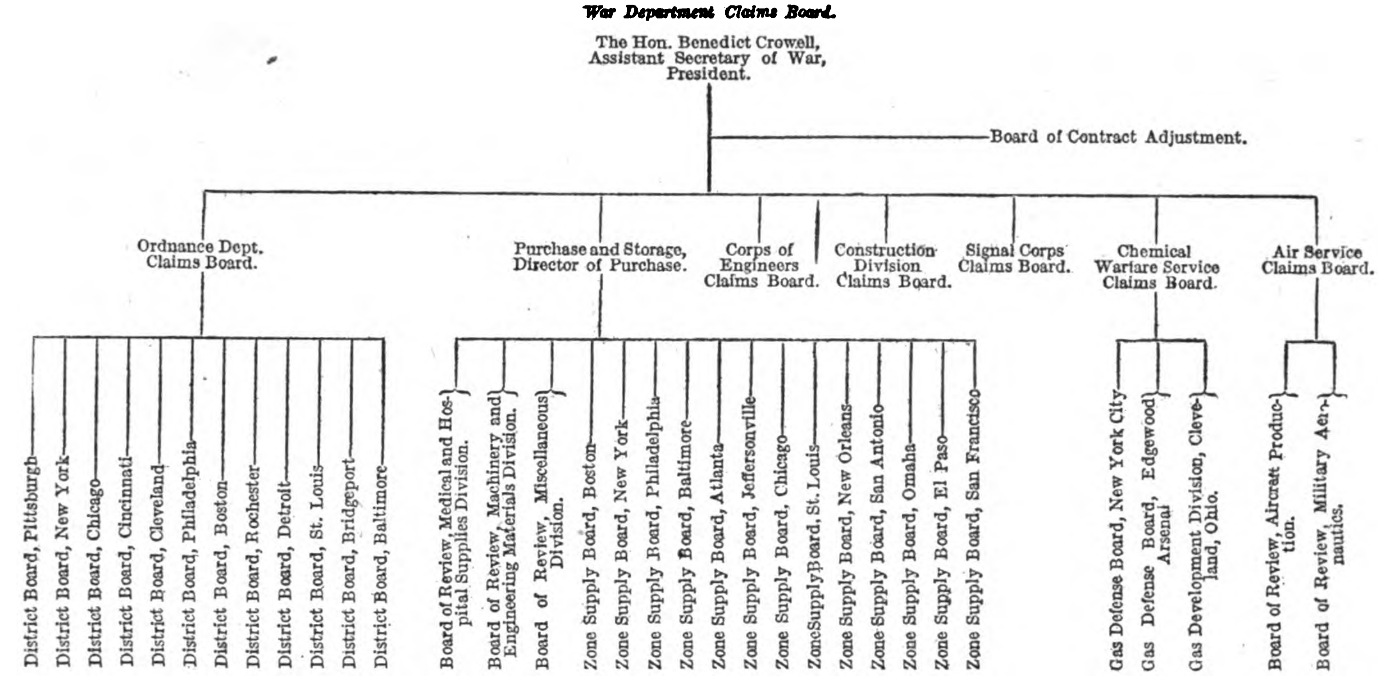


Chart of the organization of the War Department Claims Board

War Department Claims Board Organized to Adjust and Review War Contracts

WASHINGTON, Feb. 14—The composition of the War Department Claims Board, together with the list of boards supervising and passing upon adjustment of War Department contracts, has been made public by the War Department, and is as follows:

War Department Claims Board.

President, Hon. Benedict Crowell, the Assistant Secretary of War, director of munitions.

Mr. G. H. Door, assistant director of munitions.

Brig. Gen. George W. Burr, assistant to Maj. Gen. Goethals, director of purchase, storage and traffic.

Brig. Gen. Herbert M. Lord, director of finance, purchase, storage and traffic division.

Lieut. Col. Herbert H. Lehman, assistant to Maj. Gen. Goethals, director of purchase, storage and traffic.

Special members: Mr. W. H. Davis. Col. C. A. McKenney, Maj. H. L. Goodhart, Maj. Harry D. Rawson, Capt. Arthur Day.

Recorder: Maj. Erskine Bains.

The function of this board is to supervise and co-ordinate the work of contract adjustment throughout the department. Through its special representatives sitting with the bureau boards all contract adjustments of the department are subject to its scrutiny and approval, and adjustments involving matters of policy and of particular difficulty and importance are brought before the full board for decision.

Board of Contract Adjustment.

Lieut. Col. Herbert H. Lehman, assistant to Maj. Gen. Goethals, director of purchase, storage and traffic.

Lieut. Col. E. F. Malone.

Lieut. Col. C. B. Garnett.

This board passes on the questions of contract adjustment on which the contractor and the local and bureau boards of the department have been unable to reach agreement.

Ordnance Bureau.

Ordnance claims board—Brig. Gen. W. S. Peirce, Col. R. P. Lamont, Col. G. H. Stewart, Col. Earl McFarland, Maj. John R. Delafield.

This board reviews the action of the ordnance district boards.

District Claims Board.

1. Baltimore—Maj. A. V. Barnes, Capt. R. W. Smith, Maj. L. B. Webster, Capt. F. E. Baldwin, Mr. J. J. Nelligan, Mr. E. G. Baetjer.
2. Bridgeport—Maj. B. A. Franklin, Maj. Frederick Payne, Capt. Miller Brainard Charles G. Sanford, Edmund C. Wolfe, David H. Day, Charles W. Graham.
3. Boston—Levi H. Greenwood, Lieut. Col. O. S. Lyford, Maj. Herbert S. Brussel, Maj. A. S. Douglass, Mr. Stuart W. Webb, Mr. Charles M. Davenport, Mr. Atherton D. Converse.
4. Chicago—Mr. Edmund A. Russell, Lieut. Col. E. E. Arison, Maj. Frank R. Bacon, Mr. James W. Lyons, Mr. John J. Mitchell, Maj. F. R. Schenck, Mr. George S. Pines.
5. Cincinnati—C. L Harrison, George S Raydock, B. W. Lamson, R. K. Leblond, O. De Gray Vanderbilt, Carl M. Jacobs, Stanely G. Rowe, F. H. McClellan.
6. Cleveland—Samuel Scovil, W. B. McAllister, Philip P. Merrill, Amos B. McNairy, Joseph H. Scobell, Judge Thomas H. Strimple, Maj M. F. Loomis.
7. Detroit—F. J. Robinson, C. C. Huyette, C. C. Jenks, Maj. C. W. Owston, Maj. P. C. Thomas, Henry M. Campbell, Maj. S. L. Depew, Capt. J. G. Dalgleish.
8. New York—Mr. G. J. Roberts, Maj. C. S. Reed, Mr. B. Goldsmith, Maj. C. C. Smith, Mr. R. A. C. Smith, Lieut. Col. Arthur Adams.
9. Philadelphia—John C. Jones, Capt. Malcolm F. Ewen, Maj. R. M. Appleby, Isaac Hathaway Francis, Maj. F. M. Masters, John Dickey, Jr., Mr. Alexander H. Carver.
10. Pittsburgh—R. M. Drave, Maj. H. B. Scovil, Maj. J. F. Drake, Harrison Nesbitt, George S. Oliver, Charles Gulentz.
11. Rochester—Frank S. Noble, Maj. J. L. Crane, Mr. Langdon Albright, Maj. J. J. O'Connell, Mr. Herbert J. Sinn, Joseph W. Taylor, George A. Carnshan.
12. St. Louis—Mr. M. E. Singleton, Maj. E. S. Ready, Maj. B. S Bope, Mr. W. F. Carter, Mr. C. W. Nelson, Mr. Davis Biggs.

Office of the Director of Purchase and Storage.

All final contract agreements or settlements are personally approved by Brig. Gen. William H. Rose, Director Purchase.

Board of Review for Termination Agreements handled by the following divisions under the office of the director of purchase: Clothing and Equipage Division, General Supplies Division, Subsistance Division, Remount Division, Motors and Vehicles Division. Raw Materials Division—Col. H. S. Kilbourne, Capt. William E. Lee, Capt. R. D. Stephens.

Board of Review for Medical and Hospital Supplies Division. office of the director of purchase—Lieut. Col. J. F. Fletcher, Capt. J. Van Putten, Jr., Maj. Frank L. McCartney, Maj. G. W. Wallerich, Capt. Harry G Gunther, Capt. John C. Schweiger.

Board of Review for Machinery and Engineering Materials Division. office of the director of purchase—Col. Earl Wheeler, Lieut. Col. J. E. Long, Maj. George A. Bentley, Maj. Ira D. Hough, Maj. H. W. Eels, Maj. C. B. Loomis, Maj. H. McC. Yost, Capt. B. H. Arnold.

Zone Board of Review.

Atlanta, Ga., Transportation Building—Maj. G. M. Alden, Quartermaster Corps, Maj. L. M. Thibadeau, Quartermaster Corps; Maj. E. de T. Ellis, Infantry; Capt. J. A. Graham, Quartermaster Corps.

Boston, Mass., 108 Massachuetts Avenue—Maj. J. W. Blunt Quartermaster Corps; Maj. W. H. Rhoads, Quartermaster Corps; Capt. Leroy Holder, Quartermaster Corps; First Lieut. A. A. Lucey, Quartermaster Corps; Mr. George E. Barnard.

El Paso, Tex.—Capt. F. C. Allen, Quartermaster Corps; Capt. F. C. Shelley, Quartermaster Corps; Mr. W. H. Dent.

Jeffersonville, Ind., Meigs Avenue—Maj. M. T. Levey, Quartermaster Corps; Maj. L. L. Sims, Quartermaster Corps; First Lieut. Henry Pirtle, Quartermaster Corps; First Lieut. L. C. Clarke, Quartermaster Corps.

New Orleans, La., Audubon Building—Maj. P. T. Murphy, Quartermaster Corps; Maj. E. I. Sharp, Quartermaster Corps; Capt. F. L. Hester, Quartermaster Corps; Second Lieut. S. Roccaforte, Quartermaser Corps; Mr. Benjamin Coswell Cassenas.

Omaha, Neb., Army Building—Maj. William H. Faringly, Quartermaster Corps; Lieut. Col. P. H. Holcombe, Quartermaster Corps; First Lieut. George E. Comins, Quartermaster Corps; Mr. C. E. Adams, inspector, Quartermaster Corps; Mr. Fred S. Knapp.

Philadelphia, Pa., Twenty-first and Oregon Avenue—Maj. Remi Hueper, Quartermaster Corps; Maj. Archibald H. Bronson, Quartermaster Corps; Maj. Herbert Knox Smith, Quartermaster Corps; Maj. James M. Taft, Quartermaster Corps; Capt. Otis S. Carroll, Quartermaster Corps.

St. Louis, Mo., Second and Arsenal Streets—Maj. R. Field, United States Army retired; Maj. J. W. Byrnes, Quartermaster Corps; Capt. J. P. Keleher, Quartermaster Corps; Second Lieut. G. Rosenbaum, Quartermaster Corps; Mr. A. J. Davis.

San Antonio, Tex., General Supply Depot—Maj. E. O Baldwin, Quartermaster Corps; Maj. T. O. Baker, Quartermaster Corps;

Calendar

ENGINEERING

S. A. E. Meetings

Feb. 27—Kansas City. S. A. E. tractor meeting at Sweeney School Auditorium; dinner at Hotel Baltimore.

March 5 — Minneapolis Section, S. A. E.—Hotel Radisson. "Tractor Service and Sales."

April 2—Minneapolis Section, S. A. E. — Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

MOTOR SHOWS

Feb. 17-22 — Louisville, Ky. Louisville Auto Dealers' Assn.

Feb. 17-22—Des Moines, Iowa. Tenth Annual, Des Moines Automobile Dealers' Assn. C. G. Van Vliet, Manager.

Feb. 17-22 — Pittsfield, Mass. Pittsfield Automobile Dealers' Assn., State Armory. James J. Callahan. Manager.

Feb. 17-22 — Passenger Cars; Feb. 24-27, Trucks—South Bethlehem, Pa. Lehigh Valley Auto Shows Co. J. L. Elliott, Manager.

Feb. 17-22—Grand Rapids, Mich. Grand Rapids Automobile Business Assn. E. T. Conlon, Manager.

Feb. 17-22—Seattle, Wash. Cars, Motor Car Dealers' Assn., State Armory. A. G. Schaeffer, Manager.

Feb. 18-22—Baltimore, Md. Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland, Fifth Regiment Armory, H. M. Lucius, General Manager.

Feb. 18-22 — Oklahoma City, Okla. Automotive Show. R. H. Haun, Manager.

Feb. 18 - 22 — Wichita, Kan. Wichita Automobile Dealers' Assn.

Feb. 19-22 — Evansville, Ind. Cars, Evansville Automobile Dealers' Assn. Coliseum.

Feb. 22-March 1 — Hartford, Conn. Hartford Automobile Dealers' Assn., Inc., Broad Street Armory. Ben F. Smith, Manager.

Feb. 22-March 1—Atlantic City, N. J. Auto Trades Assn. of Atlantic City.

Feb. 22-March 1—New Castle, Pa., Lawrence County Association of Automobile and Accessory Dealers.

Feb. 22-March 1—Reading, Pa. Reading Auto. Trade Assn.

Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.

Feb. 24-March 1—Burlington, Ia. Second Annual.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 24-March 1—Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.

Feb. 24-March 1—Springfield, O. Auto. Trade Assn.

Feb. 24-March 1—Portland, Ore. Ninth Annual Dealers' Motor Car Assn., Automobile Palace. M. O. Wilkins, Manager.

Feb. 24-March 1—Duluth, Minn. Duluth Automobile Dealers' Assn.

Feb. 25-March 1 — Erie, Pa., United States Garage.

Feb. 26-March 1—Mason City, Ia. Fifth Annual, Mason City Auto Show Assn.

Feb. 26-March 1—Madison, Wis. Seventh Annual, Automobile Dealers' Division of Madison Assn. of Commerce, Union Transfer Bldg.

Feb. 26-March 1—Quincy, Ill. Cars, Quincy Automobile Trade Assn. Armory.

Feb. —Wheeling, W. Va. Automobile Show at Market Auditorium.

March 1-15—New York Aeronautical Exhibition, Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

March 3-5—Quincy, Ill. Trucks and Tractors. Armory.

March 3-8 — Muskegon, Mich. Third Annual, Armory, Muskegon Lodge No. 274, B. P. O. E. John C. Fowler and George M. Friant, Managers.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

March 3-8—Scranton, Pa. Ninth Annual, 13th Regiment Armory, Scranton Automobile Assn. Hugh B. Andrews, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

March 5-8—Lancaster, Pa. Automobile Trade Assn., Rowe Motor Co.'s Bldg. R. W. Shreiner, Manager.

March 8-15 — New Brunswick, N. J. Armory, New Brunswick Motor Trade Assn. William Kuehle, Manager.

March 8-15 — Philadelphia, Pa. Philadelphia Automobile Trade Assn., Commercial Museum. A. L. Maltby, Manager.

March 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gradner, Manager.

March 10-15 — Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn., Auditorium. Clark G. Powell, Manager.

March 12-18—Peoria, Ill. Passenger cars, 12 to 15; trucks, 17 and 18.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Passenger cars only. Chester I. Campbell, Manager.

March 15-22—Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.

March 17 - 22 — Great Falls, Mont. Montana Automobile Distributors' Assn.

March 17-22—Philadelphia, Pa. Motor Truck Assn., Commercial Museum.

March 19-22—St. Joseph, Mo. St. Joseph Automobile Show Assn., Auditorium. John Albus, Manager.

March 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.

March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 22-29—Passenger Cars. April 1-5—Trucks, Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkman, Manager.

March 24-29—New Orleans, La. Henry B. Marks, Manager.

March 24-29—Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.

March 24-29—Utica, N. Y. Utica Motor Dealers' Assn.

March 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock. Manager.

April 5-12 — Bridgeton, N. J. Fourth Annual, Automobile Dealers' Assn.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink T. C. Kirby, Manager.

April 13-19—Bristol, Tenn. Cars trucks, tractors, airplanes and accessories. Bristol Chamber of Commerce.

Not decided—Bridgeport, Conn Auspices of City Battalion B. B. Steiber, Manager.

Not decided—Indianapolis, Ind Indianapolis Auto Trade Assn. John B. Orman. Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

TRACTOR SHOWS

Feb. 15-22—Minneapolis, Minn.

Feb. 18-22—Wichita, Kan. Annual Mid-west Tractor and Thresher Show. Wichita Tractor and Threshing Club. Forum.

Feb. 24-March 1—Kansas City. Mo. Fourth Annual Tractor Show. Sweeney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

RACES

March 15—Santa Monica, Cal Speedway.

May 17—Uniontown, Pa., probably 112½ miles.

July 5—Cincinnati, O., Speedway.

CONVENTIONS

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

Feb. 25-28 — Ninth American Good Roads Congress and 16th Annual Convention of the American Road Builders' Assn. Hotel McAlpin, New York.

April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago — National Foreign Trade Council Sixth National Foreign Trade Convention. Congress Hotel.

Capt. E. N. Purvis, Quartermaster Corps; First Lieut. E. A. Mechling, Quartermaster Corps; Mr. Ray Mackey.

Chicago, Ill., 1819 West Thirty-ninth Street—Col. Roy B. Harper, Cavalry; Capt. J. M. Griffith, Quartermaster Corps; Capt. John A. Bussian, Quartermaster Corps; Mr. Frederick C. Hack; Maj. E. J. Zimmerman, Quartermaster Corps; Maj. E. H. Caswell, Quartermaster Corps; Maj. George F. Mayer, Quartermaster Corps; Capt. J. C. Shugert, Quartermaster Corps; Capt. H. M. Rodgers, Quartermaster Corps; Capt. E. A. Hey, Quartermaster Corps; Capt. Edward Rosing, Quartermaster Corps; Capt. George H. Bussman, Quartermaster Corps.

San Francisco, Cal., Fort Mason—Maj. Gen. C. A. Devol, United States Army; Col. Charles A. Varnum, United States Army, retired; Mr. Clay Miller.

San Francisco, Cal.—Mr. William Thomas; Mr. Milton H. Esbert.

Baltimore, Md.—Maj. D. W. O'Neil; Maj. J. L. Beatie; Capt. S. T. Griffith.

New York, N. Y.—Lieut. Col. Benjamin L. Jacobson, Maj. Joseph E. Lee, Quartermaster Corps; Mr. William R. Collins; Mr. John H. Love; Mr. Henry Ittleson; Second Lieut. William C. Lovett, Quartermaster Corps.

Washington, D. C., Seventeenth and F Streets N.W.—Capt. W. J. Schaefer, Quartermaster Corps; Maj. H. A. Barnard, Quartermaster Corps; Capt. C. F. Young, Quartermaster Corps; Capt. R. A. Burbank, Quartermaster Corps; Mr. Ben J. Miller.

Signal Corps.

Board of Contract Review—Lieut. Col. R. H. Morse, Maj. R. A. Klock, Maj. J. R. Whitehead, Capt. Lawrence Thompson, Capt. S. M. Conant, Capt. W. S. Kelly, Capt. Milhau.

Chemical Warfare Service.

Board of Review—Maj. Gen. W. L. Sibert, Col. N. T. Bogart, Maj. C. C. Combs, Capt. William K. Jackson, Capt. H. S. Brown.

Board of Review, Gas Defense, New York City—Col. Besse, Maj. Schult, Capt. Kay, Lieut. Mitchell.

Board of Review, Gas Offense, Edgewood Arsenal—Col. William H. Walker, Maj. E. E. Free, Capt. R. D. Gordon.

Board of Review, Gas Development Division, Cleveland—Col. Dorsey.

Air Service.

Board of Review of the Bureau of Aircraft Production—Lieut. Col. A. C. Downey, Lieut. Col. H. S. Brown, Lieut. Col. F. E. Smith, Capt. F. B. Schnacke, Capt. S. M. Wiley.

Board of Contract Review of Division of Military Aeronautics—Lieut. Col. Harold Bennington, Maj. Edw. Burns, Maj. W. G. Roberts, Capt. Otis Van der Mark, Capt. William G. Dean.

Engineer Corps.

Board of Contract Review—Maj. C. M. Goodrich, Capt. H. L. Beach, Capt. M. B. Keeler, Capt. J. B. Hall, Capt. Grove Ketchum.

Construction Division.

Board of Review—Col. J. N. Willcut, Lieut. Col. J. N. Pease, Lieut. Col. H. F. Durant, Lieut. Col. L. L. Calvert, Maj. H. J. Burke, Maj. C. F. Neff, Maj. L. G. Kelly, Capt. C. N. Foster, Capt. William B. F. Manice, Capt. J. B. Hudgins.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 9

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, FEBRUARY 27, 1919

Fifteen cents a copy
Three dollars a year

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, N. Y., under the Act of March 3, 1879.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, FEBRUARY 27, 1919—CHICAGO No. 9

High Tariffs and Prohibitions Hold Industry Back

European Cars Will Benefit American Products—Internationalization of Product Needed—Need for Co-operation and Not Exclusion To-Day

By David Beecroft

NEW YORK, Feb. 25—The decision of France to prohibit the importation of automobiles for one year and the total war prohibition of England being continued indefinitely are about as sensible as our protective duty of 45 and 30 per cent on all automobiles imported into the United States. Imaginary fears and needless protection are at the bottom of the situation in all three countries.

Take the United States first: As the largest producers of automobiles and a country whose production has risen steadily until a year ago, instead of practically shutting out all foreign-built cars by our high tariff wall we would be better off to have a real liberal sprinkling of foreign-built cars sold throughout the country, yes some in each of the forty-eight states. A reduced tariff would make this possible.

The reason is not far to seek: Europe has been compelled to build with regard to the conditions of her people and surrounding conditions. The high price of fuel has given rise to the smaller engine of high efficiency. The individualistic nature of her people has led to a luxury and comfort in body design that is not known in America. The national British characteristic for reliability and roadability has resulted in a class of workmanship that is very desirable. The limited pre-war incomes of many car owners made it necessary to have vehicles of relatively low maintenance cost. Low maintenance cost has resulted in certain character of accessibility that can be imitated to advantage.

France has operated along similar lines. So has Italy. For years we have recognized the development that France and England and Italy and Germany have achieved in racing automobiles. We have liberally copied European designs in all aspects. Our industry got its foundations in these countries.

Ten or 20,000 automobiles from these countries would be a healthy leaven among the 1,500,000 automobiles our own makers are distributing annually in our forty-eight states. The value of these machines would have an influence on our automobile design. Let them come in and compete with us and if they are better than ours we have the opportunity of making such a discovery rather quickly. If they are superior we should be quick to take advantage of those designs that are responsible for such, just as it was necessary for us in automobile racing to fashion our racing machines very closely after those of Europe and endeavor to improve on the European design wherever possible or keep out of racing.

We have a much better opportunity of discovering the good qualities of these foreign machines by having a healthy supply of them in our midst, where

we can get accurate records on them on all our road conditions, than if we shut them out of our country and only get a line on them from their performances in South American countries, Africa, Australia, India, Japan, or other parts of the world. Let us meet them at home and learn of them here.

Question of Low Clearance

Some have argued that the European car cannot be used on our roads excepting in a few of our larger cities. If this is the case we have little reason to fear, but as a matter of fact, there are two sides to this argument. We argue that the low-clearance European automobile cannot possibly operate on our roads in the grain belt. The European engineers say that their clearance is such that they can operate successfully and that to have a low body on an automobile does not necessarily mean reducing the necessary clearance. We should find this out in America rather than in Chili.

European designers and manufacturers have no little fun at our expense in the matter of body design. They put it aptly when they remark: "You sit in a European car but on an American car." There is more truth in the remark than many of us wish to admit. We learned a lot from European racing cars that came to this country. The development of the Liberty aviation engine was to quite an extent due to the European racing cars that came to America in the two or three years previous to the war.

Had we shut such racing vehicles out we would have paid a heavy penalty for the prohibition. Let us be careful that we do not shut out a lot of good things in the European automobiles which while not selling anything like so cheap as ours have a lot of merit in them, and perhaps the best step in progress might be abstracting some of the good qualities from these cars, reshaping them to American production and factory methods and thus going one step farther in our great accomplishment of making a better low-priced automobile. We have much to learn in body design and Europe can teach us a whole lot.

Does Not Need Tariff Wall

American automobile makers do not need the 45 and 30 per cent tariff wall to protect them to-day. It seems gravely possible that this tariff wall has shut out more good in the way of quicker progress than it has afforded good through its scheme of protecting our makers from foreign invasion. It was necessary in early days when we could scarcely walk.

We had the high tariff walls because of cheaper European labor, but the war has altered labor costs and while we still lead in high-priced labor the difference is not so great as it was in 1914. What we lose in labor costs we more than make up in production methods and production machinery.

Looking now at the case of the British and the French as well as the Italians: The French and British have asked for complete protection by way of total prohibition in order, as they put it, to get turned around after the war. This is true with regard to many of the factories and so the rule must be for the benefit of all. But in these countries they are to-day shutting out automobiles that their people want, namely, lower-priced machines than any of the makers in these countries are preparing to produce. This does not look so much like protection for the benefit of any class of maker so much as a failure to recognize that in England and France there are tens of thousands of people who want very cheap automobiles, but which are not made for them in their own country, and which the makers are not taking definite steps to produce. In both of these countries the automobile manufacturer built for the classes more than for the masses, and yet to-day, after the war, we fail to find much greater recognition of the farmer who wants the utility car. The European post-war program by price is still for the classes, the people of wealth, rather than for the masses. Total prohibition does not remedy such a situation.

European Plants in Good Condition

The majority of these European factories are in a much better position to-day than American factories. This is particularly true speaking financially. They have been on war work for 4 years and in some cases longer. After making great factory expansion they had 2 and 3 years to make good war profits out of the expanded plants, whereas those American makers who made heavy expansion enjoyed the fruits of such for a very brief time. We have some makers who did not have 6 months production in their new or expanded plants. They got the plants but not the profits out of them.

It is quite common with the expanded French factories to write them off at the value of 1 franc, 20 cents, in the financial report of the company. This is true with many of them. It also applies to some of the British and Italian factories. These factories cannot ask for total protection through total prohibition for financial reasons, but in most cases because of lack of preparation for post-war work, and yet they do not in scarcely a case contemplate that low-priced production which they are shutting out. Their present prohibitions are preventing certain masses of their peoples from purchasing vehicles that the makers in these countries are rarely if ever planning to provide. Again the shutting out process does not appeal as a specially rational one. It is about on a par with the wall on the west side of the Atlantic.

Lock Out More Than We Lock In

Some steps in a general re-adjustment might be made to the advantage of all. There are factors in our cars that European makers want and there are factors in European automobiles that our makers are in need of. An interchange is desirable. A fair exchange never has been robbery, nor will it be in this instance. The more we apply the total-prohibition-of-cars order to merchandising the further off do we keep the exchange of ideas. The more we apply total prohibition the more we shut out automo-

biles, but also the more we shut out engineering and manufacturing experience. It becomes an international application of that threadbare epigram on the locked-door of the engineering department, namely, "we lock more out than we lock in."

The automobile as well as the motor truck, the airplane, the farm tractor, the motorcycle and the motor boat are international in their usefulness. Our automobiles from a Detroit factory go to forty countries of the world, they go to every country. The automobiles from other countries will go to every land on the globe. There are only five or six countries that have to supply all of the other countries with their automotive apparatus. The world is large and there is abundance of money in it to buy twice as many cars as are sold to-day or any day, month or year up to the present.

The major objective is to make it easier for the world to buy, operate and maintain automotive apparatus. It is not nearly so easy to-day as it should be and if manufacturers of different countries got closer together and knew more about each others products and talked the industry more it would be better for all.

An Example

Take a case in question: European makers are all installing electric starting and lighting equipment. This means a battery for each car. England has twenty-three different battery makers, nearly all of whom are working to any standard the automobile maker insists upon. France has its quota of makers and so has Italy. Some of the automobile companies are manufacturing their own batteries. Add to this the numerous battery models in America and then for a few minutes transplant yourself to Cape Town, or Sydney, or Buenos Aires, and imagine you are a dealer handling an English, a French, an Italian and an American car. Perhaps you have two or three different models of each make with a different shape of battery for each. To make it easy to operate all of the different models you sell you must carry a liberal stock of all these battery sizes on hand and in doing so you are tying up capital, and in a word you are paying the bill for this lack of international standardization, but with true business characteristic you pass it on to the consumer and he eventually pays the price. It is not so easy for that consumer to own and operate an automobile as it should be.

The Question of Tread

The situation might be analyzed further with regard to tires, spark plugs, headlights, electric bulbs, tail lights, etc.

A further case in question is that of tread. What walls of sales resistance we would be erecting if Italy undertook to merchandise export models with 60-inch treads in several countries that might insist on such. How much better for all concerned that Italy should market cars with 56 or 57-inch treads. With this there is no wall of sales resistance built up that American makers have to wage constant merchandising attacks against and vice versa.

What walls of sales resistance would be immediately knocked down if the rules of the road were internationalized just as the rules of navigation on the sea are internationalized and just as the rules of navigation in the air are to be internationalized! When different rules of the roads first sprung into use the vehicles then used could be driven on either side of the road without any changes being made, but when the motor car arrived with its steering gear it was necessary to mount it on one side for England and on another side for America. If all countries agreed on the laws of using the road a wall of sales resistance would be quite eliminated and manufacturing costs would be reduced as well as sales costs. The tail light could be then put on one side for all vehicles. It would be easier for more people to own automobiles.

Prohibition Separates U. S. and Great Britain

When the different countries in the Commonwealth of Australia built their railroad systems they built them selfishly for their own country only. New South Wales built for herself only, and Queensland and Victoria and the other political divisions did likewise. Each used a different tread so that one locomotive cannot travel over the lines in any other country. It was a beautiful scheme of exclusion and prohibition that is to-day costing the commonwealth millions annually and will continue to do so until the treads are standardized. The longer the day of transition to a standard is put off the more expensive will be the task.

The same is true of automotive apparatus. The more Great Britain shuts herself up unto herself; the more France builds walls around herself; the more Italy does; and the more the United States does, the more are all of these great producers keeping apart at the very time when they should be getting closer together. Instead of prohibition, greater interchange of ideas is needed.

America Sold to High-Gear Cars

If we are afraid to let French, British and Italian cars into our midst and they have the same attitude toward us, it is a case of all four having about the same imaginary fears. If the European car is not suited for our agricultural areas because of low clearance, lack of horsepower, and lack of high-gear performance, then it is not necessary to shut it out, because those who attempt to sell such vehicles will find out that they cannot be sold, if all these charges are true. On the other hand if we find that their lower and more comfortable automobiles are suitable for our highways then we should be quick to adopt such features and incorporate them into our designs and re-shape them for our conceptions of production. To-day America is sold to the high-gear car for every hill. Europe changes gears and claims many advantages for it.

A goodly supply of European cars might serve to convince us that some modification might be highly desirable and would not be followed by great sales resistance.

Europe is not going to be able to permanently

(Continued on page 506)

Experimental Design and Testing of Airplane Ribs

Testing Machine Used in Determining Wing Rib for Glenn L. Martin Company's Twin Engined Bomber Distributes Load as in Flight

By George B. Fuller and Lessiter Milburn

THE function of the rib in an airplane is to carry the load with the least possible distortion and with the proper factor of safety.

Inasmuch as no mathematical solution is readily applied to the average airplane rib, a method of experimental design was adopted to produce a rib which should meet the requirements with the least possible weight, and at the same time utilize the least possible time, labor and material expense in production.

The airplane rib is, at best, a very light and non-rigid member. The rib shown in Fig. 2 has a 94-in. chord, is ½ in. wide, weighs 11½ oz. and carries and ultimate load of not less than 555 lb. This rib was the final selection from the results of a series of tests made upon ribs of various types which were designed by approximate mathematical methods.

The conditions demanded of a rib-testing machine follow:

1—A rib-testing machine should hold the rib and apply the load in the same manner as the air load when the rib is in the wing.

2—The distribution of the load along the chord must not vary from the predetermined load grading when the rib deflects as the load is applied.

3—The machine should be so arranged that the load may be varied from zero to the breaking load, and an accurate means of measuring the load at any point must be provided.

4—An accurate means of measuring the distortion of the rib under load should be provided.

As the load on the rib varies continually with the varying angle of incidence of the wing, the most severe case was chosen. The supports of the rib, also, are not all the same. At or near the drift struts the ribs may be said to have a fixed or rigid support, while near the center of the bay, the rib supports may be considered as not being fixed, due to the spring of the beam. In these tests a non-rigid support was used

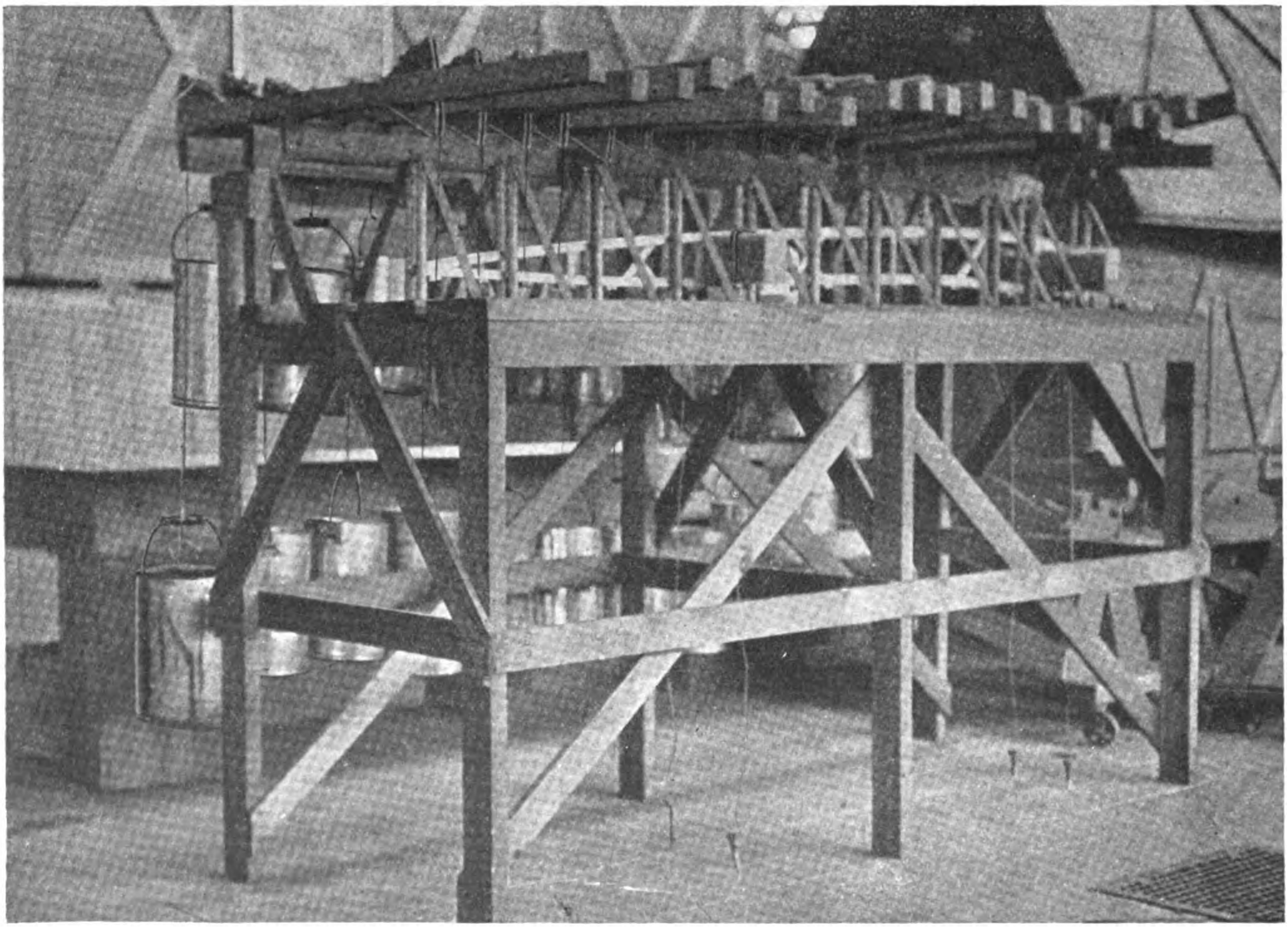


Fig. 1—General view of the testing machine with the rib mounted in place for test

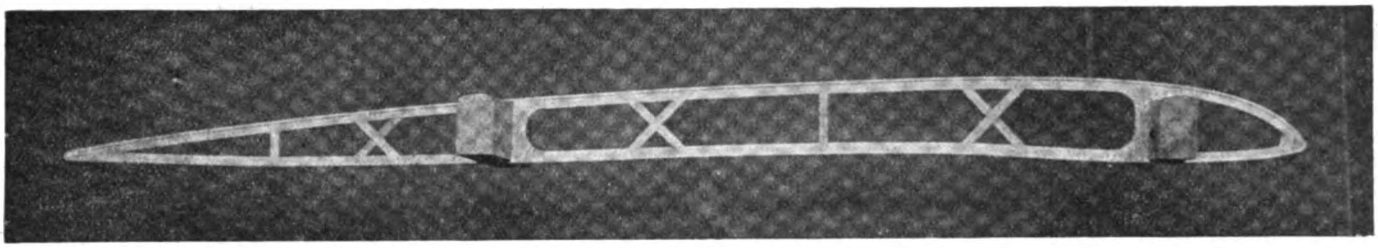


Fig. 2—The final rib selected from the results of the tests has a 94-in. chord, weighs 11½ ounces and carries an ultimate load of not less than 555 lb.

after the first five tests, to give the most severe condition.

Bearing in mind the above conditions of loading and methods of fastening, there were some five methods of applying the load to be considered, as follows:

1—A system of equalizing levers, linked together, which would distribute the load over the rib, the lengths of the levers being proportioned to give proper loads at the points required.

2—A system of loading the rib, through rubber bands of varying strength, to agree with the load-grading curve.

3—A system of springs used in the same manner as the rubber bands.

4—A system of hydraulic cylinders, the area of each being proportional to the load, as taken from the load-grading curve at the particular point, all having the same pressure.

5—A system of levers resting on knife edges, each lever being independent of any other and having its own load applied in a pail, or the like.

After a number of sketches had been made and the points of advantage and disadvantage of each of the above methods fully considered, the fifth or last method was adopted and used in all the following tests.

Description of the Machine Used

Several views of the machine are shown, in Figs. 1, 3, 4 and 5. It was constructed of wood, with a platform at about the height of a man's arm, on which the rib was to be placed. Guides of ¾-in. pipe were secured to the platform to maintain the rib in a vertical position, as shown in Fig. 4. At the rear of the platform knife edges were mounted on a horizontal beam. Over these knife edges twenty ash levers were set, each having a metal plate to take the knife edge, Fig. 3. Both ends of these levers were cut in the form of an arc, having the center at the knife edge, so that the lever ratio was always the same. At the rear end of each lever a pail was attached and the front ends were connected to the stirrups by wires, Fig. 4. The lower end of the wire was slipped through the stirrup, bent up and secured with a small washer so that the stirrups could be readily fastened to the wires. The distance from one stirrup to the next was 4.7 in. Each lever was counterbalanced with a weight, so that when the pails were empty the lever rested evenly on the knife edge.

To reproduce the condition of non-rigid support of the ribs mentioned above, the test ribs were made up on dummy spars as shown in Fig. 2. Two U-bolts were passed over each spar and connected to the floor by steel cables, leaving the spars free to move without respect to each other.

Method of Loading

The load may be applied by putting either water or sand in the pails. When the machine was designed it was intended that a water load be used. A tank was to be placed over the loading pails with twenty lines of hose, one leading to each pail. In the end of each hose a nozzle was placed having an exact diameter and calibrated for various heads. The diameters were such that the water would flow into the pails according to the ratio established from the load grading curve. The flow of water was to be controlled by a gate valve operating on all the lines of hose at the same time.

On account of delay in securing apparatus for water loading, sand loading was substituted. A small measure was made for each of the load pails, and the capacity of each cup was so proportioned that when one round of cups of sand had been poured into the pails the pull on the stirrup was in agreement with the load-grading curve chosen.

In order that the size of pail used would not be too large, it was necessary to adopt three ratios of leverage for the levers. Beginning with the leading edge of the rib, the first six levers were made with a ratio such that the pull on the stirrup was three times the load in the pail. The next seven levers had a ratio of two to one, and the last seven, one to one. The three sets of knife edges may be noticed in Fig. 3.

Operation of the Machine

The rib being assembled and secured to the dummy spars ready for test, twenty small grooved blocks were tacked along the lower edge as seats for the stirrups, to prevent crushing of the cap-strip and to simulate the sewing of the fabric to the rib, as done in the wing. The rib was placed on the platform of the machine, between the guides, and the stirrups

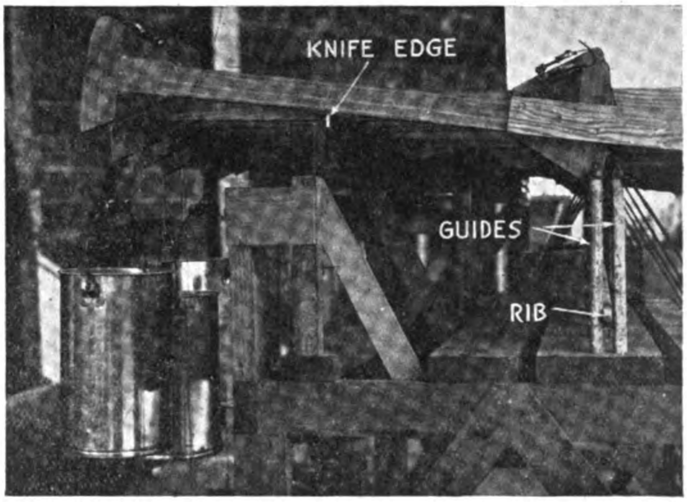


Fig. 3—Detail of airplane rib-testing machine showing the knife edge which supports the system of levers

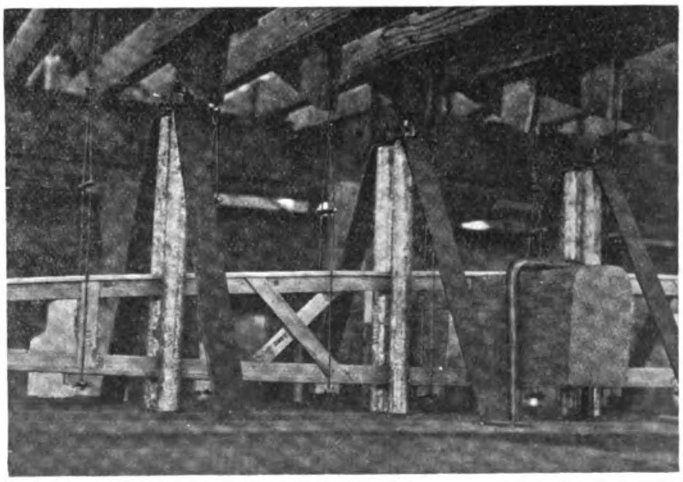
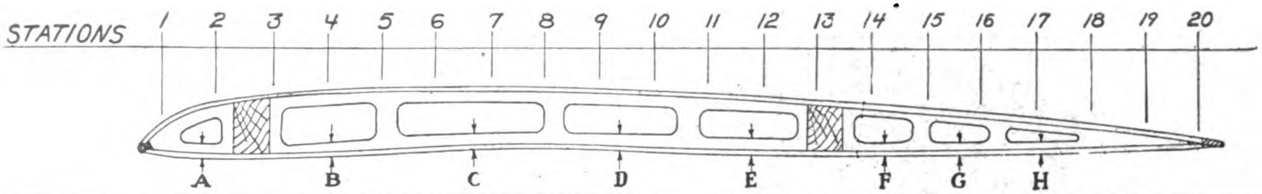


Fig. 4—Close-up showing the method of holding the dummy beams, guide bars and stirrups



Results of Tests on Airplane Ribs

Conducted in the Glenn L. Martin Laboratory

Rib No.	Type	Web (Between Beams) Material	Grain	A	B	C	D	E	F	G	H	Portals	Tail	Nose	Capstrip-Spruce, 3/16 by	Beams Fastened	Weight, Oz.	Load Total, Lbs.	Factor of Safety	Inches Total Deflection Divided by F.S./2	Failures Station	Cause	Remarks
1	A	5/32 birch veneer	Horizontal	1/2	5/8	1/2	1/2	1/2	5/8	1/2	1/2	Cut out horizontal grain	5/32 veneer	5/32 veneer	5/8 plain	Rigidly		358	4.8		9-bottom	Shear	Method of fastening true only for ribs close to box ribs and drift struts.
2	B	5/32 birch veneer	Horizontal	1/2	5/8	1/2	1/2	1/2	5/8	1/2	1/2	Cut out, horizontal grain, with vertical side-strips	5/32 veneer	5/32 veneer	5/8 set-in	Rigidly	15	624	8.4	.077	12-bottom	Bending	Method of fastening true only for ribs close to box ribs and drift struts.
7	B	5/32 birch veneer	Horizontal	11/16	13/16	1/2	1/2	11/16	5/8	1/2	1/2	Cut out, horizontal grain, with vertical side-strips	5/32 veneer	5/32 veneer	5/8 set-in	From floor	16	383	5.2	.104	11-bottom	Shear	Humps over portals for last third of load.
8	B	5/32 birch veneer	Horizontal	11/16	13/16	1/2	1/2	11/16	5/8	1/2	1/2	Cut out, horizontal grain, with vertical side-strips	5/32 veneer	5/32 veneer	5/8 set-in	From floor	16	322	4.4	.094	13-bottom	Shear	Veneer had diagonal grain at point of failure.
9	C	3/16 spruce	Horizontal	3/4	1 1/16	3/4	3/4	1	3/4	5/8	1/2	Cut out, horizontal grain, with X side strips	3/16 spruce double-side strips	3/16 spruce cut-out	5/8 set-in	From floor	19 1/2	350	4.7	.061	Portals	Shearing	Turning moment between upper and lower sides sheared portals.
10	B	5/32 veneer	Vertical	5/8	13/16	5/8	5/8	11/16	5/8	1/2	1/2	Cut out, vertical grain, with double vertical side-strips	5/32 veneer vertical grain	5/32 veneer vertical	5/8 set-in	From floor	16 1/2	274	3.7	.135	11-bottom	Bending	Sharp failure.
12	B	5/32 veneer	Vertical	5/8	13/16	5/8	5/8	11/16	5/8	1/2	1/2	Cut out, vertical grain, with double vertical side-strips	5/32 veneer vertical grain	5/32 veneer vertical	5/8 set-in	From floor	16 1/2	275	3.7	.136	11-bottom	Bending	Sharp failure.
13	C	3/16 spruce	Horizontal	3/4	1	3/4	3/4	1	3/4	5/8	1/2	Cut out, horizontal grain, with X side strips	3/16 spruce double-side strips	3/16 spruce cut-out	5/8 set-in	From floor	18 1/2	600	8.1	.053	3-top gusset	Bending	Shape good to 450 lbs., then humped in center (secondary failure at Sta. 13).
15	B	5/32 veneer	Horizontal	3/4	1	3/4	3/4	1	3/4	5/8	1/2	Cut out horizontal grain, with double vertical side-strips	5/32 veneer horizontal grain		5/8 set-in	From floor	20 1/4	660	8.9	.050	3-bottom gusset	Bending	Humps over central portals.
16	B	5/32 veneer	Horizontal	3/4	1	3/4	3/4	1	3/4	5/8	1/2	Cut out horizontal grain, with double vertical side-strips	5/32 veneer horizontal grain		5/8 set-in	From floor	20 1/4	868	11.7	.017	13-bottom gusset	Shear	Shape good throughout, failure sharp.
17	B	3/16 spruce	Horizontal	3/4	1	3/4	3/4	1	3/4	5/8	1/2	Cut out horizontal grain, with double vertical side-strips	3/16 spruce, no side-strips	3/16 spruce	5/8 set-in	From floor	18 1/2	459	6.2	.018	14-tail	Bending	Tail portals weak without side strips. Tail portals sheared at about half load.
18	C	5/32 veneer	Horizontal	1/2	1	1/2	1/2	1	5/8	1/2	1/2	Cut out horizontal grain, with single X side-strips	5/32 veneer, no strips	5/32 veneer	5/8 set-in	From floor	15 1/2	378	5.1	.077	9-10 bottom	Local	Central X portals weak, and crumpled under eccentric load.
19	D	3/16 spruce	Horizontal	3/4	7/8	7/8	7/8	7/8	3/4	5/8	1/2	Built up spruce 3/4x3/16 single X, wrapped and doped	5/32 veneer no strips	5/32 veneer	9/16 set-in	From floor	19 3/4	662	9.00	.072	5-top	Bowing of portal	Central X portals weak, and crumpled under eccentric load. Portals bowed out at about 425 lbs. load.
20	D	1/8 spruce	Horizontal	3/4	7/8	7/8	7/8	7/8	3/4	5/8	1/2	Built up 3/4x3/32 veneer, double X, wrapped and doped	5/32 veneer no strips	5/32 veneer	1/2 set-in	From floor	17	637	8.6	.046	5-top	Bowing of portal	Front portal crumpled inward at about 575 lbs. load.
21	D	1/8 spruce	Horizontal	3/4	7/8	7/8	7/8	7/8	3/4	5/8	1/2	Built up 3/4x1/8 spruce double X, wrapped and doped	5/32 veneer no strips	5/32 veneer	1/2 set-in	From floor	16	705	9.5	.041	5-top, web & cap.	Local	Humps over portals. X portals had a 1/4" block at their cross points to bow them out in center.
22	E	1/8 spruce	Horizontal	3/4	3/4	3/4	3/4	3/4	3/4	5/8	1/2	Built up 7/64x5/8 spruce double X, & vertical	5/32 veneer no strips	5/32 veneer	1/2 set-in	From floor	14	533	7.2	.016	12-web bottom	Split	3/32 mahogany veneer beam gussets. Beam brace blocks partially cut away.
24	F	1/8 spruce	Horizontal	7/8	7/8	7/8	7/8	7/8	3/4	3/4	3/4	Built up spruce 3/32x5/8 double X, & vertical	3 vertical spr. portals	3/16 spr.	1/2 set-in	From floor	13 1/4	624	8.4	.044	4-5 bottom	Shear	
25	F	1/8 spruce	Horizontal	7/8	7/8	7/8	7/8	7/8	3/4	3/4	3/4	Built up spruce 3/32x5/8 double X, & vertical	3 vertical spr. portals	3/16 spr.	1/2 set-in	From floor	12 1/4	610	8.2	.016	5-bottom web	Splitting	Horizontal spruce beam gussets.
26	G	1/8 spruce	Horizontal	7/8	7/8	7/8	7/8	7/8	3/4	3/4	3/4	Built up spruce 3/32x5/8 double X & vertical	3 vertical spr. portals	3/16 spr.	1/2 set-in	From floor	13	509	6.9	.017	3-bottom web	Splitting	Vertical spruce beam gussets.
28	H	1/8 spruce	Horizontal	3/4	7/8	7/8	7/8	7/8	3/4	3/4	3/4	Built up spruce 3/32x5/8 double X, & vertical	2 vertical spr. portals	3/16 spruce	1/2 set-in	From floor	11 1/4	626	8.5	.046	3-4 bottom web	Splitting	Tail took strong crescent shape. 3/32 mahogany veneer beam gussets.
29	H	1/8 spruce	Horizontal	3/4	7/8	7/8	7/8	7/8	3/4	3/4	3/4	Built up spruce 3/32x5/8 double X, & vertical	2 vertical spr. portals	3/16 spruce	1/2 set-in	From floor	11	665	9.0	.011	14 tail	Bending	Tail took strong crescent shape. 3/32 mahogany veneer beam gussets.
30	I	1/8 spruce	Horizontal	3/4	7/8	7/8	7/8	7/8	3/4	3/4	3/4	Built up spruce 3/32x5/8 single X & vertical Type 1	spruce, single X, & vertical	3/16 spruce	1/2 set-in	From floor	11 1/2	546	7.4	.016	3-4 bottom	Shear	3/32 mahogany veneer beam gussets.
32	Hand. Page	1/8 spruce	Horizontal	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	3/32x1/2 vertical spruce, with diag. tension strips			1/2 set-in	From floor	10	436	5.9	.037	3-tension strip	Torn loose	
33	Hand. Page	1/8 spruce	Horizontal	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	3/32x1/2 vertical spruce, with diag. tension strips			1/2 set-in	From floor	10	370	5.0		3-tension strip	Torn loose	
34	Hand. Page	1/8 spruce	Horizontal	Rib No. 33 was rebuilt with screws, but did not show fair test													10	250			3-web split		
35	I	Made in production, same as Rib No. 30, Type I														From floor	12	615	8.3	.035	4-bottom	Bending	
36	I	Made in production, same as Rib No. 30, Type I														From floor	12 1/4	451	6.1	.050	5-top	Splitting	Web at 4, 5, 6 had diagonal and spiral grain.

were attached to it. The stirrups were then attached to the levers, and the balance of the levers checked as a precaution. The four U-bolts were put on and connected to the steel cables leading to the floor, the lengths of the cables being adjusted so that all four would become taut at about the same time. The guides were fastened so that the rib would just slide easily between them. The purpose of these guides was to approximate the condition in the wing, where the ribs are cross-tied with tape and sewed through the wing every 2 or 3 in. with a stout linen cord to prevent them from twisting out of the vertical.

One round of cups, or measures, of sand of a fine, dry grade was placed in the loading pails to take up all slack in the wires, cables and stirrups. The total load on the rib at the end of one round was 41 lb., distributed in this case according to the load-grading curve shown in Fig. 6. A steel scale was placed at the center of the rib and a reading point selected and marked on the rib-web.

A second round of cups was then poured into the pails, and a reading taken on the scale, for the purpose of comparing the relative rigidity of various ribs. The loading was continued by rounds, until failure occurred, the contour, and weak points of the rib being carefully observed meanwhile, together with the readings for rigidity. At stated points during the loading, as, for instance, at normal load, at two, four, six, or eight times normal load, photographs were taken of the rib. By comparing tracings, made from these photographs, with the natural, free outline of the rib, an accurate measure of the rib contour under stated loads was obtained.

When the rib failed, the point, and probable cause of failure were noted. Fig. 5 shows a typical fracture.

After failure, the amount of sand in each load pail was carefully determined, and the weight recorded with the pail number. From these weights, the total load on the rib was checked, and also the distribution of the load by means of a curve, plotted with the loading points as abscissae, and the pail weights as ordinates. This curve will have the same form as the load-grading curve, if the test has been properly carried out.

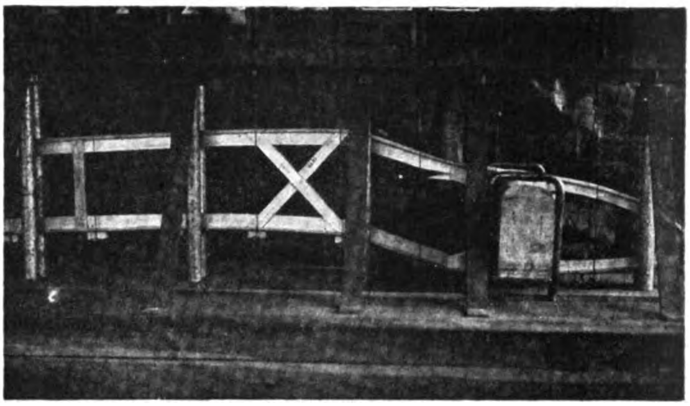


Fig. 5—Failure of rib showing the effect of spiral and diagonal grain spruce

The time required for test was three to five minutes, which was the disadvantage of using sand, instead of water. The water load can be applied in any time, down to about 15 seconds, by enlarging the orifices in the nozzles, or increasing the water-head.

After test, the rib was removed from the machine, detached from the dummy beams, and weighed in fractions of an ounce.

Progress in Design

The method of experimental design is at best a "cut and try method." The first five ribs were designed by approximate mathematical methods. All the others were an evolution from them by making a study of the action of the rib during the test to destruction, and either making the weak section stronger and the strong sections lighter, or by redesigning the various details of the rib, which failed, or showed extra strength, to secure the desired results.

Ten types of ribs were experimented with, nine of which are shown in Fig. 9, the tenth being the well-known Handley-Page type of rib. Thirty-four ribs were made and tested before a satisfactory rib was produced. Since production has been in progress, a number of tests have been made which are not shown in the table.

All the ribs tested were loaded according to the air loading shown in Fig. 6. This chart also shows an average typical loading, the result of a test, and gives a good idea of the small error in the loading by this method of testing. While this error may seem to be large at some stations along the chord of the rib, it is known by actual weight and no interpolation is necessary to find the load at any station.

The following table gives a complete analysis of this difference between the sand loading and the air load curve selected. The average difference over the stations is

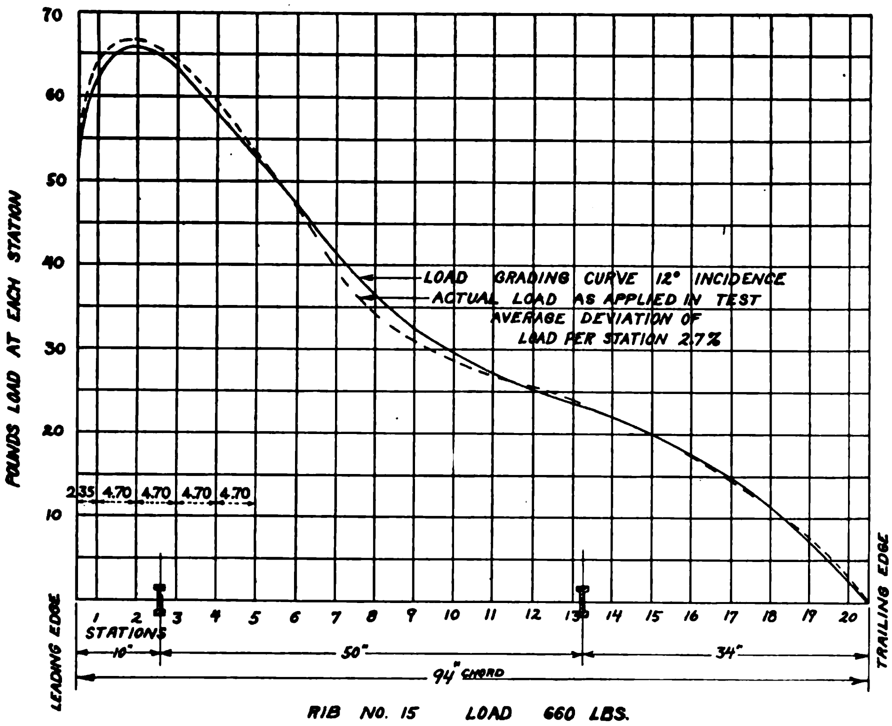


Fig. 6—Curve showing the distribution of load along the rib

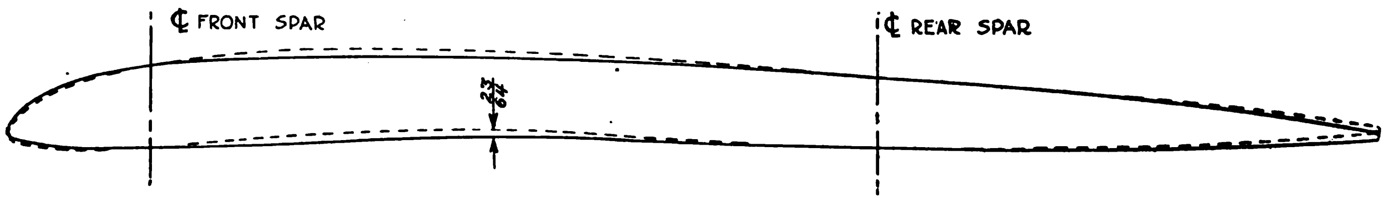


Fig. 7—Rib section to scale obtained by tracing photograph showing total deflection under distributed load

.78 lb. The average difference in per cent is 2.7 and appears largely to be due to the loading at station 20. If we neglect station 20, the average per cent of error is 1.8 per cent instead of 2.7 per cent.

Types of Ribs Tested

The large table on page 458 illustrates the various types of ribs designed and tested, and gives a complete detail of each rib as to material used and the dimensions.

Type "A" was designed along the standard type of rib generally used. It had a 5/32 in. birch veneer web with the grain of the outer ply running horizontal. The cap-strips were 3/16 x ⅝ in. selected spruce.

Type "B" is the same as Type "A," except that reinforcements were put on the web to prevent buckling. Ribs 2 to 8, inclusive, were of this same type and material, 7 and 8 being a little heavier than the others. These ribs also showed a strong tendency to bend in the horizontal portion of the rib at each portal near the vertical portion of the web.

Type "C" is the same general design as Type "B." The web in the center, nose and tail sections being of 3/16 in. thick spruce instead of 5/32 in. veneer. The "X" bracing was put on the web between each portal. In the tests this prevented the shearing of the webs and leads to the next type.

Type "D" is similar to Type "C," except that the portalled web is replaced by the "X" brace of veneer and a thin strip of spruce next to the cap-strip shaped to conform to the curve of the wing section, this strip with the cap-strip forming a "T" section. The cap-strips were reduced from ⅝ x 3/16 in. to 9/16 x 3/16 in. and again to ½ x 3/16 in.; also the web thickness has been reduced from 3/16 to ⅛ in. thick. The shape of the "X" brace will be seen. It was taped and doped to prevent any shearing tendency. Veneer gussets 3/32 in. thick on both sides of the web next to the beams are used to take up part of the bending.

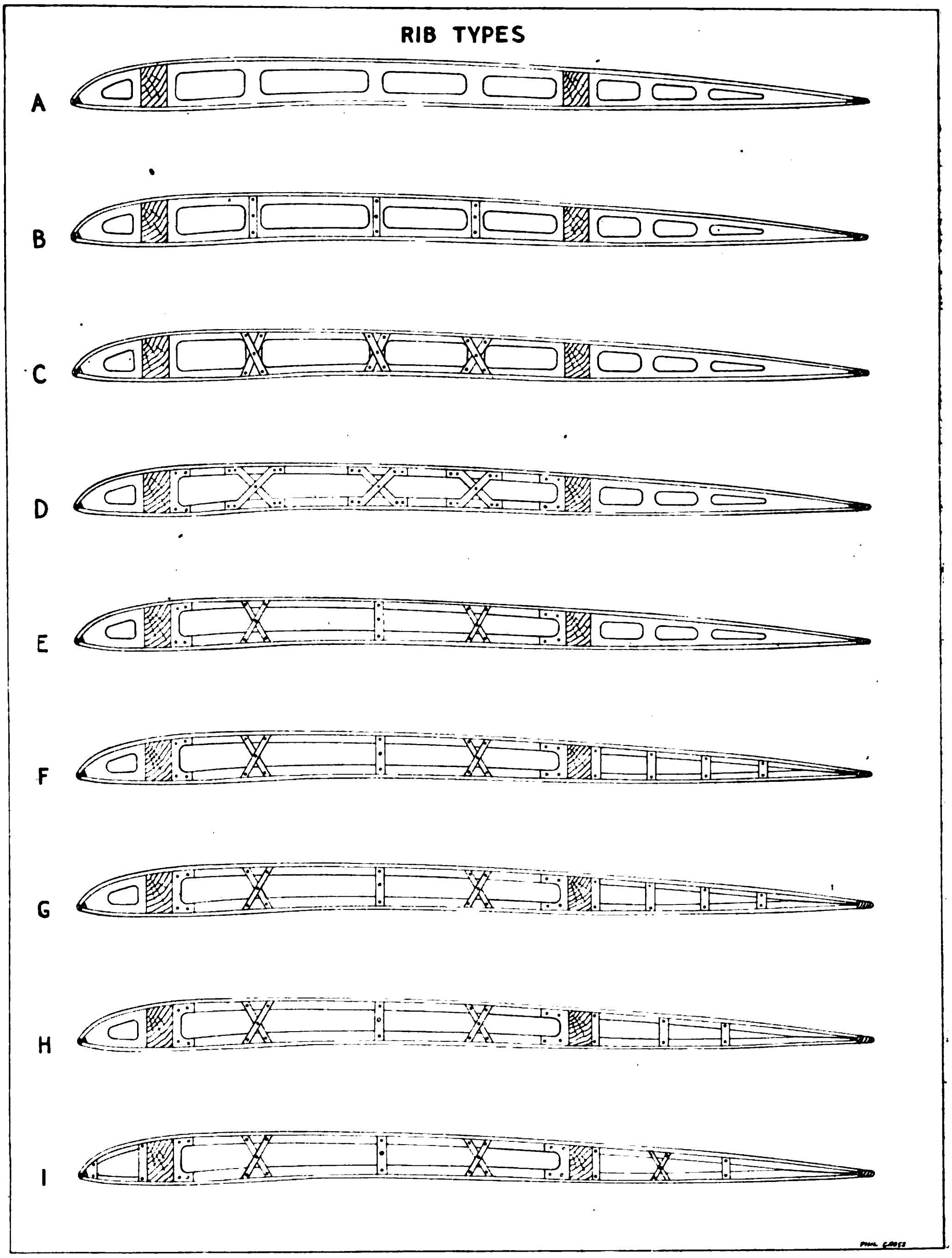


Fig. 9—Various types of ribs tested. The reference letters are those used in the table on page 458

From the table, page 458, it will be noted that the size of the cap-strips is ½ x ⅛ in., and that the central "X" brace was replaced with a vertical brace. This now makes two sets of "X" bracings in the center section. It might be noted here that the "X" bracing and the single vertical bracing are double, one on each side, separated by a block ½ x ½ x ⅛ in.

Type "F" is a marked departure from all previous types, in that the portalled section at the rear of the rear beam is replaced with a built-up section similar to the center section. Vertical grain spruce gussets were substituted for the veneer gussets next to the beams on the central section.

Type "G" is the same as Type "F," except that horizontal grain spruce gussets were used instead of the vertical grain. On trial the spruce gussets proved to be unsatisfactory.

Type "H" has veneer gussets on the central section, but had only two verticals in the tail section and, as in Type "G," the tail section took a marked crescent shape showing the necessity of an "X" brace to take the shear.

Type "I" is similar to Type "H," except that it has one "X" brace in the tail. The section in front of the front beam is built up of strips similar to the center and tail sections. This type of rib is the one used in all the airplanes so far produced by The Glenn L. Martin Co. It is made entirely of spruce, except for the four small gussets, next to the wing spars, which are 3/32 in. veneer.

Only two ribs of the Handley-Page type rib were made and tested. At this time it was decided not to carry the experiments any further, but to use Type "I" rib, as it made a very good production job and was found to be equally strong for normal flight as well as for upside down flying.

Since the table was made, a large number of tests have

(*Continued on page* 489)

Airships Practical for Commercial Use

Valuable for Trans-Oceanic Flight or for Difficult Country—Can Be Supplemented by Airplane for Short Haul Work

"A CONTINENTAL airship service could be run from Lisbon to New York, passengers being taken to Lisbon from Paris, Rome, etc., by airplane."

This is only one of the statements which appear in the report on Airships for Commercial Purposes, issued by the Air Ministry of Great Britain. Official statistics show that only one airship has been lost in England owing to catching fire in the air, although 83,360 hr. have been flown and over 2,500,000 miles covered during the war. In the case referred to the flight was an experimental one with a new type of ship, and the cause has since been ascertained and eliminated.

In a matter-of-fact way the official report of the Air Ministry covers some of the most startling developments in aerial navigation. It is impossible to read through the report without the feeling that we are just on the verge of utilizing the air as a medium of transportation to an extent which was not dreamed of before the war. When thinking of flight, it has become customary with us to think of the heavier than air machine, or airplane, but the airship has been developed to an extent which has not been generally realized, and it appears from a study of the British report that the Air Ministry is well aware of the relative advantages of each and of the particular fields in which each can do its work.

The Relative Advantages of Airships and Airplanes

In view of the different characteristics of airships and airplanes, it appears that the future uses of the two types for commercial purposes will not conflict. The airship is essentially a long-distance weight-carrying craft as compared with the short-distance high-speed airplane. It should be noted, however, that even in the matter of speed the airship of to-day with a speed of 77.6 m.p.h. can be considered slow relatively to the airplane, as she is unquestionably fast in comparison with land and sea methods of transport. In addition to this the airship has the advantage of not being dependent upon her speed through the air for her ability to remain aloft, and is not, therefore, liable to forced descent in case of engine failure, as is the airplane. Quite large repairs to engines, such as the changing of a cylinder, are possible in an airship.

The airship, then, is worthy of consideration for commercial flights over sea or land of a wooded or broken nature, such as to be unsuitable for the landing of airplanes, and on journeys involving non-stop flights of 1000 miles and upward. In addition to this, airships are the most suitable aircraft for the carrying of passengers, where safety, comfort and reliability are essential. An airship can remain aloft while engine repairs are effected; she always remains on an even keel, and there is, therefore, no danger in flying at night or in fogs or clouds, and the great lift permits of much more comfortable accommodation being provided than is possible in an airplane, there being room to move about. In the case of a rigid airship, for example, a walk of 400 or 500 ft. may be taken along the keel. The fact that the envelope is filled with an inflammable gas need not cause any misgivings as to safety, when one remembers the large number of motor vehicles which have been used during the war carrying bags filled with equally inflammable coal-gas at no greater distance from the engine than in the case of the airship.

Airship Stations for Trans-Oceanic Traffic

It appears that for commercial purposes large rigid airship stations should be established at distances of 2000 to 3000 miles apart, mainly for trans-oceanic traffic, while the airplane would be used for bringing passengers and merchandise to these from the neighboring countries. In this way the airplane would compete with the train and the airship with the steamship, over which she would have the advantage of reducing the average time of transit by at least 50 per cent. In addition to this airships would be used for linking up the railways in such places as Central Africa, where the country is difficult both for airplanes and land transport.

It is worthy of note that, though airships are generally considered to be fair-weather craft, up to the end of November there were only nine days in 1918 when no airship flight took place in the British Isles—which are notorious for possessing almost the worst weather conditions of any country in the world. The airship is able to fly on days when fog or low-lying clouds are prevalent, which might be considered unsuitable for airplanes.

Features of Latest German Rigid Airship

In long voyages, advantage could be taken of favorable winds and the routes chosen accordingly. Owing to her long endurance, an airship could afford, should a depression be met with, to fly either over or round it.

The latest German rigid airship has a disposable lift available for crew, fuel, merchandise, etc., of over 38 tons, which gives her a theoretical endurance (if all the available lift be employed in carrying gasoline) of 177.5 hr. (7 days) at a cruising speed of 45 m.p.h.—the maximum speed being 77.6 m.p.h.—during which 8000 miles would be covered. A detailed statement of the "disposable lift" available for freight of each existing type of British airship showing the gasoline consumption is attached. From these figures the freight which can be carried and the time taken over any given route can be readily worked out.

It should be noted that for purposes of short distance pleasure trips from, for example, South Coast towns, it would not be necessary to establish large stations at each town, but the following principle, which has been found most economical and successful during the war, might be adopted. This consists of building a station provided with permanent sheds, quarters, etc., at some convenient center, and forming temporary bases consisting merely of a small cheap portable shed and a few tents or huts at other places, from each of which one or two airships are run; main supplies being drawn from the "parent" station, where all large repairs are effected. In addition to the use of portable sheds at sub-stations, experiments have been carried out in mooring out airships in the open, which have had such a large measure of success as to promise well in the future.

Mooring Out Airships

An airship has been successfully moored out for six weeks in a perfectly open expanse to a specially designed mast. Only two or three men are required to look after the ship, and winds of up to 52 m.p.h. have been ridden out without any damage whatever resulting. There seems little doubt that with this system an airship could live out in the open for many months at a time. Up to the present this method has only been tried with small non-rigid airships, but it is on the point of being tried with rigids, and there seems no reason to expect other than equal success. The possibilities of using floating sheds on water are also being inquired into and appear to be promising.

It should be noted generally that greater reliability as well as decreased cost will undoubtedly be attainable by improvements resulting from careful research and experiment. For example, the use of a mooring mast will very greatly

increase the regularity of any airship service, as the chief difficulty at present consists in taking airships in and out of sheds. If an airship is left permanently ready at a mooring mast in the open it will be possible to fly in any wind up to the speed of the ship. In the same way improvements in the fabric for non-rigid envelopes and other covers of rigid airships will result in decrease in running costs by reducing the hydrogen consumption, and generally lengthening the life of the ship.

Similarly, a system of recovering water-ballast during flight would obviate waste of hydrogen by preventing the ship becoming "light," owing to the consumption of fuel during a long voyage. It will be understood that as an airship becomes light she tends to rise, which causes the hydrogen to expand, so that it must be allowed to escape through the automatic valves, or the gas-bags would be burst by the internal pressure. This tendency to rise must be counteracted by taking in weight to counterbalance that lost in the fuel consumed.

It may be of interest to note that nine airship stations of various sizes will in all probability shortly cease to be in use by the Admiralty. These will, therefore, become available for commercial purposes, though the greater part of the ground is occupied under the Defence af the Realm Act. In addition a certain number of S. S. Zero airships and coastal star airships will become available for disposal.

Comparison of Rigid Airships and Planes

During the last 4 yr. sufficient experience has been obtained in the construction and use of rigid airships to enable future developments to be forecasted with some assurance of accuracy; and it is, therefore, possible to consider the lines along which progress should be sought, and the performances which, within the next few years, can be obtained from rigid airships. In view of the widely-held opinion that the development of the large airplane will ultimately kill the large airship, it is necessary to institute a comparison between the future possibilities of both types. The result shows that in each case certain inherent qualities govern progress, and that these qualities, being widely different, will cause the two types to cover different fields of utility. It appears also that, whereas increase in size of airplanes brings many difficulties in its train with no compensating improvement in efficiency, increase in size of airships results in a reduction of the difficulties experienced at present, and gives improved efficiency, thereby opening up future possibilities of extraordinary value.

The development of rigid airships has been even more rapid than that of airplanes. In 1914 the average endurance of a German rigid at cruising speed was under one day, and the maximum full speed about 50 m.p.h. In 1918 with the German L.70 class, 2,195,000 cu. ft. capacity, the endurance at 45 m.p.h. has risen to 177.5 hr. (7.4 days) and the maximum full speed to 77 m.p.h. The ceiling has correspondingly increased from 6000 ft. to 23,000 ft. The British R.38 class (2,720,000 cu. ft. capacity) has an estimated cruising endurance at 45 m.p.h. of 211 hr. (8.8 days), 34 hr. greater than the German L.70 class. It is a matter of some difficulty to make a fair and at the same time simple comparison between the two types of transport possessing widely different qualities.

Comparison of Rigids

The figures for rigids are comparatively simple, as they are few in number and all of approximately the same class, compared to the many different classes of H/A machines which have been developed for various purposes. The Avro has been taken as the best all-round machine actually in use in August, 1914; large machines such as the Sikorski, the Caproni and the Graham-White five-seater were then only in the experimental stage, and besides did not possess the all-round efficiency of the Avro. The D.H.10a has likewise been taken as the best all-round machine in August, 1918. Although the two-engined Handley-Page and Caproni have greater endurance and weight-carrying capacity, their all-round efficiency appears inferior to the D.H.10a. The Handley-Page V gives promise of having a slightly better performance than the D.H.10a, but this machine is still in the experimental stage and reliable performance figures are not available.

Tables 1 and 2 give the progress in L/A and H/A since 1914. Table 3 shows the difference in performance between corresponding L/A and H/A craft of 1918.

IMPROVEMENT IN SHIPS AND PLANES

TABLE 1. L/A.

	August, 1914 Average figure for German Naval Zepp.	August, 1918 German L. 70	Progress Per Cent
Maximum speed at 10,000 ft.	50 m.p.h.	77.6 m.p.h.	55
Endurance at 45 m.p h......	20 hours	177.5 hours (7.4 days)	787.5
Total lift	30 tons	66.64 tons	122
Disposal lift	8.5 tons	38.84 tons	357
Efficiency ratio	27.3 per cent	58.3 per cent	113.5
Static ceiling	6000 ft.	21,000 ft.	250
Indicated hp.................	800	2100	162.5

TABLE 2. H/A

	August, 1914 Avro	August, 1918 D.H. 10a	Progress Per Cent
Speed at 10,000 ft............	70 m.p.h.	125 m.p.h.	78.3
Endurance	4 hours	10 hours	150
Total weight loaded..........	737 tons	4.02 tons	455
Useful load	268 tons	1.45 tons	445
Efficiency ratio	36.6 per cent	36.1 per cent	0.55 (decrease)
Ceiling	14,000 ft.	22,500 ft.	35.7
Indicated hp.	80	810	913 per cent

	August, 1914 Avro	August, 1918 Handley-Page	Progress Per Cent
Speed at 10,000 ft............	70 m.p.h.	85 m.p.h.	21.4
Endurance	4 hours	12.5 m.p.h.	212.5
Total weight loaded........	737 tons	5.27 tons	524
Useful load	268 tons	2.17 tons	709
Efficiency ratio	36.3 per cent	36.4 per cent	0.28
Ceiling	14,000 ft.	15,000 ft.	7.1
Indicated hp.	80	720	800

TABLE 3

Comparison of Existing H/A and L/A Machines

	H/A	L/A	Percentage Superiority
August, 1918	D.H. 10a	German L. 70	Per Cent
Speed at 10,000 ft...........	125 m.p.h.	77.6 m.p.h.	H/A 61.1
Cruising endurance	14 hours	177.5 hours	L/A 1167
Total lift (weight loaded)...	4.02 tons	66.64 tons	L/A 1557
Disposal lift (useful load)...	1.45 tons	38.84 tons	L/A 2580
Efficiency ratio	36.1 per cent	58.3 per cent	L/A 61.5
Ceiling	19,000 ft.	21,000 ft.	L/A 10.5
Indicated hp.	810	2100	L/A 159

It will be seen that at the present time the largest rigids in commission have over 10 times the total lift of the corresponding H/A, and that the disposal lift is about 25 times greater. The proportion of useful lift compared to gross lift is much higher in airships than in airplanes. An approximate figure for an airplane of average engine power is one-third, while in a rigid the useful lift available for fuel, crew, passengers, freight, etc., is well over one-half. In the case of L.70 the figure is 58.3 per cent, although this ship is the most heavily-engined and fastest airship yet built. It cannot be too strongly emphasized that many of the advantages apparently possessed by H/A at the present time result from their relatively small lift. Thus, by airplane of 60 tons total lift, if found to be possible at all, would certainly be very much less convenient to land and handle on the ground than airplanes of existing sizes, and would require overall dimensions about twice those of the largest existing machines.

It is important to note that in H/A there is no automatic improvement in efficiency resulting from greater dimensions. In L/A, on the other hand, such an automatic improvement

takes place to a very marked degree. The reason for this difference is as follows: In similar H/A machines of different dimensions, the total lift, air resistance, and b.h.p.—other things being equal—all vary nearly as the plane areas, i. e., as the square of the liner dimensions.

It follows that the ratio $\dfrac{\text{weight of machinery}}{\text{total lift}}$ does not vary much with size of machine. The ratio $\dfrac{\text{weight of structure}}{\text{total lift}}$ tends to increase with size of machine. Unit area of wing surface can only exert a definite lifting effect, and as the machine increases in size it is necessary to increase proportionally the weight of each preceding unit area of wing surface to make the machine proportionally strong. A point is finally reached where every additional unit of wing surface results in as much increased weight as its lifting effect, so that any further increase in size will involve a definite falling off in the total lifting capacity of the machine. A further small increase in size can be effected by increasing the number of planes; but, owing to the inefficiency of middle plane surfaces, due to the blanketing effect of the top and bottom planes, the resulting gain in endurance will not be large, and it will only be effected at the price of a loss in efficiency.

The theoretical property of structure may, to a certain extent, be modified by the material used. Thus, in airplanes, there is a certain size of machine which can be built most economically of wood. Any machine of smaller or larger size entails a certain proportion of uneconomical weight, due to the inherent qualities of the material. This question of material applies equally to rigids; thus, for ships of 2,000,000 to 4,000,000 cu. ft. capacity, duralumin is the most suitable material for hull structure, while for ships of 8,000,000 to 10,000,000 cu. ft. capacity a saving in weight can be effected by the use of steel. In H/A machines, therefore, all round efficiency, as measured by the ratio of $\dfrac{\text{disposable lift}}{\text{total lift}}$ tends to decrease with greater dimensions. Greater efficiency will, therefore, not result from increase in size, but, on the contrary, great increase in size will not be attainable until greater efficiency has been first obtained by progress in design and materials. In other words, increase in size in H/A craft will be the result and not the cause of increased efficiency.

Benefits from Increase in Size of Airships

In L/A the total lift varies as the cube of the linear dimensions, while the air resistance and b.h.p.—other things being equal—vary as the square of the linear dimensions. Hence the ratio $\dfrac{\text{weight of machinery}}{\text{total lift}}$ decreases automatically.

The proportion of useful lift compared to gross lift is much higher in airships than in airplanes. An approximate figure for an airplane of average engine power is 33 per cent, while in a rigid the useful lift available for fuel, crew, passengers, freight, etc., is well over 50 per cent.

It is concluded that in H/A increase in size without loss in efficiency must result from, and be limited by, the extent of improvement in design, etc. The tendency will, therefore, be to confine airplanes to moderate dimensions, except where large size is rendered necessary by the need of reducing the number of units employed upon a particular service. or by other causes, such as where long-distance non-stop flights are necessary. The outstanding characteristics of H/A will, therefore, remain as at present: high speed, handiness, moderate lift, independence of all weather conditions except the worst. As regards L/A, the functions now performed by the smaller airships will be usurped more and more by H/A. Airships may be expected to develop in the direction of increased size to a limit which is not yet in view. The outstanding characteristics of L/A will be reasonably high speed, very long endurance, great weight-carrying capacity for freight, stores, passengers, etc.

The practical range of all types of aircraft carrying mails, passengers, or merchandise, will be small compared with their maximum range given in these notes, which is calculated for calm air, and assumes, besides, that all the disposable lift (useful load), aside from crew, food, emergency water ballast, etc., is available for fuel. For transport purposes, allowance must be made for the commercial load and additional fuel over and above that actually required for the given flight, which must always be carried in case unfavorable weather is encountered. Actually, the practical range will not be much more than one-fourth of the maximum range.

Summarising, therefore, it would appear that the line of policy to be adopted is to develop the airplane for transport over distances under, say, 500-800 miles, and the rigid airship for trans-oceanic and possibly trans-continental flights of this length.

Large Airships

To obtain a reasonable performance with a small ship, every effort has to be made to save weight, and complicated built up girders must be used owing to their property of forming a light and strong joint. In a large ship, owing to the increase in efficiency with size, it would be possible to sacrifice a certain amount of lightness in construction for the sake of simplicity in design. With increase in size, steel could be used with advantage in place of duralumin, and a great saving in cost effected thereby. With increase in size, too, it should be possible to produce a rigid of so much more rugged construction that it might even be erected in some form of roofless dock, remain either moored out or in flight while in commission and only return to dock for a complete refit, thus saving much of the expense of housing stations. Just as with H/A craft, where airplanes have gradually increased in size, checked and modified in each successive stage by the results obtained under service conditions; so the construction of the really large rigid must be approached systematically, in successive stages, checked and modified at each stage by practical results.

Bad weather will not appreciably endanger a rigid in flight, and its chief operational handicap has so far been the probability that it will sooner or later be caught out in a high wind lasting for a longer period than the endurance of the ship, so that the ship would then have to attempt to land before the wind dropped and would probably be wrecked. If the meteorological reports for previous years are examined it will be seen that even under unfavorable conditions it will be possible for a ship with a three weeks' endurance to leave the shed during any temporary lull in the wind, carry out a fortnight's flight, and calculate on being able to return and land during another lull in the ensuing week. Should the large ship meet a storm, she will be able to go round or over it, and could afford to wait in the air for fine weather in which to land. Thus, if the endurance of a rigid is increased to a sufficient extent, it will be possible to carry out flights with a regularity comparable to that maintained by surface craft. The range, practically speaking, is almost unlimited, and the weight carrying capacity large. A 10,000,000 cu. ft. capacity rigid will have a disposable lift of over 200 tons, which is available for gasoline, ballast, crew, passengers, freight, in varying proportions as desirable. The uses to which such an airship could be put are clearly of great importance. Further, there is no other type of vessel which could as efficiently undertake them.

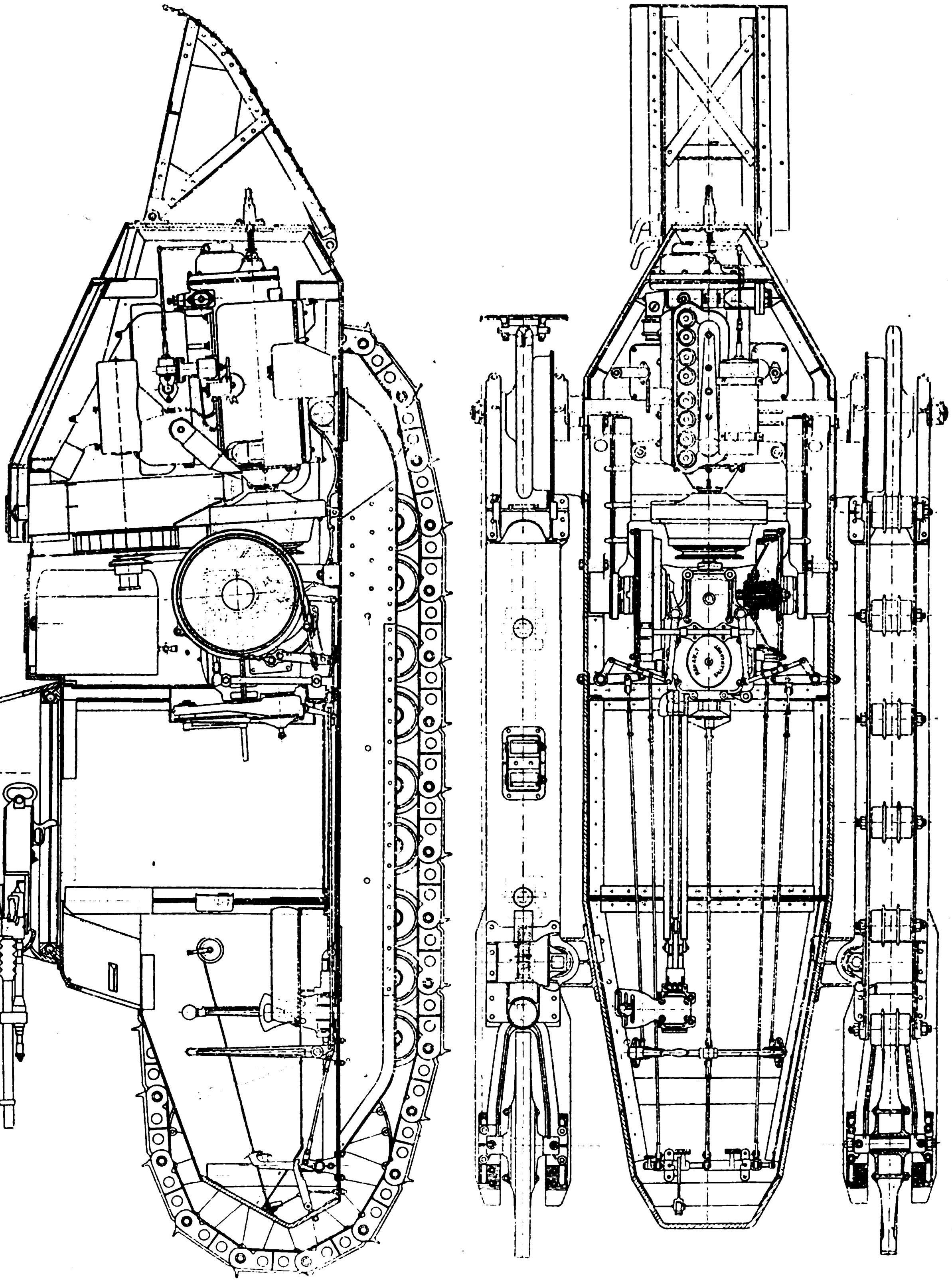
With a rigid of about 10,000,000 cu. ft. capacity, and endurance of approximately 3 weeks at 40 to 45 m.p.h., with a maximum speed of 70 to 80 m.p.h., a ceiling of some 30,000 ft. can be obtained, and a maximum range of over 20,000 miles, or nearly once round the world. This colossal endurance and range of action can be achieved in large rigids because, contrary to H/A, the characteristics of L/A are governed by two factors:

1—The lift of a rigid is proportional to its cubic capacity (dimensions).

2—All fuel carried is used for forward propulsion and not, as in the case of H/A craft, chiefly for maintaining the structure in the air, the head resistance of the airship being small compared to that of an airplane of the same lift.

THE RENAULT TWO-MAN TANK

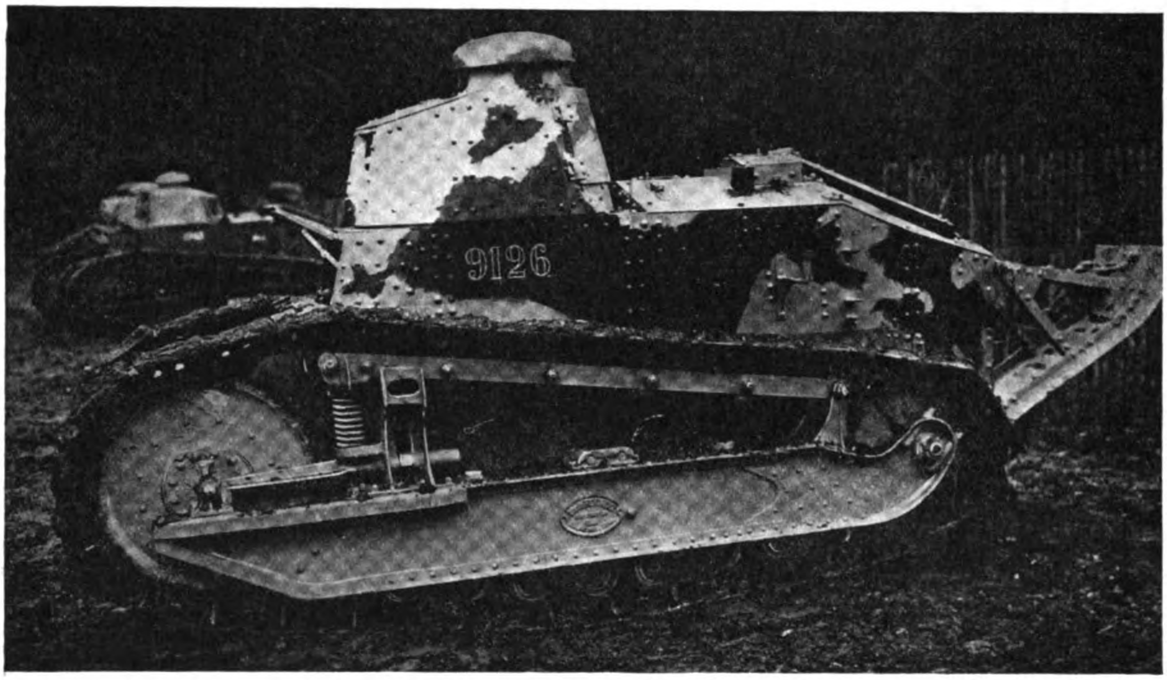
Sectional views showing the arrangement of the power plant in the tail. The driver sits forward and controls the vehicle by operating a clutch on each of the endless driving bands



The French Baby Renault Tank

Weighs 6½ Tons Complete with Machine Gun—Has a Maximum Speed of 4.8 M.P.H.—Can Climb a Gradient of 119 Per Cent—Is Driven by a Small Four-Cylinder Engine and Can Be Handled Efficiently by Two Men

By W. F. Bradley
AUTOMOTIVE INDUSTRIES' *European Correspondent*



Showing the general construction of the Renault tank. The driving sprocket is at the rear, the endless band passes around a pulley at the front, and between these is a series of idlers and automatic tensioning apparatus

IN October, 1917, Louis Renault presented to the French War Department a new type of tank with the remark: "Try it out, and if it meets your requirements I can supply you thousands like it."

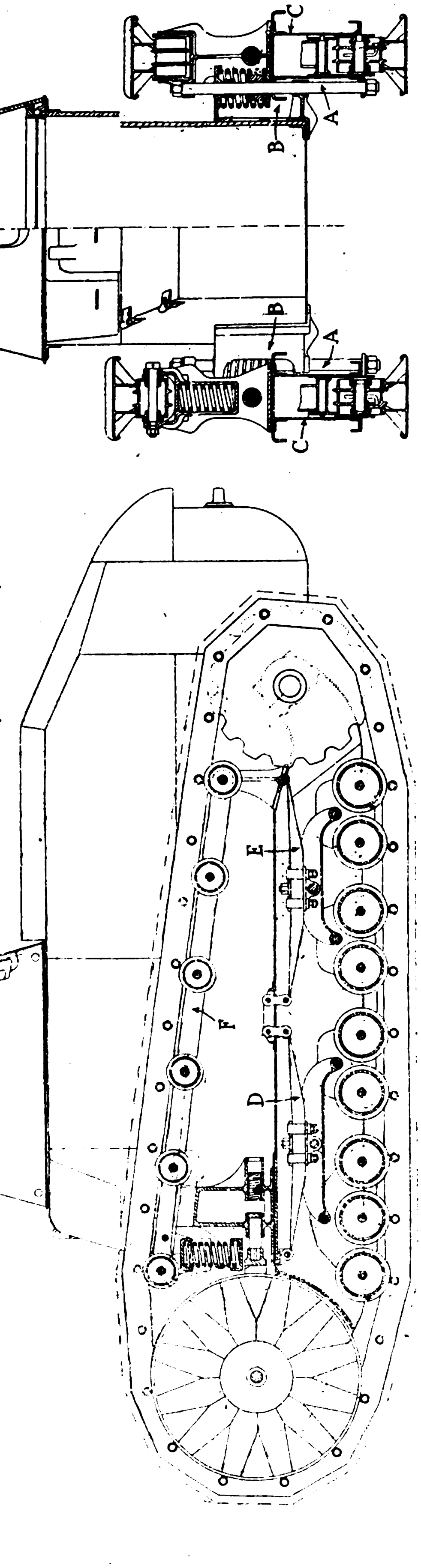
Up to this time France had followed in the wake of England so far as tank construction was concerned. The first British tanks, as is generally known, were huge structures of heavy weight and armament and of very slow speed. The French set to work on the same general lines, but were far from being as successful as their Allies. Not only were the first French tanks inferior in design and construction to the first produced in England, but they no longer possessed the factor of surprise for the enemy. Two or three types were made, both with mechanical and electrical transmission, but without in any case the results being satisfactory. Military men declare that the very best results were obtained when the big French tanks fell into the hands of the Germans, for our enemies immediately set to work to copy them, and in doing so accentuated all the worst defects. As a consequence, the German army has the worst tanks in Europe.

The big tank, weighing 30 tons and more, is slow, and difficult to maneuver. When under observation, its rate of travel being accurately known and its course being comparatively fixed, it becomes an easy target for artillery. Its rate of travel is about two miles an hour; experience has shown that this is too slow. Although popularly supposed to be able to travel anywhere, a big tank can get into positions from which it is impossible to extricate itself, and, the unit being big and important, the loss is considerable.

Acquainted with the general history of tank development, Louis Renault decided to strike out on different lines. He himself laid out the general plans, entrusted the details to his engineers, and had the first tank built entirely in his own automobile factory at Billancourt, near Paris.

Renault's tank weighs 6½ tons completely equipped with machine gun; it has a maximum speed of 4.8 miles an hour; it can climb a gradient of 119 per cent; its motor is a small four-cylinder of only 3.7 by 6.29 in. bore and stroke, and the machine can be handled with extreme ease by two men—one gunner and one driver. Owing to its small weight and area, the transportation of this tank aboard a truck is a very easy matter.

The first tests of this machine were so satisfactory that a big series was ordered at once. Work was carried out actively during the winter of 1917 and the spring of 1918, with the result that they were able to play a very important rôle in holding up the last German attacks in the early summer of 1918 and in carrying through to



Scale drawings showing the suspension of the Renault Baby Tank. The endless driving band is kept in tension by a lever F pivoted at the rear, furnished with a series of idler wheels and held up by a spring under the forward end of the lever

a successful issue the Allied attacks from July, 1918, to the signing of the armistice.

The general lines of these tanks are familiar by reason of the number of illustrations which have been published. The motor is at the rear; it drives through a four-speed and reverse gearset and a series of reduction gears to the large sprocket at the rear of the self-laying track. The driver is at the forward end. Behind him is the gunner, who operates either a machine gun or a cannon mounted in the revolving turret. This design divides the tank into two compartments: a rear one for the motor, transmission, radiator and gasoline tank, and a forward one for the driver and gunner. When in action the driver must remain seated; the gunner has standing room in his turret.

The Renault tank is divisbile into three components: the two side frame members with the main driving sprocket at the rear, the idler pulley at the opposite end, and the rollers and endless track between the two; the steel-plated body of the tank, containing the motor and reducing gears, attached to the side frame.

Details of Endless Tracks

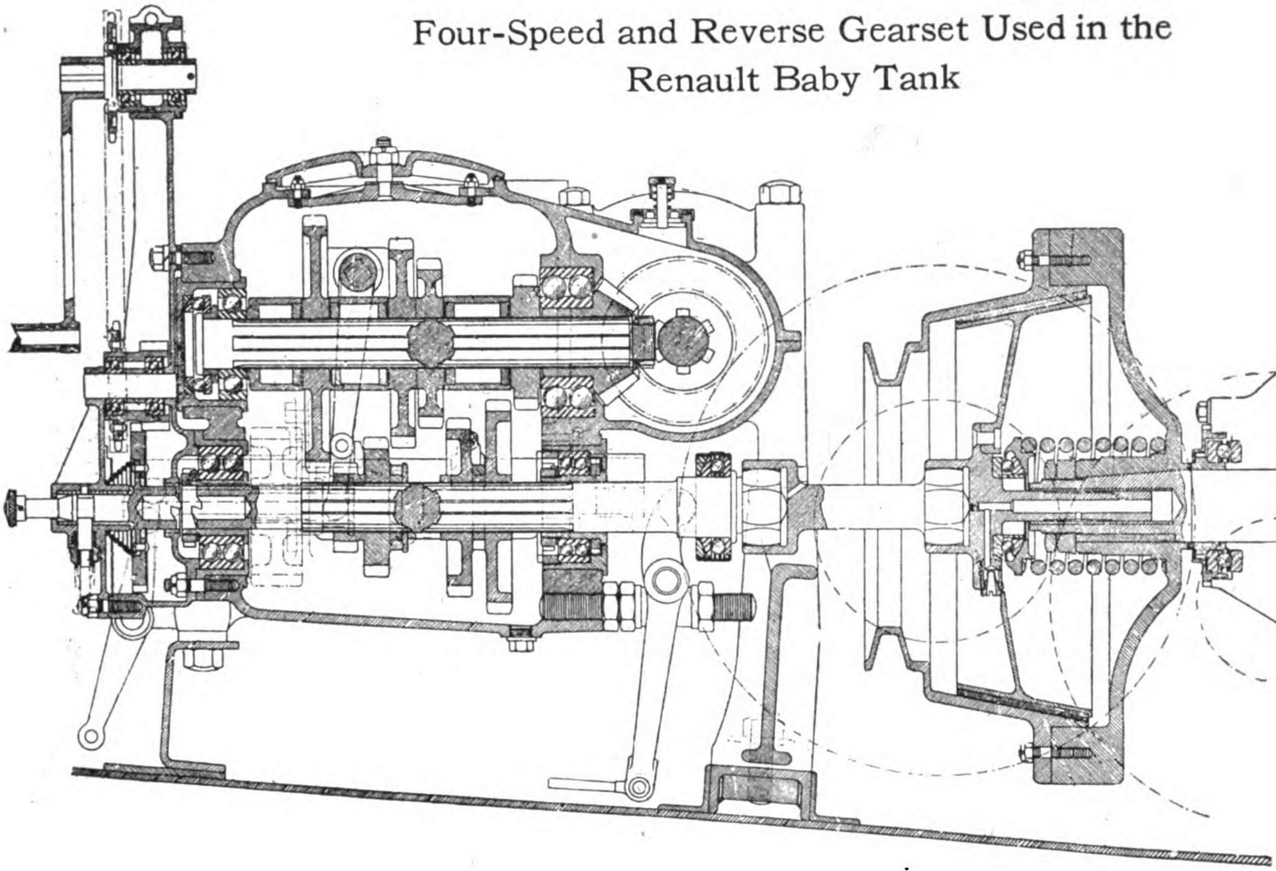
As Renault claims a patent for the construction of his endless tracks, they are worth describing in some detail. The frame members—by this term is understood the whole of the track-laying mechanism—are mobile in relation to the body of the tank, for they are pivoted around the rear axle, and at the forward end they are attached by means of two guiding bars, *A*, Fig. 1, secured to the body of the tank by means of the hangers *B*. Each of the main frame members *C* is carried by means of two laminated Springs *D* and *E* on two balance arms, on the extremities of which are four bogies. The wheels of these bogies run on the endless track.

The main driving sprocket is at the rear. At the opposite extremity is a larger diameter wooden pulley with a steel rim. This is shown in the drawing with spokes, but it is now disk construction. This forward pulley is carried in a fork, and has a lateral movement to allow of adjusting the endless band. In order to support the endless track between the driving sprocket and the jockey pulley there is a bar *F* pivoted at the rear, carried in guides at the front, and maintained in position by a coil spring under its forward end. This bar carries six rollers, and the arrangement gives a constant and automatic tension of the endless track, and at the same time supports it for a length of about 78 in. As the two tracks have a width of 13½ in. and a length of 110 in., the load per square inch is nearly 5 lb.

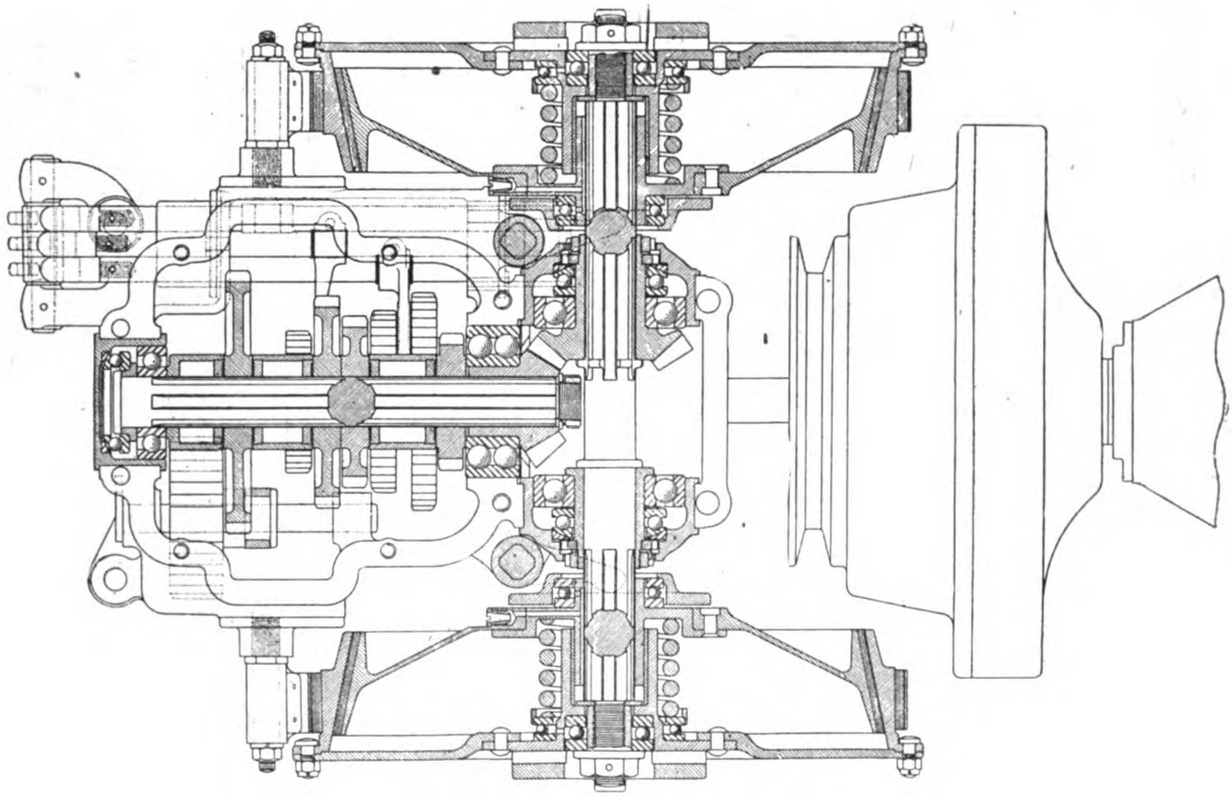
The individual links of the endless track are connected by means of case-hardened bolts having a diameter of 0.9 in. All the rollers have phosphor-bronze bushes. Trouble has been experienced in many makes of tanks with the breakage of the bolts connecting the links of the endless track. It is claimed that, providing the case-hardening is satisfactory, and the tracks are kept under correct tension, there is very little trouble with the Renault in this respect. The bushed rollers, too, have a comparatively long life. It is generally found that the track needs tensioning after 2 hours' hard running. After this it can be run 15 to 20 hours under severe conditions—in heavy mud and in water—before it needs further attention.

The body of the tank is an all-steel construction, varying in thickness from 0.6 to 0.3 in. The maximum thickness is found in the vertical sides; but most of the surface is either inclined or rounded, so that the tendency of a bullet or shell splinter would be to strike obliquely, and this allows thinner armoring to be made use of with security. The turret is mounted on ball bearings,

Four-Speed and Reverse Gearset Used in the Renault Baby Tank

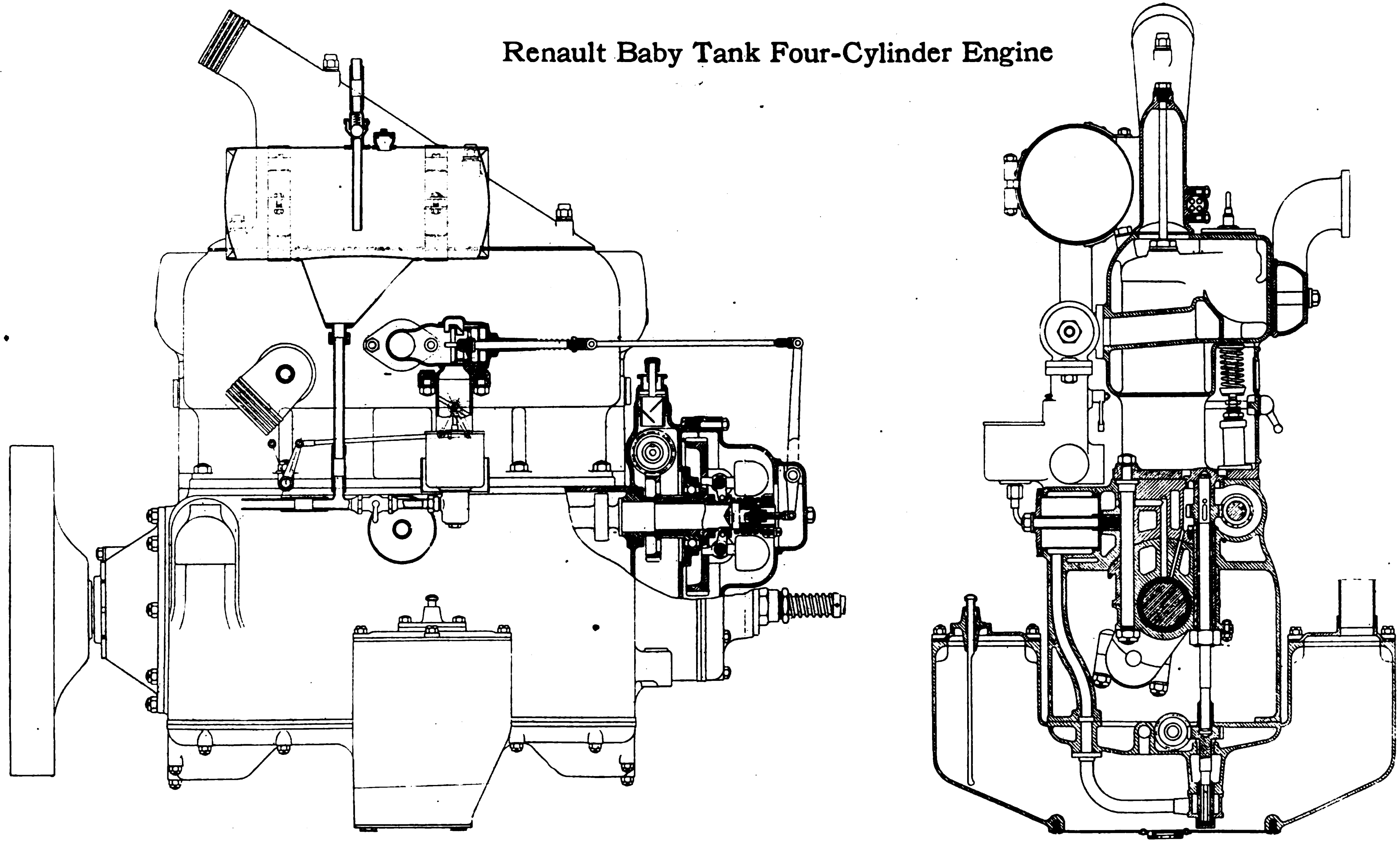


Power is transmitted to the endless driving bands of the tank through a cone clutch on the engine and four-speed gearset. Immediately behind the gearset is a transverse shaft which is driven by a bevel on the end of the intermediate shaft. Note the hand cranking device at the forward end



Horizontal section through the gearset, showing the two cone clutches, independently operated, which transmit the power to the endless driving band. Steering is accomplished by releasing one or other of these two clutches

Renault Baby Tank Four-Cylinder Engine



Part sectional views of the 3.7 in. by 6.9 in. four-cylinder engine used in the Renault two-man tank. The view at the left shows the governor-controlled Zenith carbureter which has an interesting method of feed. Gasoline is supplied under pressure from a main tank and any quantity above that taken by the engine is by-passed up to a reserve tank on the top of the engine, from which it overflows through a ball-check valve back to the main tank. The lubrication of the engine is of the dry sump type, oil being supplied to the bearings under pressure.

and carries in its interior either a machine gun or a cannon.

A four-cylinder engine of only 3.7 by 6.29 in. bore and stroke is much smaller than is popularly imagined to be necessary for a tank. It has been found, however, to be quite sufficient for the work. The actual horsepower developed is 30 at 1100 revolutions, 33 at 1200 revolutions, 35 at 1300 revolutions, and 39 at 1500 revolutions. The torque is 19.7 kilogram-meters at 1200 revolutions.

The lubrication and the gasoline feed systems are the most distinctive features about the motor. Its four cylinders are a block casting, the central bearing is of considerable length, and being a Renault construction the water circulation is by thermo-siphon. The radiator, a plain tubular type similar to those used on Renault trucks, is mounted transversely inside the tank body, ahead of the engine. A centrifugal fan, driven from the main shaft by a motorcycle type rubber belt, draws air in through all the openings in the body and expels it vertically. This not only cools the circulating water, but ventilates the entire tank. While it is admitted that the engine can be kept cooled without a water pump, this feature of the construction has been much criticised by the tank crews, who point out that they are at the mercy of a rubber belt. If this breaks in action the engine is almost certain to overheat and all ventilation is stopped.

Dry Sump Lubrication

Lubrication is of the dry sump type. There are two large capacity pumps, one at each end of the base chamber. These drive all the oil which drips from the bearings into the main oil reservoir, built under and to left and right of the central portion of the base chamber. A pump driven off the camshaft delivers the oil under pressure to the main bearings and to collector rings, which distribute it by centrifugal force to the connecting-rod bearings and to the wrist pins. With this dry sump and central oil reservoir the engine can operate at any inclination.

The motor has a governor operating on the throttle of a Zenith carbureter. The main gasoline supply is carried just ahead of the motor, the fuel being fed from this tank to the carbureter by means of an air pump driven off the camshaft. The excess gasoline not absorbed by the carbureter is carried up a vertical tube, Fig. 3, to a reserve tank immediately above the cylinders, and the overflow from this tank goes to the main tank by means

In this picture the tank is practically standing on its tail and consequently is being stabilized thereby

Showing the Renault tail, a feature which was added when its possibilities became apparent

of a standpipe. As the outlet of this pipe is provided with a ball check valve, the gasoline cannot return to the main tank unless a determined pressure has been reached in the reserve tank. This pressure is such that whatever the inclination of the vehicle, gasoline must be carried under pressure to the carbureter. As the reserve tank is airtight, the mass of air above the gasoline forms an elastic regulator of the gasoline pressure in the feed pipes. Also, if the pump ceases to work, the carbureter is fed from the gas carried in this reserve tank. As a precaution against pump failure there is a hand air pump by the side of the driver.

Steering Through Clutches

Power is transmitted from the motor through an inverted leather-faced cone clutch to a four-speed and reverse gearbox, Fig. 6. The intermediate shaft of this gearbox carries a bevel pinion at its rear end, engaging with a crown wheel on the transverse shaft. Fig. 7 shows how the power is transmitted from the gearset through two large diameter cone clutches lined with Ferodo to the reducing gear (not shown in this drawing). These lateral clutches can be operated independently, and by throwing out either one or the other both the reducing gear and the endless band on that side are stopped. Each set of reducing gears is contained in an aluminum housing mounted by the side of the motor, and consists of the first driven pinion, two intermediaries, and the final driven pinion carrying the endless band. Connection from the clutch shaft to the first pinion of the reduction gears is by means of an Oldham coupling, not shown in Fig. 7. The two sets of reduction gears are in dustproof and oil tight casings, and the whole construction is remarkably compact, the space occupied being very much less than the motor and gearset of a 3-ton truck.

The total gear ratios are 114.5 on first and reverse, 56.3 on second, 34.5 on third, and 22.3 on fourth gear. The reducing gears between the lateral clutches and the main driving pinion carrying the endless band have the following ratios: 58:12, 30:16 and 38:13. The drawbar pull is 11.090 lb. on first and reverse and 992 lb. on fourth speed.

The total length of the Renault tank, without tail, is 161 in.; total width is 66 in.; track, measuring from center to center of the bands, is 55 in.; distance between the two main wheel centers (main driving pinion and main pulley) is 110 in.; the width of the endless bands is 13½ in., and the total height of the machine is 84 in. The weight is 6½ tons with machine gun.

Front view of the tank with all doors open. The driver is grasping the right-hand clutch lever

The driving of these tanks is a remarkably simple operation. The driver sits on a cushion on the floor, with his back supported by a transverse girth. He has the same pedal controls as on a standard automobile: clutch, brake and accelerator. To his right is a selective change-speed lever, giving four combinations ahead and one reverse. There is no steering wheel. In its place are left and right-hand levers. By pulling out the left-hand lever the left-hand lateral clutch is withdrawn and the left-hand track is stopped. To make a quick turn the left-hand clutch lever is pulled further to the rear, when it applies a band brake on the left-hand clutch drum, thus locking the left-hand track and causing the whole machine to pivot around. To turn to the right the same movements are made with the right-hand lever.

A mobile tail is bolted to the rear of the tank. The object of this is to facilitate the passage through holes and trenches. When a tank is obliged to crawl down into a trench the tail finds a support against the bank, thus decreasing the inclination of the machine and giving a support for climbing up the opposite bank. Briefly, it has the same functions as the crocodile's tail.

The military organization of the tanks is in companies of twenty, one of which is the commanding officer's tank, provided with wireless, and in consequence not carrying cannon or machine gun. When going into action the commanding officer keeps in communication with headquarters by means of his wireless and communicates orders to the men of his company by means of signals. As the chief work of the tanks is to destroy machine-gun nests, about half the machines in each company are fitted with a machine gun and half with a cannon. Each company has attached to it a mechanical staff of one non-commissioned officer and half a dozen mechanics, who are provided with a truck and hand tools, and are capable of carrying out all slight repairs.

The moderate weight of these tanks and their comparatively small dimensions make their rapid transportation to different portions of the battle front a very easy matter. A loading platform can be built by a gang of men in two or three hours. Gasoline or steam trucks with flat bodies can be backed up to this platform, and the tanks run aboard under their own power. With a single platform a company of twenty tanks can be loaded in an hour, and when loaded can be moved away at an average speed of 10 miles an hour. Thus, between sunset and sunrise a fleet of Renault tanks can be moved a distance of about 80 miles, and immediately on being unloaded they are ready to proceed to the fighting line and go into action. Or the tanks can be grouped 60 miles in the rear of the battle line, where they are completely hidden from enemy observation, and the following morning they can get into action to the complete surprise of the enemy. This extreme mobility is one of the most valuable features of the Renault type tank compared with the big machines, which must necessarily, on account of their weight, always proceed under their own power, at a road speed of only 2 or 3 miles an hour.

Driving Is Simple

There has never been any difficulty in training all the men that were required for handling the Renault tanks. Recruits are asked for, and usually young men are selected, but it is not considered necessary that they shall have had previous automobile experience. They are first of all taught to drive a touring car, then are given some practical instruction in general motor mechanics. After this they go right into the tank school. The control of the Renault tank is so simple that any person who can drive an automobile is capable of taking one across country after a few minutes preliminary instruction. Skill and judgment have to be acquired in the manner of tackling different kinds of trenches and shell holes, but this is not a long process.

There is no doubt that Louis Renault was on the right line of thought when he decided on the reduction in size and weight of tanks and the limiting of the crew to two

(Continued on page 506)

A squadron of Renaults proceeding through difficult, wooded country. The machine in the foreground is that of the commanding officer and is equipped with wireless

Small Inlet Valves Satisfactory in Overhead Valve Design

Improvement in Fuel Consumption with Increase of Speed Is Clear and Unmistakable—Thermal Efficiency Independent of Load and R.P.M.

PART II

THE advantage of 16 per cent higher brake mean effective pressure in the valve-in-head design than in the L-head design is due to the shape of the combustion chamber.

Mr. Pomeroy said: Fig. 7 is a diagram showing the following relationships:

1. The average brake mean effective pressure at various revolution speeds for the tests in which the inlet gas velocity was under 300 feet per second.
2. The compression pressures (gage) corresponding to the above. Table VI. shows the tabular values corresponding to Fig. 7.

TABLE VI.

Revs. per minute	A: "p, lb. per sq. in.	A: Compression pressure, lb. per sq. in.	B: "p, lb. per sq. in.	B: Compression pressure, lb. per sq. in.
800	80	91	83	94
1,200	83	94	94	101
1,600	83	99	96	104
2,000	81	101	94	103
2,400	78	98	91	99

The general characteristics of the curves are:

1. A rapid rise up to speeds of 1,000 to 1,200 revs. per minute.
2. A slow rise to a maximum of about 1,600 revs. per minute.
3. A gradual fall as the speeds increased to 2,400 revs. per minute.

The rapid rise in brake mean effective pressure in engine B is probably due to the fact that the engine is fitted with a light flywheel and presents greater difficulties in taking slow speed tests. In both engines it was very difficult to get accurate readings at speeds of 800 revs. per minute or under.

It will be seen that the compression curve of engine A rises more rapidly than that of engine B, and approximates to the latter at speeds over 1,800 revs. per minute.

Further, the brake mean effective pressure in engine A is appreciably more independent of the compression pressure at the various engine speeds than in engine B.

The most significant point, however, is the very distinct difference between the average brake mean effective pressures obtained in the two engines, approximately 13 lb. per sq. in.

The author is somewhat at a loss to account for this in view of the almost identical construction of the engines. The detailed figures which have been given in Tables I and II seem to exclude any simple explanation which might be suggested on the grounds of varying compression pressure, carburetion, etc.

Many subsidiary tests were made to throw some light on this question, among them the fitting of light aluminum pistons to engine A, the fitting of different carbureters, alterations of valve settings, in fact, the whole resources of the tuner-up were invoked with no result; engine A seemed completely indifferent to all such treatment.

From these experiments the author considers that the cause of the difference in brake mean effective pressure, which gives engine B an advantage of some 16 per cent over engine A, can only be sought in the feature in which the engines differ most, *i. e.*, the combustion chamber.

The combustion chamber of engine A was of the orthodox side-by-side valve design, the two valves being in a pocket projecting laterally from the cylinder barrel and being formed in part by the valve caps screwed in from the top of the cylinder. In the case of engine B the combustion chamber was also pocketed laterally, the two exhaust valves being in one pocket and the inlet partly in another, partly

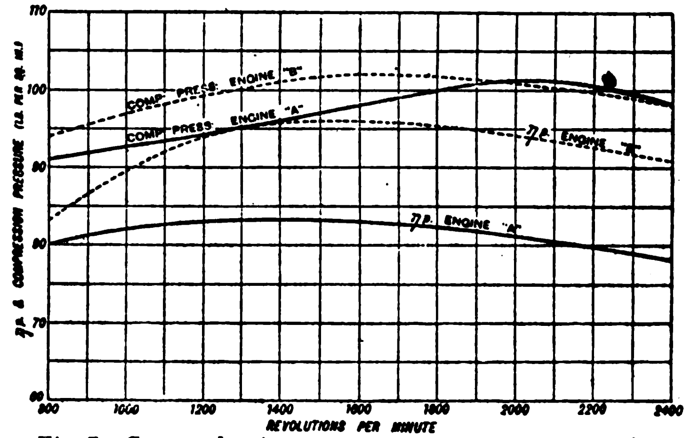


Fig. 7—Curves showing compression pressures in relation to r.p.m.

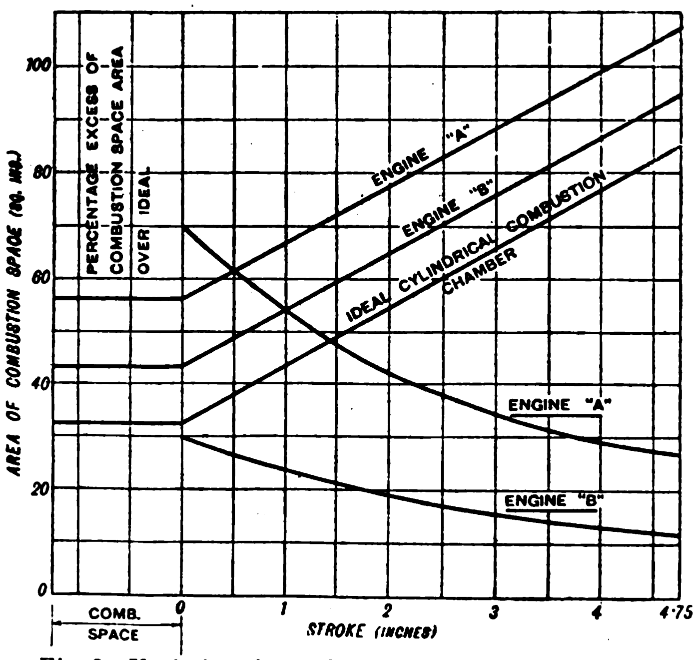


Fig. 8—Variations in combustion area from the ideal in engines A and B, expressed as percentages

discharging direct into the cylinder barrel. The valves were inserted from inside the cylinder.

The ratio of surface of combustion chamber to volume is as follows:

Engine A	4.66:1
Engine B	3.6:1
Ideal cylindrical type	2.75:1

The proportions of water jacketed to unjacketed surface in each case are approximately as follows:

	Water jacketed	Unjacketed
Engine A	30.4 sq. in.	25.6 sq. in.
Engine B	24.8 sq. in.	18.2 sq. in.
Ideal cylindrical type ...	18.3 sq. in.	14.7 sq. in.

Fig. 8 is a diagram showing the area exposed to cooling at each point of the stroke. From this it will be seen that the area of the combustion chamber in engine B is about midway between that of engine A and that of the quasi-ideal cylindrical type. Expressed as percentages, the excess of the surface over the ideal in engines A and B is given in the curves in Fig. 8. At the top dead center the excess of combustion chamber area over that of the ideal cylindrical type is 70 per cent in the case of engine A and 30 per cent in the case of engine B. At the bottom dead center the figures are 27 per cent and 12 per cent respectively. These figures are striking and suggest that in the ratio of surface to volume of the combustion chamber may lie the reason for the increased brake mean effective pressure found in engine B.

If such is the case it is of interest to compare the performance of engines A and B with that of an "ideal" engine of the same proportions.

Following Mr. Ricardo's analysis of the various factors concerning engine performance given in Mr. Berriman's paper before the Institution last month, it will be found that for a compression ratio of 4.8:1 the ideal indicated mean effective pressure is 134 lb. per sq. in.

In these engines, however, the inlet valve does not close till a crank angle 45 per cent past the bottom center, corresponding to an upward piston movement of 0.4 in. This is equivalent to shortening the compression stroke and alters the compression ratio accordingly, which now becomes

$$\frac{4.8 \times 4.35}{4.75} = 4.4:1.$$

Checking this against the actual compression pressure, say 100 lb. per sq. in., and assuming that the pressure in the cylinder at the moment of closing the inlet valve is 14.7 lb. per sq. in.:

$$P_1V_1^n = P.V.^n$$

$$\frac{114.7}{14.7} = 4.4^n$$

$$7.8 = 4.4^n$$

or $n = 1.37$, a value for n which is not unreasonable.

The indicated mean effective pressure corresponding to this corrected compression ratio is 128 lb. per sq. in.

Fig. 9 and Table VII show the following:

Curve 1. Revolution speed and brake mean effective pressure engine A.
Curve 2. Revolution speed and brake mean effective pressure engine B.
Curve 3. Revolution speed and brake mean effective pressure ideal engine (calculated).
Curve 4. Revolution speed and calculated indicated mean effective pressure engine A.
Curve 5. Revolution speed and calculated indicated mean effective pressure engine B.
Curve 6. Revolution speed and calculated indicated mean effective pressure ideal engine.

The calculated figures in the above are obtained by taking the figures given above, and adding to these a mean pressure for the suction exhaust loop of the diagram of 2 lb. per sq. in. at 800 revs. per minute, and 5 lb. per sq. in. at 2,400 revs. per minute.

The indicated mean effective pressures are seen to be remarkably constant with respect to revolution speed, but the

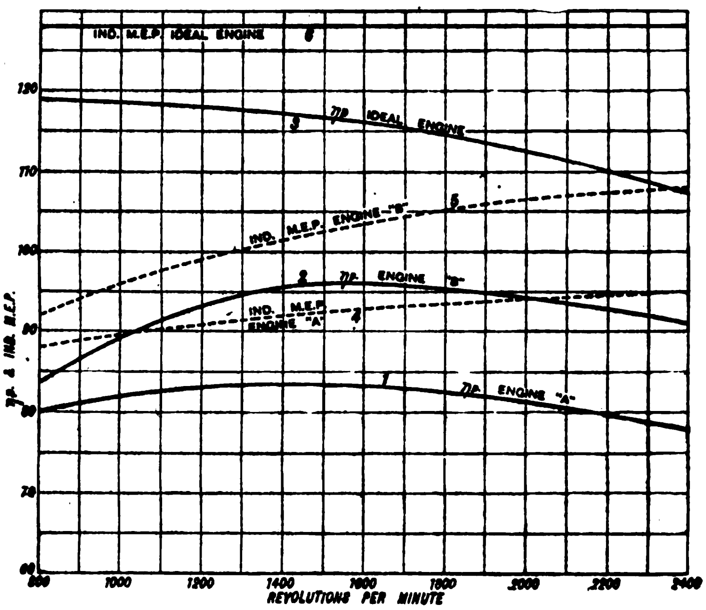


Fig. 9—Mean effective pressure of the engines under test at various speeds

difference between engines A and B, of course, remains. Comparing the average mean effective pressures in Table VII, the ideal engine gives 128 lb. per sq. in., engine A 93 lb. per sq. in., engine B 104 lb. per sq. in.

The chief advantage which might be expected in respect of the more compact combustion chamber in engine B is that the jacket loss during explosion and expansion would be less, and that part of this gain would be reflected in an increased mean effective pressure. The fuel consumption results, however, do not support this view. Table VIII gives the calculated indicated fuel consumptions, and shows that although the thermal efficiency increases with the speed, the actual consumptions are substantially the same in each engine at any given speed.

The greater mean effective pressure in engine B compared to engine A is not therefore susceptible of explanation on the grounds of greater thermal efficiency. It is of interest, however, to consider briefly the relationship between jacket loss and thermal efficiency.

The fuel supplied to an internal combustion engine can be accounted for mainly under the following heads:

1. Indicated work.
2. Heat lost to jacket.
3. Heat lost to exhaust.
4. Heat lost due to imperfect combustion.

No measurements of items 2 and 3 separately have, to the author's knowledge, been made on small gasoline engines, the usual measurements in engine tests being that of heat rejected to cooling water, which includes a large part of that which should properly be credited to the exhaust.

TABLE VII.

Lb. Per Sq. In.

Revs. per minute	Ideal Engine Ind. M.E.P.	Ideal Engine np	Engine A Ind. M.E.P.	Engine A np	Engine B Ind. M.E.P.	Engine B np
1,200	128	118	91	83	101	95
1,600	128	116	93	83	105	96
2,000	128	113	94	81	106	96
2,400	128	109	93	78	104	91

TABLE VIII.

Calculated indicated consumption. Pts. per B.H.P. per hour.

Revs. per minute	Ideal Engine	Engine A	Engine B
1,200	0.49	0.81	0.81
1,600	0.49	0.72	0.69
2,000	0.49	0.62	0.62
2,400	0.49	0.62	0.63

The subject of the proper division of the various losses has, however, been investigated in connection with slow speed gas engines by Clerk and Gibson and Walker experimentally, and by Lanchester before this Institution.

In the latter paper Lanchester shows that the heat lost to the jacket can be approximately expressed as being in part a constant loss fixed by the size of the engine, and the remainder as a constant percentage of the total fuel heat, due mainly to internal radiation, which can be expressed as a percentage of the horsepower.

Both experiment and calculation show that for an engine with an ideal cylindrical combustion chamber the jacket loss is a smaller proportion of the total heat supplied at high speeds than at low speeds. The difference, however, at full load is not great. For speeds of 100 revs. per minute to 250 revs. per minute Messrs. Gibson and Walker found the jacket loss varied from 20 per cent to 16 per cent of the total heat.

The effect of this reduction of jacket loss upon thermal efficiency is very small. In Messrs. Gibson and Walker's experiments the increase in indicated thermal efficiency for an increase in speed at full load from 100 revs. per minute to 250 revs. per minute was about 1 per cent. The reduced jacket loss was accompanied by an increased loss to exhaust of almost the same amount.

The reason for this is that a large part of the jacket loss occurs after expansion, and obviously cannot affect thermal efficiency.

Messrs. Gibson and Walker's experiments were carried out upon a gas engine, and it is known that combustion was practically complete.

In the engines under discussion there is reason to doubt if combustion is complete, owing to the extended nature of the combustion chambers and the fact that a considerable fraction of the charge may have been rendered non-effective due to being in contact with a comparatively cold surface.

Deficiency from the Ideal

The surface of the combustion chamber in engine A is, as has been said, 56 sq. in.; that in engine B 43 sq. in. The compression volume is 12 cu. in. A non-effective layer of gas 1/16 in. thick in each combustion chamber would entail a loss of 29 per cent of the fuel supplied to engine A, and 23 per cent in the case of engine B, with corresponding reduction in the mean effective pressure compared to the ideal. The actual deficiency compared to the ideal is 27 per cent in engine A, and 18 per cent for engine B.

The high fuel consumption in both engines on full load at low speeds also suggests incomplete combustion. The mixture supplied was of such richness as to be scarcely combustible if homogeneous, yet no extra air could be supplied to the engines in the low speed tests. With increase of speed combustion apparently becomes more complete with consequent reduction of the fuel wasted per stroke.

Another characteristic of an extended combustion chamber is that of the relatively sluggish ignition which takes place therein. In the tests under discussion engine B was more sensitive to the position of the spark than engine A.

The author is conscious of the vagueness of this attempt to explain the difference in the mean effective pressures of engines A and B as compared with each other and also in terms of increase of engine speed. The phenomenon of combustion in such small combustion chambers is undoubtedly very complex, and there is ample scope for experiment to determine the extent to which heat loss and mean effective pressure are affected by combustion chamber shape and revolution speed, and the true explanation thereof. The general conclusion in respect of the influence of revolution speed upon brake mean effective pressure is that the rise in brake mean effective pressures at the lower speeds is due to the diminishing effects of incomplete combustion, while at the higher speeds these influences are more than negatived by the decrease in mechanical efficiency, thus causing the characteristic slow fall in the brake mean effective pressure—revolution per minute curve.

A—Full Load

Deduction.—Whatever the cause, the evidence as to improvement in fuel consumption with increase of speed is clear and unmistakable.

Mr. Pomeroy analyzed the performances as follows:

In both engines A and B the fuel consumption at 800 revs. per minute is about one pint per brake horsepower per hour, and falls to about 0.72 pints per brake horsepower per hour at 2400 revs. per minute. As mentioned in the previous section, no great improvement would be expected due to reduction in jacket loss with an engine in which the combustion chamber was of compact form. On the other hand, there is ample evidence that combustion is more complete with increase of engine speed. The fact that the fuel consumptions in the two engines are so nearly the same, while the combustion chamber proportions are so different, calls for some explanation. The author suggests that this is due to delayed combustion of what may be called the surplus fuel supplied. If this is being burnt more or less non-effectively during the latter part of the expansion stroke, and quite non-effectively during the exhaust stroke, the *excess* of combustion chamber surface in engine A over that of engine B must be considered as a fraction of the total surface exposed during the process of delayed combustion, in which case it becomes so small as to be negligible. Whatever the cause the evidence as to improvement in fuel consumption with increase of speed is clear and unmistakable.

B—Varying Loads

The average consumptions of engines A and B at varying loads are given in Table IX:

Engine A Revs. per Minute	Engine A Pts. per B.H.P. per Hour Consumption	Engine A Load	Engine B Revs. per Minute	Engine B Pts. per B.H.P. per Hour Consumption	Engine B Load
2,400	0.73	Full	2,400	0.72	Full
2,000	0.74		2,000	0.71	
1,600	0.79		1,600	0.76	
1,200	0.87		1,200	0.88	
800	0.99		800	1.12	
2,400	0.71	0.8 full load	2,400	0.74	0.8 full load
2,000	0.73		2,000	0.71	
1,600	0.77		1,600	0.73	
1,200	0.84		1,200	0.78	
800	0.98		800	0.86	
2,400	0.82	0.6 full load	2,400	0.81	0.6 full load
2,000	0.84		2,000	0.77	
1,600	0.88		1,600	0.81	
1,200	0.97		1,200	0.87	
800	1.15		800	0.97	
2,400	0.98	0.4 full load	2,400	1.0	0.4 full load
2,000	1.05		2,000	1.0	
1,600	1.12		1,600	1.04	
1,200	1.24		1,200	1.06	
800	1.38		800	1.19	

An inspection of this table reveals the fact that on the whole in both engines the best fuel consumptions occur at 0.8 full load.

The effect of increased speed from 800 revs. per minute to 2400 revs. per minute may be expressed as follows:

Improvement in Consumption with Increase of Speed from 800 revs. per minute to 2400 revs. per minute

	Engine A	Engine B
Full load	26 per cent	35 per cent
0.8 Full load	27 per cent	11 per cent
0.6 Full load	28 per cent	16 per cent
0.4 Full load	29 per cent	16 per cent

The figures are not conclusive, but they indicate that broadly the improvement in consumption with increase of speed is of the same order at part load as at full load.

The average consumption throughout the speed range of 800 revs. per minute to 2400 revs. per minute is given in Table X for the various fractions of full load.

TABLE X

Average Consumption

Pints per Brake Horsepower per Hour

800 *revs. per minute to* 2400 *revs. per minute*

	Engine A	Engine B
Full load	0.83	0.71
0.8 Full load	0.83	0.78
0.6 Full load	0.95	0.86
0.4 Full load	1.18	1.05

From this it is seen that the effect of increasing the load from 0.4 to full load, *i. e.*, 150 per cent, is to cause an improvement in consumption of 29.6 per cent in engine A, and of 32 per cent in engine B.

The conclusion from the above is that on the one hand an increase of speed of 100 per cent improves consumption in the order of 25 per cent irrespective of load, and on the other that an increase of load of 150 per cent irrespective of speed causes an improvement in consumption in one engine of 29.6 per cent, and in the other of 32 per cent.

Fuel Consumption Per Hour for Any Given Horsepower

Deduction.—For small gasoline engines working between 25 and 50 per cent of their maximum brake horsepower, the brake thermal efficiency for any given horsepower is independent of the load and revolutions per minute of engine.

Mr. Pomeroy completed his analysis as follows:

The conclusion of the last section leads directly to the main point of practical interest in the paper: In automobile design, the conflicting interests of fuel consumption and engine speed which are usually supposed to lead in general to the use of the highest top speed gear ratio consistent with preserving enough excess torque to enable the vehicle to climb hills without gear change to an extent sufficient to placate the user.

The use of a low top speed gear ratio is commonly understood to carry with it the penalty of excessive consumption.

In the last section it has been shown that both increase of load and increase of speed carry with them reduction of consumption to somewhat the same extent, *i. e.*, 100 per cent increase of load reduces consumption in the same order as 100 per cent increase of speed.

The chief function of an automobile engine is the performance of a given task. In order to propel it at, say, thirty miles per hour on the level a given horsepower is required. Further, this horsepower is only a small fraction of that capable of being developed. In the case of a medium-sized touring car the horsepower exerted at thirty miles per hour is only about 25 per cent to 40 per cent of the maximum it is capable of developing according to the size of the engine and the top speed gear ratio or engine speed.

Selection of Gear Ratio

In selecting the gear ratio for a given engine the designer has obviously a wide range of choice for the development of such a small fraction of the total power available. He can, for example, with an engine such as those under discussion obtain the requisite horsepower at, say, 500 to 600 revs. per minute at full load, or at 2000 revs. per minute at, say, quarter load. In the first case there is no reserve for hill climbing; in the second, the engine revolutions would be a very long way above those appropriate to maximum horsepower before the car was traveling at the speed of which it would otherwise be capable. It is obvious that between these extremes lies the most suitable gear ratio.

If fuel consumption is regarded as being to any extent inversely proportional to engine speed it is necessary to keep the gear ratio as high as possible. On the other hand, if this consideration can be neglected the gear ratio can be chosen so that the engine speed at the maximum car speed on the level corresponds to that of maximum brake horsepower. It can, in fact, go well over this owing to the usual flat top of the curve relating brake horsepower and engine speed.

Consideration of Fuel Consumption

The question is, can considerations of fuel consumption be neglected? The author considers that this can be answered in the affirmative over a large range of engine speed and load.

Horsepower depends upon the product of torque and speed. If consumption varies inversely to the same extent for the same percentage variation of torque and speed, it is obviously a matter of indifference whether a high or low gear ratio is used so far as consumption is concerned.

In the last section some figures relating to the change in consumption with load and speed were given which support this view. Figs. 10 and 11 show the fuel consumption per hour, brake horsepower, and revolutions per minute plotted on three planes of projection for each engine.

Taking the consumption per hour for 10 hp. between speeds of 1200 revs. per minute and 1800 revs. per minute, the increase in consumption is from 11.5 to 12 pints per hour. It follows, therefore, that for an additional consumption of one pint per hour the designer can produce a car with a reserve torque capacity greatly in excess of that usually given.

To confirm the above the author has carried out road tests on his own car fitted with engine A, the car being driven as nearly as possible at a constant speed of 20 miles per hour and 30 miles per hour on top and third speeds respectively.

The results are as follows:

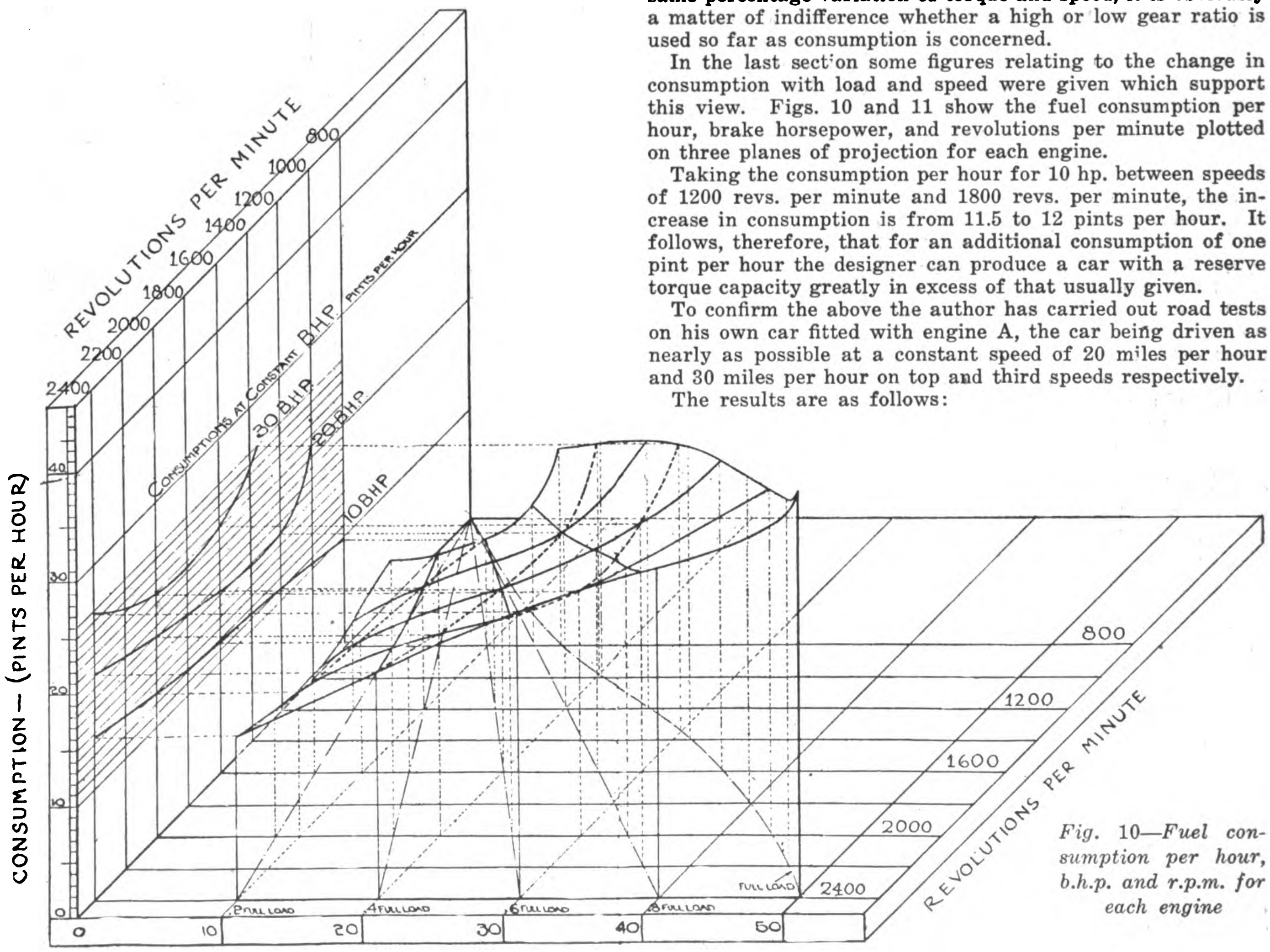


Fig. 10—Fuel consumption per hour, b.h.p. and r.p.m. for each engine

Top speed	Engine revs. per minute	Miles per gallon	
20 m.p.h.	860	24.7	
30 m.p.h.	1,290	23.0	
Third speed			
20 m.p.h.	1,320	21.8	(24)
30 m.p.h.	1,970	19	(21)

In parentheses alongside the actual road consumption is given the consumption allowing for a loss of 10 per cent due to oil churning, gear friction, etc., when running on third speed.

The horsepower necessary to overcome the tractive resistance at 20 miles per hour is about seven, and at 30 miles per hour about twelve. The maximum brake horsepower developed at corresponding engine speeds is about 16 and 25 respectively on top speed. The maximum brake horsepower developed at the same road speeds but at engine speeds corresponding to third speed gear is about 27 and 39 respectively. The power exerted by the engine in these tests therefore varies from about 25 per cent to 50 per cent of full load.

In short, for small gasoline engines working between 25 per cent and 50 per cent of their maximum brake horsepower, the brake thermal efficiency for any given horsepower is independent of the load and revolution speed.

Deductions and Lessons

In conclusion, the author is aware that a series of tests extending over many months such as those described are susceptible of criticism on the grounds of doubt as to their strictly scientific accuracy in view of the infinite number of varying conditions entailed. In spite of this the author feels that the experimental data are substantially accurate. Constant experience with one or two engines produces a very accurate sense of any departure from the normal, and causes the repetition of any tests which seem to be unreasonable.

The principal lessons from the work done are in the opinion of the author the evidence of the high charging capacity of a small overhead inlet valve and the comparative independence of consumption in respect of engine speed and torque for horsepowers up to 50 or 60 per cent of the maximum.

There are many designers now engaged upon the design of overhead valve engines for touring cars inspired by either aero engine practice or the fashion in America, as the case may be. The author would remark that the development of overhead valve engines is being caused not so much on technical or scientific grounds as by the fact that with the ordinary type of engine the fitting of a dynamo and self-starter both carried on the engine is well-nigh impossible.

Utility of Industrial Laboratories

AMONG the reasons for the success of German industries in the period preceding the war must be reckoned the recognition of the importance of the union of science and practical work, demonstrated by the value ascribed in Germany to industrial laboratories, says a writer in *Le Genie Civil* for Oct. 18. The results, however, obtained up to the present in France have been disappointing when viewed from the financial standpoint, and the author fears that laboratories founded for the purposes of the war will be abandoned as soon as peace is declared.

After laying stress upon the distinction between a laboratory for merely testing the qualities of the product of a given factory and a laboratory for research work proper, he remarks that the manufacturer will rarely hesitate about a reasonable expenditure on the former, but is difficult to convince about the value of the latter. He considers that there is too much individualism among French manufacturers and too little recognition of the work of their subordinates, and he pleads finally for a wider extension of the research laboratory.

British Want Ministry of Ways and Communications

IN England there is a movement on foot at the present time looking toward the establishment of a separate Ministry of Ways and Communications. The Commercial Motor Users' Association, which corresponds to our Motor Truck Club, has placed itself on record as favoring the proposition by adopting the following resolution:

"The National Council of the Commercial Motor Users' Association (Incorporated), having considered the proposal to place the control of (a) roads and road transport, and (b) railways under the same ministry, is of opinion, the interests concerned being seldom identical and sometimes conflicting, that housing and other national reconstruction programs, and development of industrial and agricultural road transportation, are likely to be retarded unless such control be entrusted to distinct and separate ministries, or guarantees of like effectiveness be provided by the government in any new departmental organization."

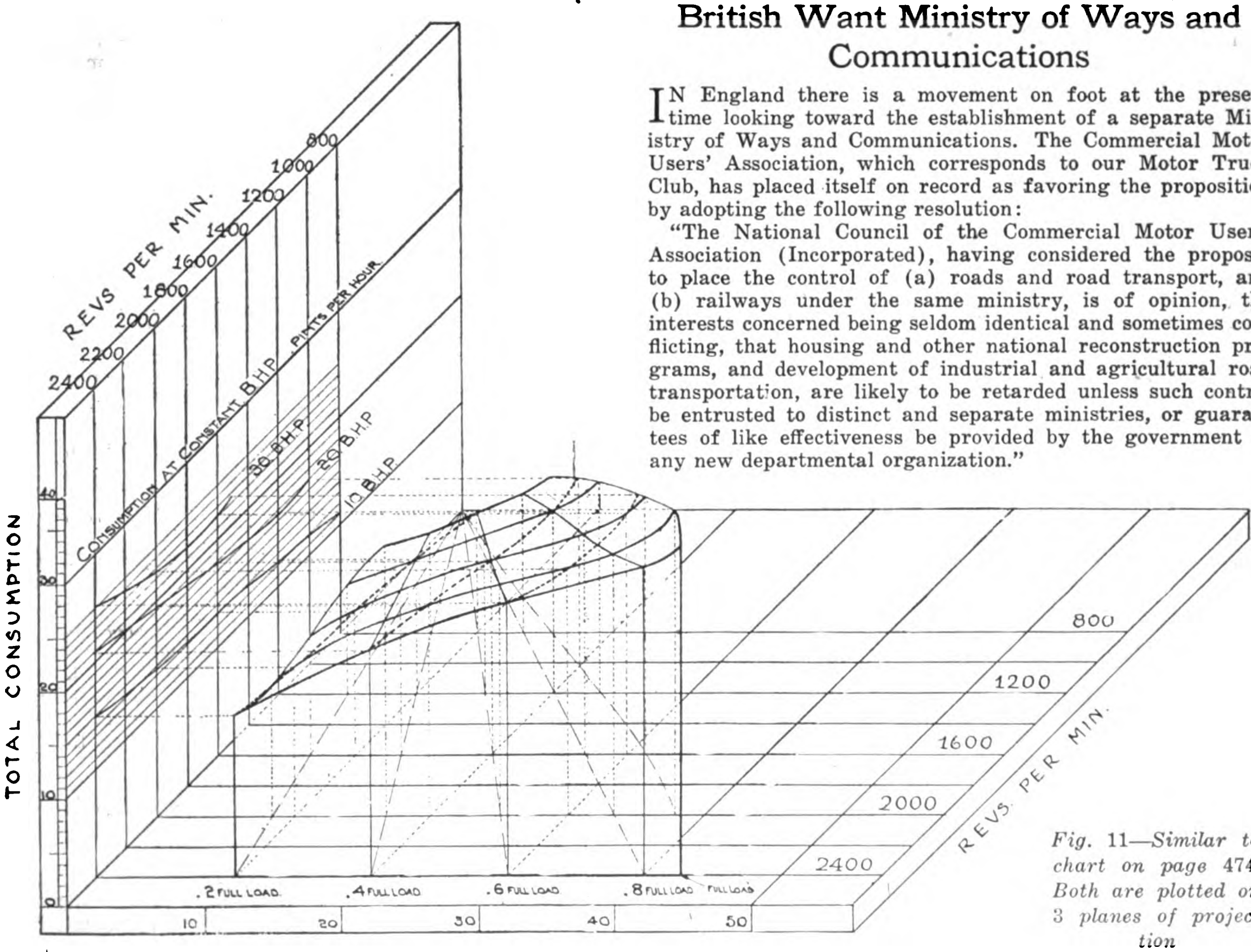


Fig. 11—Similar to chart on page 474. Both are plotted on 3 planes of projection

Labor's Representation in Plant Management the Immediate Problem

Workers' Demand for Voice in Factory Conditions Growing—Elective Representation Successful

By Harry Tipper

IT is evident from the discussions which are occurring in the various engineering and scientific associations and in the organizations of a less specialized character that the labor problem is receiving more study at the hands of the various industries than it has received at any other time. It is also evident from the tenor of these discussions that the futility of any attempts to solve the labor problem which do not take into account the lack of responsibility of the worker to his organization is becoming recognized more and more. The remarks which were contributed by Mr. Corless at the discussion of the Institute of Mining Engineers are indicative of this attitude:

"They have very little or no voice in governing themselves. They are parts of an organization, cogs in an economic machine which they do not fully understand, and in which they almost lose their identity—that is, their freedom for self-development. Somebody, somewhere, shapes the organization and sets it in motion, but the parts of the organization they see or the work they perform usually have little, if any, scientific or social meaning to them. Hence their spirit rebels. The human spirit, unless it has been utterly suppressed, is fortunately so constituted that it always rebels against any form of external authority in which it has no share, and which it does not intelligently grasp.

"Industrial peace will never be attained as long as capital and management assume the right to a final say on matters intimately affecting the welfare and even the self-respecting existence of a very numerous class, whose loyal co-operation is as essential to the success of every industrial enterprise as their own.

"Is it clearly recognized that we are at the beginning of a great transition period of industry? Do we realize that the autocracy of capital is coming to an end?"

All this emphasizes the necessity of those organization changes which have been discussed in AUTOMOTIVE INDUSTRIES and which look to the introduction of organization machinery which will give a definite share of the responsibility to the worker and throw open to the decision of the combined worker and governors of industry those matters which affect the welfare and even the existence in a self-respecting manner of the worker. The tendency of the events which have occurred since the armistice was declared in the relations between employers and workers in the various manufacturing countries is very easy to see.

There is a definite demand on the part of the worker for a larger control of the conditions under which he will work and for a larger share in the profits of the industry. This tendency has been noted many times in these articles, but it is so important a matter that it must be emphasized again in order that its significance will be thoroughly appreciated. In all the history of the relations of employers and employees as labor and capital since the beginning of the industrial revolution, the issues have never been drawn more clearly than they are drawn today, and the necessities of the case require more thorough and definite attention to the situation with a much closer study of the conditions and a much greater willingness to institute the organization changes which are necessary in order to provide the machinery for the solution of the present troubles.

No other system of organization has been found of any value in the development of industrial work up to the present, except the system which includes some form of representation by the worker and their proper methods of election in the body which has charge of the decision upon the hours of work, the rates of pay, holidays, welfare activities, and other matters that are concerned, under which the worker shall operate. It is interesting to note in this connection that the full plant of the Bethlehem Steel Corporation, which was mentioned in one of the previous articles, includes a complete organization for the joint operation of the worker and the management in all matters relating to the conditions of the worker, and in this respect takes in more detail than is definitely determined in most of such organization plans.

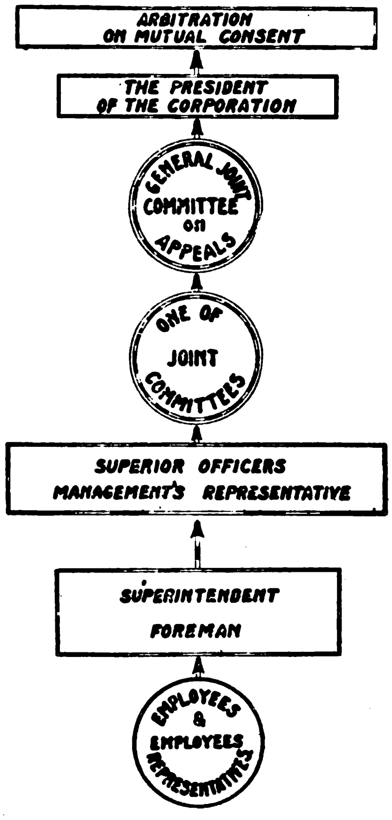


Chart illustrative of procedure in the prevention or adjustment of matters arising for settlement

This plan varies from the plans of the other steel companies which have been considered in this series in that it provides for a different representation based upon the size of the plant.

1. Representation shall be on the following basis:

Plants employing under 1500 employees: One representative for each 100 employees.

Plants employing 1500 to 10,000 employees: One representative for each 200 employees.

Plants employing over 10,000 employees: One representative for each 300 employees; provided, however, that in no case there shall be less than ten representatives.

Such adjustments as may be necessary to meet special cases shall be made.

2. For the purpose of applying the unit of representation, the plants should be subdivided according to departments and natural subdivisions. Wherever it is necessary to group a number of small departments in order to complete a unit of representation, regard shall be had to logical groupings and location.

3. Adjustments in units of representation shall be made in accordance with the recommendations of the Committee on Rules.

It has the usual provisions which have been accepted in large organizations for the qualifications of the representative and the elections. It provides for meetings of

the joint committees once every 2 months and for the representatives committees once every month. This frequency of meetings is an important point in the development of any such organization which was omitted from the earlier plans developed in some of the large steel companies, and which omission we noted at the time. The frequent meetings of these committees will do much to get them on a working order and to iron out the difficulties which must appear in the beginning of the organization work.

As we stated previously in considering this point, one of the important factors in this getting together of joint committees is the knowledge which will be gained by the different men of each other and of the respective personalities, opinions and desires. This knowledge itself will operate to clear away a great deal of the suspicion of misunderstanding which is the root of so much labor trouble, and this knowledge cannot be acquired unless the committees meet frequently.

The procedure for adjustment of personal grievances which is considered in this company has the same defect which has been found in a number of these plants. The number of steps which can be taken in order to settle such personal grievances are too many and the judicial procedure is much too involved to serve the purpose adequately. From observation, in a great many plants where some form of review is permitted for the settlement of personal grievances, the writer is convinced that it is not necessary to provide a great many steps of appeal in order to secure thorough satisfaction on these matters.

It is very important, however, that the procedure should not become involved to the delay in rendering a decision until the final result is an irritation in comparison with which the personal grievance is small, instead of a settlement of the matter which will remove the irritation.

Prompt Decisions Desirable

One of the great complaints insisted upon by the labor organization in Great Britain in respect of the Whitely Council which promises so much has been the difficulty of securing a decision from such councils, and the fact that between the action of the councils themselves and the references which had to be made to the central bodies where the council could not reach a decision, too long a time has been involved before the final decision of the final board of appeals could be issued. In the case of the review of a personal grievance, the important matter is to have a review board which by its composition will be above suspicion in the eyes of the worker; then to give that board sufficient leeway for the examination of witnesses and material involved in the case, so that it can render a decision promptly.

There is a tendency in a number of these cases in the judicial procedure of the industrial organization to follow the judicial procedure involved in the courts so as to provide a great many different lines of appeal, growing, finally, in this as in some other cases, out of the organization for the arbitration of the matter. It is not apparent that any good purpose will be served by this, and it may result in conditions of irritation which will destroy to some extent the good effect produced by the development of the representative system of organization. For those interested in the matter the chart presented by the Bethlehem Steel Corporation for both the representative committees and the legal procedure are shown in connection with this article.

During this time of adjustment there is an opportunity to stabilize the industrial establishment to avoid a great deal of turmoil which might ensue unless the adjustment is kept within orderly points, and to build a foundation which will permit the future stable growth of the industrial organization on a basis of efficiency not possible under present conditions. These organization developments which we have mentioned indicate the desire of many industrial establishments to place their business upon such a foundation, and the possibilities involved are important enough to merit the attention and study of every manufacturer.

There is a feeling among manufacturers that organization changes, looking to the removal of the continual warfare which exists between labor and capital, will be made at the expense of efficiency in production. There is no evidence which would indicate that this attitude is correct in any way. It arises from our old habit of considering the machine as the limiting point of capacity and looking to machine improvement for the development of more speed and efficiency in production.

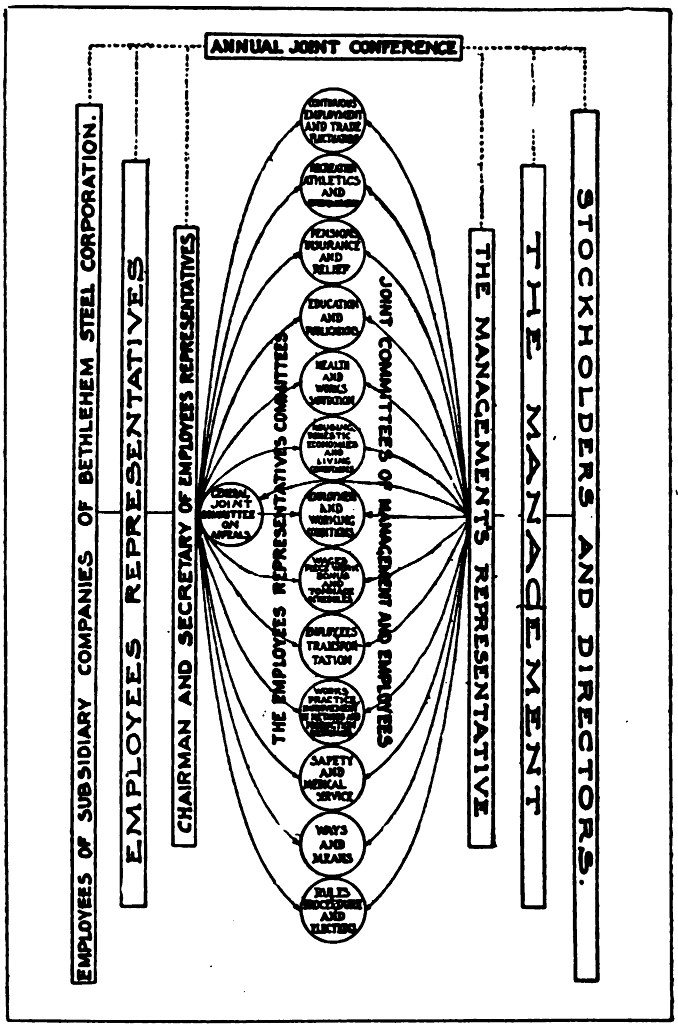


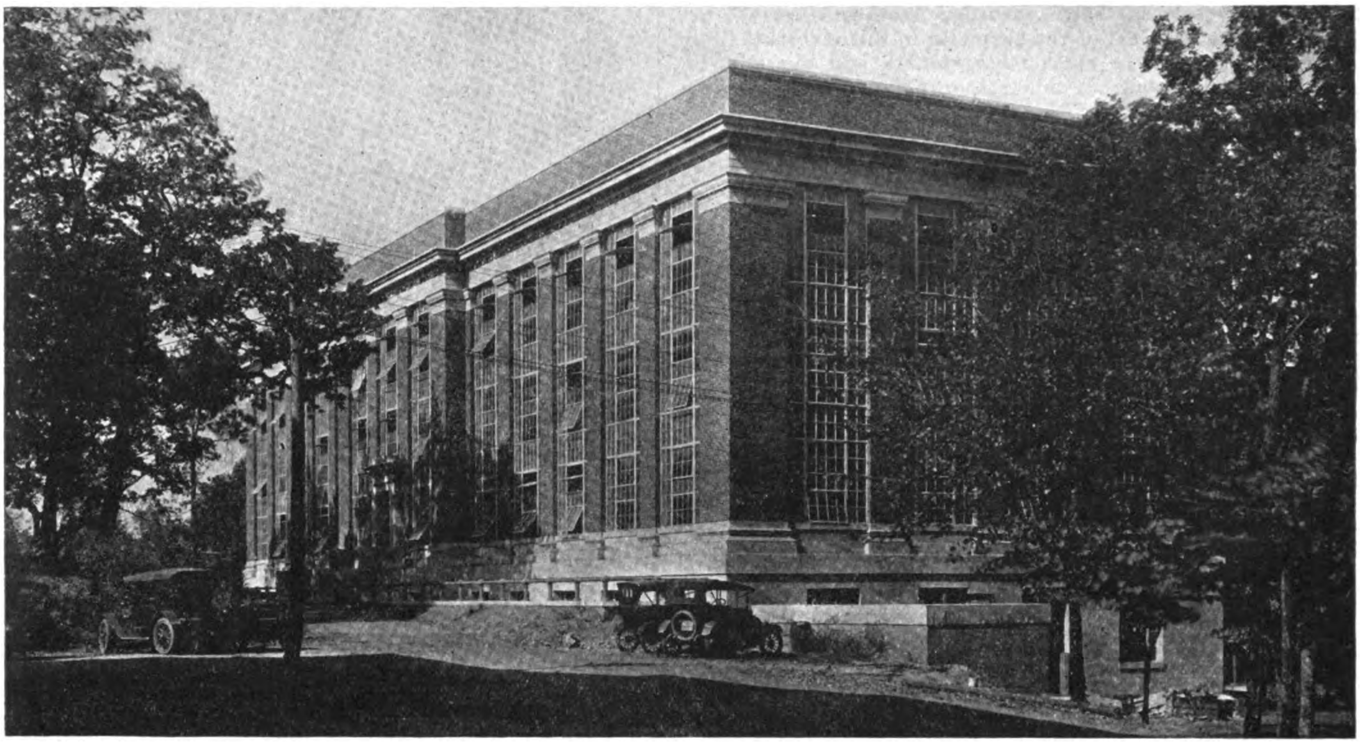
Chart illustrative of representation of employees of the Bethlehem Steel Corp. and subsidiary companies

The history of the industrial development since the beginning of the modern factory system does not indicate that there has been any particular advance in a knowledge of the conditions which govern the personal efficiency of the individual. Its success and its tremendous development have been due almost entirely to the possibilities involved in massing men together for particular operations. In a very large measure, the benefit industrially from massing people together for particular operations has been due to the transfer of the skill from the worker to the machine so that the required efficiency of the individual was not so high, the period of training much shorter and the possibilities of error not so great.

Now that the factory system is thoroughly established and that improvements in machinery come more slowly, the necessity of an increase in the efficiency of the individual laborer is forced upon the manufacturer. Where organization changes have been instituted for several years, so that their effects have become visible, and these organization changes have been based upon sharing the responsibility for the labor condition with the employees, it has been found that the personal efficiency has increased a great deal so that it has been possible to secure a more effective production per dollar of wages outside of the saving secured by the lack of disorder and the elimination of strikes. It is necessary to know this so that the full economic value of such organization changes may be understood.

Industrial Tests by Bureau of Standards

Co-operated Closely During War with Military and Industrial Establishments—Wide Scope of Experiments and Tests—Wind Tunnel for Aviation—Standardization of Master Gages



Metallurgical Building, Bureau of Standards, Washington, D. C.

EDITOR'S NOTE—*Mr. Heldt has just completed an intimate study of war and other technical work performed by the Bureau of Standards at Washington. The following commences a series of articles, each separate and discussing, in detail, the tests, and results secured. The series will be published from week to week.*

FEW people, probably, have any conception of the great expansion during the war of the Bureau of Standards at Washington and of the present wide range of its work. No so many years ago there was little connection between this Government Bureau and the industries of the country. Everybody knew that the Bureau tested thermometers, calibrated weights and measures, and did similar work requiring an equipment of scientific apparatus and the necessary skilled personnel for handling it, but little was heard of co-operation between it and the great industries of the country.

During the period of the war, however, the Bureau has been co-operating closely with these industries and most of all with the automotive industries. In fact, all problems requiring scientific research or accurate tests that came up in connection with war activities were assigned to it.

Naturally the facilities of the Bureau soon proved inadequate to cope with the new work. Building construction has been going on all the time since the beginning of the war, and the personnel has been multiplied more than threefold.

It is an indication of the wide scope covered by standards that the following statement of the functions of the Bureau drawn up some years ago seems to fully cover its activities to-day: The development, construction, custody, and maintenance of reference and working standards and their intercomparison, improvement and application in science, engineering, industry and commerce.

The laboratories of the Bureau, which had been of great use to the nation in times of peace, proved of special importance during the war. Instruments, materials and supplies were on hand which were almost unobtainable elsewhere. Examples of the problems which were referred to the Bureau for solution are those which arose from the failure of the linen supply for aircraft construction and the lack of optical glass, which was formerly obtained exclusively from Germany. Other lines of activity of the Bureau during the past year that grew out of war requirements had to do with ship chronometers and with development work in connection with light alloys.

A very important branch of the Bureau during the past year has been that engaged in the standardization and testing of master gages used in the manufacture of munitions. The work done in this line by the Bureau has proven an important aid to the mechanical industries. Just previous to the declaration of the armistice the gage section of the Bureau had a staff of 140, and a special building has been erected for it. This section of the Bureau has a branch in New York City and maintains laboratories in Cleveland, Ohio, and Bridgeport, Conn. No less than 27,865 gages were tested during the last fiscal year.

Undoubtedly of most interest to the automotive industries is the work that was done in connection with aircraft development. As a matter of fact there has hardly been any line of development in connection with airplanes in which the Bureau has not co-operated in one way or another. This work was carried on under arrangements with the National Advisory Committee for Aeronautics. While the Interna-

tional Commission for Aircraft Standardization was sitting in Washington, much experimental work was done at the Bureau to help in the solution of the problems that confronted this commission. The work of the Bureau covered every detail of airplane design, materials, construction, efficiency of form, motor performance, efficiency of lubrication, carburetion, ignition, choice of fuel, propeller in plane performance, measuring instruments and the appliances required for control.

One of the most interesting investigations now in preparation is that of tests on airplane power plants in free flight. For this purpose six autographic test instruments have been designed, of which three have already been completed. These will automatically record the torque, engine speed, propeller thrust, plane speed, angle of attack and inclination to the horizon. All these factors will be recorded automatically while the plane is in flight, without the instruments requiring the least attention on the part of the pilot.

Much work has naturally been done during the past year by the section on aeronautical instruments, the staff of which was greatly enlarged. This section acted in an advisory capacity to the military authorities and also made numerous tests for them. Further researches are now being conducted with the object of improving the efficiency of altimeters. A special wind tunnel was built at the Bureau, operated by a 9-ft. propeller direct connected to a 100-hp. electric motor. In this wind tunnel it is possible to obtain air speeds up to 90 m.p.h. It serves to test the accuracy of aeronautical measuring instruments and to study the design of airplane parts, stabilizing control devices, the effect of stream lines, plane sections, etc.

The activities of the Bureau during the past year have been too many to be all enumerated here. Most of the work, of course, has been done either directly or indirectly for the Government. Now that peace has come again and that our industries are being directed into new channels, it is to be hoped that the facilities of this great national institution may be made available for the solution of problems confronting the various industries. Why should not our industries in times of peace look to the Bureau for the same assistance which our Government received from it in time of war?

Tests of Airplane Radiators

An Experimental Study by the Bureau of Standards Conducted at the Request of the National Advisory Committee for Aeronautics, Bearing on Head Resistance, Resistance to Water Flow and Weight, All in Relation to Heat Energy Dissipated

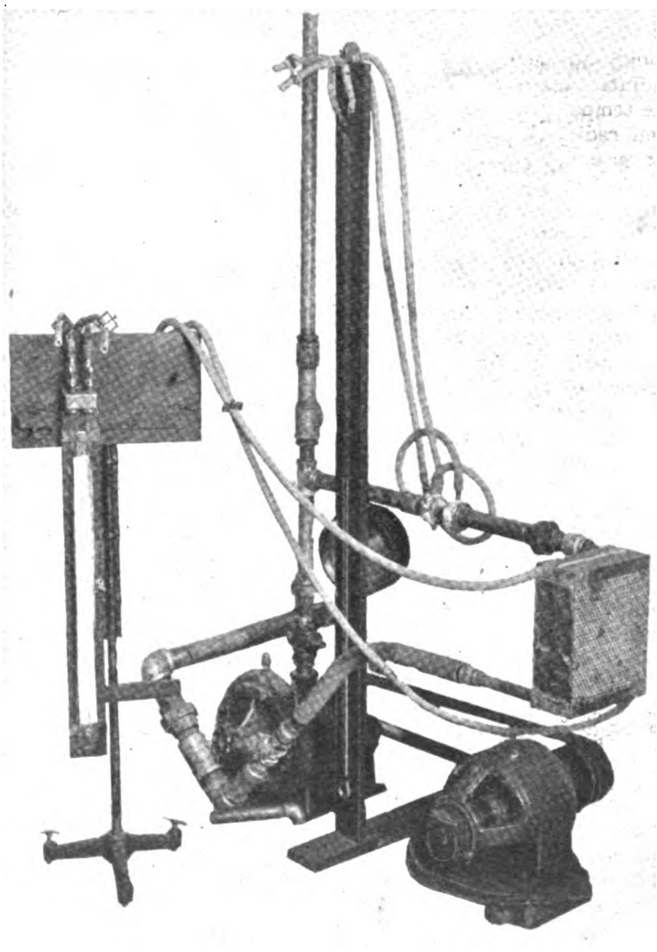
By P. M. Heldt

IF a number of automobile radiators were to be compared on a strictly technical basis, leaving out of account such factors as cost of construction and freedom from tendency to develop leaks, it would probably be agreed that the proper basis would be the amount of heat dispersed per unit of time per unit of radiator weight. In an automobile any unnecessary weight is a detriment, and if a radiator construction can be found which will permit of reducing the weight without loss of cooling qualities, it is an improvement over existing types.

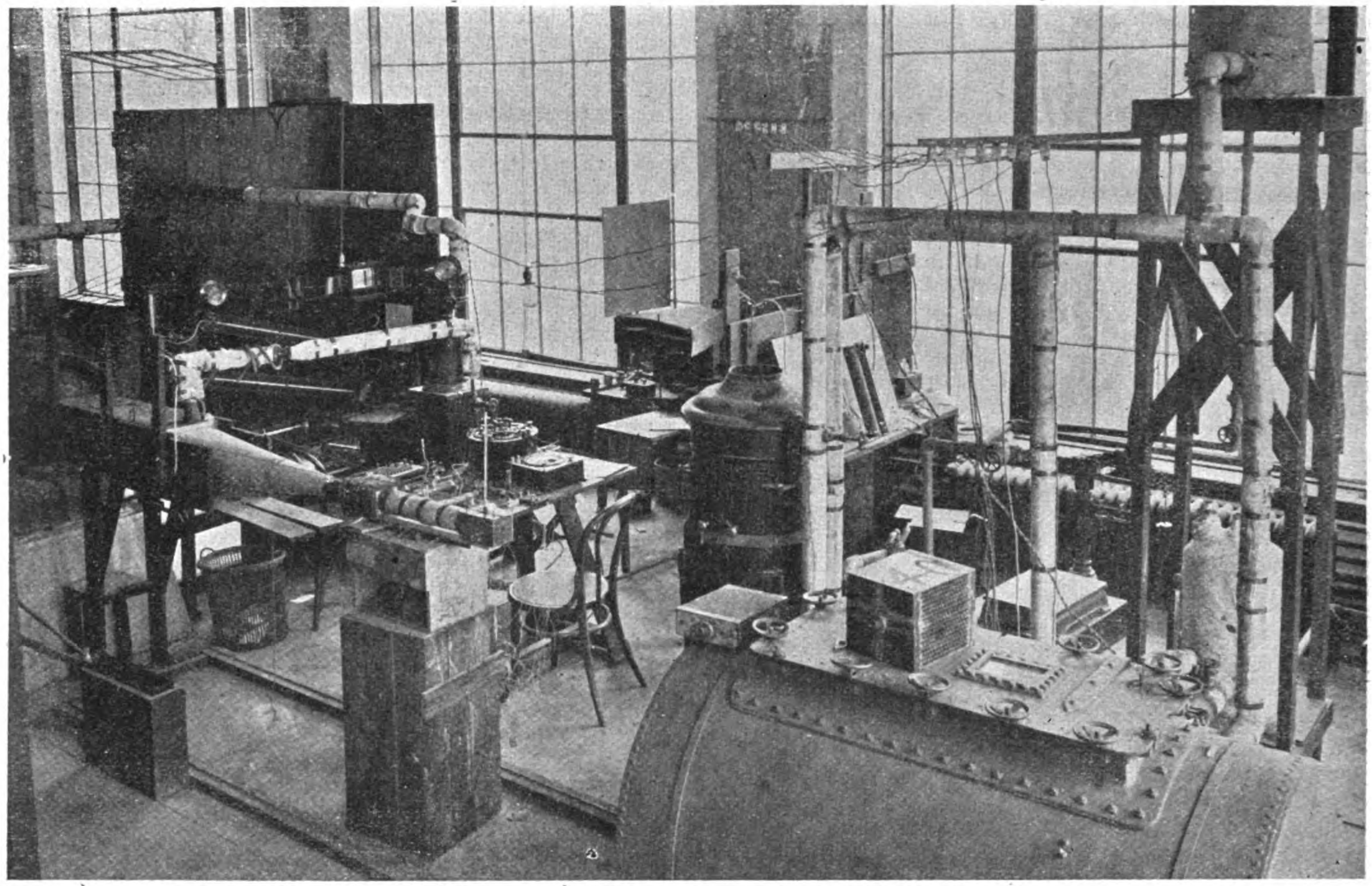
In aircraft work unnecessary weight is far more objectionable than in automobiles, for the reason that the horsepower expenditure in transporting, say, 100 lb. of weight in an airplane at the usual speed is incomparably greater than that expended in transporting the same weight in an automobile. Yet lightness is not the most important characteristic of an airplane radiator. What is required most is a minimum head resistance per unit of heat dissipated per unit of time. The radiator cannot be placed inside the airplane body or in some other location where it merely absorbs the carrying capacity of the plane, but must be located where it is fully exposed to the wind created by the plane's motion, hence it adds materially to the head resistance of the machine, and, other conditions being the same, that design of airplane radiator is best which for a given rate of heat dissipation creates the least additional head resistance.

Test Apparatus Used

At the Bureau of Standards in Washington quite elaborate apparatus has been installed with the object of testing samples of radiator cores with respect to their ability to disperse heat, and their head resistance. These samples, which are made up in uniform sections 8 in. square, are being tested in a vacuum chamber in which the air pressure can be reduced to that corresponding to different altitudes of flight. The air is circulated through the specimen by means of a blower mounted in one end of the chamber. The vacuum chamber is made of boiler plate, with one concave and one convex head. The specimen is placed inside of a wind tunnel made up of 1-in. planking, of square cross section with pyra-



Apparatus used to measure pressure necessary to produce water flow through radiator core



View of the radiator test laboratory

midal approaches at each end. On each side of the specimen radiator are located thermo couple grids by means of which the temperature of the air on entering and leaving the specimen radiator may be accurately measured. The quantity of air passing through the radiator in unit time, or, in other words, the rate of air flow through the specimen, is measured by means of a Thomas meter or a grid of pitot tubes in front of the specimen.

Through the specimen radiator is circulated either hot water or steam from a heating boiler close by. It has been found that when the rate of circulation through the radiator exceeds a certain value, the heat dispersal is practically the same whether water or steam is being circulated. The amount of heat given off by the specimen radiator can be measured in two diffrent ways—by measuring the rate of water flow through the radiator and the drop in temperature of the water, and by measuring the rate of air flow through the radiator and the temperature rise of the air—and the two results usually check to within 1 per cent. The air that is passed through the radiator for the purpose of abstracting heat from it is circulated only within the vacuum chamber. It is drawn through the central wind tunnel by the blower located at one end of the chamber and returns through the outer portion of the chamber where it has to pass through the cells of a cooling radiator through which cold water is circulated. In this vacuum chamber air speeds up to 70 m.p.h. can be obtained. For higher air speeds, up to 120 m.p.h. the atmosphere test chamber is used, and head resistance measurements are made in the large wind tunnel of the Bureau, where air speeds up to 90 m.p.h. can be obtained.

There are glass windows in the top and in one side of the vacuum chamber through which the specimen and other apparatus within the chamber can be observed while a test is on.

A very careful study of the problems connected with aircraft radiator design has been made by the Bureau of Standards and several reports on this subject have been made to the National Advisory Committee for Aeronautics. In its study of the problem the staff of the Bureau had the advantage of access to reports on the same subject made earlier by scientific committees in Allied countries.

There are several distinct types of radiator core construction. Cores in which the air passages are of substantially tubular form are called cellular radiators. The true honeycomb core is a cellular core in which the water can circulate freely in all directions on all sides of each air tube. Water tube cores are cores in which the tubes form the water passages and the air passages are formed by the spaces between these water tubes. In one type of water tube core sheet metal fins are secured to the water tubes and extend out into the air passages to give additional indirect cooling surface, but this type has proved of little value in aeronautic work. Another type, consisting of very flat tubes set edgewise to the air current, has given promise of great value for planes of very high speed.

Definition of Terms

In a radiator the air flow and the water flow are always at right angles to each other. The dimension of the core parallel to the direction of water flow is called its length; that parallel to the direction of air flow, its depth, and that perpendicular to both is called the width of the core. The frontal area is the total area of the core perpendicular to the direction of air flow. While there are three steps in the transfer of heat from the water in the radiator to the air passing through it, it is found that the transfer of heat from the metal of the air tubes to the air is the most important and limits the capacity of the radiator, so that the surface area of the air tubes, which is called the "cooling surface," is the most important factor.

A distinction must be made between direct cooling surface, which is in contact on one side with water and on the other side with air, and indirect cooling surface, which is not in direct contact with the water but to which the heat must flow through a considerable length of metal. The temperature of direct cooling surface is substantially the same as that of the water in contact with it, but owing to the length of the

path of heat flow from the water to the indirect cooling surface, the latter is of considerably lower temperature than the water and the rate of heat dispersal is much less from indirect than from direct cooling surface. In some types of core, pockets are formed in the water tube walls in which there is very little circulation of water, and the Bureau of Standards regards such surface as indirect cooling surface.

Factors Involved

The following is taken from an anlysis made by the Bureau of Standards of the properties which determine the suitability of a particular radiator for use under aircraft conditions:

1—The cooling capacity must be equal to the heat to be dissipated under the worst conditions, that is, when the plane is climbing at its maximum rate from the ground in hot weather. It must also be possible to control the cooling capacity so that the water temperature in the engine jackets will not fall below a predetermined value under conditions of most rapid cooling, as when diving or when flying at high altitudes in cold weather.

2—The head resistance of the radiator has an important influence on the total amount of power required for propelling the plane and is a factor in determining its aerodynamical properties.

3—Another important factor is the combined weight of the radiator and the water contained by it. This affects the balance of the plane as well as the power required to carry the radiator.

4—If the head resistance of the radiator is known, the power required to overcome this resistance at any given speed may be readily calculated, as may the power required to carry the radiator, which is simply that proportion of the total brake horsepower usefully expended which is represented by the ratio of the radiator weight to the total loaded weight of the plane.

5—The pressure required to force the water through the radiator is a factor.

6—It is desirable to have a simple means of comparing the relative values of different radiator constructions. It has already been stated that the criterion of radiator merit is that it shall absorb the least power for the given rate of heat dispersal. As it is possible to express the heat dispersal in horsepower, the ratio of heat dispersal to energy absorption due to the head resistance and weight of the radiator will be a simple number which will be the same irrespective of the units employed. This figure for any particular radiator is called its figure of merit. The best airplane radiator for "free air mounting" is that having the highest figure of merit.

In making a study of different core constructions, the Bureau took note of the following features:

1—The form of the air and water passages.

2—The depth of the core.

3—Quality and thickness of the metal.

4—Weight of the core empty and of the water contained.

5—The free area of the air tubes, defined as the percentage of the total frontal area occupied by the free cross section of the air tubes.

6—The hydraulic radius of the air tubes, that is the area of the tubes divided by their combined perimeter.*

7—The ratio of length of air tube (depth of core) to hydraulic radius.

8—The cooling surface in square feet per square foot of frontal area.

9—The proportions of direct and indirect cooling surface.

10—The dimension of the water tubes, including the length in the direction of flow for a section of the core 1 ft. long, the width of the tubes, the thickness and the hydraulic radius, all expressed in inches.

11—The cross sectional area of the water tubes normal to the direction of flow. With uniform tubes this is equal to the area of a single tube normal to the direction of flow, multipled by the number of tubes per foot of width.

Factors in Radiator Operation

Following is an enumeration of the factors entering into the operation of a radiator:

1—The mass flow of air through the core, which may be defined as the rate of flow, in pounds per second through a unit of frontal area.

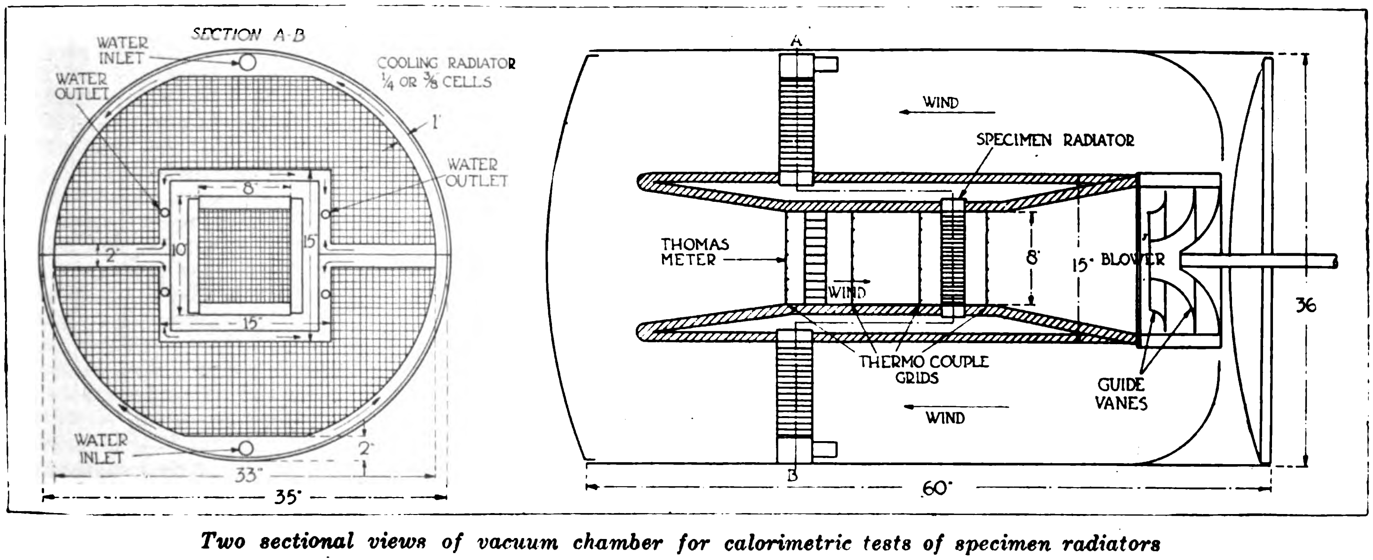
2—The temperature difference between the air and the water. This is taken as the difference between the arithmetic mean of the entering and exit temperatures of the water and the temperature of the entering air, in degrees Fahrenheit. It is pointed out in this connection that for the highest degree of accuracy the logarithmic mean of the water temperature should be used, but as there is little difference between the logarithmic and arithmetic mean, the latter is used for the sake of simplicity.

3—The air density, which is taken at 0.075 lb. per cubic foot at ground level.

4—The flow of water through the core, in gallons per minute.

5—The nature of air and water flow through the core, reference being made particularly to the difference between stream line and turbulent flow. When the flow is turbulent the exchange of heat between the fluid and the surrounding wall is much more rapid than when the flow is of a stream line character. Turbulent flow is obtained at all speeds met with in airplane radiators. The speeds required to produce it are smaller the larger the diameter of the tube. When a fluid flows around an obstruction not conforming to the

*Since the cooling surface of a plain cellular radiator is very nearly equal to the depth multiplied by the perimeter of the air tubes, the hydraulic radius of the air tubes for such a core may be obtained by dividing the total volume of the air tubes, i.e., the free area multiplied by the depth, by the total cooling surface. This has the advantage of being a quantity which can be found for noncellular types of radiator.



Two sectional views of vacuum chamber for calorimetric tests of specimen radiators

stream line form, turbulent flow is produced even at low velocities, this being referred to as artificial turbulence.

In the work of the Bureau of Standards on radiator cores, the properties of the cores were defined as follows:

1—The energy dissipated is expressed in horsepower per square foot of frontal core area and for a standard temperature difference of 100 deg. Fahr. It is intended that the rate of water flow when this figure is attained should be high enough to produce turbulence.

2—The weight of the core in pounds per square foot of frontal area, both empty and with the water required to fill that section of the core.

3—The head resistance of the core, which may be defined as the force which would be exerted on the radiator if it were supported in a free air stream which produces the given mass flow.

4—The mass flow of air through the core when supported in a free air stream, which for all ordinary types of core has been shown to be proportional to the free air speed to which the core is subjected, so that if the proportionality factor has been once determined the mass flow for any free air speed, in pounds per second per square foot of frontal core area, may be readily found. This proportionality factor, which is based on air density of 0.075 lb. per cubic foot, is called the mass flow factor of the core.

5—The energy absorbed by the core under free air conditions in horsepower per square foot of frontal area.

6—The figure of merit of the core, which is obtained as described for a radiator.

Head Resistance Problems

Among the problems which it was proposed to study by the Bureau of Standards are the effect of the nature of the cooling surface and the effect of depth on the head resistance of a core. It is pointed out that the head resistance is composed of two factors, namely, the force due to impact on the front and rear areas of the metal and the effect of skin friction in the tubes which exerts a drag on the core. This latter effect may be obtained by measuring the pressure drop within the tube over a portion of its length. This factor alone will vary with the depth of the core if the entrance and exit of the tubes are constant, and so the head resistance of the core as a function of the mass flow can be computed if the resistance of one depth of core and the drop through the tubes per unit length are obtained.

Procedure of Tests

In the experimental work that has been done, a large number of standard specimens of various types of core obtained from manufacturers were submitted to 5 series of measurements:

1—Measurements of the physical dimensions of the specimens, the average value for the entire specimen being obtained as accurately as possible.

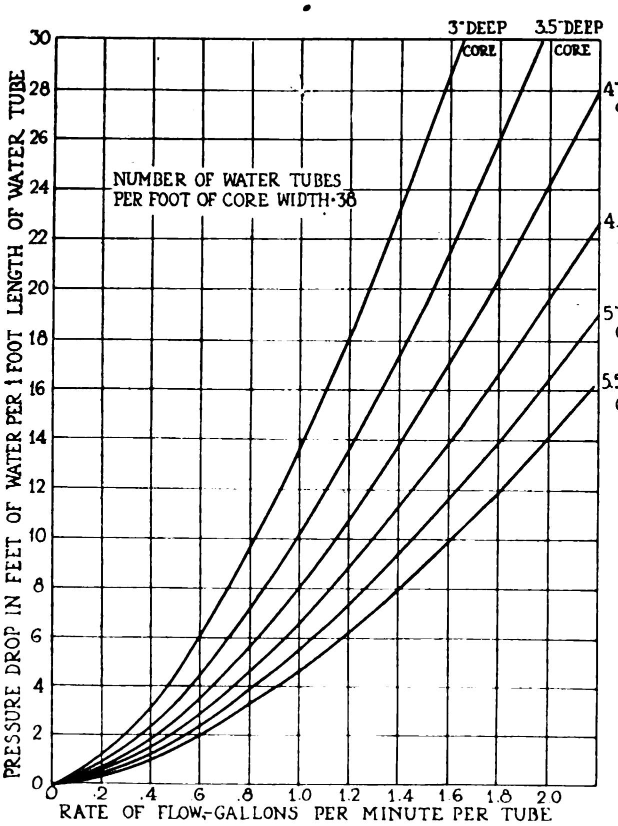
2—Measurements of the energy dissipated for various mass flows and under various conditions of air density; rate of water flow and temperature. These experiments were made in tunnels in which all the air flowing through the tunnel is forced through the tubes of the specimen, so that the mass flow is actually measured.

3—Measurements of the mass flow of air through the core under free air conditions were made in the 54 in. wind tunnel of the bureau by means of a specially designed air venturi.

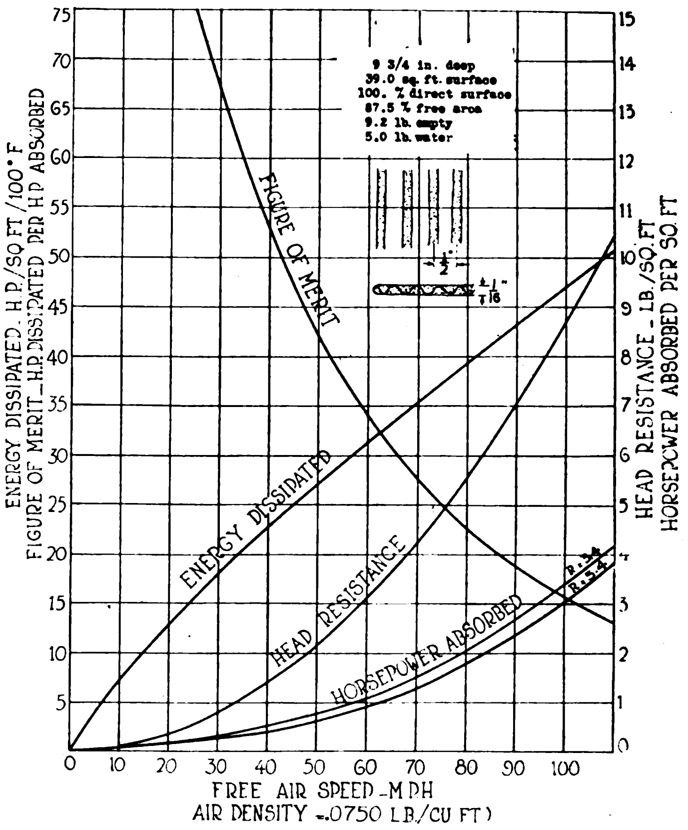
4—Head resistance was measured also in the large wind tunnel by mounting the specimen on the arm of a balance.

5—Some work has been done on the pressure required to produce water flow through the core, though the opinion prevails that this test should be made on complete radiators.

The mass flow through a core supported in free air can be obtained from tests made in a wind tunnel, but if the flow of air through or around the core is in any way obstructed, it is necessary to study the performance to some extent in position on a plane in flight. The simplest method of determining the thermal properties of a radiator in any location is to determine the mass flow through various parts of the core, as with this data at hand the heat dissipated can be calculated from laboratory tests. A plan for measuring the mass flow through a radiator core in flight has been laid out but has not yet been carried out. Another problem to be studied is the amount of heat per brake horsepower of the engine that must be dissipated in flight, and the effect of cowling of the engine on this factor.



Pressure required to force water through core at different rates



Curves showing results obtained with a flat tubular radiator core

The results obtained in the experimental work were expressed in the following form:

1—A table of core characteristics.

2—Curves showing the heat dissipated, the head resistance of the core, the power absorbed with an average lift-drift ratio for the plane, and the figure of merit under given assumptions at various mass flows of air, together with an auxiliary scale showing the equivalent free air speed, that is the free air speed which, striking the core unobstructed, would cause the same mass flow and consequently the same dissipation of heat, head resistance and power absorption.

3—General relations showing how the properties of the core vary when the conditions of use are changed.

4—Data showing the relation between the conditions under which the radiator is to operate on the plane and the conditions under which the parts of the core operate.

Method of Using Results

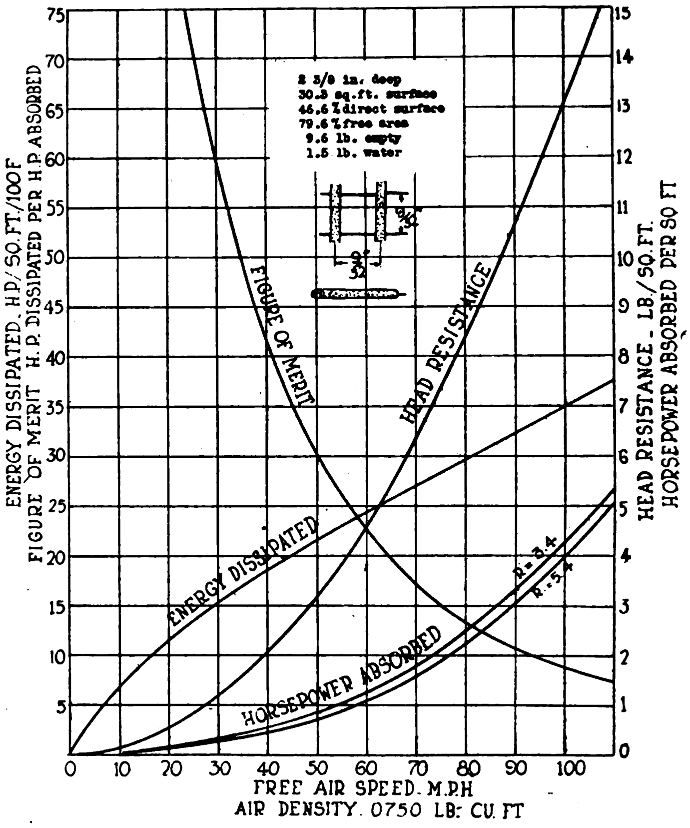
By means of a few simple rules the experimental results can be applied to a predetermination of the performance of an actual radiator on a plane. In the first place, the energy dissipated by a core of any size is directly proportional to the frontal area. In applying this rule the mean temperature of the water in the whole radiator must be used in computing the temperature difference.

The weight of the core of a radiator is directly proportional to the frontal area, but, of course, the weight of the water tanks and of the water they contain is in some cases a considerable factor. Experiments have shown that the resistance of a radiator core is substantially proportional to its frontal area. The effect of the tanks must be allowed for, as must also the effect of location. The power absorbed by the core is also directly proportional to the frontal area.

The pressure necessary to produce water flow is given not for a square foot of frontal area but for a section of core 1 ft. wide and 1 ft. long; in other words, it is the pressure per foot of length necessary to produce the given flow per foot of width. It is then necessary to divide the total flow desired by the width of the core to obtain the flow per foot of width, in order to be able to find from the data the pressure drop per foot of length, and then multiply this by the total length of the core to obtain the total pressure drop. When the widths of different parts of the radiator are different, and when there are intermediate tanks, as around the propeller hub, corrections must be made.

The figure of merit of a radiator is computed from the power absorbed and the heat energy dissipated. If the effect of the tanks is neglected the figure of merit depends on the core structure and on the location on the plane, but not on the frontal area.

For a radiator to be mounted in a free air position on the plane, so that the effect of location on the properties of the radiator is negligible, the figure of merit for the core is the fundamental criterion. When a radiator is placed in an inclosed position, as in the nose of the fuselage, the mass flow of air through it will be less. In general the mass flow will be decreased less relatively in a radiator of high resistance than in one with an open type of core. For given mass flow the resistance of a radiator in an inclosed position appears to be considerably greater than under free air conditions. Similarly, the absorption of power is greater and the figure of merit lower. There has been a tendency recently to place the radiator in the plane of the wing. In that case the air flows upward through the core, decreasing the lift of the wing but producing little effect on the resistance. It is believed that for this mounting a core of very compact structure would be preferable.



Test results obtained from a cellular effect core

Spring Tires Used by German Army

SINCE practically all imports of rubber into the Central Empires ceased with the outbreak of war in 1914, and mechanical vehicles are used very intensively in modern warfare, it is no wonder that rubber was a very scarce article in Germany toward the end of the struggle. It appears that synthetic rubber is now a regular article of manufacture, and a recent report has it that a works at Leverkusen turns out 165 tons of this product a month, but it seems this finds application chiefly for insulating purposes, for which it is said to be superior to natural rubber.

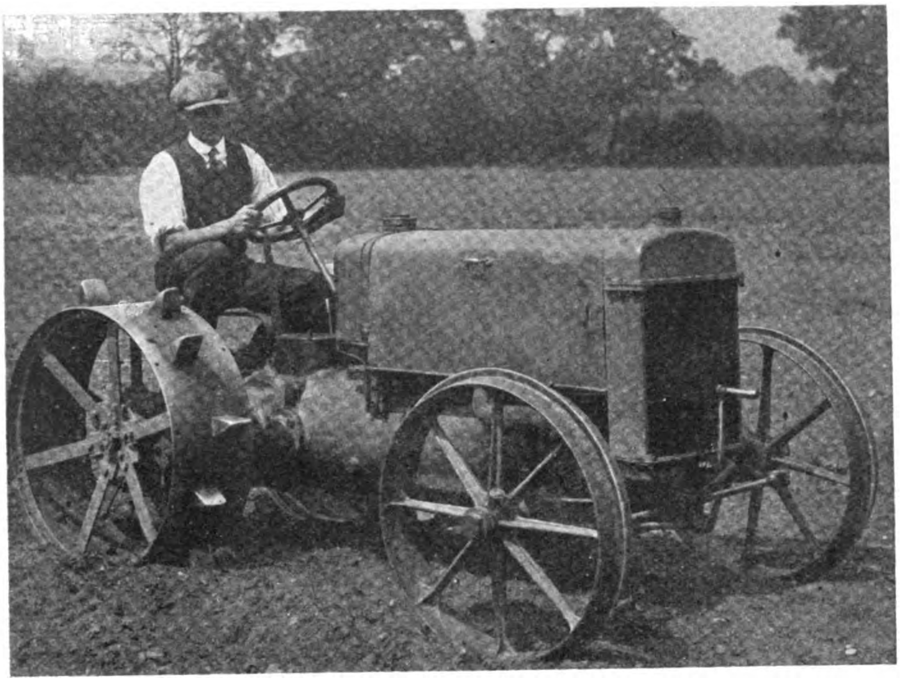
At any rate, vehicles attached to the German army on the Western Front were fitted with a combination steel spring and leather tire and a section of such a tire has been sent to the B. F. Goodrich company by Capt. August Barth, who is serving in France with the 303d Repair Unit of the Motor Transport Corps. It was from a vehicle of the personal messenger and body guard of Prince Eitel Frederick, it is claimed.

In his letter Captain Barth said this type of tire was used extensively by the Germans and that it proved fairly satisfactory when the roads were good and the rate of speed moderate. It was practically useless when excessive speeds were called for because the radially mounted spiral springs became easily misplaced when turning corners or when obstacles were encountered. The spring tire sent by Captain Barth contained three plies of spring steel on the outer band on which was bolted a heavy strip of leather.

AN active propaganda in favor of road improvement is being carried on in England by the Automobile Association and Motor Union. Just previous to the recent Parliamentary election the organization circularized candidates to secure their support for legislation for the reconstruction of roads upon lines suited to modern traffic, for the assurance of a sufficient supply of fuel at a reasonable price, together with the encouragement of home-produced fuel, and an up-to-date Motor Car Bill under recognized auspices. Of the 341 replies sent 276 were in entire agreement and none were hostile.

The Austin Farm Tractor

A British Tractor on Fordson Lines Which It Is Anticipated Will Sell at $1,000



A new British tractor on Fordson lines manufactured by the Austin Motor Co., Ltd., Birmingham

LONDON, ENGLAND, Feb. 4.—The frameless form of tractor continues to find favor among European manufacturers. The model shown is being introduced by the Austin Motor Co. at Northfield, Birmingham.

The trunk or tubular casing is made up of four cast-metal sections, flanged and bolted together. Of these the foremost section is a transverse bracket which carries the radiator on a trunnion about which the front axle beam is free to oscillate, but is held against a fore and aft displacement. The second, third and fourth sections of the casing compose the engine and clutch, change-speed gear, and axle-gear units. The gross weight is under 2912 lb., but a large driving wheel of 3½ ft. diameter by 10 in. wide is being substituted for the present dimensions of 3 ft. by 14 in.; it is anticipated that the gross weight will exceed slightly that tare.

Engine with Four Cylinders En Bloc

The engine has four cylinders *en bloc*, with a detachable head which covers the valves, the usual protruding side pockets being avoided. The cooling is by natural or thermal circulation through large bore pipes. The bore and stroke of the cylinders and pistons measure 3¾ in. x 5 in. A crankshaft speed of 1200 r.p.m. is the normal rate.

The engine is started on gasoline and then runs on kerosene, a Zenith carbureter being used for both fuels, with a change-over valve interposed in the fuel pipe line. The output at normal speed is about 25 hp. The engine shaft has the unique feature among tractor engines with *en bloc* cylinders of five main journals, with suitable provision for their adequate and direct pressure-fed lubrication by a pump. Ignition is by a high-tension magneto with fixed firing point.

The power is transmitted through a pressed-steel cone clutch having a self-cushioning engagement through the medium of interposed under-periphery springs. The cone is faced with asbestos fabric, which can be removed in a short time without dismantling the clutch. The transmission is through a bevel-geared first-motion shaft, which also carries a belt pulley on its end, which is carried through the casing. This gearing is so arranged that at normal engine speed the pulley shaft speed is about 330 revolutions per minute. It is intended to provide three speed changes for the driving wheels; at present there are but two rates through a second motion shaft and a large spur-gear wheel in the axle casing, the latter gear wheel combining the differential or axle balance mechanism.

The driving wheels are of the built-up light traction engine pattern, and are secured to the axle ends by splines of integral feather-keys. The main journals revolve about Timken roller bearings, and the rear wheel hubs and the fore axle have rubber buffers for cushioning shocks. The fore end of the tractor casing is suspended on coil springs; the rear portion is springless, as is usual with tractors designed for land work. The steering lay-out follows the Ackermann system, with the cross bar placed in front of the axle beam. The price first mentioned is $1,000, and its listed capacity is a two-furrow plough.

A LARGE bombing machine built at the Farman aircraft works in France, which has been named the Goliath, is being adapted for use in passenger service. Seats have been installed running the length of the fuselage, large lateral windows have been fitted for sight-seeing, and a flight to London on this big twin-motored machine is contemplated as soon as fine weather sets in. The two Salmson engines give 540 hp., and the anticipated speed is in the neighborhood of 90 m.p.h., with a relatively slow landing speed. Internal heating apparatus has been provided, and on a regular run the machine should carry 30 passengers with comfort.

SOME experiments bearing on the importance of properly focusing bulbs in headlamps are reported in the *General Electric Review*. With a 10-in. headlamp and 21 candlepower Mazda lamp, it was found that the beam of light was reduced to 31 per cent, if the filament was 1/16 in. out of focus, to 18 per cent with ⅛ in. error, and was only 4 per cent of its proper power if the filament was misplaced to the extent of ¼ in.

Automotive Industry Just Stripped for Action When Germany Quit

Contributed Many Unusual Products and Heavily of Employees and Executives to Uniformed and Civilian Service—Some Interesting Sidelights

By J. Edward Schipper

THROUGHOUT the country manufacturers in the automotive industry are ruefully surveying great rows of machinery and great piles of shell blanks and other raw materials stored in various parts of their factories. Hundreds of accountants are busy making up claims to be presented for adjustment and hundreds of millions of dollars are temporarily tied up awaiting approval and payment of the claims. Working its way through the country is the feeling that the Kaiser quit just about a year before he should have, in order to see what this country could do after it had fully gotten into action.

The final chapters are now being written on the participation of the automotive industry in the government war program. The books are being closed on what has been the most eventful two years the industry has ever spent, and while the readjustment period is a difficult one, it is in the main being handled efficiently by the manufacturers who are endeavoring to get back into production. It must be confessed, however, that the industry is still sadly torn up and disarranged because the order of the government to be on 100 per cent war work by the first of January, 1919, meant the tearing out of all the production methods and machinery in every plant which was not so fortunate as to secure orders for its standard products. New government machinery had to take the place of the production machinery formerly employed. Generally, the machinery used in automobile manufacture was too light for the heavier products, such as shells used in government work, and consequently many shops did not have a machine standing in its original place. With the financial backing of the government, however, and with everything cleared out of the way for the purpose of winning the war, it was much easier to get into war work than it was to get out of it. Former sources of supply are just as disrupted as the factories, so that it is impossible to start manufacturing automobiles in many instances without the threat of a much unbalanced inventory, owing to the inability of parts makers to deliver on schedule.

This leads back to the interesting question of what did our industry do during the war. What was accomplished which merited this disruption and confusion? The history of the larger companies has become more or less well known where the work has been of a spectacular nature, but hundreds of smaller concerns which made every sacrifice to do their bit, and which in hundreds of instances are now threatened with financial disaster because of this work, have been passed by unnoticed.

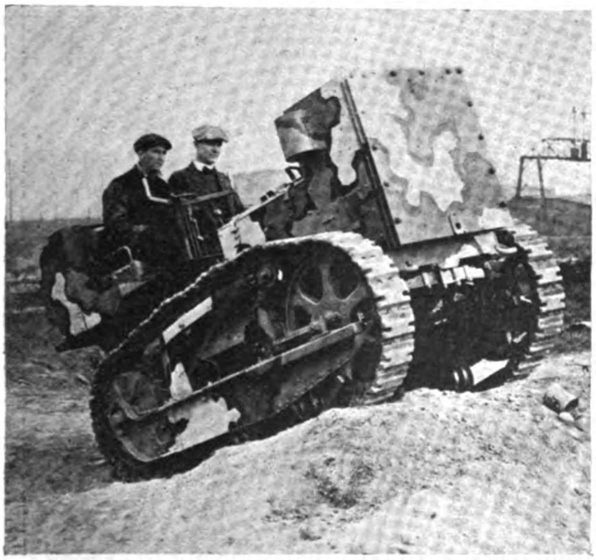
What the Industry Did

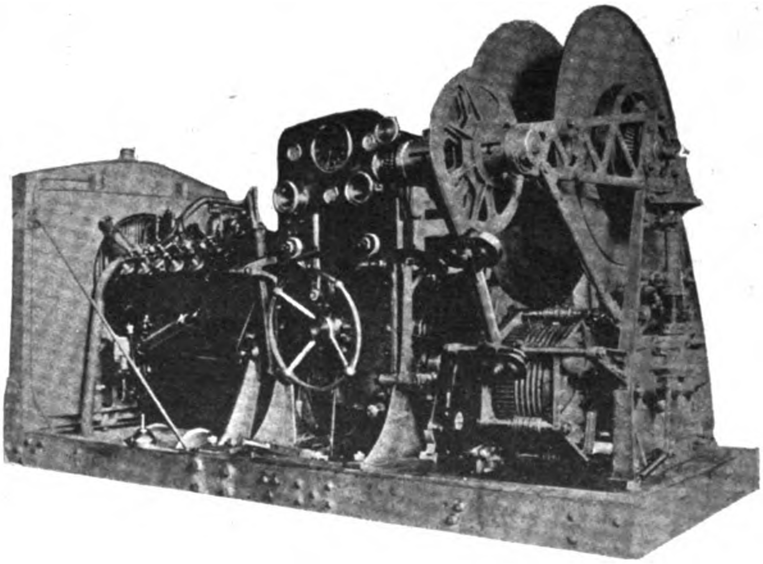
There is no more interesting phase in the study of what the automotive industry did during the war than the survey of the products which the different factories made and which in many instances were far different from anything that they had ever previously attempted. For instance, we find the Willys-Overland Co. making the OX-5 training plane engines, 77-mm. gun carriages, 8-in. shells, Liberty eight engines, Liberty twelve engines, Mark III adapters, types A and B lifting plugs, Sunbeam airplane engines and military tractors for the British government, and a miscellaneous assortment of smaller parts.

Packard and Ford, as is well known, did a tremendous work in the development and manufacture of the Liberty aircraft engine. In addition, the Packard army trucks left in a continuous stream during the entire period of their participation in the war. Besides, there were militor tractors and many small gun forgings made at the Packard factory.

Maxwell made 6-ton trucks, Ford was just starting big production on a small two-man tank, and Locomobile made the first of the Mark VIII 35-ton tanks, besides great numbers of Riker trucks.

The Hudson company made the transmissions for the 6-ton





Left—2½-ton artillery tractor driven by a Cadillac eight-cylinder engine. Right—Eight-cylinder Cadillac engine being used as a motive power of a balloon winch to lower observation balloons

General view of the larger of two machine rooms at the Willys-Overland Co. Building and equipment especially designed and built for 8-in. shell production

tanks. It also had a contract for making Nash Quad trucks, and the company was shortly to engage in the manufacture of the higher speed types of 6-ton trucks, equipped with its own Super Six engine.

When the armistice was signed the Olds Motor Works was in the midst of diverting its entire facilities, including both plant and organization, to Liberty engine work on an extensive scale. Large factory additions were under construction, and between a million and a million and a half dollars' worth of equipment had been ordered, all with a view of taking on about two thousand workmen in addition to the regular force of 1500. It was expected that this concern would be in production during the early part of January. Work was stopped with the signing of the armistice, and by now the plant is nearly up to normal production.

Dodge Bros. went into artillery manufacture. Shortly after war was declared the United States went into the manufacture of the 155-mm. howitzer and the 155-mm. Filloux rifle. These guns required a hydraulic recoil or recuperating device, but as none of this mechanism had ever been built in America, the problem involved the gigantic task of not only constructing a special plant, but the designing and making of special machinery and tools. Dodge Bros. put up a plant valued at $10,000,000 and for months have been shipping these vitally important parts. These recoils permit the gun to return to normal in 13 seconds when fired at an angle of 45 deg. They are made from billets of steel, that for the rifle weighing 7800 lb.

The Hupp Motor Car Corp. made tools and gauges for subcontractors, ordnance shell parts, tank parts, engines, light trucks and heavy truck parts, and this concern is stated to have been just about ready to take on a wide variety of additional work.

No one would ever picture the Haynes Automobile Co. building Buda engines or Quad transmissions, and yet both these products were on the Haynes program of war work.

The smaller production companies, such as Harroun, turned out thousands of the 155-mm. long-range high-explosive shells. The Templar Co. of Cleveland made the same type of shell; the Dort company, in place of the small touring car and roadster, turned out in quantities of perhaps 15,000 a year, turned its attention to cargo trailers and then to the G. M. C. ¾-ton truck, kitchen trailers and special truck bodies. Reo made army tractors.

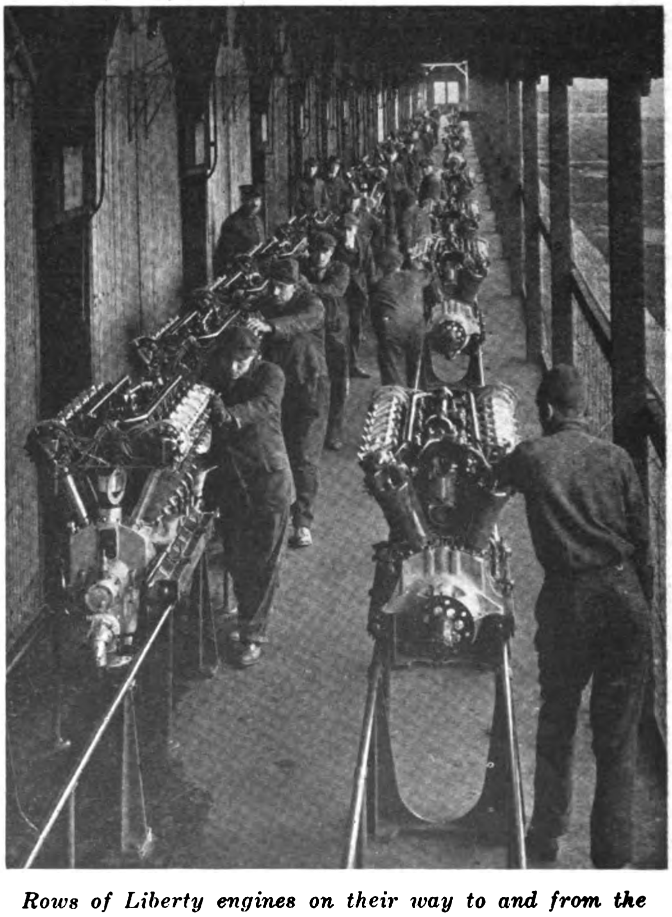
The Grant Motor Car Co. turned out 612 anti-aircraft gun trailers, 830 3-in. field gun trailers, 576 4-ton shop trailers and more than 200,000 155-mm. Mark V shells.

The electric car companies were not behind in this work, as is evidenced by the Anderson Electric Car Co., which turned out ambulance bodies for the G. M. C. chassis.

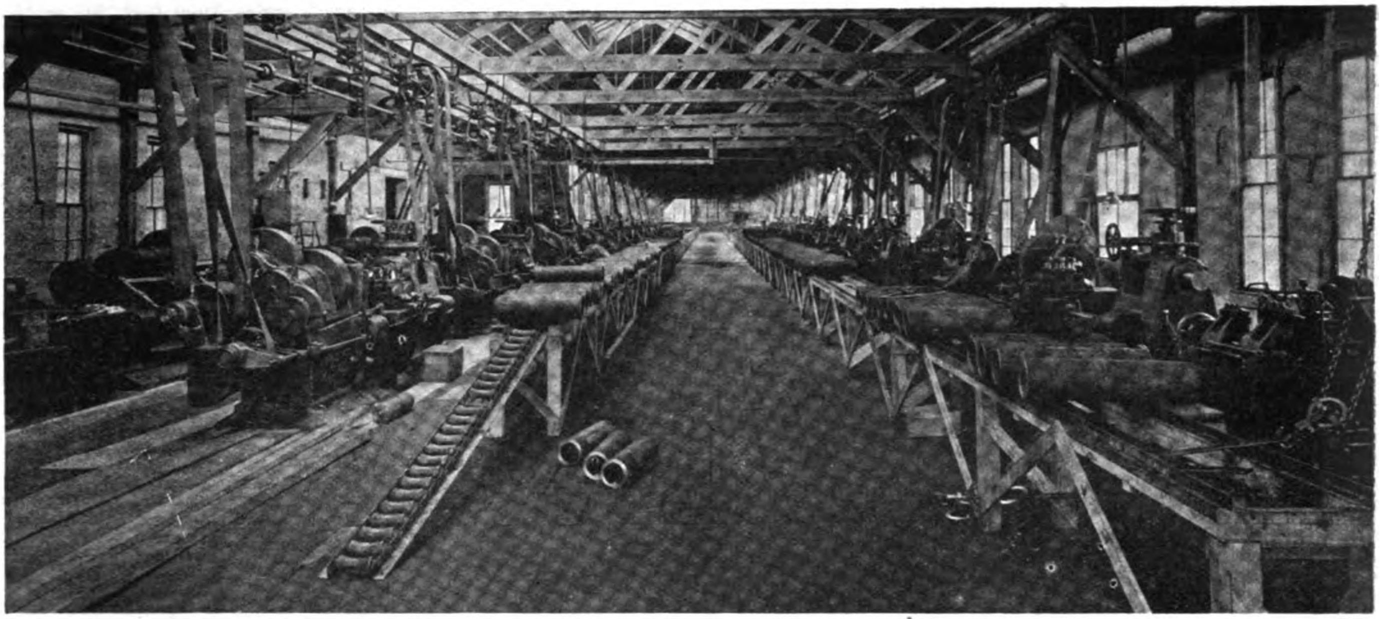
All of the above are random examples of work done by the passenger car manufacturers along lines which were different entirely from their standard products, and they were not alone in this. The truck manufacturers also did work which was a radical departure from anything they had previously been accustomed to.

For instance, the Avery Co. was just about ready to start on self-propelled big gun mounts; the Bates Tractor was making parts for the 4-in. gun mounts; the Columbia Motor Truck & Trailer was making four-wheel trailers for the Quartermaster's Department; the Federal Truck was making artillery tractors; the Kelly - Springfield made 1225 heavy aviation trucks; the United Motors also made heavy aviation trucks. The Class B trucks were made by such concerns as the Gramm-Bernstein, which contracted for 1750, the Lewis-Hall Iron Works, the Service company and J. C. Wilson, the latter concern also having contracted for the Wilson 2-ton and Class AA trucks.

Axle manufacturers also departed radically from their lines in many instances. For example, the Empire concern made airplane propeller hubs and flanges, and airplane drive shafts; the Salisbury Axle Co. made 3-in. anti-aircraft shells and military truck parts, such as drawbars, bumpers, sprag releases, assemblies for Class B trucks, also the front and rear Quad axles.



Rows of Liberty engines on their way to and from the testing sheds



Shells for 115-mm. guns in process of manufacture at the Grant Motor Corp., Findlay, Ohio

The engine manufacturers were generally fortunate to be turning out nothing but engines. However, these engines varied greatly from their standard practice, but now that they have proven themselves in government service will probably be manufactured in a commercial way. Continental, Hinkley, Wisconsin, Hercules and others made the Class B military engine. A variety of truck engines was made by such concerns as Waukesha and Continental, who, in addition to the Class B engine, made four and six-cylinder engines for light ambulances for the medical department, light ordnance trucks, Class AA government trucks, light aviation trucks, heavy aviation trucks, quartermaster trucks, trucks for the Navy, trucks for cantonment camps, fire brigades and the light and heavy Signal Corps work.

Class B clutch and transmissions required the efforts of such concerns as the Covert Gear, Detroit Gear & Machine, Fuller & Sons, Muncie Gear Works, Warner Gear and T. W. Warner. The Grant-Lee company made gears for the F. W. D. trucks, and the American Die & Tool made airplane parts and also got into armored tank production, locomotive building, shipbuilding and kindred lines.

Body Makers Turn to Airplanes

The body manufacturers were in big demand for all sorts of government purposes. The Fisher Body Co. was in a position to turn out 200 airplanes a day when the armistice was signed. It produced large numbers of De Haviland planes and also the training type of planes. The Lang Body made boxes for the Browning machine gun and trays for ammunition. This concern also mounted and crated the reconnaissance and machine gun trucks and did the camouflaging work on these trucks. The Rubay Co. got into airplane work; the Markley Commercial Body Co. produced airplane cylinder boxes and wedges for shipment. Ambulance and transport bodies were made by Erdman-Guider, the Highland Body Co., the Motor Truck Body Co. and the Trippensie Mfg. Co. Escort wagon parts were made by the Sidney Mfg. Co. These are chosen from a wide list, showing the great variety of work that was done in this field and gives some sort of a picture of the disruption necessary in the industry to produce the required material for the government.

Even before this country had declared war, the United States had begun to place contracts with different concerns for war material. For instance, the Peerless company received its first United States contract in June, 1916. During 1917 a great number of contracts for war materials were of course placed, war having been declared in April, 1917, with this country in a tragically unprepared condition. As a result of this, it was not until December that contracts began to be placed rapidly for war material, although we had declared war in April.

During the month of December, Hudson, Reo and a number of others received their ordnance contracts. The airplane contracts received by Packard and Overland were somewhat in advance of this and much nearer the declaration of war. Many of the shell contracts such as Harroun were not placed until March, 1918. Dort received its contract in February, Hupp in May, 1918; Anderson in May, 1918. Saxon and Liberty did not receive their contracts until August, 1918, and the Crow-Elkhart in December, 1918, showing the immense advantage which would have been possessed if this country had utilized the 3 years of war on the other side to get into a real state of preparedness.

A great amount of new plant area was added by the industry during the war, and this is going to be of advantage as soon as the industry gets its stride. At the present time much of it is superfluous. However, the prospects for getting back into bigger production than ever before are so good that any added plant space is not looked upon as a liability, but an asset.

The Willys-Overland Co. added 391,374 sq. ft. for war purposes, the Hudson company added 30,000 sq. ft., Packard added 300,686 sq. ft. for government purposes alone, the manufacture of passenger cars being completely eliminated during the war. The Anderson Electric Car Co. put up a two-story building, 360 ft. by 120 ft. wide. The Federal Motor Truck put up a $250,000 addition; the Gramm-Bernstein more than doubled its plant capacity since the beginning of the war; the Indiana Truck Co. added 53,000 sq. ft.; the Kelly-Springfield built two buildings, one 450 by 62 and the other 592 by 62 ft. The Lewis-Hall company devoted 26,000 sq. ft. of floor space to its Class B contract; the Service company put up a building 775 ft. long by 75 ft. wide; Standard added 18,000 sq. ft., and the United Motors Co. 5400 sq. ft.

Parts and Accessory Makers Also Enlarged Plants

The parts and accessory makers also erected plants and greatly increased their space. For instance, the Continental Motors Co. added 200,000 sq. ft.; the Waukesha increased its plant area 40 per cent; the Warner Gear put up 87,000 sq. ft. in new buildings; T. W. Warner increased its plant by 300 per cent.

The body companies were noticeable in their increase, led by the Fisher Body, which put up an entirely new 10-acre plant to take care of airplane work. Rubay put up 90,000 sq. ft., the Lang Body 24,000 sq. ft., and Erdman-Guider and the Motor Truck Body each 12,000 sq. ft.

The value of the production turned out by the automotive

industries for the government during the war amounts to billions of dollars. It would be hopeless to attempt to list the articles manufactured here or to give any idea of the quantities and the value in money. Taking the Peerless company alone, $37,000,000 worth of trucks were furnished by this one company. As another random example, the Dort had orders for approximately $6,000,000 worth of work, about one-half of which was completed. To give an idea of the quantity of materials that this means, it may be interesting to take other typical examples. Packard delivered over 6,000 trucks, more than 550 Liberty engines, and they were just getting into quantity production on La Pere planes. The Haynes company had completed 4,000 engines and 600 transmissions. Reo turned out 1560 army tractors.

Parts Makers Also Busy

Among the truck manufacturers, when the armistice was signed, Federal had made 1465 trucks and 200 tractors and manufacture was still going on. The value of these trucks was $5,650,000, with $2,000,000 additional in parts. The Gramm-Bernstein had turned out 1750 Class B trucks, the Indiana Truck Corp. 1045 trucks and about 1,000,000 pieces of small machine parts.

The parts makers were not far behind the manufacturers of complete vehicles in the money value or quantity of production turned out during the war. The Standard Parts Co., Cleveland, had completed approximately $10,000,000 worth of manufactured articles for the government; the Covert Transmission about $3,000,000; Rubay, $5,500,000. Continental had turned out 60,000 engines; Hinkley, 3600 up to Nov. 27, 1918; Wisconsin, 15,000; Waukesha, 4500. The Detroit Gear & Machine Co. had made 8000 clutches up to the end of December; Grant-Lees, 2000 sets of gears for four-wheel drive trucks; Warner Gear Co., 6500 transmissions, 700 clutches, 10,000 control sets, 4500 differentials and 5000 steering gears. T. W. Warner was running at 500 transmissions a day when the armistice was signed.

Contributed of Their Personnel

Outside of contributing all of this manufactured production, of which it must be realized the examples given are only scattered instances taken at random from our long list of manufacturers, the automotive companies were also heavy contributors of personnel, not only to the uniformed service, but to the civilian departments of the government. From the Willys-Overland Co. alone 5500 skilled and unskilled laborers entered the service. This is approximately 33 1/3 per cent. This same percentage was reached by other concerns; for instance, the Liberty Motor Car Co., of which 34 per cent of all people employed, including the office and factory force, entered the service. At the Grant factory 584 were enlisted or drafted, or about 65 per cent of the laboring force. To take other typical examples of the number of skilled and unskilled entering the service, Dort lost 180, or 15 per cent; Hupp, 287, or 25 per cent; Anderson, 100, or 16 per cent; Reo, 812, or 20.3 per cent.

The percentage also ran high among the truck manufacturers. At the Avery company, for example, 459 men or 16 per cent of the organization went into service; at the Federal Truck, sixty-five or about 10 per cent; Kelly-Springfield, 160 or 21.3 per cent; Indiana Truck, 110 or 25 per cent; Gramm-Bernstein, 146 or 20 per cent of entire force.

One Company Lost 51 Per Cent of Its Men

As noted, the percentages of men entering the service from the different plants varied very considerably, running all the way from more than 50 per cent down to 5 or 6 per cent. This depended very largely on whether or not the concerns claimed exemption for their men. The parts makers had about the same experience, percentages varying considerably.

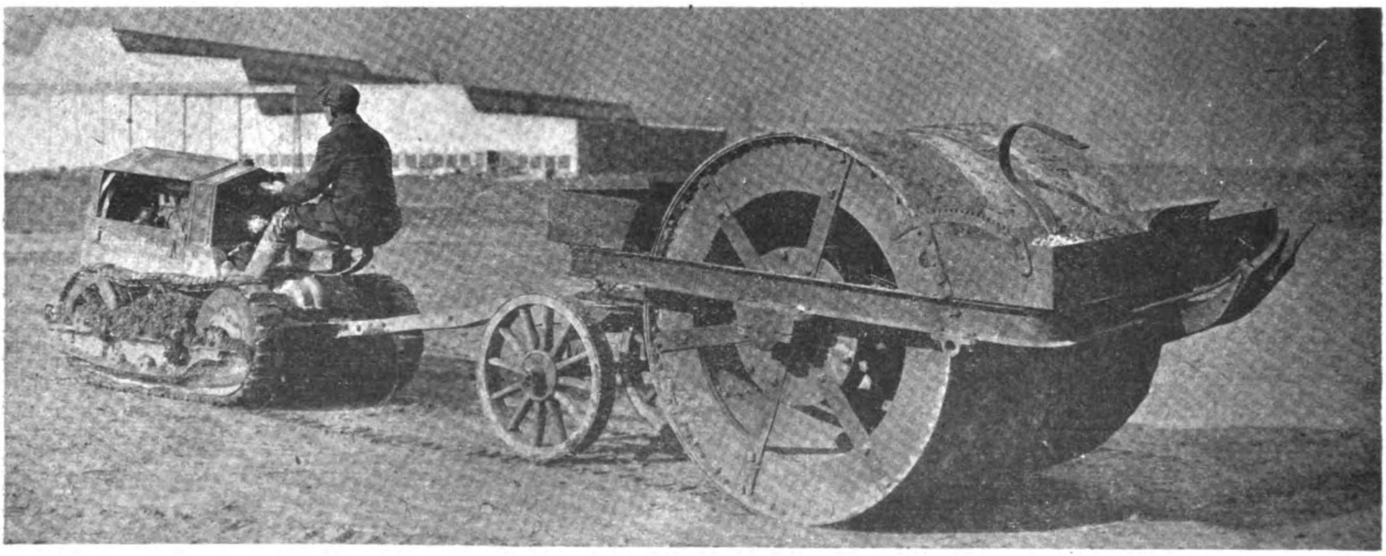
For instance, the Waukesha Motor Co. lost 51 per cent. of its force through enlistment or draft, while the Muncie Gear Works lost five men or about 3 per cent. The average is somewhere around 20 to 25 per cent. Continental, employing a large force of men, lost 1300 men through enlistment, this being about 21.6 per cent of the total employed and forming a fair average from which to base statistics.

The automotive industry contributed heavily from its executive officers to all branches of the service. Taking the office force, the percentages of those entering the service did not run so high, the average being somewhere around 12 per cent. The Willys-Overland Co. had about 175 of its office force in the service or about 18 per cent; Reo had about thirty or about 9 per cent; Haynes had eight or about 13 per cent.

Those entering the service from the offices of the commercial vehicle manufacturers ran somewhat higher in percentage, the average being about 20 per cent. The Lewis-Hall office force lost about 50 per cent through entering the service; Kelly-Springfield, fifteen or 25 per cent; United Motors, seven or 25 per cent; Gramm-Bernstein lost twenty-two from its office force or about 20 per cent of the total. These percentages are lower than the skilled and unskilled laborers, largely due to the exemption pleas entered by concerns for their executives, and also due to the predominating number of older men in the executive and office positions.

Parts Makers Released 20 Per Cent of Force

The parts makers averaged about the same as the truck manufacturers, 20 per cent being the approximate average. Probably as large a percentage as any in the parts making business is exemplified by the Empire Axle Co., which lost nine of its office force or about 75 per cent. The Sheldon Axle lost ten or about 10 per cent; Standard Parts, thirty-five or about 10 per cent; Warner Gear, fifteen or 10 per



Cleveland tractor pulling a road roller in preparing the flying field at the Glenn Martin plant at Cleveland

cent; the Grant-Lees lost 25 per cent; Muncie Gear, 25 per cent, so that, all in all, the average losses in the office staffs of the different companies was about 25 per cent.

The industry is gratified by the fact that many of its prominent members were selected for high civil and military positions. It is impossible to attempt to list the executives of automobile, truck and parts concerns who were commissioned and held high rank in the service. Practically every executive staff of the larger concerns in the business contributed its quota of majors, captains and lieutenants. These men entered the service and in many cases sacrificed large incomes in order to be of assistance to the government. Henry B. Joy, ex-president and director of the Packard Motor Car Co., was a colonel in the Signal Corps; J. G. Vincent, vice-president of engineering of the same company, was a lieutenant-colonel. H. L. Shepler, vice-president in charge of production at the Willys-Overland Co., was a major in the aircraft service. Howard E. Coffin, vice-president of the Hudson company, was chairman of the aircraft board and did much to frame the policy which was eventually developed in our aircraft service. Vice-President Alden of the Timken-Detroit Axle Co. became a colonel in the Ordnance Department and was in charge of the development of tanks. W. G. Wall of the National company became a lieutenant-colonel in the Ordnance Department and distinguished himself in the development of military tractors. This list could be made indefinitely long, telling of the contributions of the executive staffs of the different automobile factories of their men to important uniform and non-uniform branches of the service.

Executives on Patriotic Work

The important work done by executives of the automobile, truck and parts makers in helping the Liberty Loan and War Savings Stamp work cannot be overlooked. Many executives turned over a large percentage of their time to this work. As a typical example, J. D. Dort, president of the Dort Motor Car Co., may be mentioned. When war with Germany was declared, Mr. Dort turned his interests over to others and devoted his entire time to war work, becoming chairman of the Genesee County, Michigan, War Board, which exceeded its quota by $1,000,000 in voluntary subscriptions alone on the Fourth Liberty Loan.

There are many interesting sidelights in connection with what the different companies of the industry did and many fascinating human-interest stories. One of these is the rise of Edwin Denby, treasurer of the Denby Motor Truck Co., through the sheer force of personality. Mr. Denby entered the marines as a private and rose to a captain by the time the armistice was signed.

Spent $12,000,000 for New Buildings

The story of the Willys-Overland Co., which spent $12,000,000 for new buildings, equipment and for changing over old equipment in 19 months and 6 days in order to get into production, is noteworthy. John Willys went ahead and produced airplanes before he ever received an order for them, so sure was he that the government would need this product. Special machinery had to be made by the Overland company in order to produce the French 77-mm. gun carriage. There were over 1600 parts in this gun carriage, of which 146 are forgings, but by the time the armistice was signed the Overland company was putting these through at the rate of twenty-five a day. The manufacture and machining of 8-in. shells was another tremendous undertaking. As an example, every single shell manufactured had to be tested under a hydrostatic pressure of 8500 lb. per sq. in., and the shell had to withstand this or be rejected.

The utility of the type of internal combustion engine developed by the automotive industry proved itself in numerous ways. We are no longer surprised to hear of Cadillac eight-cylinder engines, which we at one time pictured as exclusively a passenger car proposition, actuating 2½-ton artillery or driving the winches for pulling down captive balloons. These and many other adaptations of well-known power plants were common in war service.

The White convoys were distinguished by being merited the Croix de Guerre, this being the first and only instance in French military history of a truck formation receiving this high honor. And yet all of the above is of necessity only a smattering of what was actually done; this country was only in the midst of diverting its entire automotive facilities to war work. Many factories were just converting themselves to their new lines when the armistice was signed and the contracts cancelled, allowing them to hurry back to their normal lines, and many are in the midst of the work of getting back to usual production at the present time.

Experimental Design and Testing of Airplane Ribs

(*Continued from page* 460)

been made on the Type "I" rib, as made in production. These tests were made with the load grading, as shown in Fig. 6, and the load grading as specified by the Army in sand loading of wings. These tests are not only for the standard rib, but for the rib in the section of the wing with the aileron cut out.

It will be noted that the weight of the various ribs started in at 15 oz. and ran as high as 20¼ oz. The average weights of ribs in production is 11½ oz.

The cost of manufacture of this rib as produced is much less than the standard type using veneer for the webs and cutting out various shaped portals.

All tests were made with certified glue, but later some ribs were built up with cold glue and apparently there was no difference in the results. But in production only certified hot glue is used.

The deflection in the table is given for each load of factor of safety of one, and is a convenient indication of rigidity. It is seen that the final type of rib held its original shape the best and that the aerodynamic characteristics will not be appreciably changed in normal flight. In the table on page 458 the deflection is shown for the center section. Space hardly permits of any more detail information on this.

Fig. 7 shows the contour of the rib and the dotted outline shows rib No. 31 with a load 8 times normal load. The total deflection is 23/64 in., or .043 in. deflection for normal load.

Station.	Readings from Load Grading Curve.	Actual Weight.	Difference in Weight.
1..........	61.80	64.2	2.4
2..........	65.80	66.8	1.0
3..........	63.40	64.2	0.8
4..........	57.79	58.5	0.51
5..........	52.95	53.5	0.55
6..........	47.35	47.0	0.35
7..........	41.35	39.5	1.85
8..........	36.52	34.0	2.52
9..........	32.50	31.0	1.50
10..........	29.28	28.5	0.78
11..........	27.28	26.8	0.48
12..........	25.27	26.0	0.73
13..........	23.67	24.0	0.33
14..........	22.06	22.0	0.06
15..........	20.06	20.0	0.06
16..........	17.25	17.2	0.05
17..........	14.84	14.2	0.64
18..........	10.83	11.0	0.17
19..........	7.62	7.3	0.32
20..........	2.51	3.0	0.49
	660.13	658.5	15.59

Average difference in weight, 0.780 lb.
Tabulated loadings as shown in Fig 6.

The Carburetion Temperature of Oil Mixtures

By C. A. Norman
Professor Ohio State University

THE present article gives a method of determining the temperature necessary to keep in a permanent state of vaporization any oil fraction contained in a carburized mixture. It gives curves applicable especially to the fractions of kerosene and derives the temperature necessary to form a permanent vapor mixture of kerosene and air. The knowledge of this temperature is of very great practical importance. If carburetion at a lower temperature is attempted, then partial condensation will most likely result; hence very incomplete combustion, high fuel consumption, dilution of the lubricating oil in the crankcase, carbon formation on the spark plugs and cylinder walls, unequal firing, etc.—all troubles too well known in kerosene engine practice. If the temperature is much exceeded then avoidable knocking may appear; likewise dissociation of the fuel with carbon even in the inlet passages; finally reduction of power. The point of perfect carburization ought then to be known.

Kerosene is a mixture of fractions with widely varying boiling points. A leading company has communicated to the author the following as a typical composition of kerosene:

	Deg. Fahr.
Boiling starts at	292
10 per cent off at	369
20 per cent off at	386
30 per cent off at	400
40 per cent off at	415
50 per cent off at	422
60 per cent off at	441
70 per cent off at	458
80 per cent off at	476
90 per cent off at	496
98 per cent off at	554

It is seen that nearly 10 per cent of the kerosene under atmospheric pressure boils off above 500 deg. Fahr. and 2 per cent above 550 deg. Fahr. It is tolerably safe to assume that no noticeable fractions boil above 600 deg. Fahr. Now, when these fractions occur in a kerosene air mixture their boiling points correspond, not to the total pressure of the mixture, but to the partial pressure of the fractions in the mixture. Thus, to aid in the distillation of lubricating oil, quantities of steam are blown into the still. Say that the pressure in the still is 15 lb., and that we blow in enough steam to maintain a pressure of 8 lb. of steam alone. Then the pressure of the oil distillate is only 7 lb., and its boiling point lowered to correspond to 7 lb. pressure instead of 15 lb.

The ratio of the partial pressures P_1 and P_2 of the gases occurring in a mixture in weights G_1 and G_2 is

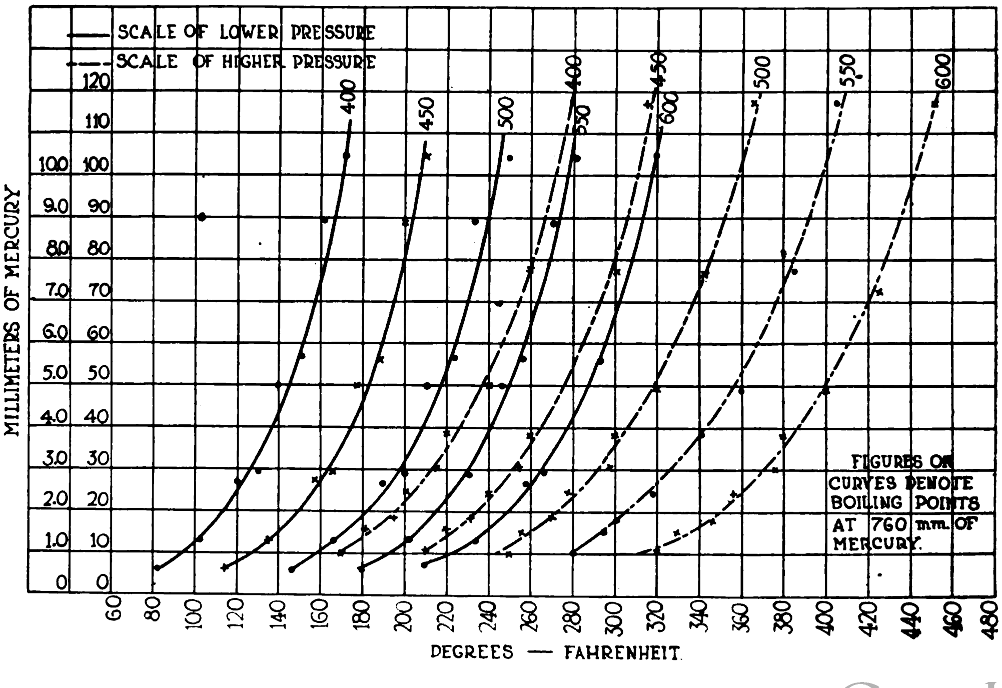
$$\frac{P_1}{P_2} = \frac{G_1 R_1}{G_2 R_2}$$

Here R_1 and R_2 are the "gas constants" of the mixtures.

The gas constant for any gas or vapor is very nearly equal to 1540 divided by the molecular weight of the gas. Thus for oxygen, O_2, the molecular weight is $2 \times 16 = 32$, and the gas constant, $1540 \div 32 = 48$; for nitrogen N_2 the molecular weight is $2 \times 14 = 28$ and the gas constant $1540 \div 28 = 55$; while for air a mixture of N and O with average molecular weight = 29.95. The gas constant is $1540 \div 28.95 = 53.2$.

In order to estimate the partial pressure of kerosene fractions in kerosene-air mixtures we have to find their gas constants with the aid of the molecular weights. These molecular weights can be figured directly from the chemical formula for the fraction. These formulas vary from kerosene to kerosene; but for most practical purposes we may assume the kerosene fractions to be either simple paraffins or naphthenes; in this country the former. The boiling points, molecular weights and gas constants are given in the table on page 491.

It is found that for highest power development it is often necessary to have a somewhat over-rich mixture. For complete combustion 1 lb. of kerosene requires about



Curves showing vapor tensions of paraffins derived by means of Ramsay's and Young's law from those of Octan and Dekan

15 lb. of air. Suppose we wish to be sure of the perfect evaporation of a mixture containing 1 lb. of kerosene to 13 lb. of air.

In the kerosene-air mixture listed in the table, only 2 per cent will at atmospheric pressure boil above 554 deg. Fahr. Let us, for the sake of safety, however, assume a kerosene with 10 per cent boiling at 600 deg. Fahr. In the mixture we would have 0.1 lb. of this fraction, 0.9 lb. of other kerosene and 13 lb. of air. The gas constant of air is 53.2; of kerosene we can assume it to be on an average 8.5.

For the whole mixture it is with sufficient accuracy

$$\frac{13 \times 53.2 + 1 \times 8.5}{14} = 50$$

For the heaviest fraction we shall, for the sake of safety, assume the gas constant rather high than low, say 6.5.

The pressure of the mixture will not exceed 14.7 lb. The partial pressure of the fraction is very low. Such low pressures are more conveniently expressed in millimeters of mercury, the unit usually employed in chemical works; 14.7 lb. correspond to 760 mm. of mercury.

We find the pressure of the heaviest fraction certainly not greater than

$$P = \frac{0.1 \times 6.5 + 760}{14 \times 50} = 0.7 \text{ mm.}$$

The drawing contains a set of curves showing the vapor pressure of various kerosene fractions for varying temperatures. Read from the vertical scale to the horizontal scale, it represents the boiling points, or perfect vaporization temperatures, of various fractions under various pressures. The full-line curves refer to the scale of lower pressures; the dotted curves, to the scale for higher pressures. We find that a fraction boiling at 600 deg. Fahr. at 760 mm. of mercury boils at about 210 deg. at 0.7 mm.

In other words, if the mixture has a temperature of 210 deg. or higher, the heaviest fraction will most decidedly be above its boiling point and no condensation will ensue. In a leaner mixture than the one here assumed the partial pressure of the fuel will be lower, the necessary vaporization temperature also lower. Since the lighter fractions occur in greater quantities, it might be advisable to check up what the average vaporization point for the kerosene will be.

We find

$$P = \frac{1 \times 8.5 \times 760}{14 + 50} = 9.2 \text{ mm.}$$

Taking the average boiling point to be 450 deg. at 760 mm., we find that this corresponds to a vaporization temperature of about 205 deg. Fahr. at 9.2 mm.

There is then no reason to doubt that almost any kerosene will give a permanently vaporized mixture at temperatures betwen 200 and 220 deg. Fahr.

It is very interesting to note that an unusually able experimenter in the field of kerosene carbureters, in private conversation with the writer, gave 220 deg. as the temperature in the intake manifold, at which his device worked most satisfactorily—giving abundant power without knock. Strange to say, at a temperature of around 180 deg. he found much less power with considerable knock.

It should be noted that the temperature of vaporization is not the temperature of the air before mixing. The evaporation of the kerosene consumes heat. The amount of this heat at reduced pressure is not accurately known, but will probably be around 250 B.t.u. per pound of kerosene, or about 20 B.t.u. per pound of air in a rich mixture. This corresponds to a cooling of the air amounting to about 80 deg. Fahr.

Name.	Formula.	Boil. Pt. deg. Fahr.	Molar Wt.	Gas Cnst.
Pentan	$C_{5}H_{12}$	100	72	21.4
Hexan	$C_{6}H_{14}$	160	86	17.9
Heptan	$C_{7}H_{16}$	208	100	15.4
Octan	$C_{8}H_{18}$	257	114	13.5
Nonan	$C_{9}H_{20}$	302	128	12.0
Dekan	$C_{10}H_{22}$	344	142	10.85
Undekan	$C_{11}H_{24}$	384	156	9.85
Dodekan	$C_{12}H_{6}$	418	170	9.05
Tridekan	$C_{13}H_{28}$	454	184	8.35
Tetvadekan	$C_{14}H_{30}$	485	198	7.75
Pentadekan	$C_{15}H_{32}$	519	212	7.25
Hexadekan	$C_{16}H_{34}$	549	226	6.80
Heptadekan	$C_{17}H_{36}$	578	240	6.40
Octadekan	$C_{18}H_{38}$	605	254	6.05
Nonadekan	$C_{19}H_{40}$	626	268	5.73

For perfect vaporization the air before mixing should then have a temperature around 300 deg. Fahr.

For a present-day gasoline with 10 per cent boiling above 400 deg. Fahr. at 760 mm. the computations carried out in the foregoing lead to a vaporization temperature of around 100 deg. Fahr. and an air temperature of, say, 160 deg. Fahr. A cold engine and a cold hood should therefore certainly not be expected to constitute ideal conditions for this fuel.

The curves have been derived from experimental curves for Octan and Dekan by means of Ramsay's and Young's law. This law states that for the same pressure the absolute boiling temperatures of two related chemical substances stand to each other in a fixed ratio. Thus, if Dekan at 760 mm. boils at 312 deg. Fahr. = 772 deg. Fahr. abs., and at 25 mm. boils at 140 deg. Fahr. = 600 deg. Fahr. abs., then a fraction boiling at 500 deg., at atmospheric pressure, will at 25 mm. boil at

$$\frac{(500 + 460)}{772} \times 600 = 746$$

deg. Fahr. abs. = 746 = 460 = 286 deg. Fahr.

With the aid of this law we can exterpolate the curves to any desired extent.

Suppose, for instance, we have a gasoline mixture which vaporizes completely at zero Fahrenheit = 460 deg. Fahr. abs. The partial pressure of the gasoline in the mixture may be 10 mm. What would be the average boiling point of this mixture at atmospheric pressure? We notice that the 400 deg. fraction under 10 mm. pressure boils at 170 deg. Fahr. = 630 deg. Fahr. abs. Consequently the gasoline at issue would at atmospheric pressure show an average boiling point of

$$\frac{460}{630}(400 + 460) - 460 = 165 \text{ deg. Fahr.}$$

In other words, an aviation gasoline vaporizing completely at zero degrees Fahrenheit boils considerably below the boiling point of water; yet does not, on the whole, need to be such an extremely volatile product.

The writer was led to the foregoing investigation through a conversation with Mr. F. W. Howe, chief engineer on motor trucks to the International Harvester Corp. To Mr. Howe the potential value of the data furnished had long been apparent.

It is to be noted that all above temperatures referred to carburetion by perfect vaporization. Carburetion by mechanical suspension resulting in a so-called fog mixture may be possible at lower temperatures.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, February 27, 1919 No. 9

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 2727

Cable Address - - - Autoland, New York
Long Distance Telephone - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - One Year, $3.00
Canada - - - One Year, 5.00
Foreign Countries - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Executives Who Understand Labor Needed

IT is a little surprising that we have not insisted upon the understanding of human principles and impulses in our industrial executives to a greater degree. We are prone to put men into executive positions, primarily, because they understand the products and the processes of manufacture when the principal problem which confronts them is the human problem.

This tendency to minimize the study of human affairs has resulted in the neglect of this study by most industrial executives to such a degree that each development of industrial disturbances finds us almost as far away from any idea of solution as before.

Fortunately, there is a distinct improvement in this direction. We no longer speak of labor as some abstract problem, not related to living and not concerned with social and political environment. We have thrown away the idea that labor interests us merely for so much time and so much physical accomplishment.

The rest must come. To successfully manage an industrial establishment in the future will demand a consideration of human affairs, deep enough to give a reasonable understanding and sympathetic enough to breed intelligent tolerance.

The struggles for self-expression and a measure of control in the management of his own destinies have impelled the man to turn his attention from political to industrial development and the recognition of this by the industrial executive must bring the study of causes and effects which is required for solution.

Wasted Money

HUNDREDS of thousands of shell blanks are lying in the yards of automobile and other factories that were working on shell contracts when the armistice was signed. The Government ordered in many instances that the work on these shells be stopped on Jan. 31. The purpose is to take the blanks to the Government arsenals and finish up the work later, perhaps under a different administration.

The question that naturally springs up immediately is: Why not finish up the shells in the plants where the blanks are stored? The forging companies finished their work and turned the blanks over to the plants where they were to have been machined. These plants were busy on machining work and in numberless cases had hundreds of workmen employed on the job when they had to lay off when the Government stepped in and stopped the work.

It is going to cost the Government additional money to move the blanks to the arsenals and there to set up the machinery and heat-treating apparatus to take care of the work. The plants could have efficiently finished the work on the spot and painted the shells and turned them over for storage. The men who were employed on this work could have been kept employed and not turned loose and it would have given the factories an opportunity to have gradually absorbed this labor into their normal lines.

The machinery was all set to do the work and to clear away these orders in fast time. Why stop them in the middle of the work? The machinery had to be taken down and stored and there it lies in these plants waiting for Government adjustment, while the blanks lie out in the factory yards, awaiting the time when the Government will move them away to the arsenal. This requires twice the transportation work, twice the manual handling of the forging and many times the work in setting up machinery instead of using what was already set up and running on regular production. It is indeed difficult to understand why the run was not carried through to the exhaustion of the blanks as long as the shells are going to be made anyway.

Keep Fuel in Mind

NOW that the excitement of the show season is passing like a wave over the country, and attention is swinging rapidly back to peace time channels, do not let us forget some of the big things that were brought to our attention during the past few weeks.

The fuel situation is a prominent case in point. It has always been difficult for the experimental department of a factory to get money appropriations when the production and sales departments were clamoring for funds, but it would be well for every factory in the business to set aside a sum of money for the research men to use in their studies of the fuel situation.

Do not let the movement for a fuel section of the Society of Automotive Engineers fail to go through to its logical conclusion. This is a matter which requires constant thought and study in order that the development on the engineering side of the business shall keep pace with what is sure to occur in the refining industry. We know from what unbiased experts told us at the S. A. E. meeting in New York that a continuance of the present fuel uses in the present manner and with the increased requirements due to trucks and tractors that the price is sure to advance materially.

The industry will be hampered by increases in the price of fuel, therefore the industry should do its part in forestalling these either by aiding in the development of engines or devices that will utilize other and more plentiful fuels. The money to carry on the necessary research work can readily be contributed by the industry either through its own companies, through the S. A. E. or both. There is no more vital problem confronting us to-day, and we would be failing in ordinary common sense if we did not continually study the fuel prospects of 1921 and 1922. If a reminder is needed, remember that the *curve of crude consumption has crossed the curve of crude production.*

Disposition of Railroads Important to Industry

THE statements made in and out of Congress in regard to the disposition of the railroads and the plans which have been brought up by the late Directer General and others who have given the railroad situation some study from the point of view of the necessities of the railroads or the political effect of certain methods of handling them, calls to our attention the fact that very little has been said about the effect of the disposition of the railroad problem upon the country's industries and economic development.

Perhaps this is to some extent the fault of the business men in this country who paid no attention to the railroad question in the past except to appear in Washington at regular intervals to fight against an increase in rate. Little discussion has occurred on this subject in the Chamber of Commerce and in the meetings of other business bodies which would indicate that the business men of this country fail to realize the intimate relation between the railroad problem and the possibilities of their own business.

Manufacturers in the automotive field drawing raw materials from many sources, depending upon transportation by railroads to a very large degree for the continuance of their supplies and for the operations of this tremendous industry, should be thoroughly concerned with the proposed methods of dealing with the railroad situation and should make it their business through their associations to see that their influence is exerted in favor of such a method of solving the future operation of the railroads as will assure the proper extension of railroad facilities in this country, the adequate increase of terminal and distributing facilities to keep pace with the growing traffic on the railroads and the adequate up-keep of the trucks and equipment so that the service upon the present lines will be maintained at its maximum.

The failure of the business men of this country to exert their influence for the proper extension of transportation facilities of all kinds in the past should only emphasize the lesson which has been pointed out by the war necessities, that is, that the growth of industry depends upon adequate extension and up-keep of transportation facilities to such a degree that no group of manufacturers can afford to have the matter decided at a peace conference or by political adjustment or without respect to the industrial necessities of the case.

The time is ripe for organized bodies to concentrate on the problem and possibly for the appointment of committees representing industry to investigate the matter and present the industrial view of the railroad question to Washington.

Will Road Racing Be Revived?

WILL racing be revived? There can be no question but that racing, properly and scientifically restricted racing, over highways for long distance provides the motor car engineer and builder with a means of testing for which there is no adequate substitute. It can be made, by suitable regulations, the supreme test of efficiency rather than a mere contest of speed. It is expensive and, therefore, requires commercial competition to influence the manufacturer to take it up. Perhaps that competition will be supplied by foreign makers who may find it desirable to revive racing in order to build up prestige for their products; we cannot say, but it seems to be at least a possibility.

Latest News of the

New Models and Strong Representation of Parts Makers at K. C. Tractor Show

Automobile Practice Adapted to Tractor Design—New Models Emphasize Tendency—Thorough Enclosure of Working Parts Popular—Parts Makers Show Realization of Tractor Importance by Complete Exhibits

KANSAS CITY, Feb. 26 (Special Telegram).—Clean-cut lines and thorough enclosure of working parts are strongly emphasized at the Fourth National Tractor show, which is running here this week. Most of the new models emphasize tendency and some of them are worthy additions to the few makes that have already worked toward this end.

A case in question is the new Twin City three-plow tractor which is undoubtedly one of the best jobs yet produced. It is a well balanced design, clean-cut in appearance and exceptionally accessible. The use of a 16-valve engine is an example of how automobile practice can be adapted to tractor design. The new four-wheel-drive Heinz is the simplest type of this drive yet produced, and its development will be watched with interest.

A large part of the show is devoted to implements designed exclusively for tractor use, and these are improved designs and stronger than those heretofore marketed for tractors. It is now recognized that more strength must be put into a tractor plow than a horse plow if satisfactory service is to be given. Other types of specially designed tractor implements are on hand in greater numbers than ever before, including disk harrows, corn planters, silo fillers, cultivators and threshing machines.

Enclosed Drive Through Axle

The show is not only the greatest tractor show ever held, but containing, as it does, exhibits of all the important tractor and tractor implement makers, as well as a most imposing array of makers of such parts as engines, transmission systems, ignition apparatus, carbureters, radiators, castings, forgings, stampings, etc., it ranks as one of the greatest shows of automotive apparatus ever had.

The general character of the show is high grade in every respect. It is staged in a one-story frame $40,000 building, erected in the last three weeks for the purpose and which will be torn down as soon as the show is over. In the mechanical line there is a good deal that is new, though most of the novelties are quite divergent in character, so that it is difficult to discover distinct new tendencies.

One exception must be made to this general statement, namely, that there is a recognizable tendency toward enclosed drive through the axle. This practice, almost unknown four years ago, is to-day found on a dozen tractor models and is constantly gaining ground.

Front Axles Clumsy

From an inspection of models exhibited it is evident there are two schools of design, which may be referred to as the strap iron school and the drop forging and casting school.

The first builds all the structural parts of rectangular bar steel and angle iron while the latter uses drop forgings or castings. The difference begins at the front axle, where one school uses a built-up construction and the other a drop forged one-piece axle. We had occasion last year to remark on the great number of clumsily designed front axles which were excusably only in experimental jobs. There has been little change since. In explanation it should be stated that during the war it was impossible to get dies made for forgings and since the armistice there has not been sufficient time to allow makers to redesign. On the whole, It may be said with assurance that front axles are a part in which there is much room for improvement.

There is one factor which is retarding progress along sound engineering lines, and that is that many farmers do not appreciate good engineering. A farmer examining one of the best tractors exhibited, remarked that there was too much fine machinery in the tractor. He recognized the quality of construction, but it actually repelled him. Some day he will probably learn that fine machinery is not synonymous with delicate machinery and that a machine carefully designed with respect to stress imposed on its parts is sure to give greater satisfaction than one bearing marks of crudeness all over.

Increased Use of Springs

Springs are used to an increased extent, especially in front. Some employ semi-elliptics while others use coils on the steering knuckle pins. While the spring action may be made the same in both, it is evidently accompanied by more sliding motions where coils are used and where the machine has frequently to work in a cloud of dust the sliding motion should be reduced to minimum. Spring suspension at the front end can be readily obtained and as it eliminates some of the short period vibrations which make it so difficult to hold parts together in a tractor it will become a universal feature in time.

Little Change in Frames

There is little change in frames, but more designers are dispensing with a separate frame. In this way weight is saved and in some cases increases the accessibility of important parts.

Several new engines are exhibited, including the Walker overhead camshaft type, and entirely new type in the tractor field. It tends toward clean-cut design as all moving parts are enclosed. There is a considerable number of excellent tractor engines on the market and any concern about to enter the field as an assembler will have no difficulty in securing an engine suitable to requirements.

No departures in practice are noticed in carburetion and ignition, but the size of temperature regulators and indicators is making headway. This is not surprising when it is remembered that the successful burning of kerosene depends so much on proper engine temperatures.

Lengthwise Worm Drive Gaining

In transmissions and final drives there is a wide variety of layouts. Some accomplish the necessary gear reduction which for conventional engine speeds and drive-wheel diameters range between 40 and 50, in a single step, while others use as many as five distinct steps for gear reduction. It is not necessary to state that, other things being equal, the fewer the reduction steps the better, as each transmission of power from one shaft to another is accompanied by loss. The all-spur type of drive continues with several adherents, though most newer designs have the engine lengthwise. Worm-drive is gaining. There is a notable tendency to use the worm in first gear reduction and spur gears or chain drive for final reduction. This overcomes the difficulty of enormous tooth pressures and thrust loads encountered where the worm is used for final drive.

There are a few striking departures from established practice. The Heinz is one, which is a four-wheel-drive type in which the complication ordinarily asso-

(Continued on page 506)

Automotive Industries

Citroen Post-War Car Out

Has First French Post-War Car—$1,450 to $1,960—Plans 100 Daily

PARIS, Feb. 12—André Citroen will produce the first really post-war automobiles in France. It will be on the market in about one month. His production will be 100 per day from the middle of April. Although a few other French manufacturers have cars almost ready for delivery, nobody else has got down to a production basis, nor has any other firm announced prices.

Citroen is specializing on a single model 10 hp., four-cylinder block engine of 65 x 100 bore and stroke. It has forced feed lubrication, high tension ignition, a three-speed gear box and final drive by Citroen herring-bone gears; left-hand steering is fitted; Michelin steel disk wheels have been adopted; wheel base of this car is either 98 in. or 110 in.; track is 46 in.; weight of the car is 1450 lb., completely equipped; speed on the level is 40 m.p.h., and gas consumption is 31 miles per American gallon. The car is equipped with electric lighting and starting.

As a three-seater, this car will be put on the market at $1,450. Price with four-seater body is $1,590, with inside steering body the price is $1,600 and as a town coupé, $1,960. The same chassis is also built with an express delivery body carrying a load of 550 lb., the price of this being $1,480.

Before the war, Citroen was engaged in the production of gears for automobiles. Before the signing of the armistice he was producing 50,000 shells per day. As the factory has never before built automobiles, the change over from a war to a peace basis is exceedingly rapid. None of the old French automobile firms have been able to get back to automobile production in such a short time. In addition to automobiles, Citroen will produce bicycles and sewing machines.

Columbia Six to Be Exhibited at Lyons Fair

DETROIT, Feb. 24—The Columbia Motors Co. will exhibit one of its model sixes at the fair in Lyons, France. The car was shipped a month ago.

Briscoe Has Space at Lyons

JACKSON, MICH., Feb. 19—The Briscoe Motors Corp. will exhibit one of its cars at the Lyons Fair through Messrs. Dutrieu & Co., Paris.

Provisions in the Revenue Bill

Three per cent tax on motor trucks and trailers.
Five per cent tax on passenger cars.
Five per cent tax on tires, parts, accessories and inner tubes.
Ten per cent tax on shows.
Ten dollars annual tax on taxicabs seating 7 or less.
Twenty dollars annual tax on taxicabs carrying more than 7 persons.
Three per cent of transport cost for freight by truck in competition with rail or water.
Five per cent of transport cost for express by truck or passenger car in competition with rail or water.
Eight per cent of transport fee for carrying passengers by truck, passenger car or motorcycle in competition with rail or water.

Signs New Revenue Bill

Law in Force at Once—Will Tax Trucks, Passenger Cars and Accessories

WASHINGTON, Feb. 24—President Wilson to-day signed the new Revenue Bill.

The law becomes effective beginning Feb. 25. The provisions, which were published in detail in a recent issue of AUTOMOTIVE INDUSTRIES, include a tax of 3 per cent on motor trucks, trailers and the equipment, including tires, tubes and other parts; 5 per cent on passenger cars and all other automobiles, including equipment, excepting on tractors, which are not taxed, and 5 per cent on tires, inner tubes, parts and accessories made for automobiles and sold to any person other than an automobile manufacturer. A tax of 1 cent for each 10 cents is assessed on tickets of admission and supplies to automobile or parts shows held during the year.

The tax of 3 per cent on motor truck haulage where it competes with rail or water transportation of freight remains in the bill, and there is a tax of 1 cent paid for motor truck express where it

(Continued on page 501)

Stage for Makers' Aero Exhibit Set

Eighty-Five Exhibits Scheduled—Cabinet Officers to Be Present

NEW YORK, Feb. 25—Preparations for the Aeronautical Exposition of the Manufacturers' Aircraft Association are completed and arrangements have been made for displays by 85 exhibitors in Madison Square Garden and the 69th Regiment Armory for the two weeks beginning March 1. The semi-official character of the show has brought about the co-operation of the war, naval, post-office and interior departments, and the program as arranged designates Monday, March 3, as Army Day, when Secretary of War Baker will deliver an address. It is expected that Secretary Burleson of the Postoffice Department, Secretary Daniels of the Navy Department and Secretary Lane of the Interior Department will also be present.

The largest airplane on display is the F5L U. S. Navy flying boat, capable of carrying fifty people. The letter F stands for Felixstowe, the British Naval Construction Station. The figure 5 designates the series number and the letter L indicates that the plane is equipped with the Liberty engine. This ship is an adaptation from a British flying boat. During the war it is used as a submarine chaser, has an upper wing span of 103 ft. 9 in. and a lower wing span of 74 ft. 4 in. Its length over all is 49 ft. 4 in. It stands 8 ft. 9 in. from the ground to the top wing. The chord is 8 ft. and the gap 8 ft. 10 in. Although its gross weight is 13,000 lb. it has a maximum speed of 87 m.p.h. and can climb to 2625 ft. in 10 min. It is equipped with two Liberty engines.

That the exposition will have a distinctly international character is assured by the exhibit of the American built adapted Handley-Page, the Caproni triplane, Spad scout, Breguet, a captured German Fokker D-7 and other foreign planes.

The Glenn L. Martin bombing plane, a biplane engined with two Liberty engines, will be displayed. Both wings are of the same span, 71 ft. 5 in. The length overall is 44 ft. 10 in. The height is 14 ft. 7 in. It has an inner surface of 1070 sq. ft. Its gross load is 9663 lb. In speed it outstrips all of its huge rivals, being officially credited with 118 m.p.h. and a climb of 10,000 ft. in twenty-one months. Another type of British machine will be the SE5, which at one

time during the war created consternation among the Germans.

Another feature of the Italian section will be the SVA Gabriel D'Annunzio, the Italian poet, used in his propaganda trips in Vienna.

There will also be a Nieuport Breguet and a LaPere. The latter plane was built in this country by the Packard company at Detroit.

The balloon exhibit will take up a large portion of the air space in Madison Square Garden.

—

List of Exhibitors at Aeronautical Exposition March 1 to 15, 1919

Empire Art Metal Co., College Point, L. I.
Arthur Johnson Mfg. Co., New York.
Dodge Mfg. Co., Mishawaka, Ind.
Valentine & Company, New York.
Zenith Carbureter Co., Detroit.
Wellington, Sears & Co., New York.
John A. Roebling's Sons Co., Trenton, N. J.
Eastman Kodak Co., Rochester, N. Y.
Motor Compressor Co., Newark, N. J.
Cold Light Mfg. Co., New York.
Livingston Radiator Corp., New York.
American Balsa Co., New York.
Jones Motrola Company, New York.
Champion Ignition Co., Flint, Mich.
Dayton Eng. Lab. Co., Dayton.
Ajax Auto & Sheet Metal Co., New York.
Stone Propeller Co., Dayton, Ohio.
Aerial Age, New York.
Splitdorf Electrical Co., New York.
National Cash Register Co., Dayton.
Jamestown Propeller Co., Jamestown, N. Y.
American Propeller & Mfg. Co., Balt., Md.
Hartzell Walnut Propeller Co., Piqua, Ohio.
Dayton Wire Wheel Co., Dayton.
Lunkenheimer Co., Cincinnati.
General Ordnance Company, Groton, Conn.
Society of Automobile Engineers, New York.
Gardner Moffat Company, Inc., New York.
Torrington Company, Torrington, Conn.
Simms Magneto Co., East Orange, N. J.
Triplex Safety Glass Corp., Mount Vernon, N. Y.
Radium Dial Co., Pittsburgh.
American Bosch Magneto Co., New York.
Detroit Accessories Corp., Detroit.
Sterling Engine Co., Buffalo.
Perry Austen Mfg. Co., Grasmere, S. I.
Dayton-Wright Airplane Co., Dayton.
Curtiss Aeroplane & Motor Corp., Buffalo.
L. W. F. Engineering Corp., College Point, L. I.
Wright-Martin Aircraft Corp., New Brunswick, N. J.
Aeromarine Plane & Motor Co., New York.
Thomas Morse Aircraft Corp., Ithaca, N. Y.
Burgess Company, Marblehead, Mass.
Gallaudet Aircraft Corp., East Greenwich, R. I
B. F. Sturtevant Company, Hyde Park, Boston, Mass.
Packard Motor Car Company, Detroit, Mich.
Lawrence Aero Engine Corp., New York.
Gio Ansaldo & Co., New York.
Goodyear Tire & Rubber Co., Akron.
Cantilever Aero Co., New York.
L. Sperry Aircraft Co., Farmingdale, L. I.
Boeing Aeroplane Co., Seattle.
Glenn Martin Co., Cleveland.
Stewart Hartshorn Co., New York.
Matthews Bros. Mfg. Co., Milwaukee.
Budd Wheel Corp., Philadelphia.
A. G. Spalding & Bros., Nassau St., New York.
Titeflex Metal Hose Corp., Newark, N. J.
Doehler Die Casting Co., Brooklyn.
Norma Co. of America, New York.
Stromberg Motor Devices Co., New York.
United Aircraft Engineering Corp., New York.
Anderson Forge & Machine Co., Detroit.
Wyman-Gordon Co., Worcester, Mass.
Standard Parts Co., Cleveland.
Mossberg Co., Attleboro, Mass.
Aero Science Club, New York.
Dural Rubber Corp., Flemington, N. J.
Aeronautical Society of America, New York
Rich Tool Co., Chicago.
Hess-Bright Mfg. Co., Philadelphia.
Liberty Starter Corp., New York.
Ericsson Mfg. Co., Buffalo, N. Y.
B. F. Goodrich Co., Akron.
Champion Spark Plug, Toledo.
U. S. Light & Heat Co., Niagara Falls.
Standard Turnbuckle Co., New York.
A. J. Meyer Mfg. Co., West Hoboken, N. J.
Junior Plattsburg, Inc., New York.
Class Journal Co., New York.
Edison Electric Appliance Co., Inc., New York

France Will Need 40,000 Tractors

More Than 8,000,000 Acres to Be Cultivated Mechanically—Only 3033 Tractors in France

By W. F. Bradley

PARIS, Feb. 15—France can absorb 40,000 agricultural tractors during the next four or five years, according to an estimate made by Representative Compère-Morel of the Agricultural Commission. This estimate, which appears to be a very moderate one, is based as follows:

In the period immediately preceding the war, France had 44,500,000 acres of land under cultivation for grain, potatoes and beets. It is estimated that one-quarter of this area, or 8,600,000 acres, will be cultivated by mechanical means within a very short time. These 8,600,000 acres will have to be plowed in 100 days, on an average; but two-thirds of this land, which is made use of for autumn sowing, will have to be plowed in a period of about sixty days. This gives, therefore, 5,500,000 acres of land to be worked in sixty days, or 98,000 acres per day. It is estimated that a tractor will plow 2 2/5 acres per day. This is probably a rather liberal estimate. On this basis, therefore, 40,000 tractors are required.

A short time ago, figures were issued showing that France possesses only about 800 agricultural tractors. These figures were incomplete. The total number of tractors in service at the end of December, 1918, was 3,033, composed as follows: One thousand eight hundred and thirty-five belonging to French farmers, 898 belonging to the Government and loaned to farmers on special terms, 300 tractors in Government's reserve. Of the 898 practically all were of American origin, for only forty-seven had been bought from French manufacturers, as follows: Filtz, 20; Doizy, 12; De Dion-Bouton, 3; Tourand-Latil, 10, and Julien, 2.

In the opinion of Representative Compère-Morel, the immediate requirements of France will have to be met by gasoline tractors. But the greatest development, he considers, will be with electrically propelled tractors, the electric current being generated either from water power or from wind mills. At the present time all tractors are either gasoline or steam driven.

—

Big Merger Rumor

DETROIT, Feb. 24—The automotive world awaits with interest the announcement expected any day of a big merger of automobile, truck and tractor companies into an organization patterned after General Motors. Norval A. Hawkins, former sales manager of the Ford Motor Co., is busy upon the project but has made no statement regarding his plans. He is said to be backed by Kuhn-Loeb Co., a New York banking house.

Many Detroit companies have been mentioned as possible units in the proposed corporation. It is said to-day that the following five concerns may form the nucleus of the Hawkins organization. These companies are the Commerce Truck Co., the Signal Truck Co., Grant Motor Car Corp., the Doble-Detroit Steam Motor Co. and the Lincoln Motor Co. The Saxon Motor Car Co. and the Hupp Motor Car Corp. have also been mentioned, but officials of these two concerns emphatically deny the rumor.

—

NEW YORK, Feb. 25—Kuhn-Loeb Co. deny that any plans for financing or organizing a merger of automobile interests under Norval Hawkins is contemplated. The bankers state that they have heard the rumors for several weeks, but disclaim any knowledge of them other than as current gossip.

—

Record Flight from Washington to New York

WASHINGTON, Feb. 24—Lt. Frank H. Harmon, pilot of Bolling Field, Anacostia, made a record flight from Washington to New York in a La Pere plane, landing at Hazelhurst, N. Y., 85 minutes after his take-off at Bolling Field, on Feb. 19. In this flight a straight distance of 269 miles was covered, making the average speed 189.9 m.p.h.

—

Agreement Reached on Informal Contracts Bill

WASHINGTON, Feb. 26—After a long disagreement by the Senate and House conferees over the bill to validate informal war contracts a compromise was reached to-day that gives promise of early action and passage of the law. The deadlock was over the payment of contracts for metals and minerals ordered and production of which had been stimulated by the war contracts. The bulk of the contracts validated by the bill total over $2,000,000,000 and include business with the automotive industry of more than $300,000,000.

—

Air Regulations Under Department of Commerce

WASHINGTON, Feb. 26—President Wilson to-day recommended that aerial licensing and regulation be placed under the Department of Commerce as suggested by the National Advisory Committee for Aeronautics, and asked Congress for the necessary legislation. Secretaries Baker, Daniels and Redfield also indorsed the plan.

The legislation would give the Department of Commerce authority to issue licenses for civilian flyers and includes an appropriation of $250,000. Without some sort of regulation and control of licenses, it was pointed out, there would be many fatalities caused by amateur flyers, and in addition airplanes might be used for smuggling from Mexico or Cuba.

Organizing Federal Highway Committee

All Bodies Interested in Road Contruction to Be Fully Represented

WASHINGTON, Feb. 21—As a result of the meeting of various organizations interested in highway construction in Chicago recently the National Highway Committee is being organized to represent practically every organization for the construction of roads and those interested in this work and to secure intensive industrial support for road construction.

S. M. Williams, president of the Highways Industries Association, has appointed the State Highway Commissioners and Engineers and various prominent men throughout the country to the committee, giving each State representation of three or more and in each case selecting men known for their present interest and activity in highway development. Total membership of the committee will be about 300 and will include the presidents of various prominent national organizations such as the American Road Builders' Association, National Automobile Dealers' Association, etc.

Although the Federal Highway Committee is not yet completed, it is already assuming important proportions. Following is the organization as formed to date:

Federal Highway Committee

W. T. White, Cleveland.
F. A. Seiberling, Akron.
R. D. Chapin, Detroit.
A. G. Batchelder, Washington, D. C.
Coleman du Pont, Wilmington, Del.
F. A. W. Vesper, St. Louis.
A. H. Blanchard, New York.
Chas. H. Davis, Cambridge, Mass.
Alfred Reeves, New York, and others.

National Road Organizations

Highway Industries Assn., Washington, D. C.
National Highway Assn., Washington, D. C.
American Road Builders' Assn., New York.

Transcontinental Road Organizations

Lincoln Highway Assn., Detroit.
Dixie Highway Assn., Chattanooga, Tenn.
Jefferson Highway Assn., St. Joseph, Mo.
National Old Trails Assn., Kansas City, Mo.
Pacific States Defense League, Seattle, and others.

National Trade Organizations

National Automobile Dealers' Assn., St. Louis, Mo.
National Real Estate Boards, Washington, D. C.
National Retail Hardware Assn., Argos, Ind., and others.

State Trade Organizations

Penna., New Jersey and Delaware Wholesale Growers Assn., Philadelphia.
New England Hardware Dealers' Assn. Boston.
Illinois Valley Manufacturers' Club, La Salle, Ill., and others.

State Good Road Organizations

Ohio Good Road Federation, Columbus.
Michigan Good Road Federation, Hastings, Mich.
New York State Road Builders' Assn., Albany, N. Y., and others.

Commercial Organizations

Chamber of Commerce, Philadelphia.
Chamber of Commerce, St. Louis.
Chamber of Commerce, San Francisco, and others.

Rotary Clubs

Ohio State Assn. of Rotary Clubs, Columbus.
Michigan, State Assn. of Rotary Clubs, Grand Rapids.
San Francisco Rotary Club, San Francisco.
New York Rotary Club, New York City, and others.

Travellers Protective Associations

Post L, T. P. A., New Orleans.
Post E, T. P. A., Charleston, S. C.
Post C, T. P. A., Reading, Pa., and others.

United Commercial Travelers

Council No. 16, U. C. T., Philadelphia.
Council No. 75, U. C. T., Cincinnati.
Council No. 165, U. C. T., Brooklyn, N. Y.

FEDERAL HIGHWAY COMMITTEE

Advisory — Direction — Finance

Vice-Chairman — Chairman — Vice-Chairman

Executive Committee

Highways Industries Association

Advisory and Co-operative Organization for Federal Highway Legislation

National Road Organizations
Transcontinental Road Organizations
National Trade Organizations
State Road Organizations
State Trade Organizations
State Grange Organizations
Commercial Clubs
Rotary Clubs
Traveling Men's Protective Association—Local Posts
United Commercial Travelers' Association—Local Councils

Half Billion Planned to Build Highways

WASHINGTON, Feb. 24—Expenditures for highway work in the United States this year are likely to amount to a half billion dollars, according to the Bureau of Public Roads. The bureau estimates the expenditures for roads and bridges at \$385,000,000, or \$110,000,000 more than the average expenditures for 1916 and 1917. This does not include additional Federal funds which will be available if the amendment to the Post Office Appropriation bill, making \$50,000,000 immediately available and \$75,000,000 more on July 1, is enacted into law.

Estimated work under control of the state highway departments includes \$45,000,000 for the construction of 5,000 miles of road now under contract, \$30,000,000 for 4,000 miles of construction ready for contract, \$100,000,000 for 16,000 miles of contemplated construction, and \$60,000,000 for maintenance of 200,000 miles. Expenditures of counties, and local districts are estimated at \$100,000,000 for the construction of 150,000 miles and \$50,000,000 for maintenance of 100,000 miles.

Federal Highway Plan Outlined in Bill

Provides for Commission of Five Members and National System of Main Highways

WASHINGTON, Feb. 25—The bill to create a Federal highway commission, to establish a National highway system and promote road construction, introduced by Congressman Townsend, provides for a commission of five members, to be appointed by the President. Provisions are made for a complete system of highways and post roads, and specifies that no less than two main trunk line roads are to be in each State. The commissioners will receive \$10,000 yearly salary. They will have complete control of highways with power to determine types of construction and improvement, repair and maintenance.

The War Department is authorized to deliver to the commission any vehicles needed for use in the construction and control of highways, without charge, and in addition, any road machinery and equipment requisitioned.

Road building along economic, scientific lines, will be given a tremendous impetus the country over by the passage of the bill, in the opinion of Roy D. Chapin, former chairman of the Highways Transport Committee of the Council of National Defense and chairman of the Highways Committee of the National Automobile Chamber of Commerce.

"The United States is on the eve of a revolutionary epoch in highways transportation," said Mr. Chapin. "Hundreds of millions of dollars are available now for construction throughout the country and scarcely a day passes that we do not hear of some new movement looking toward better highways.

"The Townsend bill provides a sure means for such a program and it is safe to say that all who understand the importance of efficient highways transportation will be solidly in favor of its adoption by Congress at the earliest possible moment."

No State will benefit from expenditures of Federal money for highway construction until it approves this bill. The bill was read to the House and referred to the Committee on Post Offices and Post Roads. There is little chance that it will pass during this session. Following is the complete bill:

That there is hereby created a Federal highway commission, and to provide a connected system of main highways adequate to sustain the demands of interstate commerce, to provide adequate post roads for the transportation of the United States mails and parcel post, and to provide for the common defense and promote the general welfare of the people of the United States there is hereby authorized to be established, constructed, and maintained a system of highways, hereinafter referred to as the national highway system, to comprise not less than two main trunk-line roads in each State, and joining the national highway system in the adjacent States and countries. The term "commission" used in this act shall mean the Federal highway commission, hereinafter referred to as commission; a highway, within the meaning of this act, shall be deemed to include the

(Continued on page 507)

Elysee-Palace Hotel for Auto Sales

Citroen Buys Hotel for Sales Building—Avenue Champs Elysees Auto Row

PARIS, Feb. 10—The Elysée-Palace Hotel, the biggest and the most luxurious of the hotels of Paris, situated in the Champs Elysées, recognized as the finest avenue in the world, has been purchased by André Citroën, and it is declared that it will be used as an automobile showroom and business headquarters.

This hotel belonged to the Compagnie Internationale des Wagons-Lits, and Citroën has secured it by the purchase of a predominant number of shares in this concern. The public is at a loss to understand how Citroën can make use of such a huge building as automobile showrooms and office. The hotel must have not less than 1000 rooms, including several handsome halls. It is at present occupied by the Quartermaster and Signal Corps of the American Army, but, being much too big for these services, they will move out at an early date.

Citroën is only just entering the automobile field, and the car he is producing is of a popular type, sold at a very moderate price. It is not the class of cars usually associated with the luxurious Champs Elysées showrooms.

The Avenue des Champs Elysées is becoming more and more commercialized by the automobile industry. Originally the trade was located in the Avenue de la Grande-Armée, which is a continuation of the Champs Elysées. It is on the north side of the Etoile Monument. Now manufacturers and dealers are coming to the more luxurious south side of the monument. In addition to Citroën, those who have secured or are preparing to secure showrooms in the Champs Elysées are: Fiat, Rolls-Royce, Panhard & Levassor, Renault, Delaunay-Belleville, Lorraine-Dietrich, Braiser, Sizaire-Berwick, Bellanger and Berliet. The German Mercedes showrooms in this avenue have been used by a war charity organization for the past two years, and probably will be taken by some French automobile firm as soon as normal conditions are restored.

Committee to Standardize Petroleum Specifications Asks State Co-operation

WASHINGTON, Feb. 24—In appealing to the Governors of the various States for co-operation in standardizing petroleum specifications for the entire country, letters have been sent to the Governor of each State containing memorandum as to the laws for gasoline inspection in each State along with the bulletins issued by the Committee on Standardization of Petroleum Specifications. This committee has been investigating the subject for months, and a series of standards are gradually being developed which are put out from time to time in bulletin form.

EXPORTS OF PASSENGER AUTOMOBILES IN 1914 AND 1918

Country	Twelve months Ended Dec. 31, 1918 No.	Value	Twelve months Ended June 30, 1914 No.	Value
Canada	8,543	$7,141,405	4,377	$5,445.052
Australia	3,826	3,271,317	3,099	2,615,896
Japan	2,699	2,877,693	96	100,995
Mexico	1,915	1,539,266	155	239,166
Chile	1,734	2,315,386	195	160,194
Cuba	1,780	2,638,001	297	254,428
Philippine Is.	1,690	1,462,571	614	697,175
Argentina	1,628	1,673,137	940	963,586
New Zealand	1,418	1,228,864	1,065	974,708
Uruguay	1,351	799,787	183	167,269
Brit. S. Africa	1,205	1,070,570	1,618	1,437,883
D'ch E. Ind's	1,260	1,567,766	290	208,722
Brazil	1,108	856,374	299	264,992
France	1,003	1,134,818	1,427	919,060
China	874	896,728	144	143,619
Spain	808	1,042,788	83	64,758
Germany	...	......	1,411	1,040,787
England	398	997,342	6,992	5,615,487
Russia (Eu'pe)	10	8,325	926	898,458
Other co'tries	3,686	3,756,256	4,094	3,180,728

EXPORTS OF MOTOR TRUCKS IN 1914 AND 1918

Country	Twelve months Ended Dec. 31, 1918 No.	Value	Twelve months Ended June 30, 1914 No.	Value
France	3,356	$12,920,029	2	$5,070
England	2,080	5,999,541	203	189,099
Canada	1,596	2,035,464	247	474,724
Japan	605	895,125	1	900
Cuba	557	1,109,368	19	33,500
Mexico	397	524,035	12	17,509
Chile	154	239,621	2	10,743
D'ch E. Ind's	154	335,536	7	14,232
Philippine Is.	152	205,519	38	64,805
Norway	108	320,574	2	3,852
Scotland	182	667,413	..	......
Peru	100	246.398	3	5,301
Other co'tries	864	1,336,334	248	361,876
	10,308	$26,814,952	784	$1,181,611

According to the committee, the variety of standards prevailing in different localities tends to raise the price of gasoline and other petroleum products for the consumer. Common standards, it is believed, would also improve quality. In this communication to the State Governors it is also pointed out that although the Fuel Administration will cease to function after peace is declared, the Committee on Standardization of Petroleum Specifications will continue for six months after that time.

U. S. May Now Ship to Finland

WASHINGTON, Feb. 25—Arrangements have been made by the War Trade Board whereby both export shipments and import shipments from Finland can be resumed. All shipments for export to Finland must be governed by the import certificate issued by the Inter-Allied Trade Committee at Helsingfors. Exporters should apply for licenses to the Bureau of Exports, Washington, but before filing applications must have advice from the prospective importer in Finland that a certificate has been issued by the Inter-Allied Trade Committee approving the proposed consignment.

St. Louis Show Huge Success

ST. LOUIS, Feb. 22—Judging by the attendance, the twelfth annual auto show being staged here at the Exhibit Building is a remarkable success. All past records have been broken. Facilities had been arranged to handle 16,000 people at the doors and the great crowds caused a call for special police details. More than 20,000 people clamored for admission.

Change in Post-War Exports Expected

Truck Exports to Decrease, Passenger Car Exports to Grow

NEW YORK, Feb. 24—That a radical change may be expected in the exportation of passenger cars and trucks with the ending of the war is the view of the National Automobile Chamber of Commerce. During the war, it is pointed out, yearly exports of cars more than doubled over the pre-war shipments, due to the inability of European makers to meet export demands. A much more pronounced effect, however, was noticeable in motor truck exports, which averaged 13,300 per year with an average value of $42,500,000 as against 888, valued at $1,459 for the fiscal year ended June 30, 1913 and 1914.

As the military demands of Europe greatly increased the truck shipments, it is now anticipated that there will be a drop that will bring truck shipments near their former proportion to passenger car exports.

A report of motor vehicle exports to all countries during 1918 shows that 10,308 trucks, valued at $26,814,952, and 36,936 passenger automobiles, valued at $36,278,292, were shipped abroad last year. In the fiscal year ended June 30, 1914, the last 12 months' period before the war, we exported only 784 trucks, worth $1,181,611, and 28,306 passenger automobiles, worth $25,392,963.

Analysis of the exports in 1918, as compared with 1914, shows that while the exports of passenger cars to England, France, Germany, Russia and British South Africa decreased notably and increased only slightly in Australia, they doubled to Canada, increased 28-fold to Japan, 12-fold to Mexico, nearly 9-fold to Chile and Spain, 6-fold to Cuba and China, more than 7-fold to Uruguay, more than quadrupled to the Dutch East Indies and almost doubled to Argentina.

Of the truck exports last year, on the other hand, more than half of the 10,308 went to England and France alone, while in 1914 less than one-third of the 784 shipped abroad went to these two.

M. A. M. A. Closes Washington Office

WASHINGTON, Feb. 24—The Motor and Accessory Manufacturers' Association office here was closed to-day, and R. M. McConnell, who has been in charge of it, is returning to Detroit. The office was a temporary one used chiefly to keep in touch with the Congressional action in the matter of the "Bill to Pay Informal Contracts."

Ontario to Build Roads

TORONTO, Feb. 24—The Ontario Government will spend $5,000,000 on highway construction this year. This means that with federal aid $8,333,333 will be expended for roads in Ontario this year.

British Aero Mfrs. Society Permanent

All Makers Are Members of Society of British Aircraft Constructors

LONDON, Feb. 2—One of the war organizations which will take its place as a permanent organization of peace days is the Society of British Aircraft Constructors formed in the early months of 1916, when aircraft manufacture was taking on the stature of an industry, and when it was apparent that all makers engaged in different phases of the work must co-operate to the fullest extent to give the necessary output of aircraft.

To-day every maker of aircraft in Great Britain is a member of this society. The list includes not only the makers of planes and engines, but those producing parts, dope, materials, steel in all forms, textiles, etc. There is no rivalry between those firms who before the war represented the aircraft industry on the one hand, and those new firms born of the war, that have become the greatest producers of aircraft.

There are two grades of membership: Poll members, made up of manufacturers of planes and engines; and associate members, representing makers of parts, materials, etc. Steel and aluminum makers also have membership in the society.

In the plan of organization the Committee of Management, composed of 14 members, manages the society. The membership is divided into sections according to manufacturing interests. Thus there is the dope section, the engine section, metallurgical section, etc. One section, known as Aerial Transport, has as its specific task all matters relating to aerial navigation. The government consults this section whenever it wishes advice from the manufacturers.

So far it has been impossible for the society to take any action relating to cross licensing of patents, as the government took over all aircraft patents in the early days of the war and still controls them. It is not known what action regarding patents may be taken when government control is released, if it ever is released with reference to patents.

The society has left the entire work of aircraft standardization in all its ramifications to the British Engineering Standards Committee, which is the final authority on all work relating to standardization in the British Empire. No manufacturing specification becomes a standard until so designated by the B. E. S. C. All standards for all industries come under its control. The actual steps in arriving at different standards are largely carried out by the members of the industry concerned, but the approval of any specification as a standard must come through the B. E. S. C.

During the war the society had little to do with government contracts except to work for their uniformity, and if manufacturers had complaints with reference to them these reached the government through the channels of the society rather than by direct representation of the manufacturer concerned.

—

French Racers for Indianapolis

PARIS, Feb. 21 (Special Cable. Delayed in Transit).—René Thomas, Albert Guyot and Bablot will race at Indianapolis on May 31.

Guyot drove one of the Sunbeams on the occasion of its first appearance in this country in 1913. The following year he came in third, driving a Delage, at Indianapolis. On his discharge, the result of wounds received, from the French Army, in which he saw active service as an airplane pilot, he entered into partnership with N. Causan and engaged in the profession of consulting engineer. The partner, who collaborated to produce successful car and boat engines for the Delage Co. and others, is particularly interested in racing and aviation development.

—

Ready for S. A. E. Air Meeting

Will Discuss Commercial Future of Airplanes, Aircraft Radiators and Dirigibles

NEW YORK, Feb. 25—The program for the meetings of the Society of Automotive Engineers, to be held in conjunction with the Aeronautical Exposition on March 7, is practically complete, and will include afternoon and evening sessions with a dinner at 6.30 p. m. The meetings and dinner will be held at the Engineering Societies Building, 29 West Thirty-ninth Street.

The afternoon session will include a paper on the commercial future of airplanes from the engineering standpoint by C. H. Day, chief engineer of the Standard Aircraft Corp.; a paper on aircraft radiators by Archibald Black of the United States Navy and former chief engineer of the L. W. F. Engineering Co., and a paper on dirigibles by Ladislas d'Orsy, editor. Pictures will be used to illustrate the discussions.

The dinner, which will be given at 6.30, is particularly intended to afford the members to become acquainted with one another and to allow for informal discussions on aviation. The evening session following the dinner will include addresses by officers of the United States Army and Navy and members of the automotive industry, whose names cannot yet be announced, as the evening program is not definitely completed.

The S. A. E. is also conducting an exhibit at the Aircraft Exposition on standards.

It is expected that there will be a large attendance at these sessions, when C. H. Manly, the newly elected president, will preside.

Auto Export Chiefs Will Meet

To Discuss All Pertinent Questions of Foreign Trade—Addresses Already Scheduled

NEW YORK, Feb. 25—A convention of automobile export managers will be held in the city March 7 under the auspices of the National Automobile Chamber of Commerce. Foreign trade opportunities, foreign credits, service abroad, packing for foreign shipments and the effect of the revenue bill on exports will be among the many subjects discussed. The meeting is being held as a result of the numerous export problems now facing the industry, and because of the new and unparalleled foreign conditions which are so intricate that co-operative discussion and action are made necessary.

Addresses already scheduled for the convention include:

"Trade-Marks in Foreign Countries." By James L. Stuart, of Stuart & Perry.

"What Our New Ships Can Do for Exporters." By Ira Campbell, U. S. Shipping Board, Washington.

"Definite Things We Must Do to Advance Export Trade." By Roy S. McElwee, Assistant Chief, Bureau of Foreign and Domestic Commerce, Department of Commerce.

"How to Use the Webb-Pomerene Law Providing for Combination of Competitors for Export Selling." By Allen Walker, Mgr., Foreign Trade Dept., Guaranty Trust Co.

"Automobile Publicity in Foreign Lands." By Peter S. Steenstrup, Export Manager, General Motors Export Co.

"Straight Side Tires and Right Hand Drive for Foreign Markets." By D. B. Richardson, Export Manager, Studebaker Corporation.

"Financing Foreign Trade." By G. A. O'Reilly, Foreign Trade Representative, Irving National Bank.

The meeting will be at the direction of the Export Committee of the N. A. C. C., which includes J. Walter Drake, chairman, Hupp Motor Car Co.; H. M. Robins, Dodge Brothers; D. B. Richardson, Studebaker Corp.; B. S. Steenstrup, General Motors Corp.; J. Rathburn, White Co., and R. T. Williams, Willys-Overland Co.

—

Mexican Oil Imports Increase

WASHINGTON, Feb. 24—Regardless of embargoes and other restrictions imposed by the Mexican Government, oil imports from there to the United States are steadily increasing, according to the Department of Commerce. During the period between July 1 and Jan. 13 last, crude oil imports from Mexico amounted to 1,060,615,650 gal. and refined to 26,744,049, valued in total at $15,500,000. This was a greater amount than the imports for the entire year 1917.

—

Tax Mexican Parcel Post Imports

WASHINGTON, Feb. 22—The Mexican decree of Jan. 7 provides a special surtax of 15 per cent of the respective customs duties on all goods imported or exported by parcel post.

England Standardizes Steels

Institution of Automobile Engineers Evolving Complete Standards Program

LONDON, Feb. 4—With the signing of the armistice activities connected with the Institution of Automobile Engineers have taken on renewed interest. In the first days of war the institution's work was greatly hampered. In fact, it was throughout the war, but the organization was maintained, and a more or less depleted office force carried along.

A monthly schedule of meetings has been drafted and carried out. The attendance at the last two meetings was greater than at any previous meetings during the war. Meetings are held on the 5th of each month.

The program for the remainder of the winter and spring season follows: Feb. 5, "Efficient Invention," by Douglas Leechman, a leading patent attorney and agent; March 5, "Lubrication," by Capt. G. W. A. Brown of the Arrol-Johnston Co.; April 5, "Electric Vehicles," by Carl Opperman, who has been closely associated with electric vehicle matters for many years; May 5, "Diesel Engines," by J. Day of Mirrless, Bickert & Day, makers of Diesel engines. At the Jan. 5 meeting L. H. Pomeroy's address on "Valve-in-the-Head Engines" was heard by over 200 members and guests.

The war almost completely disrupted the standardization program of the institution, but since Nov. 11 the go-ahead has been given, and a comprehensive committee organization has been created and pushed into action.

Standardize 20 Automobile Steels

The 100 per cent turning of the automobile industry to electric lighting and starting has called for quick standardization decisions on all such apparatus. The work on battery standardization has just started. The holding of a preliminary meeting represents accomplishments to date. It is quite certain that plate dimensions will be standardized, and the desire is to work as closely with American standards as possible.

With electric starting motors outside dimensions are going to be standardized. The committee is under way in this work. No decisions with regard to electric generators have been made. The committee has not yet started work on this. A committee is working on carbureter flanges, but as yet it is not very active and little progress has been made.

The greatest standardization work accomplished to date is that on 20 different automobile steels. All of the research work on these has been done and the specifications decided upon as well as the physical tests each must meet. In this work the steel manufacturers co-operated to the fullest extent with the automobile engineers. In 11 months from the start of the work it was completed, and by that time ten of the standard steels were in production by the steel men. The specifications of these steels appeared in a recent issue of AUTOMOTIVE INDUSTRIES.

In tire standardization much work has been done, but as yet Great Britain has more standard sizes than the United States. The sentiment in the I. A. E. is to still further reduce the number of sizes and if possible adopt the same standards as in America. Standardization work on magnetos and spark plugs has been completed.

The final adoption of any standard does not rest with the I. A. E., but with the British Engineering Standards Committee, an organization for standardization which represents all British industries, and whose approval is necessary before any standard in any industry can be officially recorded.

The automobile industry works through the B. E. S. C. in all standardization. In fact, the preliminary work is all done by committees of the I. A. E. and other automobille organizations. There is what is known as the Technical Committee of the Motor Industry, which is composed of representatives of three leading industrial groups, namely, (a) the Institution of Automobile Engineers, (b) the Society of Motor Manufacturers and Traders, (c) the Association of British and Allied Manufacturers, (d) representatives of other concerned organizations. This Technical Committee does the preliminary investigating work on any standard, and presents its conclusions to the B. E. S. C., which takes action as seems best.

Resumption of Trade with Bulgaria, Turkey and Black Sea Ports

WASHINGTON, Feb. 24—The War Trade Board has authorized trade and communication between this country and Bulgaria and the Turkish Empire, both in Europe and Asia Minor, subject to its rules and regulations. Russian Black Sea ports, Roumania and all ports on the Black Sea are now open to trade with the United States.

Applications will be considered for licenses to export and import all commodities to or from such territory.

The War Trade Board has received no official statement as to what the import regulations into this territory, if any, will be. Prospective exporters should therefore communicate with their customers abroad before making shipments, to comply with any import regulations that may be in effect.

U. S. May Now Ship to British Guiana

WASHINGTON, Feb. 25—Proclamations which restricted the importation of motorcycles and side cars, motor cars, including spare parts, farm tractors and trucks into British Guiana from the United States, have been revoked, according to a consular report. This revocation removes all restrictions on imports that were enforced in British Guiana during the war.

New Line of Hinkley Heavy-Duty Engines

Truck and Tractor Types Built on Design Standards of Class B Army Model

DETROIT, Feb. 24—The Hinkley Motors Corp., Detroit, is now producing a line of truck and tractor engines built around the standards of design and workmanship employed in the construction of the class B government engine. These are known as the Hinkley class B. In addition, models HA and HAA are built along similar lines, and show the same characteristics with reference to appearance and performance.

The line is rated at 55 hp. at 1400 r.p.m.; 45 hp. at 1500 r.p.m. and 35 hp. at 2000 r.p.m. for the respective models, and the engines are respectively suitable for 4-6 ton, 3-4 ton and 1½-2½ ton trucks, or 4 plow, 2-3 plow and 1-2 plow tractors.

The class B military engine has been described frequently and the Hinkley class B is similar in all essential respects. It is a 4¾ x 6-in. job with block cast cylinders. Model HA is 4½ x 5½ in. and is constructed along similar lines to the class B. Model HAA is 3¾ x 5¼ and is also adapted for cylinders of 4 in. bore for the purpose of being used with a maximum load capacity truck of 2½ tons. Detailed specifications and illustrations will appear in an early issue of AUTOMOTIVE INDUSTRIES.

New English Motorcycle

LONDON, Feb. 10—A motorcycle produced by the Sopwith Aviation Co., Ltd., which first made its appearance before the war, is now being put on the market. Because of the war, work on this machine, the A. B. C., was stopped, while the company centered its efforts on aviation design.

The frame of the new machine is suspended on long leaf springs, both fore and aft. In the rear the chain stays are pivoted on roller bearings. At each end the springs are rigidly clamped, giving the effect of the cantilever pattern. A horizontally opposed 3 hp. twin-cylinder engine sets across the frame and is bolted to an aluminum gearbox, giving four speeds controlled by a gate lever. The flywheel and clutch are also enclosed, the drive being taken care of through bevel pinions and a slow-running chain to the back wheel. An elastic coupling in the driving sprocket absorbs any snatch in the transmission.

A positive lubrication system supplies both the gear and the engine, the oil being contained in a common pump. The valves are in the cylinder heads, which are of cast iron, and detachable. The cylinders are turned with their cooling ribs from the solid steel billet. Pistons are of aluminum alloy. The connecting rods have roller bearings running on a hardened crankshaft.

Road Builders Hold Annual Convention

Proceedings Based on Principle That the Motor Truck's Needs Are Paramount

NEW YORK, Feb. 26—As this issue of AUTOMOTIVE INDUSTRIES goes to press, the sixteenth annual convention of the American Road Builders' Association is holding its daily sessions at the Hotel McAlpin.

Although the convention is far from its close, a number of fundamental principles have been laid down. First and foremost, the general consensus of opinion tends very strongly to the axiom that roads must be built with due regard to the strains and stresses imposed by heavy automotive traffic. It has been, and is being, emphasized in no uncertain way that the motor truck is the king of the road, and that it is imperative that not only main highways but connecting roads shall be so constructed as to be fully capable of standing up under intensive motor-propelled traffic.

Highway engineers who may have hitherto considered road problems on a horse and wagon basis are now obviously fully alive to the fact that mechanical road transport has arrived, and whether they may be advocates of bitumenized or brick surfaces or cement or macadam foundations they have adapted themselves to the new order in no half-hearted way and, without exception, have declared themselves staunch supporters of whatever type of highway is most suitable for the truck.

Evidence of the realization of the coming of the motor truck as the standard method of highway transport was given over and over again. For example, the Hon. Francis M. Hugo, Secretary of State for New York, stated that it was with a full realization of the importance of the motor truck that appropriations covering road construction for the present and future years were made and that, moreover, 90 per cent of the increase in 1918 registrations for the State of New York were accounted for by the increase in the number of commercial motor vehicles in service.

National Tractor Demonstration for Wichita

KANSAS CITY, Feb. 27—The Demonstration Committee of the National Implement and Vehicle Association has decided on Wichita for the 1919 National Tractor Demonstration, to take place some time in July. No definite date has yet been fixed. Exhibitions for Walla Walla and Macon have also been given official sanction.

Industrial Board for Price Readjustments

WASHINGTON, Feb. 27—The Industrial Board of the Department of Commerce has been formed, composed of representative men from industry, labor and the Government, who are being selected under the chairmanship of George N. Peek, formerly vice-chairman of the War Industries Board. They are to put into practical effect a program for the readjustment of prices for basic materials in such a fashion as to create a firm foundation on which the consumer can base his future purchases, and the producer can form necessary estimates. The Industrial Board has the assistance of the Council of National Defense.

President Signs Tax Bill

(*Continued from page* 495)

competes with rail or water express and a tax of 8 per cent of the transportation fee for carrying of passengers by motor truck, passenger car or motorcycle when it is in competition with rail or water carriers.

There is no floor tax or tax on motor fuels in the new Revenue act signed by the President Monday nor is there direct tax on car users except that persons carrying on the business of operating or renting passenger automobiles for hire are taxed $10 annually for each automobile seating more than one or less than eight passengers, and $20 a year for automobiles seating more than seven.

The tax situation regarding the exporting of automobiles, tires, parts and accessories therefor, is changed, so that under the new law, all such articles "sold or leased for export and in due course exported," are not subject to the tax. This is in compliance with the Federal Constitutional provision against taxes on exports.

There are some complicated provisions in section 1312 of the new law to the effect that on contracts for the sale or lease of cars and parts, etc., made prior to the date when this new law was first discussed in Congress, the purchaser or lessee must reimburse the seller or lessor for the tax that the latter has to pay.

Those liable for the tax on automobiles, tires, parts and accessories, must make monthly returns under oath in duplicate, to the local collector of Internal Revenue and pay the taxes due to this collector without further notice. If the tax is not paid when due, there is added a penalty of 5 per cent together with interest at 1 per cent per month.

Although it will be obligatory to report outputs of cars, trucks and accessories for each month on the last day of the month, manufacturers are being granted a 30-day grace for the few days between Feb. 25 and March 1, and do not need to report their output for these several days until the last day of March, when the reports can be turned in with the statements of March outputs.

The tax on automobiles, tires, parts and accessories becomes due when the article is sold or leased. This means, in the case of sales, when the legal title passes from the buyer to the seller or when the article ceases to be the property of the seller and becomes the property of the buyer, and in case of a lease, the lease is effective generally when the lessee receives possession of the article. Therefore, all sales and leases by automobile manufacturers and accessory manufacturers made on and after Feb. 25 are subject to the tax rates of the new law. All sales and leases made prior to Feb. 25 are either tax free or subject to the old tax rate, as the case may be.

Tax for Trucks In Canada

Fear Multiple Taxation by Different Municipalities—Not on Own Business Use

MONTREAL, P. Q., Feb. 25—An amendment to the Motor Vehicle act of the Province of Quebec gives municipalities power to tax commercial motor vehicles and horse-drawn vehicles and truck owners fear that the authorities may neglect to provide distinctly that an owner of a commercial motor vehicle be only taxed by one municipality. Owing to the fact that the saddling of this tax by municipality is entirely optional, a motor owner might own several commercial vehicles in an adjoining municipality which did not levy a tax, yet that owner might use the streets of Montreal or of another municipality far more than those of his own municipality and, therefore, it would be manifestly unfair that he should go absolutely untaxed. On the other hand, provided that all municipalities take advantage of this amendment the burden upon the owner of the vehicle would be very heavy if he were called upon to pay a tax in every municipality in which he operated. Owing to the fact that motor vehicles are designed to cover long distances and comparatively few of them operate within a single municipality, it is felt that if the scope of this amendment is not clearly and definitely outlined in its construction that this clause may lead to confusion and hardships.

The amendments that are to be made to the motor vehicle law to allow municipalities to levy a business tax on motor vehicles by the Legislature will not apply to those firms who use automobiles, whether they be trucks or light delivery vans, for their own business, unless they be cabmen or common carriers.

Firms who use motor vehicles for delivering orders, such as the big department stores, will not have to pay any municipal tax, but only their provincial license fee. Those who use their trucks for hire, such as cartage and express companies, will, however, come under the Act, and will be liable to a tax by the municipality within whose limits they have their place of business, and not be liable to a tax by any other municipality within whose limits they may travel in the course of their business.

There is nothing specified in the bill as to the amount of this tax, but this will probably be amended so as to ensure that municipalities shall not charge a business tax greater than that specified for a 4-wheeled wagon with two horses, which is $12 for general carriers.

Kelly-Springfield Gross Profits, $7,187,834

NEW YORK, Feb 21—Gross profits of the Kelly-Springfield Tire Co. for the year ended Dec. 31 amounted to $7,187,834, as against $4,323,955 for 1917, and the surplus after dividends were paid was $2,939,992, an increase of $1,486,407 over 1917. The general surplus of $9,197,858 is an increase of $3,492,226 over $5,705,632 in 1917.

The company's balance sheet for the past two years follows:

Assets	1918	1917
Cash on hand	$1,392,729	$772,448
Accounts receivable	1,467,296	1,748,346
Inventories	5,945,417	3,760,161
Deferred charges	37,883	52,188
Liberty bonds	596,793	272,353
Common stock purchased for re-sale to employees	42,197	8,560
Plant, patents, etc	9,665,677	8,781,775
Total	$19,147,995	$15,395,835
Liabilities		
Preferred stock	$3,407,100	$3,409,300
Common stock	4,907,200	4,907,200
Liberty bonds payable	....	231,185
Accounts payable	721,815	835,752
Preferred dividend	51,106	52,639
Accrued wages, taxes, etc.	158,486	78,960
Res. for profit sharing plan.	88,148	....
Fund for redemp. pref. stock	....	75,164
Special surplus account	433,162	....
Res. of redemption of inventories	183,118	....
General surplus	9,197,858	5,705,633
Total	$19,147,995	$15,395,835

Jordan Dividends

CLEVELAND, Feb. 24—A dividend of $3.50 per share to stockholders of record Jan. 31 was declared at the meeting of the board of directors of the Jordan Motor Car Co., on Feb. 12. The total production for 1918 was about 300 cars less than 1917. The following officers were elected for the ensuing year: President, Edward S. Jordan; vice-president, T. E. Barton; secretary and treasurer, Paul Zens. Besides the officers, the directors include Russell S. Begg and P. H. Withington.

Dunlop Profits $3,250,000

LONDON, Feb. 12—A large increase in profits is reported by the Dunlop Rubber Co., which held its twentieth annual meeting yesterday. A gain of $1,057,000 over 1917 profits was made by the company last year, the profit being $3,250,000, compared with $2,175,000 in 1917. The profits for 1918 were stated to be the largest in the history of the company. The company did not include in this statement of profits a sum of approximately $1,625,000 which has been retained for development and as additional working capital in the rubber estates and subsidiary companies and for the special plant and buildings depreciations. Thus, the actual earnings for the year are brought up to $4,875,000.

The solid tire business showed a large increase, amounting to nearly 60 per cent. The company is now planning new additions to increase its production. The new works at Fort Dunlop are in the process of enlargement. Approximately $2,000,000 will be expended by next August on these additions and it is expected that the pneumatic tire production will as a result be increased doubly and the solid tire production about 50 per cent.

The retiring directors and auditors were re-elected and Sir Arthur de Cros, chairman and managing director, was elected for life as president. Alfred de Cros has been nominated as vice-president. Harvey du Cros, the founder and president of the company, died during the war.

Goodrich Sales Increase 41 Per Cent in 1918

AKRON, Feb. 24—Net sales of the B. F. Goodrich Co. for 1918 amounted to $123,470,188, an increase of $36,315,116 over the $87,155,072 sales in 1917. After deducting for bills payable, taxes, etc., a net profit of $15,637,115 remained, $5,092,437 more than for 1917. After dividends were taken off the surplus was $10,442,609, against $5,257,491 in 1917.

The balance sheet of Dec. 31 last, compared with that of 1917, shows:

Assets	1918	1917
Real estate, etc	$74,859,587	$76,381,661
Investments	5,206,363	4 410,002
Pref'd treasury stock	930,700	865,700
Inventories, accounts receivable, cash, etc.	59,795,520	63,499,294
Deferred charges	446,258	970,589
Total	$141,238,427	$146,127,246
Liabilities		
Capital stock	$85,500,000	$86,400,000
Accts. payable	16 770,900	33,649,867
Reserve	3,847,540	2,300,000
Appropriation for redemption of pfd. stock	......	3,600,000
Surplus	35,119,988	20,177,379
Contingent liabilities.	501,117	655,768
	$141,238,427	$146,127,246

National Sales $2,880,757

INDIANAPOLIS, Feb. 24—Net sales of the National Motor Car & Vehicle Corp. totaled $2,880,757 last year, according to its report for 1918. After deducting $2,395,793 for cost of sales, gross profits of $484,964 remained. Operating expenses and reserve equalled $236,502, miscellaneous income $18,325, and gross income $266,787. Subtracting interest amounting to $63,178 and $65,000 for income and war taxes, the net income was $138,609.

Detroiters Organize New Foundry Co.

DETROIT, Feb. 21—The D. J. Ryan Foundry Co., of Ecorse, Mich., has been organized and purchased the property of the Ecores Foundry & Machine Co. The capacity of the plant will be doubled. The manufacture of motor castings is now going on at full speed. D. J. Ryan is president of the company. Other officers are: Vice-president, Louis J. Felton; secretary, R. J. Lamb, and treasurer, Chester A. Trathen.

Bower Bearing Co. Surplus $299,073.55

DETROIT, Feb. 24—The Bower Roller Bearing Co. reports a surplus of $229,073.55 on Jan. 1. The capital stock is $600,000.

Hayes Wheel Co.'s 1918 Sales Total $7,655,249

NEW YORK, Feb. 26—Government contracts, increased maintenance and depreciation costs, and a falling off in production as a result of these contracts, are reflected in the financial statement of the Hayes Wheel Co., Jackson, Mich., for 1918. Notwithstanding these conditions, sales amounted to $7,655,249 on a production of 2,006,405 wheels, compared with sales of 3,571,681 wheels in 1917, valued at $8,674.370.

The falling off in number of wheels produced in 1918 was due to the output being partly of escort wheels for the Government, costing six to seven times more per wheel than automobile wheels. Escort wheels were not made after December, 1918. The company is now back on a peace basis and its production for 1919 is scheduled for more than 4,000,000 wheels.

Net profits for 1918 were $314,502, giving an average of $454,714 for the last three years, or 6½ times the $70,000 total annual requirements for interest on the $1,000,000 first mortgage bond issue. The company has an accumulated surplus of $822,673 and this added to its capital stock of $1,500,000 gives it an invested capital of $2,322,673.

The financial statement for the past two years follows:

Assets	1917	Jan. 31, 1919
Real estate, plant and equipment	$1,438,222	$1,429,794
Seourities	26,000	26,000
Accounts receivable	786,254	602,162
Inventories	1,400,130	1,704,508
Liberty bonds and cash value of insurance	60,400	39,156
Cash	393,953	412,333
Deferred charges	11,105	99,153
Total	$4,116.064	$4,313,106
Liabilities		
First mortgage 7 per cent sinking fund bonds	....	$1,000,000
Accounts payable and accrued	$1,110,908	671,433
Reserve for income and excess profit tax	270,000	280,000
Capital stock	1,500,000	1,500,000
Contingent reserve	....	39,000
Surplus	....	822,673
Five-year notes	400,000	....
Interests and taxes accrued	13,996	....
Reserve for depreciation	179,820	....
Profit and loss	641,340	....
Total	$4,116,064	$4,313,106

	1916	1917	1918
Wheels produced	2,598,928	3,571,681	2,006,405
Sales	$4,846,615	$8,674,370	$7,655,249
Profits	$609,498	$1,019,753	$950,532
Maintenance and depreciation	68,370	231,741	356,030
Balance	$541,128	$788,012	$594,502
Income and excess profits taxes	9,500	270,000	280,000
Net profits	$531,628	$518,012	$314,502
Interest and discount	60,338	37,327	63,062
Balance for stock	$471,290	$480,685	$251,440
Dividends	95,000	165,000	90,000
Surplus	$376,290	$315,685	$161,440

White Dividends

White Motor Co., Cleveland, regular quarterly dividend, $1 per share, payable March 31 to stockholders of record March 15.

Fire Wrecks Wilson Body Plant

DETROIT, Feb. 22—The five-story brick assembly plant of the C. R. Wilson Body Co. burned to the ground Friday night. The loss, estimated at between $400,000 and $500,000, is covered by insurance.

Production will not be greatly handicapped. About 400 men are made idle by the blaze, but arrangements are being made to transfer them to the other plants of the company here and at Bay City. Assembly work will be shifted to other building units and the big plant will be operating normally again in a week or ten days.

Dorris Car Up $250

ST. LOUIS, Feb. 24—The Dorris Motor Car Co. has raised the price of its touring car from $3,500 to $3,750, to become effective March 1.

Moon Getting Back to Car Production

ST. LOUIS, Feb. 24—The Moon Motor Car Co. will resume production of automobiles March 15. Owing to the fact that it was engaged in shell work during the war, returning to motor cars was somewhat delayed. The new buildings, erected especially for shell work, will be equipped for motor car production.

Will Make 15,000 Hupps

DETROIT, Feb. 25—The Hupp Motor Car Corp. will produce 15,000 cars in 1919. This is an increase of 5500 cars over last year. During the last half of January this company ran up its production to forty cars daily, and further increase is contemplated.

Dorris Adds 3½-Ton Truck

ST. LOUIS, Feb. 22—The Dorris Motor Car Co. has added to its line a 3½-ton truck, styled model K-7, to sell for $3,800. The company's 2-ton vehicle sells for $2,985.

Allen on 1919 Production

FOSTORIA, O., Feb. 22—The Allen Motor Co. is getting into 1919 production and its schedule calls for the production of between 4000 and 5000 cars this year. With exception of refinements, the 1919 car differs only slightly from the standard 1918 model.

Johns-Manville Distributes 20 Per cent Bonus

NEW YORK, Feb. 21—The H. W. Johns-Manville Co. will distribute to all its salaried employees who were in continuous service for the full year, 1918, 20 per cent on the salaries paid them during that year. The company also did this for 1917. The extra compensation for 1918 will cost approximately $1,000,000.

2000 Clydes This Year

CLYDE, OHIO, Feb. 24—The Clyde Cars Co. plans to build 2000 trucks in 1919, which is double the 1918 output.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Moline-Knight Will Not Cut Price

MOLINE, ILL., Feb. 21—Moline-Knight dealers are being notified by the Root & Van Dervoort Engineering Co., makers of the car, that there will be no price decrease in the Moline-Knight during the present year. As an assurance that the present schedule will be continued, dealers are guaranteed refunds for their customers for the amount of any reduction that might be made before Jan. 1, 1920.

Moline Addition

MOLINE, ILL., Feb. 22—To take care of increased production, the Moline Plow Co. is adding a new 160 x 28 building to furnish more convenient shipping facilities. It will be utilized for storing the finished machines prior to shipment.

Willys Export Co. Formed

TOLEDO, Feb. 22—The John N. Willys Export Co. has been incorporated in Delaware with capital of $100,000 by John N. Willys and associates to engage in export work.

Miller Rubber Yearly Sales

AKRON, O., Feb. 24—The board of directors of the Miller Rubber Co. was re-elected and all other officials reappointed at the annual meeting of the company. Charles E. Wetzell was chosen assistant secretary. Inability of the auditor to submit a report made it necessary to omit the annual statement. It was stated, however, that the gross sales were over $16,000,000 in 1918, a 45 per cent increase over 1917.

Lee Tire Earns $30,000 More Than 1917

NEW YORK, Feb. 22—The Lee Rubber & Tire Corp. showed earnings of $250,000 for 1918, as compared with $220,000 for 1917, after all necessary deductions were made. Sales for January, 1919, are about 30 per cent larger than for the same month last year. Although the company's financial position is understood to be good, there is no prospect of a disbursement to the stockholders for some time.

Paige-Detroit Ahead of Schedule

DETROIT, Feb. 22—The Paige-Detroit Motor Car Co. is producing between 40 and 45 cars daily, which is a greater production than the January and February schedules called for. By March production will exceed 65 cars. This company, when the armistice was signed, was working 90 per cent capacity on war contracts, totaling approximately $15,000,000. About 60 per cent of these contracts were completed.

Cadillac Producing 60 Cars Daily

DETROIT, Feb. 24—The Cadillac Motor Car Co. has run its production up to 60 cars daily, and anticipates producing between 90 and 100 shortly. The 1919 production schedule will probably equal that of 1918, which called for 18,000 cars.

Standard Tool Co. Getting Back to Normal

DETROIT, Feb. 22—The Standard Tool & Mfg. Co. is getting back to peacetime production and is now running at 75 per cent capacity. This concern was engaged at its full capacity on war work up to the signing of the armistice.

9000 Commerce Trucks 1919 Output

DETROIT, Feb. 24—The Commerce Motor Car Co., makers of Commerce trucks, will build 9000 machines this year, according to their proposed production schedule. The company is turning out 20 cars daily, but will increase production 50 per cent within 30 days.

Appersons Ready for Delivery May 1

KOKOMO, Feb. 22—Owing to the postwar material situation, it was impossible to have the standard Apperson models ready in time for the various automobile shows. Deliveries on the open-body models are assured for May 1, but the enclosed models in both seven- and four-passenger types will not be ready till early fall.

Canadian Ford Guarantees Price

DETROIT, Feb. 24—The Ford Motor Co. of Canada, Ltd., states that 1919 will bring no change in the price of Ford cars. The prices follow:

Runabout	$660
Touring Car	690
Coupe	875
Sedan	1075
Standard Chassis	625
One Ton Truck Chassis	750

Dividends Declared by Goodyear

Goodyear Tire & Rubber Co., Cleveland, regular quarterly dividend, 3 per cent, common stock, payable March 1 to stockholders of record Feb. 15.

$1,800,000 American Bosch Notes Sold

NEW YORK, Feb. 22—The $1,800,000 American Bosch Magneto Corp. 7 per cent gold notes have all been sold.

Inter-State to Complete 15-20 Per Cent of War Orders

MUNCIE, IND., Feb. 24—The Inter-State Motor Co. will be required to complete 15 to 20 per cent of the Government order, and manufacturing will be continued with this end in view. At the same time the engineering and experimental departments are going ahead with modifications and improvements in the Model T chassis which has a four-cylinder engine. The service department has been re-established.

Rickenbacker Back in Civil Life

NEW YORK, Feb. 25—Capt. Ed. V. Rickenbacker has received his honorable discharge from the army and has returned to this city. Although the American ace of aces has received attractive offers from motion picture producers and from publishers he has not yet decided what business he will engage in.

—

Samuel E. Ryder, for a number of years in the employ of the Motometer Co., Long Island City, is now affiliated with the Detroit branch of the company opened recently.

—

W. B. Fowell has been appointed sales manager of the Stan-Par Axle division of the Standard Parts Co.

—

Frank M. Lee, manager of the Milwaukee branch of the Fisk Rubber Co., New York, has resigned after a term of continuous service of twenty-five years. He will go to California for a rest of several months.

—

Thomas W. Brickley has succeeded F. L. Warner as manager of the Milwaukee office of the Central Electric Co., Chicago.

—

G. M. Rymarczick, until recently supervising senior inspector of the magneto section of the Bureau of Aircraft Production, is now connected with the Simms Magneto Co., East Orange, N. J., as production engineer.

—

John B. Giovanoli, formerly with the Willys-Overland Co., has become tool superintendent of the Fuller & Sons Mfg. Co., Kalamazoo, Mich.

—

Captain A. E. Callanan has been appointed general purchasing agent of the Cleveland Tractor Co. He was formerly in charge of production of de Haviland battle planes at the Dayton-Wright Co., Dayton.

—

J. H. Hardig, formerly advertising manager of the Remy Electric Co., has been appointed assistant advertising manager of the motor equipment division of the United Motors Corp., Detroit.

—

E. H. Walker, for eight years Detroit district manager for the Vanadium-Alloys Steel Co., Pittsburgh, has resigned to become secretary-treasurer of the Michigan Metal Supply Co., Detroit.

—

R. J. Snowhook, for three years connected with the Willys-Overland Co., Toledo, Ohio, has joined the advertising department of the Nash Motors Co., Kenosha, Wis.

—

Lieut.-Com. Benjamin Briscoe of the Briscoe Motor Co., Jackson, Mich., has returned from Europe, where he was in charge of navy airplanes, air bases and supply depots.

Men of the Industry

Changes in Personnel and Position

Frank Jay Heads Stanley Motor Carriage

NEWTON, MASS., Feb. 25—Frank Jay was elected president and general manager of the Stanley Motor Carriage Co. at the annual meeting of the company held on Feb. 20.

—

Albert L. Jones, for twenty years with the White Co., is in charge of the assembling branch of the Fulton Motor Truck Co., San Antonio, Tex.

—

C. M. Strieby, former advertising and sales manager of the Smith Motor Truck Corp., Chicago, has been appointed advertising manager of the Fulton Motor Truck Co., Farmingdale, L. I. He was formerly connected with the Maxwell Motor Car Co. and with the Studebaker Corp.

—

Capt. Albert G. Waddell has returned to civil life and resumed his duties as advertising manager of the Chevrolet Motor Co., Oakland, Cal.

—

H. S. Quick has been appointed manager of the Chicago office of Robert H. Hassler, Inc., which has recently been opened at 2007 Michigan Avenue.

—

R. G. Ames has joined the Black & Decker Mfg. Co., Baltimore, as branch manager in charge of the Chicago office. For the past ten years he was with Edward A. Cassidy Co., New York.

—

Lieut. F. M. Young, formerly in the aviation service, has returned from overseas and is now sales engineer with the Perfex Radiator Co., Racine, Wis.

—

Detroit S. A. E. Officers Nominated

DETROIT, Feb. 26—W. A. Brush, of the Brush Engineering Association, has been nominated to head the Detroit section of the Society of Automotive Engineers for the season of 1919-1920, to succeed J. Edward Schipper of the Class Journal Co. E. G. Gunn, carriage engineer of the Packard Motor Car Co., has been nominated for the vice-chairmanship; E. W. Seaholm, Cadillac Motor Car Co., treasurer, and Ralph H. Sherry, metallurgist General Motors Co., secretary. The nominating committee consisted of D. McCall White, vice-president Cadillac Motor Car Co.; C. C. Hinkley, Hinkley Motors Corp.; O. E. Hunt, engineer Packard Motor Car Co., and Benjamin G. Koether, Hyatt Roller Bearing Co.

Lodge Heads Candler Radiator Co.

DETROIT, Feb. 25—The Chandler Radiator Co. held its annual meeting, at which the following officers were elected: President, John C. Lodge; vice-president, George V. Candler; secretary and manager, John A. Hinger; directors, A. V. Breault, George V. Candler, W. R. Candler, John A. Hinger, James S. Holden, John C. Lodge and D. E. Murray.

—

Stout With United Aircraft Corp.

NEW YORK, Feb. 25—W. B. Stout, formerly aircraft engineer of the Packard Motor Car Co., has been appointed sales and aircraft manager of the United Aircraft Engineering Co., New York.

—

Col. Edwin S. George has been honorably discharged from the Army, where he acted as chief of the motors branch of the Motors and Vehicles Division, office of Director of Purchase and Storage. He has joined his family in Miami, Fla., and will return to Detroit in April.

—

Harmon J. Kline, formerly designing engineer for the Olds Motor Works, Lansing, has been released from the service, where he was a lieutenant in the Ordnance Department, and has joined the engineering staff of the Packard Motor Car Co.

—

Bruce J. Miles, formerly with the Cadillac Motor Car Co., has been made manager of the sales department of the Cadillac unit of the General Motors Export Co., New York City.

—

Joseph C. Faust, director of the production of advertising art for the Packard Motor Car Co., has resigned to become associated with Voelker & Scharfenberg, advertising agency.

—

A. E. Wingert, for three years connected with the sales department of the Chalmers Motor Co., has resigned, effective March 1. He will announce his future plans shortly.

—

C. F. Troupe, who represented the Fisk Rubber Co. in the East and South, has succeeded Frank Lee as sales manager of that company in Wisconsin and upper Michigan.

—

C. S. Puttman has been appointed manager of the Detroit branch of the United States Tire Co. He has been with that company since 1911.

—

Collier Annual Meeting

BELLEVUE, OHIO, Feb. 22—At the annual meeting of the Collier Motor Truck Co. on Monday, the following officers were elected; President, R. A. Palmer; vice-president, S. H. Penfield; secretary and treasurer, J. F. Corl. M. E. Crow has resigned. Otherwise the Board of Directors was re-elected, including the officers and F. W. Steinen and Charles Matz.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb. .... .02 -.03
Phosphoric (85%).. .35 -.39
Sulphuric (60%), lb. .008

Aluminum:
Ingot, lb. .... .30 -.33
Sheets (18 gage or more), lb. .... .42
Antimony, lb. ..... .07¼-.07½

Burlap.
8 oz., yd........... .07½
10½ oz., yd........ .10¾-.11

Copper:
Elec., lb. .... .15½-.16
Lake, lb. .... .18

Fabric, Tire (17¼ oz.):
Sea Is., combed, sq. yd. 1.50
Egypt, combed, sq. yd. 1.25
Egypt, carded, sq. yd. 1.15
Peelers, combed, sq. yd. 1.10
Peelers, carded, sq. yd. 1.00

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
Ceylon, lb. .... .09 -.22
Madagascar, lb. ... .10 -.15
Mexico, lb. .... .03¾

Lead, lb. .... .04⅞-.05⅛

Leather:
Hides, lb. .... .18 -.34¼

Nickel, lb. .... .40

Oil:
Gasoline:
Auto, gal. .... .24½
68 to 70 gal...... .30½

Lard:
Prime City, gal..1.90-2.00
Ex. No. 1, gal...1.10
Linseed, gal. 1.45-1.48
Petroleum (crude):
Kansas, bbl. 2.25
Pennsylv'a, bbl..4.00
Menhaden (dark), gal. 1.05-1.06

Rubber:
Ceylon:
First latex pale crepe, lb. ..... .56 -.56½
Brown crepe, thin, clear, lb. ...... .49
Smoked, ribbed sheets, lb. ..... .56

Para:
Up River, fine, lb. .58½
Up River, coarse, lb. .... .35

Island, fine, lb....... .49½

Shellac (orange), lb. .60 -.64

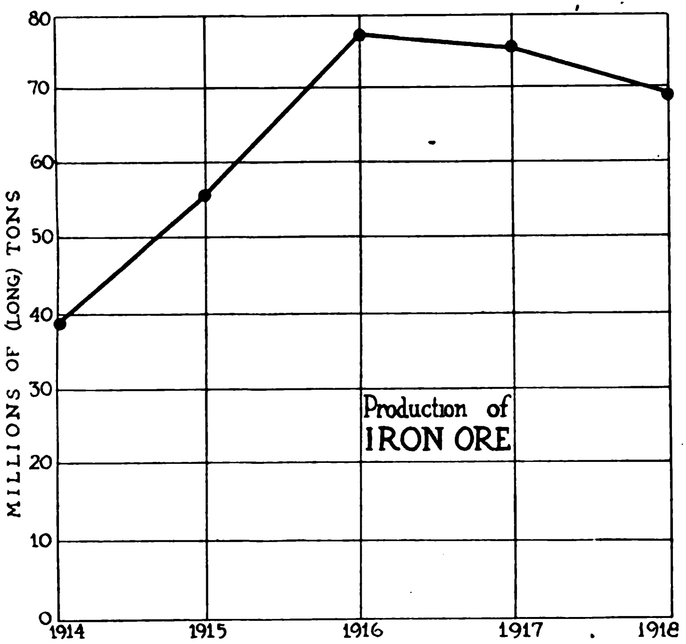
Spelter .... .06½-.06¾

Steel:
Angle beams and channels, lb. .... .03
Automobile sheet (see sp. table.)
Cold rolled, lb..... .0625
Hot rolled, lb...... .039

Tin .... .71 -.72

Tungsten, lb. 1.50-2.10

Waste (cotton), lb... .12¾-.17



Production of iron ore from 1914 to 1918

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per. 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.

Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

FOREIGN TRADE OPPORTUNITIES

WASHINGTON, Feb. 21—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has inquiries for the agencies of automobiles and tractors. Full information regarding each of the following can be secured by addressing the Bureau of Foreign and Domestic Commerce, Department of Commerce, and referring to the foreign trade opportunity number.

A firm in India desires to purchase and to secure an agency for the sale of motor cars, tires, tubes and accessories. References have been filed. Foreign Trade Opportunity No. 28,449.

A commercial agency in Honduras desires to represent firms for the sale of farm tractors. Quotations should be made f. o. b. American port. Correspondence may be in English. No. 28,452.

A firm in Italy desires an agency for the sale of farm tractors for work in the mountains as well as on the plains. Correspondence may be in English. References have been filed. No. 28,440.

A company in England desires the sole agency for the sale of automobiles. References have been filed. No. 28,441.

A Belgian importer in England desires an agency for the sale of bicycles, motorcycles, automobiles and tractors. References have been filed. Foreign Trade Opportunity No. 28431.

A man in England wishes to secure an agency for the sale of farm tractors in England and France. References have been filed. No. 28434.

A company is Switzerland wishes to secure an agency for the sale of farm tractors, motor trucks and accessories. No. 28437.

A man in Australia desires an agency for the sale of motor car accessories. References have been filed. Foreign Trade Opportunity No. 28,414.

An agency is desired by a man in Belgium for the sale of motors, automobiles and trucks. No. 28,417.

A firm in Denmark desires an agency for the sale in Poland of automobile accessories. Correspondence may be in English. References have been filed. No. 28,419.

A commercial agent in France wishes to secure an agency for the sale of farm tractors. Correspondence may be in English. References have been filed. No. 28,420.

New Models and Strong Parts Show at Kansas City

(*Continued from page* 494)

ciated with four-wheel-drive is avoided by steering on creeper type; that is by applying a brake to one or the other of the differential shafts. This plan obviates the need for extra differentials and universal joints in the axle shafts. The advantage sought is to make all the weight available for traction.

Heretofore most tractors have been designed specially for use in plowing and other tractor work on the farm has been incidental. It is well known that most other farm operations, such as corn planting, harrowing, disking and hauling, mowers and binders, require much less power than the engine of the conventional three-plow tractor is capable of giving. Hence in doing this work the tractor operates at low efficiency, not only because the engine is running at partial load but more particularly because the power expended in moving the heavy tractor is not commensurate with the power called for by the implement.

Considerations of this nature have induced some makers to bring out tractors of one-plow capacity which, while somewhat at disadvantage in comparison with large machines as regards to plowing, are superior for other work. The lower first cost will make its appeal to the prospect. Single plow tractors are shown by Allis-Chalmers and Indiana.

Motor cultivators are shown in variety for the first time in both single and double-row types. The operator steers by steering wheel and guides the cultivator by pedals, a foot rest not unlike a stirrup being provided on the beams. It is difficult to see the possibilities of a single-row cultivator as its capacity is little greater than a horse one, but it is not necessary to feed it all the year in order to use it for one or two months.

The motor cultivator must necessarily be developed along with the tractor because the corn belt farmer cannot dispense with any of his horses so long as he cannot do both plowing and cultivating by motor. As the two principal crops of the country, corn and cotton, both need it in cultivation the possibilities of this field are enormous.

In conclusion, regarding exhibit of parts at the show, the tractor industry is much more fortunate than was the automobile industry at a corresponding state of its development, considering the variety of highly developed carbureters, magnetos and friction bearings and other standard components the tractor designer has to choose from, and the fact that the makers of these components are so strongly represented at the show indicates that they all anticipate a rapid growth of the tractor industry.

Entertains Directors of M. A. M. A.

NEW YORK, Feb. 25—Following the usual monthly meeting of the Motor and Accessory Manufacturers Association, C. E. Thompson, president, gave an informal dinner. H. M. Swetland, president of the Class Journal Co., as a guest of Mr. Thompson, talked of his European experiences during the war. He was much impressed by the stability and solidity of the English as based on the principle, "not how quickly but how well" can their plants turn out merchandise.

"Don't overlook the fact, too," said Mr. Swetland, "that the English have learned the value of quantity production, and are now prepared in many lines to produce on a quantity basis articles of high quality." Among other things he mentioned the conferences he attended with leading political and industrial leaders of France and England. He also told of his visit to the great allied fleet, where he was entertained by Admiral Sims, and graphically described scenes in devastated France.

Besides C. E. Thompson, president of the Steel Products Co., and H. M. Swetland, president of the Class Journal Co., there were present: E. H. Broadwell, first vice-president of the M. A. M. A. and vice-president of the Fisk Rubber Co.; E. W. Beach, president of the Manufacturers Foundry Co.; G. W. Yoeman, treasurer of the Continental Motors Corp.; E. P. Hammond, president of the Gemmer Mfg. Co.; C. W. Stiger, president of the Stromberg Motor Devices Co.; A. W. Copland, president of the Detroit Gear & Machine Co.; M. L. Heminway, acting manager, and Sidney S. Meyers, counsel for the M. A. M. A.

"Aviation Weather" Conditions Reported in England

LONDON, Feb. 11—The announcements of aviation weather conditions appearing daily in a local newspaper show to some extent the progress of British development of aviation commercially.

Forecasts are given on wind, direction and velocity in the upper air, together with reports of similar conditions the previous day. These cover Scotland, England, Ireland, Wales and the Midlands. Under the heading, "Flying Prospects To-day," readers are advised on wind velocity at certain elevations, visibility, cloud formations and other conditions affecting cross-country work within certain areas.

Under another heading, "Aviation Weather," a chart shows the wind direction and velocity in the above sections during the previous day, in the morning, noon and evening, at elevations of 1000 to 15,000 ft. Velocities are given in miles per hour. The cloud-level over the entire British Isles is also added.

A weather chart, supplied by the Meteorological Office, indicates air conditions, temperature, velocity and weather.

Grease Cups on Cadillac

In AUTOMOTIVE INDUSTRIES on page 249, Jan. 30 issue, the Cadillac car is mentioned as having oil shackle lubrication, whereas grease cups are used and not oil cups.

High Tariffs and Prohibition Hold Industry Back

(*Continued from page* 455)

shut out our low-priced cars unless she is prepared to manufacture such vehicles herself for her tens of thousands who who want them. Her public will not permit of it. The British public, for example, may abide by such prohibition for a time but no government can withstand such a prohibition for long.

In this whole situation of our high tariffs and Europe's prohibition there is too much of the old story of "one's afraid and the other dare not."

Let us grant that European nations who have been at war for 4 years have a right to a period of protection, particularly for the types of cars they make, but should they endeavor to prohibit what they cannot produce and what in many cases they are not contemplating producing.

Europe is not going to the class of production that America has built her reputation on and neither is America going to the class of high-grade workmanship that characterizes European factories in the majority of her production jobs. The result on both sides will be a compromise. We will increase our quality and Europe will increase her production. There is enough room for all, but let us not hold back the market by political moves that serve the more selfish ends of a few but work generally against the good of the many.

The French Baby Renault Tank

(*Continued from page* 470)

men. A shell which will destroy a Renault 6-ton tank will usually eliminate a 35 or 40-ton tank. But the former, owing to its higher speed, greater handiness and smaller area, is much less liable to be hit than the latter. The personal element counts very considerably in the French army. There is no doubt that a certain weight of armament divided into twenty units, each one of these units being more or less independent and acting on its own initiative, will secure far better results than the same grouped into one or two colossal tanks. Great credit is due to Louis Renault for realizing this important fact.

Used to Haul Canal Barges

Since the signing of the armistice some of the Renault tanks have been made use of for hauling canal barges. Where two horses hauled one barge, a single Renault tank will haul three barges at 25 per cent increase in speed. The suggestion is also made that the tanks be made use of for agricultural work on heavy ground. They appear to be very suitable for this class of work if stripped of their heavy armor plating. The gasoline engine and the reducing gears are completely protected against dust and mud, and only one man is required to handle the machine.

Federal Highway Plan Outlined in Bill

(*Continued from page* 497)

necessary bridges, drainage structures, signs, guardrails, protective structures, and housing.

SEC. 2. That the commission shall consist of five members.

SEC. 3. That the commissioners shall be appointed by the President, by and with the advice and consent of the Senate; not more than three commissioners shall be of the same political party, and shall be chosen from different geographical sections of the United States.

SEC. 4. That the commissioners first appointed shall continue in office for the terms of three, four, five, six, and seven years, respectively, from the date of their appointment; the term of each to be designated by the President, but their successors shall be appointed for the term of seven years, except that any person chosen to fill a vacancy shall be appointed only for the unexpired term of the commissioner whom he shall succeed and have similar qualifications.

SEC. 5. That the commissioners shall receive a salary of $10,000 per annum, payable in the same manner as the judges of the courts of the United States.

SEC. 6. That the commission shall choose a chairman from its own membership. It shall be the duties of the members of the commission to devote the entire statutory time required of other governmental officials to their work.

SEC. 7. That the commission shall appoint a secretary who shall keep a journal of proceedings, minutes of each meeting, record all proceedings, make true copies of all notices to be published, and shall perform such other duties as the commission may designate and require.

SEC. 8. That it shall further have authority and power to employ, at a fixed compensation, a chief engineer, engineers, special experts, attorneys, and clerks as it may from time to time find necessary for the performance of its duties. All other employees of the commission shall be a part of the classified civil service, and shall enter the service under such rules and regulations as may be prescribed by the commission and by the Civil Service Commission.

SEC. 9. That the commission shall have an official seal which shall be judicially noticed.

SEC. 10. That a vacancy in the commission shall not impair the right of the remaining commissioners to exercise all the powers of the commission, and three members of such remaining commissioners shall constitute a quorum.

Shall Select Highways

SEC. 11. That the commission shall select from time to time, subject to such changes as it may deem advisable under the provisions of this act, the highways to be comprised in the National Highway System and shall determine the order in which such highway shall be constructed, reconstructed, and improved. In determining the highways to be comprised in the National Highway System the commission shall request the State highway departments to recommend the routes to be followed in their respective States. The National Highway System shall not include any highway in a place having a population, as shown by the latest available Federal census, of 5000 or more, except that portion of any such highway along which the houses average more than 200 feet apart.

SEC. 12. That the commission shall determine the types of construction and reconstruction and the character of improvement, repair, and maintenance of all highways included in the National Highway System, and shall direct, supervise, and control the making of the surveys, the preparation of the plans, specifications, and estimates, and the construction, reconstruction, improvement, repair, maintenance, and administration of such highways, or may arrange with the State highway departments in their respective States to make the necessary surveys and plans and to pay therefor. Only such durable types and adequate widths of surface shall be adopted for any highway as will effectively meet the traffic conditions thereon and the probable future traffic needs.

SEC. 13. That the Secretary of War may, in his discretion, deliver and turn over to the commission from time to time and without charge therefor, for use in the construction and maintenance of national highways, such vehicles, motor vehicles, road machinery, and equipment as may be suitable for the use of the commission; and the commission is hereby authorized to use the same, in its discretion, in the construction and maintenance of national highways, and to pay the necessary expenses thereof out of the appropriation made under the provisions of this act.

SEC. 14. That no money shall be expended in any State under this act until its legislature shall have assented to the provisions of this act, except that until the final adjournment of the first regular session of the legislature held after the passage of this act the assent of the governor shall be sufficient. In consideration of the benefits to be derived by the State from the construction, reconstruction, improvements, repair, and maintenance of the highways comprised in the National Highways System, and as a condition precedent to the construction of any such highways in any State a right of way therefor, not less than 60 feet in width, except at such points where existing buildings or structures are of such value that the cost of their removal would in the opinion of the commission be excessive, shall be furnished to the United States without expense to it by, for, or on behalf of such State or any civil subdivision thereof. Any land of the United States may be appropriated as rights of way for the highways herein provided for, and the consent of the United States is hereby given to any railroad or canal company to convey to the United States for such highways any part of its right of way acquired by grant from the United States. The highways comprised in the National Highways System shall be constructed, reconstructed, improved, repaired, maintained, and administered entirely at the expense of the United States, except State police powers, but the State or its civil subdivision shall maintain any such highway prior to the construction, reconstruction, or improvement thereof under this act.

Shall Regulate Use of Highways

SEC. 15. That the commission is authorized to prescribe and promulgate such regulations governing the use of highways comprised in the national highway system as the commission may find necessary and reasonable in order to preserve and protect such highways and to facilitate and insure the safety of travel and traffic thereon. Whoever shall wilfully or maliciously injure or destroy any part of a highway embraced in the national highway system or property or material owned or controlled by the United States in connection with such highway, or shall use any such highway or part thereof without complying with the regulations prescribed and promulgated by the commission hereunder, shall be fined not more than $1,000 or imprisoned for not more than one year, or both. Nothing in this act shall affect the jurisdiction of the State, either civil or criminal, over persons and property upon such highways, except so far as the regulation of the use thereof are concerned; that is to say, the State wherein any such highway is situated shall not, by reason of establishment thereof, lose its jurisdiction, nor the inhabitants thereof their rights and privileges as citizens, or be absolved from their duties as citizens of the State.

SEC. 16. That it shall be the further duty of the commission to encourage the proper use of all highways and to stimulate the interests of the States, communities, and rural districts in the most efficient and economical transportation over all highways in the United States, to ascertain by experiment and collect all data on new developments in highway transportation, construction, and maintenance, and to publish the same for the benefit of the people at large.

SEC. 17. That it shall be the further duty of the commission to take over and perform all duties, powers, functions, and other obligations of all Federal agencies having jurisdiction and control of highway and experimental road work and all Federal agencies of educational and investigative character relating to highway transportation. Said departments or agencies shall be so co-ordinated and consolidated as to be made most effective: *Provided, however*, That agencies dealing with all highways under control of the United States Army or Navy in military or naval reservations, or are used solely for military or naval purposes, shall not be so taken over, but shall remain under the jurisdiction and control of said agency.

SEC. 18. That, in addition to the authority conferred by the preceding sections, the commission is authorized to make all rules and regulations necessary for the efficient execution of this act. The commission may let to contract or perform in any other manner which it may deem proper any work under the provisions of this act.

SEC. 19. That, for the purpose of carrying out the foregoing sections of this act there is hereby appropriated out of any money in the Treasury not otherwise appropriated, $50,000,000, which shall become available July 1, 1919, and $75,000,000 for the fiscal year beginning July 1, 1920, and $100,000,000 for each of the three succeeding fiscal years; in all, $425,000,000, which shall be available until expended. Out of such appropriation there shall be available to the commission for each fiscal year, and until expended, such amounts as they may determine to be necessary for the payment of such administrative expenses, including such rent, printing and publications, the purchase of such supplies and equipment, and the employment of such persons and means, and the fixing of compensation therefor, in the District of Columbia and elsewhere, as may be deemed necessary for carrying out the provisions of this act. The amounts so made available to the commission may also be used for the erection and maintenance of buildings outside the District of Columbia and for the operation of housing and subsistence facilities and commissary stores, including the purchase and sale of commodities for the benefit of employees and others engaged upon work under this act, the receipts from such operations and sales to be credited to and become part of appropriation made by this section and to be available for expenditure in the same manner as the remainder of such appropriation. The commission is authorized to purchase, lease, rent, operate, and maintain such motor and other transportation facilities as it may deem necessary in performance of its duties under this act. The commission is authorized and empowered to issue permits, licenses, and franchises for openings in and the use of any portion of the right of way comprised in the national highway system, and may require such payment from the beneficiaries thereof, and in such manner as may seem equitable; and the receipts therefrom shall be credited to the appropriations made by this act, to be expendable in the same manner.

That the commission, after making the deductions authorized by this section, shall apportion the remainder of the appropriation for each fiscal year among the several States in the following manner; One-third in the ratio which the area of each State bears to the total area of all the States; one-third in the ratio which the population of each State bears to the total population of all the States as shown by the latest Federal census; one-third in the ratio which the highway mileage of each State bears to the total mileage of all the States as shown by the official bulletin issued by the Secretary of Agriculture for the year 1914; *Provided*, That if any State desires to immediately improve any section of the national highway within the State, which has been designated by the commission the commission may enter into an agreement with the State highway department of such a State to finance the construction or reconstruction of said highway or section thereof; *Provided, however*, That the amount so advanced shall not exceed the amount apportioned to said State for construction or reconstruction, and the commission shall authorize the repayment to the State highway department of the amount annually set aside for construction or reconstruction until the full amount so advanced has been repaid.

Authorized to Contract for Purchases

SEC. 20. That the commission is authorized to enter into arrangements with any public or private agency for purchase, easements, construction, installation, operation, and maintenance of any facilities which it may consider necessary in the use of the National Highway System, and to pay such part of the cost thereof out of the appropriations under this act as it may deem equitable.

SEC. 21. That in order to increase the effectiveness of an act entitled "An act to provide that the United States shall aid the States in the construction of rural post roads, and for other purposes," approved July 11, 1916, said act is hereby amended by enactment of the following provisions:

Section 2 of the act hereinbefore referred to is amended by striking out the word "may" and substituting therefore the word "can."

Paragraph 2 of section 6 of the aforesaid act is hereby amended by striking out the words "nor shall any such payment be in excess of $10,000 per mile, exclusive of the cost of bridges of more than 20 feet clear span."

SEC. 22. That for the purpose of carrying out the provisions of said act as herein amended, there is hereby appropriated, out of any money in the Treasury not otherwise appropriated, in addition to amounts set forth in said act, $25,000,000, which shall become available for expenditure July 1, 1919, and the sum of $25,000,000, which shall become available for expenditure July 1, 1920, which sums shall be expended along with and in the same manner and under the same provisions as directed in the aforesaid act and as herein amended.

SEC. 23. That not later than the first Monday in December of each year the commission shall make a report to Congress showing the operations and expenditures, under the foregoing provisions of this act, for the preceding fiscal year.

SEC. 24. That this act shall be in force from and after the date of its passage.

Calendar

ENGINEERING

S. A. E. Meetings

Feb. 27—Kansas City. S. A. E. tractor meeting at Sweeney School Auditorium; dinner at Hotel Baltimore.

March 5—Minneapolis Section, S. A. E.—Hotel Radisson. "Tractor Service and Sales."

March 7—New York. S. A. E. Aircraft Meeting at Engineering Societies Bldg.

April 2—Minneapolis Section, S. A. E.—Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

SHOWS

Feb. 22-March 1—Hartford, Conn. Hartford Automobile Dealers' Assn., Inc., Broad Street Armory. Ben F. Smith, Manager.

Feb. 22-March 1—Atlantic City, N. J. Auto Trades Assn. of Atlantic City.

Feb. 22-March 1—New Castle, Pa., Lawrence County Association of Automobile and Accessory Dealers.

Feb. 22-March 1—Reading, Pa. Reading Auto. Trade Assn.

Feb. 23-March 1—Cedar Rapids. Auditorium, Automobile Dealers' Assn.

Feb. 24-March 1—Burlington, Ia. Second Annual.

Feb. 24-March 1—Kansas City, Mo.—Kansas City Motor Dealers' Assn. E. E. Peake, Manager.

Feb. 24-March 1—Springfield, Mass. Automobile Dealers' Assn. Harry W. Stacy, Manager.

Feb. 24-March 1—Springfield, O. Auto. Trade Assn.

Feb. 24-March 1—Portland, Ore. Ninth Annual Dealers' Motor Car Assn., Automobile Palace. M. O. Wilkins, Manager.

Feb. 24-March 1—Duluth, Minn. Duluth Automobile Dealers' Assn.

Feb. 25-March 1—Erie, Pa., United States Garage.

Feb. 26-March 1—Mason City, Ia. Fifth Annual, Mason City Auto Show Assn.

Feb. 26-March 1—Madison, Wis. Seventh Annual, Automobile Dealers' Division of Madison Assn. of Commerce, Union Transfer Bldg.

Feb. 26-March 1—Quincy, Ill. Cars, Quincy Automobile Trade Assn. Armory.

Feb. —Wheeling, W. Va. Automobile Show at Market Auditorium.

March 1-8—York, Pa.

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

March 1-15—New York Aeronautical Exhibition, Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 3-4—Bristol, Conn. First Annual, Bristol Automobile Dealers' Assn., Armory.

March 3-5—Quincy, Ill. Trucks and Tractors. Armory.

March 3-8—Muskegon, Mich. Third Annual, Armory, Muskegon Lodge No. 274, B. P. O. E. John C. Fowler and George M. Friant, Managers.

March 3-8—Dayton, O., N. A. C. A. Building.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

March 3-8—Raleigh, N. C. Third Annual. H. B. Bolton, Manager.

March 3-8—Scranton, Pa. Ninth Annual, 13th Regiment Armory, Scranton Automobile Assn. Hugh B. Andrews, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

March 3-8—Richmond, Va. Third Annual, Richmond Automobile Trade Assn., Gray's Armory.

March 3-8—Worcester, Mass. Annual Show, Casino Auditorium.

March 5-8—Lancaster, Pa. Automobile Trade Assn., Rowe Motor Co.'s Bldg. R. W. Shreiner, Manager.

March 8-15—New Brunswick, N. J. Armory, New Brunswick Motor Trade Assn. William Kuehle, Manager.

March 8-15—Philadelphia, Pa. Philadelphia Automobile Trade Assn., Commercial Museum. A. L. Maltby, Manager.

March 10-12—Lancaster, Pa. Truck Show.

March 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.

March 10-15—Salt Lake City, Utah. Sixth Annual, Bonneville Pavilion. W. D. Rishel, Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gradner, Manager.

March 10-15—Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn., Auditorium. Clark G. Powell, Manager.

March 12-18—Peoria, Ill. Passenger cars, 12 to 15; trucks, 17 and 18.

March 15-22—Boston, Mass. Boston Automobile Dealers' Assn. Passenger cars only. Chester I. Campbell, Manager.

March 15-22—Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.

March 17-22—Great Falls, Mont. Montana Automobile Distributors' Assn.

March 17-22—Philadelphia, Pa. Motor Truck Assn., Commercial Museum.

March 19-22—St. Joseph, Mo. St. Joseph Automobile Show Assn., Auditorium. John Albus, Manager.

March 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.

March 19-22—Warren, Pa. Third Annual, Warren Automobile Dealers' Assn.

March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 22-29—Passenger Cars. April 1-5—Trucks, Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkman, Manager.

March 24-29—New Orleans, La. Henry B. Marks, Manager.

March 24-29—Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.

March 24-29—Utica, N. Y. Utica Motor Dealers' Assn.

March 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.

March 28-30—Peru, Ill. Illinois Valley Auto Show.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.

April 5-12—Bridgeton, N. J. Fourth Annual, Automobile Dealers' Assn.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

April 13-19—Bristol, Tenn. Cars, trucks, tractors, airplanes and accessories. Bristol Chamber of Commerce.

April 14-19—Bristol, Va.-Tenn. Cars, Trucks, Tractors. C. W. Roberts, Manager.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

TRACTOR SHOWS

Feb. 24-March 1—Kansas City, Mo. Fourth Annual Tractor Show. Sweeney Building, Kansas City Tractor Club. Guy H. Hall, Sec.

RACES

March 15—Santa Monica, Cal. Speedway.

March 23—Los Angeles. Ascot Speedway Assn., Ascot Speedway, 150 miles.

May 17—Uniontown, Pa., probably 112½ miles.

May 31—Indianapolis. Indianapolis Motor Speedway Assn., 500 miles.

July 5—Cincinnati, O., Speedway.

July 19—Uniontown, Pa. Speedway race.

July 26—Sheepshead Bay, L. I. Speedway race.

Aug. 22-23—Elgin, Ill. Speedway.

Aug. 23—Sheepshead Bay, L. I. Speedway race.

Sept. 1—Uniontown, Pa. Speedway race.

Sept. 20—Sheepshead Bay, L. I. Speedway race.

Oct. 1—Cincinnati, O. Speedway race.

CONVENTIONS

Feb. 25-28—New York. Sixteenth Annual Convention. American Road Builders' Assn.

Feb. 25-28—Ninth American Good Roads Congress and 16th Annual Convention of the American Road Builders' Assn. Hotel McAlpin, New York.

March 3-4—Pueb'o, Col. Convention Rocky Mt. Auto Trades Assn.

March 7—Automobile Export Managers Convention, N. A. C. C. headquarters, New York.

April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago—National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

War Department May Lend Aviation Engines for Educational Work

WASHINGTON, Feb. 24—The Senate has passed an amendment authorizing the loan of aviation engines and aircraft material to educational institutions. Two or three such institutions, including the College of the City of New York, have requested the War Department to lend them Liberty engines for the use of students. The War Department was willing to do this, but has not had the authority. By this amendment the War Department has authority to make such loans at its own discretion, reserving to the Government the title to the motors and all other material.

The text of the resolution reads as follows:

"That the Secretary of War is hereby authorized and empowered, for the purpose of aiding, fostering and promoting educational experimentation work, to loan aircraft motors and aircraft equipment to such educational institutions in the United States as provide advanced mechanical and technical instruction, under such rules and regulations as the Secretary of War may prescribe."

The amendment was agreed to and the joint resolution was reported to the Senate as amended. The amendment was concurred in by the members of the Upper House and passed.

Air Information by the A. A. A.

NEW YORK, Feb. 25—The American Automobile Assn., which has for years made and provided maps for motorists, has now added the production of air maps for flying, and will show at the aeronautical exhibition gigantic maps of the United States with the established air lanes, landing fields and prominent landmarks, together with compass readings. It will also display strip maps adapted to the needs of the aviator. An aero map of Long Island will be seen for the first time. Permission has also been secured to display some of the special Government aerial maps which the organization helped to prepare.

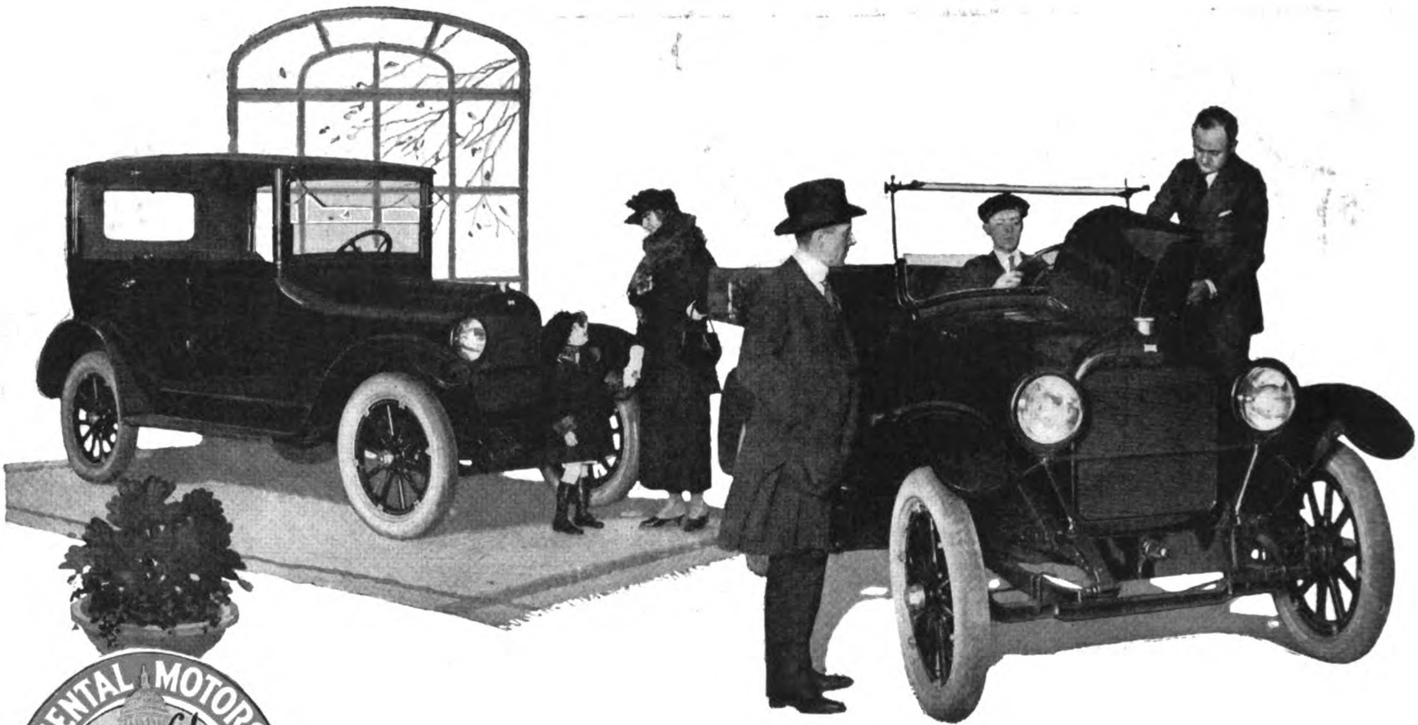
AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 10

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MARCH 6, 1919

Fifteen cents a copy
Three dollars a year

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, N. Y., under the Act of March 3, 1879



CONTINENTAL MOTORS · AMERICA'S STANDARD

Powerful as the Nation

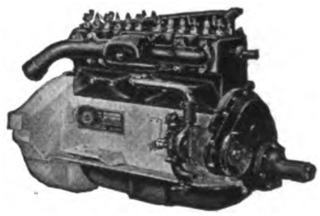
The Red Seal Continental Motor Appeals to Every Member of the Family

To those who consider the purchase of an automobile the motor is invariably the central point of interest.

Literally, the motor makes the motor-car. Almost all the main qualities of a car—its power, its speed, its silence, its reliability, its flexibility—are elements of the motor.

These essential qualities are assured in advance to those who buy Continental-powered cars. For behind each Red Seal Continental Motor stand hundreds of thousands of other Continental Motors, each of which has proved itself worthy of the Red Seal of character. Standing, as it were, at the side of every prospective purchaser of a Continental-powered car are hundreds of thousands of owners, who say:

"Take our advice. Buy the car with the Red Seal Continental Motor. Then you'll be *sure* of 100% motor value."



America's Standard Passenger Car Motor. Look for the Red Seal Nameplate.

CONTINENTAL MOTORS CORPORATION

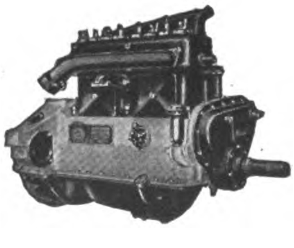
Offices:
Detroit, Michigan

Factories
Detroit—Muskegon

Largest Exclusive Motor Manufacturers in the World.

"Let's all keep industry humming by working together—employers and employees—in harmonious co-operation.
U. S. DEPARTMENT OF LABOR,
Wm. B. Wilson, Secretary."

Continental Motors



America's Standard Truck Motor. Look for the Red Seal Nameplate.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, MARCH 6, 1919—CHICAGO No. 10

Lyons Fair Discloses New Post-War Models

About One-Third of French Makers Have Entirely New Products—Remainder Have Pre-War Products—Electric Starting and Lighting Universal

TENDENCY TOWARD STANDARDIZATION PLAINLY APPARENT

Block Cylinders, Detachable Heads and Other Modern American Characteristics Come to the Front

By W. F. Bradley
AUTOMOTIVE INDUSTRIES' *European Correspondent*

LYONS, FRANCE, March 2—*Special Cable*—Europe's first great exhibition of post-war models—the Lyons Fair—was thrown open today and holds a record number of exhibits with those of automobile manufacturers grouped prominently together in one big hall. All told there are 90 separate automobile exhibits and though it was hardly to be expected that the fair would disclose a great deal that is new in the way of post-war models, it has, nevertheless done so.

Trend Toward Standardization

Perhaps the most striking feature of the automotive exhibits as a whole is the marked trend toward greater standardization and the use of engineering practices which long have been features of American products. This applies particularly to the universal use of electric lighting and starting equipment, the use of block cylinders with detachable heads and the fitting of practically all low and moderate price cars not only with bodies but with all other equipment as well.

As the Lyons Fair not only takes the place of that of Leipsic, but aims to surpass it in every sense, it is of interest to note that the number of exhibitors passes all previous records, the actual number being 4,700. Naturally, the French exhibitors predominate with a total of 2,994, but the United States makes a very creditable showing with a total of 618.

Few Foreign Cars Exhibited

Apart from the general interest surrounding the first after-war efforts of manufacturers to display their products on a really large scale, the fair holds much of interest for the American manufacturer of automotive products. It is true that automotive exhibits are relatively few, but the interest is still there. In all, there are six exhibits of cars of European make other than those of French manufacture. This small total is doubtless due to the fact

Pronounced Engineering Tendencies at Lyons Fair

1—*Increasing use of cantilever springs.*

2—*Two-unit lighting-starting systems.*

3—*Adoption of detachable cylinder heads.*

4—*Unit construction of engine and gearbox.*

5—*Spiral bevel final drive.*

6—*Detachable wheels with clincher rims.*

7—*Transverse pump and magneto shafts.*

8—*High class cars, six-cylinder.*

9—*Only one eight, no twelves.*

10—*Low-priced cars all fours.*

that at the present time the importation of automobiles to France is prohibited owing to causes relating to internal commercial economics. So far, there is but one American car, the Columbia, actually on exhibition, but it is anticipated that there may be others represented before the fair is in full swing.

About one-third of the French exhibitors are showing entirely new models, the remainder exhibiting pre-war cars with the addition of electric lighting and starting equipment. It is significant that no car shown is minus a complete electrical system, in view of the fact that hitherto starting and lighting, as looked upon in America as forming part of the regular equipment of a passenger car, has been either absent or in some few cases has been installed as an extra at additional cost.

Cantilever Springs Featured

Dominating tendencies, as applied to general production, have been conspicuous by their absence in European engineering practice in the past. Each factory has, rather, relied on its engineer's expression of individuality in its product. It is a sign of a new order of things that there is now a decided tendency to the use of cantilever springs, detachable cylinder heads, two-unit starting and lighting systems and spiral bevel final drive. Power plants, where the engine, clutch and gearset combine to form a unit, are another feature which is much in evidence and which evinces a trend toward American practice.

Detachable Steel Wheels

Magneto ignition is practically universal, a condition which is far different from that obtaining in the United States. Detachable wheels with permanent rims of clincher type are popular; in fact, the clincher type of tire attachment fully maintains its popularity. There is considerable use of detachable steel wheels, usually of Michelin make.

Individually designed bodies have always been a point with the European manufacturer and the fair discloses that sombre colors predominate. Detachable upholstery is featured and a departure from pre-war practice is indicated by the fact that all the lower-priced cars now are offered complete with all accessories.

No Twelves; Only One Eight

In the higher-priced grades engines having six cylinders predominate practically to the exclusion of all others; there are no twelves and the only eight-cylinder is the De Dion Bouton, a model which has been on the market for some years. The announcement has been made that the Lorraine-Dietrich company will build a twelve and also two six-cylinder models.

The Delage, known in the United States through its success as a racing machine, has a striking exhibit of a six-cylinder model with block-cast engine and bore and stroke of 80 x 150 mm. This engine is designed to develop 70 hp. and is fitted with a starting motor operating through a Bendix drive. Brakes are fitted on all four wheels, operating on 15-in. drums and designed to stop the car in 100 yd. or less at 60 m.p.h. High-class work and refinement of detail are in evidence throughout this car, which sells in France for approximately $5,700. This car is equipped with wire wheels.

Few New Manufacturers

But few new firms have entered the automotive industry, doubtless owing to the limitations placed on private enterprise by the universal need for the production of war munitions. An exception is that of the Voisin Aeroplane Co., which is building a car powered with a 40-hp. Knight engine. The Citroen Co. is building a light four-cylinder machine and the Swiss Picard-Pictet Co. is now backed by the manufacturers of the well-known Gnome rotary airplane engine.

Mayen, the biggest aviation engine builder in

France, is producing Hispano-Suiza cars under license and it may be said that the three most prominent European builders to-day are Peugeot, Fiat and Citroen. Much attention is being given to the production of light four-cylinder cars and it is in this connection that these three concerns are mentioned. The light-weight Fiat comes out at 1400 lb., the Peugeot at 1350 lb., and the Citroen is the same weight as the Fiat.

Left Steering, Center Control

Although the Fiat is considered to be a popular model, in a relative sense, it is of especially high-class construction. Cylinders are block-cast and have a bore and stroke of 65 x 110 mm., heads are detachable, the crankshaft has three bearings, the power plant is a unit and lighting and starting are included as regular equipment. Final drive is spiral bevel, the wheels have detachable steel spokes and the rear axle is of full-floating type.

A new Peugeot is, in effect, an enlargement of the well-known Baby Peugeot of former years. Bore and stroke are 60 x 100 mm. and the crankcase is a single casting, the only example in the fair. This car has left-hand steering—unique in European practice—and center control. Detachable wood wheels are fitted and the springs are of cantilever type.

Frame Construction Changing

The new Citroen has a block-cast engine of 65 x 100 mm. bore and stroke with detachable cylinder heads. Here, again, is left-side steering featured in conjunction with center control. The crankshaft has two bearings, final drive is through Citroen herringbone gears and the rear springs are single quarter-elliptics. Double quarter-elliptic front springs are fitted, one above and the other below the axle. The price of the two-seater is approximately $1,450. In this class car the usual frame construction embodies three cross-members, power plants being carried on three-point suspension.

This three cross-member feature is also incorporated in higher grade cars, but in these the engine is carried on four points in order to stiffen the frame. Front crankcase webs are carried out, avoiding the use of underpans and a material increase in the depth of the frame side-members is evident.

Five Makers Produce Tractors

Panhard and Levassor are producing both Knight and poppet valve models, but, except in the case of the Voisin company, there is no extended use of the Knight type of engine. There are no new valveless engines.

Automobile firms which are engaged in the production of farm tractors are Peugeot, Fiat, Paris Omnibus Co., Schneider and Latil, but it is reported that the Renault and Panhard companies are also building tractors, although they do not exhibit them. The Fiat tractor is built generally along the lines of the Fordson, but is larger and heavier, using a 4-ton truck engine.

The Peugeot tractor is of track-laying type with a modified truck engine and the Paris Omnibus Co.'s machine is built under the British Saunderson license. Trailers for commercial service occupy an important position at the fair for the first time, their importance as shown in war-service having led the firms producing them to develop them for use under normal conditions. They are exhibited in two and four-wheel types and invariably have rubber tires.

Lowest Priced Car Costs $950

The lowest priced car at the fair is exhibited by the Lyons Aviation Co. It is a four-seater with electric lighting and starting, two-cylinder, two-cycle engine with a bore and stroke of 75 x 120 mm. and a wheelbase of 123 in. The body is of enameled sheet steel, the four seats are adjustable and the weight is 1300 lb. Present price is approximately $950, but it is stated that if 10,000 cars are sold by the end of March the price will be reduced by about $40.

Announcement was made to-day that an automobile show would be held in Paris next fall, but the actual date is not yet determined, nor has it been decided where it will be held.

Trends in European Body Design

1—*Increasing use of detachable upholstery.*

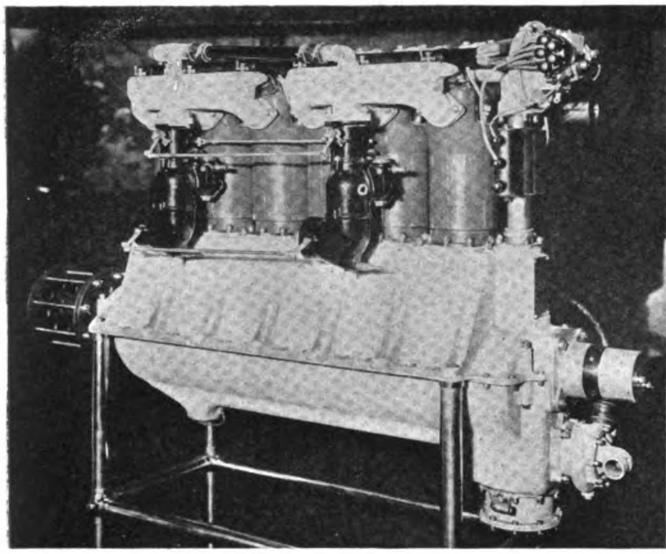
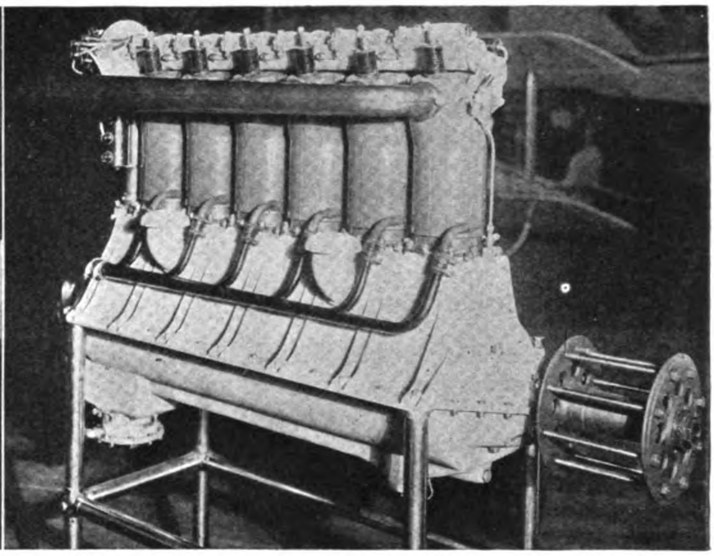
2—*Sombre color schemes the rule.*

3—*Cheaper cars completely equipped.*

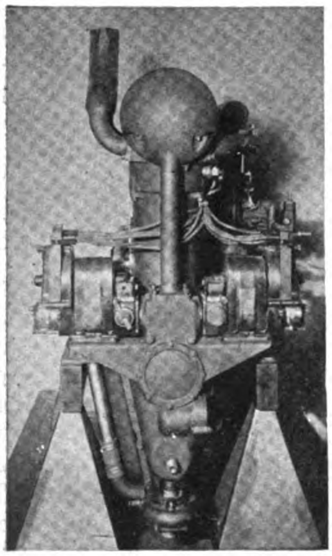
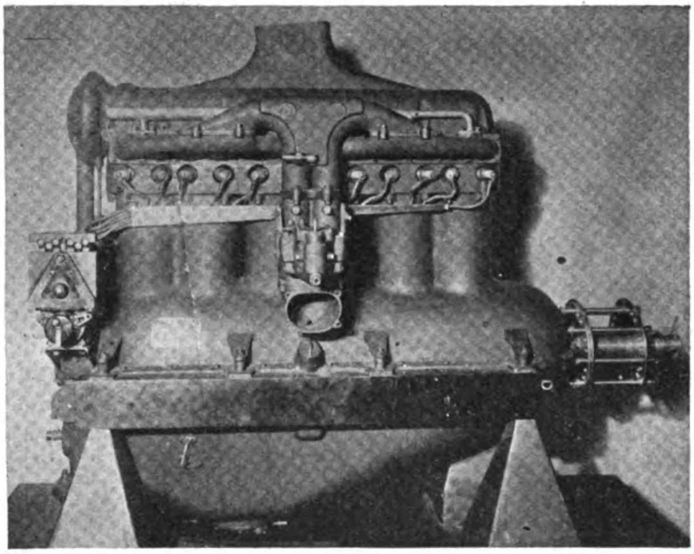
4—*Left steering, center control increases.*

5—*Many detachable steel wheels.*

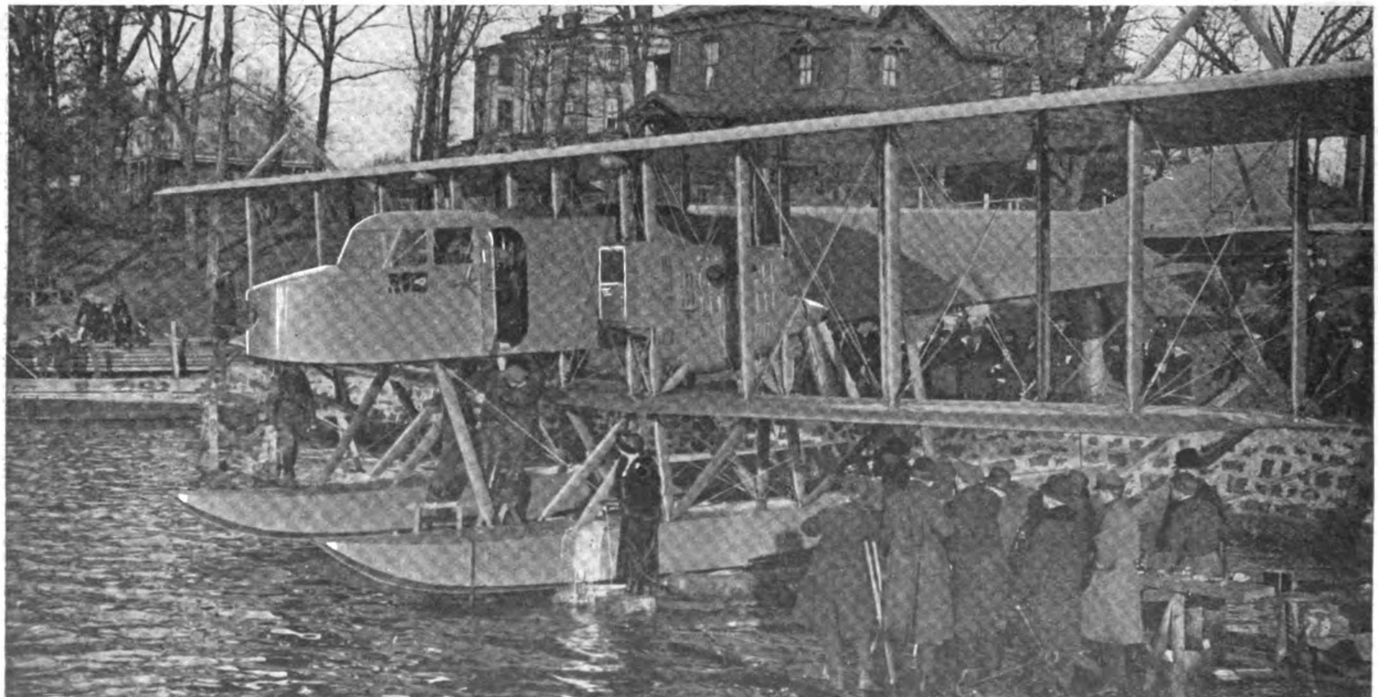
6—*New fours light in weight.*

Intake and exhaust sides of the six-cylinder Liberty aircraft engine

The new six-cylinder Curtiss engine showing arrangement of the two magnetos



The large seaplane which has been developed for an attempt at the trans-Atlantic flight

Element of Practical Business at Aeronautical Exposition

Few Commercial Adaptations But Plenty of Promise—Extensive Army and Navy Exhibits

NEW YORK, March 1—The first aeronautical exhibition since the war ended, which opened here to-night in Madison Square Garden and the 69th Regiment Armory, under the auspices of the Manufacturers' Aircraft Assn., is notable from at least three points of view:

1—It demonstrated by the huge crowds it attracted the tremendous public interest in the latest means of rapid transport;

2—It provided fruitful opportunities for students of modern aerial warfare, amateur and professional, to become acquainted with the very latest developments of both military and commercial machines;

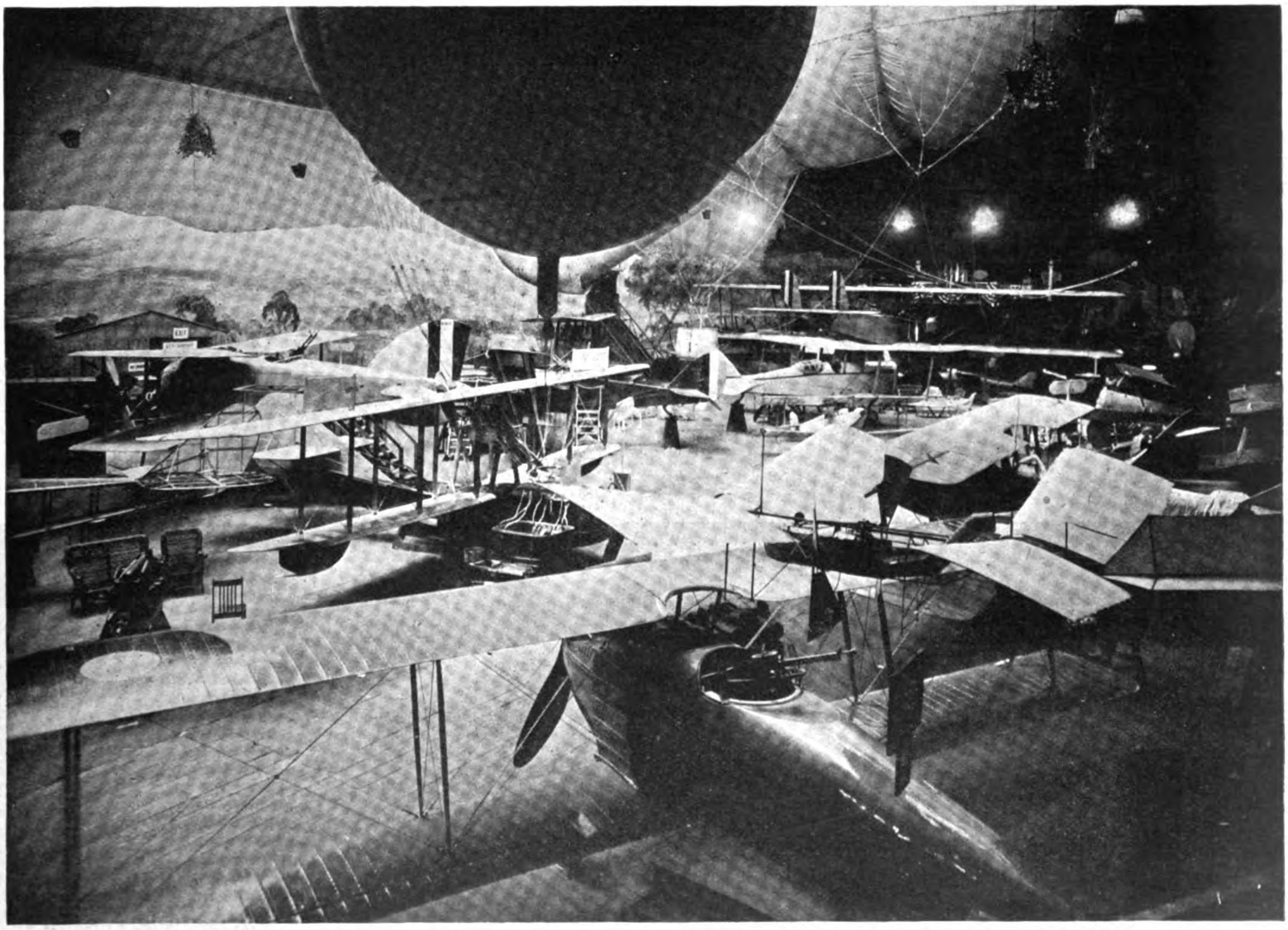
3—And, perhaps most important of all, it sounded an unmistakeable keynote of energy and optimism on the part of the aeronautical industry.

The present show differs from all previous shows, both in this country and in Europe of pre-war days, in the introduction of the element of practical business.

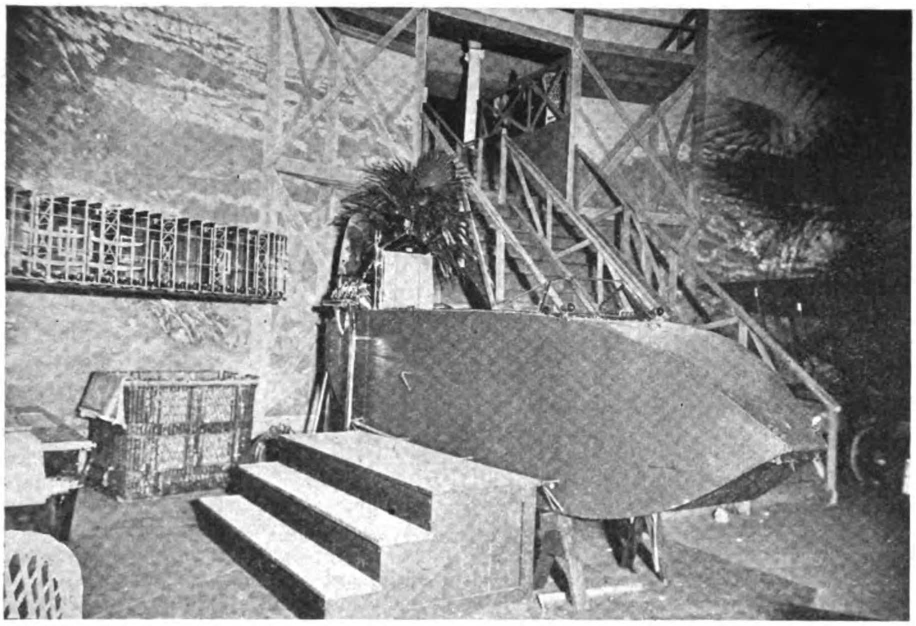
Although the exhibits are dominated by aircraft built solely for war purposes, there is easily recognizable in the spirit of the show the determination of the industry to switch over a large share of its energy to civil aeronautics.

It is true that there are no special dump bodies or attachments for the carrying of merchandise on exhibition but not much imagination is required to transform the bomb-carrying devices of the larger planes and air-boats into equipment for peaceful purposes.

The big Caproni triplane, which spans one end of the Armory, has a large structure under the lowest wing that carries 3300 lb. of bombs. And many of the smaller planes, seating one or two passengers, carry three or four guns, an appreciable weight that would be made available for freight in the commercial airplane.



General view of the aeronautical exhibits in Madison Square Garden. Suspended at the right is the steam-driven plane designed and flown by the pioneer Langley twenty-three years ago



A corner of the Goodyear company's exhibit, showing a dirigible car equipped with a Curtiss 100-hp. engine designed for 28 hr. continuous flight with four men aboard. To the left is a scale model in skeleton of the car for a proposed 1,000,000-cu. ft. dirigible to carry twenty-four passengers

But in spite of the probable early demand for commercial load-carrying aircraft, the feeling seems to be general among the manufacturers who have specialized on the smaller military machines that the readiest means of establishing themselves on a sound basis lies in the appeal to the sportsmen of the country first and afterward to the larger business of passenger and freight carriers.

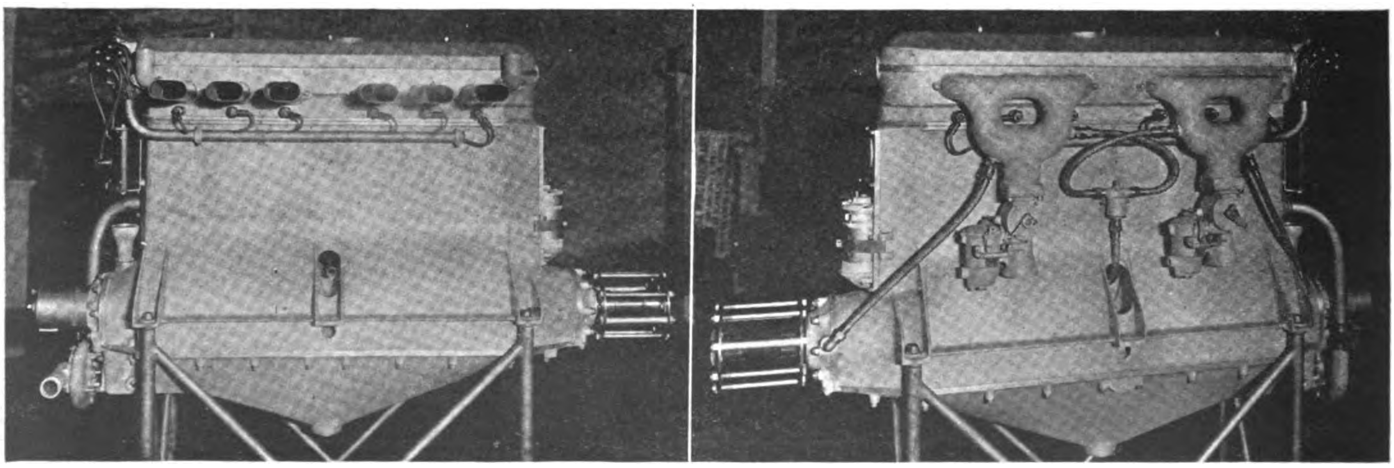
Having developed machines that are satisfactory for military or training purposes, they intend to continue turning them out with as little change as possible for a class of user who is likely to make the quickest response. There can be no doubt that the sportsman aviator already exists in appreciable numbers, and the manufacturers have started out to meet him in the New York show by displaying a number of single and two-seated planes and flying boats with a strong sporting appeal.

Enter the Sport Plane

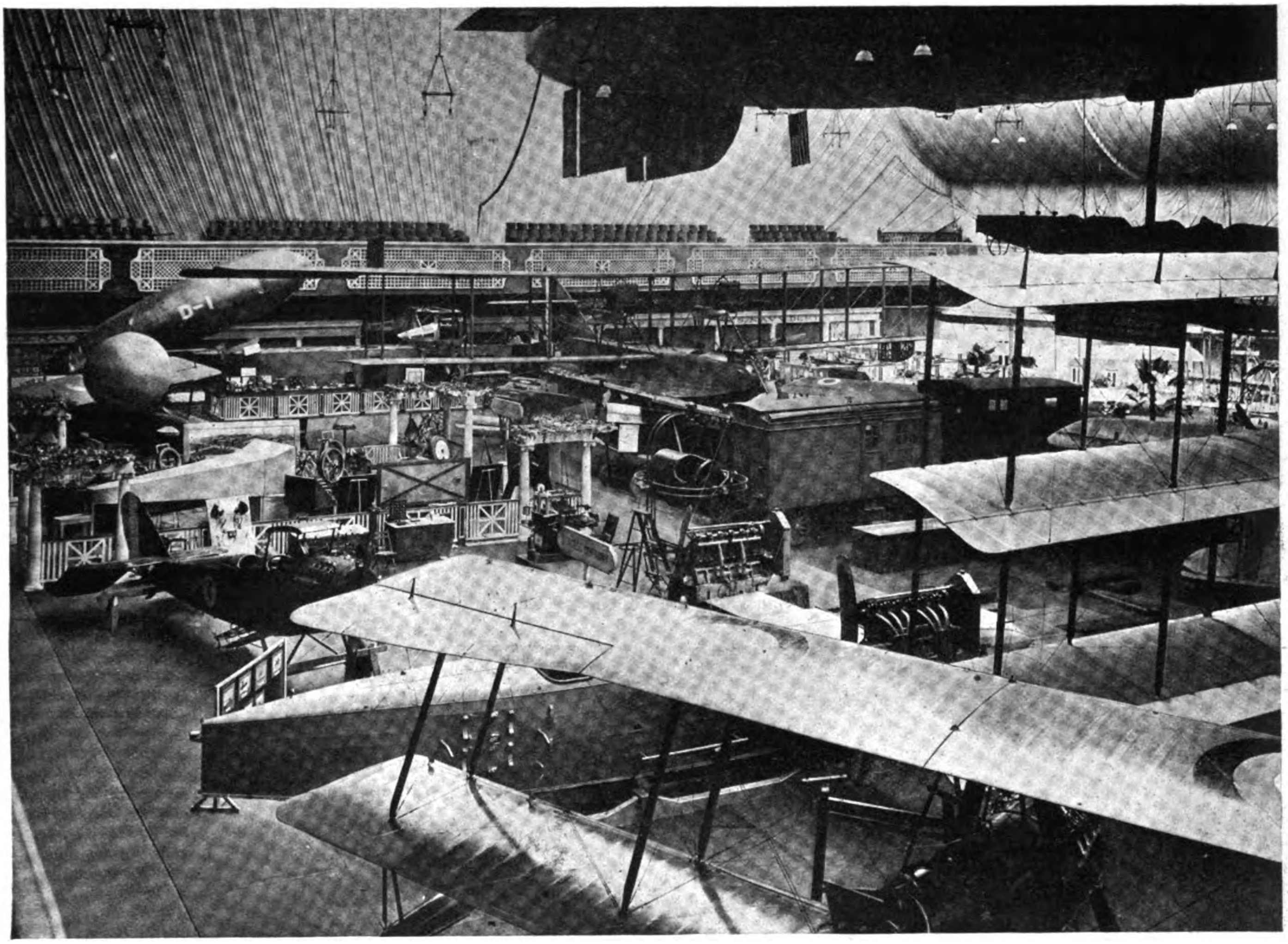
Typical of these machines is the Packard, which seats two in tandem; the Curtiss MF two-seated flying boat, in which the passengers sit side by side; the L. W. F. hydro airplane; the Messen-

American-Built Airplanes at New York Aeronautic Show

Name and Model	Type	Make of Engine	Cylinders and Dimension	Seats	Wing Span (ft. in.)	Chord (in.)	Gap (in.)	Length (ft. in.)	Weight (Loaded) (lb.)	Speed (m.p.h.)	Duration (hr.)	Ceiling (ft.)
Aeromarine	Seaplane	Aeromarine	6—3¼ x 6	3	48.4	75	78	25.6	1,925	80	2½	8,000
Boeling	Seaplane	Hall-Scott	4	2	43.6	69	72	27.0	2,430	75	3	....
Christmas	Biplane	Hall-Scott	6—5 x 7	1	28.0	60	60	21.0	2,100	175	1½	....
Curtiss 18-B	Biplane	Curtiss	12—4½ x 6	2	40.0	48	69	24.0	2,900	163	1¾	2,500
Curtiss	Seaplane	Curtiss	8	2	49.9	60	..	28.10	2,432	69	..	....
Curtiss H. A.	Biplane	Liberty	12—5 x 7	2	36.0	72	70 5/32	30.9	2,650	132	2½	20,000
Curtiss J. N. 4	Biplane	Curtiss	8	..	43.7	59½	..	27.4	2,130	75	..	....
Dayton-Wright	D-H-4	Liberty	12—5 x 7	2	48.0	66¼	66	28.0	4,150	126	4	22,500
Dayton-Wright	Honeymoon	Liberty	12—5 x 7	2	48.0	66¼	66	28.0	4,150	126	4	22,500
Dayton-Wright	Messenger	De Palma	4	1	19.3	39 9/16	44½	17.6	475	85	2	5,000
Gallaudet	Monoplane	Indian (2)	2—3¾ x 5	2	33.0	54	..	18.6	600	84	..	....
Gallaudet	Seaplane	Liberty	12—5 x 7	2	46.0	84	90	33.0	5,400	132	3	14,100
Glen-Martin	Biplane	Liberty (2)	12—5 x 7	..	71.6	114	132	42.0	5,700	118	3	18,000
Loening	Monoplane	Hisp. Suiza	8—140 x 150 mm.	2	32.0	84	..	21.0	2,600	145	3	25,000
Loening Kitten	Seaplane	Lawrence	3—4¼ x 5¼	1	18.0	48	..	13.0	500	..	..	....
L. W. F. G 3	Biplane	Liberty	12—5 x 7	2	39.0	80	76	28.8	4,550	134	4	....
L. W. F. HS-2L	Seaplane	Liberty	12—5 x 7	3	74.0	75	91	38.6	....	80	4	12,000
L. W. F. V.H-1	Seaplane	Sturdevant	8—4 x 5½	2	46.6	80	82	31.1	3,437	95	6½	15,000
Packard	Biplane	Packard	8—4¾ x 5¼	2	37.0	66	66	25.0	2,167	100.5	3½	19,500
Thomas-Morse MB3	Biplane	Hisp. Suiza	8—120 x 130 mm	1	26.6	..	..	..	2,000	163	..	....
Thomas-Morse S-7	Biplane	Le Rhone	9—105 x 140 mm.	2	32.5	..	..	21.6	1,480	90	..	....
Thomas-Morse S-6	Biplane	Le Rhone	9—105 x 140 mm.	2	29.0	..	..	20.8	1,385	105	..	....
Thomas-Morse S-4-C	Biplane	Le Rhone	9—105 x 140 mm.	1	22.6	..	..	19.4	1,150	112	..	....
United Aircraft	Biplane	Curtiss	8—4 x 5	2	43.7	..	..	..	....	80	..	....
Vought	Biplane	Hisp. Suiza	8—120 x 130 mm.	2	34.3	55½	51	24.2	1,995	105.5	3	....



The new Aeromarine six-cylinder 125-hp. aero engine



General view of the 69th Regiment Armory section of the New York show, showing overhead the Navy Coast Patrol dirigible which has seen 17 months' service for the Government. In the background is the big F-5-L Navy flying boat

ger of the Dayton-Wright Co., a tiny one-seater biplane with a span of only 19 ft., and the flying boat of the Aeromarine Co., which seats two passengers under a celluloid top in addition to the pilot.

The features that will differentiate civil from military craft have not had time to develop since the signing of the armistice, but there is ample evidence that the industry is hard at work on these problems.

Several planes at this show boast of refinements that indicate this tendency. Windowed cowls that protect the occupants from the elements, superior body finish, ease of mounting, luxurious comfort of upholstery, beauty of body lines and color strongly resembling and obviously borrowed from the best motor car body practice are a few of these that strike the eye of the visitor. That more of these features were not in evidence is due solely to the fact that there had not been time to develop them. Most of the makers of military craft are anxious to continue production of proven models with only those changes that are necessary to turn them into everyday airplanes for civil use, mail and parcel carrying and sporting types.

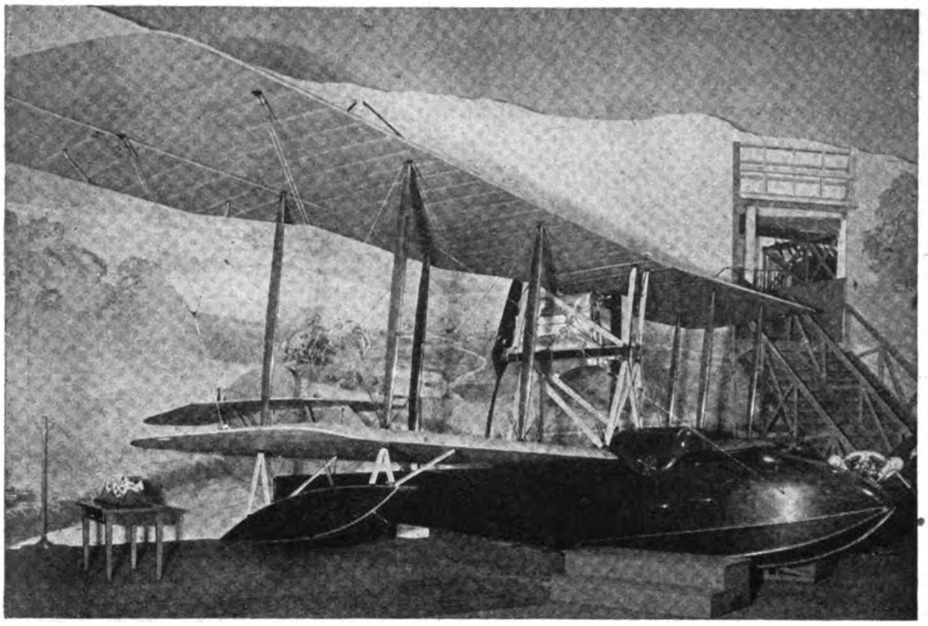
That there is a prospective market for the really small machine, a sort of motorcycle of the air, is suggested by the appearance of a tiny monoplane with floats, called the Loening Kitten, almost hidden under the shadow of the Navy F-5-L flying boat in the Armory, and one or two others scarcely any larger.

The Kitten has a wingspread of only 18 ft. and is equipped with an air-cooled Lawrence engine of 60 hp. It is a practical-looking machine with characteristics resembling the well-known Loening accepted by the Government for fast military work.

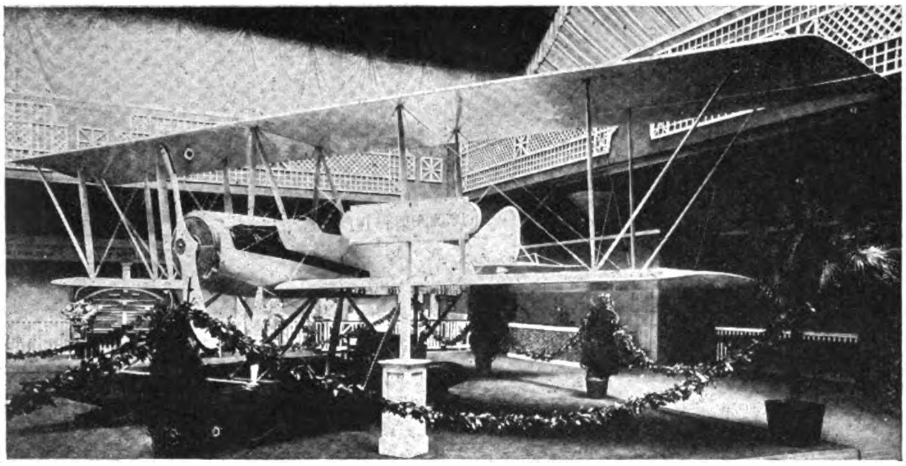
Another small plane with radical departures from standard construction is shown by the Gallaudet Aircraft Corp. The power plant consists of two Indian motorcycle engines connected through clutches and bevels to a pair of propellers on each side of the fuselage behind the

Complete Engines at the Aeronautical Show

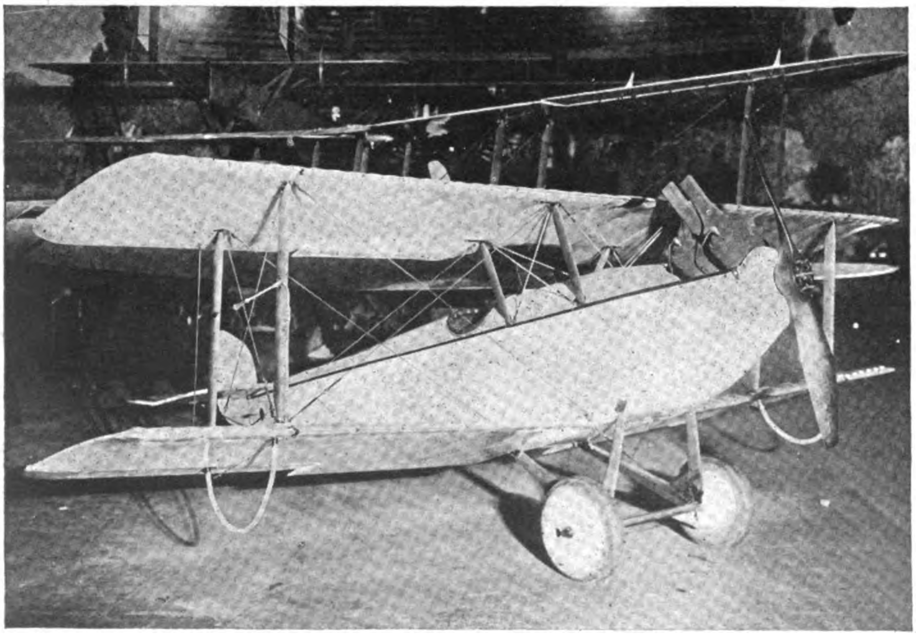
Name and Model	No. Cyl. Dimensions	Type	Cooling	Carbureter	Ignition	Weight, Lbs.
Aeromarine L......	6—4.25 x6.5	Vert.	Water	Miller	Delco	410
Curtiss	6—4.5 x6	Vert.	Water	Ball & Ball	Berling	412
Curtiss K12	12—4.5 x6	V 45 Deg.	Water	Ball & Ball	Berling	680
Curtiss OX5........	8—4 x5	V 90 Deg.	Water	Zenith	Berling	375
Duesenberg H......	16—6 x7.5	V 45 Deg.	Water	Miller	Simms & Philbrin	1370
Duesenberg A......	4—4.75 x7	Vert.	Water	Miller	Simms	450
Hall-Scott L6......	6—5 x7	Vert.	Water	Miller	Delco	495
Hall-Scott A8......	12—5.25 x7	V 60 Deg.	Water	Zenith	Dixie	1000
Hispano Suiza H...	8—5.5 x5.9	V 90 Deg.	Water	Stromberg	Optional	575
Hispano Suiza E...	8—4.72 x5.11	V 90 Deg.	Water	Stromberg	Optional	470
King-Bugatti	16—4.33 x6.229	Vert.	Water	Miller	Dixie	1160
Lawrence	3—4.25 x5.25	Y 120 Deg.	Air	Miller	Philbrin	132
LeRhone	9—4.135x5.51	Rotary	Air	Own	Dixie	260
Packard 1-A-744...	8—4.75 x5.25	V 60 Deg.	Water	Own	Delco	520
Packard 1-A-1116..	12—4.75 x5.25	V 60 Deg.	Water	Own	Delco	710
Sturtevant 5A-4½..	8—4.5 x5½	V 90 Deg.	Water	Zenith	Dixie	480
Sturtevant 7........	12—4.5 x6.5	V 60 Deg.	Water	Zenith	Dixie	900
Thomas-Morse 890.	8—4.812x6	V 90 Deg.	Water	Stromberg	Dixie	590
Thomas-Morse L6..	6—5 x7	Vert.	Water	Zenith	Delco	579
Tips	18—4.5 x6	Rotary	Water and Air	Own	Berling	855
W.B. B.	4	V 90 Deg.	Air	Own	Bosch	130



The three-passenger flying boat of the Aeromarine Plane & Motor Co.



The sporting model hydro-airplane brought out by the L. W. F. Co. is equipped with a 120-hp. Sturtevant



The Dayton-Wright company's single-seater "Messenger" has a span of only 19 *ft.*

wings. The Dayton-Wright Messenger, already mentioned, is also equipped with an air-cooled engine, of 37 hp. There seems to be a desire to try out the possibilities of air cooling to avoid the weight and complication of radiators and connections.

The Curtiss flying boat is fitted with a Spanish cedar hull that glows with the polish and finish of the high-priced automobile. The upper wing has a span of 49 ft. 9 in. and the lower 38 ft. 7 in. The landing speed is 45 m.p.h. and the maximum is 70 m.p.h. It is equipped with a Curtiss 100-hp. eight-cylinder engine with a bore and stroke of 4¼ in. and 5¼ in.

The so-called Honeymoon Express shown by the Dayton-Wright Co. is suggestive of the refinements that are to come. It seats two passengers in a comfortable canopied compartment with the pilot's seat in front. The interior is upholstered and fitted with vanity and lunch boxes and even a mirror. Its cost ranges from $15,000 to $20,000. The motive power is a Liberty 12.

A sporting plane has been brought out by the Thomas Morse Aircraft Corp. with tandem seating for two, a landing speed of 38 m.p.h. and a flying maximum of over a hundred miles an hour. Another model, the S-7, has a side-by-side seating arrangement. Its maximum is 90 m.p.h. Both models use 80-hp. Le-Rhone radial engines.

Constructional Development

Of construction interest there is much to be seen. Several machines have streamline noses, with the radiator mounted in the wing. There is a noticeable tendency to more rugged construction throughout, in landing gear strut work and engine mounting. Already salesmen have discovered selling points and these are exhibited in the same way that automobiles are sold. On the Packard sliding doors on the side of the engine casing give access to the carbureter and the crankcase.

A model showing the progressive stages in the making of the monocoque fuselages for the L. W. F. planes is shown. This body has given entire satisfaction with regard to strength and streamline possibilities. It is made of successive layers of linen and wood set spirally over a former which collapses when the work is finished.

This company exhibits two marine models, one, the G-o, carrying seven machine guns and bomb-dropping devices. With these removed there would be ample provision for the carrying of mails or parcels. It is equipped with a Liberty engine and sells for about $15,000. An L. W. F. sport hydroairplane is also shown. This model has a wing spread of 46 ft. and has two pontoons 18 ft. long. It seats two, is driven by a Sturtevant 120-hp. engine fitte dwith a starting motor and has a flying speed of 80 m.p.h.

Among the engineering exhibits is the Sturtevant company's solution of the problem of maintaining full power at high altitudes by feeding the carbureter automatically with air at a constant pressure. The device consists of an air pump driven by a belt from the crankshaft at

SPECIAL EXHIBITS BY THE U. S. ARMY AND NAVY

At the New York Aeronautical Show

UNITED STATES ARMY

Planes

Handley Page.
Spad.
Fokker.
S-E 5.
Nieuport.
Caproni.
Albatross.
Hospital plane.

Balloons

French barrage.
Propaganda.
Balloon winch.
Balloon parachute.
Gas cylinders, knots, etc.
Voice control demonstration.
Photographic exhibit.
Motion pictures.
Photo hut.
Miniature artillery range.
Rocking Nacelle.

UNITED STATES NAVY

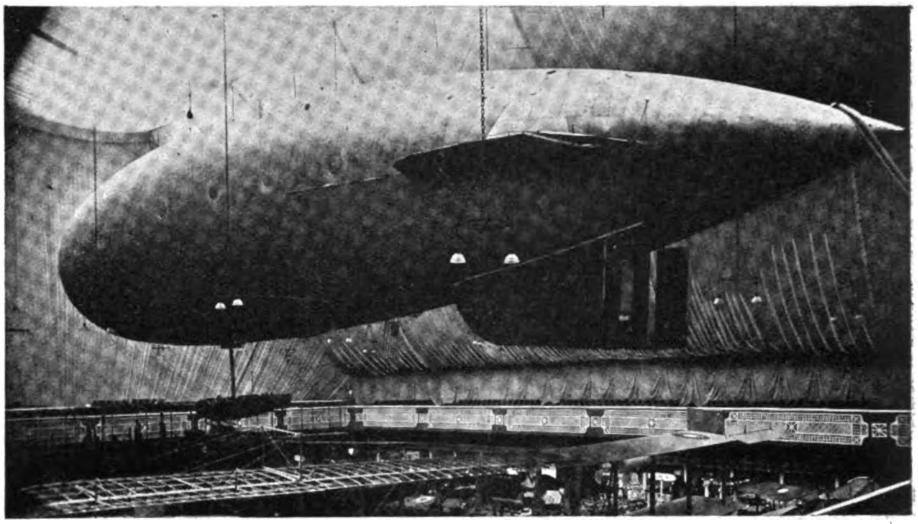
Planes

F-5-L boat.
Loening kitten.
Model of rigid dirigible.
Instruments.
Types of motors.
Types of propellers.
Self starters of different types.
Exhibits by Bureau of Steam Engineering.
Exhibits by Bureau of Ordnance, including various types of aerial bombs, machine guns, etc.
Exhibits by Bureau of Navigation, including altimeters, clocks, compasses, barometers, etc.
Exhibit of live pigeons, including birds with war service records.
Photographic exhibit, including motion pictures, equipment, samples, etc.

—

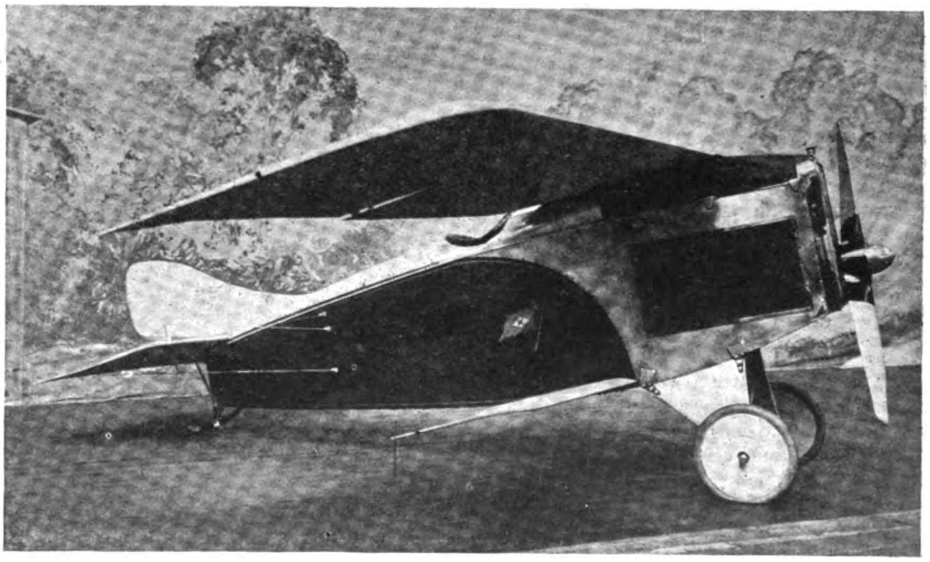
PLANE AND MOTOR EXHIBITORS

Army Air Service mechanical exhibit.
Aeromarine Plane & Motor Co.
Boeing Aeroplane Co.
Burgess Company.
Curtiss Airplane & Motor Corp.
Cantilever Aero Co.
Dayton-Wright Airplane Co.
Gallaudet Aircraft Corp.
Goodyear Tire & Rubber Co.
Gio Ansaldo & Co.
B. F. Goodrich Co.
L. W. F. Engineering Corp.
Glenn Martin Co.
Packard Motor Car Co.
B. F. Sturtevant Co.
Lawrence Sperry Aircraft Co.
Thomas-Morse Aircraft Corp.
United Aircraft Engineering Corp.
U. S. Army Hospital.
Wright-Martin Aircraft Corp.
Whittemore-Hamm Co.

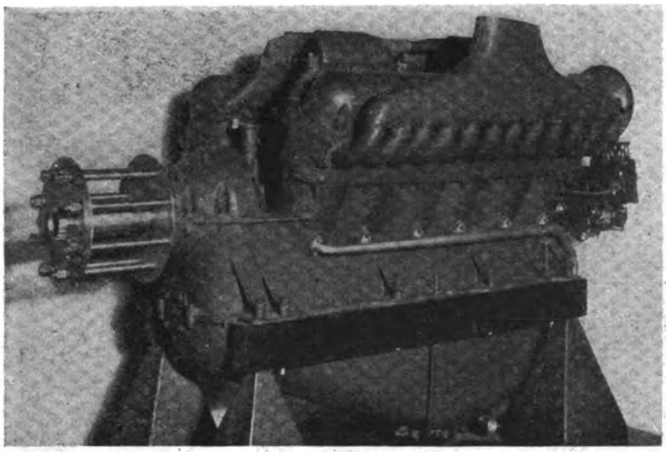


The Navy Coast Patrol dirigible built by the Goodrich company occupied most of the sky space in the Armory. This ship has covered 23,000 miles in Government service. It is 167 ft. long, has a volume of 80,000 cu. ft. and is driven by a 100-hp. engine

Curtiss model 18-B biplane, said to be capable of 170 m.p.h. The fuselage is similar to that used in the Curtiss K triplane



The Christmas "Bullet" has no exterior supports for the wings



The Curtiss 375-hp. twelve-cylinder aero engine has its cylinders set at a 45-deg. V. The bore and stroke are 4½ in. by 6 in. It weighs 680 lb.

a speed varied according to the altitude by an air controller. This controller is a small cylinder and spring supported piston open to the atmosphere. The position of the piston controls the tension of the belt. It is said to consume about 0.6 of the engine horsepower which represents a considerable increase on the available horsepower of an engine with the carbureter air inlet open to the atmosphere, at high altitudes.

The Navy exhibits, shown in an accompanying table, are of great interest. The big F-5-L flying boat is exhibited with one half of body and wing completely stripped, exposing the construction, the bomb release mechanisms, instruments, controls, gasoline tanks, guns, ammunition racks, etc. This machine is of the type which has done so much work in convoying transports and merchant ships. It carries a crew of five men and ammunition and bombs for 8 hr. at a speed of 80 m.p.h. The total weight, fully equipped, is almost 14,000 lb. Other Navy exhibits are the various instruments, clocks, compasses, barometers, etc., used in aviation work. A small model of a dirigible filled with helium, the new non-inflammable gas with a buoyancy only slightly less than hydrogen, is also shown.

Of Lighter-Than-Air Interest

The lighter-than-air side of the industry is well represented, and there is evidence of the same optimism and planning for the future. The Goodyear company is showing an army fuselage for dirigibles, equipped with a 100 hp. Curtiss engine, designed for 28 hours continuous flight with four men aboard. This company also shows a scale model for a passenger car for a proposed dirigible with a cruising radius of 5000 miles without landing. This ship will be 450 ft. long. The car is 50 ft. x 7 ft. and has accommodation for twenty-four passengers.

From the decorative point of view the exhibition surpasses anything hitherto staged in these buildings. The always difficult problem of combining conventional design with naturalistic treatment has been avoided by leaving out the conventional geometric pattern entirely. The entire wall surface of the Garden is a vast scenic painting representing rocky country, with great distances and a sky which meets the blue gauze which covers the entire roof. The whole effect is magnificently spacious and particularly appropriate to the nature of the exhibits.

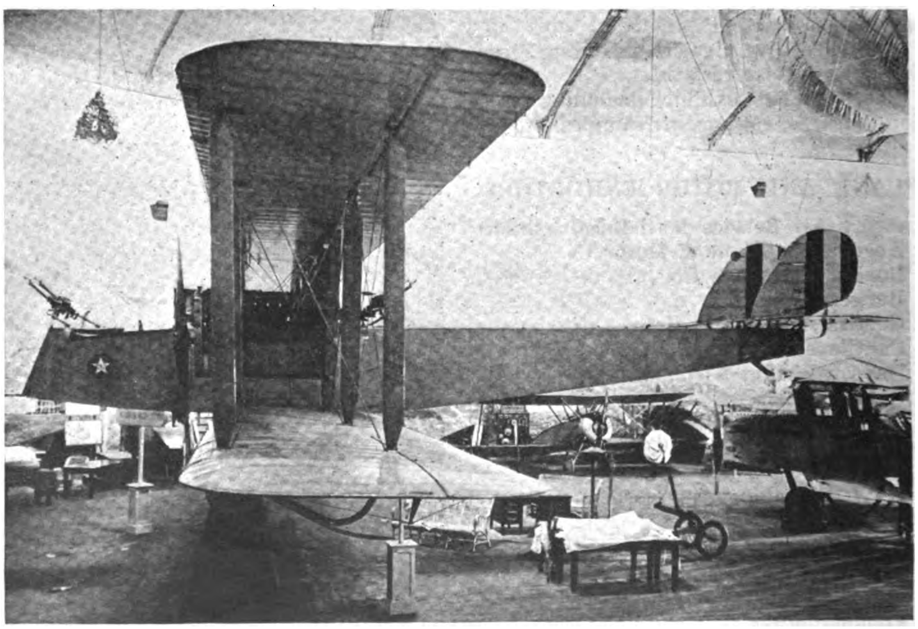
"Farm Mechanics" a New Trade

WASHINGTON, March 3—The extensive use of motor trucks, farm tractors, passenger cars and lighting and power systems on farms will soon create a demand for specially skilled "farm mechanics" on farms of 100 acres or more, according to the opinion of the Federal Board for Vocational Training. These "farm mechanics" it is expected will operate and repair all farm machinery operated by gasoline engines.

ACCESSORY EXHIBITORS

At the New York Aeronautical Show

The Acieralo Co.
Aero Science Club
Aeronautical Soc. of Amer.
Aircraft Engineering Corp.
Ajax Auto & Sheet Metal Co.
American Balsa Co.
American Bosch Magneto Co.
American Prop. & Mfg. Co.
Anderson Forge & Mach. Co.
Mrs. W. Allen Bartlett
The Bristol Company
Budd Wheel Corp.
Champion Ignition Co.
Class Journal Co.
Cold Light Mfg. Co.
Conn. Aircraft Corp.
Dayton Eng. Lab. Co.
Dayton Wire Wheel Co.
Detroit Accessories Corp.
Dodge Mfg. Co.
Doehler Die-Casting Co.
Dudley, Lee, Tenney & Co.
Duesenberg Motors Corp.
Eastman Kodak Co.
Edison Elec. Appliance Co.
Empire Art Metal Co.
Ericsson Mfg. Co.
Gardner Moffat Co., Inc.
General Ordnance Company
Hart & Hutchinson Co.
Hartzell Walnut Prop. Co.
Hess-Bright Mfg. Co.
Jamestown Propeller Co.
Arthur Johnson Mfg. Co.
Jones-Motrola, Inc.
Junior Plattsburg, Inc.
Lang Propeller Co. of Amer.
Lawrence Aero Engine Corp.
Lawrence Sperry Aircraft Co.
Liberty Starters Corp.
Livingston Radiator Corp.
Lunkenheimer Company
Matthews Bros. Mfg. Co.
A. J. Meyer Mfg. Co.
Mossberg Co., Frank.
Motor Compressor Co.
National Advisory Comm.
National Cash Register Co.
Norma Company of America
Perry Austen Mfg. Co.
Radium Dial Co.
Marlin Rockwell
John A. Roebling's Sons Co.
Schneider Bros. Instrument Co., Inc.
The Simms Magneto Co.
Society Automotive Eng'rs
A. G. Spalding & Bros.
Splitdorf Electrical Co.
Standard Parts Co.
Standard Turnbuckle Co.
Sterling Engine Co.
Stewart Hartshorn Co.
Stone Propeller Co.
Stromberg Motor Devices Co.
Thompson, J. James
Tips Aero Motor Co.
Titeflex Metal Hose Corp.
Torrington Co.
Triplex Safety Glass Corp.
U. S. Ball Bearing Mfg. Co.
U. S. Light & Heat Corp.
Valentine & Company
The Van Sicklen Co.
Wellington-Sears & Co.
Maccomber White
Wyman-Gordon Co.
Zenith Carburetor Co.



The big Glenn Martin bombing plane which confronts the visitor at the entrance of the show. It has a span of 71 ft. 6 in. and is equipped with two Liberty engines

Worthy Merchandising Features at Kansas City Tractor Show

Cutaway Chassis—Better Painting and Well Arranged Booths

By David Beecroft

KANSAS CITY, MO., March 1—More attention to the merchandising of tractors was shown by the manufacturers at the Fourth National Tractor Show this year than at any previous show, and if the spirit that was evidenced here is carried on as it should be, it augurs well for a high standard in the future.

Several exhibits are deserving of special mention. They were good in themselves and their influence on the show was splendid. They expressed a new thought in tractor expositions. They possessed a practical appeal.

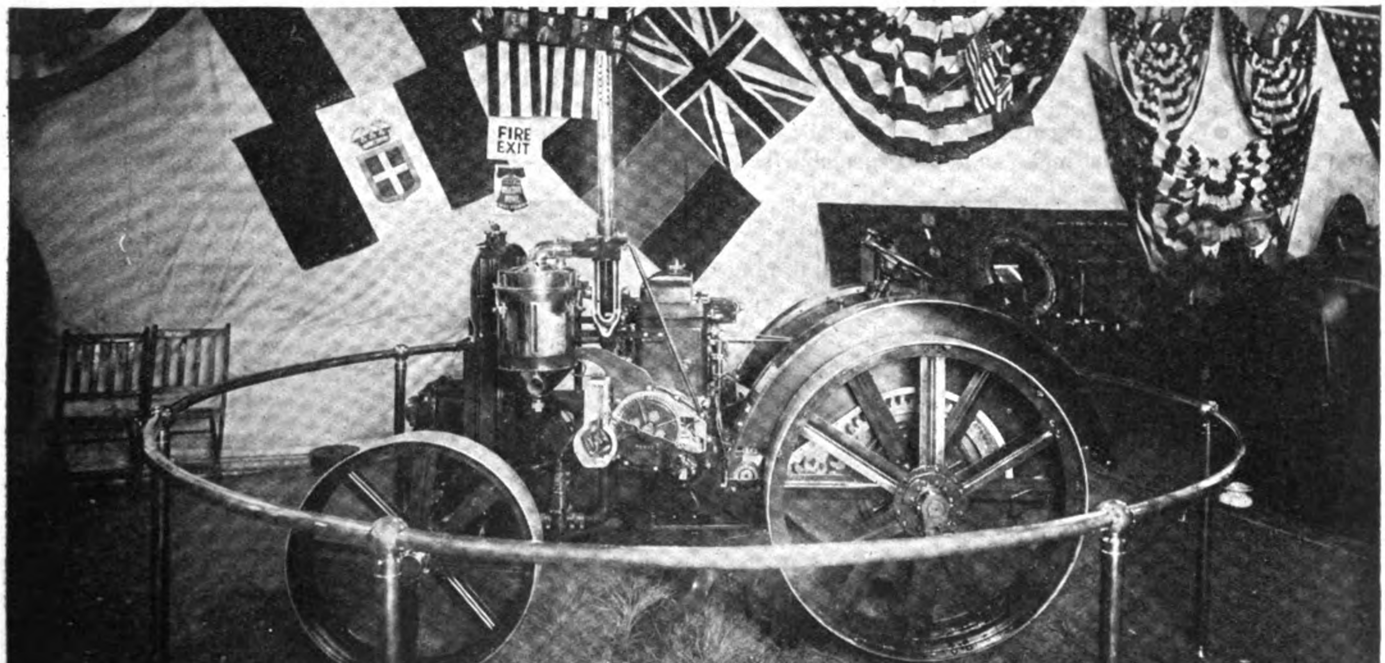
A word of merit goes to the Bates exhibit, which, while unusually attractive, was entirely suitable for the show and carried with it an appeal that must have carried home the new thought of what a revolution the tractor is to work on the farm. It constituted an appealing, well-written chapter on motorized farming. The photographic reproduction tells most of the story.

For a total expenditure of scarcely $300, a plain area of unpainted floor space was converted into a few acres literally extracted from the country. There stood the Bates steel mule in white hitched to a plow in the same color and both in their native element. By means of a platform, a few bushels of good black soil and a few square yards of real grass that grew greener as the show progressed, it was possible to build up a landscape for which a colored farm scene made a fitting background and completed a typical agricultural landscape of the kind we hope to see in all of our forty-eight states within the next decade. The plows were deep in the furrows. You could scarcely tell where the platform stopped and the painting started.

But this was only a part of the exhibit. To the left of this was a raised platform on which the Bates tractor traveled to and fro from the opening of the show until it closed each day. An electric motor and an automatically controlled switch did the job. It was a fine example of motion in an exhibit.

Clever Cutaway Chassis

To the J. I. Case T. M. Co. goes the credit of staging the first high-class cutaway chassis display ever seen at a tractor show in America. One of the two-plow models finished in gun metal with cutaway sections painted in red and white was mounted on a heavy metal pedestal on which it was slowly revolved by an electric motor. There was another electric motor that propelled the mechanism



The Case tractor with cutaway parts was the finest exhibit of its kind ever seen at a tractor show. The finish on the chassis was as good as any on any automobile chassis at an automobile show

of the chassis so that as it revolved on the pedestal the observer had an opportunity of seeing every portion of it working.

As a cutaway chassis it deserves the highest praise, and as an effort to bring class into the tractor industry and impress on every one that the tractor is a beautifully designed, well-finished engineering job, the work could scarcely have been done better. The castings were cut away to show practically every bearing used in the gear-set, transmission system and axles. Never did a motor car chassis go to a New York or Chicago show better worked out to carry its merchandising message.

Surrounding the exhibit with a brass rail permitted many to examine the chassis from all sides with equal ease and satisfaction. It is impossible to think of a better way to disclose good workmanship and design; and where a maker puts these assets into his product he is losing possibilities if he does not follow some such scheme as this to carry the message into the hearts of prospects. We do not know what this exhibit cost, but as a factor in elevating the standard of tractor exhibitions and as a means of silently telling to farmers and dealers the status of tractor design it is unparalleled.

The Value of Color

A new thought in tractor merchandising was expressed by J. B. Bartholomew of the Avery Co., who had the complete line of Avery tractors and cultivators painted white, with gold striping. It represented a great improvement over the implement red that is too frequently seen on tractors. This Avery act recalls a story told by C. F. Kettering, inventor of the many Delco systems, including Delco light. Kettering had an investigation made before putting out Delco light to discover the color of paint most used on farm implements and most asked for by farmers. The majority favored red. That settled it with Kettering. He would paint his Delco light apparatus any other color but red. It simply must not be red.

Here is why: The Delco apparatus was the highest class piece of apparatus Kettering could build and he decided that if it ever went onto the farm painted implement red it would be treated just as any other bit of farm machinery painted red.

It must not go on the farm as such. It must go as a high class job and it must make an appeal as such. There is a strong silent message in the color a machine is painted and if the Delco light was to be cared for as it should and respected as it should then such a continual command should come from the apparatus because of its color. At least color should not be a handicap.

There is an application of this in the color of tractors. The tractor must not fall into the farm machinery class so far as being cared for on the farm is concerned. It is too expensive a product for that. It must carry an appeal for special care. It must carry an appeal that it is a well-designed, well-built, costly yet efficient piece of machinery. The color it is painted will help immensely.

The Avery white line, as it was called at the show, carried a message. There was a good thought back of it, and while tractors would not be serviceable to go into the field in white and gold, the show is a good place to remind the farmer of the value of the machine. The use of white and gold was not limited to Avery, as the American Bosch had a fine exhibit with the center piece in this color, and Bates used it to advantage in his landscape exhibit.

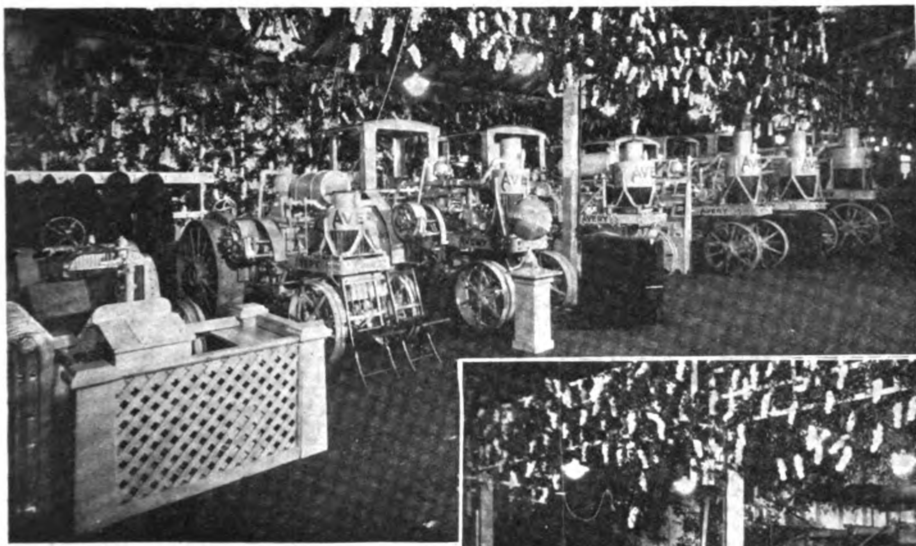
The American Bosch center piece was a Fordson tractor placed on a dais to exhibit its magneto attachment for the tractor. The magneto as well as the gear-case housing the driving gears was in gold. It was the only gold on the chassis and as you passed along the aisle it did not require the services of a salesman to tell you the purpose of the exhibit and explain why a Fordson was in this magneto booth.

Clever Merchandising-Advertising Stunts

Another excellent bit of American Bosch merchandising was a series of large sized photographs telling in sequence every step you had to take in removing the Fordson timer and mounting the magneto system in its place. The pictures told a better story than any salesman could. They were mounted on a large revolving rack adjacent to the front end of the Fordson.

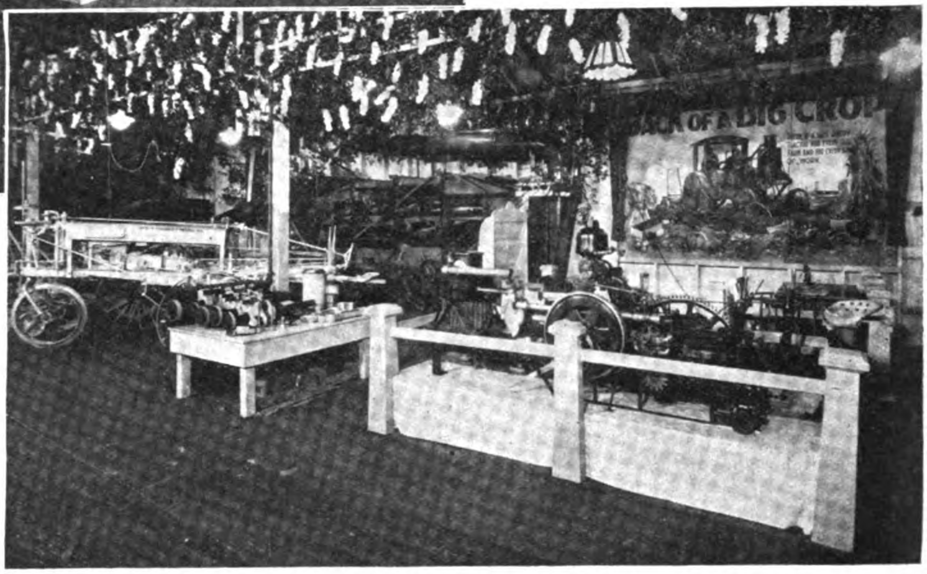
Hyatt took advantage of the show in a merchandising sense; perhaps it would be fairer to say in an advertising sense. This took the form of a goodly sized brown paper portfolio which was for carrying catalogs. So general was its distribution that everybody carried one under his or her arm and the usual littering of the floor with catalogs was not noticed. Hyatt did a good service to the show by this clever scheme and also did a service to every

The center of the American Bosch Magneto stand contained a Fordson tractor painted white, with the Bosch magneto in gold, showing all attachment parts



Manufacturers' Merchandising at the Tractor Show

The long line of Avery models was all painted white with gold stripes, a scheme of uniformity not employed by anyone else, and a pleasant change from red so often used



other exhibitor by insuring more catalogs being carried to the thousands of homes represented at the show. It was fitting that such a pioneer in the tractor field should come out with such a generously useful feature.

Credit is due Strom bearings for a clever display of all bearing types and sizes on a large polished wood pyramid. It stood so high that some exhibitors thought it was too conspicuous and lodged a complaint with the show management, but it was permitted to remain. Exhibits of this character add materially to the interest of a show. The exhibit was a duplicate of one which is now being used at the great Lyons trade fair at Lyons, France.

The use of an automatic steering device for the Cleveland tractor was well shown by having the tractor mounted on what was intended to be a plowed field, with the entire steering mechanism carrying a polished finish and the wheels of the steering apparatus resting in a real furrow of earth. It caused everyone to pause, take a look, grasp the story and generally make some favorable comment before passing.

Never before at a tractor show has there been such an effort to make exhibits pleasing to the eye, attractive and also useful from an educational and merchandising point of view. The show has taken a place in the front rank of exhibition merchandising in this respect. Timken had, for example, one of the yokes which carries the creeper of a Cleveland creeper to show how its bearings are used to carry the idlers as well as the sprockets.

The Cleveland company had a similar yoke exhibit to show the improvements that have been made in the sprockets and other parts.

Rock Island had a moving exhibit of its Heider tractor in the form of a back and forward movement of it.

Most of the tractor concerns had their machines driven by electric motors.

There was a lack of uniformity in size of cards giving information about the tractors, such as rating, weight, price, and a few other essentials. These cards should not necessarily all be the same color but they should be standardized in information given and size.

There is opportunity to make the exhibits of parts such as engines, ignition apparatus, sheet metal goods, bearing materials, castings and other tractor parts more interesting than merely spreading them on the top of a burlap-covered table. That may be the easiest way to exhibit them, but it is far from being the most potential way. Endeavor to put some thought into your exhibit. If you only want it to look pretty without regard to the useful, go ahead and do the best you can. If you want to tell an engineering story think out means of doing it. It may be your mission to incorporate a merchandising story in your exhibit; if so, think out an unusual plan.

Start now planning your exhibit for the fifth tractor show next year. Decide on what message you wish to convey. Make the planning of the exhibit a subject for two, three or perhaps more conferences of factory heads that are interested in the product. Start early.

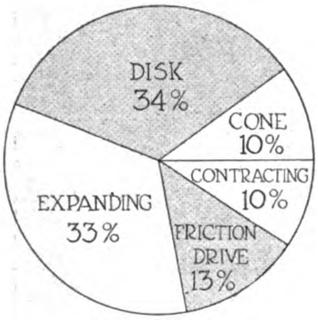
Do your part to elevate the merchandising of tractors and their equipment.

IT is the general view among steel men that the application of the electric furnace in steel refining and steel melting is limited by the cost of electric power. This subject was dealt with in a recent paper by H. Etchells before the Birmingham Metallurgical Society, who said that when electric power was generated with 30 per cent efficiency at the generating station electric furnaces would compete as regards fuel cost with other types. The success of the electric steel-making furnace was due to the utilization of scrap materials hitherto of little value; the production of a class of steel with slightly improved physical properties and of much greater reliability, and easy manipulation and facilities for installing small or large units, as desired.

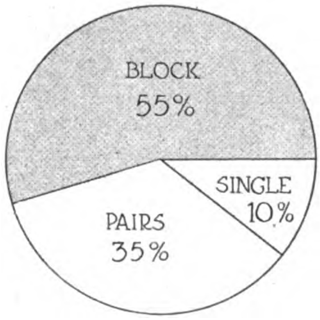
An Analysis of Tractor Specifications

Showing Representation of Different Features of Design on a Percentage Basis—Engine Weight Per Belt Horsepower and Per Cubic Inch Displacement—Average Tractor Weight

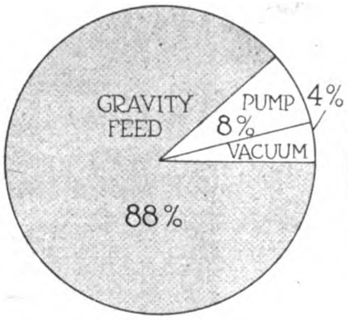
By P. M. Heldt



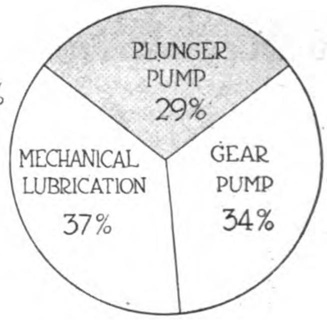
Clutch Types



Cylinder Construction



Fuel Supply



Lubrication

Charts showing the percentage of various constructional features of American tractors

FOR years it has been the custom of AUTOMOTIVE INDUSTRIES to analyze the specifications of automobiles gathered annually on the occasion of the New York Show. The figures thus obtained, showing the prevalence of various practices in percentages, furnish a valuable guide in later years with regard to tendencies in design. In fact, they are about the only basis on which an opinion regarding the trend of engineering practice can be formed. We have often noted how erroneous impressions are obtained from the practice of a few concerns very much in the public eye, which, however, happens not to be in accord with the general lines of progress.

In the following article the specifications of tractors gathered for the Statistical Number of AUTOMOTIVE INDUSTRIES are analyzed. Most of the data collected were published in tabular form, but some had to be omitted from the table on account of space limitations. This is the first time that we are making such an analysis, and, therefore, no comparison with previous practice is possible.

Of the tractors listed 86 per cent were of the wheeled type and 14 per cent of the track-layer type. In the latter class are included both those tractors having tracks only and those running on tracks and wheels.

Three-Plow Preponderates

It was shown some time ago by a questionnaire sent out to farmers in the state of Illinois that the majority of farmers in the corn belt of the Midwestern states consider the three-plow tractor best adapted for their requirements, and the greatest number by far of the tractor models listed are of this capacity. It is quite likely, however, that as many two-plow tractors as three-plow have been manufactured, for, although the number of two-plow tractor models listed is only 13 per cent of the total, the makers of these tractors include most of the largest producers in the country.

The one-plow tractor has only just arrived and represents only 2 per cent of all the models listed. There are indications, however, that next year's analysis will show an appreciable gain for this type, as there is a noticeable tendency among tractor manufacturers to develop machines that are specially suited to such light farm operations as corn cultivating, seeding, etc., and which when used for plowing must be hitched to a single plow.

The four-plow tractor has a greater representation than the two-plow, namely, 22 per cent, while tractors capable of pulling five or more plows make up 14 per cent of the total number listed.

Engine-Plow Ratio

The writer considered it of interest to determine the average piston displacement of two, three and four-plow tractors respectively. The comparison suffers somewhat from the fact that although most of the ratings are based on 14-in. plows, this does not hold in every case.

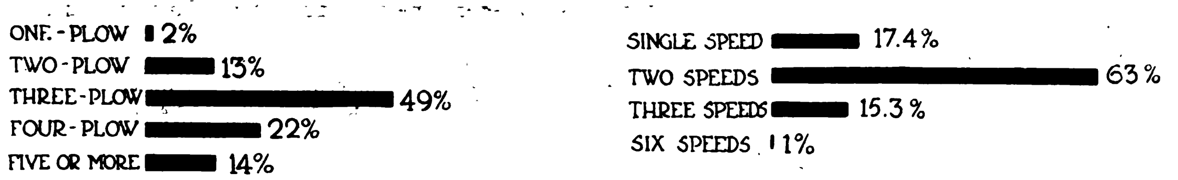
It was found that the average piston displacement of the engines on two-plow tractors is 240 cu. in.

The corresponding figure for three-plow tractors is 370 cu. in.

For the four-plow tractors it is 450 cu. in.

It will thus be seen that the piston displacements are very closely proportional to the working capacity of the tractors and plows, which is as it theoretically should be.

It is a well-known fact that a great majority of modern tractors are equipped with four-cylinder engines, and an analysis of the specifications shows that the four-cylinder and the two-cylinder together practically control the field. Only 1 per cent of the tractors have a single-cylinder engine, and the same percentage is equipped with an eight-cylinder engine. Four-cylinder



Charts based on a count of American-built tractors, showing at the left the relative percentage of one to five-plow sizes and at the right the number of speeds provided in the gearsets

engines are found on 82 per cent of the tractors and the two-cylinder on 16 per cent.

It might be supposed that all of the four-cylinder engines at least were vertical engines, but such is not the case, as is shown by the fact that only 72 per cent of all the engines are vertical, while 28 per cent are horizontal.

The following analysis of the method of casting the cylinders is limited to the four-cylinder engines: It is found that 55 per cent of the total, or a little more than half, are block cast, and 35 per cent are cast in pairs and 10 per cent are cast singly.

Motor Pump Circulation

The statement was made a short time ago in these columns that the thermo-syphon method of circulating the cooling water possessed special advantages when applied to tractor engines. A great majority of these engines are designed to run on kerosene; in order to burn kerosene successfully the cylinder walls must be maintained at as high a temperature as possible without causing preignition, and thermo-syphon circulation tends to keep the temperature of the combustion chamber walls up under certain conditions under which there would be a tendency to over-cooling with pump circulation. However, the figures show that the great majority of the engines used on present day tractors are designed for pump circulation, namely, 93 per cent, while only 7 per cent have thermo-syphon circulation.

Centrifugal Governors Lead

Almost every tractor engine at the present time is fitted with some sort of governor which governs its speed of rotation within narrow limits and prevents it from racing when the clutch is thrown out. Of the tractors listed 95 per cent carry centrifugal governors, 3 per cent hydraulic governors and 2 per cent electrical governors. It is somewhat surprising that no more extensive use is made in tractor practice of the hydraulic governor, as it is certainly the cheapest type to build, and its degree of sensitiveness is easily sufficient for tractor requirements. Of course, the diaphragm would have to be removed occasionally, but this could be done at very little cost and without much trouble.

Tractor engines generally are a much heavier type of engine than automobile engines. This would be shown by a comparison on a piston displacement basis. The greater weight of the tractor engine is due to the fact that its crankcase is usually made entirely of cast iron, besides which the bearings and all other wearing parts are made larger in proportion to the explosive pressure on the piston head. On a displacement basis the four-cylinder engines listed weigh 2.4 lb. per cubic inch. We have no corresponding figure for automobile engines and consequently are not in position to make a comparison. On the other hand, an approximate comparison on the horsepower basis is possible, as automobile engines generally weigh from 10 to 12 lb. per horsepower.

The average weight of all of the four-cylinder tractor engines is 36 lb. per belt horsepower, showing that the average tractor engine weighs at least three times as much as an automobile engine of equal output. While this difference in weight is largely due to the use of such materials as cast iron in the crankcase and to the provision of more liberal bearing surfaces in the tractor engine, another important reason is the very much lower piston speed of this engine.

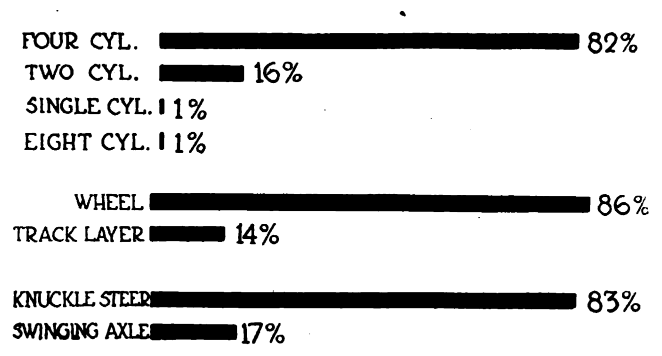
Majority Favor Gravity Fuel Feed

Gravity fuel feed, the simplest system known, is favored by the majority of tractor designers. It is employed on 88 per cent of all tractors, while 8 per cent use fuel pumps and 4 per cent the vacuum system. In the majority of tractors of what may be regarded as the most modern type, in which there is a vertical engine in front, the fuel tank is generally placed directly behind the engine, and can be easily located sufficiently high to insure positive flow under all conditions. The pump system with overflow is an adaptation from stationary engine practice, in connection with which it is used chiefly on account of its inherent safety, as there is no possibility of fuel leakage when the engine is not running. Air cleaners are used almost universally.

The following analysis of the types of oil pumps is given for what it is worth. It was obvious from the replies on the question blanks that many of those who had filled out these blanks did not fully understand the questions. The blanks enumerated gear pumps, plunger pumps and individual pumps, by which latter was meant the mechanical lubricators used on a number of engines, which usually consist of a series of small plunger pumps having a common drive. From the figures collected it would appear that 34 per cent of all the engines were fitted with a gear pump in the lubricating system; 29 per cent with a plunger pump and 37 per cent had mechanical lubricators. It may be pointed out that the comparatively large use of mechanical lubricators is due to the use of kerosene as fuel. This has a tendency to get by the pistons and dilute the lubricating oil in the crankcase, thus quickly depriving it of its lubricating qualities. With mechanical lubricators oil is fed directly to each of the bearing surfaces and no oil is ever used over.

Impulse Starters General

Magneto ignition is the almost universal practice in tractor work, only 3 per cent of the tractors being fitted with battery ignition. All except the very smallest engines using magneto ignition are equipped with impulse starters, which make it unnecessary to spin the engine when starting up in order to produce a spark. There has been much development work done in connection with impulse starters during the past 2 or 3 years. All of the early impulse starters developed for tractor service were of the semi-automatic type in which the impulse mechanism must be set by hand before it will act; but recently the automatic type, which was first brought out for automobile work some 12 years ago, has received renewed



Charts showing, at the top, the relative proportions of one to eight-cylinder engines used in American tractors and below the percentages of wheel and track drives and of methods of steering

attention. This not only makes it possible to start the engine without spinning it, but also goes into action automatically when the speed of the engine for any reason drops below a certain value, thus preventing stalling of the engine due to inability of the magneto to generate a spark at exceedingly low armature speeds.

It was found that the average piston speed of all of the four-cylinder engines was 860 ft. per minute.

All of the well-known types of friction clutches are used to a greater or lesser extent in tractor work, many of the old line manufacturers producing their own clutches, which are generally of a type familiar in stationary work. Of all of the tractors listed, 13 per cent are of the friction-driven type and consequently use no friction clutch. The various types of friction clutches are represented in the following proportions: Disk type, 34 per cent; cone type, 10 per cent; expanding type, 33 per cent; contracting type, 10 per cent. Most of the expanding clutches are adaptations from power transmission practice.

While the majority of the better known tractors are fitted with variable gears affording two forward speeds and one reverse, there are a great many tractors with both a lesser and a greater number of speeds. Thus, 17.4 per cent of the tractors have only a single forward speed; 63 per cent, two forward speeds; 15.3 per cent, three forward speeds; 3.3 per cent four forward speeds and 1 per cent has six forward speeds.

S. A. E. Standard Belt Speed Too Low

An analysis of the average belt speeds corroborates the opinion expressed at a recent Standards Committee division meeting, to the effect that the S. A. E. standard belt speed of 2600 ft. per minute is too low. The average for the tractors listed is 2725 ft. per minute.

It would naturally be expected that the wheelbase of a machine should increase with the capacity in plows, and the figures at hand show that this is actually the case, though the average wheelbase of all of the three-plow tractors and those of all of the four plow are almost identical. The wheelbase of the two-plow tractors averages up to 83.5 in., that of the three-plow to 96 in. and that of the four-plow to 97 in.

Two general types of steering gear are employed, the knuckle type and the swinging axle type. The latter was universally used on steam tractors and has been adopted by most of the manufacturers who entered the gas tractor industry from the steam tractor field. Knuckle steering is used on 83 per cent of tractors and swinging axle steering on 17 per cent.

An analysis of the tractors with respect to frame materials is rendered somewhat difficult by the fact that a practice has recently grown up of dispensing with the ordinary type of frame extending the whole length of the tractor and using only short frame members by which the engine is supported upon the front axle. Of the total number of tractors, 93 per cent have frames made of structural steel, which in nearly every case is of channel section. Pressed steel frames are used on 3 per cent of tractors and cast frames on 4 per cent. It will be understood that these cast frames are not separate frames, but are constituted by the cases of the engine, transmission and rear axle. This practice of using the cast iron machinery cases for frame purposes is rapidly gaining ground, as it reduces the weight of the tractor.

Driving wheel diameters vary within wide limits, but there is no noticeable dependence of this diameter upon the plow capacity of the tractors, as the average diameter of drivers for the two-plow tractors is 50 in. and that of the three-plow tractors 52 in.

Weights Are Decreasing

Finally comes the weight of the complete machine. This, very naturally, increases with the plow capacity, but not in direct ratio thereto. The average weight of the two-plow tractors is 3670 lb., that of the three-plow tractors 5100 lb. and that of the four-plow tractor 6050 lb. There are strong evidences that the weight of tractors of a given capacity is on the decrease. The refinements in design of various parts all tend in this direction. Lighter wheels result from the use of rolled rims of straight section, and still lighter wheels are obtained by using very thin stock for the rims and securing the necessary rigidity by flanging.

In frames a beginning has been made in the use of pressed steel, which, of course, permits of a considerable saving in weight. The elimination of separate frames tends farther in the same direction.

Determining Center of Gravity

As the question of how to determine the center of gravity of an automobile has been asked several times recently, and, so far as I am aware, no solution of the problem has been offered, the following may be of interest:

$$P'' = 2400 - 1400 = 1000 \text{ lb.}$$

so by equating the moments we find

$$P'' 60 = PX \text{ and } X = \frac{P'' 60}{P} = \frac{1000 \times 60}{2400} = 25.$$

In order to determine f accurately we must figure $f = 30 - x$ sec. $e = 30 - 25 \times 1.0075 = 4.8125$ "e" being the angle of inclination from the vertical, but

$$\text{Tan. ``}e\text{''} = \frac{7.368}{60} = .1{,}228$$

indicating that the angle "e" equals 7 deg. and the secant of 7 deg. $= 1.0075$, therefore $f = h$ Tan. e and we have ....

$$h = \frac{f}{\text{Tan. } e} = \frac{4.8}{.1{,}228} = 39.$$

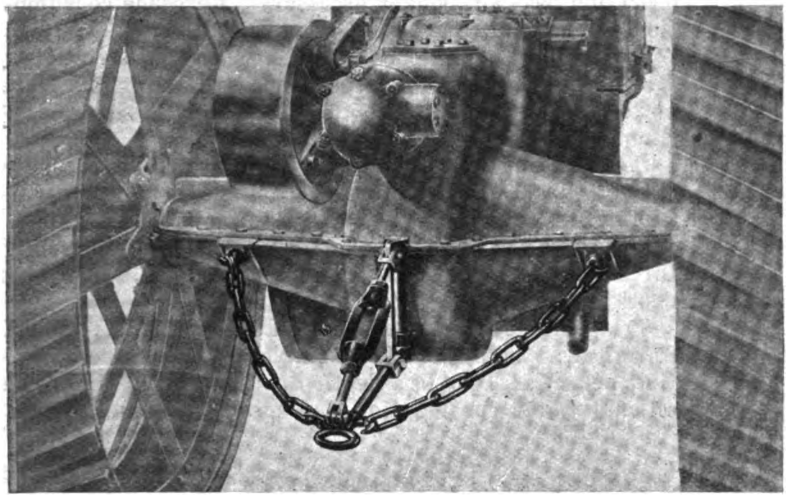
—H. E. Parsons.

An Analysis of the Hotchkiss Drive

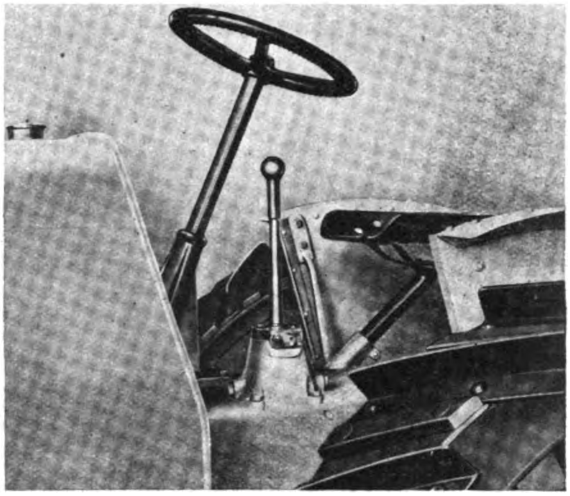
There exists a great deal of misconception in regard to the stresses imposed on the springs of motor vehicles if the torque member is eliminated.

In an article published in Automotive Industries of Jan. 23, 1919, I presented an analysis of the various forces. In this I misplaced the point of application of one component denoted with P''.

This error is pointed out by A. W. Happel in your issue of Feb. 20, and I wish to thank your correspondent.—O. M. Burkhardt.



Rear of the new Fiat tractor, showing redesign of axle housing and present location of the pulley for belt drive



Operator's seat, steering wheel and control elements of the Fiat tractor

Fiat Tractor Design Changed

Secondary Shaft Behind Axle Housing—Straight Belt Drive—Engine Bore Now 4.1

By W. F. Bradley
AUTOMOTIVE INDUSTRIES' *European Correspondent*

TURIN, Italy, Jan. 22.—Several changes have been made in the Fiat agricultural tractor since it was described in these columns Oct. 31, pages 772 and 773. On the original design the pulley for belt drive was mounted on the extremity of the propeller shaft, which necessitated the removal of one of the wheels when belt connection was made. In order to make this practicable special jacks were provided. On the machine as now produced there is a short secondary shaft immediately behind the axle housing, on which a 14-in. pulley with 7-in. face width is mounted. This gives a straight belt drive and also makes it possible to tighten the belt merely by moving the tractor ahead.

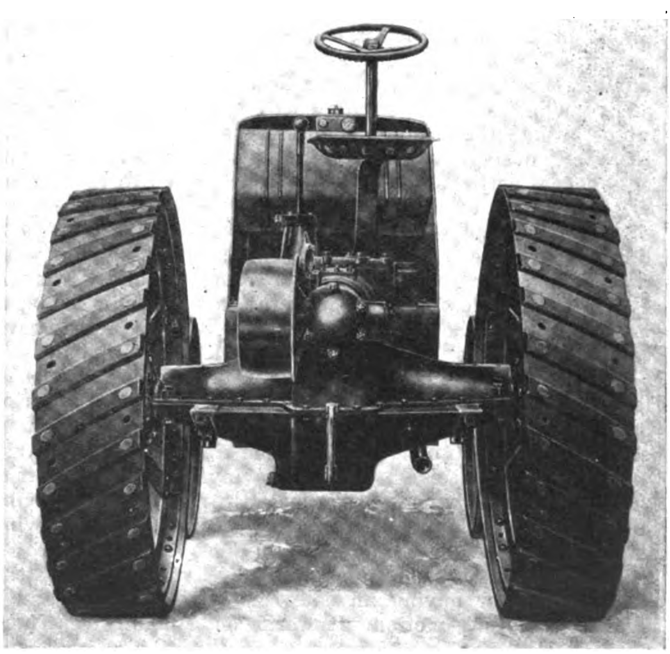
The engine was originally 100 x 180 mm. (3.9 by 7.08 in.) bore and stroke. The bore has now been increased to 4.1 in. The detailed specifications of the tractor are now as follows:

Total weight	5730 lb.
Maximum height	75 in.
Clearance	15 in.
Drawbar pull, first speed	5520 lb.
Drawbar pull, second speed	3750 lb.
Drawbar pull, third speed	2530 lb.
Wheeel track	52 in.
Wheelbase	68 in.
Minimum turning radius	122 in.
Front wheel	32 x 48 in.
Rear wheel	51 x 12 in.
Engine, 4-cylinder, 105 x 180	18/25 hp.
Diameter of driving pulley	14 in.
Width of driving pulley	7 in.
Speed on first gear	1.2 m.p.h.
Speed on second gear	2.8 m.p.h.
Speed on third gear	4 m.p.h.
Reverse speed	2.3 m.p.h.
Revolutions of pulley in forward speed	100 to 750
Revolutions of pulley in reverse speed	135 to 400

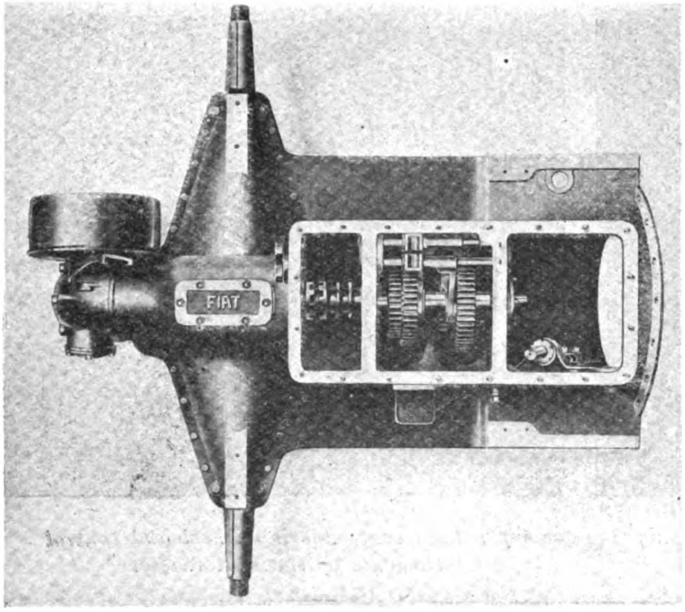
During the official plowing experiments a maximum tractive effort of 6170 lb. was obtained on first speed. On a level road no difficulty was experienced in hauling two trailers of 10 tons each and on a 12 per cent gradient the tractor has hauled a trailer of 3½ tons.

Some of the practical results obtained in open competition are as follows:

Plowing.—Soil of medium hardness plowed with a three-bottom plow at a speed of 3.7 m.p.h.; area plowed, 7176 sq. yd. per hour to a depth of 7.8 in. The soil having been sufficiently broken during this operation it was not found that the harrowing, which is done as a second



Full rear view of Fiat tractor, showing sturdy construction and symmetry of design



operation, was any longer necessary. Kerosene consumption per hour during this work was 19.8 lb.

Fuel consumption trial at Piacenza on an old meadow to be reclaimed—ground was very hard. Hammer one-bottom plow was used; depth of plowing, 12½ in.; consumption per acre, 40 lb. of kerosene.

Consumption trial at Falchera on a very wet stubble field of maize.—Parling three-bottom plow; kerosene consumption per acre, 25.4 lb.; depth of plowing, 8.6 in.

Trials on a very hard soil at Nichelino with a Parling three-bottom plow.—Consumption per acre, 40.5 lb.; depth of plowing, 9 in.

Trial on easy soil (stubble field).—Speed of plowing, 3.7 m.p.h.; Parling three-bottom plow; kerosene consumption per acre, 16.5 lb.; depth of plowing, 6.3 in. The oil and water consumption per acre was a mere trifle.

Gearset, rear axle and pulley drive of the new Fiat tractor. The 14-in. pulley is driven by a short secondary shaft immediately behind the axle housing. This location of the pulley facilitates fitting the belt and placing the tractor in the best operating position

Bethlehem Four Plow Tractor

A FIRM well known in the truck industry, the Bethlehem Motors Corp., Allentown, Pa., has recently entered the tractor field, having brought out a four-plow tractor with many uptodate features. It is an assembled product, having a Beaver 4¾ x 6 in. engine, and is rated at 18-36 hp. The total weight of the machine is 6200 lb.

In general layout the tractor is along the most uptodate lines, there being a short frame in front to which the bell housing arms are bolted. At the front of this frame there are two cross members, the forward one of which has a pivot support at the center of the front axle, while the other cross member, directly behind the first, supports the forward end of the engine on a trunnion.

All four cylinders of the engine are cast in a block, and the cylinder heads are detachable. A centrifugal governor maintains the engine speed at 900 r.p.m. Kerosene is the fuel used normally, and a supply of 14 gal. can be carried in the tank directly behind the dash board. This tank also has a compartment for gasoline for starting, of which a supply of 4 gal. can be carried. All air entering the carbureter has to pass through a Bennett air cleaner, and the air is heated by the exhaust. Ignition is effected by a Bosch high-tension magneto.

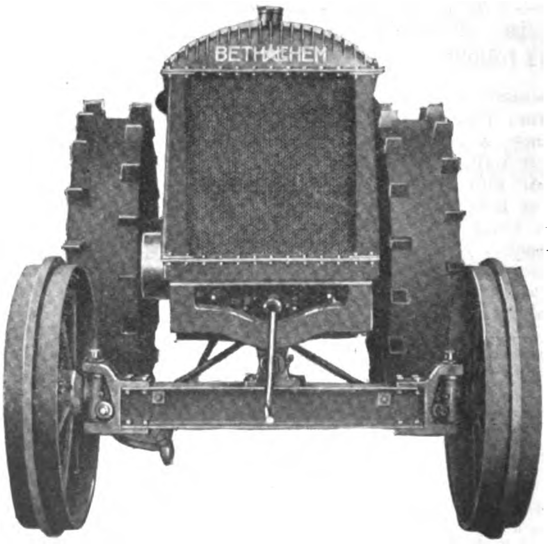
The cooling water is circulated by means of a centrifugal pump through the Fedders cellular-type radiator. This is of "armored" design, with cast-iron top and bottom tanks and cast spacers between these tanks. Fuel is fed to the Stromberg carbureter by gravity.

A Hilliard 4 plate clutch is used, together with a Foote sliding gear type of transmission which gives two forward speeds and one reverse, the former being 1.8 and 3.3 m.p.h. respectively. The final drive to the rear axle is by spur gears, and all of the gearing is inclosed. The high gear ratio from the engine to the drive wheels is 42.6 to 1 and the low gear ratio 82.2 to 1. The driving wheels are of French & Hecht make and are 54 in. in diameter by 12 in. width of rim, while the front wheels are 32 x 6 in. Hyatt and Timken bearings are used in the transmission and on the rear axle, while the front wheels have plain bearings. There is a brake drum on each driving wheel, cast directly on the driving spider. The wheels are driven through coiled springs, giving a flexible drive.

Control of the transmission gears is by the selective system, the control lever having an endwise shifting motion and a sideways swinging motion. It works on a quadrant. There is a throttle lever on the bracket supporting the gear control shaft. The clutch is arranged the same as on automobiles, being normally in engagement. It is withdrawn by means of a pedal located adjacent to the driver's seat.

Two lengths of channel steel are bolted to brackets cast on the rear axle housing and extend backward. These carry a floor board of platform steel. The drawbar is spring cushioned and the point of hitch can be adjusted laterally by means of a U-bolt passing through holes in an angle iron bar supported from the floor beams.

The tractor is steered by means of a hand wheel through a worm and wheel mechanism bolted to the side of the transmission gear housing. The front axle consists of a length of I-beam, to which steering yokes are riveted. The axle is braced by means of two radius rods connecting to a swinging beam having a swivel support at the center of a frame cross member. The radius rods are slightly inclined outwardly toward the front axle. Three point support is used for the engine. A sheet metal hood covers the power plant, being fastened to the dash board and radiator. There is a large opening in the center of this hood, through which access may be had to the overhead valves. The side openings of the engine space can be closed by means of tarpaulin curtains, which can be rolled up and strapped in place to the sides of the engine bonnet when desired.



Front view of the Bethlehem tractor, showing construction of front axle and steering knuckles

Characteristics *of a* High-Grade Standardized Engine

Greater Efficiency and Smoother Running Obtainable Better by Increasing Valve Size Than by Increasing Cylinders —Overhead Camshaft Best

By J. H. W. Kerston

THE successful conclusion of the war and the lessons learned through four and one-half years of concentrated automotive production, with practically unlimited funds available, will make it possible to offer the public machines superior in every way to any pre-war creation.

The influence of aeronautical engine practice will be particularly felt in the design and construction of new automobile engines, replacing the clumsy, heavy engine of yesteryear by a high-efficiency, light-weight motor, showing strongly the influence of scientific engineering practice.

Its lighter weight, guaranteeing better all-round efficiency, smaller fuel and oil consumption per shaft horsepower, will benefit the purchaser of a high-grade motor car equipped with such an engine, although the initial cost may be a trifle higher than that of the old-fashioned, heavy engine.

The use of steel for cylinders has been universally recognized as the standard metal for high-efficiency engines, because of its uniform structure and ability to machine the barrel outside and inside. The question in connection therewith remains as to the most efficient cooling of these cylinders—either in a unit aluminum casting or in individual waterjackets. The two recognized standard practices are typified by the Hispano-Suiza and the Mercedes. The American Liberty engine follows the Mercedes practice very closely in this respect, as do also most foreign aviation engines, as well as in the adaptation of the overhead camshaft and valve gear design with rocker arms.

From the point of accessibility, easy machining and interchangeability it must be said that the individually cooled cylinder of the Mercedes type is without the least doubt to be recommended. The aluminum casting may offer smoother lines, more pleasing to the eye, but it is also heavier than a separate cylinder jacket design.

Four-Cylinder Motor the Leader

For a high-efficiency fast car the four-cylinder motor will be in the lead, because of its four-throw crankshaft set at 180 deg., which is always in natural static and dynamic balance. For town driving the six-cylinder engine has many followers because of its throttling ability in congested traffic. V-engines will prove to be a passing fad, dictated by fashion and built to supply the fancy of a certain part of the public, rather than by sound engineering practice, for the horsepower we are accustomed to use for automobile work anyhow.

Much greater efficiency and smoother running will be accomplished by providing larger valve areas than by increasing the number of cylinders. Engines with at least four valves per cylinder will replace the multiple-cylinder engines, because they are lighter, more economical and more efficient.

The overhead camshaft with rocker arms and a vertical driveshaft with bevel gears throughout is the lightest and most efficient drive. This layout also lends itself to a very effective installation of the "accessories"; the magneto driven by a cross-shaft set at 90 deg. to the crankshaft at one end, the water pump or an additional magneto (for racing and sporting type cars) at the other end of the cross-shaft, form the most accessible installation. Where two magnetos are employed, the spindle of the water pump may form part of the vertical drive shaft. Another vertical shaft below the crankshaft may operate the oil pump. The air pressure pump and the tachometer drive will be most accessible if driven off the rear end of the camshaft. It will therefore readily be seen that in this typical layout the number of driving parts and gears is reduced to a minimum.

The employment of steel will be more general than has been customary heretofore. In an internal-combustion engine stresses for every part can be figured, and those parts can be designed and built accordingly. Steel forgings, so superior to any metal castings, will replace these, as it does away with the factor of uncertainty in castings, and consequently a great many rejections due to defects in rough castings and numerous other defects which do not show up until in the various stages of machining, with consequent additional cost of material, time, labor and depreciation of machinery.

Piston and Exhaust Valve

There are especially two parts in an internal-combustion engine in which other factors besides the imposed stresses are of paramount importance and must be taken into consideration. These are the piston and the exhaust valve. Both parts must be designed with a view of dispersing the tremendous heat quickly; in other words, the thermal conductivity becomes the most important factor. To illustrate the foregoing, a steel piston may be built lighter and stronger than an aluminum casting, yet the additional metal and consequent heavier weight of an aluminum piston is preferable, because it gives the intense heat a chance to disperse all over the heavy section of the piston skirt and from there through the oil film into the cylinder walls and into the cooling water.

The proper design of effective exhaust valves offers a similar problem. However, with provision for ample water circulation around the valve stem, no difficulties are encountered, especially in the four-valve-per-cylinder-head design, where the use of two smaller valves instead of a single large one prevents overheating and consequent warping, usually found in large-diameter valves of the old type.

In this connection another point is apparent. With the employment of two smaller valves instead of a single very large one, lighter valve springs may be used. The next step forward is then the employment of two valve springs for each valve, which has the added advantage of enabling us to use two very light springs of about 20 to 30 lb. pressure each, instead of one large and extremely stiff spring of, say, 65 to 85 lb. pressure. These stiff springs are, of course, more liable to breakage at high speeds due to crystallization of the steel, and at certain critical speeds synchronism of the spring will prevent the proper seating of the valve stems on the cams.

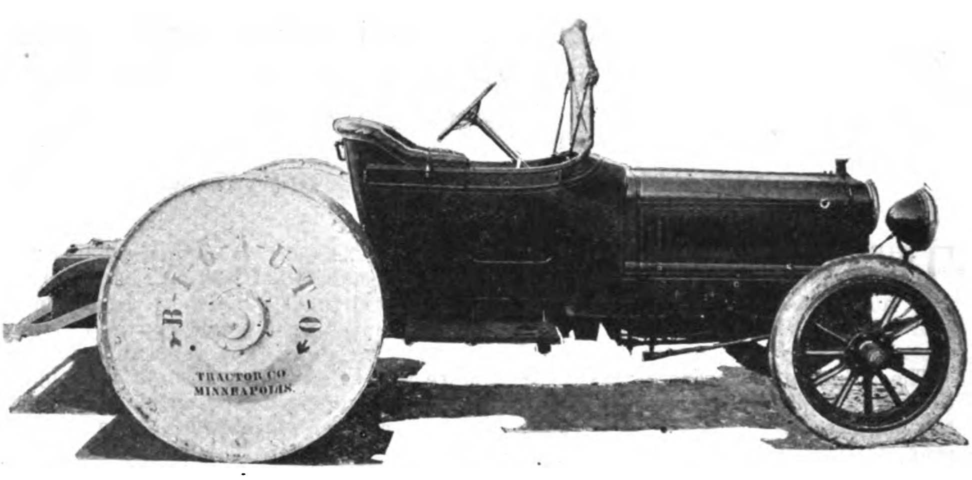
(*Continued on page* 549)

The Big Auto Tractor Attachment

A Conversion Unit for Converting Large Touring Cars of Older Models Into Farm Tractors—Outfit Weighs About 2500 Lb.

TWO or three years ago, after the truck conversion unit for Ford cars had proved a great commercial success, similar units designed to convert Ford cars into farm tractors were placed on the market. These, however, do not seem to have proved as successful as the truck attachments, and little has been heard of them recently. One of the reasons undoubtedly is that the Ford passenger car engine hardly has sufficient power for operating even a two-bottom plow, if the soil is at all heavy.

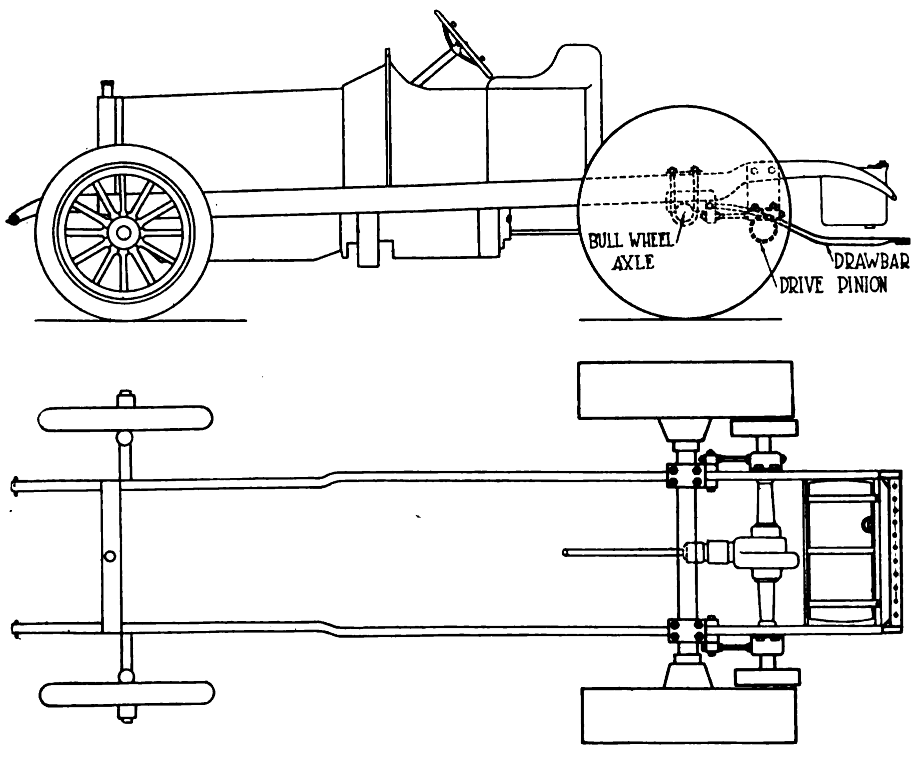
More success is likely to attend the effort to introduce a conversion unit for automobiles of larger type. Large touring cars of either the four or six-cylinder type, such as sold about six years ago at from $2,000 to $3,000, can now be "picked up" at a relatively low price. They are not sufficiently up-to-date to suit the requirements of the original owners, and they do not appeal to the man who is looking for a second-hand car because of their high cost of operation. The power plants of these touring cars usually are powerful and sturdy, as are their transmissions, and the material used in these machines was of the highest grade. Therefore, provided the engine is of sufficient capacity, so that when drawing its normal rated number of plows it will not be overloaded, and provided it is still in good working order, it should be capable of giving very satisfactory service.



Attachment applied to a Winton car

A conversion unit for transforming cars of the above described class into farm tractors has been placed on the market by the Big Auto Tractor Co., Minneapolis, Minn. Their attachment has been manufactured during the past two years, and has been supplied mainly to farmers who already owned cars of earlier models which were sufficiently powerful for the purpose. Attachments have actually been fitted to the following makes of cars: Glide, Buick, Packard, Russell-Knight, White, Inter-State, Hudson, Locomobile, Stearns, Case and Welch.

The design of the attachment may be studied by means of the accompanying illustration. There are two steel disk wheels, 48 in. in diameter, which are provided with internal gear rings, which are bolted in place. A 14-tooth spur pinion is secured to each end of the axle shaft, after the rear wheels have been removed. As the seat of the driving flanges or rear wheel hubs differ in all cars, these pinions have to be fitted separately for each make of car. To the car frame, ahead of the rear axle, is secured a 9-in. channel steel beam, to which is bolted a heavy cast iron bracket which receives the 3¼-in. round axle, the latter being closely fitted and pinned in place. This bracket is also trussed by means of two tie rods underneath. A flange at the rear of the bracket has holes drilled through it to allow of raising and lowering the drawbar, and there is another flange at the bottom of the bracket which has the radius rod connected to it, by means of which the mesh of the gears can be adjusted. A filler is inserted into the frame channels where the brackets go, and is held in place by means of heavy U-bolts. The object of these fillers is to strengthen the frame members. In addition to being adjustable up and down, the drawbar is provided with a number of holes in its transverse member, so that adjustment can be made to shift the draft.



Elevation and plan of converted machine, showing the general layout

On each end of the main axle is pro-

vided a thrust collar which takes the thrusts in both directions. A thrust collar cap is screwed on the outer end of the wheel hub so that the collar may operate in oil. Oil grooves are cut radially into the faces of the thrust collar, and provide for efficient lubrication of the thrust surfaces.

When the conversion from automobile to tractor is made, the rear springs of the car are removed, and are replaced by a heavy plate and angle, which insures a rigid connection between the frame and the spring plate on the rear axle housing. Vibration is taken up on a wood liner. The large roller bearing in the rear axle is utilized to take the pressure due to the transmission of power by the bull pinion. The internal gear ring secured to the driving wheel has 48 teeth, giving a reduction from the car axle of 6 to 1. The drawbar is attached to the axle bracket, and therefore is independent of the car body. It is suggested that a heavy open tool box be carried on the back of the car frame, which comes in very handy in plowing, as extra plow bottoms, chains, etc., can be carried in it.

Old Front Wheels Usually Retained

We understand that most of the users of the Big Auto conversion unit continue to use the front wheels with their pneumatic tires. In some cases these tires are filled with a so-called tire filler, which permits of their use until the tires practically are in shreds. The Big Auto Tractor Co., however, makes a wood felloe with steel tire 6 in. wide, to which is shrunk a skid ring, having a ¾-in. square section. The tire is 5/16 in. thick. The wood felloe is strongly built up and ironed. These wheels are special and are not included in the regular unit, the price of the wheels depending upon the conditions.

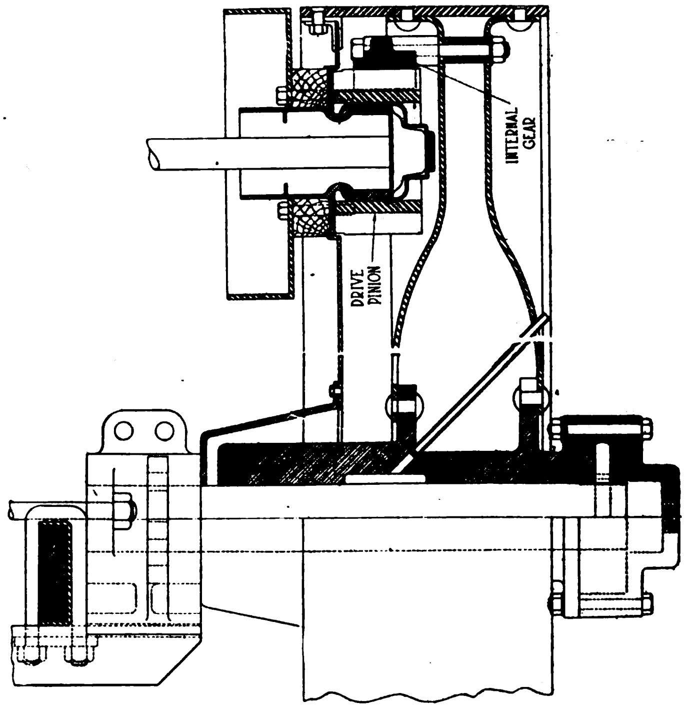
It has been found that when these large cars are used for tractor purposes, owing to the low speed at which they are operated, their cooling equipments are not adequate for the requirements. To overcome this difficulty an auxiliary tank is sometimes carried on the running board. This can be easily attached, and connected up in such a manner that the water circulated by the pump, after passing through the radiator, passes through the auxiliary tank on the running board, and then to the engine jacket. This increases the cooling area as well as the water capacity. To make up for the reduced air circulation, due to the low speed of the tractor, the fan must be geared up higher, which can be done by changing the driving pulley or gear, and, besides, it is advantageous to give the fan blades a larger angle, which can be easily done by means of a wrench. In some cases, where the cooling capacity is far from adequate, an additional fan has been installed in front of the radiator, and provided with a hood, to direct the air and protect the fan.

In designing the driving wheels, special attention has been given to the protection of the pinion and gears from dust and dirt. The gear wheels are protected on the outside by the solid disk of the driving wheel, and on the inside by a steel sheet with an accurately fitting opening for the pinion. This steel sheet does not revolve with the wheels, but is fitted close, and by the use of heavy grease all sand and mud is said to be excluded, the grease also serving as a lubricant for the gear and pinion.

Disk Wheels Stand Hard Service

The Big Auto Tractor Co. states that it developed a disk wheel after having in its early models used various kinds of spoked wheels with ill success. It was found that the spoked wheels would not stand usage on stony roads, but no trouble has been experienced with the steel disk wheels under such conditions.

The weight of the complete conversion unit is 2500 lb., and the average weight of a big car chassis stripped for the tractor as described is also about 2500 lb., making the total weight of the tractor 5000 lb. Of this nearly three-fourths is on the rear wheels, so that ample traction is secured under practically all conditions. It is stated that the conversion of a big car into a tractor by means of the unit described takes a handy man about one day. Occasionally he will require help from another person, especially in lifting. The tractor can be used not only for plowing, but also for hauling purposes, for road building and similar work. It has been found



Section through Big Auto tractor wheel, showing internal drive from old car axle

that the average period of use of a tractor in plowing is only 3 months per year. As the gear reduction from the rear axle to the tractor driving wheels is 6 to 1, and these wheels are larger in diameter than the car wheels, speeds of upward of 10 miles may be obtained with the tractor on the road, if the road conditions permit. With the semi-trailer attached, the tractor can be used for hauling grain and other produce to market. Where heavy hauling is required, three wagons carrying 3 tons each can be drawn by the machine. It is also possible to reconvert the car for touring purposes, but the advantage of this is not emphasized by the manufacturers.

The driving wheels revolve on a solid steel axle and have a bearing surface 16 in. long, which is lubricated by means of grease cups. Two types of lugs are furnished, a cone lug for plowing on sod and an angle lug for use on hard roads and soil. The latter, it is claimed, can be used on any street without damage. Both wheels have holes 4½ in. apart on each side, so that any type of lug can be applied. For use on very light or soft soil, extension rims can be attached.

Editor, AUTOMOTIVE INDUSTRIES: In your issue of Dec. 19, on page 1065, you have a little article stating "Goodyear Patent Is Not Infringed."

In the last paragraph of this you state that Firestone discovered new evidence in the form of a Belgian patent of 1906 and that a replica of the machine, the original having been purchased from Mathern in 1909, was set up in the court room. Now, this part of the information is all incorrect. The Belgian machine, issued under a patent to Mathern, was first introduced in this country by the Hood Rubber Co., who purchased the first machine. The machine was put into evidence, with affidavit of the writer regarding the facts, and was furnished to Firestone for entering into the suit.

The machine, following the decision, has been sold to the Firestone company, so that they could keep it in evidence for future suits.

The right to manufacture under this patent is held by the Hood Rubber Co. in this country. Furthermore, Firestone did not discover the evidence. It was offered to them through our attorney for their first suit in the lower court and was not accepted. There is no question but what the Mathern machine represents the machine building of automobile casings even prior to the time of the Seiberling and Stevens machines in 1904, having been widely operated in foreign countries prior to that time.—Hood Tire Company, Watertown, Mass.

Follow-Up System for Engineering

Checks Up Thirty Jobs at One Time—Cards Arranged To Indicate All Stages of Work

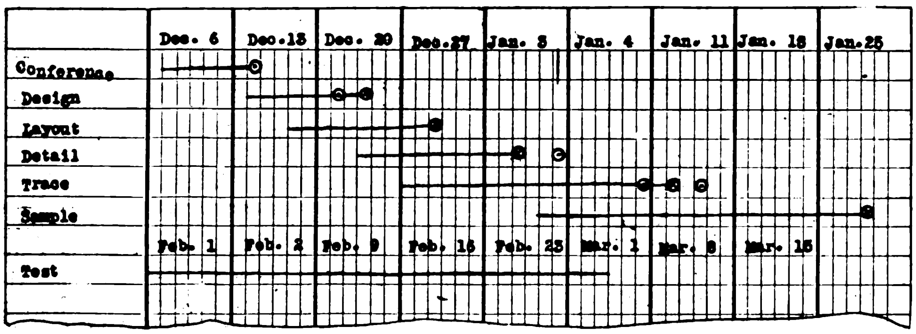
AN interesting system is in use by the Standard Parts Co., Cleveland, Ohio, to follow-up engineering, or any other work which requires definite steps of progression, from the time it is started until it is completed. The system is simple and at the same time allows an executive to follow up readily the different steps in his work. It is applicable to any kind of executive work, such as sales, production, collection, financial matters, etc. The system was invented by Major Lewis T. Kalb, who has now joined the Standard Parts Co. as an assistant to J. G. Utz, director of engineering. He used the system in the work of the engineering division of the Motor Transport Corps, where the great volume of work necessitated some such method of keeping in touch with the progress on different jobs, and at the same time allowing none to lag. There were over 350 persons employed in the engineering division of the Motor Transport Corps, including draftsmen, clerks, testers, etc., and this system was used for following up the design, testing, sending out of prints and keeping a record of all vehicles used by the Motor Transport Corps.

Kept Record of Thirty Jobs at One Time

By the use of this system as many as thirty different jobs were carried on at the same time and an accurate check-up of the progress of each maintained. In addition to the designed jobs there were perhaps sixty or seventy testing jobs and thirty or forty sets of specifications to get out. Naturally, it is impossible for the head of such a department to carry this work in his mind and some sort of follow-up is necessary. The scheme outlined herewith was found to be very satisfactory and is adaptable to a wide variety of uses. The method consists of the utilization of 5 by 8 in. cards for each job. On one side is typed all of the information pertaining to the work, such as specifications, the date of release, etc. The other side is ruled for a follow-up chart, as shown in the accompanying illustration. The horizontal rulings on the chart indicate the various stages through which the work must pass before it is completed, and the vertical rulings indicate periods of time, such as days and weeks. When the work is started the weeks are typed in, as shown in the illustration, designating each week by the month and date of the first day, or Monday. If the operations are definite and known in advance they may be typed at the time the job is started, or if definite steps are not certain they may be typed in as each successive stage is reached.

As each stage is reached the man in charge of this particular phase of the work is consulted and the probable date of completion is determined. This is shown by a bull's eye on the card. Each day that the work progresses a mark is put in the space for that day and for that stage of the work. It is thus possible for anyone to determine, by consulting the card, just how far along the job has progressed. It is possible to tell what stage it is in at the present and the probable date of completion, and in fact all of the important facts that the executive wants to know regarding it. The bull's eye makes it possible to check up when any definite period of time allotted for any stage of the work has elapsed and indicates whether that particular department of the work is up to or below its estimate. In this way it is possible to put on more men should they be necessary to insure the job being kept up to program.

It is very common practice not to look for a job until the date it is completed and then to find that the work has been neglected, or shelved for other jobs, with the result that the promised date cannot be met. In addition to acting as a follow-up system, the card also becomes a valuable record and furnishes a ready clue as to what can be expected in future jobs of a similar nature. The system, if desired, could be elaborated to indicate the number of men hours spent on any job, or the card could be used as a time record by key marks for the particular man on the job and accurately telling the length of time spent on the work. If not desired as an accurate time record, it could be used as a check against more complete time systems used by a factory. The real merit of the system is its simplicity and its ability to be used in a wide variety of applications.



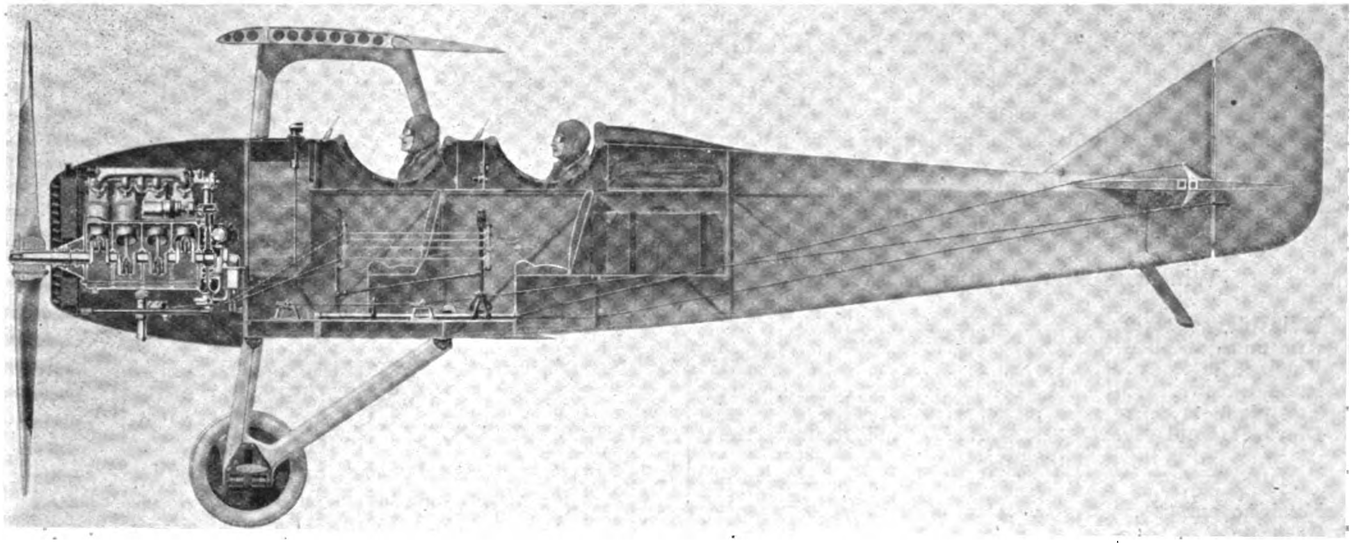
Typical card of the DeKalb system used for following up engineering and other executive work

Reconstruction Will Demand New Machinery

THE Oakland Motor Car Co., Pontiac, will not continue the manufacture of pants. The upholstery department of this concern was turned over to the manufacture of trousers for soldiers' uniforms during the war, but of course is swinging back to tops and seat covers, now that hostilities have ceased. The alterations necessary in getting into the war manufacturing program and back again to a peace basis have furnished an opportunity for revising the equipment which in the stress of previous competition did not exist.

Soon again the material market and the dealer organization will have been swung back into line and the old order of things will, in a large measure, have returned. There is going to be an interval before that time, during which manufacturing methods and machinery are going to be thoroughly rearranged so the best possible conditions for the commercial race will exist. Everywhere in the automotive world, particularly in the passenger car, truck and tractor fields, designers are busy on new products. As soon as these designs are complete and the experimental models have been carefully tested, production facilities must be arranged and manufacture started. This is going to mean the greatest demand for special machinery that the automotive world has ever witnessed.

AN inquiry has been received for C. K. Salisbury, writer of a letter on constant compression engines which appeared in AUTOMOTIVE INDUSTRIES for Nov. 28, 1918. If Mr. Salisbury will send us his address we will communicate it to our inquirer.



Sectional view through Packard plane, showing location of gasoline tank, baggage compartments, and the control system in pilots' and passengers' seats

Packard Exhibits Its First Commerical Plane

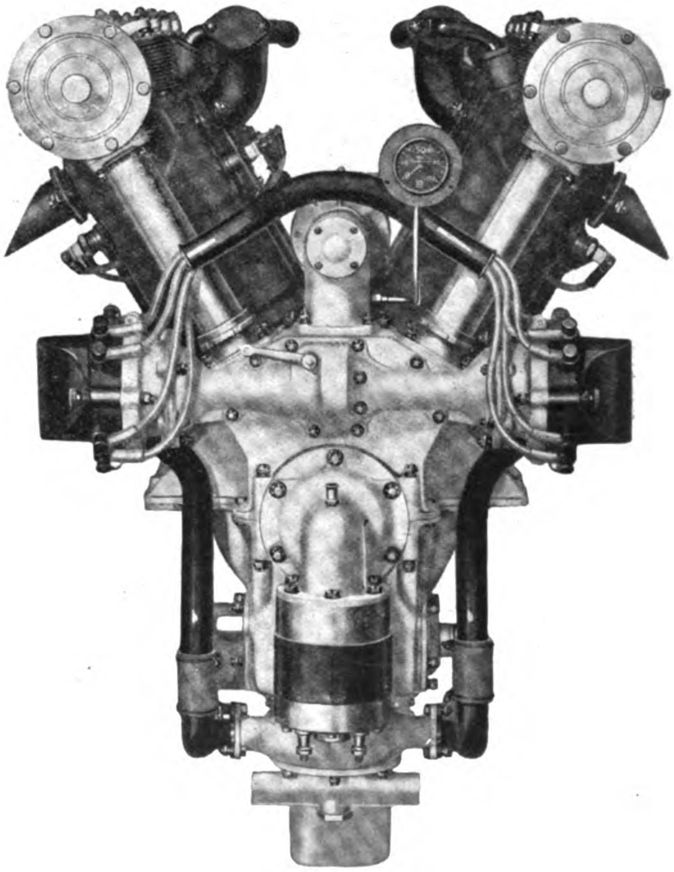
Has Line of Three Engines and Plane Designed to Take Eight-Cylinder Power Plant—To Be Marketed Through Packard Sales Organization

IMMEDIATELY after the armistice was signed the Packard Motor Car Co. began to consider the matter of turning its war experiences in the airplane field into commercial channels. The factory, having been tooled up and laid out for the production of Liberty aircraft engines and having already commenced the manufacture of the La Pere type of plane, found itself in an advantageous position to swing over to commercial airplane production should a demand be found for this product.

Based on the assumption that in this country there are hundreds of wealthy sportsmen to whom flying would appeal, the Packard company has already designed and brought out its first line of airplanes. These will be made at first in limited quantities and marketed through the Packard dealer organization. Some of the dealers have already placed their orders for planes and are now reporting sales to users.

In designing the planes and engines, it has been the aim of the engineering department of the Packard company to incorporate the best features of the Packard and Liberty aircraft engines developed before and during the war. It has been found possible to eliminate some of the objectionable features of the previous types, these largely having to do with installation difficulties. The changes have resulted in a material saving of weight in the completed plane, as well as giving greater simplicity in design and more reliability in performance.

Some of the important alterations may be mentioned. For instance, the carbureter is now located on the bottom of the crankcase, with the necessary intake passages carried through the case. This has resulted in a very low carbureter, making possible the use of simple gravity feed for all types of planes. At the same time the intake



Rear end view of Packard airplane engine, showing mounting of starting motor and generator location in V

SPECIFICATIONS OF THE PACKARD AIRPLANE

Powerplant

Packard eight-cylinder, 160 hp. engine; 160 hp. at 1525 r.p.m.
Weight, complete with propeller hub, self-starter, battery and engine water—585 lb.
Fuel consumption .50 to .54 lb. per hp.-hr., sea level.

Wing and Control Surface Areas

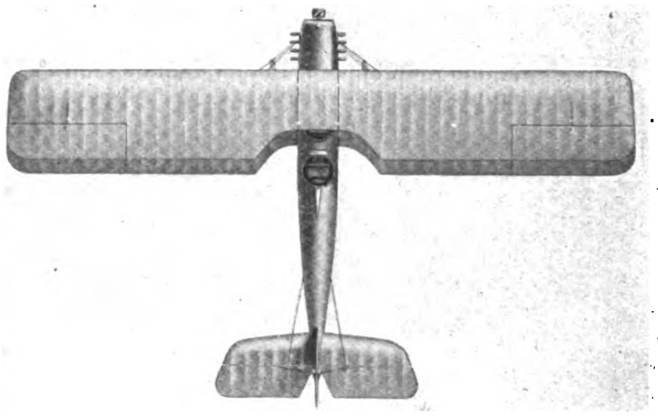
	Sq. Ft.
Main planes, total	387
Ailerons, total	48
Vertical fin	5
Rudder	11
Tail plane	30
Elevator, total	22

Weight

	Lb.
Machine empty	1520
Gasoline	210
Oil	30
Water	52
Tools and extras	25
Pilot	165
Passenger	165
Normal flying weight	2167
Weight, pounds per hp	13.5
Wing loading per sq. ft	5.6
Permissible extra luggage	100

Performance

High speed near sea level	102	m.p.h.
High speed at 10,000 ft	98	m.p.h.
Climb to 5000 ft	7.5	min.
Climb to 10,000 ft	18.1	min.
Climb to 15,000 ft	34.5	min.
Absolute ceiling	19,500	ft.
Fuel range wide open near sea level	2.5	hr.
Fuel range wide open at 5000 ft	3.0	hr.
Fuel range wide open at 10,000 ft	3.5	hr.
Fuel range wide open at 15,000 ft	4.0	hr.



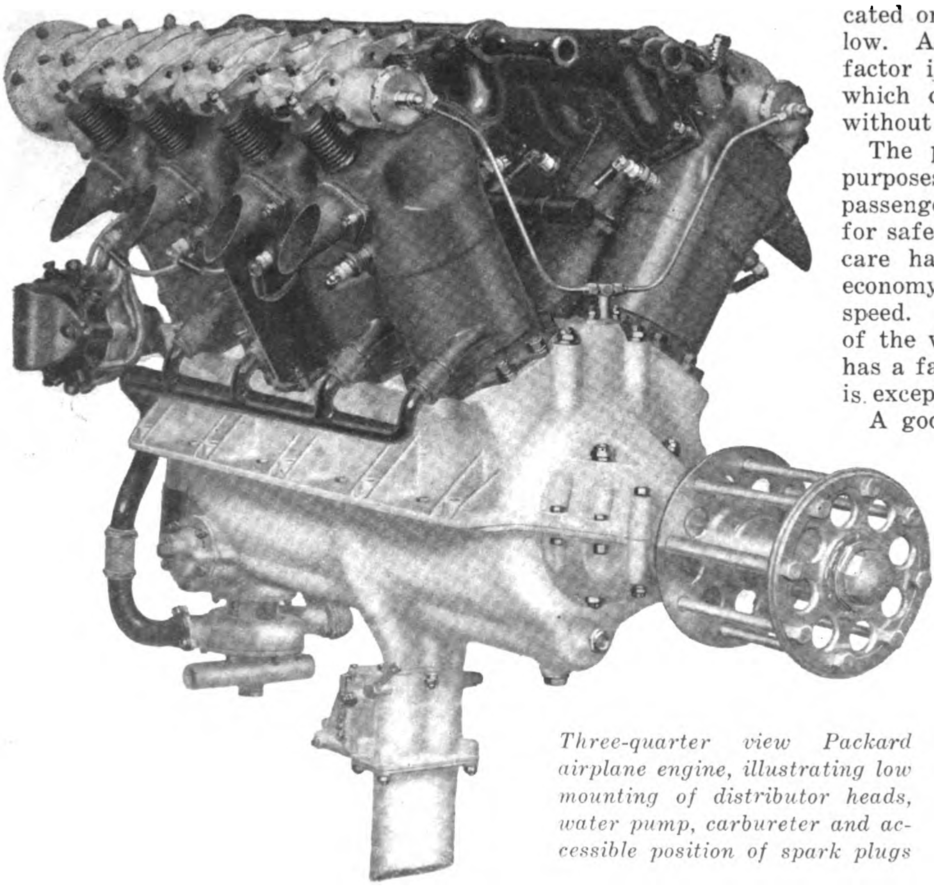
Plan view of the Packard airplane. Note the form of the planes and the visibility from pilot's seat

passages are kept properly warmed and the weight required for water-jacketing the intake is eliminated. Furthermore, removing the carbureter from the V leaves the space between cylinders entirely clear, giving greater accessibility for the spark plugs and providing for unusual vision.

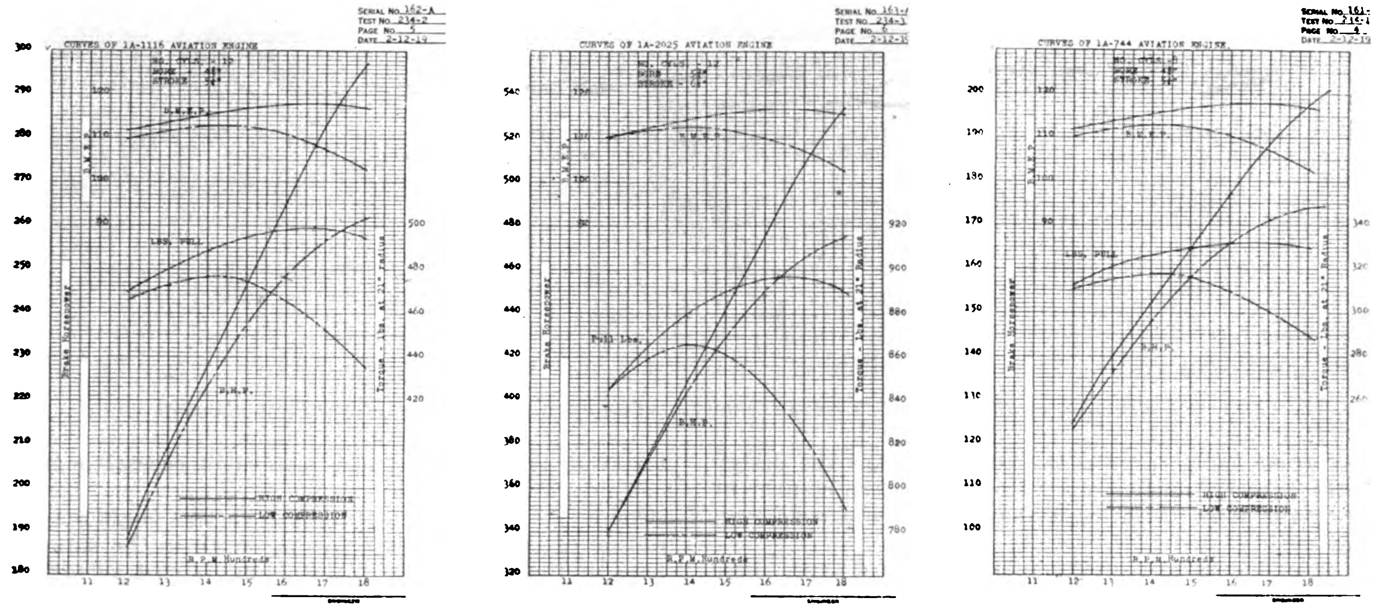
The water pump is located underneath the crankcase. The oil pump is located low down on the left side and the oil pump screen and blow-off valve are also located low on the right side. Another unit to be mounted lower than formerly thought possible is the ignition distributor head, the head for each set of cylinders being located low down on that side of the engine. All of these units are made very accessible for examination or adjustment through convenient openings in the engine cowl. The generator is placed in a saddle carrier in the V and is quickly detached for examination and adjustment. The starting motor is also very accessibly placed, being located on the rear of the engine and quite low. Accessibility has been made a prime factor in the design and there is nothing which cannot be reached with ease and without removing any other part.

The plane, being utilized for sporting purposes largely or for cross-country fast passenger transportation, has been designed for safety and speed, and at the same time care has been given to have reasonable economy and comparatively low landing speed. The plane is designed to make use of the very best materials obtainable, and has a factor of safety of over seven. This is exceptionally high in plane construction.

A good idea of the arrangement of the machine, which is a two-passenger biplane, is given by the sectional illustration herewith. It will be noted that a clothing compartment is provided, also a suitcase compartment to carry two suitcases, which will be found very convenient in cross-country traveling. The plane illustrated herewith has been designed around, and to be a complete unit with, the 1-A-744 engine, which is an eight-cylinder type of 160 hp. at 1525 r.p.m. The general specifications of the plane are tabulated herewith. The per-



Three-quarter view Packard airplane engine, illustrating low mounting of distributor heads, water pump, carbureter and accessible position of spark plugs



Performance charts of the three Packard aviation engines as calculated by the Packard engineering department, based on previous similar designs

formance, as will be noted from the charts, is estimated.

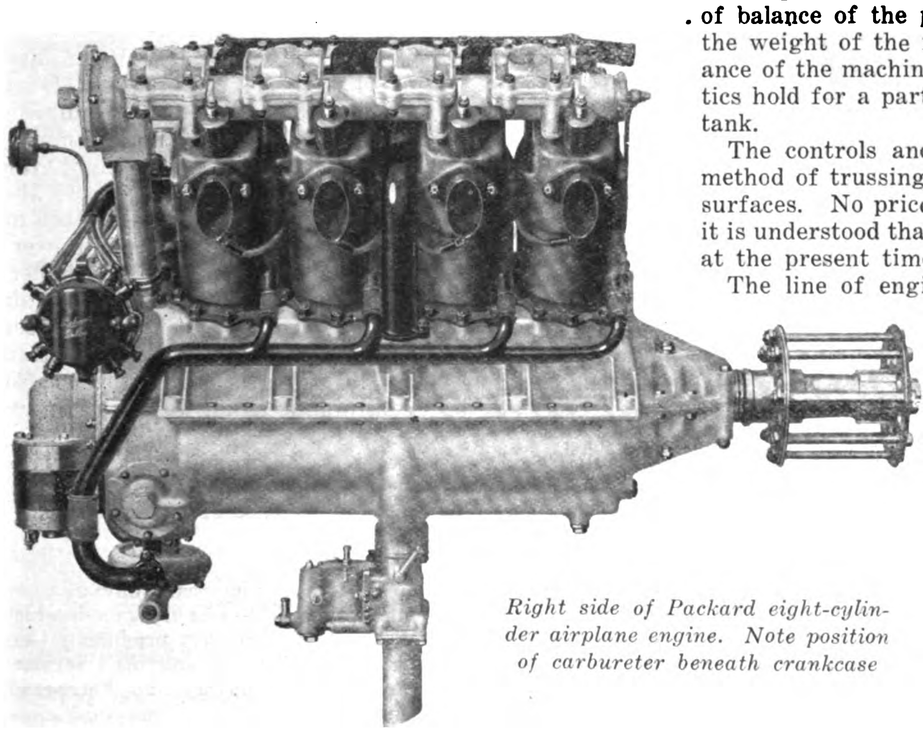
The Packard company is not in production on this plane at the present time, but it will probably go ahead with its manufacture, and in this event, before placing the plane actually on the market, exhaustive sand tests and other tests will be made under official supervision. Before any deliveries are made to customers a sand test will be made on each plane and a copy of the sand test report will be furnished to the purchaser, so that he may be fully informed as to the strength of the various units.

It is estimated that the plane will fly about 100 m.p.h. with full load on account of its comparatively light weight and clean-cut design. The landing speeds have not yet been determined, but it is claimed that they will be quite low and probably about the same as the usual primary training machine. To further facilitate landing in unknown and rough fields, the landing gear is located well forward to guard against nosing over and a rugged tail skid is provided to take care of unusual strains and shocks.

One of the features of the plane is the attention given to the comfort of the passengers. For instance, the engine is entirely housed in, making it impossible for oil or gases to blow back in the passengers' faces and the passengers are guarded against drafts by bulkheads on each side. This is a feature which will be appreciated by those who have been out in disagreeable weather.

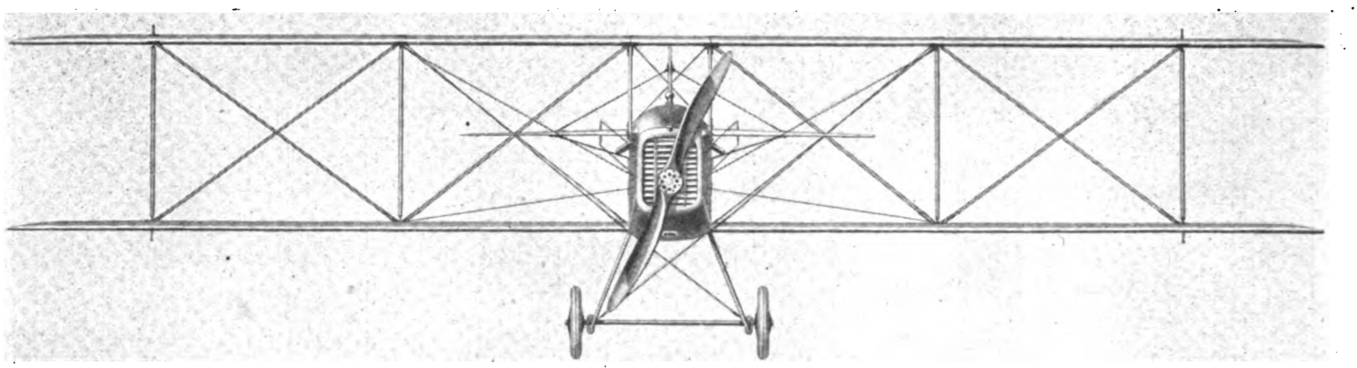
The rear cockpit is arranged especially for the pilot, but the necessary dual controls are provided, so it can be flown from the front seat, thus making it possible to use this machine for instruction work when desired. The controls in the front compartment can be lifted out quickly, making it impossible for the passenger to interfere with the control of the plane, should this be desired. The gasoline tank is located between the passenger and the engine. This location, at approximately the center of balance of the plane, takes care of the variations in the weight of the fuel without interfering with the balance of the machine, so that the same flying characteristics hold for a partially empty tank as well as for a full tank.

The controls and fittings are standard and a strong method of trussing is used to properly support the wing surfaces. No price has been set on the plane as yet, but it is understood that it will sell somewhere around $15,000 at the present time.



Right side of Packard eight-cylinder airplane engine. Note position of carbureter beneath crankcase

The line of engines includes three models of similar design. Two of the models, known as the 1-A-744 and the 1-A-1116, use the same 4¾ by 5¼ in. cylinders, the 1-A-744 being an eight-cylinder and the 1-A-1116 being a twelve. In addition, there is a larger engine, using 5¾ by 6½ in. cylinders, twelve in number. The general characteristics and arrangement of these engines follow along similar lines. They are all V-type engines having an inclined angle of 60 deg. The eight-cylinder type has a five-bearing crankshaft and the twelve-cylinder design has seven-bearing crankshafts.



Front elevation of the Packard airplane, showing wing span and absence of parasitic elements

In a great many respects the engines follow the design of the Liberty, particularly in respect to the manner of taking the drive off the crankshaft for the overhead camshaft.

The cylinders are of the individual steel type, these having been adopted on account of their lightness and because of the advantages of water circulation and easy valve cooling with this type. The pressed steel jackets are welded on in a manner similar to that employed on the Liberty engine.

The pistons are aluminum die-cast, equipped with a floating piston pin, and an arrangement of rings to prevent fouling of plugs when coasting down from high altitudes. The valve drive is similar to that used in the Liberty engine, being of camshaft and rocker arm type, the drive being taken off the crankshaft by a bevel gear and carried upward through a vertical shaft to the overhead camshaft. The valves are 2 in. in diameter in the clear, with 30 deg. seats. The intake valve lift is 7/16 in. and the exhaust 3/8 in. This large valve size is claimed to produce a very high mean effective pressure even at speeds of 1800 and 1900 r.p.m.

Performance Curves

The performance curves of the various engines are given in the chart herewith for both the high and low-compression cylinders. The brake mean effective pressure curves are shown for both compression ratios. These curves are calculated curves, but owing to past experiences with engines of this type will be found closely to coincide with actual results. The cylinders in this type of engine are exactly opposite each other, as the straddle type of connecting-rods are used, these rods having proved themselves satisfactory in the Liberty and other types of successful war airplane engines.

Lubrication is by full pressure feed, the system being very similar in many respects to the Liberty engine lubrication, the camshafts being taken care of by independent leads through the hollow shafts.

The engine is designed especially for the use of a nose type of radiator, but can be attached to any other type of radiator arrangement. The water pump is driven from the lower end of the vertical shaft and rests horizontally beneath the engine, allowing a straight lead to be carried back from the radiator. The water pump is equipped with an automatic spring take-up for the stuffing box and is readily accessible, due to the fact that it is clear of the engine beneath the crankcase.

Ignition is by the Delco system which incorporates the newest Delco improvement in which the head remains stationary and the spark advance is secured by advancing the drive shaft. Complete double ignition is supplied to two sets of spark plugs and the engine will function properly on either set. The location of the ignition distributor heads is such as to make them easily accessible from each side of the fuselage.

One of the important innovations in this engine is the location of the carbureter. As is shown in the exterior views of the engine, the manifolding is cast integrally with the lower half of the crankcase, thus permitting an exceptionally low location for the carbureter. Not only is this an advantage from the standpoint of being able to use gravity feed, but it also readily permits of the air intake being carried through the bottom of the plane, thus eliminating any danger of fire in starting a heavily primed engine.

The matter of weight has been carefully worked out in all three engines. The eight-cylinder engine weighs 520 lb. complete; the smaller twelve weighs 710 lb., and the larger twelve 1000 lb. The weight of the engine is given complete with the propeller hub, carbureter, ignition distributor heads, ignition switch, generator, starting motor and starting switch. To this may be added, for engine equipment, 40 lb. for the cranking and ignition battery and the weight of the water system. What this weighs may be judged from the eight-cylinder, in which the water contained in the cylinder jackets, pump and pipes weighs 25 lb. The radiator holds 27 lb., giving the total weight of 52 lb. of cooling water. For the eight-cylinder engine, which uses a 4-in. nose type of radiator of tubular type, the radiator weight is 73 lb.

The engine is 14½ in. from center to center of the bed timber bolts, the extreme width overall being 27½ in. The highest point above the bed timber is 20½ in., and the necessary distance between the radiator and front bulkhead for proper mounting 34 to 36 in., these dimensions applying to the eight-cylinder. On the smaller twelve, employing the same cylinders as the eight, the engine is 12 in. longer. On the larger twelve with the 5¾ by 6½ in. cylinders, the center to center distance of the bed timber bolts is 16¾ in.; the extreme width overall, 30½ in.; the highest point above the bed timber, 23½ in., and the necessary distance between radiator and front bulkhead, from 52½ in. to 54½ in. The nose radiator in the case of this engine is 5 in. thick instead of 4 in., and weighs 110 lb. This is one of the largest aircraft engines designed to date, but it is very compact.

ALTHOUGH all private use of automobiles was prohibited in Great Britain last year, that country imported 193,074,560 gallons of gasoline, an increase of nearly 54,000,000 gallons over 1917.

IN Helsingfors, the capital of the new Scandinavian country, a Finnish Air Traffic Co., Ltd., has been formed, which will in co-operation with the large aircraft producing German firm, A. E. G., run daily passenger and mail services between Helsingfors and Riga, Helsingfors and Petrograd, and Helsingfors-Stockholm via Abo.

The Altitude Engine Test Laboratory

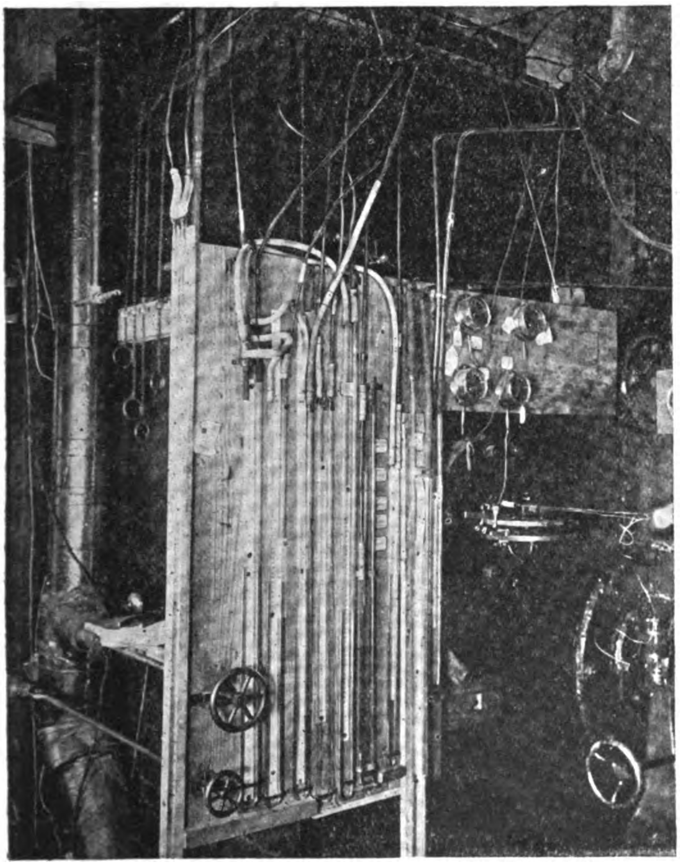
Installed for the Advisory Committee of the Bureau of Standards to Make Tests on Airplane Engines Under Conditions Duplicating Those Met With When Flying at High Altitudes

By P. M. Heldt

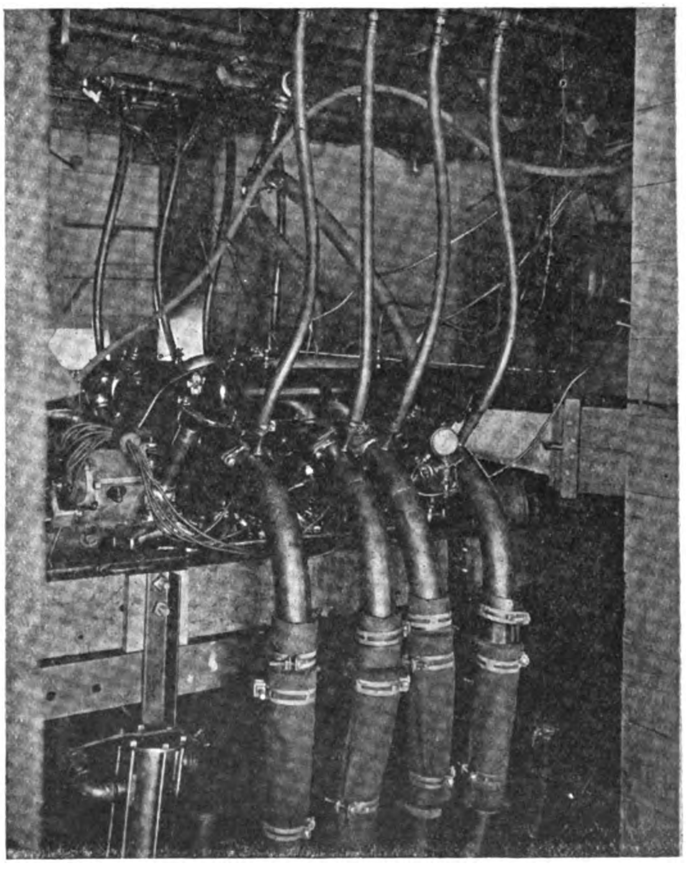
AIRCRAFT engines are required to operate mainly at high altitudes, and the performance of an engine under the conditions of low atmospheric pressure and temperature obtaining at these altitudes largely determines its practical value for aircraft work. It is as yet impossible to make complete tests on an engine during a flight. After the first experimental models of the Liberty engine had been completed, two sample engines were taken to Pike's Peak, Col., and tested out there. This, however, is a rather remote place, and besides the top of this mountain does not represent the limit of altitude to which airplanes are required to ascend. So it was decided to construct an "altitude chamber" at the Bureau of Standards in Washington in which conditions of engine operation at high altitudes could be closely reproduced. The altitude laboratory was completed more than a year ago, and has been in almost continuous use since, although some changes have been made in the equipment from time to time which facilitate the tests and tend to give more accurate results.

The altitude laboratory consists of an airtight chamber of reinforced concrete from which the air can be exhausted to such an extent as to reduce the pressure within to about one-third atmosphere, if desired, a centrifugal Nash turbo-blower being used for this purpose. While the pressure of the air within the chamber is being reduced, its temperature is at the same time lowered to a degree corresponding approximately to that observed at the altitude which is to be simulated. This necessitated the installation of refrigerating apparatus in the form of a set of coils located within the chamber, over which the air is passed by means of electrically driven fans. These fans keep the air within the chamber in constant circulation, thus tending to facilitate dissipation of the heat given off by the engine and to maintain the temperature of the air constant throughout the chamber.

The power developed by the engine is measured by an electric cradle dynamometer located outside the chamber, which is connected to the engine by means of a flexible shaft. All of the devices required for making temperature and pressure observations are mounted outside the altitude chamber and are connected to the engine by means of tubes, wires, etc., extending through the chamber wall. Means for the control of the engine are also located outside the chamber, thus enabling the tester to vary the conditions of operation.

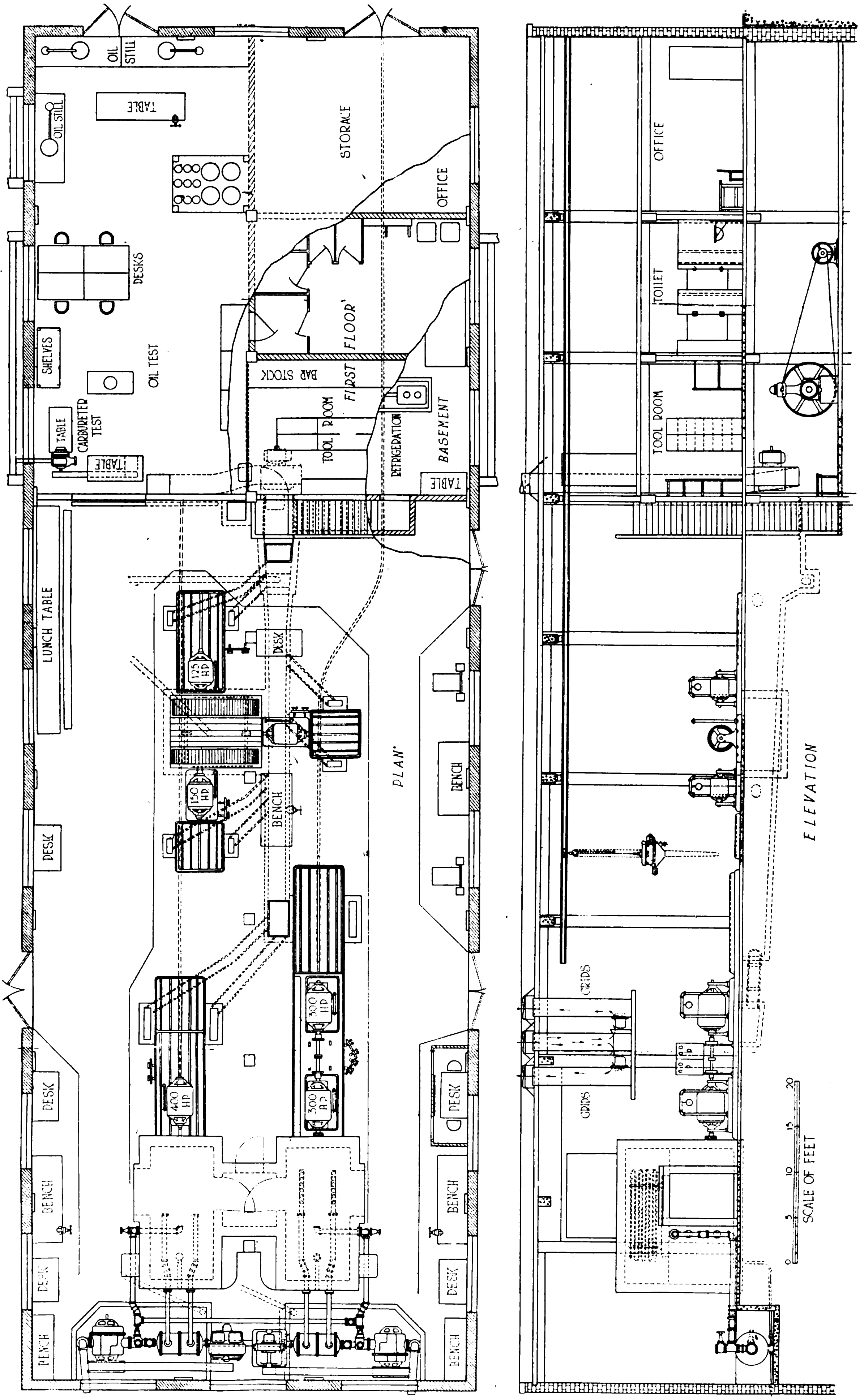


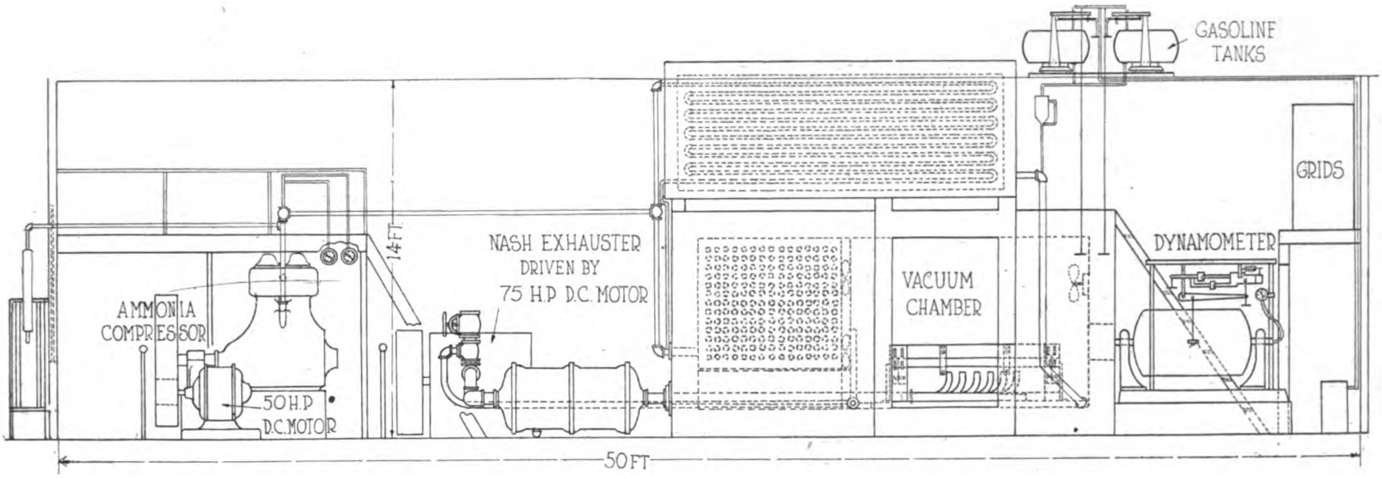
Pressure gage board of altitude chamber



Liberty engine in vacuum chamber

Plan and Elevation of the New Altitude Laboratory





Elevation of the present altitude chamber, Bureau of Standards

Originally, because of the haste with which the installation had to be made, the altitude chamber was installed in a temporary frame and stucco structure 24 x 50 ft. in dimensions. Later on, however, the present altitude laboratory, together with a duplicate one, will be installed in a concrete and brick building especially designed for the purpose.

Roominess Essential

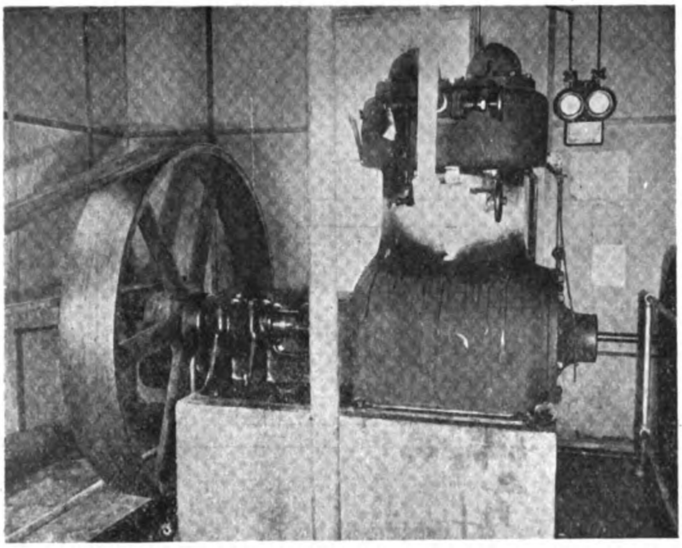
In order that the results obtained may be dependable it is essential that the entire engine should be surrounded by air at a temperature and pressure equal to those at the altitude for which the tests are to be made. This made it necessary to lay out the chamber of such a size as to accommodate the largest size engine which would ever have to be tested, as well as the necessary accessories and auxiliary apparatus. It was further necessary that the chamber should be sufficiently roomy to permit of an operator working around the engine between tests. It was found that this called for a space 6 ft. 2 in. in width, 15 ft. in length and 6 ft. 6 in. in height, and the chamber was accordingly made to these dimensions. In deciding upon the thickness of the walls and the form of construction to use, it had to be borne in mind that with the pressure of the air within the chamber reduced to one-third of atmospheric, there would be a very strong pressure tending to crush the walls in, besides which it was of course necessary to insure airtightness. The walls were accordingly made of reinforced concrete, 1 ft. thick, the reinforcements consisting of ¾-in. steel bars. There are two entrances to the chamber, on opposite sides, each 4 ft. by 6 ft. 6 in. These are closed by doors made up of 2 x 7-in. oak beams spaced 7 in. between centers and are covered on the outside with ½-in. soft wood boards, over which there is a covering of airproof roofing paper. These doors are swung on hinges and are fitted with heavy rubber gaskets to insure an airtight joint. In designing the doors the possibility of an explosion in the chamber was kept in mind. The oak beams form a sort of grid which is covered by the thin soft-wood boards on the outside, and if an explosion should take place within the chamber these boards would be torn from their framework, thus preventing injury to the walls of the chamber. Each door contains a small window through which the engine can be observed while under test. In order to reduce the transmission of heat, the walls of the chamber are provided with a cork lining on the inside and to minimize air leakage they are painted with heavy asphalt paint on the outside.

The engine test stand is located at one end of the altitude chamber and the cooling coils occupy the other end. It has already been stated that all of the engine controls as well as connections to pressure gages, thermometers, etc., are carried through the walls of the chamber. These rods, pipes, etc., must be carried through the walls in such a manner that there can be no air leakage through the openings. To this end each hole is closed by a flange and gasket. This applies also to the larger pipe connections, such as the inlet pipe to the carbureter, the exhaust pipe from the engine and the ammonia pipes to and from the cooling coils.

In designing the altitude laboratory the aim was not only to duplicate as far as possible the conditions of atmospheric pressure and temperature encountered at high altitudes, but also those of the nonrigid engine support furnished by the airplane fuselage. A form of engine support was designed which permits of adjusting the limits of engine vibration in both the vertical and transverse planes and around the three principal axes of the engine. Of course, no reliable data were at hand as to what the amplitudes of vibration in these planes and around these axes amount to in actual flight, so an estimate had to be made, and officials of the Bureau believe that the actual conditions of engine support on an airplane have been very closely duplicated. The engine support may be briefly described as follows: Two 2 x 6-in. oak beams, 6 ft. 3 in. long, are secured to the flooring at their ends. To these are bolted two supplementary beams, of 2 x 4 in. cross section and of a length differing with the engine under test. Where the supplementary beams are bolted to the other beams thin separating blocks are inserted between them. Means in the form of yokes are provided to prevent twisting of the individual beams. While the oak beams forming the base of the engine support were described as of 2 x 6-in. section, this section can be varied, and in this way a change in the vertical and lateral stiffness of the support can be effected. To vary the stiffness of the support as regards rocking motion around the axis of the crankshaft, a third beam of suitable dimensions can be rigidly secured to the yoke rods if desired. This, however, has not proved necessary.

Duplicating High-Altitude Engine Operation

In order to fully duplicate the conditions of engine operation at high altitudes with respect to temperature, it is not sufficient that the air within the test chamber should be cooled to the required degree, but the air drawn into the carbureter must also be reduced in temperature. To produce this refrigerating effect, a two-cylinder, 9 x 9-in. vertical ammonia compressor, having a refrigerating capacity of 25 tons in 24 hours, is installed at one end of the building. This compressor is belt-driven from



Refrigerating machine of altitude laboratory

a 50-hp. electric motor. Next to the compressor is located the ammonia condenser, the plant operating on what is known as the direct expansion principle.

While a single compressor and one condenser handle all of the ammonia used in the refrigerating operation, two sets of cooling coils have to be provided, of course. In addition to the cooling coils within the altitude chamber there are coils for cooling the carbureter air, which are located on top of the altitude chamber. These coils consist of 2000 ft. of 1¼-in. pipe, and are enclosed in a box with 4-in. sawdust insulation. The air, in passing through this box, follows an undulating path, which gives it a better chance to give up its heat to the cooling coils, and from the box the air passes to the inlet pipe connection in the altitude chamber wall through an insulated pipe in which there is a control valve. An air meter is incorporated in the line between this valve and the carbureter.

Five Fans Maintain Air Circulation in Chamber

The other cooling coil, that within the altitude chamber itself, contains 800 ft. of 1¼-in. piping. To maintain a strong circulation of air within the altitude chamber five motor-driven fans are installed, of which four force the air directly over the cooling coils, while the fifth may be used to maintain a strong circulation of air over the engine. The cooling capacity of the coils is such that the temperature of the air entering the carbureter may be reduced to that corresponding to an altitude of 30,000 ft. The air in the chamber cannot be maintained as cold or thin, but can be reduced to below the freezing point with an engine in operation.

However, the refrigerating plant does not afford any means for quickly and accurately controlling the temperature of the air. So, in order to permit a close temperature regulation of the air admitted to the carbureter, this air is passed through a series of electrically heated grids, by means of which its temperature can be raised again. The amount of heat imparted to the air by these grids can be accurately controlled by switches.

Some difficulty has been experienced in the past from condensation of moisture which entered the air after it had been refrigerated, and which occasionally choked the carbureter inlet and the valves. In the new installation it is hoped to overcome this difficulty by passing the air, on its way from the refrigerator to the carbureter, through a settling chamber, through which it will move so sluggishly that practically all of the snow will get a chance to settle.

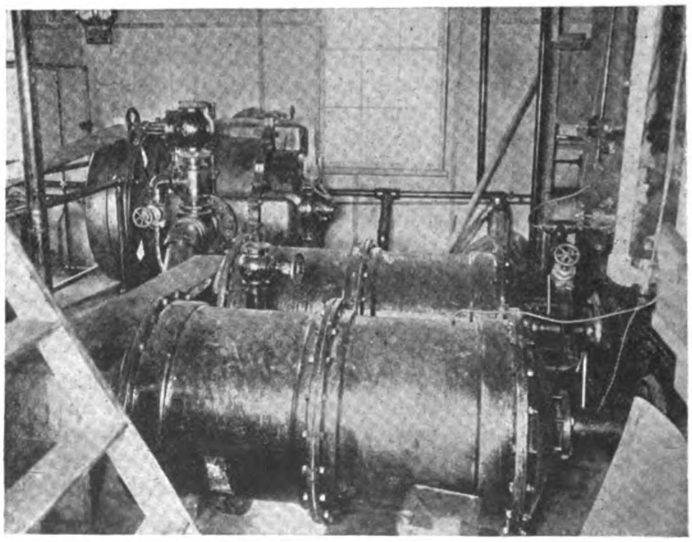
When an engine of several hundred horsepower is being operated at full load in a small closed chamber a great amount of heat is necessarily given off to the surrounding air. In order to reduce to a minimum the heat thus given off to the air within the chamber, the exhaust pipes are water-jacketed. Water is also mixed with the exhaust products in the exhaust pipes, with the object of reducing their volume and thus making it easier to handle them. Just outside the altitude chamber are located two auxiliary exhaust tanks, into which the exhaust products are discharged through two 5-in. pipes. The water condenses in these tanks and is drained off, while the non-condensing gases pass to the exhauster.

Exhausting Into Vacuum

There is one other condition besides those already mentioned which must be fulfilled in order to closely simulate engine operation at high altitudes, and that is that the engine must exhaust into a rarefied atmosphere. It is this condition which makes necessary the use of exhaust tanks. The two auxiliary exhaust tanks are connected to the 6-in. main of the exhaust pump, to which the altitude chamber is also connected by a 3-in. pipe. Hence the pressure within the auxiliary exhaust tanks is at all times substantially the same as that within the altitude chamber. There is a regulating valve on the main, close to the exhaust pump, opening the main to the outside air, by which means the degree of vacuum can be easily and accurately adjusted without varying the speed of the pump.

The exhaust pump used is driven by a belt from a 75-hp. direct-current electric motor, and has a rated capacity of 1500 cu. ft. per minute, with a 12-in. vacuum when running at 300 r.p.m.

All of the gages and engine controls are mounted on two instrument boards at one corner of the altitude chamber. These boards are so arranged that one man can control the operation of the engine and at the same time conveniently read all the gages and other instruments. Following is a list of the instruments on these boards: Five venturi gages for carbureter air inlet, gasoline supply line, jacket water, exhaust cooling water and oil-cooling water respectively. Eight pressure gages, for carbureter float chamber pressure, exhaust back pressure, carbureter choke pressure, average pres-



Exhaust pump and exhaust separator tanks

sure in exhaust manifold, difference between carbureter air venturi and chamber pressures, average pressure in inlet manifold above carbureter choke, difference in pressure between entrance to carbureter and chamber, and difference between exhaust pressure and pressure within chamber respectively; also a barometer, auxiliary barometer, thermometer and indicator showing fluctuation of chamber pressure. In addition to the instruments here enumerated, which may be regarded as part of the permanent laboratory equipment, any gages or indicators forming part of the equipment of the engine under test are also mounted on the instrument boards, as well as an ignition switch and a tachometer.

Measuring Torque

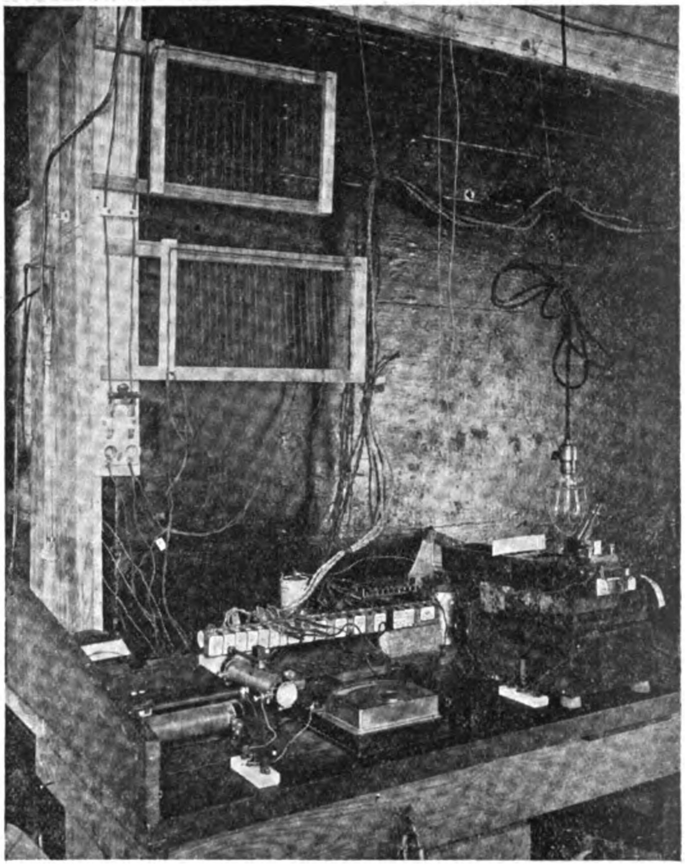
The dynamometer, which is of Sprague make, and of 300 hp. capacity, is of a type that has already been described in AUTOMOTIVE INDUSTRIES. Ordinarily, the torque is measured by means of weights placed on a scale on which rests the torque arm, secured to the field frame of the dynamometer. In addition there is a spring balance which is interposed between the scale beam and the torque arm of the dynamometer, this latter being handy for taking torque readings when no great accuracy is required. The energy absorbed by the dynamometer is dissipated in resistance grids placed outside of the building, or it may be turned into the regular power circuits of the Bureau of Standards. A hydraulic brake is mounted coaxially with the electric dynamometer, and may be coupled to it when it is desired to test engines of greater power than the capacity of the electric dynamometer. The valve for controlling the hydraulic dynamometer is placed close to the switchboard from which the electric dynamometer is controlled.

Duplicate means are provided for measuring the amount of air entering the carbureter. The first consists of what is known as a Thomas meter, an electrical device by means of which the air is heated and the temperature of the air taken before and after passing the heating element. Then from the amount of heat energy imparted to the air, as calculated from the voltage and current consumption of the heating element, the rise in temperature of the air as obtained from thermocouples placed in front and behind the heating element, and the known specific heat of air, the amount of air passing in unit time can be calculated. Changes in the amount of air flow can be compensated for by a change in the electrical energy supply to the heating element or grid, and the temperature rise thus maintained constant. The other means for measuring the amount of air passing to the carbureter consists of a venturi meter, comprising the usual form of venturi tube with connections leading to the instrument board.

Thermocouples Measure Temperature

Temperature measurements are made practically exclusively by means of thermocouples, of which no less than twelve are installed for measuring the following temperatures: Oil-cooling water, carbureter air at entrance to venturi meter, jacket water at inlet, jacket water at outlet, exhaust cooling water at inlet, exhaust cooling water at outlet, altitude chamber temperature, oil temperature at engine inlet, oil temperature at engine outlet, carbureter air between carbureter and air horn, inlet manifold and gasoline.

The thermocouples, of course, are located within the altitude chamber, while the switches and potentiometer of the temperature measuring system are mounted on a board on the side wall of the chamber. In order



Temperature measuring equipment in altitude laboratory

to obviate or minimize the effect of engine vibration on the galvanometer the latter is swung in a cradle mounted on a concrete pier.

Alternate methods are also provided for measuring the fuel consumed by the engine during a test run. One of these consists in the use of a calibrated volume tank, the other in the use of a pair of tanks mounted on platform scales. The first method is used when it is desired to determine the volume of fuel consumed, the latter when the weight is desired. The weighing tanks are most suitable for use in making a continuous test, as one of the tanks may be filled while the other is being emptied. This arrangement is also found very convenient when making a comparison of different grades of fuel. The two tanks are then filled with a standard fuel and with the fuel to be tested respectively, the engine is first run on the standard fuel, after which it is switched onto the tank containing the fuel under test, and after the run has been made on this fuel it is switched back to the tank containing the standard fuel. For the main fuel supply there are underground tanks, while the measuring tanks are located on a platform adjacent to the altitude chamber.

The new altitude chamber now under construction will be a double one, and will differ from the original one in several respects. Instead of placing the refrigerating coil at one end of the chamber it is placed under the ceiling, which allows more space for working around the engine. The two chambers are placed adjacent to each other, and can be brought into communication by opening the two doors at the ends of the communicating passage between them. This permits of testing engines of very much greater output than were contemplated when the original chamber was designed, as both exhaust pumps and both cooling coils can be operated with only a single engine under test.

Benevolent Enterprises and High Wages Offer No Solution of Labor Problem

By Harry Tipper

THE quotation below, taken from the *New York Times* of Friday, Feb. 28, concerning the strike of taxicab chauffeurs, has been called to the attention of the writer with the request that he comment upon this case:

> The company has had at all times very radical views with regard to the rights of labor, and it has always paid higher wages and given better working conditions than any other enterprise of a similar character in the city. In order to avoid any injustice, the drivers, encouraged by us, formed their own association, and it was agreed that only members of same could be employed by the company, making it thereby a closed shop in the best acceptance of the term. In addition to this the association collected $1 a month from each member, and had benevolent features covering sickness and death.
>
> In order to increase the association funds the company itself has donated regularly 25 cents for each dollar subscribed by the drivers. It elects every six months, by secret ballot, its own officers, and it has been a rule of the company that, when a driver was charged with a violation of the company's rules, he was tried before the association committee and representative officers of the company, and a final appeal to the president has always been allowed.
>
> It has unfortunately worked out in practice that this association, created with the best and fairest motives in the world, has failed in its mission, and the elected representatives of the drivers do not, for reasons best known to themselves, assist in arriving at any just and satisfactory verdict on any particular case, but constitute themselves purely and simply, no matter if they know the man before them guilty, counsel for the defense. It has come to such a pass that if a man, after a full and patient hearing, is dismissed from the service a strike is immediately threatened.

There have been several quotations at various times where manufacturers, and other men who are interested in the study of labor problems, have asked for comment upon cases similar to the above, where they allege that the fair and even generous treatment of the employees by employers has not sufficed to institute a stable labor condition and that the demands of the men in the face of such treatment have been manifestly unfair.

It is obvious that this is the case viewed from one standpoint, although conversation with the leaders of the men in most of these cases would indicate that they are not aware of their unfairness, and that they have considered the course of events justify it.

It has been pointed out in a number of these articles, however, that labor organizations have been concerned with a growth of control in the government of their own conditions of work, and as their power has grown they have attempted to seize more and more of this control. It has also been pointed out that at the beginning of the factory system, which arose coincident with the industrial revolution, the employer absolutely controlled all the conditions of work and the employee had no voice at all, even to the slightest degree, in his own affairs. From that time the employer has been concerned with retaining as much as possible of his former control, giving up a point here and there only as circumstances necessitated it.

At no time in the history of the matter, except in a few individual cases, has there been any attempt at agreement, or any desire to arrive at a common point of view on either side, and, in consequence, what may appear to the manufacturer to be fair and even generous treatment of his employees may be regarded by the employees as a merely additional protective measure, or an attempt to fasten the control still more firmly in his own hands.

Labor Takes Improved Conditions for Granted

This is the case to such a degree that no endeavors to improve the housing, the welfare, or the sanitary conditions or to take a benevolent interest in the surroundings of the employees have been of any value in materially altering the labor point of view. It does not appear to be understood by the manufacturer that in the tenets of the labor organization good housing conditions, comfortable living, sanitation and education and a reasonable opportunity for enjoyment are laid down as the rights of the worker. They are not conceded as generosity on the part of the employer but they are demanded by the worker as rights of which he has been too long deprived, and which he is justified in securing and assuring to himself no matter at what cost. It is, however, a part of the creed of the labor organization that the worker should exercise complete control of his working conditions, and this again is demanded by the worker as a right of which he has been deprived and not as a concession which he desires.

In effect, all that the company has done in the case of this chauffeur strike was to create within its own organization a labor union of its own employees to take the place of the general labor union to which the chauffeurs might belong. The encouragement which they have given in the formation of a benevolent association among their men for sickness and death benefits is of no more importance than similar associations in the general labor bodies. The payment of higher wages and even the donation of a certain amount of company funds for this benevolent enterprise are not, in themselves, incentives or a closer co-operation between the employer and the employees, and what is more, a closer study of the history of labor troubles would have informed the company that such benefits to their employees would not in themselves provide any solution for their labor troubles.

To organize employees into a labor organization does not improve their loyalty to the concern. Neither does

it provide any basis for clearing away the suspicions which have been created by the divergent views and traditions, and it does not in the least remove the desire of the worker to exercise a more complete control over his working conditions.

Capital's Disappointment Due to Misunderstanding

It is to be noted that the company has expressed its disappointment at the ungratefulness of the worker, but that expression of disappointment can be attributed to nothing else than a lack of knowledge of the employee's point of view and the history of his organization growth.

An impartial study of the whole development of labor organization, of the history of strikes, both general and individual, would have shown that the improvement of labor conditions from decade to decade did not mitigate the severity of the labor demands in the slightest degree, but only added force to these demands by virtue of the increased strength of the organization.

It is not the change in the physical conditions of labor, nor the payment of higher wages, nor even a degree of paternal interest in the employees' welfare which will have any bearing in the settlement of labor difficulties; for the reason that they simply serve to emphasize the distinction between capital and labor and, therefore, widen the split between employer and employee. They do nothing to clear away the suspicion, the opposing ideas, the misunderstanding which exists on both sides. It is not by such means that the worker and the employer can be drawn together and present a unified organization, working for the common purposes of more efficient production and distribution.

Where this organization has failed to produce harmonious relations between itself and the chauffeurs has been in its failure to recognize the fundamental fact that human unity depends upon a common responsibility, commonly shared.

It is true that the character and class of workers employed in such a company, being as a rule less intelligent than the skilled mechanic and not so well informed, can be dealt with only when greater care and ingenuity are exercised in the formation of the organization, and in the determination of their responsibility in connection with it. This difficulty, however, does not alter the necessities of the case. It merely increases the demand upon the executives, by requiring of them a greater measure of wisdom in their operations, and a much greater degree of patience in working out organization changes so that they have time to go into effect.

It is obvious that where workers are of a less stable character, belonging to the rougher elements, and without the general information which is to be found among the skilled mechanics and similar classes, it requires a great deal more patience and study, and a great deal more time to work out organization changes to the point where suspicion and misunderstanding have been cleared away and confidence has been established.

Wanted—The Labor Point of View

In any case the time for complaint has gone by. Constant reiteration of the fact that the workers' demands are unjust will not improve the situation. Complaint about the attitude of the worker is not only ineffectual but foolish. It is like any other criticism which does not offer any hope of reconstruction. The newspapers carry their news of strikes in different countries; of industrial conferences under governmental auspices in Great Britain; of proposals for the same thing in this country, the breakdown of the industrial system in European countries and of the enforcement of demands by workers which involve political changes.

These things all speak for themselves. They show the necessity for the consideration of the labor question and the consideration of some organization which will offer hope of harmonious relations without the violent overturn that is growing in some parts of the world, or without the extreme political changes which are advocated by large and powerful bodies even in this country.

This necessity for consideration, if the employer of to-day is to find a solution which will permit him to go ahead with his production work, goes right back to the ceaseless human demand for a larger share of responsibility in the government of its own destinies. This demand has been the source of political changes which have given an entirely new aspect to government in the last three hundred years. It has been transferred from political to industrial government, so that the demand of the worker to-day is for more control of his working conditions and more effective political action in respect of his social necessities. This demand will continue to grow unless the manufacturer meets it by arranging voluntarily to follow the action of some of the individual organizations where arrangements have been made to include the worker, through properly organized systems, in the discussions and decisions in regard to matters affecting his working conditions, making him responsible equally with the employer for such conditions and giving him an opportunity to share in some measure the responsibilities and the rewards of the organization.

Responsibility and Confidence Demanded by Workers

It is not enough to pay high wages, and it is not enough to invite the worker to share in the decisions affecting his conditions. Responsibility must be given, and the reward for that responsibility must also be included. The most successful operations of this kind have included both, and it is significant that the comment of the workers in these individual organizations has continually opened up with the statement that this organization was "on the square," or "on the level," or some similar expression designating the removal of suspicion.

The most difficult thing to establish and the one thing most necessary in the development of an orderly industrial organization is the demonstration among the workers of the fairness of the company's policy and operations, and it constitutes in the minds of the workers the most important basis for satisfaction, as evidenced by the fact that this point is always brought out by the workers as the first and most important accomplishment.

This necessity for clearing away suspicion and establishing confidence demands a great deal of understanding on the part of the executives or representatives of the employers who have the matter in hand. It demands a study of the reasons for the suspicion, of the ideas which permeate the worker's mind as to what he ought to have and what his rights in the case are. It demands a knowledge of the strength and weakness of the labor movement, and an understanding of the workers which should be keener than any understanding they themselves possess.

The ignorance of labor organization movement, its history and its development and the reasons for its present tendencies which exist among employers, is one of the greatest barriers to any solution of the labor problem which exists to-day. The tendency to regard it in the abstract, to view it entirely from the prejudice of the individual experience, from impressions received through reading more or less inaccurate propaganda, and from the activity of extremists make it difficult to establish any organization methods which will be successful. The attitude toward the matter is then determined by such a background.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, March 6, 1919 No. 10

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 2727

Cable Address - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - - - - One Year, $3.00
Canada - - - - - - - - One Year, 5.00
Foreign Countries - - - - - - - - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation. Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907

The Consulting Engineer

THERE is need in this country for a broader and more frequent use of the consulting engineer. It is too frequently the case in the automotive industry that a plant does not call in a consulting engineer until it is confronted by some knotty problem in production or design.

It is rare that the consulting engineer is called in to help paint the general picture of what a new model shall be.

The consulting engineer fulfills many requirements in assisting to help solve immediate problems, but this is only one of the ways in which he should be utilized.

The consulting engineer should have at his fingers' ends the best practice used to meet specific problems in manufacture and design, and also he should have a vision which can look into the future clearly enough to ascertain the lines of development and to note in which way the trend lies.

The plant engineer has his mind so closely wound up in the problems of his own plant that he does not often have the opportunity to acquire the broad vision of the fields which lie within the scope of the consulting engineer. The plant engineer is generally largely concerned with the solution of detail problems, which, while of paramount importance, occupy so much of his time that his opinions should be balanced with those of a well-informed consulting authority.

It is ridiculously narrow for the plant engineer to feel himself slighted if a consulting engineer is brought in. In other professions than the engineering it is common practice to call in consulting authorities. The family physician or general practitioner will always do so when confronted with extraordinary cases.

The small expense required to call in the services of a good consulting engineer is slight indeed when compared with the expense which could be caused by some part going wrong on a big production run. The consulting engineer should be fortified with a thorough knowledge of the weakness and strength of every type of construction. He should know the problems of maintenance which will be involved in any particular kind of products, and he should be able to help solve these problems in a broad way.

Now that the war is over it is realized more than ever that we must improve our products if we are to get a firm grip on the world's market. It must cease to be a question of what we can get by with, but a question of what is best practice to meet a given condition.

Services Should Be Invaluable

The services of a consulting engineer in assisting in the planning of new models along these lines would be invaluable. The consulting engineer should know the requirements of the particular field into which the product is going, and by knowing these he should be able to tell in advance what the problems of service are going to be so that these can be foreseen in laying out the designs, with the result that instead of having to make expensive replacements and having the user always confronted with repair bills, the service will be built into the manufactured article in such a way that necessity for repairs and bills for repair parts will be kept to a minimum.

A big manufacturing organization should not attempt to produce a new model without going outside its organization to call in the services of a broad-minded consulting engineer who is well versed in the particular fields in which the factory is going to enter.

The remark, "A man who turns his key in his laboratory door locks out much more than he locks in," is true. After a rough outline of the future job, no one is better fitted to give advice regarding the method of procedure in manufacture and in the determination of important points than the consulting engineer who has made a study of the field, who knows engineering practice, and who at the same time knows the service requirements and knows the points which should be avoided in that particular type of product.

Tractor Merchandising

ONE of the questions agitating the tractor industry at the present time is that concerning the class of dealers through which farm tractors are to be distributed. There are two main classes from which tractor dealers could be quickly recruited in considerable numbers, namely, the implement dealers and the automobile dealers.

Before going into the respective qualifications of the two classes for carrying on this business it should be pointed out that many of the present automobile dealers in the farming districts are now or were formerly implement dealers. They recognized the opportunity offered by the development of the automobile into a serviceable vehicle and took the necessary steps to profit by it.

On casual reflection it would seem as though the tractor business should fall to the implement dealer who already has business relations with the farmers and sells them all the necessary apparatus for working their farms. There are two reasons, however, which explain why the implement dealer has not proven very successful in selling tractors.

In the first place he is not a very aggressive merchandiser. He is an order-taker rather than a salesman and in competition with the forceful methods which have been developed in some of the newer industries he does not stand a very good chance.

Secondly, the implement man does not thoroughly understand the gas engine and its maintenance and has no organization capable of giving the service that is required in order to keep the tractor in good working condition without costly and exasperating lay-ups during the working season. It cannot be denied that there have been enterprising men in the implement trade in the past, fully capable of learning the tractor business and of organizing the necessary service force. But most of these were attracted by the automobile business at an earlier date, and those who still remain are for the most part of the conservatively inclined class.

Another angle to the problem of tractor distribution is that tractors and tractor implements must be sold by the same parties. Practically every sale of a new tractor involves the sale of a plow. Other implements specially suited for operation by tractors are rapidly being developed and eventually the business in tractor implements may exceed that in tractors themselves. The question then comes up whether the entire implement business in any locality is to be combined with the tractor business or only the tractor implement business.

One of the leading tractor and implement manufacturers recently made the statement that in his opinion the solution of the problem would be that tractor implements would be handled by the tractor dealer and horse implements by the hardware dealer. Evidently his inference was that the hardware dealer and hardware-implement dealer were not suitable material from which to recruit tractor dealers.

A New Era for the Dirigible

IN warfare the dirigible has proven a less formidable weapon than the airplane, but this is largely due to its vulnerability to attack because of its great bulk and the highly inflammable nature of the gases with which it is filled.

That there are great possibilities in the dirigible airship was also proven during the war, best of all, perhaps, by a Zeppelin which was sent from Bulgaria to relieve the hard-pressed forces in German East Africa with 25 tons of medicines and munitions. It reached its destination and upon learning that the German forces had surrendered returned to its base without even having landed. This round trip is of greater length than the distance across the Atlantic Ocean at the narrowest part.

In considering the dirigible for commercial purposes, its vulnerability to enemy attack is no longer a factor, but there remains that other great danger factor, the highly inflammable nature of the hydrogen gas with which it is filled. This is now in fair way also of being eliminated, for means have been found of producing on a commercial scale an inert gas of low specific gravity, which has hitherto been considered one of the rare elements. Hydrogen has been almost universally used, notwithstanding its fire danger, because of its light weight and consequent great buoyancy. It weighs only one-sixteenth as much as atmospheric air.

The new gas which it is proposed to use as a substitute for hydrogen is helium, which is found in very small quantities in the air. It has been discovered that this gas is also a constituent of certain natural gases, and the United States Bureau of Mines has been studying means for extracting it from these gases and obtaining it in sufficiently pure form on a commercial scale. These efforts, it seems, have been crowned with success. A plant has already been installed capable of producing 50,000 cu. ft. of the gas per day and the cost is said to be no more than 10 cents a cubic foot, which cannot be so very far removed from the cost of hydrogen.

Although helium has a specific gravity of nearly 4, as compared with hydrogen, the standard for gaseous specific gravity figures, its buoyancy is not so very much less, the buoyancies of the two gases being in the ratio of 15 to 12. The number of Zeppelins that were burned during the war may give a somewhat exaggerated idea of the natural fire risk of a hydrogen-filled bag, for the reason that many of the explosions were due to enemy fire; still, the proximity of a number of internal combustion engines to such enormous quantities of highly inflammable gas constitutes a very serious risk which would have been a great drawback to commercial development. With this risk eliminated the lighter-than-air type of machine may still come into its own in the commercial field.

Latest News of the

Contract Validating Bill Signed

Forms and Instructions for Immediate Payments Now Being Distributed

WASHINGTON, March 3—President Wilson last night signed the bill validating so-called informal war contracts which had been made by telegraph, telephone or in other ways not "legally" executed. Payment of these contracts had been refused by the Treasury and the new bill therefore validates them and authorizes payment. The contracts that came under the informal classification totaled $2,000,000,000, of which more than $300,000,000 were held by automotive manufacturers. The delay in paying these was said to be one of the chief causes of unemployment, as many manufacturers were unable to secure funds to proceed with peace time work.

The bill as signed following numerous amendments and revisions in Congress provides the Secretary of War power to authorize payment, allows for appeals from his decision to the Court of Claims, insures that sub-contractors be protected by direct investigation by the War Department of all prime contractor's contracts, and limits the filing of claims under the act of June 30, 1919. The Secretary of War is also ordered to report all payments made under the act at the next session after June 30, 1919.

Those contracts which were properly executed prior to the signing of the bill will come under class A and the claims will be forwarded directly to the various claim boards handling the respective products called for by the contracts. For example, an ordnance contract, after being prepared for claim in quadruplicate form, will be sent directly to the Ordnance Claims Board, where it will receive an identifying number, be reduced to certificate form embodying the important details and the award made. No awards will be paid until the approval and acceptance of the claimant is secured.

In those instances where the Government officials decide it is best to make direct payments to the sub-contractors who are interested in the contract of a prime contractor this will be done.

Those contracts which have not been reduced to the proper legal form and which are still merely in the form of a telegram or verbal will come under class B. Special blank forms are provided for reducing these to concrete form. All class B contracts will come before the Board of Contract Adjustments which will investigate their proof of claims and refer them to the Bureau Claims Board, Ordnance, Air Service or Quartermaster, as the case may be.

In event a claiment is not satisfied with the award of the Bureau Claims Board he may appeal to the Board of Contract Adjustment.

(*Continued on page* 556)

To Pass on All Contracts

WASHINGTON, March 6—A Board of Contract Review of the Motors and Vehicles Division of the Office of Director of Purchases has been created and will pass on all termination agreements of formal and informal war contracts for trucks, cars, motorcycles, parts and accessories and trailers, before the agreements are submitted to the Claims Board of the Office of the Director of Purchases for final approval. The Board of Contract Review will consist of five members and the Chief of the Motors and Vehicles Division. These will be appointed by the Chief of the Motors and Vehicles Division and approved by the Director of Purchases.

Urge Road Building Program

Conflicting Views on Labor, but Not on Value of Highway Development

WASHINGTON, March 5—Conflicting views of the labor situation and unanimous approval of the value of good roads directly to the public and as a "buffer" employment for labor marked the conference held here this week by President Wilson and Cabinet members with Governors and Mayors of the United States.

Some discussion as to the best methods for reducing existing prices and for maintaining the proper equilibrium of national sentiment on the present immediate problems also took place.

The reports from the Governors or their representatives included 16 states, with a summary as follows:

Arizona—A billion pounds of copper thrown on the market recently have drugged it, with the result that 60,000 miners are working short shifts or are out of work. Buffer, or temporary work, is being rapidly designed to take care of the men, but need of a special agent from the Government to restore the morale of business men is needed.

Delaware—No soldiers who return will fail to find a job. The situation is far more serious. More than $6,000,000 to be spent on good roads.

Florida—Could use labor if it will work at a fair price. Many projects for drainage and improvements of roads contemplated.

Georgia—Conditions in labor market are generally as satisfactory as could be reason-

(*Continued on page* 553)

K. C. Show Mecca for Parts Makers

Makers of Tractor Parts Plan for Next Year's Show—Attendance Sets Record

KANSAS CITY, March 5—The closing of the Fourth National Tractor Show here this week turns the attention of tractor and parts makers ahead to next year, when the fifth tractor show will be held here. This will be larger than the present one. Next year's show is already assured and the exhibit of parts, too, will without doubt be much more extensive than this year.

At a national tractor show it is to be expected that all of the tractor makers will be present, but many were surprised at the wonderful exhibit of parts, and almost all of these were from the automobile industry, or, more accurately speaking, the automotive industry.

There were practically all of the makers of ball and roller bearings. There were the makers of magnetos, spark plugs, carbureters, piston rings, radiators, sheet metal goods, engines, bronze materials, castings, lubricants, etc. Makers of stampings were on hand, but not in such great numbers. Some of these have already brought out very light tractor wheels, pressed steel frames, etc., and are preparing to make stampings for other parts.

Exhibits Best Ever Seen

The exhibit of such parts was the best ever seen at a tractor show and was better than any seen in recent years at the New York or Chicago shows. These makers are selling their product in large quantities to the tractor maker.

One manager of a parts organization did not think it necessary to make an exhibit or to bring his engineering representative along. After making one circuit of the show and seeing what a comprehensive exhibit there was of tractor parts he at once wired his factory to send some of his engineers and also men from the sales end to study the field. He was too late for this year but was not going to lose any time.

Being held the same week as the automobile show there was a good attendance of distributers and dealers. The tractor makers have shown good business judgment in holding it this week in order to get the benefit of all of the dealers. Nearly every maker was looking for a dealer. Some placed one or two distributers and appointed a dozen or more dealers. There were many prospects for

(*Continued on page* 549)

Automotive Industries

Money Provided for Highways

President Signs Bill Appropriating $200,000,000—Total Available, $574,000,000

WASHINGTON, March 3—President Wilson has signed the Post Office Appropriation bill carrying an amendment providing for $200,000,000 to be expended in the next 3 years for road construction. This sum, together with the State appropriations which must meet the Federal funds on a dollar-for-dollar basis, will provide at least $574,000,000 for highway building before 1922. As most of the States are appropriating sums in excess of the Federal requirements, it is expected that this figure will be greatly exceeded, and, in fact, it appears that this amount may be spent during the year 1919 alone. Reports already received of State appropriations indicate $385,000,000 already available.

Employment will be given to 100,000 men for the road work, according to a statement by Secretary Houston of the Department of Agriculture Saturday before representatives of the highway departments of 27 States. The secretary said his department would give every aid to the work.

Expect Freight Rate Revision

Complaint was made by the highway commissioners that existing freight rates for road building materials are too high and hamper work. Railroad officials have promised a decision regarding lower rates within 10 days. The conference also asked that engineer regiments now building roads in France be returned at an early date and demobilized so these men could be secured for road work in this country. Secretary Houston promised to bring this matter before the War Department.

An important effect of the new bill is that it broadens the definition of a rural post road and allows the funds to be used for highways where mail may be carried at some future period as well as where it is carried at present.

The act also raises the limit of Government contribution from not to exceed $10,000 per mile to not to exceed $20,000 per mile, and further authorizes the Secretary of War to transfer to the Department of Agriculture such road building machinery and materials as are suitable and not required by the War Department.

With the $200,000,000 made available by the new law, there is not included $9,000,000 also appropriated and which will be used for roads and trails in national forests.

The original Federal Aid Road act, passed in July, 1916, appropriated $75,000,000 for the 5 years ending June 30, 1921, and $10,000,000 for forest road building. Not over $3,000,000 of this fund has been spent, due to the war, so that $82,000,000, plus $209,000,000, or a total of $294,000,000, will be available during the next few years. The act and its amendment requires the States to provide at least an equal amount on the post road work.

On page 553 is a table showing approximately what each State will receive in Federal aid under the terms of the act.

American Motors Increases Production

NEW YORK, March 5—The American Motors Corp. is planning an increase of production to take effect in 3 or 4 weeks. The company built 600 cars in 1918 and now plans an output of five a day, and ten a day when the full capacity of the plant is brought into play. A $500,000 increase in the capital has been made in order to take care of this increase. Leslie F. Smith has become general sales manager. Mr. Smith was supervisor of zones for the Maxwell company and branch manager for Willys-Overland. In 1912 he opened the Oakland branch in this city and later became general manager for ten Southern states. L. P. Rife will become works manager in charge of purchases and production. He was formerly supervisor of production at the Hudson plant in Detroit.

Cross-Ocean Flight Planned

WASHINGTON, March 3—Plans for a flight across the Atlantic are being completed by the U. S. Navy, according to continued rumors here, none of which are as yet confirmed. It is said that the navy will use the NC-I flying boat and will conduct test flights at Rockaway Point this week. This is the largest American seaplane equipped with three Liberty engines and having a capacity of 10,000 lb., and a present fuel capacity for 1200 miles.

Texas to Have Airplane Company

DALLAS, March 5—Incorporation papers of the Texas Airplane Manufacturing Co. will be filed soon. The company will have a paid-up capital stock of $1,000,000, and its purpose is to construct and operate an airplane manufacturing plant here. Lt. C. G. Taylor of Lexington, Ky., is chief promoter of the project.

Ford Will Produce $250 Car

To Withdraw Entirely from Present Company—$19,000,000 Decision Caused Move

LOS ANGELES, March 5—Henry Ford gave out an interview here to-day in which he stated he would quit the present Ford Motor Co. and bring out a $250 car. This decision, he states, was brought about by the recent court decision compelling him to divide $19,000,000 profits.

"I have decided on the new undertaking, and as matters stand I intend to go ahead with it," said Mr. Ford. "This idea developed from the recent court decision whereby I am obliged to distribute about $19,000,000 accumulated profits. The public will not suffer from this because as a result they will get a better car, a cheaper car and one more fully up to date than before or than is now in existence. The present Ford car was designed 12 years ago.

"The decision that caused me to make this move is because of my principle to have plenty of cash with which to do business. Of that $19,000,000 I have to distribute to myself about $12,000,000, but I cannot in justice to myself put that back in the business, because I have no way to oblige those who own the other portion to so employ it.

"My only recourse is to get out, design a new car which can be sold cheaply and which will be in all details up to date. We are already looking for water power sites. The car itself is well advanced, for I have been working on it while resting here in California. We shall have a plant on the coast and stations all over the country. We propose to dot the whole world with our factories because I believe that every family should have a car and this can be done.

"Our tractor factory is paying at the rate of $500,000 a month. It is capitalized at $5,000,000 and has accumulated $12,000,000 assets.

"I do not know exactly what will become of the present Ford Motor Co. The portion of it that does not belong to me cannot be sold to me; that I do know. I must do business on the basis of what I think is right. I do not like stock companies. The Ford Tractor Company stock is all held by members of the Ford family."

DETROIT, March 5—Officials of the Ford Motor Co. will neither affirm nor

(*Continued on page* 556)

Problems of Tractor Design Discussed at Kansas City S. A. E. Meeting

Difficulty of Accurate Tests and Technical Points of Construction Brought Up—Need of Scientific Research Applied to Agricultural Machinery—Standard Fuel Suggested for All Internal Combustion Engines

KANSAS CITY, March 1—The tractor meeting which the Society of Automotive Engineers arranged in connection with the Kansas City Tractor show was held in the auditorium on the top floor of the Sweeney Automobile School on Thursday afternoon and was attended by about 200. To the program of three papers originally published, there was added at the last moment a fourth paper, on "The Redesign of Farm Machinery for Tractor Work," by Prof. White, of the University of Illinois. Unfortunately two of the authors of papers could not be present to take part in the discussion.

How to Determine Drawbar Horsepower

The first paper read was on "Tractor Testing," by Prof. J. B. Davidson of the California State Agricultural College. Prof. Davidson outlined the different tests which it is desirable to make on farm tractors and said that his paper was confined to the subject of field tests.

The drawbar horsepower, which is determined in these field tests, is one of the important elements of the commodity sold by the tractor manufacturer, and is, therefore, worthy of careful measurement. Prof. Davidson referred to the S. A. E. horsepower rating formula and the difficulty which had been encountered in accurately determining the proper rating of tractors. This he said was largely due to the fact that there was no traction dynamometer on the market which permitted of the two-hour test called for by the rating formula. It was stated in the paper that the test horsepowers of the 42 tractors tested last summer at Salina varied from 50 to 200 per cent of the rated horsepowers. If there were a convenient method of accurately determining the actual horsepower of which a tractor is capable it would not be necessary to provide such a large reserve of power and there would be less overloading.

Further, the purchaser would not have to discount the manufacturer's rating, as he is in the habit of doing now. The proposal has been made to do away with horsepower ratings entirely, and instead to express the capacity of tractors by the number of plows they will pull. Inasmuch as the size of plow bottoms vary, and as there are great differences in the amount of power required to pull a bottom in different soils, this would be a very haphazard method.

Accuracy in Dynamometer Tests

Prof. Davidson said that two of the essentials in making a dynamometer test are accuracy and a clear record of the data obtained. A direct reading dynamometer, he explained, was almost useless, on account of the continual and wide fluctuations of the indicator hand. The author described the Hyatt dynamometer in general terms. It had been objected, he pointed out, that a spring was not suitable for measuring drawbar pull, but it was shown that some kind of elastic material was necessary in order to register this pull. The direct indicating type of instrument being unsuitable, a recording mechanism is absolutely necessary in order to obtain reliable results.

There are advantages in having tractor tests in connection with field demonstrations. When there are a large number of tractors assembled together at one point tests can be made with the least effort. However, the hurrah and excitement which usually mark these assemblies are detrimental to the conduct of the tests.

In the discussion of the paper it was pointed out that the subject of a standard rating was one of great importance to the tractor industry. Many state agricultural colleges are studying the problem and the State Legislatures are planning legislation covering the point, with the object of protecting the farmer. Therefore, if the tractor manufacturers are not careful there may soon be as many tractor rating formulas in use as there are States in the Union.

It was pointed out by Prof. White of Illinois State University that the statement that no tractor dynamometer was manufactured suitable for making two-hour dynamometer tests was incorrect. The Burr Co. of Champaign, Ill., had been manufacturing railroad dynamometers for 15 years and had recently developed a dynamometer suitable for tractor work which had been used in plowing tests at the university. It was based on the hydrostatic principle, had a range of 1 to 10,000 lb., and was fitted with a recording mechanism. It was also brought out in the discussion that the National Vehicle and Implement Association had been considering the subject of tractor ratings.

A Standard Fuel for All Engines

The second paper was that on "The Fuel Situation," by Dr. Joseph E. Pogue of the United States Fuel Administration. Dr. Pogue covered substantially the same ground as in the paper which he read at the S. A. E. annual meeting in New York last month, but handled the subject more from the standpoint of the tractor manufacturer. He said that the present tendency in the tractor industry with respect to fuel appeared to him unwise. At the present time the United States has an annual production of 40,000,000 bbl. of kerosene, which sells at about one-half the price per gallon of gasoline. Seventy million barrels of gasoline are produced per year. Kerosene, however, may not always be cheaper than gasoline, as with the rapid increase in the number of tractors the demand will grow quickly, while, on the other hand, owing to the development of the so-called cracking process, the amount of kerosene derived from a certain production of crude oil will become less. Gasoline, under present conditions bringing a higher price than kerosene, the tendency naturally is to convert more and more kerosene into gasoline. This will before long result in a scarcity of kerosene.

Reverting to his remark that it would be unwise to design tractor engines for kerosene fuel, Dr. Pogue said that kerosene had been specially designed to possess wick climbing properties, which were unessential in an internal combustion engine.

The Fuel Problem

The present outlook was that both automobiles and trucks must be developed to burn heavier fuel, and Dr. Pogue suggested the advisability of designing all types of automotive apparatus to use the same kind of fuel. The tractor fuel problem does not stand alone, but will have to be solved along with the fuel problems for other types of internal combustion engines. The problem really is, whether both truck and tractor engines shall be designed to consume a heavier grade of fuel, leaving the lighter constituents of petroleum for use in passenger car engines, or whether all kinds of automotive apparatus shall use the same fuel. From one point of view at least the latter course would be preferable, as it would greatly simplify the fuel distributing problem, and result in important economies.

One other point brought out by Dr. Pogue was that the price of the fuel determines the saturation point of the country with respect to both automobiles and tractors. That is to say, if there are a certain number of farmers who can afford to operate a tractor burning a fuel costing, say, 15 cents per gallon, then the number of farmers who can afford to operate a tractor designed to run on a fuel costing 50 cents per gallon is materially smaller.

In the discussion of this paper Dr. Pogue was asked about the probable influences the resources of the country in shale oil deposits would have on the fuel situation. In the reply it was brought out that shale oils are analogous to petroleum in their chemical composition, and by distillation will yield practically all of the fractions which are now obtained from crude oil. However, the cost of obtaining these fractions from shale oil is very much greater, as the latter have to be mined, crushed and then subjected to the distillation process.

(*Continued on page* 554)

Tractor Trials in Great Britain

Shortage of 60,000 Tractors in United Kingdom—Agencies Under Car Dealers Popular

LONDON, Jan. 28—The Society of Motor Manufacturers and Traders, Ltd., which corresponds to the National Automobile Chamber of Commerce in America, has decided to hold a trial of tractors about the end of September in the Midlands. At first there were hopes that this body as representing the motor industry would be assisted by and associated with the Royal Agricultural Society of England, the premier and oldest organization of farmers and implement makers, but the latter body favored postponing the trial to next year.

It is of interest as marking the passing of the implement and tractor trade from the older order of implement dealers to the motor dealer. The step has been in preparation since the introduction of tractor plowing and cultivation on the grand scale, which was brought about by the threatened shortage of food cereals in consequence of the war's demands on ships and the losses of food ships by submarines.

Tractors and Farm Implements

The tractor and implement trade was solely in the hands of the implement dealers; and of tractors, at least of the gasoline sort, there were but a few scores where now they number hundreds, three-fourths of them being American. The implement and farm engine makers concentrated on steam plant until about three or four years before the war, when there began to be seen fewer steam engines and more oil and gasoline engines, but hardly any except steam locomotives for land work.

The result was that such equipment was hired by those whose farm lands were large enough to make it remunerative; the vast majority of farmers having no interest in it or its development, instead of horses. It is otherwise since motor dealers began to push American tractors.

Fortunately, at the outset of this branch of motor trade enterprise, the cost of imported tractors was not prohibitive, and when it did rise in consequence of war conditions, prices of crops and other factors had turned in favor of the farmers, backed by the compulsory tillage policy of the Government acting through its Food Production Department.

It happened also that the services of motor dealers were taken advantage of in this campaign, and latterly the dissemination of hundreds of Fordson tractors both increased the hold on this industry of the motor dealers as Fordson agents (most of them being also dealers in Ford cars) and widened the farmers' interest.

Officially, it was stated last year that there were nearly twenty million acres now in tillage in the United Kingdom. It has been computed that from 50,000 to 75,000 tractors are needed to maintain the vast bulk of British farms under 500 acres in arable condition.

At the moment there are probably not more than 10,000 tractors available in the United Kingdom, and so far there is no evidence of any real effort toward a home production of tractors. The Auston Co., at Birmingham, were recently reported to have fixed the price of their tractor at £200 ($1,000), but, considering that the Fordson, which has been on the market for nearly two years, is listed here at £250 ($1,250), and that the Austin has a governor and geared belt pulley, it may be doubted if the Austin or any other British tractor can be produced to sell at less than the Fordson under present market conditions in this country.

A Scottish firm has been trying out a two-cylinder tractor after the style of the older Moline. Beyond having seen the first sample on a farm land in course of testing, nothing has appeared. Prior to the big rise in transatlantic freight charges the Moline was one of the cheapest and most interesting imported tractors, hence it may be inferred that this Scottish model, if it is a success, will be priced to correspond with the Moline on the British market. The Moline appeals to British farmers, as it is light and handy, and one of the very few really single-handed tractors. The Fordson has sold here largely on price, and because of the Ford "service" associated with it, the bulk of the dealers concerned in it being also Ford car dealers.

Need of Special Tractor Implements

British farmers are not too favorable to a three-furrow tractor, and certainly they do not take kindly to the usual American 14-in. bottom with its flat turn over of the furrow. Our normal horse plow will average ¾ acre per 10-hr. day, with two horses. A two-furrow tractor, capable of averaging three acres per day, of corresponding duration, is appraised better than a more powerful machine, with a bigger output on a very much larger fuel consumption.

Many tractors here have not been improved by efforts to run them on kerosene. The International Harvester Co.'s tractors may be cited as successful on this score, but these have slow-running engines, and an adequate lay-out for water injection. The fuel drawback, however, is likely to be removed with the large increase of gasoline. In fact, at present there is more gasoline than there are engines and vehicles in which to use it.

A need found here as well as in America is a line of special implements for tractors of the sort and size referred to. The implement makers promise to supply this want, but, judging from the delay in starting on tractors themselves, the outlook is not too reassuring in that quarter.

Among implements needed is a smaller

(*Continued on page* 554)

Standardized Fuel Urged by Pogue

Speaking at S. A. E. Dinner—Two Kinds of Dealers and Three Types of Tractors

KANSAS CITY, MO., Feb. 27—The present policy of fuel for automotive apparatus is unwise in that the greatest possible fuel value is not being had from each gallon of crude, and something must be done to determine the future of this question, is the opinion of Joseph A. Pogue of the fuel administration, Washington, at the annual tractor dinner of the S. A. E. here to-night. Mr. Pogue, speaking especially to tractor men, sees two solutions to the fuel question.

1—The first is to use the entire range of petroleum products which will burn successfully in all types of internal combustion engines. It means one standardized fuel for all types of apparatus.

2—The second is to have two standard fuels, a light one for motor cars and airplanes and a heavier one for trucks and tractors.

Mr. Pogue favors the first plan. He wants one fuel because it will mean cheaper and easier merchandising, and it will also give more fuel value out of a gallon of crude. He argued for a greater splitting up of kerosene and thus greatly increasing the production of gasoline and reducing the quantity of kerosene.

J. B. Bartholomew, president of the Avery company, looks for two kinds of dealers, and two only. There will be the tractor dealer who sells tractors and all farm machinery to be used with them. The second class will be the hardware man, who will handle horse-drawn machinery and equipment. The division between motor equipment and horse equipment is becoming more defined every day.

Finley P. Mount, president of the Advance-Rumely Thresher Co., and toastmaster for the dinner at which 270 attended, looks for three kinds of tractors to round out the field of farm requirements—heavy, medium and light.

E. A. Johnson, engineer of the International Harvester Co., also spoke.

David Beecroft gave an illustrated talk on his trip over the devastated areas of France and Belgium.

S. A. E. to Visit Splitdorf

NEW YORK, March 5—The Splitdorf Electrical Co. has invited the Metropolitan Section of the S. A. E. to make an inspection trip through its plant in Newark on March 7. The company will have automobiles meet the party at the station and will entertain them at luncheon. It has requested that the number be limited to 150.

New Comet 1½-Ton Truck

DECATUR, March 1—The Comet Automobile Co. is now producing a 1½-ton truck to sell for $1,750 in place of the 1¼-ton model which sold for $1,575.

January Exports Satisfactory

New Year Augurs Well for Our Foreign Trade in Automotive Products

	Cars	Value	Trucks	Value	Parts
Jan.	2,137	$2,916,381	907	$2,375,584	$2,406,783
Dec.	1,703	2,203,027	896	2,636,689	2,191,511
			1918		
Jan.	4,325	3,841,871	1,156	3,328,870	2,665,278

WASHINGTON, March 5—Although it may not be apparent at a casual glance why our export figures are tabulated for the seemingly odd number of seven months in the tables herewith there is a reason. This reason is that the seven months in question bring the data to the commencement of the new fiscal year, commencing on July 1. As on this basis the figures coincide with the commercial year of a number of concerns engaged in the automotive industry, it is suggested that they may be peculiarly applicable for purposes of comparison.

January exports from the various ports of the United States are exceedingly satisfactory. There is an appreciable (though possibly not a really substantial) increase in cars, trucks and parts, and that this is the case argues well for our increased merchant marine. After all, the matter of available shipping when and where it is needed is of primary importance if we are to maintain our position in the world's markets. So far it has not been a matter of lack of orders, it has been simply a question of ships to transport the goods.

It is true that at the present time many ships which will be available for commercial expansion at a later date are engaged in the work of repatriating our men from overseas. Once this shipping is released (and the time does not seem far distant) there is every reason that the present automotive export figures will be increased appreciably.

It is, however, equally correct to state that much of our export trade has been simply handed to us. For some time we have had no competitors in the markets of the world. Conditions are altering rapidly, and it is up to us to retain, and improve, our position in those markets.

Weekes-Hoffman to Make Gears

SYRACUSE, N. Y., March 4—The Weekes-Hoffman Co. has completed plans to enter the gear manufacturing industry, and will shortly be turning out gears for automobiles and tractors in quantities which will necessitate the employment of 250 men in the plant on Dickerson Street. W. H. Diefendorf has severed his connection as chief engineer and a director of the New Process Gear Corp. to join the Weekes-Hoffman Co. as vice-president and general manager. J. M. Weekes is president, and A. J. Hoffman secretary and treasurer.

Air Service Club of America Formed

NEW YORK, March 4—The Air Service Club of America has been organized by army fliers to promote the social interests of aviators.

January Exports from New York

New Year Brings Big Increase in Cars, Trucks and Parts Value

NEW YORK, March 5—Exports of automotive products from this port have fluctuated throughout the past year, not so much on account of the variation in the volume of orders as on account of the limitations of shipping facilities. The real position has been that each month would have fully maintained its average but for restrictions brought about by lack of ships.

Latin American Trade Satisfactory

The new year starts well with increased exports in cars, trucks and parts. In January cars numbered 1047 as against 740 in December, 1918, the respective values being $1,480,832 and $1,020,126. Trucks numbered 515 in January, as compared with 430 during the previous month, and their value advanced from $1,564,293 to $1,604,418. Similarly, the value of parts was $1,189,577, as compared with $898,513 in December.

Latin American trade continues satisfactory, Argentina being our principal customer for passenger cars, but Australia and British South Africa were our largest buyers. Japan's purchases of trucks were surprisingly large and augur well for trade development.

Exports of Automotive Equipment for January and Six Previous Months

	Month of January				Seven Months Ending January, 1919.			
	1919		1918		1919		1918	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	......	....	......	....	41	$562,600	13	$161,465
Airplane parts	......	$77,331	......	$759,106	......	9,217,112	......	4,106,595
Commercial cars	907	2,375,584	1,156	3,328,870	6,308	17,012,820	8,317	22,635,150
Motorcycles	541	142,084	1,134	257,977	4,241	1,018,766	6,271	1,330,059
Passenger cars	2,137	2,916,381	4,325	3,841,871	16,482	18,614,487	34,080	28,702,545
Parts, not including engines and tires	......	2,406,783	......	2,665,278	......	19,751,407	......	19,335,816
Total	......	$7,698,748	......	$9,836,019	......	$55,378,714	......	$70,673,816
ENGINES								
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas	508	$65,274	3,127	$369,623	15,203	$2,367,577	22,846	$2,610,508
Marine, gas	499	288,942	365	177,745	3,313	1,785,801	4,921	1,486,875
Stationary, gas	1,998	330,224	1,913	226,409	13,555	1,907,499	14,413	1,598,254
Tractor, gas	3,897	4,410,305	1,910	1,827,760	12,323	14,024,784	10,483	11,035,483
Total value	......	$5,094,745	......	$2,601,537	......	$20,085,661	......	$16,731,120

	EXPORTS BY COUNTRIES JANUARY, 1919				SEVEN MONTHS ENDING JANUARY, 1919			
	Passenger Cars		Trucks		Passenger Cars		Trucks	
	No.	Value	No.	Value	No.	Value	No.	Value
Argentina	232	$247,388	28	$60,800	791	$956,241	31	$64,894
Australia	308	282,653	......	....	1,890	1,774,952	......	....
British India	1	985	......	....	28	43,741	......	....
British South Africa	129	144,614	......	....	670	675,565	......	....
Canada	......	....	64	98,215	......	....	959	1,291,048
Chile	73	139,064	......	....	746	1,149,028	......	....
Cuba	91	197,856	82	154,016	962	1,493,341	361	693,086
Denmark	11	28,839	......	....	107	184,255	......	....
Dutch East Indies	79	116,632	......	....	1,157	1,476,443	......	....
France	28	128,619	244	1,224,830	523	439,763	2,269	9,236,165
Mexico	163	217,934	......	....	993	1,011,548	......	....
New Zealand	72	79,333	......	....	711	687,140	......	....
Norway	......	....	......	....	187	398,266	......	....
Philippine Islands	156	211,147	......	....	759	827,584	......	....
Russia in Asia	......	....	......	....	3	11,734	15	18,200
Russia in Europe	......	....	......	....	6	6,605	......	....
Spain	9	11,976	......	....	468	622,820	......	....
United Kingdom	......	....	17	34,176	......	....	849	2,495,445
Uruguay	44	108,673	......	....	462	415,894	......	....
Other Countries	658	911,002	472	803,547	4,283	4,733,423	1,824	3,213,982
Totals	2,137	$2,916,381	907	$2,375,584	16,482	$18,614,487	6,308	$17,012,820

Refinance Saxon Company; Pick Prominent Head

DETROIT, Feb. 27—It was stated today by officials of the Saxon Motor Car Corp. that Chicago, Boston and New York bankers have agreed to refinance the company to the extent of $5,000,000, and that the Saxon would start operations within 60 days. Reorganization details were completed at a meeting in Chicago Wednesday, Feb. 26. The new organization will be effected within the next 10 days. Financial men backing the project assume all Saxon liabilities, and the company will start again with a clean slate. Details of the refinancing plan cannot be announced at this time, but it is said the banking interests involved are among the largest in the country and are amply able to put the project across.

The Saxon officials deny the rumor published in New York and Boston financial dailies telling of a proposed merger with the Doble-Detroit Steam Car Corp. There will be no enlargement of the present Saxon plant this year. The present manufacturing policy will be continued, and standard Saxon models embodying many refinements will be produced.

Characteristics of Standardized Engine

(*Continued from page* 527)

An additional advantage is the fact that a valve equipped with two springs will still function, even with one spring broken or out of commission.

Force-feed lubrication is of course essential to insure a proper and efficient lubrication. A high pressure up to 80 or 90 lb. per square inch is recommended for speeds up to 3800 r.p.m. A series of gear pumps or a multiple-plunger type pump may be used. Oil leads should be of generous size, and provision for effective cooling of the oil should be made before returning it through the engine circulating system. The above oil pressure of from 80 to 90 lb. per square inch may seem unnecessarily high, but it is advisable, because the function of the oil in the bearings is not only to reduce friction to a minimum but also to disperse the heat. For that reason very large aluminum bearing caps may be used, although ordinarily a light steel forging is to be preferred.

In such a standardized engine most parts, such as cylinders, pistons, valves, connecting-rods, may be made interchangeable, thereby effecting a considerable saving in manufacture. Special bracket or hanger adapters will make the engine installation suitable to several makes of chassis.

K. C. Show Mecca for Parts

(*Continued from page* 544)

retail sales obtained which are being handed over to the dealers.

The attendance was much ahead of last year; in fact, it was beyond expectations. There were several thousand dealers and the farmers filled the place from early morning until supper time. There was little doing at night.

Every exhibitor is pleased and plans for next year are for a bigger show. The $40,000 building used this year is already being torn down. One thing is certain: Kansas City has had the national tractor show for 4 years and is not going to let it slip away. Minneapolis is being watched with anxious eye, but there is room for two or three.

It is more or less of a mistake not to have several larger territorial tractor shows. They could not all be national shows but they would be most valuable to dealers and farmers.

Vahan Products Enters Cleveland

CLEVELAND, March 1—The Vahan Products Co., a new corporation, has purchased from the Western Machine Products Co. its property on the northwest corner of East Seventy-third Street and St. Clair Avenue N. W. The land, building and equipment will cost more than $350,000, and the new company will employ at the start from 300 to 400 men. Automatic screw machine products will be manufactured. The Western Machine Products Co. during the war, manufactured airplane parts for Rolls-Royce. S. S. Shields is president of the Vahan Products Co.; L. H. Mesker, vice-president; A. W. Leuke, treasurer, and L. M. Lucius, secretary. Operations in the new plant will commence at once.

American Plane Establishes New Record for Speed

WASHINGTON, March 1—New records for speed and climbing were established yesterday by an American designed and built airplane, according to announcement by the War Department of the results of preliminary tests of a machine constructed at Ithaca, N. Y.

In the tests the plane attained an officially timed speed of 163 2-3 m.p.h., or 2.72 miles per minute, and climbed 10,000 ft. in 4 min. 52 sec. The best previous climbing performance was 10,000 ft. in a little more than 6 minutes.

The new plane, except for diminished wing span, was described as not widely different from the common type of single-seated biplane. The wings measure only 26 ft., or 6 ft. less than the small Spad machine. The motive power is a 300 hp. Hispano-Suiza engine. The machine, full loaded, weighs 2050 lb. and has a full speed operating period of three hours.

The quickest trip between Washington and New York in a mail plane with a 150 hp. engine was also made yesterday when Aviator Biffle took mail from College Park to Belmont Park, a distance of 218 miles, in 2 hrs. 2 min., flying time. The speed between Washington and Philadelphia was 97½ m.p.h. and between Philadelphia and New York 125½ m.p.h.

AUTOMOBILE, TRUCK AND PARTS EXPORTS FROM NEW YORK FOR JANUARY

	Cars		Trucks		Parts
	No.	Value	No.	Value	Value
Argentina	192	$212,286	28	$60,800	$345,846
Australia	225	187,866	3	10,200	78,469
Barbadoes	1	1,800	1	3,000	1,785
Bolivia	..	......	..	......	5,592
Brazil	48	70,659	..	......	46,019
British East Africa	19	15,415	..	......	4,038
British East Indies	..	......	3	4,000	3,185
British Guiana	2	2,250	..	......	6,587
British India	1	985	..	......	31,890
British Oceania	..	......	..	......	50
British South Africa	105	121,333	23	29,886	79,462
British West Africa	1	1,075	..	......	2,872
British West Indies	1	936	..	......	14,122
Chile	73	139,064	1	3,282	42,179
China	16	20,148	..	......	7,942
Colombia	17	29,068	..	......	9,757
Cuba	34	84,109	24	57,061	143,178
Danish West Indies	..	......	..	......	3,697
Denmark	11	28,839	..	......	130
Dutch East Indies	10	13,827	6	20,154	12,401
Dutch Guiana	..	......	..	......	1,125
Dutch West Indies	..	......	..	......	184
Ecuador	2	2,925	..	......	1,214
England	5	5,795	17	34,176	127,636
France	22	117,700	211	1,047,980	1,176
French Africa	..	......	..	......	170
French Guiana	..	......	..	......	77
French West Indies	2	2,250	2	1,233	14,440
Greece	6	8,806	1	700	19,310
Haiti	22	18,558	..	......	4,314
Honduras	..	......	..	......	32
Hongkong	..	......	..	......	2,055
Iceland	..	......	..	......	584
Italy	..	......	..	......	33,822
Jamaica	3	5,400	..	......	4,983
Japan	57	73,789	168	269,750	6,620
Liberia	..	......	..	......	13
Mexico	14	24,770	6	12,581	6,217
Newfoundland	1	893	..	......	184
New Zealand	24	29,852	2	5,966	4,354
Nicaragua	..	......	..	......	1,175
Norway	..	......	7	15,800	10,477
Panama	2	950	1	1,430	2,294
Peru	30	57,158	..	......	15,871
Philippine Islands	6	4,480	5	13,719	24,437
Portugal	11	20,977	1	2,044	4,672
Salvador	1	1,500	..	......	587
Santo Domingo	10	15,098	1	2,523	1,468
Scotland	..	......	..	......	2,335
Spain	8	10,976	..	......	2,844
Straits Settlements	..	......	8	5,533	879
Trinidad	1	1,276	..	......	4,677
Uruguay	44	108,673	1	2,600	45,969
Venezuela	20	34,396	..	......	4,181
Totals	1,047	$1,480,832	515	$1,604,418	$1,189,577

Current News of Factories

Notes of New Plants—Old Ones Enlarged

New Twin City Tractor of Backbone Type

MINNEAPOLIS, March 3—A new tractor, known as the Twin City 12-20, has just been brought out by the Minneapolis Steel & Machinery Co. The engine is of the 16-valve type, all valves being located in the cylinder heads. Samples of the machine have been in the hands of farmers for some time, but its public announcement was reserved for the New York and Kansas City shows.

It is claimed for the double valve construction that it permits the cylinders of clearing themselves better of burnt gases, thus insuring a higher volumetic efficiency and increased power. The new tractor is designed to operate on kerosene, on which fuel its engine is claimed to develop 35 hp., while on gasoline it develops 40 hp. at 1000 r.p.m.

Other features include a pressure feed lubrication system, water circulation controlled by a thermostatic valve, a sealed and enclosed governor and a backbone type of frame. A full technical description of this machine will be published in an early issue of AUTOMOTIVE INDUSTRIES.

Sperry Wants Enemy Gyroscope Patents

WASHINGTON, March 1—The Sperry Gyroscope Co., Brooklyn, has asked the Federal Trade Commission for licenses to use nine alleged enemy patents covering the manufacture of gyroscopic apparatus. The commission is considering the application.

Gramm-Bernstein Trucks to Be Sold Direct

LIMA, OHIO, March 1—The Gramm-Bernstein Motor Truck Co., which until recently sold its truck in the Eastern territory through the Gramm-Bernstein Sales Corp., with offices in New York, Philadelphia and Akron, will direct sales and service hereafter from the factory.

Hudson Peace Schedule

DETROIT, March 1—The Hudson Motor Car Co. will devote the entire plant erected for the manufacture of shells during the war to the production of its new Essex. It is estimated that it will make 20,000 Essex cars this year. The same number of Hudson Super-Sixes will be turned out and by June it is estimated that the monthly output of Super-Sixes will be about 2000. At a recent meeting of the Board of Directors the expenditure of $1,000,000 was authorized for additional machinery and manufacturing facilities.

Reo Shipping 74 Cars Daily

LANSING, March 5—The Reo Motor Car Co. is making a number of shop changes and otherwise getting back into peace production. Although not completely adjusted as yet to domestic business, the company is shipping an average of 74 vehicles a day.

Hawkins Denies Merger Rumors

DETROIT, Feb. 27—Norval A. Hawkins, former sales manager of the Ford Motor Co., denies all rumors of a proposed truck and tractor combine which he is said to be forming.

Republic Purchase Story Unfounded

DETROIT, Feb. 27—W. C. Durant, president of General Motors Corp., which is said to have recently purchased the Republic Motor Truck Co., Alma, positively denies that such a deal has taken place.

To Make English Dunlop Tires in Canada

TORONTO, March 3—The Dunlop Tire & Rubber Goods Co. has obtained rights to the tire-making methods and formulae of the English company and will have access to the large rubber plantations owned by the parent concern in England.

First Wolverine Tractor Completed

SAGINAW, MICH., March 1—The Wolverine Tractor Co., newly organized, has built its first tractor, and within 30 days quantity production will start. One thousand machines will be built during 1919. Within 60 days 75 men will be working in the plant, which will occupy about half of the old Bransfield-Billings factory. W. E. Wood, Detroit, is president of the new concern, and W. H. Wagenhals superintendent.

Champion Ignition Co. to Produce 120,000 Plugs Daily

FLINT, March 1—The Champion Ignition Co. is now producing 80,000 plugs a day, but will run this production up to the 100,000 mark in March, and 120,000 daily by early summer. During the war the company was busy on plugs for the Liberty and other aircraft engines, producing 40,000 daily for the Government.

1000 Trenam Tractors Planned for 1919

STEVENS POINT, March 4—The Trenam Tractor Co. at its annual meeting made provision for the beginning of quantity production of the Trenam tractor. It is hoped to manufacture more than 1000 during 1919. Since establishing its plant, the Trenam company has devoted much of its capacity to the production of castings for other companies, at the same time developing its tractor design, which now is ready for the market. J. J. Trenam of Milwaukee, who designed the tractor, was re-elected president and general manager of the company.

Six-Cylinder Maibohm Half-Ton Business Car

RACINE, March 4—A business car with a capacity of ½-ton, selling for $1,290, is being delivered to dealers by the Maibohm Motors Co. It is powered with a six-cylinder Falls engine with cylinders 3⅛ x 4¼ in. The valves, which are in the head, are adjustable, and the cooling is by thermo-syphon system, using a Perfex radiator. Starting and lighting is by a Wagner 6-volt, two-unit system with a Bendix drive starter and generator driven through helical gears in the gearcase. The Willard battery is carried in a steel cradle under the floor boards. The car is assembled of standard parts, including such units as Borg & Beck clutch, Mechanics Machine selective sliding gearset, Brown-Lipe-Chapin differential, Jacox steering gear and Thermoid brakes. The gearset and clutch form a unit with the engine and the control levers are overhung from the gearset case within easy reach of the natural driving position. The drive is Hotchkiss with two 4-in. universal joints and a seamless tubing propeller shaft. Springs are semi-elliptic, wheels artillery type, and the tire equipment consists of 32 x 3½ in. pneumatics with non-skid in the rear. The wheelbase is 116 in., weight 2420 lb., loading space 6 ft. long, 4 ft. high and 3½ ft. wide.

Saxon Offices in London and Paris

DETROIT, March 1—The Saxon Motor Car Corp. is about to open export offices in London and Paris. The Paris office will be in charge of M. Eller and the London office under the supervision of D. Eller, both of New York. They sail for Europe next week.

Aument & Gillespie, Consulting Engineers

NEW YORK, March 4—Carroll M. Aument, formerly an engineer of the Wright-Martin Aircraft Corp., has resigned his position and opened a consulting, designing and sales engineering office at 87 Nassau Street under the name of Aument & Gillespie.

Wilson Body Co. to Deliver 63,000 Bodies

DETROIT, March 3—The C. R. Wilson Body Co.'s business for January exceeds $600,000. Orders already on the books call for the 1919 delivery of 63,000 bodies. The company is making bodies for the Ford Motor Car Co., Paige-Detroit Motor Car Co., Hupp Motor Car Corp., Liberty Motor Car Co., Oakland Motor Car Co., Reo Motor Car Co., Saxon Motor Car Corp. and Willys-Overland Co.

Packard Back in Passenger Production

DETROIT, March 5—The Packard Motor Car Co. has completed its shift from 100 per cent war production back to commercial work. It has resumed the manufacture of passenger cars, the first of which will be ready in May. Commercial truck manufacture has been under way for some time.

Nash Net Profits $1,473,638 for 1918

KENOSHA, WIS., March 3—Net profits of the Nash Motors Co. for the year ended Dec. 1, 1918, after all necessary deductions were made, amounted to $1,473,638, which is $554,146 less than the $2,027,784 earned from Aug. 31, 1916, to Dec. 1, 1917. The surplus of $2,503,831 was $87,697 more than $2,416,-134 in 1917.

The balance sheet of Nash Motors Co. as of Dec. 1, 1918, compares as follows:

Assets

	1918	1917
Property less depreciation	$2,911,633	$3,261,175
Miscellaneous investments	103,941	117,241
Liberty bonds	800,000	......
Accounts receivable	3,226,364	2,120,735
Inventories	4,889,102	4,607,830
Prepaid expenses	5,316	4,275
Total	$11,936,385	$10,111,256

Liabilities

	1918	1917
Preferred stock	$5,000,000	$5,000,000
Common stock	50,000	50,000
Accounts payable	1,788,674	1,311,126
Accrued taxes	764,141	355,109
*Reserves	1,829,739	978,887
Surplus	2,503,831	2,416,134
Total	$11,936,385	$10,111,256

*These reserves do not cover Federal taxes which have been provided for by deduction from cash and receivables as above shown.

—

Commerce Declares Dividend

Commerce Motor Car Co., Detroit, 1½ per cent on capital stock, payable to stockholders of record on April 1; 1 per cent, extra dividend, payable to stockholders of record April 1.

—

Pennsylvania Rubber Declares Dividends

The Pennsylvania Rubber Co., Jeannette, Pa., quarterly dividend 1¾ per cent preferred, 1½ per cent common.

—

Republic Truck Dividend

The Republic Motor Truck Co., Inc., Alma, $1 a share on its common stock, paid Feb. 15 to all stockholders of record Jan. 31.

—

Hebb Dividends

Hebb Motors Co., Lincoln, Neb., 7 per cent quarterly, preferred; 10 per cent, common. The capital of the company has recently been increased from $1,250,000 to $2,500,000.

—

Chandler Declares Dividend

The Chandler Motor Car Co., Cleveland, has declared a quarterly dividend of $3, payable April 1, to stockholders of record March 11.

—

Swinehart Declares Extra Dividend

AKRON, March 5—Directors of the Swinehart Tire & Rubber Co. have authorized the payment of a dividend of 2 per cent in cash on April 15 to stockholders of record March 31, also an extra 10 per cent in preferred stock on March 5 to stockholders of record Feb. 20. These are the first dividends on common stock of this company authorized since Oct. 15, 1917.

Sales in 1918 amounted to $3,910,000, an increase of 100 per cent over those of 1917. Net earnings, it is said, amounted to $500,000. There is $800,000 common stock outstanding. The only change in officials was the addition of C. C. Lee of the Union Commerce National Bank, Cleveland, as director.

—

Emerson-Brantingham $2,071,604 Surplus in 1918

ROCKFORD, ILL., March 3—A surplus of $2,071,604 is reported in the balance sheet of the Emerson-Brantingham Implement Co. of Oct. 31, 1918. This amount is $1,069,284 more than the $1,002,320 earned in 1917.

The competitive balance sheet for the last three years follows:

Assets

	1918	1917	1916
Real estate, buildings	$7,295,865	$6,928,961	$6,814,661
Patents and good will	4,614,402	4,614,403	4,614,403
Preferred stock	388,065	147,198	......
Inventories	12,258,672	8,566,498	6,552,165
Accounts receivable	4.439,242	6,135,592	7,398,435
Sundry debtors	292,543	199,984	112,711
Cash	837,301	627,852	504,501
Liberty bonds	326,468	......	......
Miscellaneous	56,788	110,028	170,752
Prepaid expenses	114.770	112,490	120,462
Total	$30,623,110	$27,443,006	$26,288,091

Liabilities

	1918	1917	1916
Common stock	$10,132,500	$10,132,500	$10,132,500
Preferred stock	12,170,500	12,170,500	12,170,500
Notes payable	4,446,516	2,692,959	3,098,061
Accounts payable*	957,012	950,865	344,793
Reserve for contingent losses	631,992	493,862	464,153
Surplus	2,071,604	1,002,320	78,084
Total	$30,623,110	$27,443,006	$26,288,091

*Including Federal taxes accrued.

—

Stromberg Extra Dividend

The Stromberg Motor Devices Co., Chicago, has declared an extra dividend of 25 cents a share in addition to the regular quarterly dividend of 75 cents a share, payable April 1, to stockholders of record March 15.

—

Wisconsin Motors Stock Issues

MILWAUKEE, March 1—The Wisconsin Motor Mfg. Co. is marketing an issue of $800,000 of 8 per cent cumulative preferred stock at par. In addition, the company has $1,000,000 of common stock, valued at $1,500.000 at market value. Its net sales for 1918 exceeded $5,700,000.

—

Hilo Varnish to Share Profits

BROOKLYN, March 3—The Hilo Varnish Corp. has decided to distribute half the profits of the company annually among its employees, giving each a share proportionate to his salary and the length of time he has been in its service.

Fisk Sales $6,765,482 Ahead of 1917

CHICOPEE FALLS, MASS., March 4—Net sales of $36,682,163 are reported in the financial report of the Fisk Rubber Co. for the year ended Dec. 31 last, which is $6,765,482 more than the $29,916,681 in 1917. Net profits for the year are $3,760,279 after deducting manufacturing cost, depreciation, interest, etc. Federal taxes paid in 1917 amounted to $549,913, and in 1918 the estimated provision for Federal and excess profits taxes was $1,253,426.

The balance sheet, dated Dec. 31, 1918, compares as follows with the reports of the two previous years:

Assets

	1918	1917	1916
Real estate, buildings, machinery, etc.	$7,780,649	$7,146,447	$5,876,308
Good will and patents	8.000,000	8,000,000	8,000,000
Investments	334,599	284,623	404,342
Inventories	14,909,531	17,737,638	7,476,204
Tires in use under mileage contracts	67,479	68,561	38,202
Due on notes from employees for stock subscriptions	429,927	462,717	99,835
Accounts receivable	4,915,453	6,262,541	5,274,296
Cash	1,976,098	1.658,894	367,088
Deferred charges	315,038	365,348	260,479
Total	$38,728,778	$41,986,769	$27,796,754

Liabilities

	1918	1917	1916
Capital stock	$21,129,900	$21,525,000	$21,900,000
Loans and accounts payable	9,731,123	14,684,683	2,832,294
Accrued wages	11,061	24,010	37,764
Unpaid dividends	....	6,706	4,485
Reserves	238,801	360,648	171,768
Surplus appropriated for retirement of preferred stock	1 938,542	1,380.329	975,000
Surplus	4,425,923	4,005,393	1,875,443
Total	$38,728,778	$41,986,769	$27,796,754

—

Allis-Chalmers Sales $35,031,233 for Year

MILWAUKEE, March 5—Gross sales of $35,031,233 are reported in the financial report of the Allis-Chalmers Mfg. Co. for the year ended Dec. 31, 1918, an increase of $8,901,916 over $26,129,317 in 1917. Profits, before taxes were deducted, amounted to $9,754,748 compared with $5,308,790 in 1917. Manufacturing costs in 1918 were reduced to 66.6 per cent of the gross business handled, as against 73.27 per cent in 1917 and 75.61 per cent in 1916. The total surplus as of Jan. 1, 1919, after all necessary deductions were made, was $8,439,470.

—

Universal Mfg. Co. in Bankruptcy

MILWAUKEE, March 1—The Universal Mfg. Co., 491 Broadway, manufacturer and dealer in farm lighting plants, electrical devices and specialties, has filed a petition in bankruptcy, scheduling liabilities at $23,820 and assets at $21,-912. Julius J. Goetz has been elected trustee. Creditors will meet March 13 at 10 a. m. in the office of Referee John F. Harper, Federal Building, Milwaukee.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb. .... .02 -.03
Phosphoric (85%).. .35 -.39
Sulphuric (60%), lb. .008

Aluminum:
Ingot, lb. .... .30 -.33
Sheets (18 gage or more), lb. .... .42

Antimony, lb. ...... .07¼-.07½

Burlap:
8 oz., yd.......... .07½
10½ oz., yd........ .10¾-.11

Copper:
Elec., lb. .... .15½-.16
Lake, lb. .... .18

Fabric, Tire (17¼ oz):
Sea Is., combed, sq. yd. 1.50
Egypt, combed, sq. yd 1.25
Egypt, carded, sq. yd. 1.15
Peelers, combed, sq. yd. 1.10
Peelers, carded, sq. yd. 1.00

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
Ceylon, lb. .... .09 -.22
Madagascar, lb. .... .10 -.15
Mexico, lb. .... .03¾

Lard:
Prime City, gal..1.90-2.00
Ex. No. 1, gal...1.10

Linseed, gal. 1.45-1.48

Petroleum (crude):
Kansas, bbl. ...2.25
Pennsylv'a, bbl.4.00

Manhaden (dark), gal. 1.05-1.06

Lead, lb. .... .04⅞-.05⅛

Leather:
Hides, lb. .... .18 -.34¼

Nickel, lb. .... .40

Oil:
Gasoline:
Auto, gal. .... .24½
68 to 70 gal...... .30½

Rubber:
Ceylon:
First latex pale crepe, lb. ...... .56 -.56½
Brown crepe, thin, clear, lb. ...... .49
Smoked, ribbed sheets, lb. ..... .56

Para:
Up River, fine, lb. .58½
Up River, coarse, lb. .... .35

Island, fine, lb. ...... .49½

Shellac (orange), lb.. .60 -.64

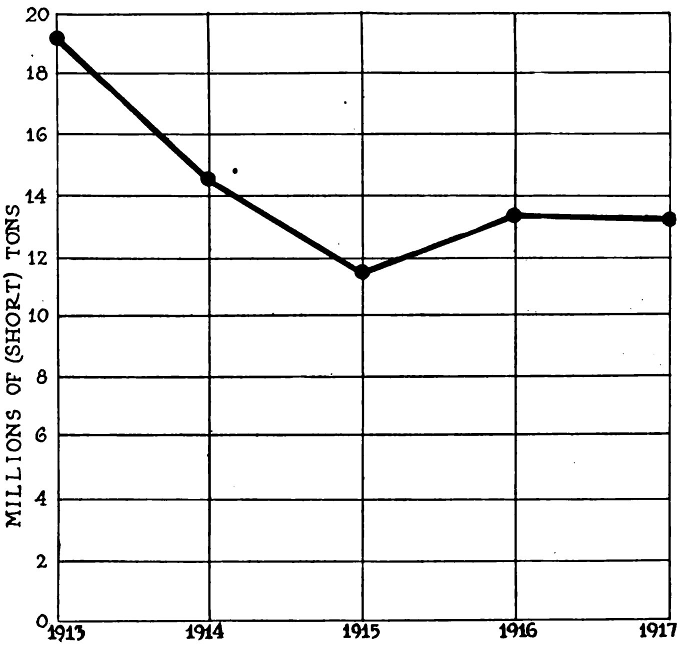
Spelter .... .06½-.06¾

Steel:
Angle beams and channels, lb. ..... .03
Automobile sheet (see sp. table.)
Cold rolled, lb..... .0625
Hot rolled, lb...... .039

Tin .... .71 -.72

Tungsten, lb. 1.50-2.10

Waste (cotton), lb.. .12¾-.17



Germany's output of pig iron during wartime. Such 1918 figures as are available indicate a further drop in production

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock................	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock................	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping................	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close March 1

	Bid	Asked	Net Ch'ge
Auto Body Company......	6½	8½	..
Briscoe Motor Car com....	10	..	..
Briscoe Motor Car pfd....	40	60	+5
Chandler Motor Car.......	122	124	+8
Chevrolet Motor Car......	164	166	..
Cole Motor Car C●........	90	105	..
Continental Motors com...	7¾	8⅛	+¼
Continental Motors pfd....	97	..	+1
Edmunds & Jones com....	15	20	..
Edmunds & Jones pfd.....	75	90	..
Electric Storage Bat......	56	62	+2
Federal Motor Truck......	32	36	+2
Fisher Body Co. com......	50	55	+9¾
Fisher Body Co. pfd......	92	94	+2
Ford Motor of Canada....	315	325	+51
General Motors com.......	149	150	+19
General Motors pfd........	84⅜	86⅜	+1⅝
Hupp Motor Car com.....	6¾	7¼	+¾
Kelsey Wheel Co. com....	36	36⅛	+16
Kelsey Wheel Co. pfd.....	94	95	+3
Manhattan Electric S. com.	..	48	..
Maxwell Motor com.......	34½	35½	+3⅜
Maxwell Motor 1st pfd....	59	60	+4½
Maxwell Motor 2nd pfd....	25	26	+3½
McCord Mfg. com.........	32	35	..
McCord Mfg. pfd..........	93	96	..
Mitchell Motor Co.........	30	..	+6

	Bid	Asked	Net Ch'ge
Motors Products Corp......	..	40	..
Nash Motors Co. com.....	175	200	..
Nash Motors Co. pfd......	93	97	..
National Motor Co........	6	10	+2
Packard Motor Car com..	114	113	+2
Packard Motor Car pfd...	100	102	+1
Paige-Detroit Motor com..	28¼	30	+3¾
Paige-Detroit Motor pfd..	8¾	9¾	..
Peerless Motor Truck.....	18	21	..
Pierce-Arrow M. Car com.	44½	45½	+4
Pierce-Arrow M. Car pfd..	104	106	+2
Premier Motor Corp. com..	5	..	..
Premier Motor Corp. pfd...	..	75	..
Prudden Wheel Company.	17¼	..	+1½
Reo Motor Car Co.........	22¾	23¾	+1¼
*Republic M. Truck com..	35½	37½	..
Republic M. Truck pfd....	88	91	+1
Saxon Motor Car com.....	10	12	+1¾
Scripps-Booth Corp.	21	25	..
*Stewart Warner Spd. Corp	89	91	+6
Stromberg Carburetor Co.	40¼	40½	+ ¼
Studebaker Corp. com.....	59¼	60¼	+7
Studebaker Corp.. pfd......	90	94	—2
Stutz Motor Car Co.......	45¾	46¾	+3¼
United Motors Corp.......	41¼	43¼	+2¾
White Motor Co...........	53⅜	54⅜	+2¾
*Willys-Overland com.....	26⅜	27⅜	+1⅞
Willys-Overland pfd.......	90	91½	+2

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co...........	79⅝	80½	+8⅛
Firestone T. & R. com....	140	145	..
Firestone T. & R. pfd.....	99	101	+3½
Fisk Rubber Co. com.......	95	97	+8
Fisk Rubber Co., 1st pfd...	100	105	—2
Fisk Rubber 2nd pfd......	97	100	..
Fisk Rubber 1st pfd. conv.	99	101	..
Goodrich, B. F., com......	70	70½	+10¾
Goodrich, B. F., pfd......	10	106½	+1¼
Goodyear T. & R. com.....	243	248	—2
Goodyear T. & R. 1st pfd..	105	107	+1½
Goodyear T. & R. 2nd pfd..	105	107	+1½
Kelly Springfield com......	111	112	+28¼
Kelly Springfield pfd......	90	96	—3
Lee Tire & Rubber Co....	26¾	27	+3
Marathon Tire & Rubber..	55	75	..
Miller Rubber Co. com....	172	175	—6
Miller Rubber Co. pfd....	102	105	..
Rubber Products Co......	120	122	+3
Portage Rubber Co. com..	160	165	—2
Swinehart T. & R. Co.....	..	92	..
U. S. Rubber Co. com.....	82½	83½	+7
*U. S. Rubber Co. pfd.....	111½	112½	+2¼

*Ex. Dividend.

Urge Road Building Program

(Continued from page 544)

ably expected. Soldiers needed for farm work.

Illinois—About 40,000 are idle, of which 4000 are women. About 5000 men to be given work on State roads to cost $60,000,000 and 3000 to work on State buildings. No feeling of pessimism nor any undue optimism.

Indiana—Situation is far more alarming. About $42,000,000 available to be spent in public works. Private capital is holding back in building because of high labor and materials costs. About 50,000 soldiers have returned and been given places, many employers carrying extra men on the pay roll.

Kansas—Ready to use more men today. Will have $200,000,000 wheat crop and must have much labor in Spring and Summer. Situation very satisfactory and no reason to think that all soldiers will not be employed when they return.

Kentucky—Situation is good, except in some coal districts. Many opportunities for work on farms.

West Virginia—Less than half of 80,000 miners are working full time. Great efforts must be made if men are to be given a livelihood.

Louisiana—Labor conditions fairly satisfactory. There is a shortage rather than an oversupply of labor. Not a soldier has returned who has not taken his old job or a new one. As trade of country expands great opportunities for work will open up.

Maryland—Up to this time no labor shortage. About 13,000 soldiers have been given jobs.

Maine—Greatest trouble found in getting soldiers to come back to jobs that await them. Employers expect to face a sharp labor shortage in a year.

Michigan—Condition of copper market has hit many mines. On the whole, however, the situation appears to be good, certainly it is not serious. The State is in a good position to take care of all her soldiers. Detroit has more men idle than in normal times, due to cutting off of war work.

Minnesota—No labor troubles have come up and no great unemployment problem seems imminent. Of the 12,000 soldiers who have returned, 4674 have taken their old jobs, and of the remainder all except about 800 have been placed in new jobs. The boys from the farms show a tendency to stop in the cities and enter industrial life. Building operations in Spring may prove disappointing.

Several mayors objecting to the reports made by the governors, and especially those city executives from the far western states where there has been considerable trouble claimed that the state executives were not closely in touch with the conditions and did not know how serious the labor surplus is.

Governor Edge of New Jersey recommended that the Federal Government should release industry from Government restraint at once, and Governor Cox of Ohio combatting this view stated that the Federal powers should continue to interest themselves in industry. He said that the country was being asked at present to listen to two groups of extremists, one wanting prosperity held up in order to "teach labor an object lesson" and the other anxious to proceed with projects regardless of costs.

He urged road building as a buffer employment measure and suggested the creation of an organization in Washington to find out for the Federal Government what should be a fair price for gravel, crushed stone and other road building material, declaring that artificial prices fixed by unpatriotic men were holding up road construction.

Roger W. Babson, representing the Department of Labor, presented seven propositions which, he said, if adopted generally, would allay fear and start the country right in its attempt to get back to a proper industrial basis. His suggestions included:

1. Begin at once construction of all public works possible, including public buildings—especially schoolhouses.
2. Get behind the "build-a-home" movement by asking for a quota for your community and then publishing each week in your daily papers how you are keeping up with that quota.
3. Get your State this Summer to build its full quota of federal roads on the 50-50 basis and appropriate a larger sum than ever before for State roads.
4. See that the traction properties of your State and city receive fair treatment, remembering that the transportation system of a city determines more than any other one thing its growth and prosperity.
5. Urge labor to give greater service for its wages, but remember that high wages increase the home market for goods, so that the more money paid in wages the more goods will be purchased and the greater will be the prosperity of your state and city.
6. Get your councils of defense and safety committees to advertise as much now to get people to buy as they advertised during the war to get people to economize.
7. Help Secretaries Wilson, Lane and Redfield and the other cabinet chiefs in their efforts to provide greater opportunities for both capital and labor.

Lieut.-Governor Oglesby of Illinois said that the time is ripe for industry to assume its natural place and also to let the law of supply and demand again come into operation. Governor Catt of Florida said both wages and prices of commodities must come down before industry could resume a normal pre-war basis.

An address was made today by S. M. Williams, President of the Highways Industry Association, in which he discussed the value of road building, not only as a buffer employment for labor but also in its direct relation to the development of the public prosperity and welfare generally. He replied to the speech of Governor Cox, quoting prices for brick and other road materials to show that they were not exorbitant at present, and stated that as 75 per cent of the cost of road construction is labor, there is not much possibility of reducing the cost of road building so long as the present wages maintain.

Discussing business and labor conditions generally, Mr. Williams urged the public to cease looking for a reversion to the prices of 1914, and said that prosperity could only be found when the business men and general public realized that it is necessary to go ahead now with production and expenditure.

Approximate Apportionment of Funds Under Federal Aid Road Act and Amendment Thereto

STATES	Amount Available for Fiscal Years 1917, 1918, 1919	$50,000,000 for Fiscal Year 1919	Fiscal Year 1920 Allotment	Fiscal Year 1920 $75,000,000	Fiscal Year 1921 Allotment	Fiscal Year 1921 $75,000,000	Grand Total
Alabama	$625,903.17	$1,050,264.10	$420,105.64	$1,575,396.15	$525,132.05	$1,575,396.15	$5,772,197.26
Arizona	411,081.14	685,043.57	274,017.43	1,027,565.36	342,521.79	1,027,565.36	3,767,794.65
Arkansas	498,085.77	840,229.53	336,091.81	1,260,344.30	420,114.76	1,260,344.30	4,615,210.47
California	909,358.99	1,524,248.30	609,699.32	2,286,372.45	762,124.15	2,286,372.45	8,378,175.66
Colorado	508,349.34	867,570.90	347,028.36	1,301,356.35	433,785.45	1,301,356.35	4,759,446.75
Connecticut	185,487.77	307,064.65	122,825.86	460,596.98	153,532.32	460,596.98	1,690,104.56
Delaware	48,965.10	81,384.45	32,553.78	122,076.68	40,692.22	122,076.68	447,748.91
Florida	338,652.69	573,797.20	229,518.88	860,695.80	286,898.60	860,695.80	3,150,258.97
Georgia	806,897.89	1,346,044.75	538,417.90	2,019,067.12	673,022.38	2,019,007.12	7,402,517.16
Idaho	363,862.05	610,509.27	244,203.71	915,763.91	305,254.64	915,763.91	3,355,357.49
Illinois	1,321,102.17	2,185,550.65	874,220.26	3,278,325.97	1,092,775.32	3,278,325.97	12,030,300.34
Indiana	813,473.04	1,349,919.40	539,967.76	2,024,879.10	674,959.70	2,024,879.10	7,428,073.10
Iowa	873,180.41	1,443,046.20	577,218.48	2,164,569.30	721,523.10	2,164,569.30	7,944,106.79
Kansas	858,754.08	1,436,313.93	574,525.57	2,154,470.89	718,156.96	2,154,470.89	7,896,692.32
Kentucky	585,400.35	976,865.17	390,746.07	1,465,297.76	488,432.59	1,465,297.76	5,372,039.70
Louisiana	406,179.27	680,729.03	272,291.61	1,021,093.55	340,364.51	1,021,093.55	3,741,751.52
Maine	290,161.92	481,231.35	192,492.62	721,847.23	240,615.78	721,847.33	2,648,196.53
Maryland	263,013.09	434,737.02	173,894.81	652,105.53	217,368.51	652,105.53	2,393,224.49
Massachusetts	442,814.70	736,883.30	294,753.32	1,105,324.95	368,441.65	1,105,324.95	4,053,542.87
Michigan	872,707.53	1,447,213.80	578,885.52	2,170,820.70	723,606.90	2,170,820.70	7,964,055.15
Minnesota	853,047.58	1,420,774.53	568,309.81	2,131,161.80	710,387.26	2,131,161.80	7,814,642.78
Mississippi	535,469.12	899,488.26	359,795.31	1,349,232.39	449,744.14	1,349,232.39	4,942,961.61
Missouri	1,017,765.21	1,695,314.11	678,125.64	2,542,971.14	847,657.05	2,542,971.14	9,324,804.29
Montana	593,382.46	999,467.15	399,786.86	1,499,200.73	499,733.58	1,499,200.73	5,490,771.51
Nebraska	639,757.68	1,066,642.07	426,656.83	1,599,963.10	533,321.04	1,599,963.10	5,866,303.82
Nevada	386,424.72	642,933.45	257,173.38	964,400.18	321,466.72	964,400.18	3,536,798.63
New Hampshire	125,599.97	207,810.38	83,124.15	311,715.57	103,905.19	311,715.57	1,143,870.83
New Jersey	353,995.26	594,050.80	237,620.32	891,076.20	297,025.40	891,076.20	3,265,844 18
New Mexico	474,847.98	798,785.78	319,514.31	1,198,178.67	399,392.89	1,198,178.67	4,388,898.30
New York	1,501,835.01	2,487,956.40	995,182.56	3,731,934.60	1,243,978.20	3,731,934.60	13,692,821.37
North Carolina	685,702.23	1,139,977.47	455,990.99	1,709,966.20	569,988.74	1,709,966.20	6,271,591.88
North Dakota	458,015.09	768,360.27	307,344.11	1,152,540.42	384,180.14	1,152,540.42	4,222,980.46
Ohio	1,118,759.68	1,854,462.47	741,784.99	2,781,693.71	927,231.24	2,781,693.71	10,205,625.80
Oklahoma	691,906.34	1,153,055.50	461,222.20	1,729,583.25	576,527.75	1,729,583.25	6,341,878.29
Oregon	472,394.85	787,459.10	314,983.64	1,181,188.65	393,729.55	1,181,188.65	4,330,944.44
Pennsylvania	1,382,078.29	2,296,075.85	918,430.34	3,444,113.77	1,148,037.92	3,444,113.77	12,632,849.94
Rhode Island	69,969.51	116,530.95	46,612.38	174,796.43	58,265.48	174,796.43	640,971.18
South Carolina	430,437.00	717,297.05	286,918.82	1,075,945.58	358,648.52	1,075,945.58	3,945,192.55
South Dakota	486,013.67	810,720.68	324,288.27	1,216,081.02	405,360.34	1,216,081.02	4,458,545.00
Tennessee	683,123.95	1,132,103.50	452,841.40	1,698,155.25	566,051.75	1,698,155.25	6,230,431.10
Texas	1,752,770.13	2,926,219.37	1,170,487.75	4,389,329.05	1,463,109.69	4,389,329.05	16,091,245.04
Utah	341,613.62	567,592.10	227,036.84	851,388.15	283,796.05	851,388.15	3,122,814.91
Vermont	136,662.33	225,987.70	90,395.08	338,981.55	112,993.85	338,981.55	1,244,002.06
Virginia	597,102.90	992,052.95	396,821.18	1,488,079.43	496,026.48	1,488,079.43	5,458,162.37
Washington	432,183.03	722,367.25	288,946.90	1,083,550.87	361,183.62	1,083,550.87	3,971,782.54
West Virginia	319,525.27	532,009.10	212,803.64	798,013.65	266,004.55	798,013.65	2,926,369.86
Wisconsin	767,790.41	1,272,946.53	509,178.61	1,909,419.79	636,473.26	1,909,419.79	7,005,228.39
Wyoming	367,396.24	612,912.45	245,164.98	919,368.68	306,456.22	919,368.68	3,370,667.25
Total	$29,100,000.00	$48,500,000.00	$19,400,000.00	$72,750,000.00	$24,250,000.00	$72,750,000.00	$266,750,000.00
Administration	900,000.00	1,500,000.00	600,000.00	2,250,000.00	750,000.00	2,250,000.00	8,250,000.00
Grand total	$30,000,000.00	$50,000,000.00	$20,000,000.00	$75,000,000.00	$25,000,000.00	$75,000,000.00	$275,000,000.00

Problems of Tractor Design Discussed at Kansas City

(*Continued from page* 546)

It was pointed out in the discussion of this paper that the fuel question has an important bearing on the sale of American automotive apparatus in South America. At the present time gasoline sells in Buenos Ayres at 62 to 75 cents per gal. and it is absolutely necessary to lessen the cost of fuel before much demand for automobiles and tractors can be hoped for from that country.

The paper on "The Principles of the Wheel Farm Tractor" by E. R. Hewitt was the same as that presented at the winter meeting of the society. This paper, which had been in the hands of the membership in printed form for some time, brought out considerable contributed discussion. Mr. Hewitt's conclusion that the maximum traction which it is possible to obtain with a cleated wheel is equal to the shearing resistance of the ground over the arc of the circle described by the outer edge of the cleats in passing through the ground was taken exception to by several. It was pointed out that if this was correct a ½ in. cleat would be practically as effective as a 5 in. cleat.

Mr. Greer said that Mr. Hewitt overlooked the advantages of spiral extension cleats, which clear themselves of dirt and which do not cause shearing of the ground. Mr. Greer also disagreed with Mr. Hewitt regarding the relative advantages and disadvantages of the front drive. He said that with front driven tractors over 85 per cent of the weight may be carried on the driving wheels and that the front drive is advantageous on hills. Moreover, plowing represents only about 50 per cent of the work of any tractor, and some of its other uses should be considered in determining the best type.

Vacuum Gage as Power Indicator

Mr. Shoop brought out the point that a wheel with involute cleats would enter and leave the ground perpendicularly. Mr. Horning spoke commendingly of the use of the vacuum gage as a power indicator described by Mr. Hewitt. He said that the conditions of operation of the average tractor engine corresponded to curve 1, Fig. 3, in the paper. As regards the statement that engines were abused in service, there is no load which can possibly be injurious to any first class tractor engine.

Mr. Lohman, who was described as the engineer of a large community farm in Montana, in a written discussion regretted the tendency of tractor manufacturers to over-rate their machines. He said that 50 to 60 per cent of its rated capacity is all the work that a farmer could hope to obtain from the average tractor. The maximum that he had ever been able to get in continued service was 80 per cent of the rated capacity. He also pointed out the important fact that good weather plays a big part on the work of a tractor.

Mr. Lohman took exception to a statement made by Mr. Hewitt regarding the relative merits of wheeled and creeper type tractors. He said that a creeper type tractor when passing over a plowed field will leave as the only sign of its passage a series of splashes of loose earth. Prof. Moyer spoke of the results he had arrived at in experiments on the traction resistance of wheeled tractors, and especially the dependence of that resistance upon the wheel diameter.

Scientific Research in Tractor Design

The last paper of the afternoon was that by Prof. White on "The Redesign of Agricultural Machinery" for tractor work. Prof. White paid a tribute to the men who invented our principal agricultural machines. He said they possessed genius, enterprise and courage, but for the most part they lacked technical education. Most of their work had been done on a cut and dry basis, and as they had been so successful, their successors followed in their footsteps and continued to work by empirical methods. Prof. White asked whether the present generation would have nothing to add to the achievements of these pioneers, and he believed that the great development of the near future would be the application of scientific research work to the elucidation of problems in implement design.

Committees Appointed on Speed of Belts

A meeting of the tractor division of the Standards Committee was held at the Sweeney School on Tuesday morning, most of the members being present. The chief topic of discussion was that of belt speeds. A standard belt speed of 2600 ft. per minute was adopted by the Society last year, but it was found that this is a little too low, especially for the heavier tractors. The subject was discussed at great length and the consensus of opinion seemed to be that two or three different standard belt speeds would be required, ranging perhaps from 2800 to 3500 ft. per minute. Some consideration was also given to belt speeds suitable for small machines usually driven from stationary farm engines, but it is likely that this subject will be assigned to the stationary and farm engine division. A subcommittee is to be appointed to gather data regarding desirable belt speeds and to confer with the American Society of Agricultural Engineers and the National Vehicle and Implement Association on the subject.

Drawbar Height

Another topic discussed was that of drawbar height. This also has been standardized, the standard height being 17 in., but it has been found that this does not fully meet the requirements, and it is likely that a range of drawbar height will be adopted in the future. A subcommittee will be appointed to look after this matter. The subject of a standard drawbar connector, on which Mr. Greer of the Four Wheel Drive Co. has been working, was revived, and a preliminary report was received from a sub-committee on standard wheel rim punching.

Tractor Trials in Great Britain

(*Continued from page* 547)

threshing machine than is available in stock. Threshing here has been done mostly by steam power with traction engines which draw the threshing machines and a stacker; and these engines are more powerful than the average tractor, unless the latter is overloaded.

Another seeming market is for either a narrow or a reducible tread tractor chiefly for export to the West Indies for use in sugar and beet plantations. The French have a few promising machines of this sort, chiefly listed for working between vine rows, but they are for the most part too light and not powerful enough for other purposes.

Another point for tractor makers to note is that the exposed tractor wheels with bull-ring drive are not wanted here, because it is found that the teeth become choked. An all enclosed drive is desired, or, at the most, an exposed chain drive. The remark made previously that tractor trials are being developed by the implement makers is amply borne out by the use of the bull gear and cast metal gear exposed drive. Neither from an engineering nor a user's point of view is this sort of drive fitted for a hard worked tractor; but rather only machine cut gear of small dimensions and wholly enclosed in oil-tight cases.

The chain-track form of tractor has no monopoly of favor here. At present one make of this type is being assembled here, presumably to reduce the cost of freight.

The Fordson interests have a factory in course of building at Cork, Ireland, which may be expected to have an important effect on the price and output of that machine.

Commercial Treaties With South America

WASHINGTON, March 3—The United States is negotiating with the countries of Latin America to secure uniform recognition and taxes for traveling salesmen representing American firms in those countries. The new treaty has already been ratified with Uruguay and Guatemala, and provides that the business representatives will be accredited by the United States Department of Commerce and given a special single license that will carry them throughout the country they desire to visit without the payment of special taxes in every section as has heretofore been the custom. Provisions also arrange for a schedule to be drawn whereby samples will be admitted, in some instances free of duty, and in others by bond to re-export them within six months of entry.

Aluminum Production Falls 10 Per Cent

WASHINGTON, March 4—Aluminum production in 1918 was valued at $41,159,225, a decrease of $4,722,775, or 10 per cent from the value in 1917. The decrease is due very largely to a decline in the price of that metal during 1918, and does not represent a corresponding decline in quantity of output.

Changes in Nash Sales Force

KENOSHA, March 3—W. W. Smith has been appointed manager of passenger car sales of the Nash Motors Co. to succeed R. P. Bishop, who has resigned. He has been with the factory for the past two years. In 1909 he was connected with the Speedwell Motor Car Co. In 1912 he became sales manager of the American Lock Nut Co. and was later with the Thomas B. Jeffery Co. in an executive capacity, Lts. W. L. Tenney and Haskel Bliss will assist him. Both of these men were released recently from military service.

—

Rex D. Gilbert, Philadelphia, has been elected secretary and treasurer of the Oldfield Tire Co., Cleveland, the new concern organized by Barney Oldfield, the ex-car racer. Mr. Gilbert was with the Firestone Rubber Co. for the past six years.

—

A. L. Nelson has been appointed chief engineer of the Premier Motor Corp., Indianapolis, succeeding C. S. Crawford, who has been promoted to director of engineering and assistant general manager. During the war, Mr. Nelson was consulting engineer of Aircraft Armament at McCook Field, Dayton.

—

John H. Diehl has been elected vice-president of the Mason Tire & Rubber Co., Kent, Ohio.

—

Maj. William Mitchell Lewis, for many years a car manufacturer of Racine, Wis., has been promoted to lieutenant-colonel in the Signal Corps, U. S. A., of the American Army of Occupation, according to official word received here.

—

George B. Norcross has been placed in charge of the Detroit branch of the Hess Steel Corp., Baltimore. Previously he represented the company in this district.

—

Porter Opens New York Office

DAYTON, OHIO, March 3—Finley R. Porter, who completed his work with the Division of Military Aeronautics on March 1, will open headquarters in New York at the Engineers' Club on March 6. R. B. Porter, his son, will be associated with him in his future plans. Mr. Porter's immediate plans call for designs of some heavy engines for transatlantic ships, and after that he will no doubt enter the automobile field again to begin production of the F. R. P. cars in addition to building two or three types of aeronautical engines. Mr. Porter has been with the Bureau of Aircraft Production for the last 10 months as chief motor engineer.

—

Markley Body Co. Opens in Detroit

DETROIT, March 4—The Markley Commercial Body Co., with its factory and general offices in Pontiac, has opened a branch here at 728 Cass Avenue.

Men of the Industry

Changes in Personnel and Position

Kramer New Vice-President of Willys-Overland

TOLEDO, March 1—C. O. Miniger, vice-president in charge of production of the Willys-Overland Co., Toledo, has retired and will devote his entire time to his duties as president and general manager of the Electric Autolite Corp. Leroy Kramer, for many years vice-president in charge of manufacture of the Pullman Co., Chicago, and who for the past six months has been Federal manager of the United States Railroad Administration for the Southwestern district, St. Louis, has succeeded Mr. Miniger.

—

C. R. Miller, former assistant to the vice-president of the Willys-Overland Co., has been appointed works manager for the factory.

—

F. A. Petrie, field manager of the Dort Motor Car Co., Flint, will leave in May for a business trip through South America.

—

Walter H. Schwab, formerly president and general manager of the Auto Parts Mfg. Co., Milwaukee, has become secretary-treasurer of the General Mfg. Corp., which has taken over the business of the Minn Billiard Co., and will manufacture talking machines, pool and billiard tables, motor car specialties, parts and accessories.

—

W. B. Huntley, until recently a lieutenant in the Ordnance Department, has joined the sales force of the United Alloy Corp., Canton. Prior to his enlistment he was affiliated with the Crucible Steel Co. of America.

—

Daniel M. Crouse, vice-president and director of the Bossert Corp., Utica, died on Feb. 19.

—

Morris E. Fuller, founder of the Fuller & Johnson Mfg. Co., Madison, Wis., died at his home in Schuyler, Neb., on Feb. 14, at the age of 98. Mr. Fuller retired from active business about 20 years ago. He was one of the earliest dealers in farm implements in the Middle West.

—

Judge William J. Turner, Milwaukee, president of the Turner Mfg. Co., Port Washington, Wis., died Feb. 15 at the age of 71 years. His son, Lee H. Turner, is vice-president and general manager of the company. Judge Turner occupied the circuit court bench here for the last ten years.

Unwin to Manage Reo Branch

LANSING, March 4—Maj. Harry Unwin has been appointed manager of the Chicago branch of the Reo Motor Car Co. Major Unwin has just been released from the Ordnance Department and for several months has made his headquarters in this city, where he has had supervision of the tractor contract which the Reo company was completing for the government.

—

W. E. Perrine, assistant general manager of the Standard Parts Co., will leave Cleveland to enter the executive and production department of the Chevrolet division of the General Motors Co., with headquarters in New York. He will take up his new duties March 1.

—

L. F. Jalagas, formerly in the wholesale sales department of the Reo branch in Chicago, has become wholesale manager for the South West Motor Co., Kansas City distributer of Reo and Jordan cars.

—

List Obsolete and Active Planes

WASHINGTON, March 3—A list of airplanes that are considered active, obsolescent and obsolete has been compiled by the Department of Military Aeronautics and a policy has been formulated providing that only repair spare parts can be manufactured for obsolescent planes. A policy for the disposition of the obsolete planes will be announced later. The obsolescent planes will be used until either by accident or wear and tear they are beyond use and it will be left to the judgment of the officers at the fields to decide this.

Following is the list of planes:

Active

Planes	Engine
Curtiss JN4H (JN4HB)	Hisp.-Suiza Model 1
Curtiss JN6HO (JN4HG)	Hisp.-Suiza Mod. E
Curtiss JN7H (JN6HB)	Liberty 12
De Haviland 4 (JN6HP)	Le Rhone 80 HP
USD9A (JN6HG1)	
SE-5 (JN6HG2)	
VE-7	
S4-C	
Martin Bomber	
Hydros	
Lepere	
Handley-Page	
Spad	
Sopwith Dolphin	
Caproni	

Obsolescent

Curtiss JN4A	Curtiss OX2
Curtiss JN4B	Curtiss OXX3
Curtiss JN4D	Curtiss OX5
Canadian JN4	Hispano-Suiza Model A
Thomas Morse Scout	Gnome

Obsolete

Curtiss R4	Thomas Morse 8
Curtiss R2	Curtiss Model O
Curtiss N8	Curtiss OXX
Curtiss Twin	Curtiss OXX-2
LWF	Curtiss N-8
Standard J-1	Sturtevant 5-A
L-2	Hall Scott A5A
R-6	Hall Scott A7A
Martin R	Lawrence
Standard D	Clerget 9
Heinrich C-1	Curtiss V-2
Aero Marine	Curtiss V-X
Boeing	Wright 6-Cyl.
Martin TT	Salmson M-9
Martin R6	Renault 12
Standard H-2	Renault 8
Standard H-3	Sturtevant 4-cyl.
Sturtevant S-4	Aero Daimler 6-cyl.
Bristol Fighters	Curtiss Type S
Burgess Hydroplane	Laviateur 8

Detroit's 18th Show a Success

DETROIT, March 3—Detroit's eighteenth annual show is in full swing. It opened Saturday night in the Crosstown garage. Forty-five pleasure cars, 33 trucks, three tractors and automobile accessories are represented.

Great crowds visited the show Saturday night and all day Sunday throngs passed up and down the long lanes of cars. As early as Monday afternoon exhibitors were beginning to label numerous cars "sold," and every indication points to the complete demoralization of all previous show sales records.

The passenger car exhibits attract and hold the greatest crowds. Three tractors are on display.

Ford Will Make $250 Car

(*Continued from page* 545)

deny the interview said to have been given out to newspaper men in Los Angeles. Mr. Ford is expected in Detroit on Saturday. George S. Anderson, assistant secretary of the Ford Motor Co., said last night that he did not know anything about the correctness of the interview, but admitted that it had been reported to him late yesterday afternoon and had been taken up with the officials of the company. This is all the Ford officials claim to know about it.

Warnings for Trade With India

MADRAS, INDIA, Feb. 27—A warning has been issued from the consular officer here to American firms wishing to place orders in India, which states that no orders can be placed in America with firms not having agencies in India, since it is a Government rule that these Indian firms must certify to the receipt of articles in good order before payment can be made. Another complant deals with catalogs sent here without prices.

British Airship Stays in Air 100 Hours

ABERDEEN, SCOTLAND, Feb. 28—Remaining in the air from 2 p. m. on Sunday afternoon to 6.50 p. m. Thursday evening, a British airplane, in charge of Captain Warneford, made a record flight lasting 100 hours and 50 minutes. It ascended from Lenabo naval air station, about 25 miles north of this city. It was forced to descend, according to Captain Warneford, because of shortage of fuel and water. It carried a crew of 11 men and is equipped with beds and cooking apparatus.

Schoof-Gracey Co. to Make Ford Bodies

DETROIT, March 4—The Schoof-Gracey Co. has been organized to take over the commercial body department of the Maurice W. Fox Co., authorized Ford agents. The firm is composed of August F. Schoof and Chester W. Gracey.

Biplanes to Carry Mail to Ships

NEW YORK, March 5—The Kerr Steamship Co. is to operate a fleet of planes to deliver mail from 24 to 36 hours after the ships leave port. Mail will be carried in waterproof sacks and will be dropped on deck by the aviators.

Metz Roadster to Sell for $1,400

WALTHAM, Feb. 25—The 6-cylinder car which the Metz Co. is putting out will make its appearance about March 15 in three models. The roadster will sell for $1,400, the touring car for $1,600 and the closed car for $2,100.

Dayton Automobile Show Opens

DAYTON, March 4—The Dayton automobile show is in full swing this week. It opened Monday in one of the buildings at the National Cash Register plant. Cars, trucks and tractors are exhibited.

Procedure and Complete Forms for Validating Contracts

(*Continued from page* 544)

WAR DEPARTMENT
PURCHASE, STORAGE AND TRAFFIC DIVISION
GENERAL STAFF

Washington, March 3, 1919.

SUPPLY CIRCULAR
No. 17

Subject: Procedure on claims for relief under Act of Congress approved March 2, 1919, entitled "An Act to Provide Relief in Cases of Contracts Connected with the Prosecution of the War, and for other Purposes."

The attention of the Supply Bureaus is called to the following resolution of the War Department Claims Board for their information, action and guidance:

Pursuant to the authority conferred upon it by War Department General Order No. 33, in connection with the administration of the powers conferred upon the Secretary of War under and by virtue of an Act entitled "An Act to Provide Relief in Cases of Contracts Connected with the Prosecution of the War, and for other Purposes," (copy of which Act is annexed to this resolution), the War Department Claims Board adopts the following procedure governing the presentation and payment of claims under Sections 1 and 4 thereof.

Attention is called to the fact that the Act does not authorize the execution of contracts which have not heretofore been properly executed. The Bureaus shall not execute contracts with respect to agreements covered by the Act, but shall proceed in the manner hereinafter provided.

1. *Classification of Claims*—For the purposes of administration, claims presented to the Secretary of War under this Act will be classified as follows:

Class A. Claims based on agreements made by an officer or agent acting under the authority, direction or instruction of the Secretary of War, and the nature, terms and conditions of which have been reduced to contract form or are otherwise established by written evidence.

Class B. Claims based on all other agreements covered by the provisions of Section 1 of said Act.

Forms and Procedure with Respect to Class A Claims

2. *Form and Method of Presentation.*

(a) Claims falling under Class A shall be presented in the form of "Statement of Claim Form A." hereto attached. They shall be prepared and presented in quadruplicate, each copy being duly executed and verified. The four copies shall be forwarded to the Claims Board in Washington of the Bureau with which the alleged agreement was made. Proper addresses are as follows:

Ordnance Claims Board, War Department, Washington, D. C.
Claims Board, Air Service, War Department, Washington, D. C.
Claims Board, Chemical Warfare Service, War Department, Washington, D. C.
Claims Board, Construction Division, War Department, Washington, D. C.
Claims Board, Director of Purchase, War Department, Washington, D. C.
Claims Board, Signal Corps, War Department, Washington, D. C.
Claims Board, Office Chief of Engineers, War Department, Washington, D. C.

(Claims based on agreements with the Quartermaster Corps should be addressed to the Claims Board, Director of Purchase, as above.)

(b) Attention is called to the fact that under the act these claims must be filed and duly supported by itemized statements before June 30, 1919.

(c) In all cases where settlement negotiations with respect to such agreements are now pending the negotiations will proceed without interruption, but no award can be made until after the statement of claim has been filed in Washington, and the nature, terms and conditions of the agreement certified by the proper Bureau Claims Board and approved by the claimant, all as hereinafter provided for.

(d) For further information claimants should apply to the proper Bureau Claims Board in Washington, or to its nearest local representative. All Supply Bureaus of the War Department are directed to facilitate in every way the prompt and proper presentation of these claims.

3. *Procedure in the Bureaus after Filing of Claims.*

(a) On the presentation of any claim to the Claims Board of a Supply Bureau, all copies of said claim are to be immediately endorsed as follows:

Received by......................... ....
Name of officer or agent.
....
Date,..........day of..............., 1919.

Each claim will receive an *identifying number* which shall be of a series not at present used in the Bureau, and a record made of its receipt and disposition. In the event that claims are improperly directed to a Bureau and have to be reforwarded from the Board of that Bureau to the Board of another Bureau, they are, nevertheless, to be numbered and stamped with the name of the Officer or Agent receiving them and the date so that the fact of their presentation to the Secretary of War before June 30, 1919, may be clearly established. When forwarded to another Board that Board will give them an identifying number of its series and they will thereafter be recorded and known under that identifying number.

(b) Each Bureau Claims Board upon the proper presentation of any claim is directed to examine into and determine the facts as to the nature, terms and conditions of the alleged agreement referred to in the statement of claim. If it finds that an agreement within the provisions of Section 1 of said Act was entered into, it will make a certificate in the form hereto attached, entitled "Form C." Such certificate shall not be executed except when it is attached to (1) an agreement heretofore reduced to contract form, or (2) a purchase order heretofore signed, or (3) a procurement order or notice of award heretofore signed which sets forth all the terms and conditions of the agreement, or (4) a document to be prepared under the supervision of such Bureau Claims Board fully setting forth the nature, terms and conditions of the agreement, and which may be in the form of such contract or order as should in due course have been formulated to cover the agreement.

(c) The nature, terms and conditions of the agreement thus established and certified shall be submitted to the claimant and no award can be made until the claimant's acceptance and approval of the certificate has been endorsed thereon

(d) The Bureau Claims Boards are hereby authorized and directed to proceed, on the basis of the agreement thus established, to make detailed examination of the claim and to recommend a fair and equitable basis for the adjustment, payment or discharge thereof. For that purpose, so far as consistent with these or subsequent instructions of the War Department Claims Board, the Bureau Claims Boards may make use of the machinery and procedure which has heretofore been established for the negotiation

of settlement agreements on properly executed contracts which have been suspended or reduced.

(e) The adjustment, payment or discharge shall be recommended in the form of an award or a series of awards using the form attached hereto entitled "Award Form 1," where a single award is made covering the entire agreement, or the form attached hereto entitled "Award Form 2," where the award is one of a series, or the form attached hereto entitled "Award Form 3," where the award is the last of a series of awards. In every case the award shall bear a serial number corresponding to the serial number of the agreement, and where a series of awards are made with respect to a single agreement each award of the series shall be given a consecutive sub-letter, as A, B, C, etc. Each award must be submitted to the claimant and his acceptance endorsed thereon and must be approved by the Bureau Claims Board and by the War Department Claims Board prior to payment.

(f) Wherever, in the judgment of the Board or Officer charged with the duty of recommending a fair and equitable basis upon which the agreement shall be adjusted, paid or discharged, it is to the best interests of the United States to do so, a separate award may be made with respect to any portion of the agreement which has been sublet or with respect to any other clearly separable item of the claim.

(g) When the award is made with respect to any portion of the agreement which has been sublet, payment thereon shall be made in accordance with paragraph 4 of the Act, and disbursing officers are authorized and required to demand that the prime contractor present satisfactory evidence of having paid each sub-contractor with respect to whom the award has been made, or of the consent of each sub-contractor to look for compensation to said prime contractor only; and in the case of the failure of said prime contractor to present such evidence or such consent the disbursing officer shall pay directly to each sub-contractor the amount found to be due him under such award.

Form and Procedure with Respect to Class B Claims

4. *Form and Method of Presentation.*

(a) Claims falling under Class B shall be presented in the form of "Statement of Claim Form B" hereto attached. They shall be prepared and presented in sextuplicate, each copy being duly executed and verified. The six copies shall be forwarded to the Board of Contract Adjustment, Munitions Building, Washington, D. C.

(b) Attention is called to the fact that under the Act these claims must be filed before June 30, 1919.

5. *Procedure by the Board of Contract Adjustment on Class B Claims.*

(a) Class B claims shall be submitted to the Board of Contract Adjustment which, in handling them, will follow the procedure above outlined for Class A claims so far as it is applicable; but those claims which are based upon alleged agreements entered into with an officer or agent acting under the authority, direction or instruction of the Secretary of War shall be kept separate and given numbers of a different series from those entered into by an officer or agent acting under the authority, direction or instruction of the President; and the forms of award used by the Board of Contract Adjustment shall provide for signature by that Board and approval by the War Department Claims Board.

(b) The Board of Contract Adjustment will establish, under the direction of the War Department Claims Board, procedure for the proof of claims pending before it.

(c) The Board of Contract Adjustment may, in any case where the nature, terms and conditions of the Agreement have been established and certified by it, refer the claim to the appropriate Bureau Claims Board for action and for recommendation of a fair and equitable basis upon which the agreement should be adjusted, paid or discharged, and the Bureau Claims Board shall then proceed in the manner provided in sub-sections d, e, f and g of Section 3 hereof and in the following General Provisions:

General Provisions

6. Before executing any certificate as to the nature, terms and conditions of an agreement the Bureau Claims Board or the Board of Contract Adjustment shall satisfy itself that the agreement comes within the provisions of Section 1 of the Act. Where, with respect to any claim, a Bureau Claims Board or the Board of Contract Adjustment finds that no agreement within the provisions of Section 1 of the Act has been made, it shall certify to that effect, and transmit a copy of the certificate to the claimant.

7. In the event that the claimant is not willing to accept a finding made or an award recommended by a Bureau Claims Board he may appeal to the Board of Contract Adjustment.

8. Wherever any question arises as to whether a particular Bureau Claims Board or the Board of Contract Adjustment should pass upon a claim under these regulations, that question shall be referred for decision to the War Department Claims Board.

9. There shall be prepared and preserved within the Bureau and in the office of the Board of Contract Adjustment, for transmission to Congress under the direction of the War Department Claims Board, in each case a copy of the certificate of the Board setting forth the nature, terms and conditions of the agreement, together with a copy of the award showing the nature of the payment or adjustment thereof.

10. Attention is called to the fact that in all proceedings under the Act witnesses may be compelled to attend, appear and testify and produce books, papers and letters, or other documents.

11. Bureau Claims Boards and the Board of Contract Adjustment are directed to present to the War Department Claims Board any special cases or classes of cases in which they find that the forms provided for herein cannot adequately or appropriately be employed, and to recommend appropriate forms. BY AUTHORITY OF THE SECRETARY OF WAR: GEORGE W. BURR, Brigadier General, Assistant Chief of Staff, Director of Purchase, Storage & Traffic.

To be presented before June 30, 1919

To be prepared and executed in quadruplicate. Forward all copies to proper Bureau Claims Board, War Department, Washington, D. C.

STATEMENT OF CLAIM FORM A

(To be used in connection with agreements made by an officer or agent acting under the authority, direction or instruction of the Secretary of War, and the nature, terms and conditions of which have been reduced to contract form or otherwise established by written evidence.)

STATEMENT OF CLAIM FOR RELIEF UNDER ACT OF CONGRESS APPROVED MARCH 2, 1919, ENTITLED "AN ACT TO PROVIDE RELIEF IN CASES OF CONTRACTS CONNECTED WITH THE PROSECUTION OF THE WAR, AND FOR OTHER PURPOSES"

To the Secretary of War,

Sir:—

The Claimant, Name..,
Place of business..,
P. O. Address..,

represents,

1. That during the emergency arising from the declaration of war with the German Empire and prior to November 12, 1918, and on or about the......day of................, 19.., the claimant entered into an agreement with an officer or agent acting under the authority, direction, or instruction of the Secretary of War for

(Here state nature, quantity, unit and aggregate price of the equipment, materials, supplies, services, facilities or other matters covered by the agreement.)

2. That the agreement was entered into in good faith for purposes connected with the prosecution of the war, and the claimant had performed the said agreement in whole or in part, or had made expenditures or incurred obligations upon the faith thereof, prior to November 12, 1918.

(Here state briefly facts showing that there was some performance, expenditure or incurring of obligations on the faith of alleged agreement prior to November 12, 1918.)

3. That the claimant undertakes to furnish prior to June 30, 1919, to the Secretary of War or to such person or persons as he may direct, a properly itemized and duly verified statement or series of statements showing the amount claimed to be due for articles or work delivered and accepted, and also any additional amounts claimed as reimbursement and remuneration for expenditures, obligations and liabilities necessarily incurred, including work, labor and services necessarily rendered, in performing or preparing to perform said agreement.

4. That hereto attached is an attested copy or copies of the best written evidence within the claimant's control of the nature, terms and conditions of the said agreement in the form of

(Here insert a brief description of the written evidence of the agreement as "unsigned contract," "Improperly signed contract," "purchase order," etc. If the agreement was reduced to writing in the form of a contract, purchase order or procurement order, an attested copy of such contract or order should be attached. If the agreement is supported only by letters, telegrams, etc., attested copies of such written documents should be attached and here described. Attested copies of the documents must be attached to each copy of the statement of claim and the claimant must furnish in each case four additional attested copies of the documents referred to in this paragraph.)

5. That the said agreement has not been executed in the manner prescribed by law.

And the claimant requests the Secretary of War to adjust, pay or discharge the said agreement upon a fair and equitable basis as provided in the Act of Congress approved the 2nd day of March, 1919, and entitled "An Act to Provide Relief in Cases of Contracts Connected with the Prosecution of the War, and for other Purposes."

Signature

....
Claimant.

Executed at .... on the .... day of ...., 1919.

Form of Verification Where Claimant is a Corporation

State of ....,
.... of ...., to wit:
....,
(Insert here name of officer or director of the corporation)
being first duly sworn, deposes and says that he is the..........
(Insert title)
of the ...., claimant named in the
(Insert name of corporation)
foregoing statement of claim; that he has read the said statement and knows the contents thereof, and that the said statement is true of his own knowledge, except as to matters which are therein stated on information or belief, and that as to those matters, he believes the statement to be true.

....

Subscribed and sworn to before me this .... day of ...., 19...

....
Notary Public in and for the
.... of ...., State of ....

Form of Verification Where Claimant is an Individual

State of ....,
.... of ...., to wit:
................................, being first duly sworn,
(Insert here name of claimant)
deposes and says that he is the claimant named in the foregoing statement of claim, that he has read the said statement and knows the contents thereof, and that the said statement is true of his own knowledge, except as to matters which are therein stated on information or belief, and that as to those matters he believes the statement to be true.

....

Subscribed and sworn to before me this.................day of ...., 19...

....
Notary Public in and for the
.... of .... State of.............

To be presented before June 30, 1919

To be prepared and executed in sextuplicate. Forward all copies to Board of Contract Adjustment, War Department, Washington, D. C.

STATEMENT OF CLAIM FORM B

(To be used in connection with all agreements by an officer or agent acting under the authority, direction or instruction of the President, and in connection with any agreement made by an officer or agent acting under the authority, direction or instruction of the Secretary of War, the nature, terms and conditions

of which have NOT been reduced to contract form or otherwise established by written evidence.)

STATEMENT OF CLAIM FOR RELIEF UNDER ACT OF CONGRESS APPROVED MARCH 2, 1919, ENTITLED "AN ACT TO PROVIDE RELIEF IN CASES OF CONTRACTS CONNECTED WITH THE PROSECUTION OF THE WAR, AND FOR OTHER PURPOSES"

To the Secretary of War,
Sir:
The Claimant, Name.....................................,
Place of business...,
P. O. Address..,
represents,

1. That during the emergency arising from the declaration of war with the German Empire and prior to November 12, 1918, and on or about the .... day of ...., 19.., the claimant entered into an agreement with an officer or agent acting under the authority, direction or instruction of the Secretary of War (President of the United States) for

(Here state nature, quantity, unit and aggregate price of the equipment, materials, supplies, services, facilities or other matters covered by the agreement.)

2. That the agreement was entered into in good faith for purposes connected with the prosecution of the war, and the claimant had performed the said agreement in whole or in part, or had made expenditures or incurred obligations upon the faith thereof, prior to November 12, 1918.

(Here state briefly facts as to such performance, expenditures and obligations prior to November 12, 1918.)

3. That the said agreement has not been executed in the manner prescribed by law.

4. The nature, terms and conditions of said agreement are as follows: *(The nature, terms and conditions must be specifically stated so that the Board may from the statement decide whether they constitute an agreement within the said Act.)*

5. The facts relied upon by the claimant to establish the existence, terms and conditions of such agreement are as follows: *(Here insert every fact upon which claimant relies to establish the alleged agreement or embody them in a statement incorporated by reference. The acts of the parties and the circumstances establishing the agreement and its essential elements should be set out free from argumentative or irrelevant matter.)*

6. Attached hereto is an itemized and duly verified statement or series of statements,* showing in detail the articles or work delivered and accepted by the United States and the exact nature and extent of all expenditures, obligations or liabilities necessarily incurred, including all work, labor and services necessarily rendered by the claimant in performing or preparing to perform that portion of the agreement additional to the above recited articles or work delivered and accepted. The aggregate amount claimed to be due from the United States to the claimant is ....dollars ($).

7. The names of all officers or agents who acted under the authority, direction or instruction of the Secretary of War (the President of the United States) in making said agreement so far as known to or ascertainable by the claimant are as follows:

Name and Rank	Station
....	....
....	....
....	....

8. The following persons other than the aforesaid officers or agents have personal knowledge of the nature, terms and conditions of said agreement:

Name and Address:

....
....
....

9. Attached hereto, as per schedule below, are copies of all writings in the possession of said claimant bearing on the existence of said agreement or its nature, terms and conditions.

(Here list all such writings attached.)

10. Attached hereto is such description as the claimant is able to give of all other writings of which said claimant has information or knowledge bearing on the existence of said agreement or its nature, terms and conditions.

And the claimant requests the Secretary of War to adjust, pay or discharge the said agreement upon a fair and equitable basis as provided in the Act of Congress approved the 2nd day of March, 1919, and entitled "An Act to Provide Relief in Cases of Contracts Connected with the Prosecution of the War, and for Other Purposes."

Signature
....
Claimant.

Executed at .... on the ....day of ...., 1919.

[The same verification forms as for Claim Form A must accompany this claim.—EDITOR.]

FORM C

CERTIFICATE OF EXAMINING BOARD

We, the *(Name of Bureau Claims Board or Board of Contract Adjustment)* having made due and proper investigation, find that an agreement was entered into in good faith between ...., the claimant, and *(Give name, rank or title, and corps)* an officer or agent acting under the authority, direction or instruction of the Secretary of War (the President of the United States), on or about the .... day of ...., 19.., during the emergency arising from the declaration of war with the German Empire and prior to November 12, 1918, for a purpose connected with the prosecution of the war; that the agreement had been performed in whole or in part, or expenditures had been made or obligations incurred by the claimant on the faith of such agreement, prior to November 12, 1918; that the agreement has not been executed in the manner prescribed by law, and is within the provisions of Section 1 of the Act of Congress approved March 2, 1919, entitled "An Act to provide relief in cases of contracts connected with the prosecution of the war, and for other purposes," and that the documents attached hereto constitute a detailed statement showing the nature, terms, and conditions of said agreement; and we hereby recommend that the Secretary of War proceed to adjust, pay or discharge the said agreement.

....
(Name of Bureau Claims Board, or Board of Contract Adjustment.)

Dated.................... By..............................
Chairman.

ATTEST:
....
Secretary or Recorder.

ACCEPTED AND APPROVED:

Dated.................... ....
Claimant.

Note: (This certificate shall not be executed except when it is attached to (a) an agreement reduced to contract form, or (b) a signed purchase order, or (c) a signed notice of award or procurement order which sets forth all the terms and conditions of the agreement, or (d) a document prepared under the supervision of the Claims Board or Board of Contract Adjustment and fully setting forth the nature, and conditions of the agreement, all as provided in paragraph 3, sub-paragraph (b), of Supply Circular No. 17.)

AWARD FORM I

CLAIM No......

This Form to be used when a single award is to be made.

AWARD OF SECRETARY OF WAR UNDER THE ACT OF CONGRESS ENTITLED "AN ACT TO PROVIDE RELIEF IN CASES OF CONTRACTS CONNECTED WITH THE PROSECUTION OF THE WAR AND FOR OTHER PURPOSES"

Approved March 2, 1919

It appearing to the satisfaction of the Secretary of War that an agreement was entered into in good faith between ...., the claimant, and *(Give name, rank or title, and corps)*, an officer or agent acting under the authority, direction or instruction of the Secretary of War (the President of the United States) on or about the .... day of ...., 19.., during the emergency arising from the declaration of war with the German Empire and prior to November 12, 1918, for a purpose connected with the prosecution of the war; that the agreement had been performed in whole or in part, or expenditures had been made or obligations incurred by the claimant on the faith of such agreement, prior to November 12, 1918; that the agreement has not been executed in the manner prescribed by law; that the said agreement is within the provisions of the above entitled Act of Congress; that the documents attached hereto constitute a detailed statement showing the nature, terms and conditions of said agreement;† that the claimant presented his claim to the Secretary of War before June 30, 1919; that the sum of $................ will adjust, pay and discharge such agreement upon a fair and equitable basis and that such sum will not include prospective or possible profits on any part of the agreement beyond the goods and supplies delivered to and accepted by the United States thereunder and a reasonable remuneration for expenditures and obligations or liabilities necessarily incurred in performing or preparing to perform said agreement:

The Secretary of War hereby awards to said claimant the sum of $.................. in full adjustment, payment and discharge of said agreement.

The extent to which this award is made with respect to any portion of the agreement which was sub-let is as follows:

(Here insert a list of all sub-contractors whose claims against the prime contractor are covered by the award, giving the name, place of business, and P. O. address of each, together with the amount awarded with respect to each sub-contract.)

RECOMMENDED BY:
....
Dated........................

APPROVED:
..............................Claims Board
Dated........................
Washington, D. C.

APPROVED BY AUTHORITY OF THE SECRETARY OF WAR:
War Department Claims Board,
By..............................
Member
Dated........................
Washington, D. C.

ACCEPTED: ....
Claimant.
Dated..............................

AWARD FORM 2

This Form to be used when a series of awards are to be made.

CLAIM NO..................
AWARD LETTER.............

AWARD OF SECRETARY OF WAR UNDER THE ACT OF CONGRESS ENTITLED "AN ACT TO PROVIDE RELIEF IN CASES OF CONTRACTS CONNECTED WITH THE PROSECUTION OF THE WAR, AND FOR OTHER PURPOSES"

Approved March 2, 1919

It appearing to the satisfaction of the Secretary of War that an agreement was entered into in good faith between ...., the claimant, and *(Give name, rank or title, and corps)*, an officer or agent acting under the authority, direction or instruction of the Secretary of War (the President of the United States) on or about the .... day of ...., 19.., during the emergency arising

* *Wherever it is possible to state the items of claim on Finance Forms 1 to 10, these forms shall be used. Copies may be obtained from local representatives of bureaus of the War Department or from the Board of Contract Adjustment at Washington. In any case such statements shall include a complete list of all subcontractors, if any, and the amount of the liability claimed to have been incurred as to each by the claimant under such agreement.*

†*These documents shall consist of the certificate of the Claims Board or Board of Contract Adjustment (Form C), including the papers thereto attached.*

from the declaration of war with the German Empire and prior to November 12, 1918, for a purpose connected with the prosecution of the war, that the agreement had been performed in whole or in part, or expenditures had been made or obligations incurred by the claimant on the faith of such agreement, prior to November 12, 1918; that the agreement has not been executed in the manner prescribed by law; that the said agreement is within the provisions of the above entitled Act of Congress; that the documents attached hereto (to an award heretofore made with respect to said agreement and marked ....) constitute a detailed statement showing the nature, terms and conditions of said agreement;* that the claimant presented his claim to the Secretary of War before June 30, 1919; that an adjustment, payment or discharge of said agreement upon a fair and equitable basis will include the allowance to the claimant of the sum of $................with respect to the following separable item:

(Here insert a description of the item or claim with respect to which the award is made, which may be any clearly separable item of the claim. If the award is made with respect to any portion of the agreement which the claimant shall have sub-let, the statement should include the name, place of business, and P. O. address of the sub-contractor.)

That it is not at this time possible to make a complete award with respect to this agreement and it is of advantage to the United States to make an award at this time with respect to said separable item, and that there is not included in this award, by itself or together with awards heretofore made with respect to said agreement, any prospective or possible profits on any part of said agreement beyond the goods and supplies delivered to and accepted by the United States thereunder, and a reasonable remuneration for expenditures and obligations or liabilities necessarily incurred in performing or preparing to perform said agreement.

The Secretary of War hereby awards to said contractor the sum of $—————— in full adjustment, payment and discharge of said item.

The extent to which this award is made with respect to any portion of the agreement which was sub-let is as follows:

(Here insert a list of all sub-contractors whose claims against the prime contractor are covered by the award, giving the name, place of business, and P. O. address of each, together with the amount awarded with respect to each sub-contract.)

RECOMMENDED BY:

....

Dated........................

APPROVED BY AUTHORITY OF THE SECRETARY OF WAR:

War Department Claims Board,

By..........................

Member

Dated......................

Washington, D. C.

APPROVED:

..............................Claims Board

By..............................

Dated......................

Washington, D. C.

ACCEPTED:

....

Dated..............................

Claimant.

AWARD FORM 3

This Form to be used as final award of series.

CLAIM NO............

AWARD LETTER........FINAL

AWARD OF SECRETARY OF WAR UNDER THE ACT OF CONGRESS ENTITLED "AN ACT TO PROVIDE RELIEF IN CASES OF CONTRACTS CONNECTED WITH THE PROSECUTION OF THE WAR, AND FOR OTHER PURPOSES"

Approved March 2, 1919

It appearing to the satisfaction of the Secretary of War that an agreement was entered into in good faith between ...., the claimant, and—*(Give name, rank or title, and corps)* an officer or agent acting under the authority, direction or instruction of the Secretary of War (the President of the United States) on or about the .... day of ...., 19.., during the emergency arising from the declaration of war with the German Empire and prior to November 12, 1918, for a purpose connected with the prosecution of the war; that the agreement had been performed in whole or in part, or expenditures had been made or obligations incurred by the claimant on the faith of such agreement, prior to November 12, 1918; that the agreement has not been executed in the manner prescribed by law; that the said agreement is within the provisions of the above entitled Act of Congress; that the documents attached to an award heretofore made with respect to such agreements numbered .... constitute a detailed statement showing the nature, terms and conditions of said agreement† that the claimant presented his claim to the Secretary of War before June 30, 1919; that the sum of $........ together with the awards heretofore made with respect to the said agreement, will adjust, pay and discharge such agreement upon a fair and equitable basis and that such sum when added to the awards heretofore made will not include prospective or possible profits on any part of the agreement beyond the goods and supplies delivered to and accepted by the United States thereunder and a reasonable remuneration for expenditures and obligations or liabilities necessarily incurred in performing or preparing to perform said agreement:

The Secretary of War hereby awards to said claimant the sum of $.............. in final and full adjustment, payment and discharge of said agreement.

The extent to which this award with respect to any portion of the agreement which was sub-let is as follows:

(Here insert a list of all sub-contractors whose claims against the prime contractor are covered by the award, giving the name, place of business, and P. O. Address of each, together with the amount awarded with respect to each sub-contract.)

RECOMMENDED BY:

....

Dated........................

APPROVED:

..............................Claims Board

Dated..........................

Washington, D. C.

APPROVED BY AUTHORITY OF THE SECRETARY OF WAR:

War Department Claims Board,

By..........................

Member

Dated..........................

Washington, D. C.

ACCEPTED:

....

Claimant.

Dated..............................

These documents shall consist of the certificate of the Claims Board or Board of Contract Adjustment (Form C) including the papers thereto attached.

†*These documents shall consist of the certificate of the Claims Board and Board of Contract Adjustment (Form C) including the papers thereto attached.*

Following is the complete bill, as agreed to by the Senate-House conferees, and signed:

AN ACT

To provide relief in cases of contracts connected with the prosecution of the war, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:

That the Secretary of War be, and he is hereby, authorized to adjust, pay, or discharge any agreement, express or implied, upon a fair and equitable basis that has been entered into, in good faith during the present emergency and prior to November 12, 1918, by any officer or agent acting under his authority, direction, or instruction, or that of the President, with any person, firm, or corporation for the acquisition of lands, or the use thereof, or for damages resulting from notice by the Government of its intention to acquire or use said lands, or for the production, manufacture, sale, acquisition or control of equipment, materials, or supplies, or for services, or for facilities, or other purposes connected with the prosecution of the war, when such agreement has been performed in whole or in part, or expenditures have been made or obligations incurred upon the faith of the same by any such person, firm, or corporation prior to Nov. 12, 1918, and such agreement has not been executed in the manner prescribed by law. *Provided*, That in no case shall any award either by the Secretary of War, or the Court of Claims include prospective or possible profits on any part of the contract beyond the goods and supplies delivered to and accepted by the United States and a reasonable remuneration for expenditures and obligations or liabilities necessarily incurred in performing or preparing to perform said contract or order: *Provided further*, That this act shall not authorize payment to be made of any claim not presented before June 30, 1919: *And provided further*, That the Secretary of War shall report to Congress at the beginning of its next session following June 30, 1919, a detailed statement showing the nature, terms, and conditions of every such agreement and the payment or adjustment thereof: *And provided further*, That no settlement of any claim arising under any such agreement shall bar the United States Government through any of its duly authorized agencies, or any committee of Congress hereafter duly appointed, from the right of review of such settlement, nor the right of recovery of any money paid by the Government to any party under any settlement entered into, or payment made under the provisions of this act, if the Government has been defrauded, and the right of recovery in all such cases shall exist against the executors, administrators, heirs, successors, and assigns, of any party or parties; *And provided further*, That nothing in this act shall be construed to relieve any officer or agent of the United States from criminal prosecution under the provisions of any statute of the United States for any fraud or criminal conduct: *And provided further*, That this act shall in no way relieve or excuse any officer or his agent from such criminal prosecution because of any irregularity or illegality in the manner of the execution of such agreement: *And provided further*, That in all proceedings hereunder witnesses may be compelled to attend, appear, and testify, and produce books, papers and letters, or other documents; and the claim that any such testimony or evidence may tend to criminate the person giving the same shall not excuse such witness from testifying, but such evidence or testimony shall not be used against such person in the trial of any criminal proceeding.

Sec. 2. That the Court of Claims is hereby given jurisdiction on petition of any individual, firm, company or corporation referred to in Section 1 hereof, to find and award fair and just compensation in the cases specified in said section in the event that such individual, firm, company or corporation shall not be willing to accept the adjustment, payment, or compensation offered by the Secretary of War as hereinbefore provided, or in the event that the Secretary of War shall fail or refuse to offer a satisfactory adjustment, payment or compensation as provided for in said section.

Sec. 3. That the Secretary of War, through such agency as he may designate or establish is empowered, upon such terms as he or it may determine to be in the interest of the United States, to make equitable and fair adjustments and agreements, upon the termination or in settlement or readjustment of agreements or arrangements entered into with any foreign government or governments or nationals thereof, prior to Nov. 12, 1918, for the furnishing to the American Expeditionary Forces or otherwise for war purposes of supplies, materials, facilities, services or the use of property, or for the furnishing of any thereof by the United States to any foreign government or governments, whether or not such agreements or arrangements have been entered into in accordance with applicable statutory provisions; and the other provisions of this act shall not be applicable to such adjustments.

Sec. 4. That whenever, under the provisions of this act, the Secretary of War shall make an award to any prime contractor with respect to any portion of his contract which he shall have sublet to any other person, firm or corporation who has in good faith made expenditures, incurred obligations, rendered service, or furnished material, equipment, or supplies to such prime contractor, with the knowledge and approval of any agent of the Secretary of War duly authorized thereunto, before payments of said award the Secretary of War shall require such prime contractor to present satisfactory evidence of having paid said subcontractor or of the consent of said subcontractor to look for his compensation to said prime contractor only; and in the case of the failure of said prime contractor to present such evidence or such consent the Secretary of War shall pay directly to said subcontractor the amount found to be due under

Calendar

ENGINEERING

March 7—New York. S. A. E. Aircraft Meeting at Engineering Societies Bldg.

April 2—Minneapolis Section, S. A. E. — Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

SHOWS

March 1-8—Detroit, Mich. Detroit Automobile Dealers' Assn. H. H. Shuart, Manager.

March 1-8—York, Pa. York Automobile Dealers' Assn.

March 1-15—New York Aeronautical Exhibition, Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 3-8 — Muskegon, Mich. Third Annual, Armory, Muskegon Lodge No. 274, B. P. O. E. John C. Fowler and George M. Friant, Managers.

March 3-8—Dayton, O., N. A. C. A. Building.

March 3-8—Columbus, O. Columbus Automobile Show Co., Memorial Building. W. W. Freeman, Manager.

March 3-8—Raleigh, N. C. Third Annual. H. B. Bolton. Manager.

March 3-8—Scranton, Pa. Ninth Annual, 13th Regiment Armory, Scranton Automobile Assn. Hugh B. Andrews, Manager.

March 3-8—Buffalo, N. Y. Buffalo Automobile Dealers' Assn.

March 3-8—Richmond, Va. Third Annual, Richmond Automobile Trade Assn., Gray's Armory.

March 5-8—Lancaster, Pa. Automobile Trade Assn., Rowe Motor Co.'s B'dg., R. W. Shreiner, Manager.

March 8-15 — New Brunswick, N. J. Armory, New Brunswick Motor Trade Assn. William Kuehle, Manager.

March 8-15 — Philadelphia, Pa. Philadelphia Automobile Trade Assn., Commercial Huseum. A. L. Maltby, Manager.

March 10-12 — Lancaster, Pa. Truck Show.

March 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.

March 10-15 — Salt Lake City, Utah. Sixth Annual, Bonneville Pavilion. W. D. Rishel, Manager.

March 10-15 — St. Louis, Mo. Used Car Show, Exhibit Building. Robert E. Lee, Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gardner, Manager.

March 10-15 — Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn., Auditorium. Clark G. Powell, Manager.

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

March 12-18—Peoria, Ill. Passenger cars, 12 to 15; trucks, 17 and 18.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Passenger cars only. Chester I. Campbell, Manager.

March 15-22 — Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.

March 17-22 — Great Falls, Mont. Montana Automobile Distributors' Assn.

March 17-22—Philadelphia, Pa. Motor Truck Assn., Commercial Museum.

March 18-22 — Zanesville, O. Third Annual, Zanesville Motor Car Dealers' Assn., City Hall and Market House. Edward B. Roemer, Manager.

March 19-22 — St. Joseph, Mo. St. Joseph Automobile Show Assn., Auditorium. John Albus, Manager.

March 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.

March 19-22—Warren, Pa. Third Annual, Warren Automobile Dealers' Assn.

March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 24-29—New Orleans, La. Henry B. Marks, Manager.

March 24-29—Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.

March 24-29—Utica, N. Y. Utica Motor Dealers' Assn.

March 25-29—Wilmington, Del. Fourth Annual, Wilmington Rink.

March 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.

March 27-29—Holdredge, Neb. Third Annual, Holdredge Automobile Dealers' Assn.

March 28-30—Peru, Ill. Illinois Valley Auto Show.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.

Last of March — Harlan, Ia. Southwestern Iowa Motor Exhibit.

March 29-April 5 — Passenger Cars. April 8-12—Trucks Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkman, Manager.

March 31-April 5—Cumberland, Md., Automobile Dealers Assn., Armory.

April 1-5—Denver, Col.—Denver Automobile Trades Assn. Stadium.

April 5-12 — Bridgeton, N. J. Fourth Annual, Automobile Dealers' Assn.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

April 8-12—Deadwood, S. D Seventh Annual, Cars and Tractors, Deadwood Business Club.

April 16-19 — Waynesburg, Pa. Automobile Dealers' Assn. of Greene Co., Armory. Frank L. Hoover, Mgr.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

TRACTOR SHOWS

Mar. 10-15—Macon, Ga. Dixie National Power Farming Demonstration. A. E. Hildebrand, General Manager.

July—Wichita, Kan., Automotive Committee of National Implement Assn.

RACES

March 15—Santa Monica, Cal. Speedway.

March 23—Los Angeles. Ascot Speedway Assn., Ascot Speedway, 150 miles.

May 17—Uniontown, Pa., probably 112½ miles.

May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

July 5—Cincinnati, O., Speedway.

July 19—Uniontown, Pa. Speedway race.

July 26—Sheepshead Bay, L. I. Speedway race.

Aug. 22-23—Elgin, Ill. Speedway.

Aug. 23—Sheepshead Bay, L. I. Speedway race.

Sept. 1—Uniontown, Pa. Speedway race.

Sept. 20—Sheepshead Bay, L. I. Speedway race.

Oct. 1—Cincinnati, O. Speedway race.

CONVENTIONS

March 7— Automobile Export Managers Convention, N. A. C. C. headquarters, New York.

April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

---

said award; and in case of the insolvency of any prime contractor the subcontractor of said prime contractor shall have a lien upon the funds arising from said award prior and superior to the lien of any general creditor of said prime contractor.

Sec. 5. That the Secretary of the Interior be, and he hereby is, authorized to adjust, liquidate, and pay such net losses as have been suffered by any person, firm, or corporation, by reason of producing or preparing to produce, either manganese, chrome, pyrites, or tungsten in compliance with the request or demand of the Department of the Interior, the War Industries Board, the War Trade Board, the Shipping Board, or the Emergency Fleet Corporation to supply the urgent needs of the Nation in the prosecution of the war; said minerals being enumerated in the act of Congress approved Oct. 5, 1918, entitled "An act to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of these ores, metals, and minerals which have formerly been largely imported, or of which there is or may be an inadequate supply."

The said Secretary shall make such adjustments and payments in each case as he shall determine to be just and equitable; that the decision of said Secretary shall be conclusive and final, subject to the limitation hereinafter provided; that all payments and expenses incurred by said Secretary, including personal services, traveling and subsistence expenses, supplies, postage, printing, and all other expenses incident to the proper prosecution of this work, both in the District of Columbia and elsewhere, as the Secretary of the Interior may deem essential and proper, shall be paid from the funds appropriated by the said act of Oct. 5, 1918, and that said funds and appropriations shall continue to be available for said purpose until such time as the said Secretary shall have fully exercised the authority herein granted and performed and completed the duties hereby provided and imposed: *Provided, however*, That the payments and disbursements made under the provisions of this section for and in connection with the payments and settlements of the claims herein described, and the said expenses of administration shall in no event exceed the sum of $8,500,000: *And provided further*, That said Secretary shall consider, approve, and dispose of only such claims as shall be made hereunder and filed with the Department of the Interior within three months from and after the approval of this act: *And provided further*, That no claim shall be allowed or paid by said Secretary unless it shall appear to the satisfaction of the said Secretary that the expenditures so made or obligations so incurred by the claimant were made in good faith for or upon property which contained either manganese, chrome, pyrites, or tungsten in sufficient quantities to be of commercial importance: *And provided, further*, That no claims shall be paid unless it shall appear to the satisfaction of said Secretary that moneys were invested or obligations were incurred subsequent to April 6, 1917, and prior to Nov. 12, 1918, in a legitimate attempt to produce either manganese, chrome, pyrites, or tungsten for the needs of the Nation for the prosecution of the war, and that no profits of any kind shall be included in the allowance of any of said claims, and that no investment for merely speculative purposes shall be recognized in any manner by said Secretary: *And provided further*, That the settlement of any claim arising under the provisions of this section shall not bar the United States Government, through any of its duly authorized agencies, or any committee of Congress hereafter duly appointed, from the right of review of such settlement, nor the right to recover any money paid by the Government to any party under and by virtue of the provisions of this section, if the Government has been defrauded, and the right of recovery in all such cases shall extend to the executors, administrators, heirs, and assigns of any party.

That a report of all operations under this section, including receipts and disbursements, shall be made to Congress on or before the first Monday in December of each year.

That nothing in this section shall be construed to confer jurisdiction upon any court to entertain a suit against the United States: *Provided further*, That in determining the net losses of any claimant the Secretary of the Interior shall, among other things, take into consideration and charge to the claimant the then market value of any ores or minerals on hand belonging to the claimant, and also the salvage or usable value of any machinery or other appliances which may be claimed was purchased to equip said mine for the purpose of complying with the request or demand of the agencies of the Government above mentioned in the manner aforesaid.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 11

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MARCH 13, 1919

Fifteen cents a copy
Three dollars a year

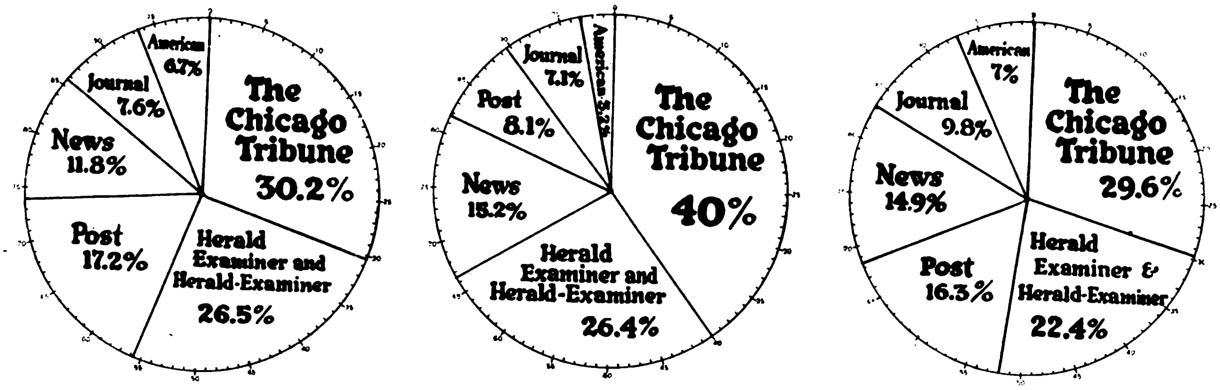
CHICAGO TRIBUNE PRINTS MORE AUTO ADS IN ONE DAY THAN OTHER PAPERS IN SEVEN

During the last six months of 1918 The Tribune printed in its Sunday issue alone more display automobile advertising than any other Chicago paper printed in all its issues. The figures are as follows:

Chicago Sunday Tribune	*168,445*	*Agate Lines*
Chicago Daily Tribune	*67,689*	"
Chicago Tribune total	*236,134*	"
Herald-Examiner total	*116,201*	"
News "	*106,554*	"
Post "	*101,832*	"
Journal "	*38,112*	"
American "	*28,903*	"

The three charts below picture the proportion of total advertising in the three subdivisions of automobile advertising printed by each Chicago newspaper during 1918:

Passenger Cars — Trucks and Tractors — Accessories



The pre-eminence of The Chicago Tribune as an advertising medium has been formally sworn to by witnesses in the million dollar libel suit of Henry Ford against The Chicago Tribune. Charles A. Brownell, advertising manager of the Ford Motor Company, testified under oath that The Chicago Tribune is "by far the best" automobile advertising medium in its territory, and E. LeRoy Pelletier swore that it was one of the few newspapers so powerful and important as to be considered a "national medium."

The Chicago Tribune

THE WORLD'S GREATEST NEWSPAPER

Largest circulation of any Chicago newspaper, Daily or Sunday. In excess of 400,000 Daily and 700,000 Sunday.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, MARCH 13, 1919—CHICAGO NO. 11

Inadequate Cost-Keeping Retarding Adjustment

Government Machinery Oiled to Handle Claims Rapidly but They Are Slow in Arriving

By J. Edward Schipper

DETROIT, March 11—Delays in adjusting government contracts are due to bad cost-keeping systems on the part of the contractor or subcontractor in practically every instance.

Government machinery for adjusting claims is now so lined up that there is no delay in any department, once the claims have been properly filed and audited. Where the delay is found is in the inability of the contractor to fix the sum for which he should be reimbursed by the Government.

Cost-keeping systems have been so bad in a large percentage of the work done by contractors and subcontractors that it is now necessary for the Government to employ engineers to make a survey of the work done and of the equipment, etc., in order to reach any basis for a settlement. This naturally has caused considerable delay which would have been eliminated immediately if the contractor or sub-contractor had maintained a good and complete cost-keeping system.

Detroit Claims $1,500,000,000

The total amount of money which will be paid over by the Government in re-adjustments in the Detroit district, when these are finally concluded, will be $1,500,000,000. About 30 per cent of this has already been adjusted. It is estimated that the bulk of the Ordnance and Quartermaster Department adjustments will have been made by April 1. The Bureau of Aircraft Production officials do not believe that their adjustments will be completed before July 1.

This is due to the fact that there are a great many more small concerns which have acted as sub-contractors for airplanes parts; due to the unusual nature of the business and the fact that there are so many small concerns, the cost-keeping methods have been entirely inadequate, which is resulting in a tremendous amount of work being necessary for concerns to get an accurate knowledge of just what the Government owes them.

Peculiar State of Affairs

A peculiar state of affairs exists in many instances. The concerns will tell others how the Government is holding them up on adjustments and at the same time Government officials will be pleading with the concerns to submit statements. This exists in a score or more of factories, usually in the automobile, truck and parts-making businesses, and it is a hard condition to understand. The whole matter, in fact, presents such a complex problem that in its entirety it is, at first glance, bewildering.

Just one phase of the work might be considered as a good example. It would seem that all the Government had to do, on the surface, would be to determine how much was coming to a concern and then pay the bill, but this does not take into consideration the fact that in settling, the Government is obliged to take over an immense amount of ma-

terial which it does not need under present conditions.

This material is all valuable and nearly all salable, but Government officials know that to dump this material on the market at bargain prices would upset industry to such an extent that it would be disastrous in many cases.

Therefore, to handle the matter properly the Bureau of Aircraft Production has a separate department for material disposition, and this department will not dispose of lumps of material of any nature until it has first gone into the market condition and determined whether or not the disposition or sale of that material would have a bad effect on business conditions in that particular line of goods. That is only one of the angles which is constantly arising.

Real Need For Cost-Keeping

One of the lessons of this war which business cannot fail to take to heart is the necessity for accurate cost-keeping. One of the financial papers recently pointed out that during 1918 alone, 9982 concerns failed in the United States of 35,000 new corporations during the same period. In 1917 there were 13,855 failures of 50,000 new corporations. It is stated by the Federal Trade Commission that the main cause of these failures is the lack of knowledge of the cost of production. This has been shown up so clearly in the work of the Ordnance, Quartermaster, and Bureau of Aircraft Production adjustment boards that it must be taken to heart by any of the business concerns which have had dealings with the Government during this war.

With all the complications in view, the progress being made in settling claims is remarkable. The various district headquarters of the army staff organizations have turned their entire forces over to adjustment. The production departments have now become the adjustment departments and the production inspectors who were in the plants, inspecting the manufactured articles, have been switched over to the adjustment department and are now assisting the manufacturers in making up their claims to be presented for settlement.

The contractor who is drawing up the claim and the Government officer who was previously an inspector, probably in his plant but who is now working in the adjustment department as a representative of the Government, go over the raw material, the materials in process, the special machinery, the new plant area, the labor cost, and all of the factors which enter into the settlement of a claim.

As each amount is itemized it is O. K.'d by the Government man and finally the claim is completed, whereupon it is submitted to the claim board with a recommendation from the Government or staff man as to its acceptance or modification. He will recommend its acceptance if he and the manufacturer are in agreement on all points. If they are not fully in agreement he will indicate the points at which he differs from the manufacturer.

Method of Making Claims

This claim and the recommendation of the staff man is brought to the claim board. An auditor is then sent out to the plant to go over the claim as submitted and to check up the items. When he has approved it, the claim comes before the claim board which sits in the district office, and when this board has passed the claim the contracting officer makes up a cancelling contract. This contract states that in consideration of the cancellation of the previous contract, the Government will reimburse the contractor for the sum required.

The cancelling contract is then turned over to a reviewing attorney, who goes over it and passes upon it, and it is submitted for the signature of the contractor. After he signs it the contractor is ready for payment, and this is made very quickly. From the time a claim is filed up to the time payment is received is generally about 10 days or 2 weeks, unless some complications have entered into the matter.

The Quartermaster Department, according to the district officer, expects to be all cleaned up on its adjustments by April 1, as is also the case with the Ordnance Department. The business of the Quartermaster Department in this territory, while large in money, does not cover, by any means, the same number of concerns as the Ordnance or Bureau of Aircraft Production. The Quartermaster Department has allowed about 150 claims, running from $4,000 to $500,000. It has but twelve claims still to audit. The Quartermaster Department has a force of 150 inspectors who are now on the advertising staff, and they are rapidly cleaning up the work as indicated.

Concerns which did extensive Government work, such as Anderson Electric, Peru Axle Co., J. C. Wilson, Federal and Denby, have all been adjusted. The adjustments of these five concerns alone totals $358,000, the smallest being $4,000 and the largest, $250,000. On the other hand, important accounts such as Packard, which has a great many sub-contractors, Continental, McCord, Republic, Service and Signal, are not as yet adjusted.

Some Complaints Not Justified

A strange condition exists in that some concerns, while stating that they are not in a hurry to file their claim and will require from 3 to 4 weeks additional time to do so, have stated to outside parties that the Government is slow in making adjustments. This is a situation difficult to understand but which certainly is found to exist.

One of the most difficult problems in the matter of adjustment is to allow the proper amount for new plants. The system used by the Quartermaster Department, in which it was necessary particularly for a large amount of plant area to be constructed, is to figure the cost of the new plant on a pre-war basis and sell it to the contractor on that arrangement. This has resulted in contracting concerns securing the plants for about 65 per cent of what they actually cost on a war-time figure. The Government arranges this by paying the concern 35 per cent of the cost of the plant, and since the concern has bought the plant at 100 per cent, this leaves 65 per cent as an average figure on plant cost adjustment.

Government Spirit Commendable

Another matter on which the two come in agreement in the cases of all departments is on scrap value. Where materials are obviously of no use to the Government, the plant is asked to bid on the material on the basis of the scrap value, and the material is frequently sold to them on that basis.

Throughout, the proceedings are being conducted by the Government departments in a spirit which is highly commendable. The machinery is all set to act rapidly upon all claims presented, the adjustments are being made on the most broad-minded scale, not only taking fully into consideration all losses due to cancellation of contracts but honoring all implied future business which was not in actual contract form—that

SUMMARY OF CLAIM

BASED ON B. A. P. CONTRACT FORM 60

Sheet No. | **CLASSIFICATION OF CLAIM** | **Amount Due Contractor**

(a) Finished products on hand at contract price .... $......

Less freight charges, if contract or order specifies delivery at point other than factory .... $......

(b) Cost of raw material on hand applying on this contract, and including handling charges and proper portion of overhead...... ......

10% profit on raw materials on hand ....

Cost of partly finished product on hand, including material, labor and overhead costs............. ......

10% profit on partly finished product on hand ....

Overhead expenses directly chargeable to uncompleted portion of contract ....

10% profit on overhead expenses... ....

(c) Commitments to suppliers and subcontractors chargeable directly to cancellation of contract ....

(d) Cost of special facilities (buildings, equipment, special tools, etc.) chargeable to cancellation of contract ....

Less fair value of special facilities at termination of contract...... ......

Loss in value of special facilities... ......

Pct. of total contract uncompleted. ......

Loss in value of special facilities chargeable to cancellation of contract ....

Total claim................ $......

(e) Less sale price of property purchased by contractor

Raw material .... $......

Partly finished products.... ...... $......

Finished products .... $......

Balance due contractor...... $......

is where a concern went ahead and constructed a plant to take care of a greater volume of business than the original contract called for, because it had received a letter from the Government stating that it may expect to do a business along bigger lines than the original contract, this has been fully considered in making adjustments.

On the other hand, manufacturers have asked for very heavy considerations for which the Government has not felt itself liable. In some cases concerns have charged in the time of salesmen due to their non-employment on company business while the concern was on war work. That is, where the companies have kept these salesmen on their payrolls while they were inactive as salesmen, they have in some cases attempted to charge the salaries of these men to the Government. This has not been allowed. Neither has advertising been allowed.

Makes Them All Cost-Plus Contracts

One of the virtual results of adjustment has been to make practically every completed contract a cost-plus contract. The adjustments are calculated on the basis of the expense to which the concern has gone in getting ready for Government manufacture and partially completing the contract, plus a reasonable percentage.

It is in the figuring of these costs that the weakest part of the system is found. Had every contractor and sub-contractor on a Government contract a good up-to-date, accurate cost-keeping system, practically all adjustments would have been made. There is no lack of money to make adjustments, because the original appropriations for manufacture are available for the purpose; there is no lack of speed in the Government machinery for making the adjustment. The delay is solely on the part of the contractor being unable to submit his claim, based on a set of figures which have been accurately compiled from a clear-cut, business-like cost system.

The Government is allowing a profit not in excess of 10 per cent on material, labor and overhead. The figure on overhead varies all the way from 50 per cent up to 800 and 900 per cent, but a fair average is 150 per cent. In reaching their conclusions, the Government departments are going out of their way to recognize fully the industrial assets of the company before the war and at the time the adjustment is made, to see that these concerns which did Government work do not industrially suffer from that fact.

Confidential reports are filed along with the claims which tell the article manufactured before the war, the articles manufactured for the Government in all departments, the articles manufactured for the particular department making the adjustment, the articles to be manufactured after the war, the total number of male employees before the war, total number of female employees before the war, total of male and female employees during the war, and the estimated number to be employed after the war. The percentage of the plant now on commercial production is estimated and also how long it will take to get into full commercial production. A careful note is also made on a form filed by the Bureau of Aircraft Production on the cost system used by the concern filing the claim.

A typical sheet used by the Bureau of Aircraft Production in drawing up the summary of the claim is shown herewith. This gives a clear idea of some of the matters considered in making adjustments.

All Adjustments Soon Made

It will not be long, perhaps the middle of summer at the latest, when all the adjustments have been made, and the money which is tied up at present will have been paid out. It is certainly true that during this interval the industry is going to suffer. The reason is not far to seek. This delay and suffering would never have occurred had cost-keeping been thorough and complete in all instances. It would not be too much to say that the Government should work out a standard cost system to be used in connection with Government contracts hereafter, and to keep this knowledge filed

(*Continued on page* 568)

Equal Representation in Management Offered Harvester Employees

Workers to Elect Representatives to Meet with Equal Number Representing Employers, to Solve All Problems of Labor

[*As* AUTOMOTIVE INDUSTRIES *was going to press a telegraphic dispatch from Chicago stated that the workers in* 14 *out of* 17 *American plants and in all three Canadian plants decided by majority vote Wednesday to adopt the Harvester plan. The three plants where approval was not given by the workers were the McCormick Works, the McCormick Twine Mill and the Tractor Works, all on Chicago's West Side.*]

PLAN OF GREAT IMPORTANCE AND SPECIAL SIGNIFICANCE

THE plan of the International Harvester Co., which is given below, is of great importance and of special significance to the manufacturer in the automotive field because the International Harvester Co. is the largest concern having business of a similar character to that of other automotive manufacturers, at least in some departments, and because of the fact that, conditions being similar in many of the shops, the form of organization has a particular significance for other manufacturers in this field.

The form of organization itself is very interesting and is very similar to the forms of organizations adopted by some of the steel companies, oil companies and other manufacturing cooncerns which have been considered in these columns in previous issues.

It will be noted that in some respects it is a much simpler form than the organization adopted by concerns like the Colorado Fuel & Iron Co., and it avoids two of the difficulties with such organization plans.

It does not make any discrimination between the worker who is paid a salary and the worker who is paid by the hour.

It makes the logical and proper distinction between those who have supervision and those who do not.

It also provides for a simpler form of judicial procedure and this is a very great advantage.

The plan is well worked out but space will not permit of a lengthy discussion of it and this will be deferred to a later issue.

We recommend it to the very careful and studious consideration of all manufacturers in this field because of the special bearing which it has to the manufacturing conditions in this field and also because of the clear character and purpose of the organization. —*Harry Tipper.*

CHICAGO, March 11—The International Harvester Co. has to-day asked its 30,000 employees to vote on whether they want to have equal representation in the consideration of all questions of policy relating to working conditions in the different factories, measures for the improvement of health, steps for educational improvement, and all other factory matters of similar nature where there is a mutual interest between the employees and the employer or the management.

The scheme is an Industrial Council form of organization in which a Works Council is the major body. This Works Council is made up of equal representation from the management of the Harvester company and the factory workers. The factory workers elect by secret ballot what is known as Employee Representatives, in the ratio of one such representative for each 200 to 300 workers.

The management appoints what it calls Employee Representatives which in the Works Council are equal in number to the representatives of the factory employees.

This Works Council shall never have less than five employee representatives and a similar number of management representatives. Both of these groups of representatives shall have equal voice and voting power in all matters brought before the Works Council.

Should the Works Council not be able to reach an agreement on any questions before it then the matter is referred to arbitration. No such question can be referred to arbitration unless by mutual agreement of the factory representatives as well as the management representatives. When it is agreed that a matter has to be arbitrated upon the Works Council proceeds to agree upon an arbitrator. In case they cannot agree upon such an arbitrator then the employee representatives select one and

the president selects another. If these two agree their decision shall be final. If they cannot agree they select a third arbitrator and the decision of the three shall be final.

All employees who are working in any factory shall have the right to vote for the election of employee representatives from that factory. Nominations for employee representatives will be made four days before voting. Employees will vote by ballot. All employees both men and women shall be entitled to vote except foremen, assistant foremen, and other employees having the power to employ or discharge workers.

Whenever employee representatives have to journey to other cities to take part in the Works Council their traveling and maintenance expenses will be cared for by the International Harvester Company.

The underlying principle of the movement is to secure equal representation between the plant management and the plant employees and thereby do away with the arbitrary power of the managment.

Whenever there are matters affecting several factories the president, Harold F. McCormick may summon what is designated as a general council. This would be made up of employee representatives from the different Works Council, there being a Works Council for each factory. There shall be one representative of the workers in the general council for each 1000 of employees or a major fraction thereof and no factory shall have less than two representatives in a general council.

In a general council the management shall appoint a number of representatives equal to that of the employees.

The president or some person designated by him shall act as chairman of the general council but he shall not have voting power.

Organization of International Harvester Industrial Council

Article I. Purpose:

The employees and the management of the International Harvester Co. and its subsidiary companies undertake by the adoption of this plan of an Industrial Council to establish these relations upon a definite and durable basis of mutual understanding and confidence.

To this end the employees and the management shall have equal representation in the consideration of all questions of policy relating to working conditions, health, safety, hours of labor, wages, recreation, education and other similar matters of mutual interest.

Article II. Works Councils:

As the principal means of carrying this plan into effect, there shall be organized, at each Works adopting the plan, a Works Council composed of representatives of the employees and representatives of the management. The employee representatives shall be elected by the employees. The management representatives shall be appointed by the management, and shall not exceed the employee representatives in number. Both shall at all times have an equal voice and voting power in considering matters coming before the council.

Through these councils any employee or group of employees, or the management, may at any time present suggestions, requests or complaints, with the certainty of a full and fair hearing. Matters which cannot be thus disposed of may, by mutual consent, be submitted to impartial arbitration as hereinafter provided.

Article III. Department of Industrial Relations:

To aid in carrying out this plan the company has established a Department of Industrial Relations which is charged with the duty of giving special attention to all matters pertaining to labor policies and the well-being of the employees.

Article IV. Voting Divisions:

The basis of representation shall generally be one employee representative for each two hundred to three hundred employees, but in no case shall there be less than five employee representatives in the Works Council.

In order that the different departments and crafts may be fairly represented, each works shall be divided into Voting Divisions, and each division shall be assigned its proper number of representatives, based upon the average number of persons employed therein during the month of December preceding the election.

The Works Council may change the Voting Divisions whenever necessary to secure complete and fair representation.

Article V. Qualifications of Employee Representatives:

1. To be eligible for nomination as employee representative from any Voting Division the employee must be employed therein.
2. Foremen, assistant foremen, and other employees having the power of employment or discharge, shall not be eligible for nomination.
3. Only employees who are citizens of the United States, twenty-one years old or over, and have been continuously in the works' service for one year immediately prior to nomination, as shown on the records of the employment department, shall be eligible for nomination as employee representatives.

Article VI. Nomination and Election of Employee Representatives:

1. Nomination and election of employee representatives shall be by secret ballot. The first nomination and election shall be held as soon as practicable after the adoption of this plan, at which time the full number of employee representatives shall be elected.
2. At the first meeting of the Works Council the employee representatives shall be divided by lot into two classes, one-half with terms expiring on Jan. 1, 1920, and the other half with terms expiring on July 1, 1920. Thereafter the election of employee representatives of the first class shall be held in December and of the second class in June. Except as above provided, all employee representatives shall hold office for one year and until their successors are duly elected.
3. Notice of the time appointed for nominations and elections shall be given by bulletins posted publicly in the works at least two days before the date set for the nominating ballot.
4. All employees, both men and women, shall be entitled to vote, except foremen, assistant foremen, and other employees having the power of employment or discharge.

Nominations

5. Nominations shall be made in the following manner: Not more than four days before the date fixed for the election, a nominating vote shall be taken. A blank ballot stating

the number of representatives to be nominated from his Voting Division will be offered to each employee present at work on the date of the nomination, including all workers on the night turn, if any.

6. On this ballot the employee will write (or he may have a fellow employee write for him) the name of the person he desires to nominate. If his Voting Division is to elect one representative then one name shall be written on the ballot; if his Voting Division is to elect two representatives then two names, and so on.

7. Any ballot containing more names than the number of representatives to be elected from that Voting Division shall not be counted.

8. Employees will deposit their ballots in a locked box carried by a teller representing the employees, who shall be accompanied by a timekeeper.

9. When all who desire have voted, the timekeeper and two employee watchers shall open the ballot box and count and record the votes, in the presence of the works auditor, or person designated by him.

10. In Voting Divisions from which *one* representative is to be elected, the *two* persons receiving the highest number of votes shall be declared nominated. If any Voting Division is to elect *two* representatives, then the *four* persons receiving the highest number of votes shall be declared nominated, and so on.

11. If any person nominated is disqualified under the provisions of Article V, then the properly qualified candidate receiving the next highest number of votes shall be declared the nominee.

12. The results of the balloting and the names of the nominees shall be posted in the works as soon as the votes have been counted and the nominations declared.

Elections

13. Not more than four days after the nominations are posted, the election by secret ballot shall be held in the same manner as for nomination, except that at the *election* only the names of the persons who have been duly nominated shall appear on the ballots, and these persons alone can be voted for.

14. The name of the nominee receiving the highest number of votes shall be placed first upon the election ballot; the name of the nominee receiving the next highest number shall be placed next on the election ballot, and so on.

15. At the election the candidate or candidates receiving the highest number of votes in his or their Voting Division shall be declared elected members of the Works Council.

Article VII. Appointment of Management Representatives:

Upon the election of the employee representatives the management will announce the appointment of the management representatives in the Works Council, whose number shall in no case exceed the number of elected employee representatives.

Article VIII. Vacancies in the Works Council:

1. If any employee representative leaves the service of the works, or becomes ineligible for any of the reasons stated in Section V, or is recalled, as provided in Section IX, or is absent from more than four consecutive meetings of the Works Council without such absence being excused by the Council, his membership therein shall immediately cease.

2. All vacancies among the employee representatives shall be promptly filled by special nomination and election, conducted under the direction of the Works Council in the same manner as regular nominations and elections. Vacancies among the management representatives shall be filled by appointment by the management.

Article IX. Recall of Employee Representatives:

1. If the services of any employee representative become unsatisfactory to the employees of the Voting Division from which he was elected, they may recall him in the manner herein provided.

2. Whenever a petition is filed with the Chairman of the Works Council, signed by not less than one-third of the employees of a Voting Division, asking for the recall of their representative, a special election by secret ballot shall be held in that Voting Division under the direction of the Works Council, to decide whether such representative shall be recalled or continued in office.

3. If at such election a majority of the employees in the Voting Division vote in favor of recalling their representative, then his term of office shall immediately cease; otherwise he shall continue in office.

4. Any vacancy so created shall be immediately filled by a special election, as provided in Section VIII.

Article X. Organization and Meetings of the Works Council:

1. The manager of the Department of Industrial Relations or someone designated by him, shall act as chairman of the Works Council. A secretary shall be appointed by the superintendent of the Works. Neither the chairman nor secretary shall have a vote.

2. A majority of the employee representatives, together with a majority of the management representatives, shall constitute a quorum, and no business shall be transacted at any meeting where less than a quorum is present.

3. The Works Council may appoint such sub-committees as it deems desirable for efficient conduct of its business. On all such sub-committees both the employees and the management shall be represented, and each group of representatives shall have equal voting power.

4. The Works Council shall hold regular monthly meetings at times fixed by the Council. Special meetings may be called on three days' written notice by the chairman, secretary, or any three members of the Council. Sub-committees shall meet whenever necessary.

5. The company shall provide at its expense suitable places for meetings of the Works Council and its sub-committees and the employee representatives thereon.

6. Employees serving as members of the Works Council shall receive their regular pay from the company during such absence from work as this service actually requires, except that if the employee representatives so desire, they shall be at liberty to arrange for compensation to be paid by pro rata assessment among the employees.

7. Employees attending any meeting at the request of the Works Council or any sub-committee shall receive their regular pay from the company for such time as they are actually and necessarily absent from work on this account.

8. The Works Council may prepare and distribute to the employees reports of its proceedings, and the expense thereof shall be borne by the company.

Article XI. Duties and Powers of the Works Council:

1. The Works Council may consider and make recommendations on all questions relating to working conditions, protection of health, safety, wages, hours of labor, recreation, education and other similar matters of mutual interest to the employees and the management. It shall afford full opportunity for the presentation and discussion of these matters.

2. The Works Council may on its own motion investigate matters of mutual interest and make recommendations thereon to the Works Management; and the management also may refer matters to the Works Council for investigation and report.

3. The Works Council may confer with the superintendent or other person designated by him in regard to all matters of mutual interest, and shall receive from the management regular reports in regard to accident prevention, sanitation, restaurants, medical service, employment, educational programs and recreational activities, including information as to the cost, efficiency and results obtained.

4. The Works Council shall be concerned solely with shaping the policies of the company relating to the matters heretofore mentioned. When the policy of the company as to any of these matters has been settled, its execution shall remain with the management, but the manner of that execution may

at any time be a subject for the consideration of the Works Council.

Article XII. Procedure of Works Councils:

1. Employees desiring to bring any matters before the Works Council may present these to the secretary of the council either in person or through their representatives. It shall be the secretary's duty first to ascertain whether the matter has been properly presented through the regular channels to the superintendent, and if not he shall see that this is promptly done.

2. If the matter is not satisfactorily disposed of in this manner, the secretary shall submit a written statement of the matter to each member of the Works Council at least three days before the next regular meeting.

3. Any employee or group of employees thus referring a matter to the Works Council shall have an opportunity to appear before it and present the case. Any such group of employees shall select not more than three spokesmen from their own number to appear before the council.

4. The Works Council may call any employee before it to give information regarding any matter under consideration. The Works Council, or any sub-committees appointed by it for that purpose, may go in a body to any part of the plant to make investigations.

5. After complete investigation and full discussion of any matter under consideration by the Works Council, the chairman shall call for a vote, which shall be secret, unless otherwise ordered by the Council. The employee representatives and the management representatives shall vote separately. The vote of a majority of the employee representatives shall be taken as the vote of all and recorded as their unit vote. Similarly, the vote of a majority of the management representatives shall be taken as the vote of all and recorded as their unit vote.

6. Both the employee representatives and the management representatives shall have the right to withdraw temporarily from any meeting of the Works Council for private discussion of any matter under consideration.

7. When the Works Council reaches an agreement on any matter, its recommendation shall be referred to the Superintendent for execution, except that if the Superintendent considers it of such importance as to require the attention of the general officers, he shall immediately refer it to the President of the International Harvester Company, who may either approve the recommendation of the Works Council and order its immediate execution by the Superintendent, or proceed with further consideration of the matter in accordance with Article XIII.

8. In case of a tie vote in the Works Council, it shall be in order to reopen the discussion, to offer a substitute or compromise recommendation, on which the votes shall be taken in the same manner as above provided.

Article XIII. Reference to the President:

1. If after further consideration, the vote in the Works Council remains a tie, then the matter shall, at the request of either the employee representatives or the management representatives, be referred to the President of the International Harvester Company.

2. The President, or his specially appointed representative, may confer with the Works Council as a whole, or any subcommittee thereof, or any group of employee representatives, at such time and place and in such manner as in his opinion will best serve to bring out all the facts of the case.

3. Within ten days after the matter has been referred to him, the President shall either

(a) Propose a settlement thereof; or

(b) Refer the matter directly to a General Council to be formed as provided in Article XIV.

4. If the settlement proposed by the President is not satisfactory to a majority of the employee representatives, and if after a further period of five days no agreement has been reached, then the President may, if he deems it advisable, refer the matter to a General Council to be formed as provided in Article XIV.

5. If the President decides not to refer the matter to a General Council, or if the vote of the General Council is a tie, then the matter may, by mutual agreement of the President and a majority of the employee representatives, be submitted to arbitration, as provided in Article XV.

Article XIV. General Council:

1. Whenever in the opinion of the President any matter coming before any Works Council affects other Works of the company, or whenever he desires to refer any matter as provided in Article XIII, he may call a General Council to consider such matter, and thereafter the Works Council shall take no further action thereon.

2. The General Council shall be formed in the following manner: The President shall issue a notice designating the several Works which he deems jointly interested. Thereupon the employee representatives in the Works Council at each of the Works designated shall select two or more of their own number to act as members of the General Council. There shall be one such member of the General Council for each 1000 employees or major fraction thereof, except that no works shall have less than two representatives in the General Council.

3. The management representatives in the General Council shall be appointed by the President and shall not exceed the number of employee representatives.

4. The President or some person designated by him shall act as chairman of the General Council, without vote.

5. The first meeting of the General Council shall be held within ten days after the President's notice calling such Council.

6. The General Council shall, when necessary, take recesses in order to allow employee representatives therein to confer with other members of their Works Councils. For this purpose special meetings of the Works Councils as a whole, or of the employee representatives alone, shall (at the request of the employee representatives serving on the General Council) be convened at the respective Works, and full opportunity shall be given for conference and discussion with such representatives regarding their attitude and action on the pending matter.

7. Reasonable traveling expenses, including hotel bills of employee and management representatives serving on a General Council, shall be paid by the company.

8. The procedure in the General Council with reference to the consideration of matters coming before it and the manner of voting shall be the same as that prescribed for the Works Council.

9. If the General Council is unable to reach an agreement as to any matter, it may, by mutual agreement of a majority of both the employee representatives and the management representatives, be submitted to arbitration.

Article XV. Arbitration:

1. Whenever the President and a majority of the employee representatives in the General Council, or the Works Council, as the case may be, have mutually agreed to submit a matter to arbitration, they shall proceed to select an impartial and disinterested arbitrator. If they cannot agree upon an arbitrator, then the employee representatives shall choose one such arbitrator and the President shall choose another, and if these two agree their decision shall be final. If they do not agree, then they shall select and call in a third arbitrator, and a decision of a majority of these three shall be final.

2. The arbitrator or arbitrators shall be furnished all the information and testimony they deem necessary regarding the matter in arbitration.

Article XVI. Decisions of General Council or by Arbitration:

All decisions of any General Council or of any arbitrator or arbitrators shall be binding upon all the Works originally designated by the President as being jointly interested. Any such decision may be made retroactive.

Article XVII. Guaranty of Independence of Action:

Every representative serving on any Works or General Council shall be wholly free in the performance of his duties as such, and shall not be discriminated against on account of any action taken by him in good faith in his representative

capacity. To guarantee to each representative his independence, he shall have the right to appeal directly to the President for relief from any alleged discrimination against him, and if the decision of the President is not satisfactory to him, then to have the question settled by an arbitrator selected by mutual agreement.

Article XVIII. No Discrimination:

There shall be no discrimination under this plan against any employee, because of race, sex, political or religious affiliation or membership in any labor or other organization.

Article XIX. Decisions Affecting Wages:

Decisions affecting wages made by any Works Council or General Council or by arbitration shall be subject to revision whenever changed conditions justify, but not oftener than at intervals of six months.

Article XX. Amendment or Termination of Plan:

1. This plan may be amended by the Works Council of any Works by a majority vote of all the duly elected employee representatives together with a majority vote of all the management representatives. Amendments must be proposed in writing at a regular meeting, and no vote shall be taken thereon until the regular meeting following such presentation. No amendment shall be adopted that will destroy or limit the equal voting power of the employee representatives and management representatives in the Works Council and General Council.

2. If in the judgment of the President any proposed amendment affects other Works, then he shall call a General Council to consider such amendment. The adoption or rejection of an amendment shall not be the subject of arbitration.

3. This plan may be terminated, at any Works, after six months' notice, by a majority vote of the employees of that Works, or by action of the Board of Directors of the company.

Adoption of Plan

This plan shall become effective at any Works upon adoption by a majority vote of the employees of such Works voting thereon at a special election held for that purpose.

Inadequate Cost-Keeping Retarding Adjustment

(*Continued from page* 563)

away for future use. What is true in Government work is true to a lesser but not insignificant degree in commercial life. Cost keeping must be put on a higher plane than ever before if general business is to be kept stable.

The situation in other districts exactly parallels that of the Detroit district. There has been held at Washington a meeting of the representatives of the districts Ordnance offices, for the purpose of planning to speed up the settlement of contract claims. It was brought out that less than 25 per cent of the expected number of ordnance claims have been presented to the district claims boards by contractors, to date. The district chiefs advised that the delay results from the magnitude of the work involved in setting up the claims which entail the taking of complete inventories of materials and supplies, determining the liability of the contractors to their sub-contractors and supplies of material.

All district chiefs present were urged by war department officials to use every effort to speed up the work of settling claims of contractors in order to relieve, so far as possible, the unemployment situation, and advised to use all means possible to bring financial relief to sub-contractors where payments are being delayed by the preparation of claims of prime contractors.

The Cleveland district office reported that seventy-two claims have been presented to it up to last week; that awards have already been made or are ready to be made in a majority of these, and that most of the remaining claims are expected to be presented by contractors within the coming two weeks.

Practically the entire staff of the Cleveland Ordnance district is now devoted to checking and expediting settlement of ordnance contractors' claims, and the contractors and sub-contractors are finding it highly advantageous to consult with the district claims board in setting up their claims resulting from cancellation or suspension of contracts.

The Wallis tractor exhibit at the Kansas City tractor show was an excellent example of manufacturers' merchandising. The chassis showed most parts exposed and there was a goodly display of components

Export Managers Enthusiastic

Optimism the Keynote of Well-Attended N.A.C.C. Convention —Plans for Combinations Under Webb Law Outlined —Importance of Proper Packing

THAT the United States has been a slumbering giant in the matter of export trade was the thought which dominated J. Walter Drake's introductory address at the Export Managers' Convention of the N.A. C.C., held last Friday in New York. He said, in effect, that an academic view of our country's present position in relation to the development of overseas business was not an ideal way of looking at things and that our future in foreign trade called for constructive and eminently practical action if we were to hold the markets we have gained and get back those we have lost owing to war conditions.

"Keep our ideals high and our hands clean," said Mr. Drake, who then went on to state that our industry's history during the 4 years of war had indelibly stamped it as the real leader in foreign trade and that it was up to the automotive export men to maintain the highest level of commercial integrity in our relations with our foreign customers in order to consolidate our future on a permanent basis.

He pointed out that history-making events now taking place in Europe would probably lead to new relationships as between ourselves and other countries, to new associations of both economic and social trends and that it was imperative that we realize to the full those differences in manners and customs which constitute (if ignored) the chief difficulty in the conduct of successful business.

Mr. Drake added that we had a vast inland population which did not always realize the magnitude of our overseas possibilities in relation to the expansion of our trade and that in his opinion the automotive industry was so organized that in future it would point the way to other branches of the country's commerce in the development of a general foreign trade of practically limitless extent.

Mr. Drake also touched upon the evident reluctance of factory executives to accept statements from their export departments as to differences and refinements demanded by buyers in various foreign countries; that this was a condition which demanded careful attention and prompt remedying; and that although the problem might be easy to the larger manufacturer it was not always such a simple matter for the smaller factory.

He emphasized that the success of our export trade called for co-operation in service to an extent which would enable the smaller maker to enter the field on terms of equality with his bigger competitor, remarking that the factory which exports 5000 cars a year benefits by the competition of the maker who exports 5 in the same period on the broad principle that America must advertise America overseas.

Export Epigrams

The United States has been a slumbering giant in the matter of export trade.—Drake.

No Orphan Annies should be permitted to compete with our standard automotive products in foreign countries.—McElwee.

European tariffs and embargoes are a temporary fence which will be pulled down as soon as demobilization is effected and normal commercial conditions have been restored.—Domeratsky.

The big commercial mind is beginning to realize that unless the community is served trade relationships abroad cannot endure.—Walker.

Keep our ideals high and our hands clean.—Drake.

The world is an expanded home market—don't conduct your foreign trade differently from your domestic business except those modifications necessary to meet foreign conditions.—Walker.

We must so establish ourselves in the foreign markets that the consumer will not realize the fact that our products had their manufacturing origin 5,000 miles away. We must give adequate and prompt service.—McElwee.

Alfred Reeves stated that at the present time the Export Committee of the N.A.C.C. was actively engaged in conjunction with the authorities in Washington on the subject of taxation and that although at this time nothing definite could be said regarding taxation on exports, yet the whole thought lying behind the new measure was that there would be no tax imposed on cars exported either direct from the factory or sent abroad through export houses or shippers.

Within a few days it is expected that a primer covering the whole situation will be printed and distributed not only to manufacturers but to every internal revenue department in the country. This course has been adopted by the N.A.C.C. to obviate all possibility of misunderstanding as to the actual conditions.

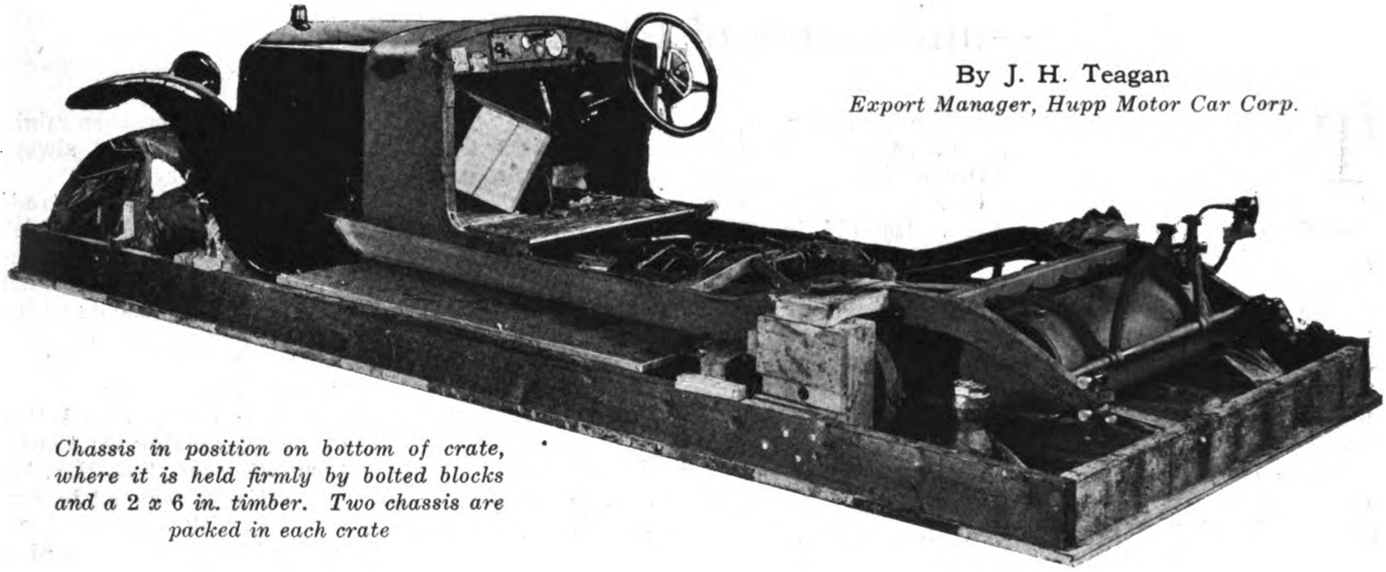
Roy S. McElwee, assistant chief of the Bureau of Foreign and Domestic Commerce, in the course of his address made a number of pertinent suggestions dealing with the subject of service in foreign countries. He pointed out that a fundamental principle to be observed, if the United States is to maintain its present position of the leading exporter of the world, was that of rendering adequate and prompt service at least equal to that afforded by foreign manufacturers.

He gave concrete instances of his personal experiences in handling agricultural machinery and emphasized that the primary mission of the American automotive manufacturer was to establish himself in the foreign mar-

(Continued on page 572)

Crating Automobiles for Export*

Demonstrating How Absolute Security Combined with Minimum Waste of Space May Be Attained



By J. H. Teagan
Export Manager, Hupp Motor Car Corp.

Chassis in position on bottom of crate, where it is held firmly by bolted blocks and a 2 x 6 in. timber. Two chassis are packed in each crate

AMERICAN manufacturers have in the past been criticised for their methods of packing and crating exported commodities, and American methods have been compared adversely with those of competing foreign exporters, indicating that customers abroad find our methods far from satisfactory. It seems to me that this question is so important to all exporters that a discussion of our methods and a free interchange of ideas and suggestions, tending to improve these conditions, should be of interest to the manufacturers represented at this meeting.

If American manufacturers expect to maintain their positions as exporters, they must study the requirements of their customers, and endeavor, if possible, to satisfy those requirements, going as far or farther than competitors in other countries. American goods of every kind must be at least as satisfactory in quality, as reasonable in price, as well delivered, and the customer's good-will as well guarded as is the custom of our competitors.

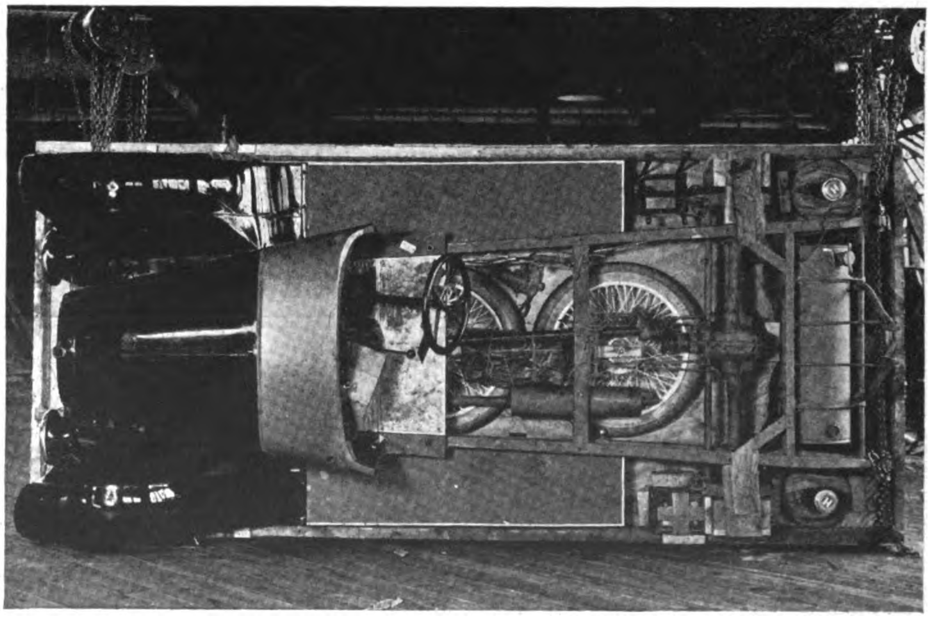
At our factory we have experimented with different types of crates, covers, paper packing and rust preventives. We have been helped by suggestions from our foreign customers and travelers, and by our study of the methods of other manufacturers of automobiles and commodities. We are still far from satisfied, but do know that our efforts have resulted in a great improvement and that customers abroad speak of it.

As the customer is charged for crating, it is essential that we keep the cost as low as it is possible and still insure the safe, undamaged arrival of the goods.

The following is the method which we have adopted. It is better than any other which we have tried, and protects our car from dust, water and damage by the elements or rough handling. Reports indicate that goods packed in this way are reaching our customers in as good condition as they left the factory.

Immediately after the car has been tested and washed it is driven onto the crating room floor, where we immediately apply to all nickel parts a rust preventive, and for this purpose we have been using a liquid called Corol. This, we believe, is the best rust preventive for nickel parts that can be found, and is easily removed. The British Government approved Corol after a very careful investigation, and specify it to be used on all of their shipments.

After the application of Corol the car is driven onto the bottom section of the crate. Surrounding this section are the

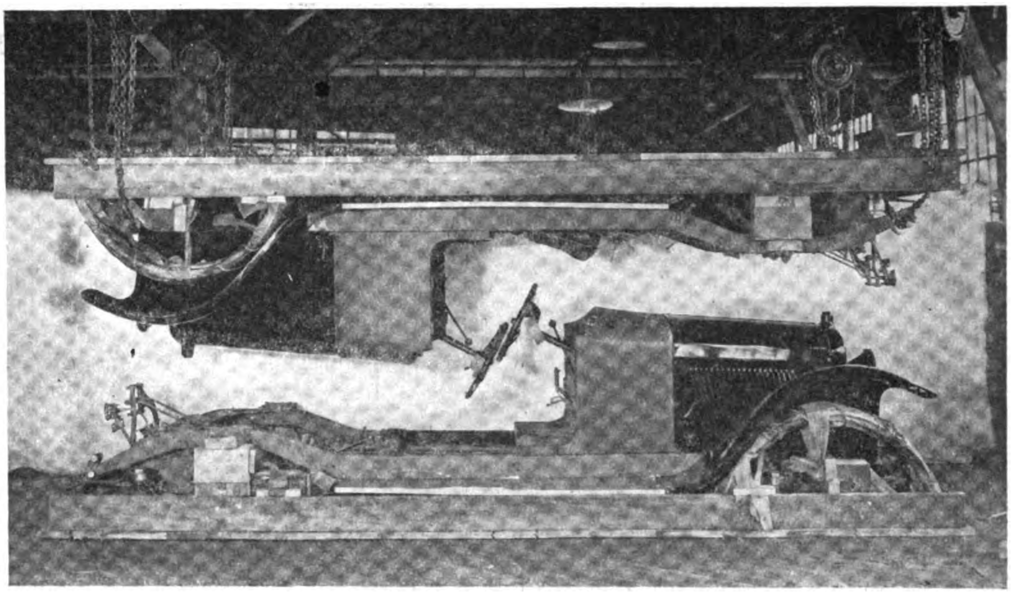


This illustration gives a good idea of how every available inch of space is utilized. This is of primary importance, as freight is charged by cubic feet

*Paper read before Export Managers' Convention, New York, March 7.

side sections and top of the crate. As the car is disassembled the parts are laid in position on the side and top sections of the crate. I emphasize this, as so often parts are taken from the car and mislaid and not put in the crate with the original shipment. Placing all the parts removed on the sections of the crate has eliminated most of this trouble.

The car is suspended by means of chain falls. Wheels, windshield and top are removed. The top carefully wrapped in burlap and fastened to the top section of the crate, directly over the position of the engine. The windshield is crated in a small box and fastened to the top section of the crate, immediately over the tonneau. Two wheels are fastened to each side section of the crate. They are secured with half-inch bolts.



Showing the method by which the chassis secured to the top of the crate is lowered into position before the ends and sides are attached

The steering post is dropped. Shackle bolts are removed and springs are compressed and held in this compressed position by means of metal straps. Brake rods are unfastened at one end and the loose end tied with burlap to the propeller shaft. This, you will readily see, makes a very compact package and reduces the cubic feet required.

The spark plugs are all removed, carefully and thoroughly oiled, placed in a leather bag and fastened to the control levers. The spark plug holes in the top of the cylinder block are tightly corked.

All of the oil is thoroughly drained from the car, also all gas and water, and the water inlet hose is disconnected at one end to insure the thorough drainage of the radiator. This prevents the dealer, when the car is reassembled, forgetting to fill the radiator.

The motor and all mechanical parts are sprayed with a mixture composed of vaseline and gasoline, which acts as a rust preventive and is easily removed. At one time we even coated the cylinder walls with a heavy oil, but this has not been found necessary and has been abandoned.

While the car is still suspended, we fasten over each rear axle spindle a 5 x 10-in. block, which has a hole bored in the center, and a 6 x 6-in. block over each of the front axle spindles. The car is then lowered to set on the bottom section of the crate, and the blocks over the axles are securely fastened. A 2 x 6-in. timber is then fastened to the tops of these blocks, which acts as a wedge from the frame to the side of the case, preventing the car from moving about, regardless of the position in which the crate may be placed.

We have found that if the car is securely fastened in this way the crates can be loaded, setting on the narrow side, and permitting four crates on the platform on a small freight car, thus obviating decking one machine over the other.

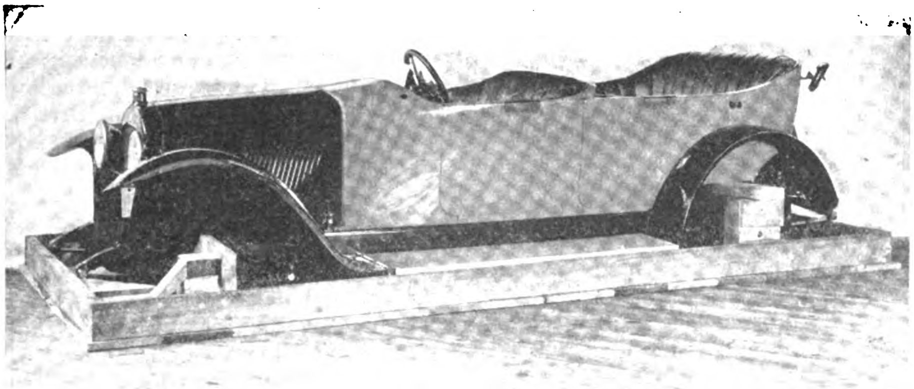
The car and parts being now securely fastened to the sections of the crate, the sides and ends of the crates are placed in position and the top section mounted, securely nailed and ready for loading.

We make our crates of 1½-in. tongued and grooved lumber, selecting the best possible quality, free from knots. This lumber is used for the top, bottom, ends and sides, braced by crosspieces, 2 x 6-in. timbers. The inside of the crate is completely lined with Kraft waterproof paper. Formerly, in addition to lining the box, we covered the car with a Safepack paper envelope and also covered the crate, after loading on flat cars, with a waterproof paper. With the type of crate outlined these last two precautions seem unnecessary.

We ship two chassis packed in one crate, fastening one to the floor section of the crate and the other to the top section. When chassis are shipped the wheels are fastened underneath the chassis.

We have tried to compress our shipments into the smallest possible crate and now cannot find any further way to reduce the dimensions, there being only ⅛ in. between the high point in the automobile and the top sections. The bottom of the differential gear housing comes within a fraction of an inch of the 1 x 6-in. timber which runs along the center of the bottom section. Only ¾ in. clearance is allowed between the edge of the fender and the side section, and less than that between the end of the springs and the timbers of the crate ends.

The question of crating cannot be given too much attention. It would seem to me that the aim of the export men should be to see that not only *their* cars, but all other cars, and all other products exported, are laid down at destination in such good order that no customer could ever complain of American methods, and I would suggest that a small committee be appointed to tabulate the methods used by various automobile manufacturers, asking each one freely to give all the information that he has regarding costs, and also any complaints or compliments that he may have from his customers regarding the method used. Copies of this tabulation could be sent to the various export managers and should result in improvements and possible economies to many of us.



Complete cars are packed singly and are held so securely that the crate may be placed on its side without damaging its contents

Suggested Combinations Under Webb-Pomerene Law

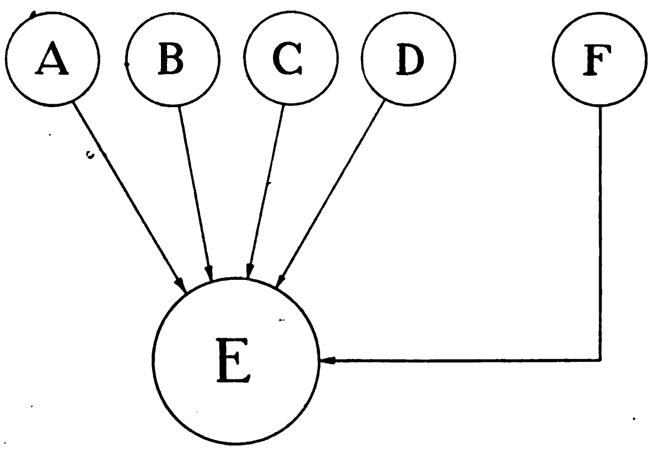


Fig 1—This represents the normal (and therefore ideal) form of combination for export.

A, B, C and D are four individual companies desirous of engaging in export trade under favorable conditions. They may be engaged in precisely similar business as in the case of the Copper Export Corp. or they may be engaged in non-competitive lines in the automotive industry.

These four companies form themselves into a single export association or corporation (E) which may either purchase the products of all outright and of itself accept all responsibility for the entire conduct of export business or it may be simply a unit selling organization acting in the interests of the four and taking instructions as to policy, etc., as applied to all.

It is conceivable that a fifth company (F) may desire to be associated in the benefits of the export association (E) to a limited extent and it would be permissible to so arrange matters that this fifth concern should retain its individuality to an agreed-upon extent, while it would be willing to come in line in matters applicable to all.

It is important to observe that the export association (E) may be only an agent or may be an outright purchaser of the combined products of A, B, C and D. If there should be an (F) it would be subject to terms to be agreed upon.

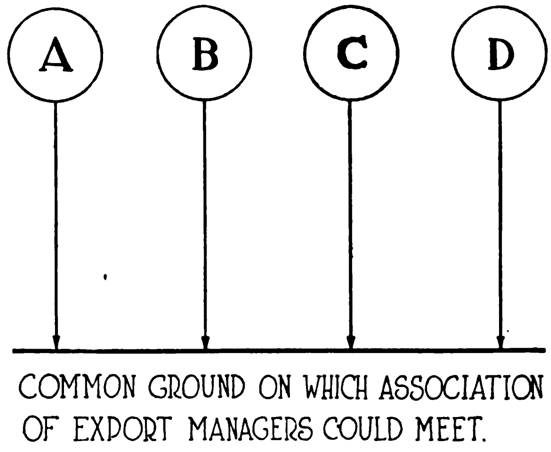


Fig. 2—In cases where the normal method of combination, as shown in Fig. 1, cannot be adopted owing to circumstances affecting the relative positions of the companies desirous of engaging in export trade, the following solution is suggested. It is understood that this method has been under consideration by the Federal Trade Commission and that they are inclined to agree that it offers a practical solution of what may be termed a half-way stage to a more permanent and unified plan.

Take four concerns, A, B, C and D, all of which have foreign connections and are at the present time engaged in export trade along lines or involving methods which are fundamentally different.

Assuming that it is impossible to unify the foreign business of these as in Fig. 1, it is suggested that the export managers of all four be formed into an unincorporated association registered in Washington.

This unincorporated association would be in a position to meet and agree upon co-operation in such matters as shipping, prices, joint stockrooms or anything else on which the four firms could have a common ground of operation.

This plan, while admittedly not perfect, would enable A, B, C and D to preserve their respective individualities, to avoid cut-throat competition and to effect considerable saving in expense in those matters which are common to all.

Export Managers Enthusiastic

(*Continued from page* 569)

ket as to make his customer unaware of the fact that his goods were manufactured 5000 miles away instead of just around the corner.

Mr. McElwee admitted that while such a proposition was a comparatively easy problem for the larger manufacturer, it was not quite so simple for the smaller exporter with relatively limited resources, and to overcome such a difficulty he suggested the possibility of co-operation between non-competitive lines in the matter of using a common stockroom for spare parts, sharing offices, etc., but maintaining individuality to a greater or lesser degree in the matter of sales methods if it were found impossible to do otherwise.

He insisted that "an embryo home office" was a primary necessity to the successful conduct of an export business, stating that even if such an office in Bordeaux, Marseilles, or elsewhere abroad simply consisted of a desk and a telephone it gave a sense of security to the purchaser. He said that such an office should be supplemented by the use of stationery bearing its address and that the adoption of such a course did not mean that the salesman had to stay indoors to answer calls so long as he could arrange for queries to be received and held for his attention.

Mr. McElwee spoke at some length on the absolute necessity of cars and trucks exported being representative of standard American practice and suitable for the purposes for which they were designed. He said, "No Orphan Annies should be allowed to compete with our standard products abroad. It is a case of the United States against the world, and an individual break-down means that every American product suffers by inference."

Louis Domeratsky of the Division of Foreign Tariffs of the Bureau of Foreign and Domestic Commerce announced his readiness to answer questions relating to the present position in regard to restrictions, tariffs, etc., and in response to many queries gave information which served to clear a number of debatable points. Obviously, there are many matters which are still in doubt, but the sum-total of Mr. Domeratsky's opinion was along the following lines:

Status of British Embargo Indefinite

It is impossible at this time to say anything definite regarding the British embargo, but it is evident that no country can maintain an embargo indefinitely. It may impose prohibitive import taxation or tariff. The British automotive industry, as also the French, considers it has claims on its government on account of war services rendered and that it merits a meed of protection.

It is believed that there is no restriction in either country on the importation of farm tractors. Tariffs are a temporary fence erected to stay only until demobilization has effected a return to normal conditions.

In response to questions, Mr. Domeratsky stated that his department experienced no reluctance on the part of foreign governments to give full information in regard to tariffs and restrictions.

Prefacing the remark by the statement that it was not an official statement, Mr. Domeratsky gave it as his

opinion that England was at the present time taking advantage of existing conditions to advance her theories on tariff reform and because of sentimental and perhaps political reasons. He added that it should not be forgotten that England was a commercial as well as a manufacturing country and that undoubtedly she would be glad to see the abolition of all restrictions affecting the import of foreign-made goods.

In response to a question, Mr. Domeratsky said that he could not give any information as to why it was possible to receive coded cables from England but impossible to send them from here. He also stated that while French tariffs applied to France's colonial possessions, Great Britain's tariffs did not apply to British colonies. A further question in regard to a possible list of present tariffs and restrictions was answered by Mr. Domeratsky referring the inquirer to a recent issue of AUTOMOTIVE INDUSTRIES in which complete data were published.

The matter of restrictions on car exports to Australia, where two chassis must be sent for each complete body exported, was raised. It was explained that this restriction was designed to encourage Australian body builders.

Mr. Domeratsky pointed out that in the event of stocks of parts being held at a free port, they could be shipped thence to any point, paying the duties called for at the ultimate destination but escaping intermediate duties in countries passed en route by being shipped through these in bond.

The Webb-Pomerene Law

Allen Walker and Gilbert H. Montague, both of whom assisted in the preparation of the act known as the Webb-Pomerene law, which provides for the combination of competitors for export selling, spoke at length on the advantages conferred on automotive manufacturers in the opportunity afforded under the new law to effect combinations for the purpose of conducting export business in a manner which simplifies operation, reduces expense and confers the full benefits of co-operation.

Mr. Walker outlined the main points of the law and mentioned the efforts which had been made by the Guarantee Trust Company to obtain commercial information sufficient to create a directory or "Who's Who" of foreign trade, a compilation which now contains 60,000 names and ratings.

He pointed out that trade combinations already effected had proved beyond the shadow of a doubt that all business conditions could be met and all problems solved irrespective of the apparent impossibility of adjusting conflicting interests where it was sought to associate large firms with an existing foreign trade connection with smaller concerns who had not engaged in overseas trade.

American manufacturers are forgetting petty differences, he said, and are getting together for the development of foreign trade on the general principle that nothing matters but the common good and that the community must be served if they are to succeed.

Mr. Walker instanced the British Empire League as an association termed to develop a bond of sentiment, to emphasize the fact that self-interest alone was useless when confronted by foreign trade conditions and to point out continuously that national pride in the Empire's products was an essential to successful export.

He said, in effect, that the shelves of the world were empty, that it was the time when we could perfect our plans for filling them and keeping them filled, and that the world should be considered simply as an enlarged home market where nothing need be changed in business methods except in so far as it might be necessary to meet a country's individual conditions, manners and customs. Mr. Walker mentioned that active steps had been taken to counteract propaganda having for its object misrepresentations of the real object of the Webb law in various foreign countries—notably in Latin America and Australia.

How Export Combinations May Be Effected

Gilbert H. Montague, who has been engaged in the formation of the Copper Export Corp. and a number of other combinations under the Webb law, spoke of the various ways in which complete or partial associations could be formed to carry on export business.

He referred to the fact that if circumstances did not seem to warrant a close combination where a number of firms pooled all their export interests through a single association and sold their products solely through that association, there were other ways of solving the problem.

He illustrated a few of the alternatives by means of diagrams, showing that it was possible to enter into export combinations in such a way as to preserve existing interests in the case of one or more of its members who might be in a better position to engage in export trade than were other individual members of the same combine, without injustice to any one of them and with marked advantages to all.

The principle upon which these combinations are being effected is that matters must be so arranged that no one member can lose the benefit of anything which has been done and that all shall gain the advantages of cooperation without losing their respective individuality.

Such matters as advantages conferred by factory location in relation to the seaboard whereby one member of an associated group would normally reap the benefit of lower freight costs and under the older conditions could cut prices on this account have been eliminated in favor of an averaged flat rate based on the cost of freight from all the factories in that particular combination.

Our New Ships

Ira A. Campbell, Admiralty Counsel, United States Shipping Board, spoke of what had been accomplished in the construction of new vessels, the acquiring of others, the difficulties of the past and the hopes for the future. Mr. Campbell did not make any statement regarding the actual number of ships available over the various trade routes for commercial shipments at the present time.

He outlined the number of vessels and the total tonnage available at the signing of the armistice, mentioned the tentative program which normally should have been in effect at the present time and stated that the Board's plans for the transfer of shipping to strictly commercial service had been completely upset by the European food shortage, which necessitated the diverting of much tonnage for the time being.

He referred to the possibilities of the future in reference to the ultimate ownership and operation of the now Government-controlled ships and made suggestions covering alternative methods of keeping them in effective service in advancing the export trade of the country.

Registration of Trademarks

James L. Steuart impressed upon the delegates the absolute necessity for protecting trademarks, pointing out that the law of the United States, where the adoption and use of a trademark gives right and protection, differs from that of foreign countries. Abroad, said Mr. Steuart, countries do not recognize such rights, but provide statutes permitting a manufacturer to apply for the

right to register a trademark—the first to register getting the right and protection.

He added that this state of affairs had caused much trouble and expense to American exporters owing to the facility with which a United States trademark could be registered abroad by anyone who thought he saw an advantage in controlling that trademark in a given country.

This practice has grown to such an extent that there have been cases where United States trademarked goods have been refused admittance at foreign ports on the application of some individual totally unknown to the manufacturer of those goods, but who had realized the opportunity for something little, if anything, short of blackmail. Mr. Steuart gave specific instances of hardships of this nature inflicted by piratical persons on American manufacturers and impressed on the convention the necessity for having trademarks protected abroad.

Foreign Selling Problems

George H. Smith, president of the American Manufacturers' Export Association, outlined the entire position of the United States manufacturer in relation to export trade and its possibilities, touching on the changed conditions and the keener competition which may be expected in the future.

"At the very outset," he said, "let me say that while the present obstacles to the development of our export trade are serious and real, there is not one which cannot be surmounted by the manufacturer who is determined to make export trade a definite and permanent part of his business.

"A great part of the world is laboring under a burden of debt and difficulty brought about by the war, but when readjustments are made (and they must be made quickly) there will be inevitably a tremendous demand for those American products which other countries must have if they are to win their way back to normal conditions.

"There is a responsibility as well as an opportunity for the American manufacturer in the field of foreign trade. The country is gradually beginning to realize that to maintain the production of the United States at its present high peak and to offer employment to the workmen of America, the nation must build up the permanent foreign markets which belong to it because of its natural aptitudes.

"The automobile manufacturer who has the courage and the energy to develop his foreign sales is, therefore, not only performing a service for himself, but by adding to the volume of his country's exports is performing a distinct economic service for his country."

Packing for Export

J. H. Teagan gave some practical advice on the subject of packing passenger cars for export as done by the Hupp Motor Car Corp. The address was highly instructive and the photographs which were passed around were examined with interest. As the subject is of general trade importance some of these photographs are reproduced, together with a synopsis of Mr. Teagan's talk, on pages 570 and 571.

Peter S. Steenstrup, general manager of the General Motors Export Co., pointed out that successful advertising methods abroad differ in important respects from the methods adopted with success in domestic advertising; that trade literature should be in the language of the country where it is circulated; and that the possibility of co-operative advertising by members of the N.A.C.C. should be considered.

Mr. Steenstrup referred to the fact that our whole-hearted participation in the war had given us a higher standing in the British colonies and in many other countries and that the present time was ideal to thoroughly establish ourselves in the overseas markets. He said: "The time to advertise is now, and the present unusual opportunities, if neglected, may never present themselves again."

All features of advertising were given full consideration, methods of placing overseas advertising were dealt with, suggestions on many points were made and in giving a list of American export journals which he described as "excellent mediums to reach overseas jobbers, dealers and agents," Mr. Steenstrup said: "There is but one American automobile trade publication with a large overseas circulation, *El Automovil Americano*, a quarterly published in Spanish by the Class Journal Co."

D. B. Richardson, foreign sales manager of the Studebaker Corp., made reference to the present popularity of the clincher type of tire in most foreign countries, a circumstance which he attributed to the early influence of the Michelin tire. The many advantages of the straight-side type were pointed out and it was suggested that both car and tire manufacturers co-operate to standardize the use of this type not only for the reason that it would be advantageous to both but that it would also confer an appreciable benefit on the user.

It was admitted that in Continental Europe there would be but little prospect of bringing this change about, but it was the opinion of the writer that it was quite practicable to standardize the straight-side tire elsewhere.

Right-Side Steering

Right-side steering is, in the opinion of Mr. Richardson, an essential for cars exported to countries where the rule of the road compels drivers to keep to the left. Under such conditions the difficulty of signaling an intention to turn is greatly increased by the use of left-hand drive and, as one of the delegates pointed out, the left-side location of the steering wheel may mean that a front-seat passenger has to alight in the roadway—possibly in mud—unless the driver first gets out and the passenger crawls under the steering post.

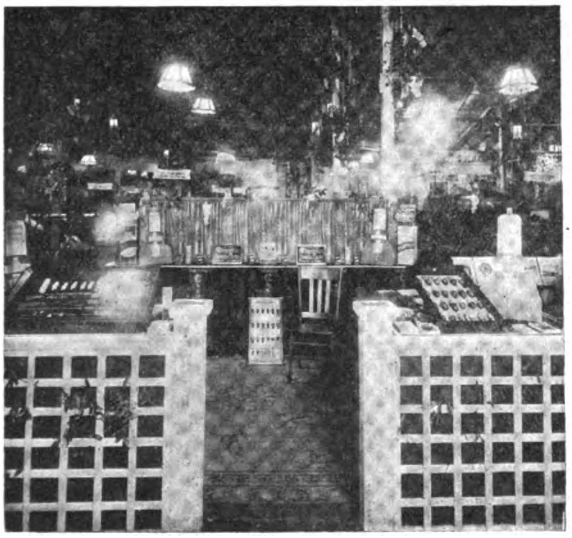
This paper concluded the regular session, but, in response to the request of the chairman, H. M. Robins of Dodge Bros. gave an interesting account of his impressions of the automotive industry gathered during a recent tour of England and France. C. J. P. Lucas, Chicago, spoke regarding the possibilities of railroad co-operation with exporters and referred to the fact that from March 15 both United States and Canadian railroads would issue through bills of lading, make out consular documents, etc., for any part of the world.

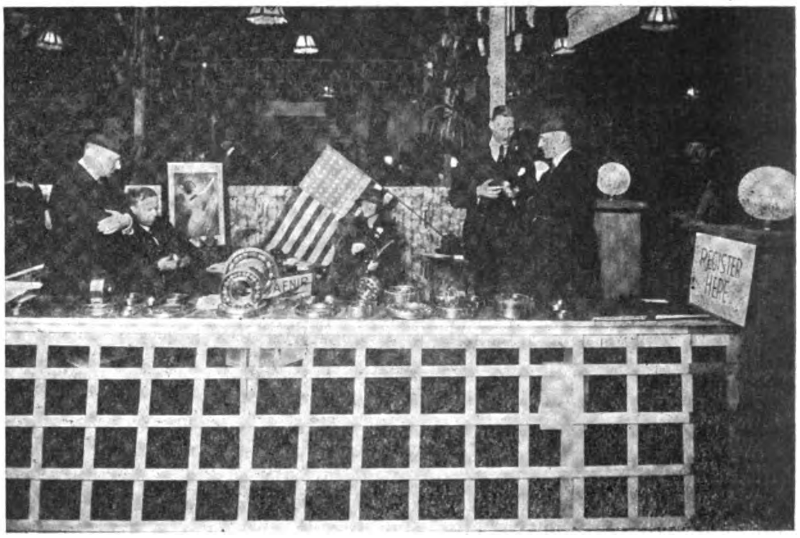
Light as Deteriorating Factor in Airplane Fabrics

SPEAKING before the Royal Aeronautical Society on the strength and deterioration of fabric and dope used for aircraft, Dr. F. W. Aston said that sunlight was the only serious agent in deteriorating the strength of doped and undoped linen aeroplane fabric. The change in rate of loss of strength was very great in summer and practically negligible in winter. Once the action of light was prevented, doped fabric was capable of sustaining continuous exposure for several years without dangerous weakening. Unprotected doped fabric lost about 12 per cent of its strength in a single average English summer day at sea level, and the rate was enormously greater at high altitudes above the clouds.

Rapid as the deterioration was in the case of an English machine, in the case of an enemy Albatross scout, captured practically brand new, it was even worse.

Good Exhibits at Kansas City Tractor Show

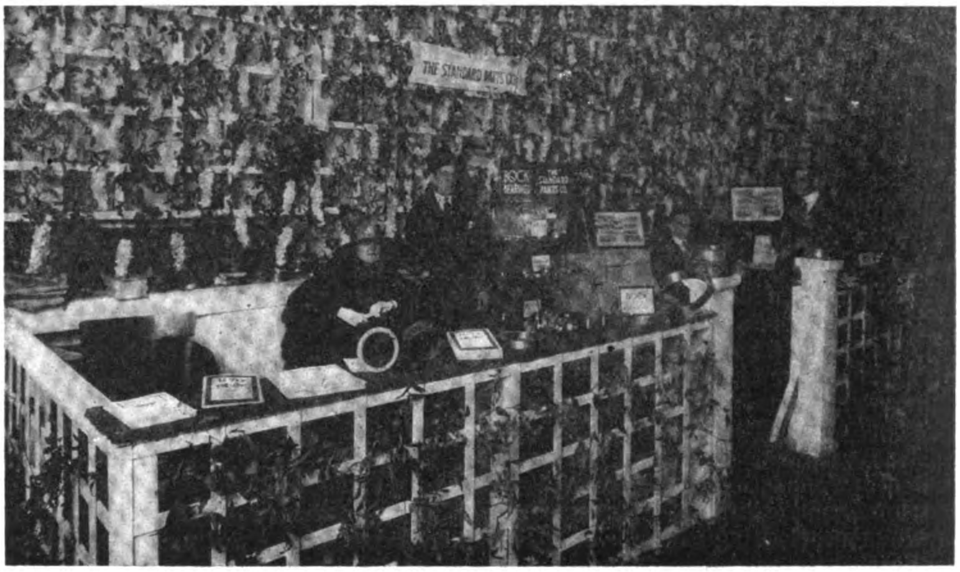


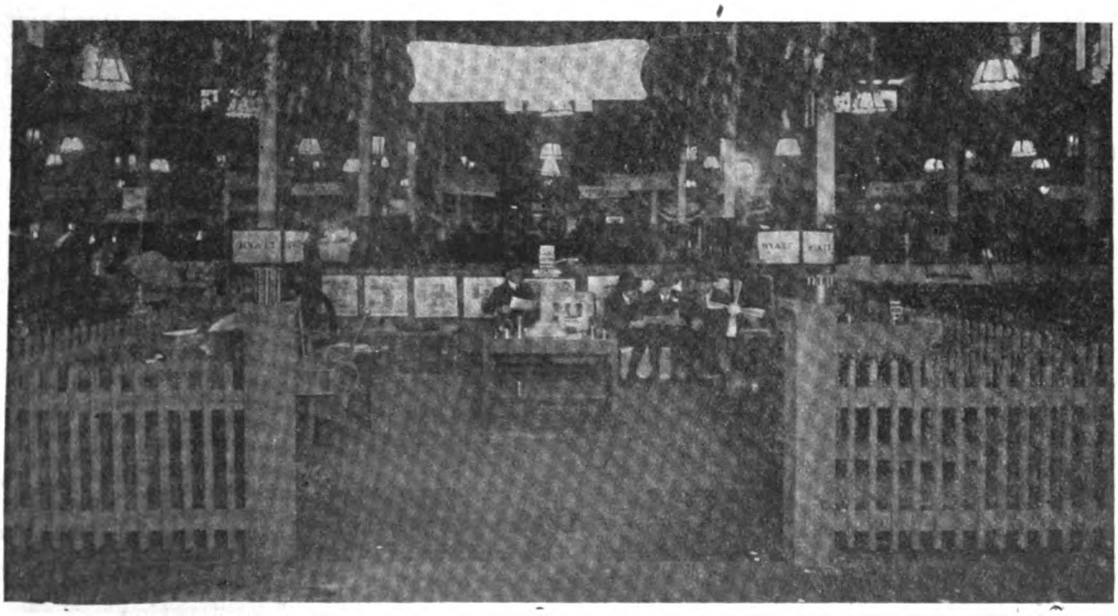


The Champion Spark Plug Co. is about the most show-going corporation in the business, and it always has a good exhibit. This set-up at the Kansas City tractor show is typical in that it has a Champion look

At the right of the Champion picture is the very good exhibit of the Fafnir bearing company. This was but one of many exhibits of the industry's best parts makers

And here is Standard Parts. With many others, it was alert to the opportunity of getting in touch with the growing tractor industry





Hyatt roller bearings had quite a lot of room, where interested engineers, farmers or any one else could come in and sit down and talk over the merits of the product. A place to sit down and talk is a big show asset

Egotism in Business a Grave Error

Consulting Engineer Can Help to Guide Executives Along Broader Lines of Progressive Thought—Quality the Eventual Criterion

By J. Edward Schipper

SELF-SUFFICIENCY is as bad for a business organization as it is for an individual.

It builds up a Chinese wall around the organization which eventually becomes fatal. Millions of dollars have been lost during the history of the industry because of this fault being carried to an excessive degree, and it is upon one of the most important methods of remedying this fault that the following observations are given.

We cannot see ourselves as others see us. Neither can we judge the product of our own hands and brains as others judge it. As every manufacturer knows, the history of his product has just begun when he has put an experimental model through its paces and finally puts it into production. It is the public or the consumer which must be the final judge.

If the public or consumer judges adversely, millions of dollars may be lost, or sums of money may be lost which are fatal to the success of the concern which loses it.

Influence of Public's Judgment

If the public judges favorably, then the opportunity is often open to fortune. It is true that the judgment of the public or consumer may be swayed by clever salesmanship and a trained and good sales organization, but even with this factor considered it is far easier for the salesman to sway the public in favor of something which is really good throughout than it is to attempt to put over a product which is weak in some vital feature.

It is a mistake for a manufacturer to attempt to bring out a new model along different lines from its predecessors without calling in the assistance of outside talent such as a consulting engineer or some advisory counsel.

Frequently our manufacturers rely too implicitly on their own engineers, expecting them to cover not only the entire field of design itself, but also to be able to project themselves into the future to the extent of knowing definitely the trend of engineering progress and the trend of popular demand.

The men who have a knowledge of both these phases of engineering work are rare indeed; in fact, it is questionable whether they exist.

A man who is thoroughly capable in detail design is rarely if ever capable of properly judging the commercial or sales angles which must always be considered in a new product. A man who designs the details of the engine knows little or nothing as a rule about the popular requirements in the line of appearance. Plant men as a rule are detail men.

The consulting engineer is a man who, being removed from the necessity of concentrating on particular details, has a wider vision and a broader aspect than the plant engineer. He should be called in to help paint the general picture of a design before the design ever gets any further than the drawing board. He should be fortified with such a store of engineering knowledge that he knows the weak and strong points of every kind of design, and will be able in advance to clear the way of troubles which are always sure to occur when a product is designed from the details out toward the finished product.

Too often the logical process of design is reversed and an automobile, for instance, will be built around an engine, or a truck will be built around an idea of spring suspension; and while the particular engine or the particular spring suspension may be the best in the world, there are too many instances where the vehicle as a whole has failed because the specialist failed to call in outside help to assist him maintain the proper balance between his own knowledge and what he has taken for granted from existing practice.

Probably never again will the automotive industry be in the condition that it is to-day. While on the surface there are many things which are disadvantageous, on the other hand we now have the opportunity for laying a foundation for future developments which will never come again. We have been given a fresh start and still are able to use the experience of past years.

One of the lessons that we should draw from this is that in the past we have not been particular enough as regards the quality of our products, but our industry taken as a whole has suffered the fault committed by many. It has been too eager for quick returns. If we have a national failing it is that we look for quick turnovers from our industrial projects.

Must Build for Quality

Rather than building for the permanency of a product, we have been building, in many cases, for the profits which could be extracted from the product within a few years. *One of the greatest means of combating this tendency is going to be in the use of men of broad vision and wide experience who can judge our products, not from the standpoint of how much money is going to be made on it, but from the standpoint of quality.*

The proper use of consulting engineers in this profession will do a world of good in creating new standards and higher planes of development for automotive products. A consulting engineer should not be called in solely in times of trouble. He should be called in more or less regularly on various lines of thought.

A consulting engineer should build up around himself a complete arsenal of engineering information as well as maintenance problems. Abroad there are many concerns of consulting engineers which are held in high esteem, and with the size of the industry in this country there should be many such who would be in a position to do the industry a great service if they were correctly trained to handle their work.

Not only can the consulting engineer help to pilot the engineering staff of an organization along the proper general lines, but he can often, through his experience, foresee trouble which if permitted to pass might ruin the reputation of a company. More than one concern has suffered materially in reputation for an error which allowed a weak link in its chain of construction.

We can call to mind a concern which was ranked among the biggest and most successful in this country not over four years ago. Three or four bad mistakes, one after another, any one of which would have been readily detected by an outside engineer of experience, were allowed to escape the vigilance of the plant engineer.

The result is that this company has lost all of its holdings and is only a mere shell of what it might have been had the proper care been concentrated on its product. One line of models had so much trouble with the rear axle that it was necessary to call in hundreds of these axles and replace them with new ones. It was necessary for the same concern to put scores of men on the road replacing pistons, which, because of faulty design, failed as soon as they got into service.

Following this a model which should have never been allowed to go further than the drafting board was put out with results that were disastrous and because of these mistakes the company shrank from an independent, wealthy concern until it now holds but a minor position in the industry. This is only one of the stories of what might be told of where the high ideal of quality performance was not kept in mind in designing the product, but rather where the cheapest thing that could be used was utilized to get by with on this car.

Should Design for Service

The fear of every manufacturer is what service problems he is going to run into after his product gets in the hands of users. One of the biggest reasons for this is that the problem is not fully considered *before* the product is designed, but only after it is ready to sell.

America is about to enter into a great contest for world trade. We have had a reputation, perhaps not undeserved, of building products cheaply but not enduringly.

The war has changed this to a great extent and countries which have hitherto kept closed doors for America's products are now ready to open them if we but step forward with the proper class of goods. This is an opportunity for which we might have had to wait a half century had not the war occurred, and it would be criminal folly to fail to take advantage of it or to destroy this wonderful opportunity by attempting to place before the markets of the world products which are not built on the ideas of quality and service.

The consulting engineer knows through his broad experience that it is possible to build a cheap product and sell it once because of its price, but it is not possible to secure repeat orders from the customers who have tried the cheap product and found that it does not give the service.

For this reason the consulting engineer is bound to be a weighty factor in demanding quality in the products with which he has anything to do. It is simply a matter of building a permanent re-order business, rather than a single-order, short-lived concern, which may flare up as a quick success, but which will not endure in anything like the manner of a concern whose product is built on a higher plane of standards.

There is some reason why in 1912 in this country there were something like 350 manufacturers of passenger automobiles, while in 1919 there are about eighty-five. Those who have survived have not been the ones who have tried to make an instantaneous financial success. Those who remain have always the temptation before them to cut down on quality and go up in annual profits.

But it is going to be the salvation of our industry and one of the greatest determining factors in the commercial standing of America in the world market if we will but make quality and not profit the chief consideration.

A consulting engineer who handles his work along these broad lines should be in the greatest demand. He can enter a conference with his broad view and bring out in discussion matters which probably would not occur to those who are connected with the plant organization.

It is not the consulting engineer's function to determine matters of policy or to entirely design a product unless under some special circumstance. It is his duty rather to see that in laying out a project all sides of the matter have been given due consideration and after this decision has been reached, he should assist in interpreting it in future production in the broadest and most accurate light.

A man who has made consulting engineering as pertaining to the automotive industry a study states that the consulting engineer's work can be considered under five headings:

1—Confirmation.
2—Criticisms.
3—Improvements and refinements.
4—Creation.
5—Checking and testing.

In considering these heads it can readily be seen that the matter of confirmation is of the highest importance because not only does the confirmation of the views of the factory men give them an infinitely greater confidence in their own judgment, but it makes a huge psychological difference to the entire plant, giving them greater ability to go ahead and push the project to a successful determination.

The statements of a consulting engineer in confirming from a broad viewpoint the detailed decision of a plant engineer are of the highest importance to the sales manager because they furnish him with the best kind of ammunition for his sales campaign.

Sales Problems Are Important

Often the sales manager will differ with the decisions made by the engineer of the plant. This condition is not healthy from a sales standpoint because it is a well-known principle of merchandising that before a man can sell well he must first be sold on his own product. The confirmation of a consulting engineer of high standing of a definite engineering policy decided upon by the plant engineers will have a wonderful effect in this direction.

Criticism by a consulting engineer must be taken in a broad way. The plant engineers must realize that constructive criticism by a consulting engineer is no reflection on their ability. Too often the petty fear of a plant engineer that his knowledge and effort will be discounted has precluded the use of a consulting engineer, when that use might have been worth thousands of dollars to the company.

A consulting engineer, knowing from his storehouse of engineering information the proper materials and proper design, or proper manufacturing methods to utilize in taking care of a product designed to fulfill certain requirements, can be a wonderful benefit to a plant.

Often important features can be improved and simplified by suggestion and by careful discussion. Manufacturing costs may be cut by a suggestion given as a result of the wide experience of the consulting engineer. The field of criticism is a fruitful one and has marvelous possibilities in the way of money saving and manufacture and trouble saving after the product is on the market.

As the art progresses refinements and improvements always suggest themselves in any product. From time to time factories have announced that they were ready to stand pat upon designs previously brought out and completed. In a sense they have said, "We have reached perfection and we know of no further refinements to incorporate in our product."

(*Continued on page* 595)

Tests of Ignition Apparatus

A New Porcelain Developed Having High Insulating Qualities at High Temperatures—Resistance to Thermo-Cracking and Shock and Gas-Tightness of Plugs Also Investigated

By P. M. Heldt

IN 1916 the Bureau of Standards was asked by the National Advisory Committee for Aeronautics to undertake a study of spark plugs, and this work was later extended to cover other ignition problems. Reports from abroad indicated that one serious trouble with spark plugs was failure of the plugs due to electrical conduction through the insulation. The ceramic laboratory of the Bureau, which is located at Pittsburgh, undertook to develop compositions of porcelain which should meet the requirements of spark plug insulators better than any available up to that time. A large number of compositions were made up and tested for electrical resistance at high temperature, for resistance to thermal cracking and for resistance to mechanical shock. In the test for resistance to change of temperature the porcelain was raised to a high temperature and then suddenly cooled by plunging it into an oil or other bath, after which it was examined for cracks or fissures. In these tests for resistance to mechanical shock the spark plug was screwed into the side of a block of metal which was struck violently against a steel anvil by means of a cam mechanism.

As a result of these tests a material was developed which was superior to any formerly in use. The formula of this composition has been furnished by the Bureau to a number of spark plug makers and may be had by any interested concern on application. The material is now in production by one of the largest manufacturers of spark plugs in the country, and its use is being considered by several others.

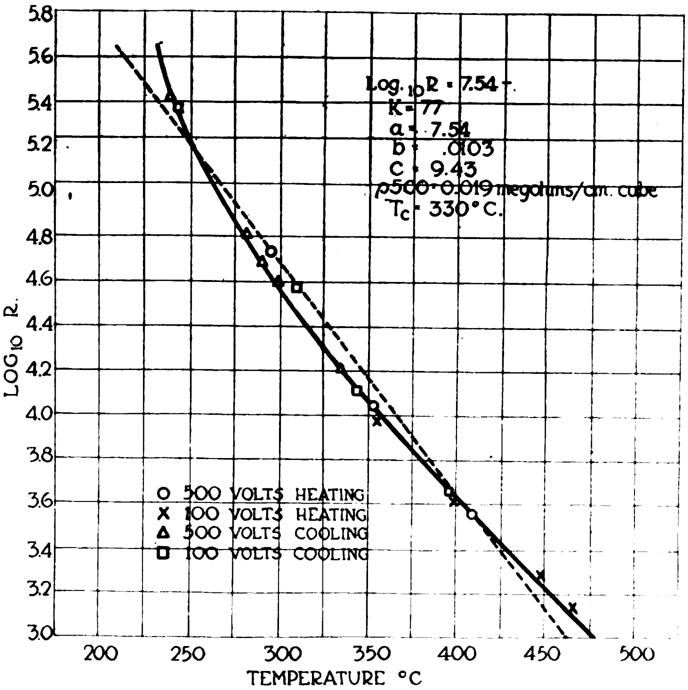
As a result of the conductivity measurements and of measurements of the temperature which the spark plug attains in an engine, it appears that failure of a plug due to conductivity of the insulator occurs only in extremely hot engines. The results of the conductivity measurements were plotted on cross-section paper, and one of the graphs is shown herewith. Instead of plotting the resistance of the porcelain against the temperature, which would seem to be the natural thing to do, the logarithm of the resistance is plotted against the temperature. The reason for this is that while the resistance varies enormously with slight changes in temperature, the logarithm of the resistance varies nearly linearly, and a nearly straight line is obtained, the inclination of which can be made anything desired by a suitable choice of horizontal and vertical scales. From this curve the resistance at any temperature can be read off.

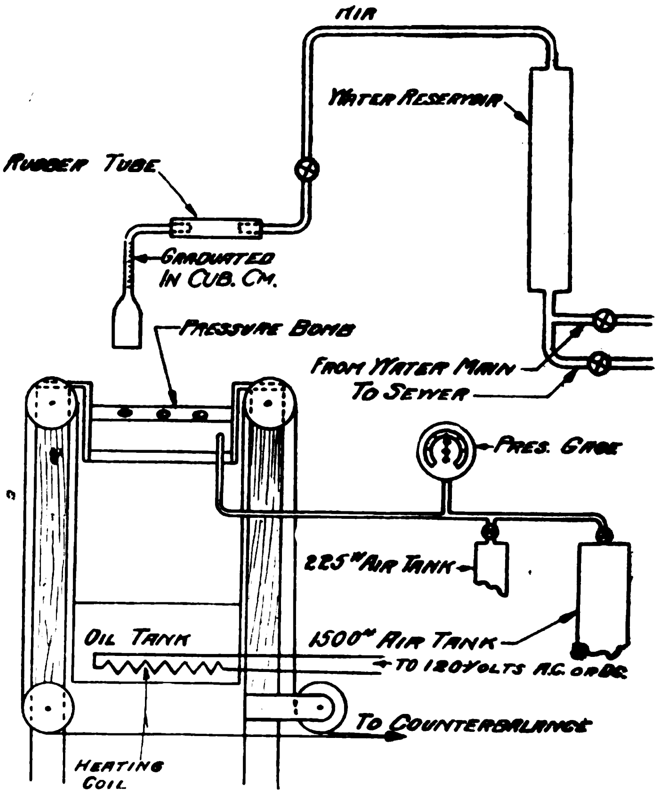
In the course of the experiments it was found that in high power aviation engines the inner end of the porcelain may reach a temperature of 900 deg. C., but the body of the porcelain seldom exceeds a temperature of 250 deg. C.

The following table gives the principal results of resistance tests on a variety of insulators used for spark plug purposes:

Description of insulator	T_e	Resistance at 500° C. in millions of ohms
Fused silica	890° C.	340
Best porcelain tested	790° C.	80
Typical high grade mica plug	720° C.	70
Average of three aviation porcelains	650° C.	40
Average of three automobile porcelains	490° C.	0.80

T_e is the temperature at which a centimeter cube of the material has a resistance of 1,000,000 ohms.





Logarithmic graph showing variation of insulator resistance with temperature. On right—Apparatus for testing air-tightness of spark plugs

Tests have also been made on the gas tightness of plugs, more than 100 different designs having been tested. Except in cases where the insulator is molded to the metal parts of the plug there is very little connection between the design and gas tightness, the latter depending much more on workmanship than on design.

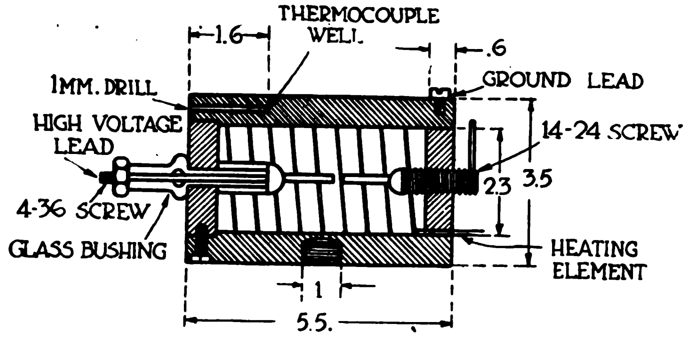
There are several different methods of insuring a gas-tight joint between the metal shell and the insulator. A great many plugs are assembled with a screw bushing, in which a gasket, either of asbestos thread or copper asbestos, is placed between a shoulder on the shell and a shoulder on the insulator. Other plugs have the edge of the shell crimped over the insulator, while still others depend upon a taper fit, these latter not employing a gasket.

In making a test for air tightness the spark plug is screwed into a pressure bomb, and a bath of oil heated to 150 deg. C. is brought up around the plug and produces a differential expansion similar to what would occur if the plug was in an engine in operation. Then a graduated glass bell is placed over the plug and any air which leaks through is collected therein. The volume of air which collects in a given time is a measure of the air-tightness of the plug. A sketch of the test set-up is shown here, and one of the illustrations shows a few of the plugs submitted for test, practically all of which will be seen to be of the airplane type.

This section of the Bureau of Standards has also made numerous oscillograph tests of magnetos and battery ignition systems for the War Department. Among other testing apparatus the Bureau developed a copper calorimeter for measuring the heat of the spark. A sectional view of this device is shown herewith. The spark takes place inside of a cylindrical block of copper, 2 in. long by 1 in. in diameter, which contains one insulated and one grounded electrode, the spark gap being at the center of the block. The temperature difference between the calorimeter block and another dummy block of similar dimensions is determined by means of a thermocouple, and the whole apparatus is calibrated by means of a resistance coil inside the cylinder through which a certain known amount of electrical energy is sent.

The actual igniting power of a spark depends on many factors which are at present little understood, and the total heat energy is by no means a direct measure of this igniting power. However, it serves to give an index of the total power output of each type of ignition system and forms a basis for a study of the effect of various features of design upon this output.

In arranging the set-up for this test, pains were taken to reproduce as nearly as possible the electrical conditions in an engine while in operation. The spark is produced under atmospheric pressure only, but the spark points are separated further than in the spark plug, to such an extent that the breakdown voltage and the voltage required to maintain the pression.
arc are substantially the same as in an engine under com-



Calorimeter for determining heat of sparks

Measurements were also made of the breakdown voltage of spark gaps at various pressures and temperatures in order to estimate the voltage required to produce a spark in the compressed charge in an engine cylinder. It was found that the spark voltage depends only on the density of the gas, the pressure and temperature of the gas affecting the breakdown voltage only in so far as they have an influence on the density of the gas. These data agree with actual measurements in aviation engines and indicate that the sparking voltage is approximately 6000 volts.

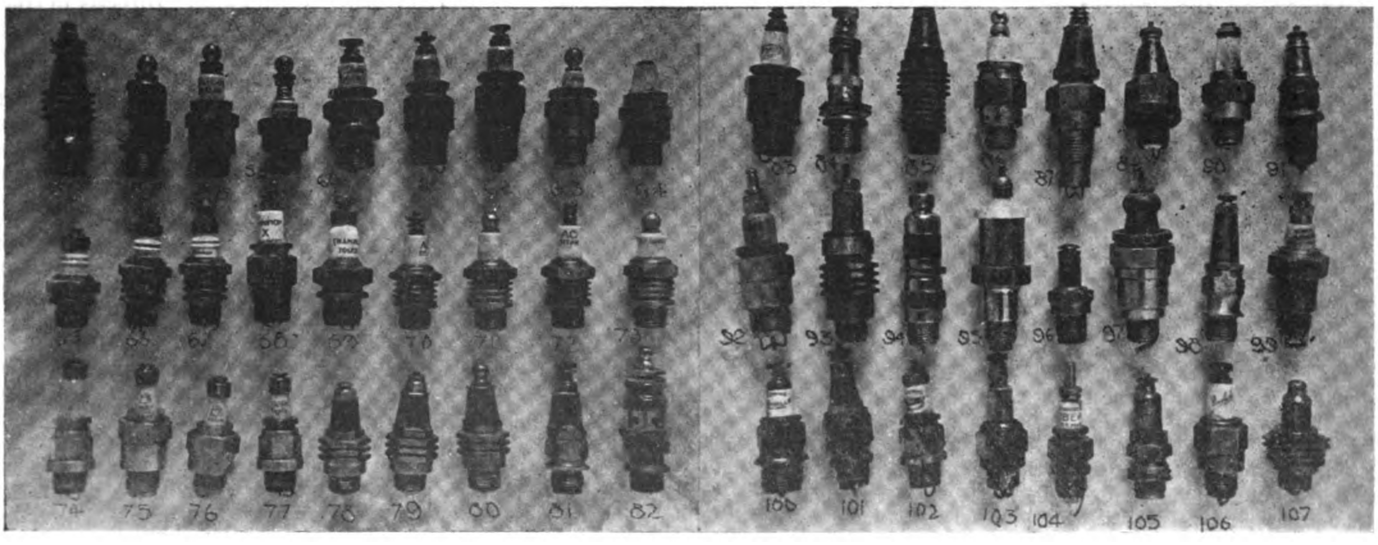
—

Investigation of Headlamp Glare

ABOUT a year and a half ago the Bureau of Standards started an investigation to determine the character of light distribution of automobile headlamps with various kinds of glare-control devices. Candlepower measurements were made on 20 to 25 different types.

These glare-control devices were divided into two different types, one in which the light distribution is symmetrical around the axis of the reflector and the other in which it is not. With the former type candlepower measurements were taken only in a horizontal plane through the axis of the lamp, through a range of about 10 deg. from the axis. Where the beam of light is not symmetrical to the axis of the lamp, as, for example, with lenses containing prisms which throw the light downward, measurements were made in four horizontal planes 2 ft. apart at a distance of 75 ft. from the lamp.

What started the Bureau on this work was a request from one manufacturer of headlight lenses for a test of his device. Later the work was conducted in collaboration with the Automobile Headlight Specifications Committee of the Illuminating Engineering Society. E. C. Crittenden of the Bureau of Standards is a member of this committee, and he was represented in most of the tests held by the Committee in New York by A. H. Taylor.



Some of the spark plugs tested by the Bureau of Standards

Motor Cultivators at Kansas City

Corn and Cotton Cultivation Problem Solved Along Two Different Lines—Light, High-Clearance Tractors for Use with Horse-Drawn Type Cultivators and Special Machines Fitted with Motor Drive

By P. M. Heldt

KANSAS CITY, MO., March 9—During the past year considerable attention has been given by implement and tractor manufacturers to the problem of a motor propelled or motor-drawn cultivator. It is generally realized that before the farmer can dispense with his horses he must be offered machines for doing all the different kinds of work for which he now uses horses. The ordinary tractor is unsuited for cultivating, as it is much too heavy, has too much power and not enough clearance. There are two possible directions in which a solution can be attempted, namely, by building specially light tractors with high clearance, to which cultivators similar to the horse-drawn implements can be hitched, or by building a cultivator to which an engine, transmission, final drive and steering gear can be applied.

Among the requirements made of motor cultivators is that they should have a considerable range of speed. This is necessary because when cultivating the corn the first time, when the plants are still very small, the machine must be driven at low speed, in order that none of the plants may be covered up with earth. A speed of about 1 m.p.h. is generally considered suitable for this operation. Motor cultivation requires only a moderate amount of power, and there is no doubt that by building a special cultivator to which an engine, transmission and final drive are attached the highest degree of operating economy can be secured.

Practically all the cultivators so far built are of the two-row type. The latter are always fitted with three wheels, two driving wheels of about 40-in. diameter and an additional central wheel, which may be either at the front or at the rear. This last-mentioned wheel of course runs midway between the two rows that are being cultivated. In using a machine of this type care is always taken to cultivate at the same time two rows which have been planted together, as the spacing of these rows is absolutely accurate. The cultivator gangs are guided by means of the feet, and all the operator has to do is to watch one row, as with the rows of corn uniformly spaced and the gangs of the cultivator set exactly the right distance apart, if the gangs are properly guided for one row they will also be guided properly for the other row.

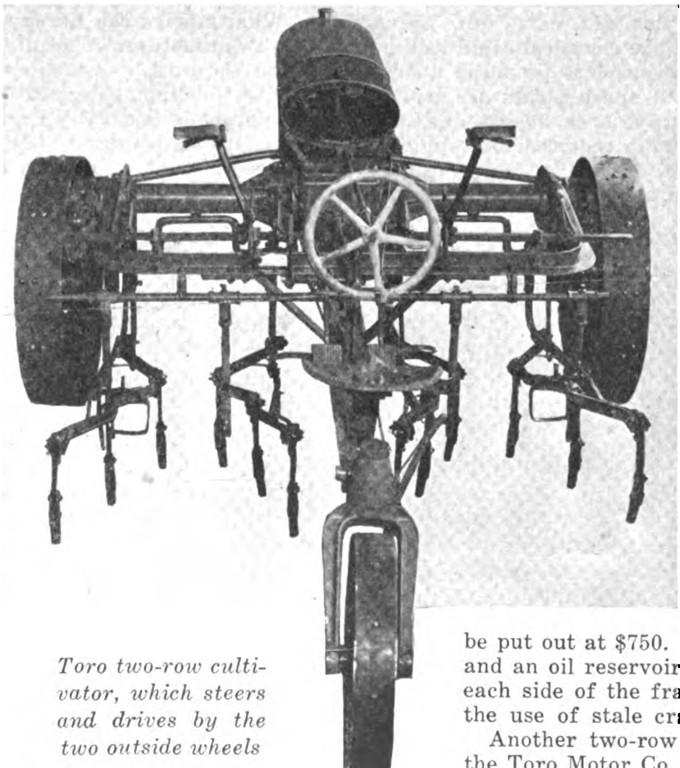
One of the first motor-propelled cultivators in the field was the Avery, manufactured by the Avery Co., Peoria, Ill. This is a 3-wheeled construction, with a single central steering wheel in front and two driving wheels at the rear. A structural-steel frame carries the engine, transmission and differential shaft, from which latter the drive is by bull gears to the driving wheels. The power plant is the same as that used on the 5-10 horsepower Avery tractor, comprising a four-cylinder block engine of 3 in. bore and 4 in. stroke, and a three-speed sliding gear transmission, giving a speed range of 1 to 3 m.p.h.

The machine is 84 in. wide over the driving wheels. The steering mechanism for the front wheel is controlled by means of a handwheel through a shaft extending along the top of the engine bonnet. It consists of a pair of bevel and a pair of spur gears. In addition to steering by the single front wheel, provisions are made for using the driving wheels for steering. A brake of the band type is located on each of the differential shafts, each brake being operated by means of a separate lever, and by applying the brake to one shaft (thus locking one of the driving wheels) and applying power to the other driving wheel, the cultivator can be made to turn around one of its driving wheels as a pivot.

Gasoline Recommended as Fuel

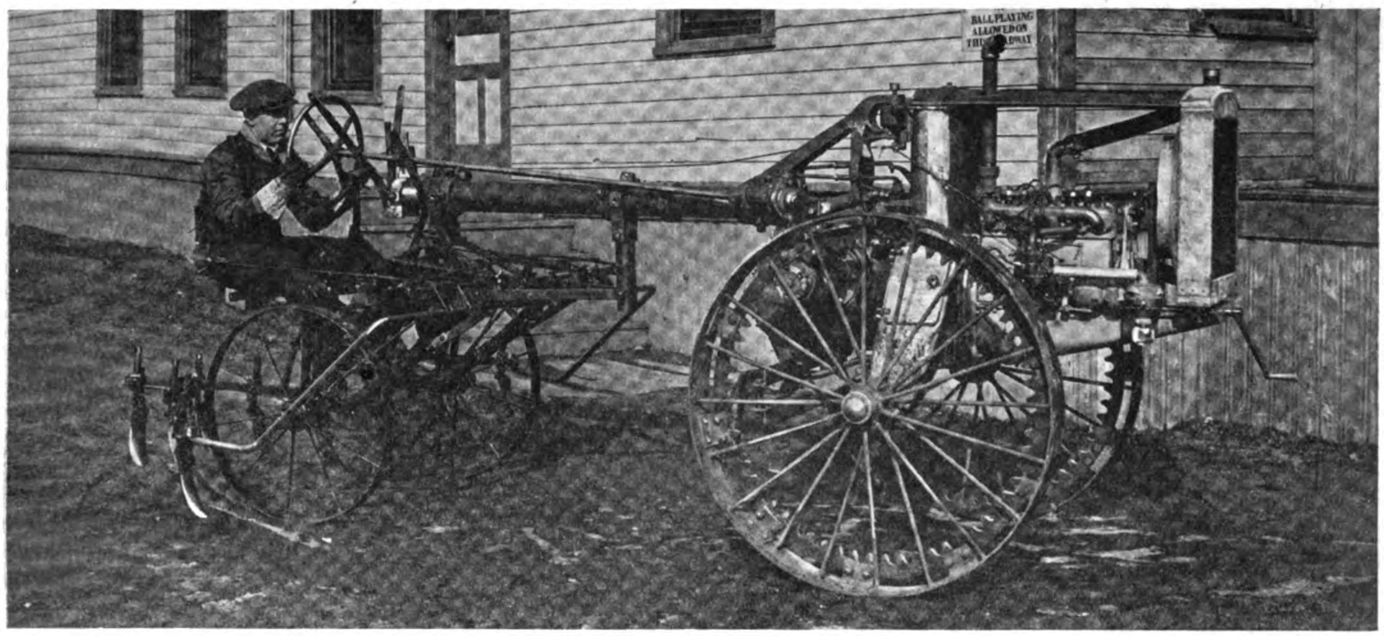
Gasoline is the fuel recommended, and a supply of 9 gal. can be carried in the tank on the engine. The driving wheels measure 42 by 6 in. and the steering wheel measures 28 by 5 in. The width between the center of drive wheels is 93 in., when built for 40-44 in. rows, but the machine is also furnished for special widths of rows. The clearance under the frame is 30 in.

This machine weighs 2800 lb. and is capable of taking care of 100 acres of crops in a season, which is said to be about twice as much as can be attended to with one team of horses. There is a seat for the operator on the bar extending back from the frame, the operator's feet resting on the lever for controlling the lateral motion of the cultivator gang. Directly in front of the operator are levers for applying the brakes to one or the other side of the differential, for changing gear, withdrawing the clutch and for lifting the cultivator gangs. With this cultivator the Avery company furnishes as extras a weeder attachment, a lister attachment, a check row attachment and a belt attachment. The price is $650 for the four-cylinder machine as described. A six-cylinder machine of the same cylinder dimensions will also be put out at $750. The bull gear drive is exposed, and an oil reservoir for lubricating it is located on each side of the frame. The company recommends the use of stale crankcase oil in these oilers.



Toro two-row cultivator, which steers and drives by the two outside wheels

Another two-row cultivator is manufactured by the Toro Motor Co., Minneapolis. This is equipped with a four-cylinder 3⅛ by 4½ in. engine, a dry-



Double-row cultivator attached to new Allis-Chalmers light tractor

disk clutch and a two-speed transmission of the heavy duty type. The cultivator is of three-wheel construction, the third wheel being located centrally at the rear. Steering is effected either by turning the driving wheel around the pivot support or applying a brake to one or the other of the differential shafts. The engine is fitted with a governor, and the gearing is such as to give theoretical speeds of 2 or 3 m.p.h., but owing to ground slippage the actual speeds are 1¾ and 2¾ m.p.h.

This machine has an overall width of 80 in. The cultivator gangs are controlled by one lever for each set, and there is also a lateral control by means of a pedal. Drive axle housings of 5 in. piping are secured to each side of the transmission housing, and to the ends of these 5 in. pipes are secured the steering heads. To the differential shaft housings is also secured an angle iron frame to which the different control members are attached. The front wheels measure 36 by 7 in. and the rear wheel measures 24 by 4 in. The drive to the front wheels is by means of an internal gear almost the full diameter of the drive wheel. A universal joint is inserted in each driving shaft, the center of which is in line with the steering pivot axis. While gasoline is to be used as the fuel at the start, it is the intention later to furnish kerosene burning equipment. The clearance is about 36 in.

Bailor's Two Types

Both a single row and a two row cultivator are exhibited by the Bailor Plow Mfg. Co., Atchison, Kan. The single-row cultivator is intended specially for cotton cultivation in the South. This is a four-wheel construction, the front wheels being mounted on a yoked axle to obtain the necessary clearance at the center of the machine. The cultivator is steered by swinging the front axle around its center support.

This machine is equipped with an 8 hp. Cushman two-cylinder, two-stroke engine, Kingston carbureter, Dixie magneto, air cleaner, Borg & Beck 10-in. clutch, a sliding gear transmission affording two forward and one reverse speeds, and chain drive to the rear wheels. The machine has an angle iron frame to which are secured the cranked rear axle and a bracket to which the cultivator gangs are attached. The cultivator is very much the same as made by Bailor for horse work. It can be equipped with either two or three shovel gangs. The weight of the machine is 1100 lb.

The two-row Bailor cultivator is fitted with a four-cylinder Leroi engine, Holley or Kingston carbureter, Borg & Beck 10-in. clutch, Dixie magneto, sliding gear transmission and chain drive from the differential shaft to a counter shaft and thence to the rear driving wheels. This machine is of the three-wheel type, having a single front wheel mounted in a caster yoke. Steering can be effected either by turning the single front wheel or by applying a brake to one or the other of the jackshafts. The frame is adjustable for different widths of rows. This machine weighs about 2000 lb. While each set of cultivator gangs can be lifted by a single lever there are two small levers adjacent to each of the aforementioned levers for controlling the relative height of each shoe.

Moline Universal

Among the lighter tractors designed to handle cultivators in addition to plows and other implements is the Moline Universal. The Moline Plow Co. manufactures a special two-row cultivator, which can be hitched to the draw-bar of this tractor. The seat is on the cultivator and the steering wheel, engine control handles, clutch and gear levers are within easy reach of the operator. A special feature of the Moline construction is that the operator does not sit in line with the center of the tractor but to one side in line with the right hand bull wheel. This gives him a clear view of the row directly ahead. This off-set hitch feature, as it is called, enables the driver to steer the tractor very closely, the design being such that the inside wheel of the tractor must be kept a certain distance from the outside row. For dodging individual hills the cultivator gangs are shifted by the operator's feet. Use is made of a so-called pendulum gang shift. The gangs are suspended at three points and are shifted by pedals. When the foot pressure is released the gangs automatically return to the center. When the corn is accurately planted and the tractor is driven straight, only very little shifting is required. Only one lever is used for raising the gangs, which are automatically leveled when raised regardless of their individual adjustment for depth. This adjustment for depth is made by a double acting hand screw. Strong springs are provided to assist in raising the gangs. The gangs are held to their work by pressure rods with compression springs. The gangs may be adjusted laterally for cultivating rows of from 40 to 46 in. The wheels of the cultivator are 40 in. in diameter with 4 in. concave tires and have dust-proof hubs and large hard oil compression grease cups.

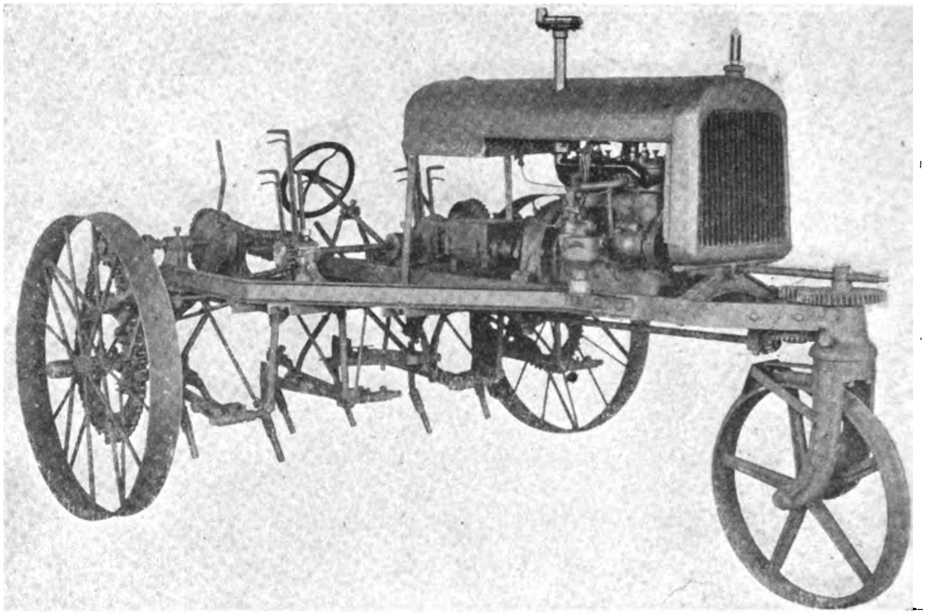
The Moline tractor weighs 3360 lb. and the cultivator 924 lb. The electric governor of the Moline, by means of which the engine speed can be varied within wide limits, is a specially valuable feature in corn cultivating. The governor adjustment is located immediately in front of the driver, and the operating speed can be instantly varied. For the first cultivation a speed of ½ to 1 m.p.h. is recommended; for the second, 2 to 2½ m.p.h., and for the third, 3 m.p.h.

The light tractor recently brought out by the Allis-Chalmers Co., Milwaukee, is also adapted for cultivator work. This

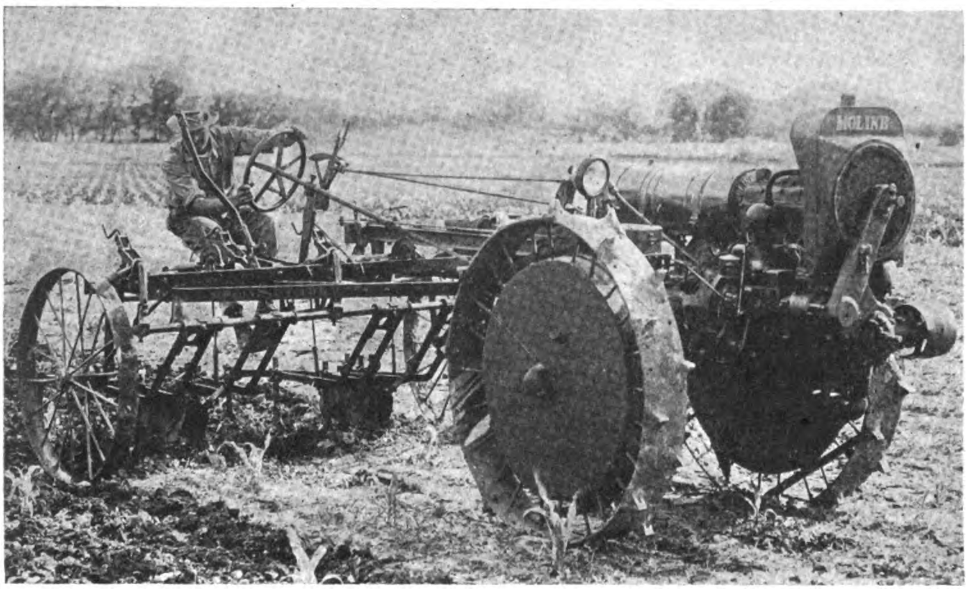
machine is rated at 6 hp. on the drawbar and weighs 1850 lb. It has a ground clearance of 28 in. and can be turned in a 16 in. circle.

Indiana Tractor

Another small two-wheeled tractor adapted for cultivator work is marketed by the Indiana Silo Co. of Anderson, Ind. It weighs 1700 lb. and is claimed to be capable of cultivating 20 acres a day with a two-row cultivator. The hitch of this tractor is so designed that almost any implement can be attached by means of two bolts which make a rigid hitch. Thus the tractor and the implement become a single unit, allowing the operator to control both, the same as he does with horses. This tractor is equipped with a four-cylinder engine of 3⅛-in. bore and 4½-in. stroke. Four different speeds may be obtained by changing driving sprockets. The final drive is by chains and steering is by rack and pinion. The usual change gear is omitted, and no change of speed, or, rather, of gear ratio, can be made from the seat. This, of course, helps to reduce the weight of the tractor.



Bailor two-row cultivator, steering both by the single front wheel and by the two rear wheels



The Moline is the only one of the larger tractors having sufficient clearance to permit of its use for cultivating

No Special Implement Needed

While it is recommended by the manufacturers of this tractor that the farmer should purchase a plow specially designed for it, most of the other stiff-tongued farm implements are available for use with the tractor. The clearance is the same as that of the standard corn cultivator and the claim is made by the manufacturers that less corn will be knocked down than with horses. Another point made is that frequent cultivation increases the growth and yield of corn and, as the tractor does the work in shorter time and therefore permits of this, it should lead to increased crops.

Dry Cell and Storage Battery Work of the Bureau of Standards

G. W. VINAL of the Bureau of Standards has been engaged in some work on dry cells and also has drawn up specifications for storage batteries for industrial trucks and tractors, the latter for the use of the Army. As a result of the work, a bulletin will shortly be issued by the Bureau of Standards which will contain a general discussion of the working principles of dry cells, enumerate the different types in use, give a list of standard sizes in which the cells are made and propose standard methods of tests. There are two ranges of sizes of dry cells, the small ones being used almost exclusively for pocket flashlights. Of the three larger sizes, the intermediate one, the 2½ by 6 in., is much used for ignition work. The two other large sizes are 1½ by 4 and 3½ by 8 in.

The forthcoming circular, No. 79, on dry cells will contain specifications for tests, including a continuous discharge test through a fixed resistance and an intermittent discharge test. It is of interest to know that although the use of dry cells for automobile ignition has been almost entirely abandoned, still 71,000,000 dry cells of the larger sizes were manufactured in 1914, and the production is said to have increased considerably since that time. The recent large increase in the price of dry cells is chiefly due to the scarcity of black oxide of manganese which is used as a depolarizer. Previous to the war this material was obtained from Russia, which source of supply has now been entirely cut off. At the present time we obtain our supplies of this chemical from South America, Japan and Cuba, and some is also mined in the United States.

The storage battery work done by this section has been entirely for departments of the Government and has been of a confidential nature, so that no results can be given out. This work has been in progress for more than a year. In 1914 the weight of storage battery plates produced in this country was 41,000,000 lb.

Tractor Problems That Are Awaiting Solution

Kansas City Show Suggests Need for Lighter Weights—Improvements in Transmissions—Better Dust Preventives—Parts Makers Are Important Factor

By David Beecroft

KANSAS CITY, MO., March 10—No greater deduction could be carried away from the tractor show here than that those national parts makers who have been such cornerstones in the automobile and truck industries are rapidly taking similar positions in the tractor industry and that the history of the tractor industry will be inseparably connected with them.

It was these makers in tens, fifties and hundreds at the show that gave it such an international significance. The products of these makers are known in the four corners of the world and no matter what kind of products they are they will help to merchandise such a product. There is great value in a reliable, well-known part in any vehicle.

So often is the story of improvements in a tractor largely the story of what these stalwarts in the manufacturing world have done in the past year. You ask in what way a tractor has been improved and the maker points with pride to an improved engine that has been purchased outside; or to anti-friction bearings in the wheels; or to an improved magneto with impulse starter; or to better and lighter wheels which have come from the parts maker; or he draws your attention to an improved radiator, an improved governor, an improved frame or an improved axle.

Parts Makers' Names Help Sales

The use of many of these parts which have been more or less standardized for international sale will make the export trade of tractors easier than it would otherwise be. If our tractors are fitted with anti-friction bearings which are interchangeable with French, British, Italian and German bearings then the maintenance of these tractors in foreign fields is correspondingly easier. It is going to be easier to sell a tractor in Australia that is so fitted. The same is true with regard to practically every other country. Such a design makes it easier for the dealer. He can secure stocks more easily. He has not so much money tied up in stocks of spares. He has a more fluid maintenance system.

Tractors must be furnished for nearly every nation. The American tractor maker has had a good export trade for several years. It dates from the huge traction engine types that got us into trouble in several countries because of the lack of competent repairmen to keep them operating. The maker must have foreign trade in view when designing his tractor.

It is putting the cart before the horse in export trade to design a tractor for home conditions and after it is completed think of selling it in the export field as well. Ninety per cent of the tractor may be suitable for foreign trade, but there may be some little parts that are going to be trouble makers. Have the foreign trade thought constantly in mind. The world will need tractors and if we do not do our part in furnishing them then we are leaving the field to some one else and in short asking those people to build up huge organizations while we let the markets slip through our fingers. We have some ships and we are going to have more and we must produce products for them to carry to all lands in order that we can be assured of getting from those lands what we need in raw materials for our industries and national life.

Foreign countries are taking up questions of tractor design in earnest. They will have their tractors for sale in the world's markets. They may set a standard of excellence that we will have to reach up to. They may establish the fact that the cheapest tractor is not always the lowest-priced one. The foreign maker's standards must be heeded.

The aim for lighter parts has taken hold in many factories. It has been demonstrated for 3 years that weight is not a first essential to tractive effort. Tractors have been in existence for some time in which the drawbar pull is in excess of the weight of the machine. With this a demonstrated fact it scarcely seems necessary to have tractors in which the weight is more than twice the drawbar pull. In such engine power is being used to transport a weight that could be eliminated.

Further chapters in weight reduction will be written when the use of stampings becomes more general. Some of the big pressed steel firms have not yet started making tractor stampings.

The use of stampings in creeper types has not even begun. It has been under consideration. There is a need for it and yet the work has been delayed. The heavy weight of the creeper tread is generally commented upon. Some makers admit a 50 per cent increase in weight of a creeper as compared with a wheeled type and yet the final step in creeper progress has not been started.

Problem of Power Application Difficult

The complete problem of engine power in relation to work to be done is not yet solved by all. Sometimes the power of the engine is not efficiently transmitted to the wheels. There are cases where the wheel diameter has not been carefully calculated with regard to engine power. Wheels are in some cases too large and in others too small in diameter. More engineering is needed.

There is yet a lack of uniformity and there may not be much uniformity for some years in power transmission. The problem is so much greater than in the automobile or truck due to greater gear reductions that there are bound to be differences of solution.

One maker uses the worm as a final reduction, whereas another uses the worm in his intermediate reductions where he can have a high worm speed. The same maker uses spur reductions in the final stages where speeds are low. The best place for the worm is a subject of discussion.

The use of very large transmission gears common a few years ago is fast disappearing. The cast gear of large diameter and great weight is being replaced by gears that are little larger than those used in trucks. There is much yet to be done. The making of gears must be carried to greater lengths in tractors than in cars and trucks. The development of a stout tooth for heavy tractor service has to be carried on. A few makers have for a three-plow tractor a gearset very little larger than in motor trucks. These gearsets are remarkable in comparison with the huge gears of other makers.

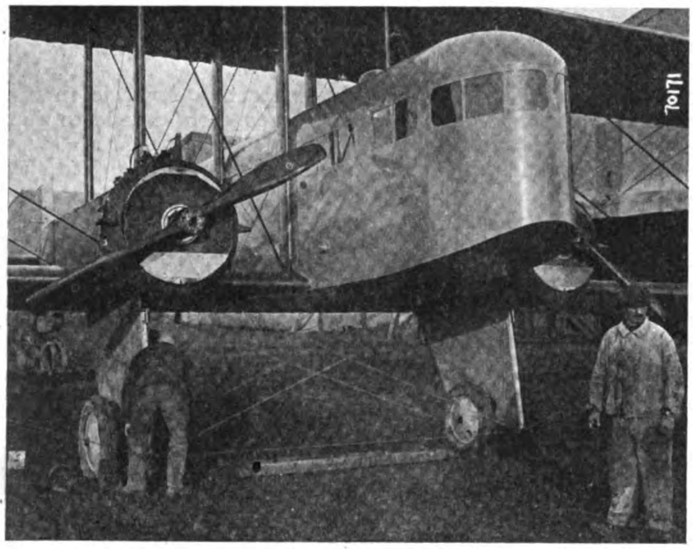
In some gearsets too many gear reductions or stepdowns are used. There are cases of five different stepdowns. This means too great a multiplication of gears. It means too heavy a gearbox. It means added bearing cost. What some do in five stepdowns others are doing in three and some in

(*Continued on page* 601)

Ambitious Flights Planned Abroad

Caudron and Farman Rivals in London-Paris Flights—Vedrines Planning World-Round Flight —Farman Bomber for Daily London Route

By W. F. Bradley
AUTOMOTIVE INDUSTRIES' *European Correspondent*



Closed cabin and one of the Salmson 9-cylinder star engines used on Farman passenger-carrying airplane

PARIS, Feb. 15—Two French firms, Caudron and Farman, are anxious to establish a regular aerial service between Paris and London. The machines are ready and have undergone their trial flights very satisfactorily, but neither can leave owing to the refusal of the British Government to give permits for civilian passengers to be carried; in consequence, the Farman machine will probably leave in a few days with a military pilot and military passengers. This, however, does not satisfy Henri Farman, whose desire is to establish a regular aerial route between Paris and London.

The Farman machine was originally designed as a big bomber; it has a wing spread of 92 ft. and a total area of 1775 sq. ft. It is equipped with two Salmson Star engines having a total power of 540 hp.; it carries a useful load of 6600 lb. and has a total weight of 11,000 lb.

Its horizontal speed is practically 100 m.p.h. and its landing speed only 37 m.p.h. It will climb to 1600 ft. in 4 min., 3200 ft. in 10 min. 30 sec., 5000 ft. in 17 min., and 6500 ft. in 25 min. The gasoline and oil consumption of the two engines is 104 lb. per hour. As the distance of 200 miles which separates Paris from London can be covered in practically two hours, the weight of fuel and oil consumption on the trip will be about 210 lb. for each journey.

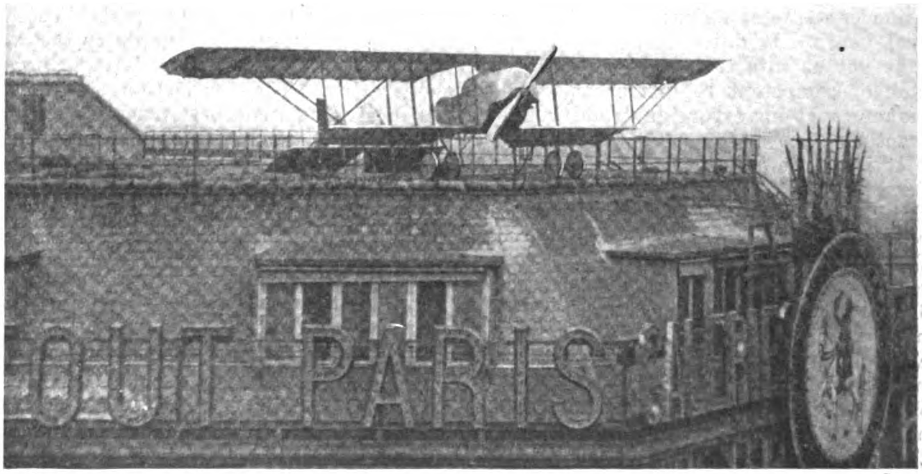
Making allowance for the weight of wireless apparatus and other internal fittings, the machine has a capacity for 30 passengers. Farman has fixed the cost of the round trip by air at $80. It is intended to make the journey from Paris to London via Lille and Boulogne-sur-Mer. A stop would be made at these two intermediate towns whenever necessary, but, of course, no stop will be made when passengers have been booked right through.

The second machine which is waiting to start the Paris-London service is a Caudron biplane type 23. This machine has a useful load capacity of 2600 lb.; thus it will carry 12 passengers on its trip from Paris to London.

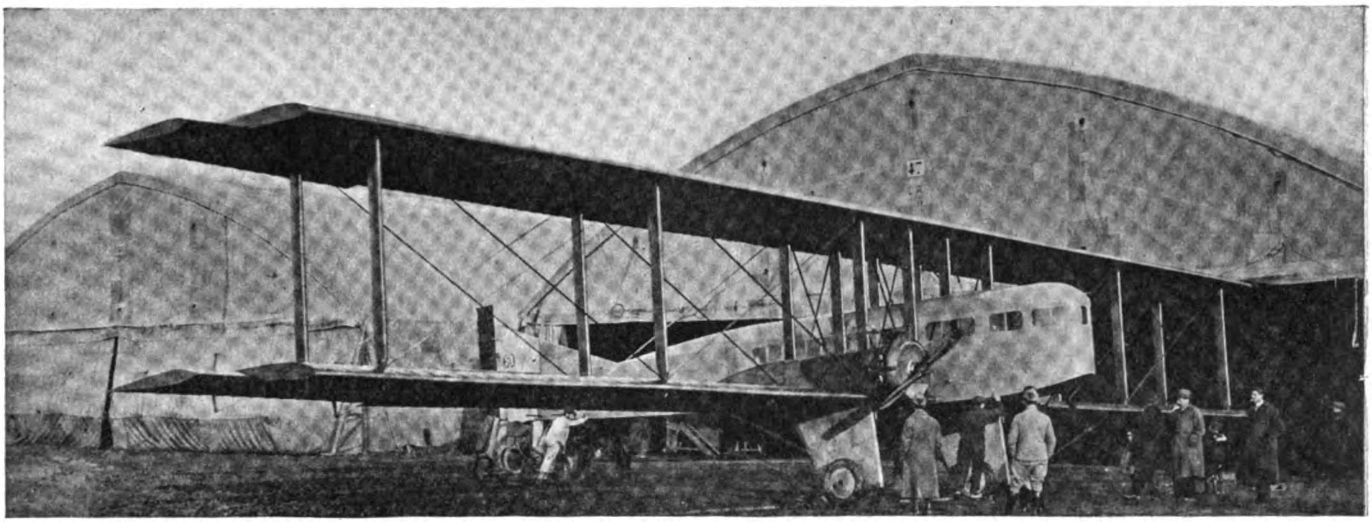
Verdrines' Exploit Nets Him $15,000

The machine with which Jules Vedrines landed on the roof of the La Fayette dry goods store last Sunday is a Caudron biplane type G3, equipped with a Gnome rotary engine. The available landing space was only 66 ft. long by 23 ft. wide. A considerable time before the war the owners of this building offered a prize of $5,000 to any aviator who would land on the roof and get away again. This offer was looked upon as a little cheap publicity, for it was never imagined that any attempt would be made to win the prize. For several days before making the attempt Vedrines had practised landing within a circle having a radius of 65 ft., and had been able to accomplish this successfully every time. The machine, which is a tractor type, is exceedingly flexible, planes well, and lands easily; it has been made use of during the war for training air pilots. Vedrines made his successful landing on this roof on Sunday morning, in the presence of very few people. By this exploit he has gained $15,000, for in addition to the $5,000 offered he had taken bets to three times this amount.

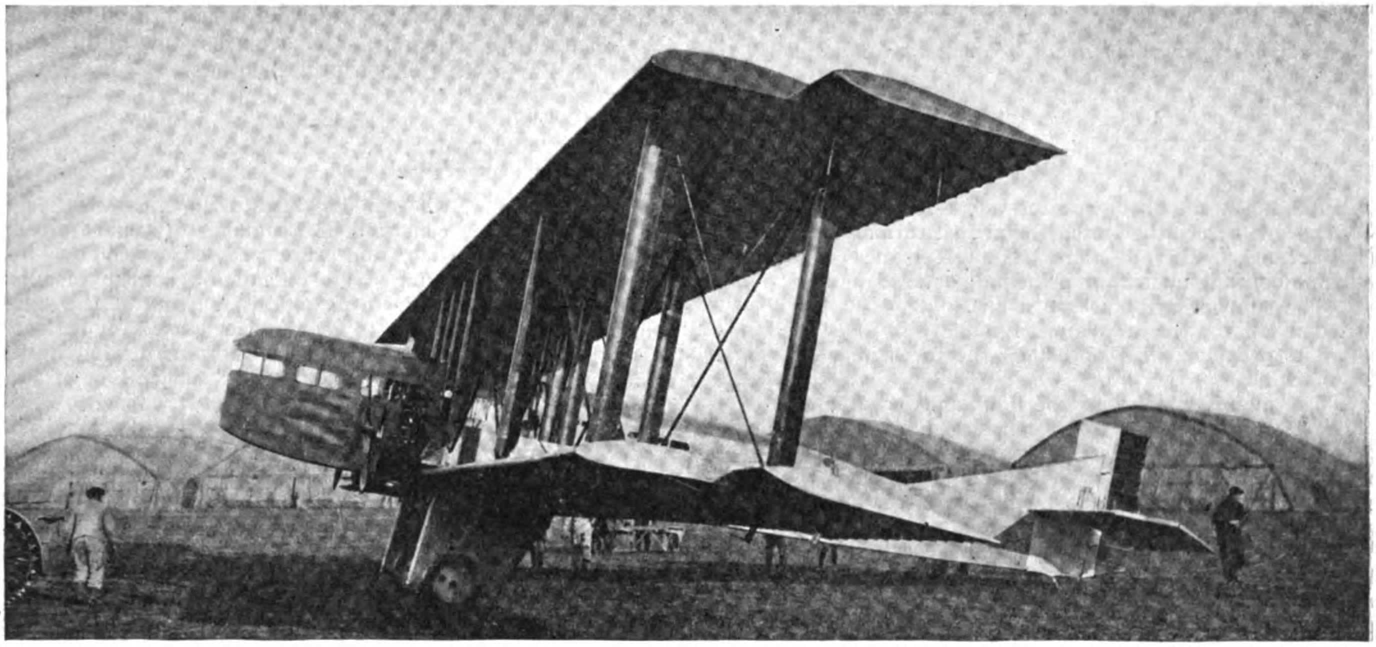
During the war Vedrines has been employed almost



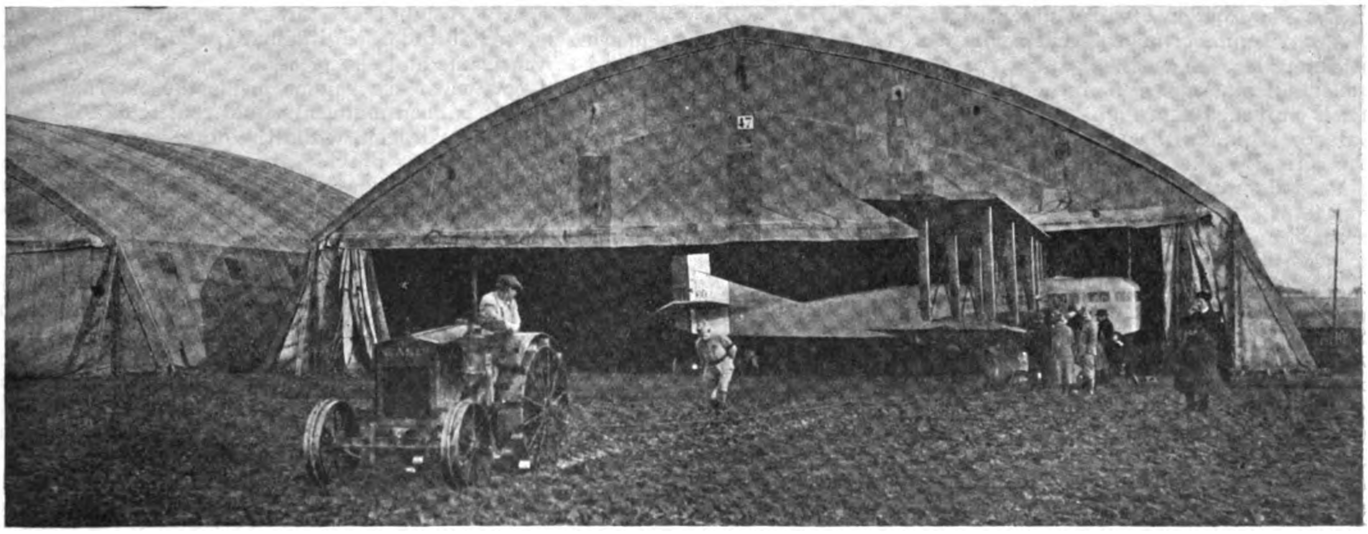
Vedrines' biplane on the roof of the La Fayette dry goods store



Farman biplane built to undertake regular passenger service between Paris and London



Big Farman biplane which will undertake a regular service between Paris and London with 20 passengers aboard



Farman biplane being hauled out of its shed by a Case agricultural tractor

First passenger going aboard Farman's Goliath, built for Paris-London service

exclusively on the difficult task of landing secret service agents in Belgium and on German territory, then calling for these men some days later at an appointed place. During his civilian and military career, Vedrines estimates that he had flown 310,000 miles. It is the intention of Vedrines, at an early date, to make a non-stop flight from Paris to Rome and return in 24 hr. For this trip he would make use of Caudron biplane type C-23, a start being made from Paris at night time under a full moon.

Will Fly Around World

Later, Vedrines declares that he will make a flight around the world. Starting from Paris, he would fly over Spain, into Africa and Madagascar; from there he would proceed to Asia by way of Persia, British India, and then to Siam, China, and Japan. He states that he will fly to America via Behring Straits. He would fly right down the Pacific coast line from North America to South America; he will visit Brazil, Guiana, Venezuela; then to St. Louis, Washington and New York; from the United States he intends to fly into Canada and Newfoundland, and from there he would make a trip across the Atlantic to Ireland. He declares that he would return to Paris via London and Brussels.

Development of Air Traffic

A PAPER on the above subject was read recently by A. P. Kapteyn before the Dutch Royal Institution of Engineers. The author points out that the performance of a flying machine depends upon four principal factors:

1. The supporting planes or wings.
2. The car for the crew and engine.
3. The propeller which produces the forward movement of the machine.
4. The motor, which must be light and powerful.

The two chief points to be considered in connection with the design of the wings are lifting power and resistance to passage through the air. The former determines the carrying capacity of the machine, while the latter has an important bearing on the motive power required.

A large number of experiments have been carried out by Mr. Eiffel and other investigators, in which models of wings were placed in a large tube through which air is propelled at a high velocity.

The lecturer is of opinion that the soaring of birds, which apparently takes place without any expenditure of force, depends on some natural phenomenon at present unknown, which, if discovered, would lead to important developments in the construction of airplanes.

A large number of experiments have also been carried out to determine the most advantageous shape of car and propeller. A stationary car model is placed in a tube by which air is propelled at a high velocity, while a special measuring balance registers the resistance they offer to the passage of the air.

Propellers driven by electric motors are similarly tested in quiescent air. These experiments are carried out under ordinary atmospheric pressures as well as in rarefied air, so as to ascertain the decreased resistance in the upper layers of the atmosphere.

The Dutch Government has decided to build a similar laboratory in Amsterdam so that the Dutch manufacturers may have all the necessary information on this important subject at first hand.

The lecturer describes the ordinary maneuvers possible with spherical balloons, the decrease in lifting power in the upper layers of the atmosphere and the usual means for regulating the altitude of flight, such as allowing gas to escape, throwing out ballast or pumping air into the balloon. He next describes the dirigible airship, and shows that the first airships made by Giffard, Hänlein and others were only about 165 ft. long, whereas the latest Zeppelins were over 400 ft. long. They consisted of a number of separate cells in an aluminum frame, and were provided with 1500-hp. engines capable of flying 55 to 62 miles per hour in quiet weather, but were unable to fly against a wind of the same velocity. It is not possible to get the fabric used for balloons quite hydrogen gas-tight, as even the best material permits 0.039 to 0.056 cu. ft. of gas to escape per square foot of surface per 24 hr. A Zeppelin of 1,800,000 cu. ft. capacity would therefore lose some 27,000 cu. ft. of gas per 24 hr. The escaped hydrogen gas is retained in the outer envelope, where it mixes with air and forms an explosive gas that has caused a number of accidents. This, together with the great weight of the aluminum framework, limits their sphere of action. If the danger of explosions could be eliminated and the weight of the frame reduced, a really useful airship might be built.

Mr. Boerner proposes to build dirigible airships of great size and recommends a length of 700 to 1000 ft., the frame to consist of three deep aluminum girders with short pointed pieces. The cabins, motors and propellers would be suspended between the girders. The cells containing hydrogen would be nearly rectangular, three being jointed together transversely, and 20 to 30 longitudinally, and all to be firmly secured to the frame and end pieces.

One-third portion of the volume inside the external cover which is to be of balloon material would consist of cells completely filled with hydrogen, while the other spaces could be partly filled in order to provide expansion for the external pressure varying according to altitude. To prevent explosions, the space between the cells and the outer cover is filled with hydrogen.

The ship would be driven by thirty-four 200-hp. motors arranged in two rows, each motor to drive its own propeller, adjustable for driving in any required direction, viz., upward, downward, forward or backward. The ship can thus be completely controlled by the engines. It is proposed to balance the ship automatically both longitudinally and transversely by pumping gas from one end to the other.

The author suggests that the airship should, on arrival at its destination, "land" in water and that passengers should step out on a pier as from a steamer. Re-starting from the water should be effected by the motors for vertical movement. He does not anticipate any difficulties either in building or maneuvering such an airship.

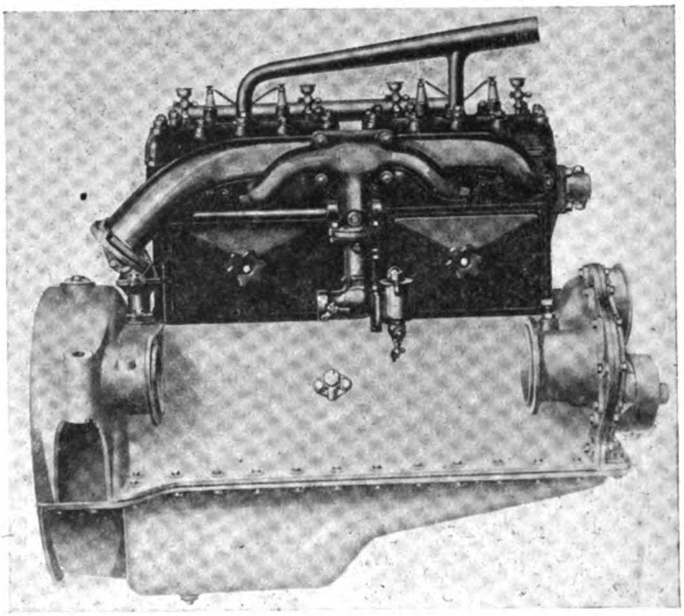
Three Hinkley Engines Built Around Class "B" Design

Models Suitable for 4 to 6-Ton. 3 to 4-Ton, 1½ to 2½-Ton Trucks and Tractors Drawing 1 to 4 Plows

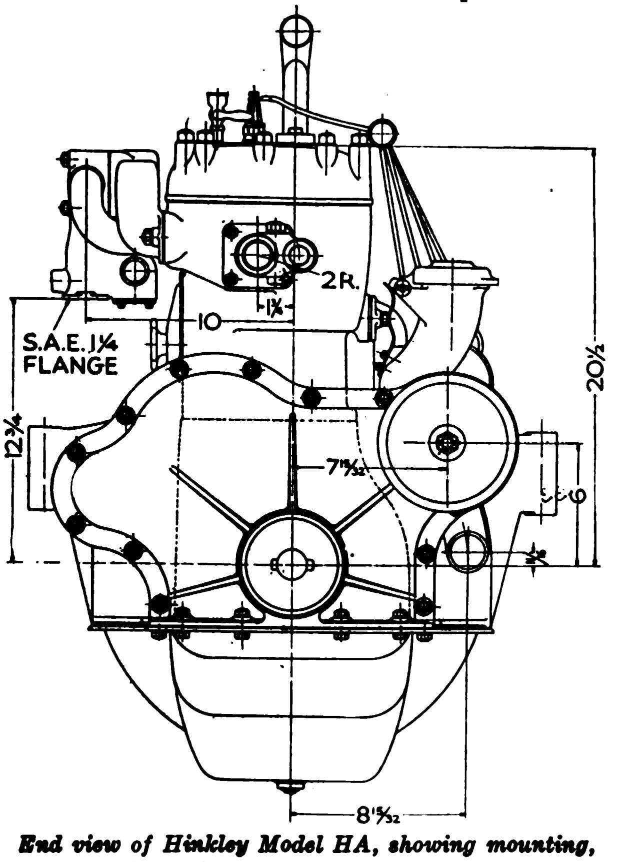
THE Hinkley Motors Corp., Detroit, is now entering commercial production with a line of truck and tractor engines, built around the standards of design and workmanship utilized in the manufacture of the Class B Government engine. Having, through its experience with the military truck engine, reached the conclusion that this design represents the best in construction for heavy-duty automotive purposes, the Hinkley corporation will manufacture this same type of engine under the name Hinkley-Class B. In addition, the models HA and HAA are built along the same lines and show the same characteristics with reference to appearance and performance.

This gives a line of three engines, all of similar characteristics, rated at 55 hp. at 1400 r.p.m. for the Hinkley-Class B, 45 hp. at 1500 r.p.m. for the HA, and 35 hp. at 2000 r.p.m. for the HAA. These engines are respectively suitable for 4 to 6-ton, 3 to 4-ton, and 1½ to 2½-ton commercial vehicles, or 4-plow, 2 to 3-plow, and 1 to 2-plow farm tractors.

In following the high standards of design and workmanship laid down by government specifications on the Class B military engine the Hinkley corporation has taken a step which has been predicted as a result of the war experiences. In designing this engine for the Government, the matter of price did not enter as a primary consideration, but the performance and life were made the prime factors. It is around the idea that the motor truck business in this country would demand the same qualities for the commercial product that the Government has demanded for the war product that the Hinkley Motors Corp. has shaped its policy in producing this line of engines.



Right-side view of Hinkley Model HAA



End view of Hinkley Model HA, showing mounting, dimensions and timing gear case

The Class B military engine has been described frequently and is familiar to truck engineers. The Hinkley-Class B is similar in practically all respects to the Government design, the only changes being in manufacturing detail. The Class B is 4¾ by 6 in. with cylinders block cast. The turning effort of the engine is 3000 in. lb. at 1000 r.p.m. and the weight is 1040 lb., less carbureter and magneto. In all essential details the military design is carried out.

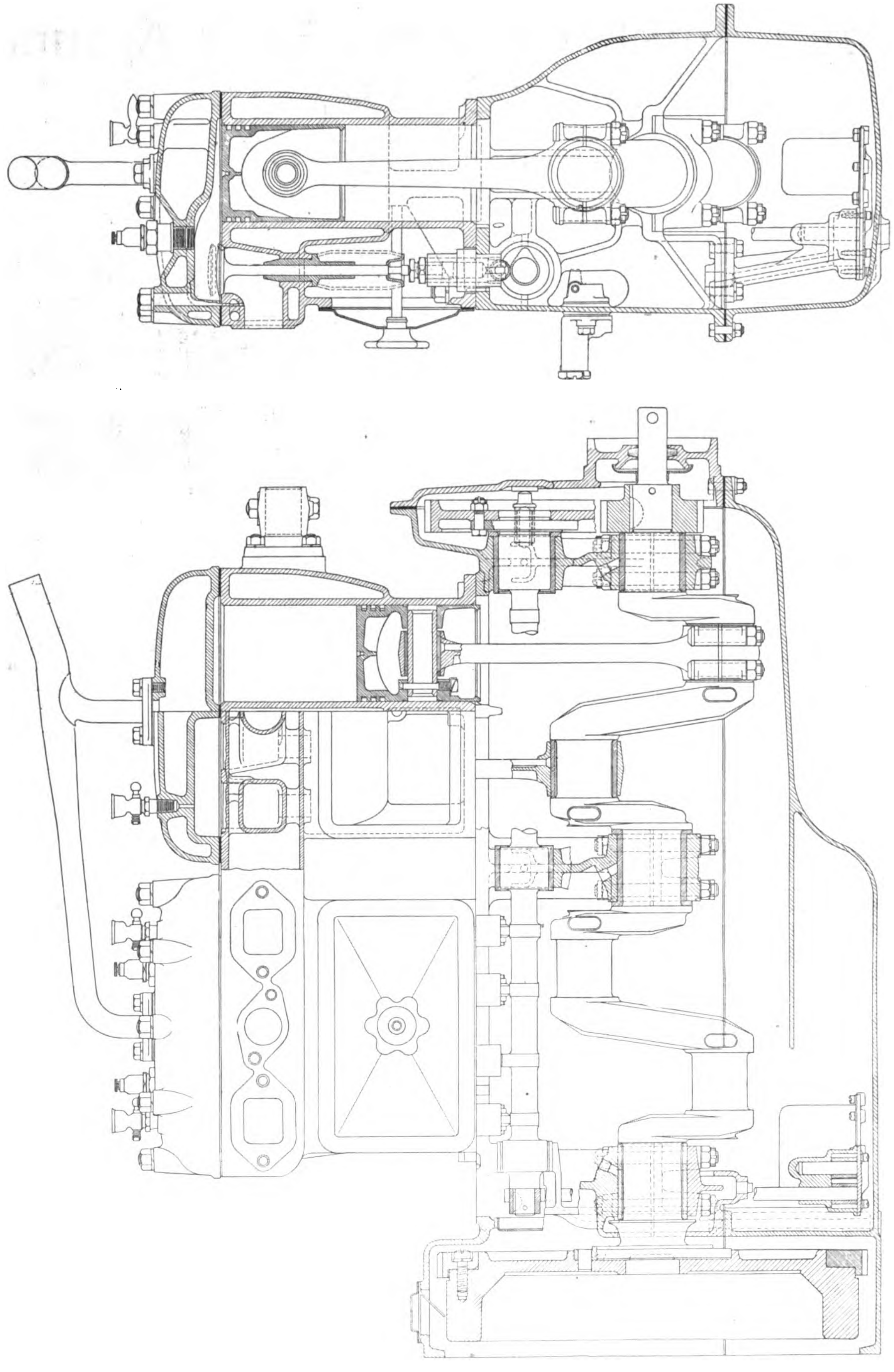
The Model HA is 4½ by 5½ in. and is otherwise identical, with the same rigid inspection safeguards as its predecessor, the Class B. The Model HAA is 3¾ by 5¼ in. and is also adapted for 4-in. bore cylinders, for the purpose of utilizing it in connection with maximum 2½-ton truck sizes, enabling truck manufacturers to standardize on one engine that will take care of trucks ranging from 1½ to 2½ tons.

The general description and specifications of these three engines are similar. The block cylinder castings have two detachable heads and are mounted on a cast-iron crankcase with a removable pressed-steel pan. The cylinders are L-head, all the valves being enclosed. All the engines have three-point suspension, the rear mountings being on the flywheel housing and the front mounting is a large-sized trunnion on the gearcase cover.

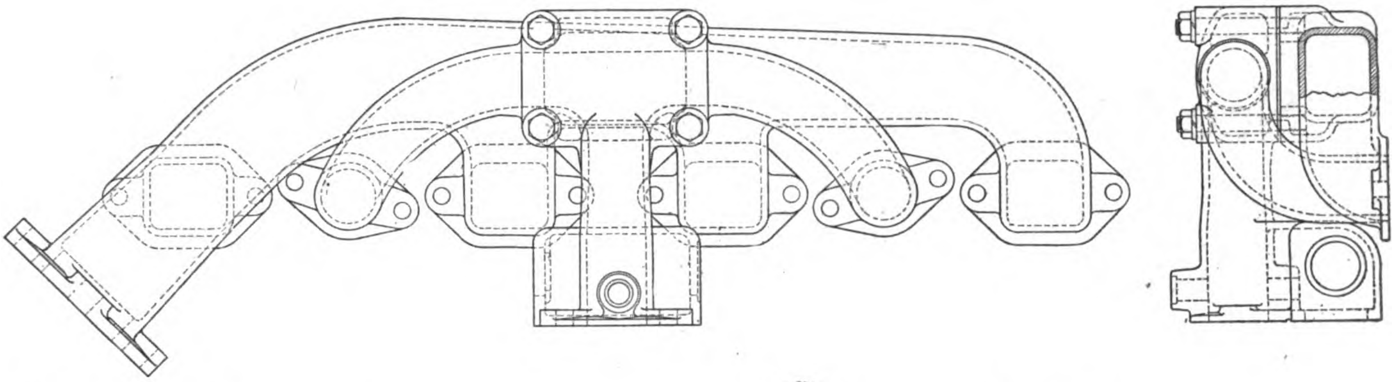
The piston displacements for the Model HA is 350 cu. in., and on the HAA, 232 cu. in. for the 3¾-in. bore and 264 cu. in. for the 4-in. bore. The valve diameters are 2 in. on the HA and 1¾ in. on the HAA. All the engines have the valves on the right side, with the manifolds on the same side as the valves. The general characteristics of the engine are such that they all show better than 0.6 lb. of gasoline per brake horsepower hour under maximum load conditions.

One of the characteristics of the Class B engine was its heavy crankshaft, and this same feature will be followed in the smaller models. On the Model HA the crankshaft is 2⅝

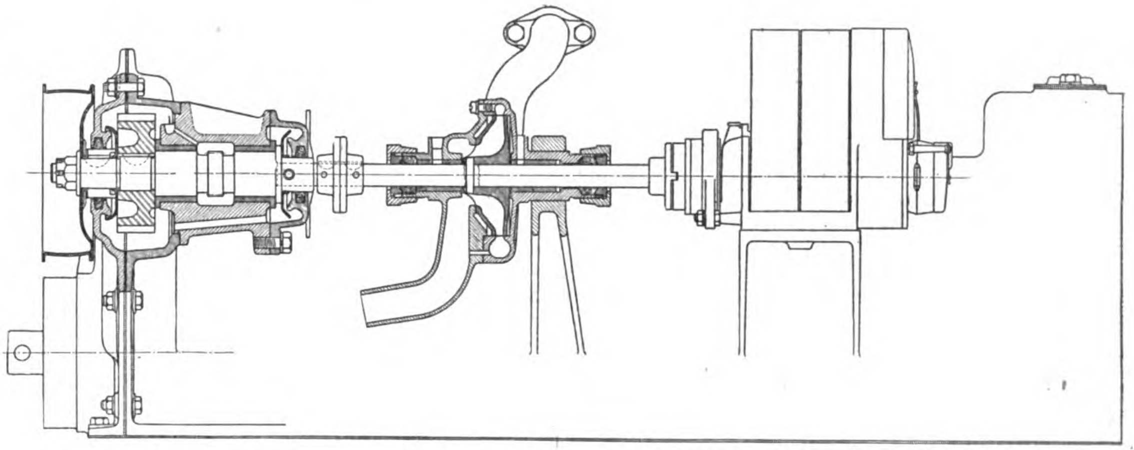
New Hinkley Engine for Truck and Tractor



This engine is built around the standards of design of the Class B government type and is especially adapted for heavy-duty purposes



Exhaust and carbureter manifold assembly on new Hinkley engines

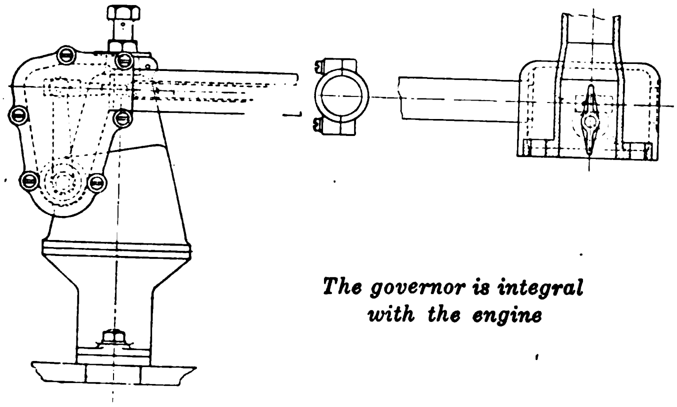


Water pump and magneto drive of Hinkley engine

in. in diameter at the main bearings and 2¼ in. in diameter at the connecting-rod bearings. The lengths of the main bearings on this model are: Front, 2⅛ in.; center, 3⅛ in.; rear, 3½ in. On the HAA engine the crankshaft is 2¼ in. in diameter at the main bearings and 2⅛ in. in diameter at the connecting-rod bearings. The main bearing lengths are: Front, 2¼ in.; center, 3 in.; rear, 3 in.

The camshafts are carried on three large collar bearings through which the camshaft may be withdrawn, leaving the bearings integral with the case. The cams are designed for the roller type of lifter and these are made of large size, as shown in the sectional illustration, to withstand wear. The large valve stems and heavy spring characteristics of the Class B military engine are followed on these two smaller models, and the same locking systems on the valve stems are utilized.

The connecting-rods on the Model HA are 12 in. in length; on the HAA they are 11½ in. long, and all are of the four-bolt construction, having alloy steel bolts to hold the caps in place. The rod is designed with the web in the center, and the upper rod bearings on the small engine are 1⅛ in. in diameter by 1¾ in. long, and on the larger engine 1¼ in. in diameter and 1⅞ in. long. Both engines are equipped



The governor is integral with the engine

with five-gear trains in front and have the camshaft gear bolted to the camshaft flange with four alloy steel bolts. The idler gear runs in a double, babbitt-lined bronze shell bearing. Provision is made on the engine for lighting generator and starting motor, the make being optional.

Pump water circulation is used, a centrifugal pump with one connection to the cylinder being employed. The water outlet header has two connections of tubular construction, to secure the proper water distribution to each cylinder group. To assist in vaporizing the fuel the engines have the hot-spot manifold design, assisting in completing vaporization and helping to minimize crankcase dilution. Another feature of the construction is the surplus of metal around the head bolts, preventing possibility of unequal pressure on the head gasket when tightening the bolts.

A full force-feed lubricating system is employed with the oil pump submerged in the oil pan, the latter being integral with the crankcase so that the crankcase can be dropped without disturbing the pump. The oiling system is so arranged that the lubricant feeds through a complete copper tubing system, clipped to the inside of the crankcase and carrying the maximum oil pressure to all the needed points. To maintain constant pressure, there is an automatic regulating relief valve. The oil gage is on the side of the crankcase and is of the conventional bayonet blade type.

Throughout the construction, sections are generous wherever there is any unusual stress. This is particularly noticeable in the pistons, which are extra heavy in section to enable the heat to be rapidly carried to the jacket wall with the greatest amount of speed to insure cool heads. Another provision for safety is in the extra large anchorage plate on the front of the cylinder block to take care of any standard make of fan. The plate is bolted to a square pad on the cylinder block in such a way that there is more than enough metal to prevent the breaking of water jackets.

There has been no departure from conservative practice throughout the engine, but, as in the case of the Class B military truck engine, the best-known principles of design have been employed without any shaving of specifications to cut production costs. The Hinkley Motors Corp. is in a position to deliver immediately the military Class B truck engine type, and within a short time will be in a similar position on the HA and HAA models.

See Great Future for Lighter-Than-Air Machines

Their Use Soon for Aerial Traffic Discussed by Engineers at S. A. E. Aeronautical Session—Planes Should Land in and Leave Small Spaces

OF all speculations as to the future of aerial traffic nothing seems as certain as that lighter-than-air craft of very large size will be tried out as long distance passenger carriers within a short time. That airplanes of anything near the load capacity of these ships will be built in the near future seems extremely unlikely.

These views, held by many whose opinion is entitled to respect, were emphasized again in two interesting papers read at the S. A. E. meeting in New York March 5. C. H. Day, of the Standard Aircraft Co., discussed the future of the airplane, pointing out constructional changes which would be necessary to adapt the war-developed plane for commercial usage, and Ladislas d'Orcy in a following paper gave much information as to recent performance of airships, showing how their development in war has been little less than that of airplanes.

Day anticipates a very important change in airplane construction which will permit the motor power to be used in a variable direction so that lift can be obtained at a lower speed than that at which the machine will fly when the whole power of the propeller is applied horizontally, or nearly so.

He considers that the practical use of an airplane and its safety depend in large measure upon ability to alight upon, or to rise from, a small area. At the present time 45 m.p.h. is about the minimum landing speed of a fairly fast plane; it might be possible to devise braking systems which would permit a machine to be pulled up quickly after landing, but such would be of no assistance in getting off the ground, and there is not much point in enabling a machine to land in a smaller space than it can get off from.

Vary Application of Power

To vary the direction of application of power Day suggests two possibilities, one the use of a propeller which can be inclined variably to the center line of the plane, the other variable wing surfaces which could be changed at will either as to area or inclination.

He points out that these are mechanical problems which should not be impossible to overcome, and that short distance flying, especially near cities, will only be fully practical when the plane can land on a city lot or even on a roof. For mail service especially the necessity for landing and transferring the load a good many miles from its ultimate destination is a serious handicap.

Day considers it unlikely that practical airplanes with a capacity for more than twelve passengers are to be expected till the art is much further advanced, but he has a strong belief in the small machine once the landing difficulty is overcome.

He voiced an opinion shared by many engineers, namely, that to make flying commercial the machine as a whole, and especially the engine, would have to be less delicate. He suggested that the air-cooled engine, so far, had always been developed with an extreme of lightness, so that it would be much lighter than a water-cooled engine of corresponding power, and that it therefore seemed likely that much could be done with air cooling. An air-cooled engine weighing the same for its power as a water-cooled motor, plus its water, ought to be, he said, much stronger and more durable, while also being cheaper to manufacture.

Day also believes in the evolution of twin-engined planes, even for small sizes. For one thing a plane with twin engines can be manœuvered on the ground by the pilot without the help of a gang of men to set it facing the right way. Also it is safer, if so proportioned, that it can just fly with one motor alone.

He suggests that twin motors of as low a power as 60 hp. would be valuable for single-seated "sportsman" types. For large machines he considers twin motors advisable because of their safety and also because of two motors arranged in nacelles the fuselage can be much better arranged for passengers and also protected from much noise and all thrown oil.

The following quotations from the paper cover these leading ideas of the authors:

"The commercial airplane of the future will be used for sport and the carrying of mail, passengers and express. All of these things are now being accomplished successfully but in a limited manner, and to what extent the field of usefulness will be increased depends largely upon the ability of engineers to develop machines better suited to this purpose than those that at present exist.

Factors to Be Considered

"Of paramount importance are the questions of safety, low initial cost, low cost of upkeep and low cost per ton-mile. A great deal of attention has been given to devices to increase the stability of the airplane with an idea that this will greatly increase its safety. I do not believe that the development of such devices will greatly enhance the future of the airplane. The ease with which pilots have learned to fly existing training machines would certainly indicate that the stability of these airplanes is sufficient for present needs, and investigation will show that the majority of accidents have been due to either collisions in the air or bad landings, and not through any inability of the pilot to control the actions of the machine. The stability of these machines can be increased to almost any extent desired at very little sacrifice of efficiency. In fact, it is perfectly feasible for any aeronautical engineer to design a machine of any type with the surfaces proportioned and arranged so that the machine will be self-righting under all conditions; will not tail-spin unless forced into it, and will come out of a tail spin of its own accord. By fixing the rudder on such a machine, it will fly almost indefinitely with all controls released and in case of motor stoppage will assume a natural gliding angle and maintain that gliding angle until it reaches the ground. I might add that there are absolutely no mysteries connected with the design of a machine to accomplish these results, and while riding as a passenger in such a machine two years ago I personally saw all of these.

Must Land in Small Space

"To my mind, the most important development for the future will be that which will enable airplanes to land in extremely small fields, or literally, in a man's back yard, and this must be obtained at not too great a sacrifice of high speed. At the present time the load carried on an airplane which has sufficient reserve power for safe flying is about 20 lb. per hp., and a speed range of from 45 to 90 miles per hr. is now obtainable with this loading. It would, therefore, seem that the future airplane should be able to maintain a high speed of 90 miles per hr., speed being one of the main advantages of the airplane over other means of travel.

"Among the possible means for reducing landing speed without sacrificing the high speed is the development of more efficient airfoils, devices for increasing the camber of the airfoil in landing, increasing the surface of the main planes, and possibly the development of an angular propeller thrust or auxiliary propeller to reduce the load per square foot of surface. Landing gears having greater shock-absorbing qualities to allow of stalling into a field from a greater height than is now possible would also help greatly. Airfoils having a high lift at high angles with low resistance at low angles, and which still maintain a good lift-drift ratio at normal angles, greatly reduce landing speeds and usually allow of maximum climb at low speeds. It is very probable that the efficiency of the airfoil will be increased to such an extent that any increase of camber would be of little benefit.

"With relation to the use of angular propeller thrust or auxiliary propellers, it should be noted that with machines carrying 20 lb. per hp. not more than 50 per cent of the power is necessary for sustained flying at very nearly the airplane's lowest speed. It certainly would be highly advantageous if the 50 per cent excess horsepower available at this point could be utilized as a vertical component to reduce the loading per square foot and thus reduce the landing speed.

Cost Is Next to Safety

"Of next importance to safety is cost. There is no doubt in my mind that the future airplane can be greatly simplified and thus greatly reduced in initial cost, and at the same time be made sufficiently durable so that the cost of upkeep will be a little more than that of an automobile. Most airplanes at the present time, whether they are manufactured in small or large quantities, are practically a hand-made product, and this must be eliminated in the future. The concentration of efforts toward enormous climbs and speeds for military purposes has resulted in extremely complex structure, delicate workmanship and expensive materials. However, the military airplane has developed many new materials which will, in the future, result in not only more efficient machines but great reduction of initial cost. The use of waterproof veneer is of utmost importance and if judiciously employed will do away with fully 50 per cent of the number of small and intricate parts. In the past little attention has been given to the interchangeability of parts, it having been the custom to design each part for the particular purpose for which it was desired without regard to its use for different purposes. Proper attention given to this matter would go far toward eliminating the manufacture of airplanes by hand and would reduce both the initial cost and the cost of upkeep.

"One of the airplanes now doing very successful work which has a range of 540 miles at 90 miles per hr. and carrying a load in addition to pilot and passenger of 2000 lb., costs 20 cents per ton-mile for fuel. Reducing this range to 270 miles and utilizing the reduction of the necessary fuel for the carrying of additional load, brings the cost of fuel to 13 cents per ton-mile. It will, therefore, be seen that proximity of landing fields has much to do with the reduction in cost of the operation of an airplane.

Upkeep an Important Item

"Durability has been of very little importance, but for commercial purposes the upkeep becomes an enormous item of cost. This is true not only of the airplane itself but also of the engine propelling it. Both the initial cost and the cost of upkeep are about equally divided between the engine and the airplane, and this engine cost must be greatly reduced. In the most efficient weight-carrying airplanes of to-day with a loading of 20 lb. per hp. the structural weight of the airplane itself is about 30 per cent of the weight of the machine fully loaded, and the weight of the engine is about 20 per cent of the total weight, leaving 50 per cent for fuel and useful load. For a range of 600 miles, the weight of the fuel is about 20 per cent, leaving about 30 per cent for useful load. Improvements in the airplane structure will greatly reduce the percentage of structural weight and will allow the use of heavier engines with corresponding reduction of cost. However, it is very doubtful if the trend of engine design will be in this direction, as efforts will be concentrated toward the increase of the percentage of useful load carried.

"As to the particular type of airplane to be used for commercial purposes, the tractor would seem to be most advantageous. Inasmuch as safety is of the greatest importance and most wrecks occur in landing, the pilot and passenger should be located well to the rear of center of gravity, so that the heavier parts of the machine, such as engines, etc., may reach the ground first, as they are much more capable of absorbing the shock than is a human being. The two classes of accidents which are most common to the airplane are wrecks due to bad landings and nose dives resulting from engine stoppage in climbing out of a field when the altitude is not sufficient for the machine to recover.

Multi-Engined Machines Safer

"It would also appear that multi-engined machines will not only add to the safety of the machine but also reduce the cost per ton-mile and by decreasing the liability of breakage thus reduce the cost of upkeep. You will probably assume that the use of multi-engines means an increase in the weight of the power plant, but on investigation it will be found that the opportunities given for the reduction of the structural weight due to the distribution of loads are so great that the structural weight of the machine will be decreased in far greater proportion than the weight of the engines is increased.

"I would like to point out at this time that the greatest assistance which can be given the airplane engineer in the design of commercial airplanes is the development of suitable engines, of which there are very few in existence at the present time. As with the airplane itself, all attention for the past few years has been given to engines of very high horsepower and extremely light weight, with initial cost and cost of upkeep as purely secondary considerations. It is probable that some of the existing airplane engines, if built in enormous quantities, could be produced at a reasonable cost, but the production of commercial airplanes is, at the present time, somewhat limited, and the growth of the industry must necessarily be gradual. It would, therefore, seem that the production of existing type of engines will not be sufficiently great to get the cost down to a reasonable basis. Engines of medium horsepower would be highly advantageous for smaller types of commercial planes, and a very satisfactory sportsman's machine of the twin-engined type with units of 60 or 70 hp. would be a desirable product, and it should be possible to produce such engines at a comparatively low cost. For this type of machine the air-cooled type of engine would be particularly desirable, inasmuch as the engine may be of comparatively small size and small bore and may be exposed in a manner which would not be practicable in a single-engined type. All air-cooled engines which have previously been brought out have been of a type in which efforts have been made to reduce the weight to an extent far beyond that of the water-cooled type. I believe that an air-cooled engine of medium horsepower, weighing the equivalent of a fully equipped water-cooled engine, including radiator and water, would make an efficient power plant, and one which could be produced at very low cost."

Promise of Lighter-Than-Air Machines

D'Orcy's paper showed that with improving mechanical structure we may expect the lighter-than-air machine to increase greatly in size and capacity beyond present limits. His contention was that the fundamental facts proved the advantage of very large airships, because the lifting power increases as the cube of the dimensions, while the resistance to passage through air increases only as their square.

This means that as an airship grows larger the weight of the engines necessary to drive it at a chosen speed becomes an ever-decreasing proportion of the total lifting power. This fact is also of value in showing that as ships increase in size there is less necessity for using very light and costly metals in their construction. Beyond a certain size of rigid type it would not pay to use aluminum alloys.

Another expectation of the author is that helium, having a lifting power not greatly inferior to hydrogen, will be available in adequate quantities, and it has the enormous advan-

(*Continued on page* 595)

Performance Data on Airplane Radiators

ENGINE: Make and Model	ENGINE: Approximate B.Hp. Used	AIRPLANE: Make and Model	AIRPLANE: Low Altitude Speed, Miles per Hr.: Low	During Climb	High	RADIATOR: Location	RADIATOR: Type and Make	RADIATOR: Air Cells	RADIATOR: Depth (In.)	RADIATOR: Area, Sq. Ft.: Face	Cooling Surface	RADIATOR: Weight, Lb: Empty	Full
[1]Thomas 8	140	L-W-F, V	45	*56	90	Fuselage nose and in slip-stream	Ajax, Honey-comb	12/64"x12/64"	3	3.90000	131.00	Aver. 77.5	Aver. 107.80
[2]Thomas 8	140	L-W-F, V	45	*56	90	Fuselage nose and in slip-stream	Ajax, Honey-comb	12/64"x12/64"	3	4.10000	137.80	....	....
[3]Curtiss OXX-2	100	Curtiss JN-4	43	*51	75	Fuselage nose and in slip-stream	Rome - Turney Honey-comb	0.270"x 0.265"	2⅞	3.16000	138.20 †	....	....
[3]Curtiss VX	160	Curtiss R-3	*50	*57	80	Fuselage nose and in slip-stream	Rome - Turney Honey-comb	0.270"x 0.265"	3⅜	4.23000	186.00 †	85.0	118.00
[4]Sturtevant 5-A	145	Sturtevant S-4	48	*55	75	Leading edge of upper wing	Honeycomb	About ¼" square	3	2.69000	*107.60 †	....	....
		Martin S	40	*49	75	On upper wing in slip-stream	Flexo Honey-comb	Irregular shape	2⅞	3.52000	84.10	....	....
Hall-Scott A-5-A	165	L-W-F, V-2	45	*57		On leading edge upper wing out of slip-stream	Ajax Honey-comb	12/64"x12/64"	4	2.64000	118.30	56.0	87.00
		L-W-F, V-2	45	*57	2	On leading edge upper wing out of slip-stream	Ajax Honey-comb	12/64"x12/64"		3.33000	149.20	....	....
[6]Liberty Experimental 8. (High compression)	220	L-W-F, F	45	*63	115	On leading edge upper wing out of slip-stream	Ajax Honey-comb	12/64"x12/64"	4	4.06000	182.00	86.0	139.00
[7]Liberty Experimental 8. (High compression)	220	L-W-F, F	45	*63	115	Leading edge upper wing, about ⅓ in slip-stream	Ajax Honey-comb	12/64"x12/64"	4	2.26000	101.20	Figure of no value as radiator partly covered	
[8]Liberty 12 (Low compression)	327	L-W-F, G	*48	*69	130	Leading edge upper wing, most in slip-stream	Ajax Honey-comb	12/64"x12/64"	4	2.38000	106.80	Figure of no value as radiator partly covered	
[9]Sturtevant 5-A	145	L-W-F, V-1	45	*57	92	Fuselage nose and in slip-stream	Ajax Honey-comb	12/64"x12/64"	3	3.67000	123.30	....	....
[10]Hall-Scott A-7-A	110	Standard	...	...	......	Above engine in slip-stream	Flexo (?)	Irregular shape	5	1.50000	*68.70 (if Flexo)	....	....
[6]Liberty 12 (High compression)	430	L-W-F, G-1	50	*71	135	Upper water pocket built into edge of upper wing, nearly all in slip-stream	Ajax Honey-comb	12/64"x12/64"	5	3.75000	210.00	88.0	155.00
[11]...........	140	....	...	...	......	In curve of wing	Motor Radiation Co. Multitube Honeycomb	¼ in. diameter	4½	2.89000	130.00	45.0	....
[12]Siddeley	210	British DH-4	*55	*69	112	Pivoted below fuselage, all in slip-stream	Motor Radiation Co. Multitube Honeycomb	¼ in. diameter	4	2.08000	83.20	....	....
[13]Liberty 12 (High compression)	Probably 400	Standard Co. DH-4	60	*77	128	Fuselage nose in slip-stream	Livingston Honeycomb	Probably 1/16 in. cl. to cl.	4	5.55000	311.00 †	....	....

ENGINE: Make and Model	COMPARATIVE PERFORMANCE: Probable Air Speed Relative to Radiator, Miles per Hr.: During Climb	High Speed	Surface (Sq. Ft.) Factors: Area / B.Hp.	Area×Speed / B.Hp.: Climb	High Speed	Area×Speed ×Temp.Diff. / B.Hp.: Climb	High Speed	Temperature at Low Altitude, Deg. Fahr.: Air at Gr'nd	Radiator Inlet (Throttle Open): Static	Climb	High Speed	Probable Mean Temp. Diff.: Climb	High Speed	Weight per B.Hp., Lb.: Empty	Full
[1]Thomas 8	93	108	0.9360	87.00	101.10	10,005	10,110	*80–85	.....	*190–195	185	115	100	0.5530	0.7700
[2]Thomas 8	93	108	0.9840	91.50	106.30	10,065	10,100	*90–95	.....	......	*185–190	110	95	.....	.....
[3]Curtiss OXX-2	79	90	1.3820	109.20	124.40	....	....	....	.....	......	......	..	..	.....	.....
[3]Curtiss VX	85	96	1.1620	98.80	111.50	....	....	....	.....	......	......	..	..	0.5310	0.7370
[4]Sturtevant 5-A	80	90	*0.7420	59.30	66.75	....	....	....	.....	......	185	..	..	.....	.....
	78	90	0.5100	39.80	45.90	....	....	....	.....	......	......	..	..	.....	.....
Hall-Scott A-5-A	57	92	0.7180	40.90	66.00	4,704	6,600	80–90	190–210	......	185†	115	100	0.3390	0.5270
	57	92	0.9050	51.60	83.25	5,160	7,075	80–90	.....	......	170	100	85	.....	.....
[6]Liberty Experimental 8. (High compression)	63	115	0.8270	52.10	95.00	6,250	9,975	*80–85	.....	......	185–190	120	105	0.3910	0.6320
[7]Liberty Experimental 8. (High compression)	67% = 63 33% = 117 Mean = 81	67% = 115 33% = 138 Mean = 123	0.4600	37.27	56.60	4,470	6,226	*65–70	.....	......	180	120	110	.....	.....
[8]Liberty 12 (Low compression)	33% = 69 67% = 130 Mean = 110	33% = 130 67% = 156 Mean = 147	0.3260	35.87	47.90	5,740	7,185	*20	.....	......	170	160	150	.....	.....
[9]Sturtevant 5-A	96	110	0.8500	81.60	93.50	9,385	9,350	....	.....	......	185–187	115	100	.....	.....
[10]Hall-Scott A-7-A	......	....	*0.6250 (If Flexo)	....	....	....	....	....	.....	......	......	..	..	.....	.....
[6]Liberty 12 (High compression)	25% = 71 75% = 136 Mean = 120	25% = 135 75% = 162 Mean = 155	0.4880	58.60	75.70	7,320	7,195	70–80	Boils after 1 min.	......	170	125	95	0.2050	0.3610
[11]...........	......	......	0.9280	....	....	....	....	....	.....	......	......	..	..	0.3220	.....
[12]Siddeley	117	134	0.3960	46.30	53.10	....	....	....	.....	......	......	..	..	.....	.....
[13]Liberty 12 (High compression)	132	154	0.7770†	102.50 †	119.60 †	....	....	....	.....	......	......	..	..	.....	.....

[4] Liberty 12 (High compression)	Probably 400	Standard Co. DH-4	60	*77	128	Fuselage nose in slip-stream	Mayo Honeycomb	Probably 0.275"x 0.275"	4⅞	6.16000	*432.00 †	96.0	....	132	154	*1.0800†	142.50 †	166.40 †	....	....	....	....	......	......	..	..	0.2400	.....
[14] Mercedes	160	Albatross	...	...	......	In curve of upper wing, probably in slip-stream	Tubular	Space between tubes	Same as wing curve	Aver. 2.08500	48.62	27.5	48.34	......	......	0.3035 †	....	....	....	....	....	....	......	......	..	..	0.1720	0.3020
[16] Liberty 12 (Low compression)	385	Curtiss, L-W-F, HS-1-L	57	*65	87	In front of engine (pusher type) not in slip-stream	Livingston Honeycomb	3/16 in. cl. to cl.	5	5.60000	336.00	96.0	165.50	65	87	0.8730	56.70	76.00	6,237	7,220	*60-70	.....	......	160	110	95	0.2495	0.4300
[17] Mercedes	260	Friedrichshafen Bomber	*50	*61	93	In front of engine nacelle (pusher) not in slip-stream	Honeycomb	¼"x¼"	Probably about 4 to 5 in.	1.79000	*143.00 (?) †	....	....	61	93	*0.5500 (?)†	33.55 †	51.20 †	....	....	....	....	......	......	..	..	......	.....
[18] Rolls-Royce Series 8	360	British F-5	57	*65	*87	In front of engine in slip-stream	Honeycomb	¾"x¾"	....	9.30000	.....	....	....	94	104	....	....	....	....	....	....	....	......	......	..	..	......	.....
[19] Hall-Scott A-5 A-5-A A-7 A-7-A	....	....	...	...	Probably less than 90	In front of engine in slip-stream	Probably based on Flexo	......	Probably 3½ or 4 in.	0.02555 per B.Hp.	.....	....	....	......	......	If Flexo 3.5"=0.746 4.0"=0.850	....	....	....	....	....	....	......	......	..	..	......	.....
						On leading edge of upper wing	Probably based on Flexo	......	Probably 3½ or 4 in.	0.02048 per B.Hp.	.....	....	....	......	......	If Flexo 3.5"=0.598 4.0"=0.682	....	....	....	....	....	....	......	......	..	..	......	.....
						On sides of body in slip-stream	Probably based on Flexo	......	Probably 3½ or 4 in.	0.03575 per B.Hp.	.....	....	....	......	......	If Flexo 3.5"=1.043 4.0"=1.190	....	....	....	....	....	....	......	......	..	..	......	.....
						On fuselage nose in slip-stream	Rome - Turney Honeycomb	0.270"x 0.265"	......	....	.....	....	....	......	......	1.0800	....	..	..	..	..	..	......	......	..	..	App. 0.5500	App. 0.6800
						On side of fuselage in slip-stream	Rome - Turney Helical Tube	......	......	....	.....	....	....	......	......	0.8500	....	..	..	..	..	..	......	......	..	..	App. 0.5500	App. 0.6800
Several	....	Several			Probably less than 85	....	Honeycomb	......	......	....	.....	....	....	......	......	2.7000 evidently too high		....	....	....	....	....	......	......	..	..	......	.....
						....	Flattened Aluminum Tubes	......	......	....	.....	....	....	......	......	2.0000 evidently too high	....	....	....	....	....	....	......	......	..	..	......	.....
Liberty 12 (High compression)	Probably 400	Le Pere Fighter	*50	*72	136	In upper wing at slight angle in slip-stream	Flat plate type	Long 3/16" slot between plates	8 Vertically	4.54000	260.00	....	....	138	163	0.6500	89.70	106.00	....	....	....	....	......	......	..	..	......	.....
	Probably 400	Le Pere Fighter	*50	*72	136	In upper wing at slight angle in slip-stream	Flat plate type	Long 3/16" slot between plates	......	*5.24000	*278.00	....	....	138	163	*0.6970	96.20	113.60	....	....	....	....	......	......	..	..	......	.....
	Probably 400	USD-9 (Modified DH-9)	*55	73	125	In upper wing at slight angle in slip-stream	Flat plate type	Long 3/16" slot between plates	......	4.76000	253.00	....	....	129	150	0.6330	81.70	95.00	....	....	....	....	......	......	..	..	......	.....
	430	L-W-F, G-2	50	*75	135	In curve of upper wing	Ajax Honeycomb	13/32"x13/32"	5	8.20000	255.00	....	....	138 (?)	162 (?)	0.5930†	81.85 †	96.10 †	....	....	....	....	Boiled in steady climb	*185	..	..	......	.....
	430	L-W-F, G-2	50	*75	135	In curve of upper wing	Albatross Tubular Type	Space between tubes	Same as wing curve	6.54000	175.30	....	....	138 (?)	162 (?)	0.4080†	56.30 †	66.20 †	....	....	....	....	Boiled in steady climb	*185	..	..	......	.....
[20] Hispano-Suiza	150	Standard Aero E-4 Mail Plane	50	*63	100	On fuselage nose in slip-stream	Livingston Honeycomb	Probably 3/16 in. cl. to cl.	......	....	129.00	74.5	....	108	120	0.8600	92.90	103.20	....	....	....	....	......	......	..	..	0.4970	.....
[3] Curtiss OX	90	Curtiss (Probably JN-2)	43	*51	75 (Based on JN-4)	If JN-2 On fuselage nose and in slip-stream	Rome - Turney Honeycomb	0.270"x 0.265"	3⅜	2.89500	124.40 †	57.0	90.00	79	90	1.3830	109.30	124.50	....	....	....	....	......	......	..	..	0.6330	1.0000
[3] Curtiss OXX-2	100	Curtiss JN-3(?)	43	*52	*78	On fuselage nose in slip-stream	Rome - Turney Honeycomb	0.270"x 0.265"	2⅞	2.79000	121.80 †	57.0	83.00	82	94	1.2180	99.80	114.40	....	....	....	....	......	......	..	..	0.5700	0.8300
[3] Curtiss VX	160	Curtiss	...	...	......	....	Rome - Turney Honeycomb	0.270"x 0.2650"	3⅞	4.74000	285.00 †	85.0	117.00	......	......	1.7800	....	....	....	....	....	....	......	......	..	..	0.5310	0.7310
[3] Orlo	140	....	...	...	......	....	Rome - Turney Honeycomb	0.270"x 0.265"	3⅞	4.08000	208.40 †	77.0	116.00	......	......	1.4880	....	....	....	....	....	....	......	......	..	..	0.5500	0.8280
[3] Curtiss OXX-2	100	Burgess	...	...	......	....	Rome - Turney Honeycomb	0.270"x 0.265"	3⅞	4.65000	200.00 †	88.0	118.00	......	......	2.0000	....	....	....	....	....	....	......	......	..	..	0.8800	1.1800
[3] Liberty 12 (High compression)	420	Bristol Fighter	*55	*76	* 140	On fuselage nose in slip-stream	Rome - Turney Honeycomb	0.270"x 0.265"	4⅞	3.75000	232.60 †	92.0	132.00	142	168	0.5530	78.50	93.00	....	....	....	....	......	......	..	..	0.2190	0.3140
[3] Liberty 12 (Low compression)	*385	Curtiss H-16	55	*65	95	In front of engine in slip stream	Rome - Turney Honeycomb	0.270"x 0.265"	4⅞	4.79000	320.00 (Nearly checks)	103.0	152.00	100	114	0.8310	83.10	94.75	....	....	....	....	......	......	..	..	0.2675	0.3950
[3] Liberty 12 (Low compression)	*385	Curtiss HS-1-L	57	*65	87	In front of engine (pusher) not in slip-stream	Rome - Turney Honeycomb	0.270"x 0.265"	4⅞	5.58000	372.70 (Nearly checks)	105.0	153.00	65	87	0.9680	62.90	84.20	....	....	....	....	......	......	..	..	0.2730	0.3970

FOR REFERENCE NOTES SEE PAGE 594

Performance Data on Airplane Radiators—*Continued*

ENGINE		AIRPLANE				RADIATOR								COMPARATIVE PERFORMANCE														
			Low Altitude Speed, Miles per Hr.							Area, Sq. Ft.		Weight, Lb.		Probable Air Speed Relative to Radiator, Miles per Hr.		Surface (Sq. Ft.) Factors					Temperature at Low Altitude, Deg. Fahr.						Weight per B.Hp., Lb.	
																Area	Area×Speed / B.Hp.		Area×Speed ×Temp.Diff. / B.Hp.		Air at Gr'nd	Radiator Inlet (Throttle Open)			Probable Mean Temp. Diff.			
Make and Model	Approximate B.Hp. Used	Make and Model	Low	During Climb	High	Location	Type and Make	Air Cells	Depth (In.)	Face	Cooling Surface	Empty	Full	During Climb	High Speed	B.Hp.	Climb	High Speed	Climb	High Speed		Static	Climb	High Speed	Climb	High Speed	Empty	Full
[27]Curtiss VX-3	200	Curtiss R-4	48	*59	90	On fuselage nose in slip-stream	Rome-Turney Honeycomb	0.270"x 0.265"	......	....	.....	....	....	94	108	1.0800	101.50	116.70	....	....	....	.....	......	......	..	..	.....	.....
[28]Several	....	Several	....	....	Probably less than 90	On fuselage nose in slip-stream	Flexo Honeycomb	Irregular shape	Based on Flexo area 3½	0.02780 per B.Hp.	.....	....	....	......	......	0.8125	....	....	....	....	....	.....	......	......	..	..	0.5100	0.9000
						On side of fuselage			......	0.05000 per B.Hp.	.....	....	....	......	......	0.7225	....	....	....	....	....	.....	......	......	..	..	0.5600	0.8100
						Overhead in slip-stream			Based on Flexo area app. 5	0.01875 per B.Hp.	.....	....	....	......	......	0.7780	....	....	....	....	....	.....	......	......	..	..	0.3800	0.6800
						Over engine			Based on Flexo area 2⅞	0.03470 per B.Hp.	.....	....	....	......	......	0.8400	....	....	....	....	....	.....	......	......	..	..	0.3900	0.6200
Rolls-Royce	250	Handley Page	*55	*61	*90	On side of fuselage, not in slip-stream	Flat Tube	......	......	....	150.00	....	....	64	90	0.6000	38.40	54.00	....	....	....	.....	......	......	..	..	.....	.....
[29]Salmson A-9	230	Paul Schmitt	.	...	.....	On leading edge of upper wing in slip-stream	Honeycomb	Probably ¼ or $\frac{3}{16}$ in.	3½	2.70000	*121.50	....	....	......	......	*0.5280	....	....	....	....	....	.....	......	......	..	..	.....	.....
....	....	Aviatik	...	...	......	On leading edge of upper wing in slip-stream	Honeycomb	Probably ¼ or $\frac{3}{16}$ in.	Probably deep (4 to 5)	......	.....	....	....	......	......	0.7200	....	....	....	....	....	.....	......	......	..	..	.....	.....
Liberty 12 (Low compression)	385	Curtiss H-12	53	*61	95	In front of engine nacelle in slip-stream	Livingston Honeycomb	$\frac{3}{16}$ in. cl. to cl.	5	5.22000	313.00	98.0	170.00	100	114	0.8130	81.30	92.60	....	....	....	.....	......	......	..	..	0.3545	0.4420
Liberty 12 (Low compression)	385	Curtiss H-12	53	*61	95	In front of engine nacelle in slip-stream	Livingston Honeycomb	$\frac{3}{16}$ in. cl. to cl.	5	7.08000	425.00	122.5	205.00	100	114	1.1030	110.30	125.90	....	....	....	.....	......	......	..	..	0.3180	0.5320
Hispano-Suiza	150	Curtiss N-9	44	*53	*80	Above engine in slip stream	Livingston Honeycomb	$\frac{3}{16}$ in. cl. to cl.	5¼	1.89000	119.00	41.3	66.50	84	96	0.7930	66.70	76.20	....	....	....	.....	......	......	..	..	0.2750	0.4430

*Estimated data. Temperature data very approximate.
†See note.
[1]L-head engine cast-iron cylinders. Housed and ventilated.
[2]L-head engine, cast-iron cylinders. Housed and ventilated. Plane for use in Texas.
[3]Areas do not exactly check data on radiation used. Based on miscellaneous and Rome-Turney Co. data.
[4]Overhead valves area estimated assuming 40:1 = surface : face.
[5]Overhead valves.
[6]Overhead valves. Cylinder heads exposed to slip-stream.
[7]Overhead valves. Cylinder heads exposed to slip-stream. Same radiation as No. 9, but in slip-stream and part covered.
[8]Overhead valves, cylinder heads exposed. An old radiator part covered up.
[9]Overhead valves, housed in and ventilated.
[10]Make of radiation not certain, probably Flexo, 5½-in. section.
[11]Designed from British data. Tubes 60 deg. to Chord Motor Radiation Co. data.
[12]D. W. Douglas data
[13]Section used uncertain, assumed = $\frac{3}{16}$ in.x$\frac{3}{16}$ in. Radiator probably undersized.
[14]Probably oversized. Section used uncertain, assumed = 0.275 in.x0.275 in.
[15]Area includes water pockets. Data does not check L-W-F experiments.
[16]Water flow about 97 gal. per min.
[17]British official report data, depth, etc., uncertain, assumed 80:1 = Area : Face (5 in.).
[18]Arch cut out of honeycomb to clear engine.
[19]Data from recommendations of Hall-Scott Co. (1917.).
[20]Rome-Turney, etc., data per Hunsaker in *Aerial Age* May 29, 1916.
[21]German practice per Prof. Haffner in "Handbuch für Flugzeugkonstrukteure-Hunsaker" in *Aerial Age* May 29, 1916.
[22]96 plates = 8 in.x24⅜ in., $\frac{3}{16}$ in. cl. to cl. First installation.
[23]Later installation.
[24]Slip-stream doubtful. Too small for climb, O. K. for high speed.
[25]922 tubes ¼ in.x¼ in.x24 in. run crosswise. Too small for climb, O. K. for high speed.
[26]T. H. Huff data.
[27]Miscellaneous and D. W. Douglas data.
[28]Flexo radiation data, *Aviation*, December 15, 1917.
[29]Area estimated, assuming 45:1 = Surface : Face.

(*Continued from page* 591)

tage of being absolutely inert, that is to say it is as uninflammable as nitrogen.

D'Orcy said that airships of existing types could be depended upon to cross the Atlantic in 60 hours carrying a substantial load. He said that the famous British engineering firm of Vickers, Ltd., one of the largest concerns in Europe, had already announced that they would soon commence a regular service between England and America on a 60-hour schedule. They plan to run two ships in each direction each week and estimate that the adventure will be profitable at a fare of $250 per passenger.

The rapid increase in *useful* load capacity of airships is shown by comparative figures for two typical German ships. In 1914 a large German ship had a gross lift of 30 tons and useful lift of 8.5 tons. A larger ship of similar type built last year has a gross lift of 66.6 tons—little more than double—and a useful lift of 39 tons—nearly five times.

This means that with very large ships passengers would be able to be accommodated in real comfort, be properly housed and fed and generally as well looked after as on an ocean liner and yet make the trip at three times the speed of the fastest of them.

It is in such long-distance trans-oceanic work that d'Orcy sees the greatest immediate future for the airship. Also the engine power required for a given speed as the size of the ship grows means that with every increase in bulk the cost of transportation per unit of useful load will decrease.

Theoretically, almost the reverse is the case with an airplane whose lifting ability as well as its translational speed has to be provided by engine power. It therefore appears probable that airplanes and airships will develop independently for different classes of usefulness and have fields almost as dissimilar as those of the railroad and the steamship. Competition between the two types of aircraft is not to be expected; co-operation is more likely, the one offering the speediest long distance transportation and the other the fastest form of short distance travel.

A very useful paper of a totally different character also read at the meeting was one on airplane radiators by Archibald Black, U. S. N. This paper contains a great amount of carefully collected data dealing with the efficiency of different types of radiator, the effect of different mountings on the airplane and numerous other vital factors.

This paper, being mainly composed of collected facts, is almost impossible to digest. The uppermost thought after hearing it is that much still remains to be discovered before the last word on the subject can be written. In a general way the conventional mounting on the nose of the fuselage or nacelle appears the most efficient and satisfactory, but a good deal of premise lies in the types of radiator which are built into the wings so as to make almost an integral part of the wing surface. The author pointed out that methods of controlling motor temperature were only partly developed and his comments suggest that there is a field for efficient automatic control, the automobile form of thermostat having some disadvantages. The principal tabulation of data from this paper is reprinted on pages 592, 593 and 594.

Egotism in Business a Grave Error

(*Continued from page* 577)

This is one of the most dangerous mental attitudes that a concern can take, because while it stands still the rest of the world progresses around it, leaving it to go relatively backward. A consulting engineer who is well up on existing trends of developments can readily cure this. A concern which calls in a consulting engineer regularly will never take this mental attitude. Year by year better products are going to be turned out and not in our generation nor the next will the ultimate in any man-made product be reached.

The consulting engineer is often in a position to interpret complaints from customers and service stations. The plant engineer may fail to read between the lines and see how these complaints bear relationship to one another and perhaps vitally affect the product. The consulting engineer who is trained along these lines can readily be of material benefit in this respect alone.

In the creation of new designs the broad vision of the consulting engineer is most necessary. When a plant engineer sets out to design something entirely new it is difficult for him to remove from his mind problems with which he has been wrestling daily.

The consulting engineer on the other hand is able to sketch his mental picture of a future design from the far broader viewpoint of a man who has continually surveyed the entire field. He can sketch the outline and the main points in a way which will bring home vividly to the plant engineer the general state of the art and the plant engineer from his detail experience can fill in the minor points, and perhaps in the light of his intimate knowledge, suggest improvements which will go far to improve the quality of the new product. The consulting engineer and the plant engineer make an ideal combination on the creation of new designs.

In checking and testing work, the services of the consulting engineer are also practically indispensable. It is impossible for a man who has done a piece of work to check it properly by himself. He must call in an outside man. The plant that fails to do this is laying itself open to great criticism. It is a vital point that errors which may be found in checking or testing may be found early and before production plans are too far advanced.

After having made his test and done the checking the consulting engineer is in a position to suggest improvements which will tend to make the product better and these can be discussed in conference by the various department heads of the plant and the consulting engineer.

It must be remembered that the consulting engineer is not the man to make the final decision. He is the man to make the suggestions and give the reasons for his suggestions. It is up to the plant department heads and to the plant executives finally to decide on what is done, but by his presence at conferences the consulting engineer is able to inject lines of thought into the consultation which perhaps would never enter the mind of anyone connected with the plant. He brings into the discussion the broader thoughts of the outside world, which must be considered if the plant is going to successfully produce products that are going to be broadly sold.

The retention of a consulting engineer can never be a reflection on the personnel of an organization or on its product. Nor is the consulting engineer failing in his duty when he is not able to suggest any practical improvements over what has been reached in the plant. If he cannot do so in view of his broad experience and if he is the proper man for the job, his confirmation alone is worth much to the entire manufacturing organization.

The name of the consulting engineer need never be mentioned in connection with its production. He is a confidential adviser and in much the same way as the auditor or legal counsel, who are called in by concerns of every type. As a check on the ideas of the organization he can be invaluable and his value is largely determined by his broadness of vision, by his wide range of experience and by his diligence in securing, cataloging and keeping at his fingers' end a wide and complete range of information.

Campbell All-in-Mesh Gearset

Utilizes Tilting Key for Locking Layshaft Gears

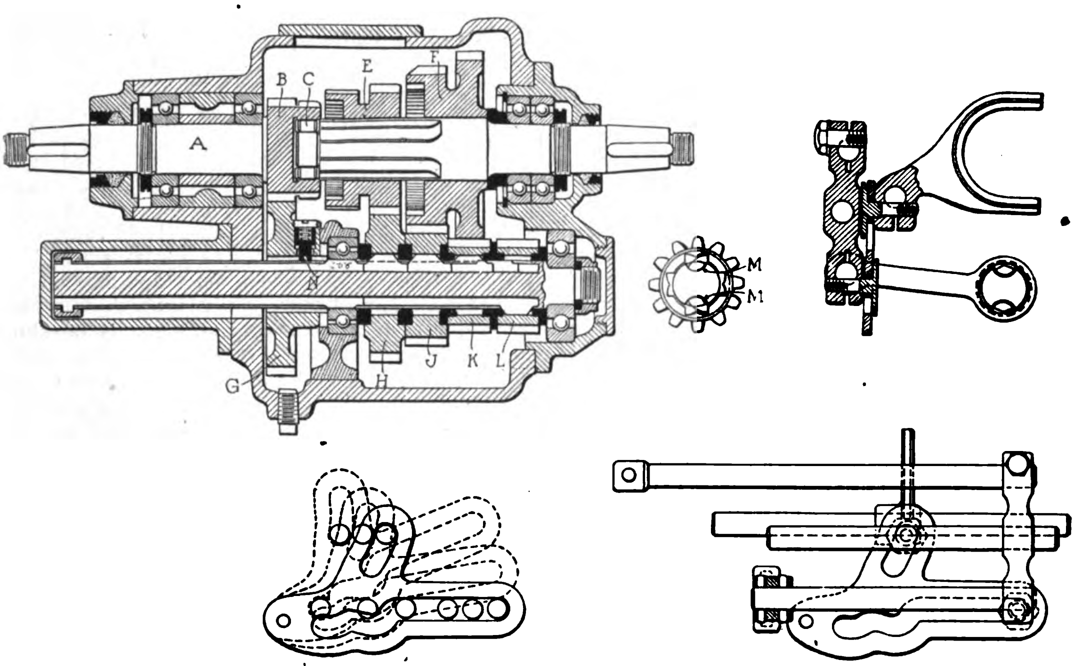


Fig. 1—Cross-sectional view of the four-speed Campbell gearset, with details of layshaft gears, cam plate and shifting mechanism

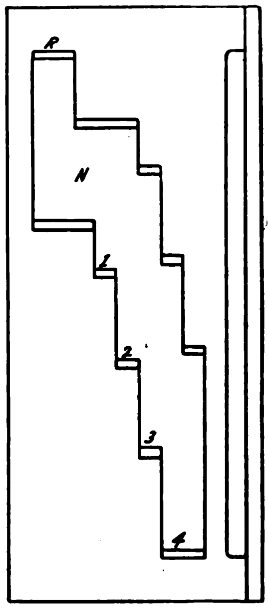


Fig. 2—Change speed lever plate used with Campbell gearset

THE Campbell all-in-mesh type of gearset is one wherein the gears are constantly in mesh, with the countershaft or layshaft gears locked internally by what is termed a rolling key. Thus the different speeds except high gear are secured by shifting the key under the desired gear.

Inasmuch as the clutching devices are located immediately under the layshaft gears and not at the sides, the Campbell gearset is shorter than other in-mesh types, resulting in but 6 in. center to center between bearings on the layshaft, and this on a 2- to 3-ton four-speed truck transmission. Model 50 is illustrated. One of these has been in use for several months in a 2-ton Garford truck at the Great Lakes Naval Station, where it has been subjected to much severe handling. A representative of the Class Journal Co. drove this truck over all sorts of roads, bringing the gearset lever into the various speeds without touching the clutch pedal and regardless of engine revolutions.

Fig. 1 shows a cross sectional view of the four-speed truck transmission, together with details of the layshaft gears, cam plate and shifting mechanism. As shown the gears are in third speed. The primer shaft *A*, which connects to the engine or clutch shaft, is supported on two No. 308 single row ball bearings and carries on its inner end the constant mesh gear *B*. The latter is recessed for the solid roller bearing *C* supporting the mainshaft *D*, which is supported at the rear by a double row No. 308 ball bearing.

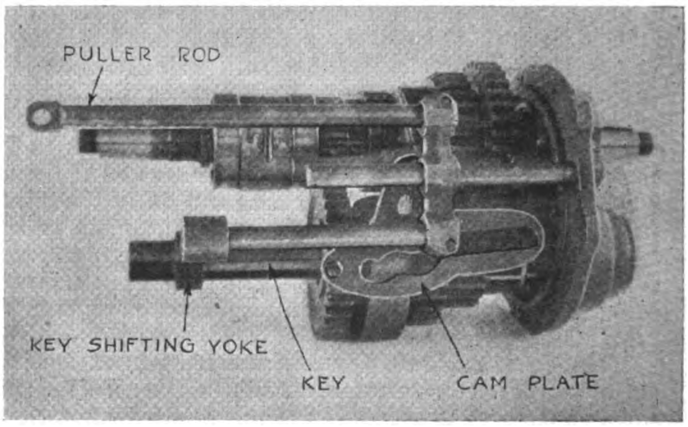
Shaft *D* is splined for the sliding member *E*, while the double gear *F* is spooled on the shaft and revolves with the shaft only when *E* is clutch-meshed with it, that is, the external teeth of the sliding gear are meshed with the internal teeth in *F*.

As shown, *F* remains idle, the shaft revolving inside of it. The bearing surfaces of this part of the shaft and inside the gear *F* are hardened. High gear is obtained when *E* is brought forward to clutch-mesh with *B* in practically the same way as is done in conventional gearsets, where the internally cut form of sliding gear is used in place of a dog clutch.

Immediately below gear *B* and in mesh with it is the constant gear *G*, an integral part of the layshaft. Adjacent to *G* is a single row No. 308 ball bearing, and then follow gears *H*, *J*, *K* and *L*, constituting the third, second, first and reverse speed gears respectively. The reverse pinion idler is not shown, but is just back of *K* and *L*, being the same length as these two combined. The bearing at the rear end of the layshaft is a single row No. 406. The bearings of the layshaft are close to the gears where the greatest load comes, minimizing the danger of a sprung shaft.

The gears of the layshaft except *G* are mounted on collars or rings acting as bearing surfaces. This can be a steel on steel construction or through brass bushings, balls, etc., as these bearings carry none of the load, but only the weight of the gear. The transmitting action is secured by simply sliding the key or keys along the circular longitudinal grooves

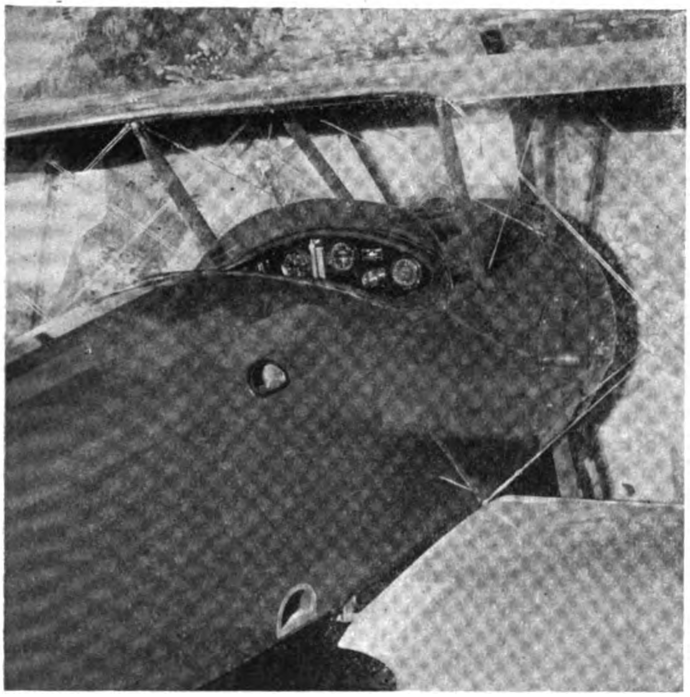
(*Continued on page* 601)



Complete shifting mechanism, showing single pull rod at top

Second Impressions of the Aeronautic Show

Some Mechanical Novelties Seen Among the Exhibit of Planes, Engines, Parts and Equipment—Educational Features Prominent—International Character of the Exhibition



Side-by-side seat of Thomas-Morse biplane. Note how instruments are arranged on cowlboard

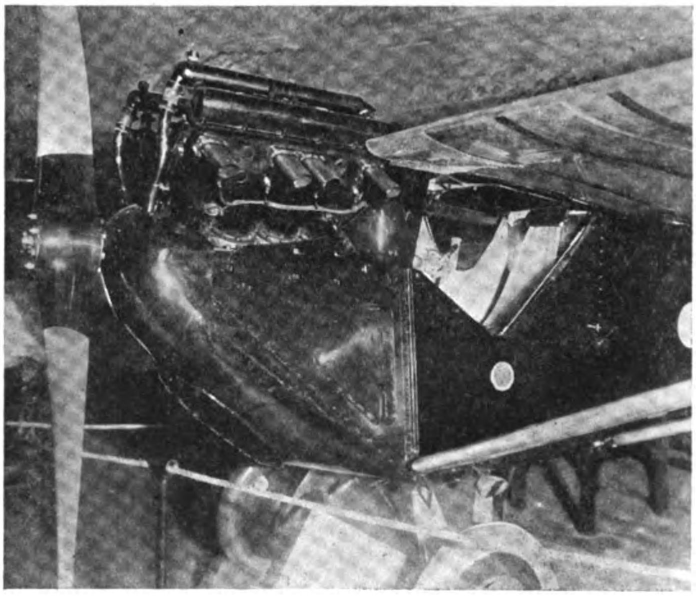
THE aeronautical industry is to be congratulated on the fine show it has staged at Madison Square Garden and Sixty-ninth Regiment Armory. There has seldom been an industrial exhibition in New York City with an equally attractive setting and as fully representative of the industry which fostered it. A very marked contrast is noticeable between this and the previous aeronautic show, in that the variety of exhibits is now much wider and the public is flocking to the show in much greater numbers.

There is more of an educational and less of a commercial aspect to the present aircraft show than to most other events of the kind. Among the great variety of types of airplanes shown, from the diminutive monoplane to the giant triplane bomber, war planes largely predominate. These have been the exclusive product of the exhibiting firms for the past several years, and they are the criteria of the achievements and the ability of their makers. Commercial uses of these same machines are being mentioned, which are said to call for only slight alterations in design, but one inclines to the belief that such machines would be subject to the same limitations as a passenger automobile converted into a commercial vehicle. Just what the chief points are in which a specially designed commercial plane would differ from a plane designed for military use it is hard to say. On first consideration one would be inclined to say that it would be lower-powered and therefore less speedy, because fuel economy is of greater importance in commercial work. However, some of the leading engineers in the aeronautical field take the opposite view, arguing that the only advantage of the airplane over competing systems of transportation is its higher speed, and that in order to justify its higher cost of operation this advantage of higher speed must be developed to the utmost.

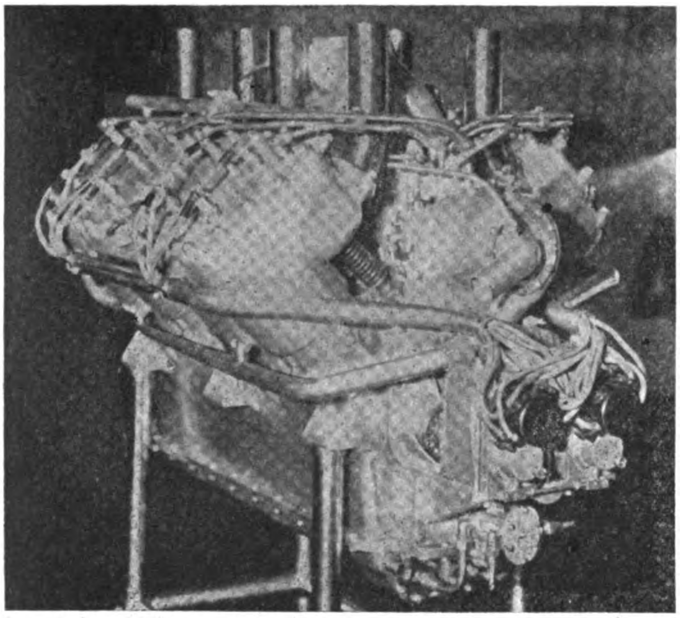
Practically every type of airplane and engine manufactured in this country during the war is being exhibited, in addition to some foreign material, both Allied and captured enemy. Most of the planes and engines have become well known to the public during the war and especially since the armistice was signed.

Super-Charging by Centrifugal Blower

At the stand of the Sturtevant Co. is seen an attachment designed to solve the problem of maintaining the power of an engine constant irrespective of altitude. This takes the form of a centrifugal blower attached to the end of the engine, for the purpose of forcing into the cylinders a greater charge than they could obtain by direct suction at high altitude. The blower is belt-driven and there is an idler pulley on the belt which is forced against it by a piston in a cylinder subjected to the atmospheric pressure, so that when this pressure drops the idler pulley is forced against the belt and causes the blower to run at greater speed. It is claimed



Front portion of Loening two-seater fighter. Note hammock seat and the position of the radiator indicated by the ring below the body



Thomas-Morse eight-cylinder engine

that only 5 per cent of the engine power is required to drive the blower. In view of the fact that at an altitude of 20,000 feet the power of an engine normally drops to 50 per cent, owing to the levity of the air, such a blower should be a useful attachment. The automatic belt tightener prevents an extra charge being pumped into the cylinders while at low altitudes and thus protects the engine from injury due to excessive explosion pressures.

That the design of the larger planes is still in its infancy is a conclusion arrived at after a comparison of the different types exhibited. The great Caproni, for instance, has a landing gear comprising two four-wheeled trucks, one under each of the engine nacelles, while the Martin bomber has a landing gear comprising four wheels mounted co-axially. A feature of interest noted on the Caproni, a night-bombing machine, is a series of electric projectors mounted under the rear edge at a downward inclination. They can be fed from a generator on one of the engines and should be a great help in making a landing at night.

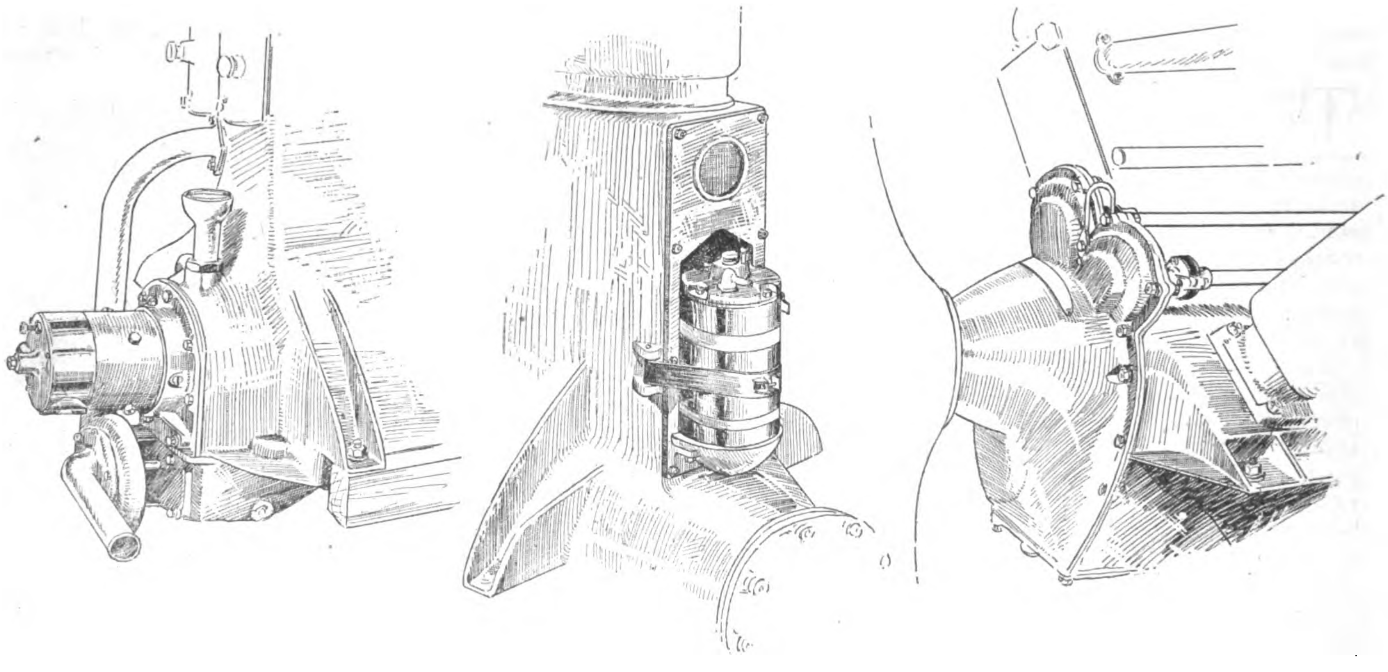
Writing of the Caproni reminds one that there is at least one other Italian exhibit at the show, and a very impressive one, by the Ausaldo firm of Genoa. This is one of the largest Italian industrial enterprises, corresponding somewhat to Krupps in Germany and Schneider in France. There are also some French planes as well as the Handley-Page of British origin, but the Italian stands out among the foreign exhibits.

Among the new engines shown is the W. B. B. two-cycle. This is a 4-cylinder air-cooled machine giving 38 hp. It is a regular three-port type engine with the inlet manifold to the crankcase cast integral with this part. Having no valves and no water cooling system, this type of engine is a model of simplicity. Engineers would probably be inclined to question its fuel economy, and the manufacturers have sought to set at rest any doubts regarding this matter by displaying prominently a sign conveying the information that the fuel consumption is 6 gal. per hour. This engine is fitted to a small plane known as the Messenger, exhibited at the Garden by the Dayton-Wright Airplane Co.

King-Bugatti Engine

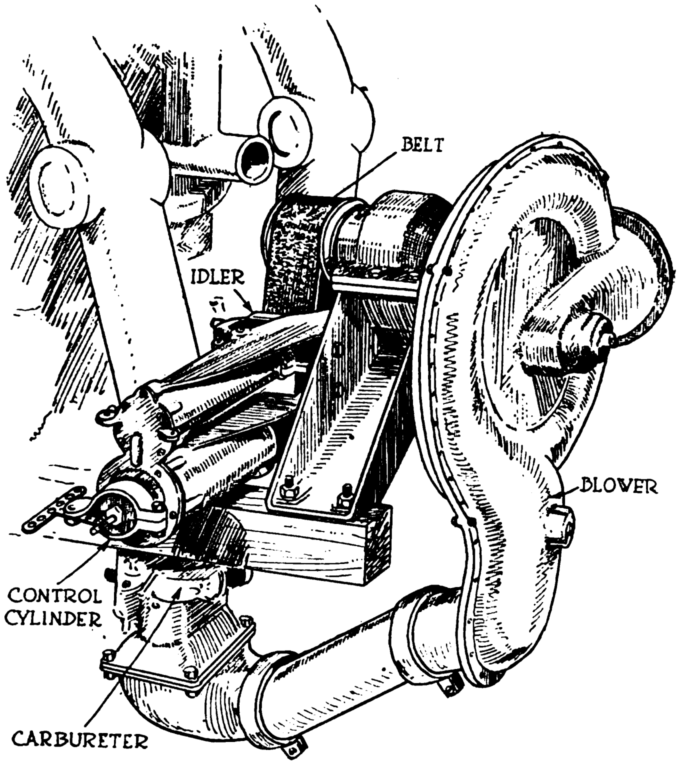
Considerable attention is being paid by visitors to the Duesenberg exhibit, which comprises the Duesenberg 800 h.p. 16-cylinder engine, the King Bugatti engine, as made by the Duesenberg Motors Corp., and a smaller 4-cylinder Duesenberg engine with 4⅜ x 7-in. cylinders. The unusual arrangement of the cylinders on the Bugatti attracts attention, there being practically two eight-cylinder vertical engines side by side, geared to a central hollow propeller shaft. This shaft is of such large size that it permits of shooting through it with a 1½-in. gun.

In the "Restaurant" of the Garden are shown a number of captured engines including a Mercedes 160 and an Austrian Hier. It is believed that the latter was designed by the Austrian racing driver Hieronymus, and that the name of the engine is an abbreviation of his

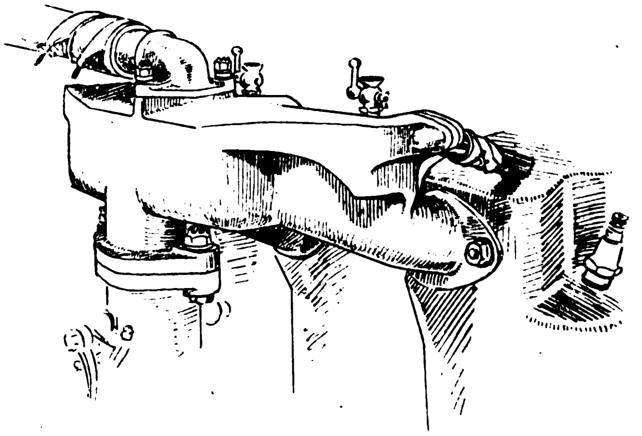


Starter mounting Generator mounting Magneto drive

Details of six-cylinder Aeromarine engine



Super-charging by means of a centrifugal blower on Sturtevant engine



Water-jacketed manifold on Liberty Six engine showing the connections to the engine jacket

name. This engine has the vertical shaft for driving the overhead camshaft at the middle, between the third and fourth cylinders. A very simple compression relief is used on this engine. It acts on the inlet cams and prevents these from closing when set. It consists of two tubes running parallel with the tappet levers. There are slots cut in the tubes where the tappet levers cross it, and when the compression relief is not set the levers move into these slots and the valves can open and close freely. When the tubes are rocked around their axes, by means of a handle which joins to both, the valves are prevented from closing fully and the compression is relieved.

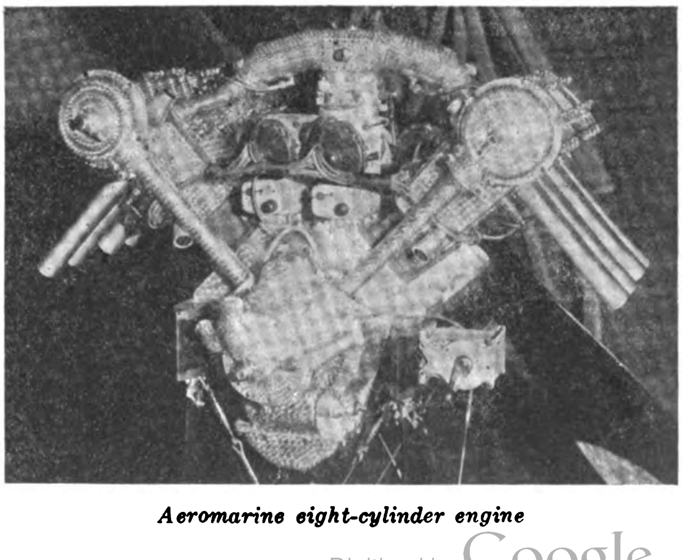
Two Aeromarine Engines Shown

The Aeromarine Plane & Motor Co., New York, exhibits two types of engine. One of these is a six-cylinder 4½ x 6½ in., weighing 375 lb. (405 lb. with electric starter and generator) and rated to deliver 130 h.p. at 1625 r.p.m. The main portion of the crankcase and cylinder jackets are cast integrally of aluminum alloy. The cylinder sleeves are alloy steel forgings, machined all over, to give a uniform wall thickness. After machining, the sleeves are heat treated and the working surfaces ground. The outsides of these sleeves are in direct contact with the cooling water over their entire surface. The cylinder-head gasket, of copper and asbestos, makes a tight joint against the top flange of each cylinder sleeve. The water joint at the bottom of each sleeve is sealed by a cork gasket, which allows freedom for expansion.

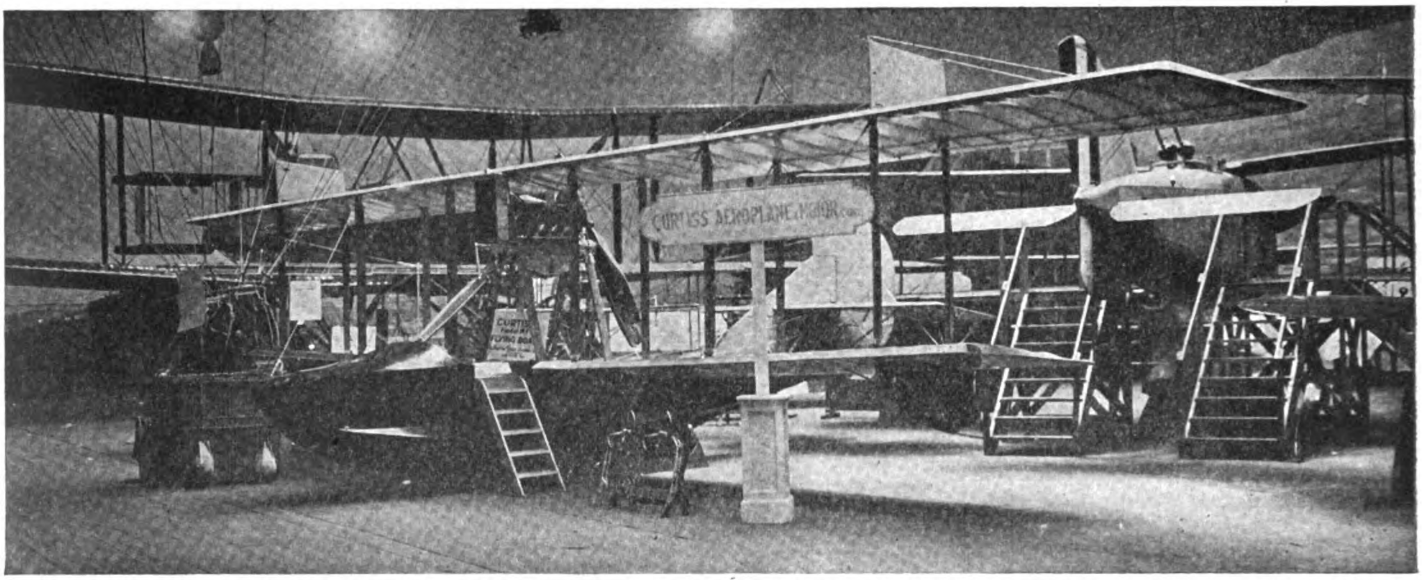
The cylinder head and valve gear form a self-contained unit, which can be removed from the combustion chamber, making it possible to remove the carbon or grind the valves. This head may be removed and replaced without re-timing the engine, owing to a special arrangement of the splined shaft which drives the camshaft gear. The head is of aluminum alloy with gray iron valve seats cast in position. The combustion chambers are machined. There are four valves for each cylinder. A special design of valve gear, embodying flat multiple leaf valve springs, effects a great reduction in length and weight of valves and valve levers, and also reduces the overall height of the engine. Each valve spring actuates two valves. There is an oil return passage from each end of the cylinder head to the crank sump. The whole valve gear is enclosed in a quickly detachable aluminum cover. A feature of the oiling system is that the oil, while passing to the auxiliary tank and from same to the engine bearings, is cooled by being passed through jackets on the inlet pipes.

The other engine of the Aeromarine Plane & Motor Co. is an eight-cylinder with two cast-iron cylinder blocks of four cylinders each, which are set to make an angle of 90 degrees with each other. It has a bore of 3⅝ in., a stroke of 5⅛ in. and develops 148 h.p. at 1300 r.p.m. Ignition is by two Dixie magnetos which are mounted side by side at the timing-gear end and are driven by two parallel shafts extending through the V, from enclosed gearing at the propeller end.

It seems that many little operations in an airplane which are somewhat dependent on the speed of the plane can be performed to best advantage by using a small propeller exposed to the air current created by the motion of the plane, serving as an air motor. Such a device, referred to as the Servo Motor, is being exhibited in two types. In one the power of the Servo Motor is transmitted mechanically by means of shafts and gear, while in the other it is transmitted hydraulically. In this case



Aeromarine eight-cylinder engine



This Curtiss flying-boat has been developed primarily for the use of sportsmen, and is finished exactly after the manner of a high-class motor car

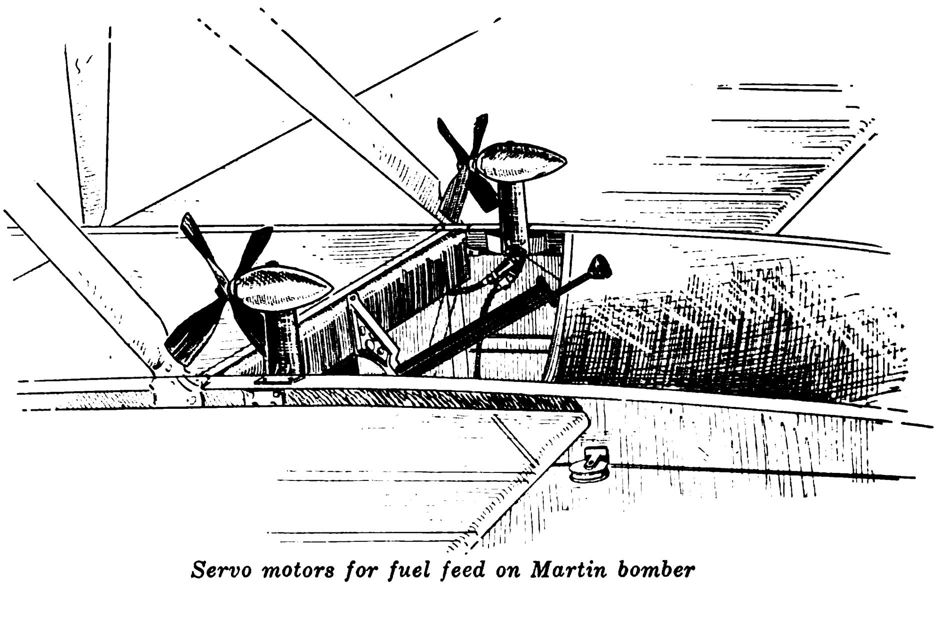
the propeller shaft carries a cam or an eccentric operating a plunger pump pumping oil. The oil may be conducted to any part of the plane and passed through a small hydraulic motor or turbine. The gear case and mounting of the small propeller are made in streamline form to reduce their air resistance to a minimum.

Indicating Instruments Exhibited

Indicating instruments form a most important item in the equipment of an airplane and they are shown in great variety. Instruments form the principal exhibit at the stand of the National Advisory Committee for Aeronautics, and there are also many exhibits by private firms. A recently developed instrument is the Vertimeter exhibited by the Aeronautical Instrument Co. It indicates the rate of climb or descent in feet per minute. It consists essentially of a spun copper tank of streamline form which is connected by means of a rubber tube to a U tube containing a colored liquid. There is a valve near the hose connection to the U tube through which air can escape from the tank to the atmosphere on ascent and pass into the tank on descent. The valve opening is so small that when the plane is either ascending or descending the pressure in the bomb lags behind the change in atmospheric pressure, and the difference between the pressure within and outside the bomb will be the greater the faster the rate of climb or descent. It is this difference in pressure which causes the fluid to rise or fall in one leg of the U tube, the only one which can be seen by the pilot, and the stand of the fluid indicates the rate of climb or descent. The scale has a range from 2000 ft. p.m. rise to 3000 ft. p.m. drop and is provided with a check valve in the top which insures that in case the machine is being put through acrobatic stunts the liquid remains in the tube at the point corresponding to the rate of rise or descent just previous to the moment when the abnormal position of the plane caused the check valve to act.

A further exhibit emphasizing the educational character of the show is that of the American Steel and Wire Co. This comprises a wind tunnel in which are suspended an ordinary ¼-in. stranded cable and a sample piece of the company's streamline airplane cable of equivalent section. Both are pivoted at one point and the air resistance drags the free end around over a graduated sector, the full round cable, of course, much more than the streamline cable. At the moderate air speed maintained in the tunnel the round wire is said to have an air resistance of 12½ per cent and the streamline cable a resistance of only 1½ per cent. It is not stated what the percentage figures are based on, but probably, since the air resistance acts against the weight of the specimen, the latter is the basis of comparison.

It is not necessary here to enumerate the long list of parts makers prominent in the automobile industry who have been drawn into relations with the aircraft industry during the war and are exhibiting their aircraft parts. This list comprises especially makers of ignition equipment, carbureters, ball bearings and forgings. Considerable space is occupied at the show by exhibits of the various branches of the Government doing aircraft work. There are some very fine specimens of aerial photography and map-making.



Servo motors for fuel feed on Martin bomber

Campbell All-in-Mesh Gearset

(*Continued from page 596*)

M in the shaft until they slip under the rings of the desired gear, after which the key automatically and positively rolls into contact with one of the broached openings on the inside of the gear. This action is shown in the cross section view of the gear in Fig. 1. One key takes the load and the other the backlash.

The keys are shown in Fig. 3 and constitute the chief feature of the transmission. In the truck job, the keys are drop-forged from ¾-in. round stock, with 1-in. face. Referring to *A*, Fig. 3, it will be noted that the portion *O* is made 1/16 in. larger than the true radius of the ¾-in. circle. Also the key clears the shaft by 1/32 in., that is, the face of the key must roll in its groove 1/32 in. before it comes in contact with the gear.

The cams on the keys are made with sloping surfaces, which serve a two-fold purpose. One of these is to assist in the engagement of the gear and the other to release it.

The gears cannot take the full load until the key has been first rolled up into place in the gear. Therefore, instead of a shearing strain across the cam as shown at *B*, Fig. 3, the key is under compression, as shown by the dotted line in *C*, Fig. 3.

It is stated that the gears cannot become noisy, as the pitch line is not disturbed. Also the tilting key clutches the gear directly in the center and therefore the gear is not distorted on the shaft, though there may be considerable play between gear and shaft. The layshaft gears are reversible, that is, they can be turned completely around from their present position on the collars to distribute the wear.

In direct drive on high gear the keys are not used, for the clutching gear *E* meshes with *B* as in a conventional gearset. In high gear the following gears revolve: *B*, *E*, *G* and *H*, but *H* is only engaged with *E* for ⅛ in. This is done so that in shifting from high to third the gears are aligned and the key is so timed by the cam lever plate that it will not engage *H* until *E* is fully meshed with it. In going from third to second the key engaged in *H* releases first and then clutching gear *E* engages the double gear *F* for first and second speeds. Here again the key is timed so the gears are fully meshed before the load is taken. Thus there is no chance of stripping

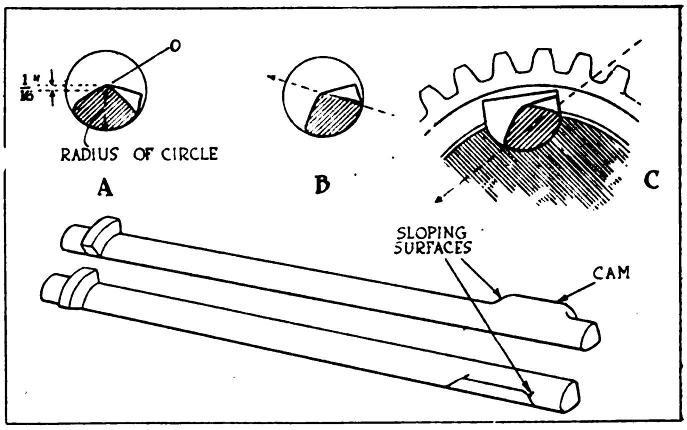


Fig. 3—Keys by which the transmission action is secured

the teeth in any of the gears, even with clutch in. The key shifting yoke at the extreme forward end of the layshaft has just enough play in it so the key slips into position under the selected gear, even though the driver attempts to make the shift very slow. This action is hastened by the sloping surfaces of the keys.

All gears are 6-8 pitch, with the following ratios: Reverse, 1 to 4.81; first, 1 to 4.00; second, 1 to 2.62; third, 1 to 1.50; fourth, 1 to 1.00.

The cam plate which works in conjunction with the key shifting mechanism makes it possible to use but a single rod between transmission and lever set. The cam plate also acts as a locking means for each speed. Thus, to pull the sliding gear out of high to another speed without operating the pull rod it would become necessary to shear the cam plate itself, which in a 2- to 3-ton job is ⅜ in. thick. With the cam plate layout it is impossible to get two speeds at one time.

Concerning lubrication, it is pointed out that the lubricant will last for a very long time, as the gears do not revolve constantly and therefore will not wear out the oil or grease. Also proper oiling of the gears on the collars is accomplished by the keys themselves, which act as pumps, carrying the oil back and forth in the grooves of the layshaft.

Tractor Problems That Are Awaiting Solution

(*Continued from page 583*)

two. The development of gearsets has not been as aggressively carried on as the development of tractor engines and a few other parts in which well-established companies with long experience have devoted their best efforts to the work.

Keeping dust out of engines is still a troublesome problem. Experiments have shown that improved crankcase breathers are needed. The conventional one will not keep out the dust in certain sections. The development of an air filter is being carried ahead, but this, too, has scarcely reached the parting of the ways, the branching toward water types and centrifugal types. Heretofore size has been too much of a factor. Some are very small but also inefficient. If the efficient filter must be large then let it be made adequately large to do the job.

There is a real lack of a rational tractor seat. The present seat, a hand-me-down from self-binder or mowing machine days, is not suitable. We place a good seat on a motor truck, or any kind of a car and then when it comes to a tractor we put on a seat intended for horse apparatus. Too frequently it is in the center of the machine, whereas it should be closer to the right side so as to afford a good view of the furrow or the other work. Too frequently it is not adjustable; it is not large enough, it cannot take a good cushion. Only one or two makers have as yet recognized that an adjustable seat is needed and that if the operator is to take the best care of the tractor and get the best out of it he should be made as comfortable as possible.

There is need for fenders and a platform for the operator. A tractor operator should not live in a cloud of dust when a standing platform and fenders will prevent it. The fenders are needed for safety. A good tool box should also be provided.

Tractor makers are recognizing that different soil conditions and different crop requirements call for changes in tractor features. The idea that one design will best fill every requirement is being exploded. The blanket tractor, that will do any job in any country in the world, is losing out. Some makers of creeper types have wider creeper belts for the rice country. At the same time that this has been done some wheeled types have been spending large sums vainly endeavoring to demonstrate that the identical size of wheel will do in the rice lands that does in the hard soil. A movement for differentiation has set in. One large maker has a new tractor which he has been selling in the East but not in the West. It is better suited to the hilly areas of the East than some of his older models.

It seems highly probable that different diameters and different widths of wheels may have to be sold with the same tractor, one for a hilly country and the other for a level area; one where the soil is hard when being cultivated and the other where it is soft. If wheel diameters were standardized how easy it would be to give the farmer what was best for him and what was also best for the tractor. Standardization may demand that we go a step further. Wheels may be made with standardized hubs so that one type of wheel can be interchanged with another.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, March 13, 1919 No. 11

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 2727

Cable Address - - - Autoland, New York
Long Distance Telephone - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - One Year, $3.00
Canada - - - One Year, 5.00
Foreign Countries - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.
Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.
Member of the Audit Bureau of Circulations.
Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repair man (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907

Quantity Production Fours

THE evident demand for light-weight, high-quality cars has caused a noticeable tendency toward the increased production of four-cylinder cars. These are not merely brought out by a few scattered, unknown concerns, but some of the best known companies that have been successful in the four-cylinder and other fields are bringing out these cars.

As evidence of this there are the Essex brought out by members of the Hudson company, the new Cleveland brought out by officials of the Chandler company, the new little Overland which will shortly be in big production, and in addition there are reports that other prominent makers will soon be out with four-cylinder designs.

There have been a great many who have predicted the day of the four-cylinder car would come back and that one of the greatest results of the multi-cylinder popularity would be the increased demand for good performance from the four.

Certain it is that it took the multi-cylinder car to show us the creamy smoothness of power, which is so much appreciated by the owner.

Owners who drive their cars around the city for business purposes are demanding more and more a light-weight, high-quality vehicle, which is economical to run and yet which has all of the qualities of acceleration, good appearance and serviceability of the heavier and more expensive types.

Doubtless there are a number of advantages for the long wheelbase, heavy type of car for cross-country work. For the city, however, where the smooth pavements and all-around good traveling conditions exist, it must be admitted that it is folly to utilize the high-powered engine, which not only is wasteful from a fuel standpoint for such use, but which has an absurd ratio of weight to the service rendered. The influx of high quality, small, four-cylinder cars for all-around business use will be welcomed by those who have the true interest of the industry at heart.

Testing Airplanes in Flight

IN no other line of engineering work is the designer so in need of accurate experimental data as in airplane design. It is generally permissible to work with a liberal safety factor, which compensates for any inaccuracy in the calculations or assumptions. For good reasons the safety factor in aircraft must be kept low, and it is therefore of the greatest importance that the calculations for strength of parts, stresses on same in flight, power required for propulsion, etc., be of the highest possible degree of accuracy and based on thoroughly trustworthy data.

So far most of the constants and design factors to be used in airplane design have been determined in the laboratory. The properties of wing sections and of different forms of struts, landing gears and bodies are studied in wind tunnels in which air currents approaching in speed those of a plane in full flight are artificially produced. Power plants and propellers are tested on dynamometer stands, and to simulate as closely as possible the operating conditions in the upper atmospheric regions these tests are now being carried out in a vacuum chamber.

It was felt, however, that there were certain factors which an aircraft designer must know which can be accurately determined only on an airplane in flight. For instance, in a wind tunnel, lift and drift experiments can be made only on reduced scale models and there is then the possibility of committing errors in applying the results to the calculation of the full-sized machine.

Consequently, the Bureau of Standards in collaboration with the National Advisory Council has decided to develop recording apparatus for determining the engine torque, speed of revolution, plane speed, propeller thrust, angle of attack and inclination toward the horizontal. Some of these devices, as, for instance, a recording tachometer for the engine and a recording air speed meter, involve no special difficulties, but we are inclined to consider

the development of some of the others, notably the engine torque recorder and the propeller thrust recorder, problems of very considerable difficulty, on account of the great forces involved and the strict limitations on space and weight on an airplane. Yet we have not the least doubt that all problems will be fully solved and that the use of the apparatus when completed will yield test results that will prove of the utmost value to airplane designers. As all test records will be timed and the timing will be synchronous, it will be possible to study the inter-relations of the different power and resistance factors in flight.

Closed-Cab Advantages

THERE is no such thing as finality—there is always room for improvement and there is always a demand for any refinement which tends to improve the condition of the worker. New York and Chicago truck shows offered a concrete example of these axioms in the case of the enclosed truck cab, a feature of improvement which has been evolved from the plain board seat, the upholstered seat, the open cab, and now the cab which insures protection to the truck driver from the inclemencies of winter weather.

Closed cabs may cost more, but in compensation for their added cost they exercise a two-fold effect. In a material way they tend to increase the working capacity of the driver by reason of the bodily protection afforded, with a corresponding increase in the earning power of the truck to which they are fitted. In an abstract way the closed cab has its effect on the mental make-up of the driver. He starts on a long haul secure in the knowledge that he will arrive at the end of his trip dry and comfortable, his temper remains equable and the physical service he renders is but a reflection of his mental state.

Comfort in Tractor Operation

IT is undoubtedly too early to attempt to standardize tractor controls, but designers individually can strive to arrange their control levers, handles and pedals so that they can be conveniently reached and operated from the seat.

There are some good examples of control layouts, but there are even more examples of poor ones. There is less need for standardized control than on automobiles, as there is no danger of a driver having become accustomed to one form of control meeting with an accident while operating a tractor in which the control devices are differently arranged. Tractor speeds are too low for this.

But the pedals and levers should be within easy reach of the driver, their range of motion should not be excessive, nor should the effort required to operate them such as to cause fatigue to the driver.

Another point that bears directly on the comfort of the driver is the type of seat and the provision for foot rests. The seat should, of course, be spring supported, so that the driver is to a certain extent protected from the shocks incident to ground unevenness. The old style of implement seat is in almost universal use and has the advantage that it is not affected by the weather. Some makers have provided cushioned seats. Owing to the habit of farmers of leaving their machinery in the open in rain or shine it is doubtful whether a permanently cushioned seat is advisable.

It would rather seem that a pressed steel seat so designed as to permit the use of a removable cushion would be preferable. Owing to the somewhat higher speed, and for other reasons, it seems desirable to make the sides and back of the seat somewhat higher than has been customary, so the driver may sit more securely therein.

Foot rests deserve more attention. If the driver must occupy an absolutely fixed position all day long it is very tiring. This is the case if only foot rests of shoe-sole form or stirrup form are provided. There is certainly a great advantage in having regular floorboards, so that the operator can change the position of his legs occasionally or can even stand up if he desired. These floorboards need be neither heavy nor expensive and they are certainly worth their cost.

The same as it pays to look after the health and comfort of industrial employees it will pay to take some of the rough edges off the tractor operator's life. In order to do the most work and the best kind of work the operator must enjoy bodily comforts.

Manufacturing Difficulties

CONCERNS which were fortunate enough to make as war products their own particular line of wares are in a much happier position to-day than those who had to go into lines that varied greatly from what they made in a commercial way.

The disruption of previous sources of supply is one of the chief difficulties. The uncertainty of the materials market is such that at the present practically everyone is waiting for breaks in prices which may or may not occur. The result is that buying is largely a hand-to-mouth proposition and long time material contracts are scarce.

This is not a good condition of affairs either for the manufacturer or the parts maker. The manufacturer is of course very wary of being caught with an unbalanced inventory and he is not going to contract for large supplies of anything as long as he is uncertain that other important parts may be late in arriving. The lesson of the cost of the unbalanced inventory has been too well learned.

It is agonizing to many manufacturers to see good labor slipping away from them when the war contracts are canceled simply because they are not able for various reasons to swing immediately over to peace production. This is particularly true in plants which are somewhat out of the way and where the labor has been gathered together for war work, but is now compelled to leave in search of other employment. These manufacturers know that in a few weeks they will be needing this labor badly and then it may be difficult to secure it.

Latest News of the

Measure to Regulate Aviation

Need for Temporary Measure Recognized—Licenses Under Secretary of Commerce

WASHINGTON, March 10—Although there has been no wholesale attempt to control or regulate future aviation in this country, or to formulate aerial laws as has been done in Great Britain by the Civil Aerial Transport Committee, there is a serious movement on foot looking toward future aerial regulations and development.

Officials in this country do not believe that the time is ripe for the formulation of complete permanent laws governing aviation. They point to the peace conference from which there may be issued an international law for aviation.

However, there is a general recognition of the need for some temporary regulations for flying and for the development of the aviation industry. Disappointment was expressed when the army appropriation bill provided for an air service of 1923 officers and 22,000 enlisted men, an organization which would only keep a maximum of 2000 airplanes in constant service.

The aviation industry in the United States, it is felt, should be encouraged as Great Britain is planning to encourage her aircraft manufacturing, by purchasing and using sufficient machines for the Navy and Army even though they are not immediately necessary and may be operated at a loss.

The Post Office also, it is said, should plan for a much wider immediate development of aerial mail so as to encourage the industry and keep it alive until it is a commercially profitable proposition. During the recent Congressional filibuster the army appropriation bill was "killed," and it is anticipated that the new bill which will be presented to the next Congress will call for a larger organization.

It is also planned to introduce at the next session of Congress a bill governing aerial navigation in the United States and its dependencies between the United States and foreign countries which will provide for the control of flying other than that for the Army, Navy and Marine Corps by the Department of Commerce, authorizing the Department of Commerce to license fliers and to publish and formulate rules and regulations for aerial navigation. The law provides for a report from the Secretary of Commerce to Congress no later than Dec. 10, 1919, of his action under this law and appropriates $25,000.

Original plans by the National Advisory Committee for Aeronautics, which has recognized the need for aerial navigation regulations, calls for a complete, comprehensive draft of law such as that of Civil Aerial Transportation Committee of Great Britain.

Toward this end the committee called a conference of representatives of the Departments of State, Treasury, War, Navy and Commerce. A subcommittee was appointed and an actual draft of aerial laws to be presented to Congress was drawn up. Under the plan it was intended to place all aviation under one head. Due to the fact that it would be difficult to assemble all air activities including those of the military and naval establishments under one civil head and also because the Peace Conference may completely alter present opinions regarding the air traffic, these plans were abandoned and it was decided instead to place the entire control of civil aerial transport under the Department of Commerce, leaving the army and navy independent.

Furthermore, it was decided that only temporary regulations should be devised, and the bill drawn up by the executive committee of the National Advisory Committee, headed by Dr. C. W. Walcott, chairman, and Dr. S. W. Stratton, secretary, therefore authorized the Secretary of Commerce "to make and publish all needful rules and regulations with the provision that he report his actions together with recommendations for further and more detailed legislation to Congress in December."

The proposed law was submitted to Secretaries Newton D. Baker, Josephus Daniels and William C. Redfield and approved by all three. The complete text follows:

"That no person, company or corporation within the jurisdiction of the United States and its dependencies, other than duly accredited officers and enlisted men of the Army, Navy and Marine Corps, shall use or operate any aircraft in aerial navigation from one State or Territory of the United States or the District of Columbia, to any other State or Territory of the United States or the District of Columbia, or from one place in a State or Territory or the District of Columbia to another place in the same State or Territory or the District of Columbia, or between the United States or its dependencies and any foreign country or any international waters, except under and in accordance with a license, revocable for cause, granted by the Secretary of Commerce upon application therefor; and the Secretary of Commerce is hereby authorized to grant such licenses and to make and publish all needful rules and regulations for the licensing and navigation of such aircraft; any violation of such rules or regulations to be punished by a fine not to exceed $500; and the Secretary of Commerce shall submit, by December 10, 1919, a report to Congress, giving in detail the action taken by him hereunder, together with his recommendations for further and more detailed legislation with respect to the navigation of aircraft and the licensing and regulation thereof. For the enforcement of this Act and the rules and regulations made in pursuance thereof, including personal services in the District of Columbia and in the field, the sum of $25,000 is hereby appropriated."

—

Gen. Mitchell to Head Air Service

WASHINGTON, March 11—Maj.-Gen. William L. Kenly, Director of Military Aeronautics, was relieved of that post to-day and in his permanent grade of colonel was ordered to report to the Chief of Field Artillery for duty. Brig.-Gen. William Mitchell, who has been in charge of the Flying Service of the American Expeditionary Forces, and who formerly had charge of the Flying Section of the Signal Corps, will be detailed to command the Army Aviation Service.

Ford Starts Plans for New Car

Edsel Ford Not to Resign—Dodge Brothers to Contest the New Venture

DETROIT, March 11—Henry Ford and his son Edsel returned to Detroit to-day, and the automobile manufacturer immediately started work on plans for his new car, which he hopes to sell at $250 or $300. How long he will continue this work is problematical for it is said attorneys representing the minority stockholders of the Ford Motor Co. are preparing to serve an injunction, halting further work and bringing the whole affair into court.

In newspaper interviews to-day Mr. Ford corroborates all statements made by himself or his son in Los Angeles and Kansas City relative to his new enterprise. He added a few more unpublished facts and discussed his proposed car in a more detailed way.

Edsel Ford will not resign as president of the Ford Motor Co. He will remain to protect the Ford interests. The Fords propose a factory organization five times that of the present Ford company, and when in full operation over 200,000 men will be on the new Ford pay-roll. One of the big plants will probably be located in Detroit.

Mr. Ford declares there will be a great and immediate demand for a car such as he proposes to build. It will embody everything necessary for a real family automobile. It will have all improvements and refinements that have been developed in recent motor car manufacture.

"The present Ford engine, Model T, was designed 12 years ago," said Mr. Ford. "Nothing of the old car will be used in the new manufacture. It will have an entirely new engine and new features. It will be just what the public wants. It is impossible for me to give you the exact details of the new car yet. Model T took 2 years and 4 months to perfect, so you see it may possibly take me a year before I have my new plan completely worked out."

Elliott G. Stevenson, of Stevenson, Carpenter, Butzel & Backus, attorneys for Dodge Brothers, declares neither Henry Ford nor his son Edsel will be allowed, without a legal fight, to withdraw from the Ford Motor Co. to manufacture a cheaper automobile for commercial purposes and which would antagonize present Ford interests. He says the Dodge brothers will contest the Ford withdrawal to the limit of the law.

"There would be no attempt to keep either Ford or his son in the firm if they desire to retire, but Henry Ford is under contract to

(Continued on page 617)

Automotive Industries

Government and Industries to Co-operate in Stabilizing Trade Conditions

Department of Commerce Industrial Board Will Function as Did Old War Industries Board But Without Definite Control—Reduce Basic Prices

WASHINGTON, March 10—That the Government will take a keen interest and supervisory attitude toward industry and will attempt to regulate prices of basic commodities is evidenced by the results of a meeting held here by the Industrial Board of the Department of Commerce, organization of which was told of in AUTOMOTIVE INDUSTRIES last week.

The board, which includes George N. Peak, formerly of the War Industries Board, and vice-president of Deere & Co., as chairman, comprises Samuel P. Bush, president of the Buck-Eye Steel Casting Co.; Anthony Caminetti, Commissioner of Immigration; Thomas J. Glenn, president of the Atlantic Steel Co.; George R. James, president of the Moore Drygoods Co., Memphis; T. C. Powell, Railroad Administration, and W. M. Ritter, president of the W. M. Ritter Lumber Co.

At the first meeting of the board it was generally agreed that although commercial stocks are depleted, money plentiful, building construction demanded, foreign trade prospects good, and the long period of forced economy relieved, yet the public is buying timidly and purchasing is decreasing in volume. Money is also timid and remains in the banks, construction of public and private works has not commenced, non-employment apparently is spreading and few factories are running full.

The first concrete step to alleviate these conditions will be a conference here Wednesday of a committee of steel and iron men with the board, at which it is planned to reach an agreement on lower prices for iron and steel to relieve the present business stagnation.

The cause for these conditions, it was decided, lies in the abnormal and abortive increased production of special war commodities, with the consequent increase of prices, leaving a highly inflated and irregular market far above what the peace demands will support.

The normal operation of the law of supply and demand, it was said, did not cause this condition, and consequently cannot cure it, and with the realization that some prices must fall there is little purchasing until they do fall, and we have as a result an unstable and dangerous market condition. Some of the uncertainty, it was decided, results from the Governmental accumulation of raw, finished and partly finished material which must be fed very carefully into the market.

The remedy, it was agreed, lies in curing the condition as it was caused. It was caused by the co-operation of the industry with the Government in the war and can be cured by the co-operation of the industry with the Government during these present peace times.

To this end the Industrial Board plans to operate as did the War Industries Board, but without the definite control which that board exercised. The Industrial Board plans a general co-operation with all industries, first, by reducing the basic commodities such as steel, to a stable basis.

The industries affected will be invited into conferences for the purpose of bringing prices of basic commodities to a normal level. It is expected that this will automatically reduce the price of fabricated articles. If it does not so operate in any instance the industry affected will be invited into conference.

It is expected that industry will agree to the policy of the board, which is that the cost of living must be substantially reduced before labor should be asked to accept lower wages. This of course must mean that industry must stand the first shock of readjustment.

In discussing this problem and this plan of fixing prices co-operatively, objections to the plan were noted and debated. It was decided that business resentment of Government interference and control could not be regarded as an argument against the plan inasmuch as the Government co-operated helpfully with industry during the war. What is proposed in this new plan is not Governmental control. The board has no power of control and plans only to provide a forum in which industry can meet and agree on a policy for this at Government instance and with the approval of Government.

The board also expects to solve the problem of redistribution and readjustment of labor by stimulating peace industries through the price-fixing plan.

That many of the industries will have to take a loss on products purchased at war prices if there is a general reduction in selling prices it was agreed is true whether the proposed plan is attempted or not, but at least it is expected that buying will begin again and the continued business will overcome the overhead which would be vastly greater if the present period of stagnation continues.

The activities of the Industrial Board will only be temporary and will endure until the gap between war and peace is closed, when a law of supply and demand will again be allowed to operate normally. The offices of the board will be located in the Council of National Defense Building, Washington.

—

TO MAINTAIN 22 FIELDS FOR AIRCRAFT

WASHINGTON, March 13—The War Department has arranged to maintain twelve temporary flying fields, which will be used for storage purposes, four permanent balloon fields and four permanent training fields, and at least two experimental fields.

The first intention to retain only two training fields was abandoned when this number was found insufficient, and in consequence Arlington Field, Houston, Tex.; Post Field, Ft. Sill, Okla.; Kelly Field, San Antonio; Rockwell Field, San Diego, Cal.; have been chosen as the permanent training fields.

The twelve fields to be maintained for storage purposes have not yet been definitely named. The War Department believes it can store its hundreds of elementary and advanced training planes for a period of years without deterioration. Langley Field will be retained as one of the experimental fields; McCook Field will be given up, as the city of Dayton wants this property back. Wilbur Wright Field, which has been suggested as an experimental field, will not be used, because of the possibility of floods.

The Air Service would like to purchase the Dayton-Wright plant and use it for its main experimental depot. The Dayton-Wright equipment includes an excellent experimental field and a number of structures, including buildings as large as 1000 x 300 ft., and is considered by the Air Service as especially suitable for experimental work. If this plant can be purchased the Air Service will move its present repairshop from Indianapolis to Dayton. The Government already has a large financial interest in Dayton-Wright, due to war financing, and the balance of the purchase price would consequently be insignificant. In the event that the purchase of the Dayton-Wright plant cannot be consummated some other site in the Middle West close to the airplane and engine factories will be selected.

—

May Sell Army Trucks

WASHINGTON, March 12—In view of the decreased size of the Motor Transport Corps and the entire army, as provided for by proposed legislation, it is now considered possible that a large number of war trucks may be sold. The National Automobile Chamber of Commerce has already informed the War Department that it desires first knowledge of any proposed sales and the opportunity to work out some scheme whereby the manufacturer will be protected. The Motors Vehicle section of the Army has assured the N. A. C. C. that it will co-operate with the industry.

—

No Plans to Sell Planes as Junk

WASHINGTON, March 12—The War Department denies knowledge of any plan to sell any airplanes as junk, in refutation of newspaper dispatches published this week to the effect that army airplanes would be sold at ridiculously low prices.

Will Pay Promptly on Contracts

Additional Regulations Promulgated to Speed Liquidation of All War Debts

WASHINGTON, March 11 — Additional regulations for the payment and adjustment of war contracts have been compiled by the Assistant Secretary of War, Benedict Crowell. They include provisions for the payment of all proper items of expense to contractors without awaiting full settlements of contracts provided they can be properly vouchered as items of cost. Provision is also made to expedite payments under termination clauses where contractors waive rights to proceed with further production and accept the notification of the termination of the contract. Where this is done it is not necessary to await final determination of the total amount of the payment due the contractor, but instead, payments can be made as rapidly as determination for raw material, commitments to sub-contractors, etc.

The provision allowing partial payment of 75 per cent of the contracts as determined by the War Department is included, and Claim Boards are authorized to make these payments when it expedites settlements of outstanding contracts.

In every instance where a prime contractor has to negotiate the settlement of a sub-contractor the local Claims Boards are urged to be prompt in determining what basis of settlement it will approve.

An interpretation of a recent circular, No. 111, with regard to compensation for capital tied up in raw material, decided that so far as the contractors have properly made expenditures and incurred obligations in the performance of contracts the War Department should provide for reimbursement of such expenditures with a reasonable remuneration for the use of capital and service of the contractor, making an allowance up to 10 per cent on the cost of the articles in process, and in addition, in the case of cost plus contracts an extra compensation estimated at the rate of 6 per cent per annum of the capital tied up in raw materials should be allowed, or if the capital tied up in raw materials was borrowed the contractor is to be allowed the rate of interest which he pays for it, provided that this is not already carried in other charges by the contractor.

—

Sales Control Board for Surplus Supply Settlements

WASHINGTON, March 11—A Superior Board of Sales Control has been organized, comprising the Director of Sales and the Chief Sales Officer of each sales organization under the various bureaus of the War Department. This board will consider all problems affecting the sale of war surplus supplies, and will formulate the policies and principles covering these sales. It will be the highest body in charge of sales under the Director of Sales, and will have under it Local Boards of Sales Control organized in each supply bureau and department which will form the administrative bodies.

These boards will comprise the heads of the particular sales organizations in each supply bureau and such other members as the Chief of the Bureau will select. Special material boards may be organized when necessary to handle the sale of certain specified materials in each department.

—

No Army Vehicles Have Been Sold in France

PARIS, Feb. 22—No American Army automobiles have been sold in France, and no decision has been taken regarding disposal of army automobiles now with the Expeditionary Forces, according to a statement made by Gen. M. L. Walker, director of the Motor Transport Corps in France.

This definite statement puts an end to the wild rumors which have been circulating in France for the last few weeks to the effect that the American government had insisted on the French absorbing all the motor vehicles owned by the American forces in France. Assuming, without any foundation whatsoever, that France had to absorb the 80,000 American army trucks, many newspapers have been crying scandal and have endeavored to stir up trade animosity.

—

Parsons Enlarges Its Plant

DETROIT, March 11—The Parsons Mfg. Co. has purchased an adjacent building having floor space of 30,000 ft. Another addition is under construction and will be completed shortly.

—

Clayden Leaves Wright-Martin—To Open English Office

NEW YORK, March 12—A. Ludlow Clayden has resigned as consulting engineer for the Wright-Martin Aircraft Co., a position he has held since the winter of 1917. He will establish a consulting engineering business in London early this summer, and will specialize on the investigation of European propositions for American manufacturers. He believes that as soon as tariff questions have been settled connections between America and the allied countries of Europe will be much closer than before the war, and plans to spend a large part of his time in this country.

Clayden spent most of 1918 in Europe studying the methods of manufacture of the Hispano-Suiza engine and its applications to allied airplanes. Previously he was engineering editor of AUTOMOTIVE INDUSTRIES for 3 years and chairman of the Standards Committee of the S. A. E. from 1915 to 1916. He plans to sail for England in about 60 days.

Sell Surplus Aircraft Material

Materials Disposal Section Formed—Machinery to Be Sold at Appraised Price

WASHINGTON, March 10—There has been formed a Material Disposal Section of the Bureau of Aircraft Production, organized on a basis similar to that followed by large commercial houses which handle sales through branch offices. This section will be under the direction of 1st Lt. Charles S. Shotwell. Sales will be made under the supervision of a sales manager stationed at Washington.

The Bureau of Aircraft Production will probably have for sale the following classes of material, and as soon as this material has been established as surplus and policy for the sale of same determined, the bureau will issue bulletins covering the material for sale.

Machine tools and fixtures.
Electrical machinery.
Dies, tools, jigs and gauges.
Chemicals, paints and oils.
Metals.
Motor Accessories.
Lumber.
Hardware.
Buildings and Lands.
Fabrics.
Scrap.
Shop equipment.
Office equipment.
Miscellaneous.

Sales negotiations will be handled by salesmen in each of eight district branches, to be located in Boston, Buffalo, Chicago, Dayton, Detroit, New York, Pittsburgh and San Francisco. These salesmen will be authorized to make sales of property wherever located, after the same has been cleared by the Board of Sales Review of the Office of the Director of Sales, so that the prospective buyers will communicate with the branch office in the city located nearest them.

This arrangement, it is expected, will make it possible for manufacturers needing machinery and supplies to purchase conveniently and at fair prices. The salesmen will have full authority to sell at the best offer made, provided that offer is at or above an appraised value arrived at independently, or at market value in the case of raw material.

—

Piehl Elected President of Chicago Automobile Association

CHICAGO, March 11—L. A. Piehl, Mitchell dealer, was elected president of the Chicago Automobile Trade Association at its fifteenth annual meeting. Other officers elected were: Secretary, R. C. Cook, Fiat dealer; treasurer, Thomas H. Hay, Chandler dealer. The new directors are: G. R. Dashiell, Dodge dealer; H. P. Branstetter, Kissel, and Charles Gambill, Marmon.

The result of the show held here by the association was $15,000 profits after rebating to the dealers 75 per cent of the cost of their space.

England Lets Down Bars Against Canadian Products

Will Permit Imports of Products Manufactured Entirely Within Domains of British Empire—Action Will Stimulate Canadian Manufacture

NEW YORK, March 13—Although it is reported from Washington that England has modified her restrictions to the extent of allowing imports from British colonies, official confirmation of the report has not been made nor has the Department of Foreign and Domestic Commerce any information on the subject. It is reported from Ottawa, however that the embargo on imports has been lifted insofar as British colonies are concerned.

Ottawa Confirms Report

DETROIT, March 13—A cable to the Trade Commission in Ottawa confirms and supplements a report published that the British Board of Trade has announced a definite removal of all restrictions of imports into Great Britain which come from within the British Empire. The Canadian mission in London further states that the Trade Board regulations will insist that goods of only British Empire origin shall be exempt from the rigid general restrictions which were imposed in continuation of wartime trade regulations. Canadian manufacturers should comprehend the importance of the fact that foreign goods cannot, therefore, reach England by way of Canada.

Willys-Overland and other big manufacturers declare that Great Britain cannot possibly manufacture enough cars to supply the British demand, and that within the next month or two the embargo against American made cars will be lifted. They are sitting tight waiting for further action on the part of Great Britain.

Would Encourage Canadian Manufacturers

DETROIT, March 12—The lifting of the embargo by England, which is now accepting imports from her colonies, will have a tendency to promote complete manufacture of American automobiles in Canada. This is the belief of several Detroit manufacturers operating Canadian plants.

Whether this will give Detroit makers a clear pathway into England through the Canadian branches is problematical, but it is certain that few would take advantage of such subterfuge to gain a European market. The ultimate tendency, they declare, will be enlargement of Canadian assembly plants into Canadian manufacturing plants turning out cars complete.

The Canadian Ford company will not be affected. This company will have its hands full caring for Canadian territory, while the Manchester plant will look after British and European business. The Manchester plant is now running 300 cars weekly, but is not making all of its parts as yet.

No Australian Embargo

NEW YORK, March 13—The report to the effect that Australia had declared an embargo against all commodities not of British origin is not entirely in accordance with facts. Cable dispatches from Melbourne state that some confusion has arisen and that the embargo is intended to cover only dyestuffs.

Preliminary Tax Interpretations

NEW YORK, March 12—Although no formal written interpretations of the new war revenue bill have been made, the National Automobile Chamber of Commerce has had a number of lengthy conferences with the officials of the Revenue Bureau on all phases of the new act. In consequence, formal written rulings by the bureau are promised for the immediate future.

In the meantime, and in consequence of these conferences, the N. A. C. C. is pointing out to its members that it seems likely that certain sections of the law will be interpreted about as follows:

All exports of automobiles, and tires, inner tubes, parts and accessories will be exempt from the tax, no matter whether the export is made direct by the factory or through any number of intermediaries. This export exemption is therefore broader than under the old law. All that is necessary is for the manufacturer when he makes the sale, to be able to determine that the sale is for export and that in due course the article is eventually exported.

The Commissioner will shortly issue regulations as to how the intent to export shall be shown. Meanwhile bills of lading and other papers involved in the transaction should clearly show that the shipments are intended for export.

Shipments to the Philippine Islands, the Virgin Islands and Porto Rico are considered export shipments, but the Panama Canal Zone, Alaska and Hawaii are considered part of the United States.

Sales of automobiles, tires, inner tubes, parts and accessories to the Federal Government, to a state or political subdivision thereof will continue to be tax free under the new law, and it will not be necessary to first obtain certain written documents from the buyer. The statement of the manufacturer that the car is sold to the exempt party will be sufficient.

Under the new law the taxpayer who sells both at wholesale and retail may estimate the tax on the retail sales on his customary wholesale price, the customary wholesale price being his highest usual wholesale price, or the wholesale price bearing the least discount.

While there is no floor tax under the new law, manufacturers of automobiles, tires, inner tubes, parts and accessories who have on hand such articles made before Feb. 25, 1919, will be subject to the tax when they sell these articles.

Under the new law no self-propelled fire extinguishing apparatus will be considered a taxable vehicle. This is a broadening of the old law under which certain particular types of fire extinguishing apparatus were considered taxable automobiles.

As the new law contains a penal section (1319) making it a misdemeanor to misrepresent to the purchaser the amount passed on and alleged to be the tax, it is extremely unsafe for taxpayers to use the so-called average tax method.

The most troublesome provision of the new law is the tax on tires, inner tubes, parts and accessories. The Revenue Bureau is having considerable difficulty in getting an exact and workable definition of parts and accessories. It will probably rule that substantially complete manufactured articles of commerce which form parts or components of a complete automobile or which are attached to or used with an automobile are taxable parts and accessories, provided they are primarily intended for such use. This would mean that sheet metal, lumber, leather, wire and the like would be considered 'material' and not taxable. Also that incompletely manufactured articles such as forgings for crank shafts, blanks for gears, and the like would not be taxable. Likewise completely manufactured articles such as ordinary bolts, rivets, screw drivers, wrenches and the like would not be taxable because they are not primarily intended for the automobile but have many other uses.

Spark plugs would probably be considered as primarily intended for automobiles and therefore taxable. The ruling on ball bearings is debatable.

Whatever may be the proper definition of parts and accessories another troublesome point is that sales of such parts and accessories as well as tires and inner tubes to automobile manufacturers are exempt from tax. The Revenue Bureau will probably rule that the sale of such articles by their makers to automobile manufacturers who intend to embody them in their product will be tax exempt, but that any excess purchased for the purpose of replacing defective parts or of selling to car users to replace articles worn out in use would be subject to the tax, with the right of the taxpayer to obtain a refund or credit of taxes if it can be demonstrated that the articles were either given in replacement or were embodied in the complete automobiles by the factory. Parts or accessories which are usually charged for pending settlement of the question as to whether they should be free replacement parts are tax free, but of course are treated as a taxable sale if, and when it is found that the returned part is not defective. It is advisable to make shipment of such replacement parts on memorandum.

In other words, the Bureau is inclined to consider that the factory when it makes the cars is operating as an automobile manufacturer, but when it sells repair parts it is not, and therefore the sale for this latter purpose is not exempt from the tax. This is considered highly unsatisfactory and steps are being taken to obtain a more practicable ruling.

Meachams Organize Gear Corp.

SYRACUSE, March 12—The Meacham Gear Corp. has been organized to take over the New Process Gear Corp., the manufacture of rawhide pinions by the process developed under the Meachams' direction. Officers of the new corporation are: President, T. G. Meacham; vice-president, T. W. Meacham; treasurer, J. F. S. Meacham. It is incorporated for $300,000 and has purchased a 3-story building at 411-415 Canal Street. George W. Wood, who is secretary, will act as superintendent, and H. W. Kiddle as assistant superintendent.

New Dodge Four-Door Sedan

NEW YORK, March 11—Dodge Brothers dealers are expecting deliveries within the next two weeks of a new four-door sedan which will sell for $100 more than the present two-door model, making the price of the new model $1,876. The chassis will be the same as at present.

New Device to Measure Gas Consumption

ST. JOSEPH, MICH., March 11—The "Silent Guard," a new device for measuring gasoline consumption and tire mileage, is being manufactured by the Upton Machine Works. The Silent Guard Co. opened offices in the Owen building.

Flint Facing an Era of Prosperity

Community Has No Unemployed—Big Production Plans Under Way—Wages High

FLINT, March 7—The last traces of war are being removed from Flint industries. The automotive plants here are winding up their war contracts, and the last government cars, motor trucks, trailers, etc., are already complete or are now leaving the assembly line. The city has withstood the shock of from-war-to-peace reconstruction well, weathering this trying period without a suspension of business or suffering a serious labor surplus. Few automotive cities have recovered so quickly the normal tenor of industrial activity. Few cities are to-day facing a brighter business future than Flint.

The armistice in November found Flint working over-time on war work. Buick, Dort and Chevrolet were bending all efforts to the production of war vehicles. Labor was at a premium. Wages were touching high marks theretofore unknown. The cost of living was climbing correspondingly. More men were being employed than ever before. Marvel Carburetor and Champion Ignition were rushing work on carbureters and spark plugs for war machines and aircraft engines. Flint was up to its neck, so to speak, in war activity, and most of its manufacturing plants were hitting the 100 per cent war production basis requested by the Government. Others were rapidly approaching this mark.

Plants Continued Operation

Flint met its reconstruction problem squarely. Its big automobile plants, in the face of canceled or greatly reduced contracts, continued operation. The men stayed on their jobs. One or two departments closed up for a few days, but comparatively few men were out of work. War work was cast aside. Everything depended on the rapidity with which the plants could get back into commercial production. For five days Dort produced no war or peace vehicles, but every man was employed at inventory work. Although conditions merited laying off at least 4000 of the 13,000 Buick employees, President Walter Chrysler kept every man on the job at the regular war-wage basis.

Flint reconstruction and just how the big men of the city met and solved their many serious problems is a story in itself. They not only cared for their laboring men but they launched an assault on the high cost of living which resulted in a cut of 15 per cent in the price of rent, clothing, eatables and other necessaries of life.

To-day, not quite four months from the day the armistice was signed, finds Flint factories back at normal. Buick is making 400 cars a day and is daily increasing the number of men employed and its production. Dort is making 65 cars daily, which is 15 cars more than it ever made before. The W. A. Paterson Co., which practically did nothing during the year of the war, has resumed normal work, giving employment to 150 men, who are turning out 20 machines a week. Flint Varnish Works, Imperial Wheel Co., Champion Ignition Co. and Marvel Carburetor are rushed with work, and their respective sales departments are flooded with new orders.

There is no question but what this city is facing a great future. It is practically a General Motors town, and the General Motors Corp. is planning a great period of expansion during the next two years. The Buick Motor Car Co. can see nothing ahead but prosperity. President Walter Chrysler publicly states that his concern will be making 1000 cars daily in 1921, doubling its present manufacturing facilities and the number of men employed.

New Plants Building

The Buick company has added several new building units. Rumor has it that Chevrolet will soon be housed in a new factory plant, and the Dort Motor Car Co. has purchased a site on the east side of Flint and is preparing to build, it is unofficially said. The Marvel Carburator Co. will be in a new factory building this year, which will permit this company to double production. The Champion Ignition Co. is now using the buildings erected for war work, but is in great need of further expansion. If this company's business continues to increase more buildings must be built, an official of the company said.

Organized labor is getting firmly established in Flint. This has always been a nine-hour town, but many of the factories are now coming down to an eight-hour schedule. The Buick company and most of its subsidiary organizations are now on an eight-hour basis. The Dort company was the first concern to adopt eight hours as a working day. Chevrolet is still running on a nine-hour schedule, however.

Unemployed from Detroit

Employment men declare that the slight labor surplus recently experienced was not due so much to Flint industrial concerns laying off men as it was due to an influx of unemployed from Detroit and other neighboring cities, where the complete suspension of many big plants threw thousands of men out of employment. Scores of these men found work here. Nearly every returned soldier, whether a former employee of a Flint plant or not, was placed at work by the various Flint companies.

Flint's great fear now is a labor shortage. With her largest industries planning huge expansion, the demand for labor is bound to become pronounced in the course of a few months. The city is already facing a serious housing situation. Hundreds of small homes have been built, but hundreds more of them must be erected at once if the city is to keep pace with her growing manufacturing interests.

The Buick company is still paying its men according to the scale in force during war days. Men working on a regular hour rate are enjoying the same rate. Workers whose efforts were compensated on a piece-work basis are of course not making as much as formerly, inasmuch as all war work is practically at an end. Piece workers are now averaging from $5.50 to $8 a day here and in the other factories. There is but little difference in the wage scales of the various plants. The average rate per hour for common labor in Flint is 46½ cents. In 1918, just prior to the entrance of the United States into the war, the average rate was 30 cents.

The future will bring a wage increase, rather than a decrease, employment officials unanimously declare. Flint will be in need of men shortly and there is likely to be a scramble for available labor. The manufacturers must offer an inducement to bring labor to the city, and this fact in itself will keep the present wage scale up, if not actually increasing it materially.

Trailer Makers to Meet in Detroit

CLEVELAND, March 10—Plans started at Cincinnati and rehearsed here recently to give trailer manufacturers a bigger place on the world's industrial map than they have had will be completed at a meeting of trailer manufacturers in Detroit March 18.

The gathering will be held under the auspices of the Trailer Manufacturers' Association of America, and the prime object will be the announcement of a program that will keep alive the trailer enthusiasm and prospects that the efficiency shown by the trailer in the war engendered.

The trailer manufacturers started an organization two years ago, but interest waned. The body was revived at Cincinnati on Feb. 20, when the association was reorganized and given the name Trailer Manufacturers' Association of America. The Executive Committee met here Feb. 28, considered plans for strengthening the organization, as well as for promoting the manufacturers' interests, and then adjourned after leaving the questions open for a general meeting in Detroit.

W. E. Ferris, secretary-treasurer of the Ohio Trailer Co., Cleveland, is president; J. C. Endebrock, of the Trailmobile Co., Cincinnati, is secretary-treasurer. These men, with W. A. Murfey, of the King Trailer Co., Ann Arbor, first vice-president; R. C. Sykes, Troy Wagon Works Co., Troy, Ohio, second vice-president; W. R. Bonds, of the Detroit Trailer Co., Detroit; W. F. Jolley, of the Miami Trailer Co., Troy, Ohio, and C. H. Martin, of the Martin Rocking Fifth Wheel Co., Springfield, Mass., compose the Executive Committee of the association.

Federal Highway Plan Endorsed

200 Acceptances to Council Received—Demand Federal Control of Roads

WASHINGTON, March 8—More than 220 acceptances have been received by the Highway Industries Association for membership to the new Federal Highway Council which the association is forming, and which will include those men most prominently identified with the industries interested in roads of the Nation. The council, formation of which was announced in a recent issue of AUTOMOTIVE INDUSTRIES, will work as a unit for the mobilization of Federal resources and control for highway construction, and for the crystallization of public opinion for three projects approved at the Chicago Highway Congress last December when resolutions called for—

Highway Congress Resolutions

1. Creation of a Federal highway commission to control highway construction and development.
2. Federal financial aid for State highway construction.
3. All governmental control of highways to be under the Federal highway commission.

The late appropriation of $200,000,000 for highways provided by the new Post Office bill completes in part the demands of section 2. These funds will be devoted largely to aiding the states, which in recent years voted road funds, but because of the increased cost of labor and materials were unable to apply the funds provided which called for a specified number of miles of construction. With the additional money from the Federal Government this difficulty will be overcome.

The creation of a Federal highway commission is well started by the recent introduction of a bill by Senator Townsend, which will probably come up at the next session of Congress and which was introduced at this time to allow for public consideration and discussion.

Government Control of Highways Urged

Government control of highways entirely under the Federal Highway Commission as demanded at the Chicago meeting has not yet been discussed in Washington. This matter, though entirely logical and feasible according to highways authorities, may meet with some difficulty from the reluctancy of Government departments to give up any work already under their supervision. The roads are now under the Department of Agriculture, and it yet remains to be seen if this department will recognize the fact that roads are now so important that they deserve a separate department that can be devoted to highways work only.

That the nation is recognizing the need and value of good roads is apparent in the national and state interest now displayed, and in the co-operation extended by industrial organizations that have no direct interest in the work, but which understand that highways mean a more prosperous and healthy condition generally. For example, more than 600 organizations, including silk manufacturers, paper box makers and automatic sprinkler producers, have endorsed the resolutions approved at the Chicago highways meeting, besides every good roads organization.

All Industries Profit by Good Roads

The association headed by S. M. Williams has been an important factor in securing the recent state and Federal appropriations. It has worked without attempting to conceal the direct relation of its interests with the industries that will profit through good roads. It has openly announced these interests, contrary to the usual custom that many like bodies adopt. But, according to Mr. Williams, the policy is based on the fact that the industries represented should and do know more about road building than any other interests, and though their interest may be more or less personal, the results that will accrue through road development more than justify the stimulating causes. Industries, it was stated, have a legitimate right to appeal to legislatures despite selfish interests, when the results make for the public good.

—

Bill for Regulation of Railroads Introduced

WASHINGTON, March 7—A bill was introduced in the Senate Tuesday for the return and regulation of the railroads. The plan was prepared by the National Association of Owners of Railroad Securities, and has had the attention of the Senate Committee on Interstate Commerce. In presenting the bill attention was called to the fact that it represents largely the interests of the millions of people holding the outstanding securities of the railroads. The fundamentals include:

A definite rule for rate-making, producing a fixed reasonable return to the railroads; provision whereby excess earnings over and above the said fixed reasonable percentage return go into a fund to be expended in the public interest; regional commissions established in the six rate-making districts into which the country is divided by the Interstate Commerce Commission; the incorporation of the National Railways Association to assist in the return of the railroads to their owners, providing means therefor to continue, inaugurate and put into effect such plans of unification, joint use of railroad terminals and other facilities as in the judgment of the trustees thereof may be expedient and in the public interest. There are to be 18 trustees of this corporation, 9 to be the present Interstate Commerce Commissioners, and 9 to be representatives of the railroads, from various sections of the country.

February Production Doubles January

Factories Nearing Normal Output—Labor Situation Cleared Up

DETROIT, March 8—Passenger car production in Michigan and Ohio during February was double that of the preceding month. This is shown in the production reports from 37 leading automobile manufacturers. These plants produced 4871 cars daily in the month, as compared with 2833 in January. Nearly every big company is nearing normal production, and the last of March will find them all back at their regular peacetime stride or setting new production records.

The labor situation has practically cleared up. It is estimated that Detroit's labor surplus has dwindled to 20,000 men. Discounting a normal floating labor surplus of 15,000, this leaves approximately 5000 Detroiters, willing to work, who are unemployed.

The materials situation is improving rapidly. Parts makers are getting back into full production and are now able to meet demands. Every company with the exception of Packard is in production. The Packard company has started work on its new passenger cars, and the first of these will leave the assembly line some time in April.

Daily production figures for January and February follow:

Car	Jan.	Feb.
Buick	100	400
Briscoe	30	50
Barley	..	4
Cadillac	55	60
Chalmers	30	65
Chandler	..	50
Chevrolet	..	300
Columbia	8	10
Dodge	300	375
Dort	40	65
Ford	1300	2000
Harroun	4	4
Hudson	30	50
Hupp	38	55
King	..	4
Liberty	15	15
Maxwell	150	150
Monroe	5	5
Oakland	160	160
Olympian	4	5
Oldsmobile	..	110
Overland	320	400
Packard	..	..
Paige	50	50
Paterson	4	10
Jackson	..	..
Reo	100	100
Saxon	10	50
Scripps-Booth	20	40
Studebaker	..	150
Essex	30	50
Grant	25	35
Roamer	..	4
Allen	..	..
Nelson	..	..
Velie	..	45
Total	2833	4871

—

1917 Tons of Rubber From Canada to United States

WASHINGTON, March 7—Following the removal of restrictions, 1917 tons of rubber were released for entry from Canada to the United States on Feb. 13, 1919, according to an announcement made by the War Trade Board.

Feb. Rubber Imports Double Jan.

14,079 Tons Set High Water Mark for Same Month in Last Four Years

NEW YORK, March 12—In the past four years the February importation of crude rubber never reached the volume of 14,079 tons brought into the United States last month. Although February is not usually as heavy a buying month as the later spring and summer, this year's record is higher than that for April any preceding year. Last month's figure is 971 tons more than February, 1918, and almost double 7,235 tons for January, 1919.

Figures compiled by the Rubber Association of America for importation records of crude rubber for the past four years follow:

	1916 Tons	1917 Tons	1918 Tons	1919 Tons
January	9,162	12,788	16,084	7,235
February	1,597	10,162	13,108	14,079

Class Automobiles as Unmarketable Staple

WASHINGTON, March 12—The Federal Reserve Board has classified passenger automobiles as "not marketable staples," and as a result many rediscounts on dealers' notes are being refused by Federal Reserve banks. In the case where the dealer is discounting his notes directly with the Federal Reserve banks there appears to be no objection on the part of the Federal Reserve Board. But they refuse to approve or allow rediscounts where the note is passed through other hands, beginning with the note broker.

There is no clue available as to the reason for this classification of passenger cars. Alfred Reeves, general manager of the N. A. C. C., is in Washington and has conferred with the Federal Reserve Board commissioners. Reeves will file complete data on the subject with the board shortly.

Saxon to Occupy New Factory

DETROIT, March 11—The concrete and steel plant built for the Saxon Motor Car Corp. will soon be ready for occupancy. Just as it was near completion, war started and the government, looking for warehouses big enough to house its ordnance supplies, took over the new plant for the duration of hostilities. As the government is now able to divert its war materials for civilian uses the Saxon plant will soon be emptied.

Weekes-Hoffman to Make Gears

SYRACUSE, N. Y., March 4—The Weekes-Hoffman Co. has completed plans to enter the gear manufacturing industry. It will shortly be turning out gears for automobiles and tractors in quantities which will necessitate the employment of 250 men in the plant on Dickerson Street. W. H. Diefendorf has resigned as chief engineer and a director of the New Process Gear Corp to join Weekes-Hoffman Co. as vice-president and general manager. J. M. Weekes is president and A. J. Hoffman secretary and treasurer.

French Mfrs. Arrange for Purchase and Manufacture in U. S.

NEW YORK, March 10—Emmanuel Pironneau, a French engineer, has opened a New York office at 1779 Broadway and is representing a number of French manufacturing concerns, for whom he will purchase machine tools and supplies, and will also arrange for the manufacture in this country of a number of French car accessories. The manufacturers of the "Solex" Carbureter and Radiator have authorized Mr. Pironneau to arrange for their manufacture in this country.

Sun Carbureter Taken Over by J. B. D. Carbureter

MILWAUKEE, March 11—The Sun Carbueretor Co., organized with a capital stock of $100,000, has taken over and will develop the business established several years ago by the J. B. D. Carbureter Co., Milwaukee. J. B. Drahonovsky, designer of the carbureter which the new company will manufacture, will be general manager. A new plant will be erected with a capacity of 1000 carbureters a day. At present the company owns a small machineshop and experimental plant on the Howell Road. F. J. Ramler, head of the Curtis Rubber Co., Milwaukee, and Emil F. Deuster are interested in it.

$82,557,557 Contracts for Motor Vehicles Still Uncompleted

Trucks.	Quantity.	Total Quantity.	Unit Price.	Value.	Total Value.
Ambulances:					
G. M. C. Standard	1,492		$1,225.00	$1,827,700.00	
Ford	392		550.00	215,600.00	
		1,884			$2,043,300.00
"AA" type, 1-ton:					
G. M. C. Standard	4,981		1,225.00	6,101,725.00	
White					
		4,981			6,101,725.00
"A" type, 1½-2½-ton:					
White Standardized	1,790	1,790	2,480.00	4,439,200.00	4,439,200.00
Unstandardized:					
Light Aviation	14		2,040.00	28,560.00	
Garford	703		2,706.00	1,902,318.00	
Pierce-Arrow	583		3,355.00	1,955,965.00	
Kelly-Springfield (domestic)	170		2,262.50	384 625.00	
Denby (domestic)	168		2,193.50	368,508.00	
International (domestic)	140		1,986.85	278,159.00	
Wilson (domestic)	75		2,262.50	169,687.50	
Moreland (domestic)	10		2,748.00	27,480.00	
		1,863			5,115,302.50
"B" type, 3-5 ton:					
Standardized "B"	6,573	6,573	4.000.00	26,292,000.00	26,292,000.00
Packard 3-ton	1,274		3,613.00	4,602,962.00	
Heavy Aviation	179		3,000.00	537,000 00	
Riker	342		4,500.00	1,539,000.00	
Pierce-Arrow 5-ton	266		4,755.00	1,264,830.00	
Mack	434		4,240.00	1,840 160.00	
Peerless (domestic)	188		3,293.75	619,225.00	
Kelly-Springfield (domestic)	439		3,300.00	1,448,700.00	
Velie (domestic)	9		3,125.00	28,125.00	
Gramm-Bernstein (domestic)					
Federal (domestic)	165		2,880.00	475,200.00	
Standard (domestic)	223		3,000.00	569,000.00	
Selden (domestic)					
Republic (domestic)	125		2.775.00	346,875.00	
Moreland (domestic)	20		3,440.00	68,800.00	
Packard 5-ton (domestic)	5		5,222.00	26,110 00	
Hurlburt, 5-ton (domestic)	100		3,597.00	359,700.00	
Federal, 5-ton (domestic)	97		3,597.00	348,909.00	
		3,866			14,174,596.00
"TT" type:					
Nash	910				
Hudson					
National	1,527				
Paige	932		2,600.00	8.759,400.00	
		3,369			
*F. W. D.	1,237				
Mitchell	1,425				
Premier	679				
Kissel	755		3,100.00	12,697,600.00	
		4,096			
*F. W. D. winch	317	317	3,775.00	1,196,675.00	
					$22,653,675.00
Total trucks		28,739			80,819,798.50
Touring cars:					
Cadillac limousine	12	12	3,332.00	39,984.00	39,984.00
Motorcycles:					
Cleveland	50		185.00	9,250.00	
Harley-Davidson	1,321		425.00	561,425.00	
		4,023			1,697,775.00
Indian	2,652		425.00	1,127,100.00	
					$82,557,557.50

WASHINGTON, March 10—Motor vehicles valued at $82,557,557.50 are still under contract to be built for the United States Army, according to figures given out in the hearings before the Committee on Military Affairs for the Army Appropriation Bill, 1920. Eighty million, eight hundred and nineteen thousand, seven hundred and ninety-eight dollars and fifty cents covers the manufacture of 28,739 trucks and 1884 ambulances; $39,984 is set aside for twelve touring cars, and $1,697,775 is included in the contracts for motorcycle requirements.

Trucks, Chassis, Cars and Motorcycle Orders Canceled by Government

Purveyor.	Article	Quantity ordered.	Quantity canceled.	Balance.
Atterbury Motor Truck Co.	B chasses	750	750	.....
Bethlehem Motors Corporation	B chasses	1,500	1,500	.....
Brockway Motor Co.	B chasses	1,000	1,000	.....
Clyde Cars Co.	B chasses	500	500	.....
Denby Motor Truck Co.	B chasses	1,500	1,500	.....
Denby Motor Truck Co.	Trucks, 1½-ton	500	250	250
Diamond T Motor Co.	B chasses	2,000	2,000	.....
Dodge Bros.	Light delivery	2,000	2,000	.....
Dodge Bros.	Light delivery	2,000	2,000	.....
Dodge Bros.	Light delivery	1,000	1,000	.....
Federal Motor Truck Co.	Trucks, 3-ton	500	250	250
Federal Motor Truck Co.	Trucks, 5-ton	300	150	150
Ford Motor Co.	Light delivery	4,000	4,000	.....
Ford Motor Co.	Light delivery	2,000	1,000	1,000
Ford Motor Co.	Ambulances	2,500	2,500	.....
F. W. D. Auto Co.	F. W. D. chasses	1,000	1,000	.....
F. W. D. Auto Co.	F. W. D. trucks	2,400	.....	2,400
Garford Motor Truck Co.	2-ton chasses	4,000	3,000	1,000
Gramm-Bernstein Motor Truck Co.	B chasses	2,000	2,000	.....
Gramm-Bernstein Motor Truck Co.	3-ton trucks	100	50	50
Hudson Motor Car Co.	F. W. D. chasses	1,000	1,000	.....
Hurlburt Motor Truck Co.	5-ton trucks	200	100	100
Indiana Truck Corporation	B chasses	1,500	1,500	.....
International Motor Co.	Mack trucks	4,675	200	4,475
International Motor Co.	Mack trucks	1,800	1,800	.....
Kelly-Springfield Motor Truck Co.	Trucks, 1½-ton	340	170	170
Kelly-Springfield Motor Truck Co.	Trucks, 3-ton	820	460	460
Kissel Motor Car Co.	F. W. D. chasses	1,500	1,500	.....
Lewis Hall Iron Works	B chasses	500	500	.....
Locomobile Co.	Trucks	2,000	1,500	500
Maccar Co.	B chasses	500	500	.....
Midland Motor Truck Co.	B chasses	500	500	.....
Militor Corporation	Tractors	1,000	1,000	.....
Mitchell Motors Corporation	F. W. D. chasses	2,000	2,000	.....
Moreland Motor Truck Co.	3-ton trucks	60	.....	60
Moreland Motor Truck Co.	2-ton trucks	40	.....	40
National Motor Car & Vehicle Co.	F. W. D. chasses	1,000	1,000	.....
National Motor Car & Vehicle Co.	Nash trucks	2,000	.....	2,000
Nash Motor Co.	F. W. D. chasses	4,000	4,000	.....
Mitchell Motor Car Co.	F. W. D. trucks	3,023	.....	3,023
Packard Motor Car Co.	3-ton trucks	3,000	1,500	1,500
Packard Motor Car Co.	3-ton chasses	2,250	2,250	.....
Paige-Detroit Motor Car Co.	Nash trucks	2,000	500	1,500
Paige Motor Car Co.	F. W. D. chasses	1,000	1,000	.....
Peerless Motor Car Co.	White trucks	3,000	3 000	.....
Pierce-Arrow Motor Co.	2-ton chasses	1,600	900	700
Pierce-Arrow Motor Car Co.	5-ton trucks	1,200	600	600
Premier Motor Co.	F. W. D. chasses	2,000	2,000	.....
Republic Motor Truck Co.	B. chasses	2,000	2,000	.....
Republic Motor Truck Co.	3-ton trucks	250	125	125
Rowe Motor Manufacturing Co.	B chasses	500	500	.....
Selden Motor Truck Co.	3-ton trucks	100	50	50
Selden Truck Sales Co.	B chasses	2,000	2,000	.....
Service Motor Truck Co.	B chasses	750	750	.....
Signal Motor Truck Co.	B chasses	500	500	.....
Standard Motor Truck Co.	B chasses	750	750	.....
Standard Motor Truck Co.	3-ton trucks	300	150	150
Sterling Motor Truck Co.	B chasses	750	750	.....
United Motors Co.	B chasses	500	500	.....
U. S. Motor Truck Co.	B chasses	1,500	1,500	.....
Velie Motors Corporation	B chasses	2,000	2,000	.....
Vim Motor Truck Co.	B chasses	500	500	.....
White Motor Co.	Trucks	8,000	5,000	3,000
Wilson Co., J. C.	B chasses	500	500	.....
Wilson Co. J. C.	2-ton trucks	200	100	100
Winther Motor Truck Co.	B chasses	500	500	.....
Hudson Motor Car Co.	Nash Quad trucks	2,000	1,500	500
International Harvester Co.	2-ton trucks	800	500	300
Velie Motors Corporation	3-ton trucks	125	100	25
PASSENGER CARS				
Cadillac Motor Car Co.	Limousines	550	550	.....
Cadillac Motor Car Co.	Touring cars	700	700	.....
Cadillac Motor Car Co.	Limousines	300	200	100
Cadillac Motor Car Co.	Touring cars	700	257	443
Dodge Bros.	Touring cars	1,000	1,000	.....
Dodge Bros.	Touring cars	1,600	1,600	.....
Dodge Bros.	Touring cars	300	300	.....
Dodge Bros.	Touring cars	400	400	.....
Dodge Bros.	Roadsters	500	500	.....
Ford Motor Co.	Touring cars	6,000	6,000	.....
Ford Motor Co.	Touring cars	7,000	7,000	.....
MOTORCYCLES				
Harley-Davidson Co.	Motorcycles and side cars	10,000	10,000	.....
Harley-Davidson Co.	Motorcycles and side cars	5,000	1,000	4,000
Hendee Mfg. Co.	Motorcycles and side cars	18,000	18,000	.....
Hendee Mfg. Co.	Motorcycles and side cars	6,000	3,000	3,000

WASHINGTON, March 8—United States army contract cancellations, affecting 76,205 trucks, 18,507 passenger cars and 32,000 motorcyles, are announced as a result of the hearings of the Committee on Military Affairs for the appropriations for 1920. According to the report, 100,683 trucks, 19,060 passenger cars and 39,000 motorcycles were contracted for.

The list of cancellations also includes the following:

Article	Quantity Ordered	Quantity Cancelled
Bodies	56,645	37,440
Differentials	5,000	5,000
Engines	2,500	2,500
Frames	27,250	25,500
Axles	36,524	35 980
Transmissions	27,500	27,500
Tires	15,000	15,000
Tires, solid	7,578	7,578
Trailers and Tanks	10 301	7,451

In addition to this list there were 25,000 each contracted for and totally cancelled of the following: clutches, universal joints, radiators, steering gears, and springs.

Swedish War Tire Prices to $500

Shortage of Tires and Gasoline—75 Per Cent of Cars Unable to Operate

NEW YORK, March 10—Some of the difficulties that Sweden had to put up with before armistice date have been told in America by Capt. John Neren, editor of Motor, a monthly published in Stockholm. Captain Neren says that during the war 34 x 4 and 35 x 6 tires sold as high as $225 and in some cases up to $500 each. Tires were regularly smuggled from Russia through Finland into Sweden. There was never a time during the war when there was a surplus of more than 5000 tires on hand for the entire country.

Required Permit to Operate Car

It was difficult to operate an automobile as it was necessary to first secure permission to use the car. It was then necessary to get permission to purchase gasoline, which sold as high as $2 per gallon. This aroused the opposition of the people and was perhaps the greatest bar to the general use of automobiles. Sweden has to-day between 6000 and 7000 automobiles and approximately 75 per cent of these were idle during the war.

Since the armistice, tires and gasoline have been arriving in Sweden so that motoring conditions are rapidly opening up. In January, over 2000 tires arrived from the United States, and upward of 1,000,000 gallons of gasoline. Motor trucks are at present on steamboats headed for Sweden.

Alcohol Successful Fuel

During the war the development of alcohol as a motor fuel made considerable progress and engines were developed in which either alcohol or gasoline could be used, the compression being doubled by some device when alcohol had to be used. Sweden has taken up the manufacture of alcohol at a production of 125,000 gallons per month. Captain Neren believes that Sweden can manufacture 5,000,000 gallons per year, which would be sufficient for all of the motor cars and motorcycles there. The price during the war was $1.50 per gallon of 4½ litres. (One litre equals .26417 of a United States liquid gallon.)

Automobile manufacture in Sweden is confined to two factories with a total production of 500 cars and a possible capacity of 1000. There are in addition two truck companies that have an annual production of 100.

There has recently been developed in Sweden a new device for feeding gasoline from the tank to the carbureter which can be used on all types of four-cycle engines, and which has already been patented in America. During the war, when alcohol was being largely used for fuel, ether was used for starting purposes.

N. A. C. C. Will Hold Shows in 1920

NEW YORK, March 12—One of the most important matters decided at last week's meeting of the N. A. C. C. was that the chamber should hold the New York and Chicago shows in 1920. The truck making members also voted in favor of truck shows, provided it is possible to hold them at the same time as the passenger car shows.

Dealers in these cities had hoped that they might be permitted to repeat their present year's program and stage the shows with the approval and co-operation of the factories, but no support for this idea was evident at the meeting despite the fact that a big percentage of the chamber's membership had unofficially gone on record in favor of the dealers.

The statement issued regarding the meeting stated that "the question of closer co-operation by and with the (New York and Chicago) dealers' associations was discussed" and "the directors probably will act upon this suggestion at their April meeting." This statement was taken to mean that the N. A. C. C. would consider giving both associations a larger share in the show profits than they have heretofore received.

The Chamber also resolved that the Bolsheviki movement is being aided by an undue amount of newspaper publicity and that the "best interests of general business and the entire nation demand that such articles should be removed from front page prominence where their real news value precludes excluding them entirely from the columns of public print."

Trade reports indicate that the factories are fast coming back into production, carload shipments for February being approximately 19,000, whereas in February, 1918, they were 12,030.

Post-War European Models Not Due Yet

CHICAGO, March 6—Passenger cars are beginning to be built in Europe for the general market, but real post-war models will not appear for many months, is a message brought back by David Beecroft, directing editor of the Class Journal Co., who has just returned from a tour of the automotive factories of France, England and Italy. Mr. Beecroft, in an address to the midwest section of the Society of Automotive Engineers last night, said that significant developments in the after-the-war designs are commencing to appear.

To Form Welding Association

NEW YORK, March 12—A meeting has been called for Friday, March 28, at the Engineering Societies' Building, New York, to form the American Welding Society, which will be a merger of the Welding Committee of the Emergency Fleet Corporation and the National Welding Council. It is the purpose of the society to become a disinterested and dependable source of information on welding, not only for the benefit of manufacturers of welding apparatus and supplies, but also to aid those who use welding processes in their production and those who purchase welded goods. A temporary organization already has been formed, and it is the plan of the permanent body, which it is hoped will come into being on March 28, to provide for membership, which will include corporations, individuals who may be employees of such corporations, and trade associations. The body plans as a part of its routine to carry on certain researches and to direct standardization, legislation, the training of welders and the dissemination of publicity on the whole subject of welding.

Chalkis Mfg. Co. Will Not Bring Out New Car

DETROIT, March 11—The Chalkis Mfg. Co., organized at the outbreak of the war for gun production, will devote its efforts to commercial automotive production, but the exact nature of its product has not been decided upon at this time. The company proposed to bring out a new automobile, but this project has been abandoned.

Indianapolis Entries to Date

NEW YORK, March 6—Five entries to date have been made for the Indianapolis Speedway race May 31. These include two Sunbeams, entered by L. Coatalen for the Sunbeam company, a Chevrolet, driven by Durant, and a Hudson, driven by W. W. Brown. Christiaens will drive one of the Sunbeams. The pilot of the second has yet to be selected. Ralph Mulford, as already stated, will drive a Frontenac.

This will be the seventh annual international race meet at this track and will include cars under Class E, or non-stock type of 300 cu. in. or less, with maximum weight at 2500 lb. Prize money will total $50,000 and the Prest-O-Lite trophy and the Wheeler-Schebler cup will be included.

Both Sunbeams will have six-cylinder engines, 3.2 x 6.14, giving cu. in. capacity of 298. The four-cylinder Chevrolet entry's cubic capacity will measure 296.8, with cylinder dimensions of 3 13/16 x 6 7/12 in. The Hudson entered will have twenty-four valves and a piston displacement of 288 cu. in. Its bore is 3½ in. and the stroke 5.

Another Foreign Driver for Indianapolis

PARIS, March 10 (Special Cable)—Another foreign driver has signified his intention of entering the 500-mile race on the Indianapolis Speedway, May 31. He is Andre Boillot, brother of Georges, and will drive a Peugeot.

Officials Undecided About Status of Self-Imported Airplane

WASHINGTON, March 7—Customs authorities have encountered the first case of an airplane imported into the United States under its own motive power. An American bought a Canadian plane, and it was flown across the border near Detroit.

The question then arose as to whether itwas dutiable, since airplanes are not mentioned in any tariff acts. Customs officials finally decided that if it remains permanently in the United States it should be taxed as a "manufactured article" at the rate of 20 per cent, but if it flies out of the country again within 6 months it will be regarded as "on a tour" and will not be taxed.

Tractor Demonstration at Macon

MACON, GA., March 13—Governor Dorsey opened the first of the six tractor demonstrations planned for this season by the National Implement and Tractor Manufacturers' Association yesterday afternoon. It is under the auspices of the Dixie National Power Farming Demonstration, with A. E. Hildebrand, general manager. The exhibition was postponed until yesterday because the field was too wet, and was confined to a parade and street demonstrations. The Chamber of Commerce invited tractor makers to view the surrounding country. They were enthusiastic about soil conditions and look forward to power farming in this territory on a great scale.

Several tractor concerns staged individual exhibits to show the special features peculiar to their own make. On Monday night seven Molines paraded through the city lit with electric lights, to demonstrate their night operating possibilities. The Case is operating a thresher on a street corner and is also showing the cutaway revolving model in the Hotel Dinkler. Hart-Parr demonstrated the strength of its steering cables by lifting the tractor's own weight by them. Other models shown here include Holt, Huber, Illinois, Lauson, Parret, Frick, Cleveland, Fordson, Lacrosse, Avery, International, Oliver, Emerson Brantingham, Beeman and Alama. The Western Electric Company's farm lights are shown at various salesrooms. Merchants are also displaying parts of implements, plow shares, etc., in their windows with various other merchandise that helps give the tractor atmosphere. Many people here are seeing tractors for the first time, and their impression is quite evident from the fact that every-one is talking tractors.

France Proposes New Import Duties

PARIS, March 12 (Special Cable)—The International Congress of Automobile Manufacturers has voted in favor of a 10 per cent import duty on European cars, and the European members of the Congress voted unanimously that a 45 per cent duty be imposed on cars of American manufacture.

The foregoing cable is printed as received from the European representative of AUTOMOTIVE INDUSTRIES, W. F. Bradley, but there is some doubt as to the constitution of the Congress to which reference is made. It is assumed that it is connected with the Lyons Fair, which is now being held, and at which several American car manufacturers are represented through their French agents. It may be remarked that at present the duty on cars and trucks imported from America into France is 70 per cent ad valorem on vehicles weighing less than 2500 kilos, and that importation is allowed only in the infrequent case where a license is granted.

Kelly-Springfield Tire Re-elects Directors

NEW YORK, March 11—The annual meeting of the stockholders of the Kelly-Springfield Tire Co., held in Jersey City to-day, resulted in the re-election of all the retiring directors.

The board of directors consists of President Van H. Cartmell, Vice-President Stephen Peabody, Secretary F. A. Seaman, Sales Manager O. R. Cook, A. L. Scheuer, J. Oppenheim, A. M. Poole and B. Maas.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. .... .02 -.03
- Phosphoric (85%).. .35 -.39
- Sulphuric (60%), lb. .008

Aluminum:
- Ingot, lb. .... .31
- Sheets (18 gage or more), lb. .... .42
- Antimony, lb. ..... .07 -.07½

Burlap:
- 8 oz., yd.......... .07½
- 10½ oz., yd.......... .10¾-.11

Copper:
- Elec., lb. .... .14¾
- Lake, lb. .... .16½-.17

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.50
- Egypt, combed, sq. yd. 1.25
- Egypt, carded, sq. yd. 1.15
- Peelers, combed, sq. yd. 1.10
- Peelers, carded, sq. yd. 1.00

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
- Ceylon, lb. .... .09 -.22
- Madagascar, lb. .. .10 -.15
- Mexico, lb. .... .03¾

Lard:
- Prime City, gal..1.90-2.00
- Ex. No. 1, gal...1.10

- Linseed, gal. 1.45-1.48
- Petroleum (crude):
  - Kansas, bbl. 2.25
  - Pennsylv'a, bbl...4.00
- Manhaden (dark), gal 1.05-1.06

Lead, lb. .... .05 -.05⅝

Leather:
- Hides, lb. .... .18 -.34¼

Nickel, lb. .... .40

Oil:
- Gasoline:
  - Auto, gal. .... .24½
  - 68 to 70 gal....... .30½

Rubber:
- Plantation:
  - First latex pale crepe, lb. ...... .53½
  - Brown crepe, thin, clear, lb. ...... .48
  - Smoked, ribbed sheets, lb. ..... .52½

Para:
- Up River, fine, lb. .56
- Up River, coarse, lb. .... .34½

Island, fine, lb........ .48

Shellac (orange), lb. .60 -.64

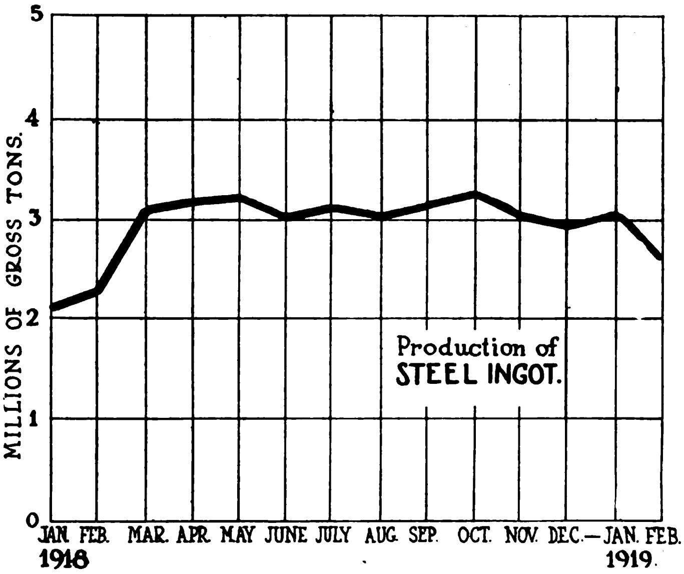
Spelter, lb. .... .06¾

Steel:
- Angle beams and channels, lb. ..... .03
- Automobile sheet (see sp. table.)
- Cold rolled, lb...... .0625
- Hot rolled, lb....... .039

Tin .... .71 -.72

Tungsten, lb. 1.50- 2.10

Waste (cotton), lb... .12¾-.17



From March to October, 1918, production of steel ingots was well maintained. However, figures now seem inclined to fall toward the point at which they were in January, 1918

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping.	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock................	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.

Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close March 8

	Bid	Asked	Net Ch'ge
Auto Body Company......	6¾	..	+¼
Briscoe Motor Car com...	10	..	..
Briscoe Motor Car pfd....	40	60	..
Chandler Motor Car......	124	126	+2
Chevrolet Motor Car......	164	166	..
Cole Motor Car Co........	90	105	..
Continental Motors com...	7¾	8¼	..
Continental Motors pfd...	97	..	..
Edumunds & Jones com..	15	20	..
Edmunds & Jones pfd....	75	90	..
Electric Storage Bat......	52	59	—4
Federal Motor Truck......	32	36	..
Fisher Body Co. com......	50	53	..
Fisher Body Co. pfd......	95	98	+3
Ford Motor of Canada....	300	310	—15
General Motors com.......	156½	157½	+6½
General Motors pfd........	84⅞	86⅞	+¼
Hupp Motor Car com.....	7¼	8¼	+½
Hupp Motor Car pfd......	90	..	..
Hupp Motor Car com....	7¼	8¼	+ ½
Kelsey Wheel Co. pfd.....	94½	96½	+½
Manhattan Electric S. com.	..	48	..
Maxwell Motor com.......	35½	36½	+1
Maxwell Motor 1st pfd....	61	62	+2
Maxwell Motor 2nd pfd....	26¼	27¼	+1¼
McCord Mfg. com.........	30	35	—2
McCord Mfg. pfd..........	93	96	..
Mitchell Motor Co.........	27	32	—3

	Bid	Asked	Net Ch'ge
Motor Products Corp.......	..	35	..
Nash Motors Co. com......	215	230	+40
Nash Motors Co. pfd......	95	100	+2
National Motor Co........	15	20	+9
Packard Motor Car com..	114	118	..
Packard Motor Car pfd...	100	102	..
Paige-Detroit Motor com..	28	29	—¼
Paige-Detroit Motor pfd..	8¾	9¾	..
Peerless Motor Truck.....	21	22	+3
Pierce-Arrow M. Car com.	44⅝	45⅝	—⅛
Pierce-Arrow M. Car pfd..	103½	105	—½
Premier Motor Corp. com..	5	..	..
Premier Motor Corp. pfd..	..	75	..
Prudden Wheel Company.	17½	19	+¼
Reo Motor Car Co........	22½	23½	—¼
*Republic M. Truck com..	35½	37½	..
Republic M. Truck pfd....	87	90	—1
Saxon Motor Car com.....	9⅝	11⅝	—⅜
Scripps-Booth Corp.	21	25	..
*Stewart Warner Spd. Corp.	90½	92½	+1½
Stromberg Carburetor Co..	39	41	—1¼
Studebaker Corp. com.....	60¼	61½	—1
Studebaker Corp. pfd.....	90	94	..
Stutz Motor Car Co.......	49½	50½	+3¾
United Motors Corp.......	41¼	43¼	..
White Motor Co...........	54	55	+ ⅝
*Willys-Overland com. ...	27¼	28¼	+2⅛
Willys-Overland pfd.	91½	93	+1½

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co..........	74¼	75	—5⅜
Firstone T. & R. com.....	140	144	..
Firstone T. & R. pfd......	99	101	..
Fisk Rubber Co. com......	105	107	+10
Fisk Rubber 1st pfd......	100	105	..
Fisk Rubber 2nd pfd......	101	105	+3
Fisk Rubber 1st pfd. conv.	99	101	..
Goodrich, B. F., com......	69½	69¾	—½
Goodrich, B. F., pfd.......	106	106½	+6
Goodyear T. & R. com....	255	260	+12
Goodyear T. & R. 1st pfd..	105	107	..
Goodyear T. & R. 2nd pfd.	105	107	..
Kelly Springfield com.....	122½	123	+11½
Kelly Springfield pfd......	95	97	+5
Lee Tire & Rubber Co....	25½	26	—1¼
Marathon Tire & Rubber..	55	75	..
Miller Rubber Co. com....	166	168	—6
Miller Rubber Co. pfd.....	101	102	—1
Rubber Products Co......	122	126	+2
Portage Rubber Co. com..	132	164	+2
Swinehart T. & R. Co.....	80	85	..
U. S. Rubber Co. com.....	82½	83	..
*U. S. Rubber Co. pfd.....	111½	112½	..

*Ex Dividend.

Men of the Industry

Changes in Personnel and Position

Van Dervoort in Europe to Study Industrial Conditions

EAST MOLINE, ILL., March 8—W. H. Van Dervoort, president of the Moline Automobile Co., recently sailed for Europe as a member of the commission ordered by the National Industrial Conference Board to visit England, France, Belgium and Italy, to study industrial conditions. It is expected he will be gone some months.

—

Stanley D. Livingston, who was in charge of the apparatus design and drafting section of the Signal Corps Radio Laboratory, Camp Albert Vail, N. J., until his release from the army, has been appointed designing engineer for the Connecticut Telephone & Electric Co., Meriden. He was, for a time, connected with the New York Edison Co., and was also assistant chief engineer of the Disco Co., Detroit, which position he resigned to become engineer in charge of the electrical installation at Camp Merritt, N. J.

—

C. F. Hepburn has been appointed director of sales for the Torbensen Axle Co., Cleveland. For the past year and a half he was a major in the Ordnance Department.

—

J. H. Malone, advertising director of the Automobile Trade Journal, Philadelphia, for nine years, has resigned to accept a position as vice-president and general manager of the Hudson Motor Specialties Co., Philadelphia.

—

Loyal E. Thompson has been appointed assistant manager of the service department of the Republic Motor Truck Co., Inc., Alma, Mich. He was formerly connected with the service department of the Cadillac Motor Car Co.

—

R. E. Clingan, for the past eleven years representative of the Hess Bright Mfg. Co., has been appointed sales manager of the Bock Bearing division of the Standard Parts Co., Cleveland. W. P. Culver will continue as sales manager of the Perfection spring plant, B. A. Quayle as sales manager of the Standard welding plant, Dan C. Swander as supervisor of sales, B. R. Winborn, manager of the Perfection heater and jobbing divisions, and James A. Braden, advertising manager.

—

T. A. Cressey has been appointed sales manager of the Cole Storage Battery Co., Chicago. For the past three years he was district sales manager of the Philadelphia Storage Battery Co., and for several years previous was sales engineer of the Electric Storage Battery Co.

—

J. F. Mackin has joined the Black & Decker Mfg. Co. as its Ohio representative. He was formerly connected with the Independent Pneumatic Tool Co.

Changes in Carlisle Tire Force

ANDOVER, MASS., March 11—A new central manager and treasurer have been added to the Carlisle Cord Tire Co. organization. A. G. Langher, former central district manager for the Diamond Rubber Co., and connected with it for the past ten years, has been appointed to the same position with the Carlisle Cord Tire Co., with headquarters at Chicago. L. H. Homer, treasurer of the Smith & Dove Mfg. Co., Andover, and previous to that, connected with Stone & Webster Management Association, Boston, has been made treasurer.

Capt. Sykes to Represent Dutilh-Smith

NEW YORK, March 8—Capt. George Sykes, R. A. F., A. M. I. E. E., who has been in this country nearly four years, attached to the British War Mission in a commercial capacity, is to be the London manager of the engineering and railroad departments of Dutilh-Smith McMillan Co., when he returns to England in May. His London office is Central Buildings, Totehill Street, Westminster.

Buckwalter Heads American Bureau of Engineering

CHICAGO, March 11—C. J. Buckwalter, formerly manager of the company, was elected president of the American Bureau of Engineering at its annual meeting.

—

S. R. Swiss has been placed in charge of the advertising department of the Republic Motor Truck Co., Alma, Mich. He was recently associated with the Ivan B. Nordham Co., poster advertising, Pittsburgh. Blaine McGrath, former advertising head, is going into the sales department to cover territory in four southern states.

—

Earl Englander, for 10 years a member of the firm of J. A. Englander Co., custom automobile top maker, is now manager of its Detroit plant.

—

Chester Naramore has resigned as Chief of the Petroleum Division, Bureau of Mines, Department of the Interior, and is now associated with the Union Petroleum Co., Philadelphia.

—

Sidney H. Copper, who was associated with Howard E. Coffin, vice-president of the Hudson Motor Car Co., during the existence of the Aircraft Production Board, and later with the National Automobile Chamber of Commerce, Washington office, has opened a stenographic office in Washington especially for visiting members of the automotive industry.

McMullen Leaves Chevrolet for Own Enterprise

FLINT, March 10—B. J. McMullen, general sales manager of the Chevrolet Motor Car Co., has resigned to enter business for himself in Minneapolis, where he will distribute Republic trucks. C. C. Meade, who was assistant to Mr. McMullen, succeeds him.

—

Allan H. MacCaffrey, former publicity manager of the S.K.F. Ball Bearing Co., Hartford, Conn., has become general sales manager of Hollister, White & Co., Inc., investment bankers of Boston.

—

New Nash Distribution Co.

SAGINAW, March 7—R. P. Bishop has resigned as assistant sales manager of the Nash Motors Co. and will distribute Nash cars and trucks under the firm name of the Nash Saginaw Motors Co. L. A. Wilson, who was also identified with the Nash factory, is his partner.

—

Templeton Heads Detroit Board of Commerce

DETROIT, March 8—Allan A. Templeton, president of the Detroit Seamless Steel Tubes Co., has been elected president of the Detroit Board of Commerce for 1919 and 1920.

—

Detroiter Heads Metal Contractors

KALAMAZOO, March 9—Three Detroit men were elected to office in the Michigan Sheet Metal Contractors Association which closed its annual convention here Friday. A. Berschbach was re-elected president. A. F. Prudsch was named a member of the executive committee. H. E. Doherty was chosen vice-president of the traveling men's auxiliary.

Other officers are: Vice-president, Frank Dailey, Jackson; secretary, F. E. Eberle, Grand Rapids, and treasurer, J. A. Shouldice, Battle Creek. The executive committee is composed of Adam Shapper, Bay City, and Harry Rhodes, Grand Rapids. Other officers of the travelers' auxiliary are: President, Harry Snow, Kalamazoo; secretary, L. H. Pearce, Grand Rapids; treasurer, E. E. Bohler, Grand Rapids.

—

Globe Tire Re-elects President

TRENTON, March 11—Joseph B. Linerd was re-elected president of the Globe Rubber Tire Mfg. Co. for a second term at the annual meeting of the stockholders of the company. Before his connection with the Globe organization he was with the Goodyear Tire & Rubber Co. and was later sales manager of the Ajax Rubber Co.

—

Stewart-Warner Re-elects Officers

CHICAGO, March 8—The retiring officers of the Stewart-Warner Speedometer Co. have been re-elected. C. B. Smith is president, V. R. Bucklin, vice-president; W. J. Zucker, secretary, and T. T. Sullivan, treasurer.

Luncheon given by the Splitdorf Electrical Co. on the occasion of the visit of the Society of Automotive Engineers to the company's main manufacturing plant at Newark, N. J., Friday, March 7

Fisk Rubber to Divide Sales Territories

NEW YORK, March 11—The Fisk Rubber Co. will divide its New York and New England territories into two separate sales districts, known as the New England district, with Walter Oakes as district manager, and Western New York District, with G. T. Newton as district manager.

Mr. Newton has been in charge of Fisk sales in the two territories for the past three years. He will now have supervision over eight direct factory branches, including Buffalo, Syracuse, Rochester, Utica, Binghamton, Elmira, Albany and Erie, Pa. His headquarters will be at Rochester. He has been with the company for four years, first as a special representative of the sales department and the last three years as district manager.

Mr. Oakes has been with the Fisk organization for 12 years. He has been branch manager at Boston for some time, and will combine this work with his duties as district manager.

—

C. O. Caniff, assistant to R. W. Langenbacher, sales manager of the Duplex Truck Co., Lansing, has been made superintendent of the eastern sales zone, with headquarters at Atlanta, Ga.

—

William A. Kent, formerly manager of the Kawneer Mfg. Co., Niles, Mich., has resigned to join the S. J. Fitzgibbons Co., manufacturers of tubing and tube products, with headquarters in Detroit.

—

A. H. Sarvis has resigned as sales manager of the Flint Varnish & Color Works, Flint, to become associated with the Willys-Overland Co., Toledo.

—

F. H. Prescott, formerly designing engineer in the automotive equipment section of the Westinghouse Electric & Manufacturing Co., has joined the staff of the Remy Electric Co. as designing engineer on motor and generator equipment.

Carl J. Spitzley, former retail sales manager of the Studebaker Corp. of America, Detroit branch, has resigned to become associated with the W. D. Block Motor Co., Detroit. W. J. Lannon, in charge of the Studebaker branch at Toledo, has also resigned to join the Block organization.

—

C. A. Riegler, Cleveland, has resigned a connection of twenty-five years with the William Edwards Co. to become director of sales for the Ohio Trailer Co.

—

Frank G. Eastman, advertising manager of the Packard Motor Car Co., resigned his position, effective March 1, and has joined the staff of the Lincoln Motor Co., Detroit.

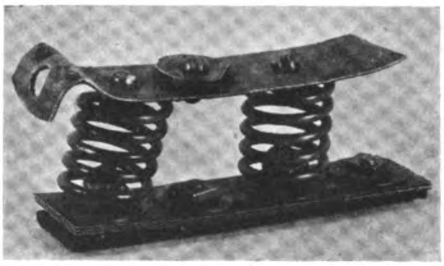
—

W. H. Holmes, who has been connected with the George H. Dyer Advertising Co., New York City, which handles the Packard, has been appointed advertising manager of the Packard Motor Car Co., Detroit, to succeed Frank G. Eastman, resigned.

—

Lt. Russell Wherrett has resigned from the aviation section of the army and has become manufacturer's representative for the Michigan territory for the Doble-Detroit kerosene burner, which is produced by the Doble-Detroit Steam Motor Co., Detroit.

GERMAN STEEL SPRING TIRE



Contains three plies of spring steel on outer band which is bolted with leather strip—See description on page 483 of Feb. 27 issue of AUTOMOTIVE INDUSTRIES

Weir Heads Canada Foundries

BROCKVILLE, CAN., March 10—At the annual meeting of the Canada Foundries & Forgings Co., Ltd., the following officers were elected: President, W. M. Weir, Montreal; vice-president, J. Gill Gardner, Brockville; secretary and treasurer, J. H. A. Briggs, Brockville. Directors elected were: T. J. Dillon, Welland; G. P. Graham, Brockville; Lieut.-Col. Monsarratt, Ottawa; Lieut.-Col. Smith, Montreal; H. Howser, Toronto; H. Bertram, Dundas, and W. J. Shaughnessy, Montreal.

—

H. H. Pete, for several years in the sales department of the Toledo Scales Co., Toledo, has resigned to take charge of the sales promotion department of the Miller Rubber Co., Akron.

—

Neil MacCoull has returned from duty in France with the Naval Air Forces and is now connected with the Texas Co. as automotive engineer in the sales department, with headquarters in New York. Just prior to enlisting he was acting as a mechanical engineer in the machine works of the Westinghouse Electric & Mfg. Co., Pittsburgh.

—

L. H. Benson has been appointed production manager of the Parker Axle & Products Corp., New York, at its Connecticut plant. Prior to his service with the Government, he was identified with the Minneapolis Steel & Machinery Co. as superintendent and previous to that was with the Triumph Electric Co., Cincinnati.

—

Frederick W. Krebs, recently with the Aircraft Production Board, is again affiliated with the United Alloy Steel Corp. and is in charge of its Cleveland sales office, 614 Swetland Building.

—

H. J. Russell has been made chief of the newly created Maxwell-Chalmers export department. He will leave for England in 10 days.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

4000 Columbias in 1919

DETROIT, March 6—The Columbia Motors Co. last week finished its war orders and is now swinging back into peace production. This company built 500 war trucks, 1200 kitchen trailers and completed the larger portion of a $750,000 contract for spare and repair parts. It plans to turn out 4000 passenger cars this year and is at present running ten daily.

Lull Trucks Ready for Quantity Production

WAUSAU, WIS., March 10—The Lull Truck Co., organized about a year ago to take over and develop a quadruple drive design of motor truck, has completed its experimental work and is ready to undertake quantity production. This city will give the company the use of a 30-acre site, including an unfinished manufacturing building, at a nominal rental, with option to purchase within three years from April 1, on condition that the building be completed and equipped, and certain other requirements met by the company. The plant is located on the main line of the Chicago & Northwestern R. R. Karl Mathie of this city is secretary.

Victory Mfg. Co. Will Make Spark Plugs

SPRINGFIELD, MASS., March 10—The Victory Mfg. Co., which has bought the assets of the Gibson & Hollister Co., Springfield, Mass., and Boston, has completed negotiations for the factory building and equipment of the Upson-Martin Co. The new corporation will manufacture spark plugs for tractors and trucks, as well as the Croxford tool and electrical specialties.

Aeromarine on Pre-War Basis

KEYPORT, N. J., March 7—The Aeromarine Plane & Motor Co. has got back into production on a pre-war basis and has reduced its working force. The construction of the 1-story building, 60 x 100 ft., for the New Jersey Motor Sales Co., which builds engines used by the Aeromarine company, has been resumed.

Moline Plow Working for Daily Production of 150

MOLINE, ILL., March 8—The Moline Plow Co. is assembling 50 to 60 tractors per day at present and is working toward a production of 150 per day by the middle of summer. The company is about to install an oven-drying system through which the tractors will be moved on a continuous chain. There is considerable congestion of factory space where air drying is used for the two coats of paint on the final varnish coat. All the engines for the Moline tractors are now being manufactured in the Wilson Foundry & Machinery Co., Pontiac, one of the John Willys plants.

Airplane Experiments

ITHACA, March 7—The Morse-Thomas Aircraft Co. is doing experimental airplane work.

The New 1-Ton Acason

DETROIT, March 6—The new 1-ton Acason truck made its first appearance to the public at the automobile show in the exhibit of the Acason Motor Truck Co. This truck carries a 3¾x5¼ engine. The rear construction is a Timken worm drive, with a three-piece driveshaft. The radiator is of the cast-tank type. It is equipped with a Fuller transmission and multiple disk clutch; Levine steering gear; Eisemann magneto and 36x6 pneumatic cord tires.

Reduction Made in Disco Prices

DETROIT, March 7—The Disco Electric Mfg. Co., Detroit, makers of Disco starting and lighting system for Ford cars, has reduced its price from $100 to $70.

Signal to Make 1000 Trucks

DETROIT, March 8—The Signal Truck Co. is back in commercial production and plans completing 1000 vehicles in 1919.

Republic Finishing Up War Work

ALMA, MICH., March 8—The Republic Motor Truck Co., Inc., is completing an order for 5000 trucks for the Government and is devoting the greater portion of its time to its commercial work. It hopes to be hitting its normal capacity of 3000 trucks monthly soon, but at present its production is considerably below. Shortage of material is seriously affecting production at present, but this situation is rapidly clearing up.

Hall to Build 1000 Trucks

DETROIT, March 10—The Lewis Hall Iron Works is again back on a peace basis after completing 500 machines for the Government. The schedule for the coming year calls for the production of 1000 trucks. This company entered the truck manufacturing field in 1915, producing 100 3½-ton models. The second year it brought out the 2 and 5-ton worm drive model and also the 5 and 7-ton chain drive truck. The first two years most of the trucks were sold along the Atlantic seaboard, but they are now being distributed nationally.

Commerce to Use Pneumatic Tires Exclusively

DETROIT, March 8—The Commerce Motor Car Co. has discarded solid tires as part of the equipment of its 2-ton truck and all new machines of this type will have pneumatic tires. The 1 and 1½-ton trucks will be equipped with either pneumatic or solid tires, according to the wish of the purchaser.

Cameron to Build Tractors

STAMFORD, CONN., March 6—The Cameron Motors Corp., formerly manufacturer of passenger cars, will produce a farm tractor to be known as the Cameron. Specifications of the machine, which it is said have been tested for two years, include a block 4⅜ bore, 6-in. stroke, 4-cylinder engine, with force feed and splash lubrication, kerosene or gasoline carburetor, ignition by generator and storage battery, sectional radiator, etc. The machine has four wheels with two drive wheels at the rear, 42 in. in diameter, 12 in. face. Length is 120 in., width 56 in., height 54 in. and weight 3000 lb. The gearset has three forward speeds and reverse.

Chandler Speeds Up Production

CLEVELAND, March 8—The Chandler Motor Car Co. produced 1200 cars during February, but expects its production to exceed the 2000 mark in March. Reconstruction work seriously interfered with the February output, but now the shift from war to a peace basis is about complete. The Chandler schedule calls for 18,000 cars in 1919. Of this production, the company expects to ship 2000 to foreign countries.

Stinson Tractors Busy on Canadian Orders

MINNEAPOLIS, March 10—The tractor manufacturing plant recently established here by the Stinson Tractor Co. will undertake immediately an order for 300 machines placed during the show here by Martin & Phillips, Medicine Hat, Canada. Delivery is to be made at the rate of 50 per month, commencing April 1. The initial capacity of the Superior works was one machine a day, which is now being more than doubled.

Harrison Radiator Opens Detroit Office

DETROIT, March 11—Sales, inspection and service departments of the Harrison Radiator Corp., Lockport, N. Y., have been opened here at 3066 West Grand Boulevard.

Baker & Lockwood Open New York Branch

NEW YORK CITY, March 10—The Baker & Lockwood Mfg. Co., Kansas City, will open a factory branch here to supply eastern trade.

McGraw Tire Offices Moved to Cleveland

CLEVELAND, March 10—The executive and general offices of the McGraw Tire & Rubber Co. have been transferred here from East Palestine, O., to 1900 Euclid Avenue. A sales and service station has also been opened at 1904 Euclid Avenue. Production plans of the company indicate expansion from 5,000 to 10,000 tires and tubes a day.

Union Truck Pays First Claims

NEW YORK, March 10—The bankrupt Union Truck Mfg. Co. paid a dividend of 2½ per cent March 8.

National Surplus $138,609 Ahead of Year 1917

INDIANAPOLIS, March 11—The balance sheet of the National Motor Car & Vehicle Corp. for the year ended Dec. 31 shows net sales amounting to $2,880,757, and a gross profit on sales of $484,964. The surplus of $1,550,821 for 1918 is $138,609 more than $1,412,212 of 1917.

Comparative financial statements for 1918 and 1917 show:

Assets

	1918	1917
Property and equipment.	$849,697	$827,689
Inventories	1,197,094	1,353,750
Accounts receivable	224,884	198,895
Cash	68,186	21,879
Prepaid insurance, expenses, etc.	52,180	67,208
U. S. Government orders (trucks)	209,788	......
Government claims on Government claims on unfinished orders other than truck	88,630	......
Liberty bonds	2,500	......
Total	$2,691,961	$2,469,421

Liabilities

	1918	1917
Notes and accounts payable	$996,198	$947,034
Deposits by dealers	33,655	44,281
Accrued taxes on car sales	5,257	12,597
Accrued payroll	6,703	7,315
Reserve for taxes	84,325	31,000
Reserve for guarantee on car sales	15,000	15,000
Capital and surplus	1,550,821	1,412,212
Total	$2,691,961	$2,469,421

—

Executive Committee Will Help Premier President

INDIANAPOLIS, March 13—A committee of three has been formed to take over the active management of the Premier Motor Corp. This committee is just another name for the manufacturing committee which has been in control of several phases of the company's activities for the last few years, and is composed of the same members: C. S. Crawford, F. T. Nehrbas and E. F. Schaeffer. The manufacturing committee has been changed to the executive committee so that it can take over some of the duties of the company's president, A. C. Flowers, who is unable at this time, because of other financial interests, to devote all his attention to Premier affairs.

—

Ford States Plans

(*Continued from page* 604)

the Ford Motor Co. and he will not be allowed to leave the firm and start a competitive business," said Mr. Stevenson.

"Both Ford's genius and his name are under contract. The Ford organization will not allow him to withdraw these without legal protest and the courts will certainly uphold the present company. Mr. Ford is also under contract to give all his inventions to the Ford Co. There are men connected with the Ford plant fully as competent as either Mr. Ford or his son to carry on the business, so the protest is not because of the loss of their services, but because of the nature of the new business in which they threaten to engage. They cannot interfere with the success of the Ford Company."

In an interview Edsel Ford is quoted as saying that the Fords would not dispose or their interests in the present Ford company. He said no attempt would be made to force the minority stockholders out of the company. He said the new company would be owned entirely within the Ford family and thus directed without outside interference.

He said the plant would be divided among many cities. All factories will not be built simultaneously. Construction work will start the early part of next year. The first three units will go up in Troy, N. Y., Hamilton, O., and Kansas City. The first factories will be complete, but later each one will be devoted to the manufacture of individual parts. The present Ford system of assembly plants will be followed by the new company.

The Ford plan has created a sensation in business and automotive circles. Automobile manufacturers declare Ford is preparing to tackle his greatest undertaking and there are many who declare that even Henry Ford and his millions are not big enough to swing the deal. They say grave problems face him before he can cut loose from his present company and start production for himself. Costly litigation over patents, contracts, trade-marks, etc., is bound to result and these will consume time as well as cash.

To produce a cheap car such as Ford proposes will require an immense plant capable of great production, for it is pointed out that such a car, to sell at so low a price, must be turned out in great quantities if the venture is to prove a financial success. To build such a plant and reach sufficient production will reuire three or four years car makers believe. They point out that it has taken two years to build up his tractor plant to a point where it will produce 400 tractors daily, and say he must build on a much greater scale if he hopes to get into automobile production with reasonable speed.

Chandler Net Profits $2,194,618 for 1918

CLEVELAND, March 11—Net profits of the Chandler Motor Car Co. were $2,194,618 for the year ended Dec. 31 last, and adding that to the surplus for Jan. 1, 1918, of $2,663,189, a surplus of $3,381,905 is totalled for the year. Net profits for 1918, however, are $187,785 less than the $2,382,403 earned in 1917. The balance sheet for the past three years compares as follows:

Assets

	1918	1917	1916
Land, buildings, and equipm't	$1,011,192	$650,056	$475,062
Good will	5,000,000	5,000,000	5,000,000
Cash	634,824	698,976	1,800,422
Liberty bonds.	1,285,938	279,190	......
Accounts receivable	147,923	148,192	67,396
Cars sold for export	288,489	192,114	123,287
Due from Government	1,476,238	......	......
Inventory	1,874,414	3,018,742	1,876,985
Investment in other companies	36,753	35,090	32,000
Advanced to manufact'rs.	59,428	35,229	72,867
Miscellaneous.	89,649	25,004	......
Deferred payments	25,790	39,011	30,830
Total	$11,930,638	$10,119,604	$9,478,849

Liabilities

	1918	1917	1916
Capital stock	$7,000,000	$7,000,000	$7,000,000
Accounts payable	1,043,476	22 349	905,799
Dealer's deposits	86,835	97,860	113,928
Dividends payable	210,000	210,000	210,000
Accrued taxes	81,907	28,384	53,122
Reserves	126,515	97,872	5,214
Surplus	3,381,905	2,663 189	1,190,786
Total	$11,930,638	$10,119,604	$9,478,849

No provision has been made in statement of income, nor in the balance sheet for Federal income, war and excess profits taxes.

—

New Cleveland Plant to Cost $650,000

CLEVELAND, March 11—The new plant of the Cleveland Automobile Co., recently organized by Chandler Motor Car Co. officials to produce a $1,300 car, will cover approximately 200,000 sq. ft. of floor space and will cost $650,000. The plant will be completed and the company in operation by July 1. The site of the new factory has not been definitely decided upon.

—

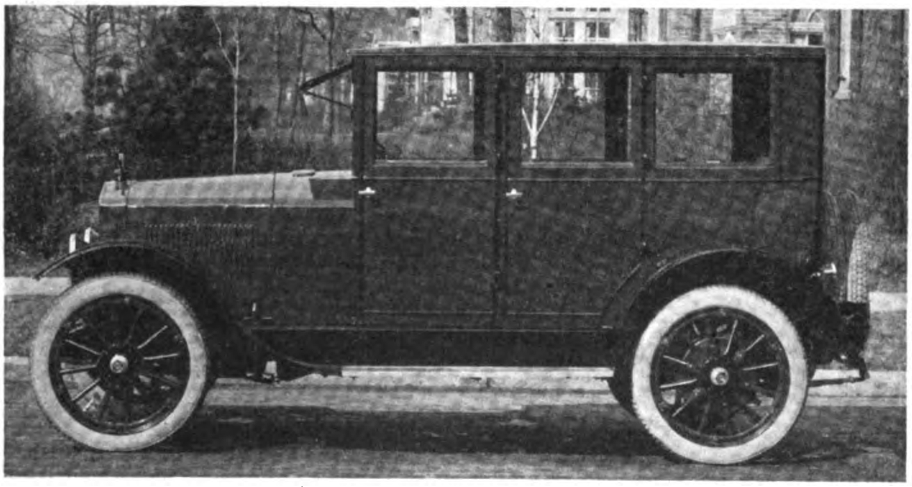
Barley Plans Increased Production

KALAMAZOO, March 12—The Barley Motor Car Co. is at present producing at the rate of 6 cars a day, and plans to increase. Recently the company's buildings were completely rearranged with this increase in production in mind.

—

Wilson Foundry Adding

PONTIAC, March 11—The C. B. Wilson Foundry & Machine Co. proposes to increase its capacity by the construction of a new building unit 100 x 800. Work is under way and the structure should be completed within 90 days.



THE Essex Co. is exhibiting for the first time at the Detroit show its sedan model. This follows in many respects the square lines of the sedan on the Hudson chassis and is finished in the same dark green as the touring model. The upholstery is in whip-cord. The front seat has a solid back, and the seating capacity is five passengers. The car will sell for $2,250 f.o.b. Detroit

Calendar

ENGINEERING

April 2—Minneapolis Section, S. A. E. — Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

SHOWS

March 1-15—New York Aeronautical Exhibition, Manufacturers' Aircraft Assn., Madison Square Garden and 69th Regiment Armory.

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.

March—Utica, N. Y. Utica Motor Dealers' Assn. W. W. Garabrandt, Manager.

March—Philadelphia, Pa. Philadelphia Automobile Trade Assn. Passenger cars.

March 8-15 — New Brunswick, N. J. Armory, New Brunswick Motor Trade Assn. William Kuehle, Manager.

March 8-15 — Philadelphia, Pa. Philadelphia Automobile Trade Assn., Commercial Huseum. A. L. Maltby, Manager.

March 10-15—Paterson, N. J. Paterson Automobile Trade Assn., Fifth Regiment Armory. H. MacGinley, Show Manager.

March 10-15 — Salt Lake City, Utah. Sixth Annual, Bonneville Pavilion. W. D. Rishel, Manager.

March 10-15 — St. Louis, Mo. Used Car Show, Exhibit Building. Robert E. Lee, Manager.

March 10-15—Syracuse, N. Y. Syracuse Automobile Dealers' Assn. Harry T. Gardner, Manager.

March 10-15 — Omaha, Neb. Fourteenth Annual, Omaha Automobile Trade Assn., Auditorium. Clark G. Powell, Manager.

March 10-15 — Seattle, Wash. Motor Car Dealers' Assn., State Armory. A. G. Schaeffer, Manager.

March 12-18—Peoria, Ill. Passenger cars, 12 to 15; trucks, 17 and 18.

March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Passenger cars only. Chester I. Campbell, Manager.

March 15-22 — Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.

March 17-22 — Great Falls, Mont. Montana Automobile Distributors' Assn.

March 17-22—Philadelphia, Pa. Motor Truck Assn., Commercial Museum.

March 18-22 — Zanesville, O. Third Annual, Zanesville Motor Car Dealers' Assn., City Hall and Market House. Edward B. Roemer, Manager.

March 19-22 — St. Joseph, Mo. St. Joseph Automobile Show Assn., Auditorium. John Albus, Manager.

March 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.

March 19-22—Warren, Pa. Third Annual, Warren Automobile Dealers' Assn.

March 19-22—Charleston, W. Va. Kanawha County Auto Trade Assn., Armory. John B. Crowley, Manager.

March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 24-29—Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.

March 24-29—Utica, N. Y. Utica Motor Dealers' Assn.

March 25-29—Wilmington, Del. Fourth Annual, Wilmington Rink.

March 26-27 — Clinton, Ia. Fourth Annual Clinton County Automobile Dealers' Assn.

March 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.

March 27-29—Holdredge, Neb. Third Annual, Holdredge Automobile Dealers' Assn.

March 28-30—Peru, Ill. Illinois Valley Auto Show.

Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.

Last of March — Harlan, Ia. Southwestern Iowa Motor Exhibit.

March 29-April 5 — Passenger Cars. April 8-12—Trucks. Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkman, Manager.

March 31-April 5—Cumberland, Md., Automobile Dealers Assn., Armory.

March 31-Apr. 5—New Orleans, La. Henry B. Marks, Manager.

April 1-5—Denver, Col.—Denver Automobile Trades Assn. Stadium.

April 5-12 — Bridgeton, N. J. Fourth Annual, Automobile Dealers' Assn.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

April 8-12—Deadwood, S. D. Seventh Annual, Cars and Tractors, Deadwood Business Club.

April 16-19 — Waynesburg, Pa. Automobile Dealers' Assn. of Greene Co., Armory. Frank L. Hoover, Mgr.

April—Little Rock, Ark. Second Annual, Little Rock Automobile Dealers' Assn., Liberty Hall.

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager

Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

TRACTOR SHOWS

Mar. 10-15—Macon, Ga. Dixie National Power Farming Demonstration. A. E. Hildebrand, General Manager.

July—Wichita, Kan., Automotive Committee of National Implement Assn

*Oct. 15—Paris, Grand Palais, International Automobile Mfrs. Congress.

November—London — Olympia—International Automobile Mfrs. Congress.

RACES

†March 15—Santa Monica, Cal. Speedway.

†March 23—Los Angeles. Ascot Speedway Assn., Ascot Speedway, 150 miles.

†May 17—Uniontown, Pa., probably 112½ miles.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 22-23—Elgin, Ill. Speedway.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Oct. 1—Cincinnati, O. Speedway race.

†Sanctioned.
*Tentative dates.

CONVENTIONS

April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

FOREIGN TRADE OPPORTUNITIES

WASHINGTON, March 7—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has inquiries for the agencies of automobiles and accessories. Full information regarding each of the following can be secured by addressing the Bureau of Foreign and Domestic Commerce and referring to the Foreign Trade Opportunity number:

A firm in England desires to buy outright or to act as agent for the sale of cheap but serviceable cars, two to three for the first order, and parts and tools suitable for garage work. Terms, cash or credit, one to three months. Cash for first order. References.

A firm in Ireland desires to secure an agency for the sale of motor cars and motor accessories for the whole of Ireland. References have been filed. Foreign Trade Opportunity No. 28,340.

A commercial agent in France desires to secure an agency for the sale of motor car accessories. Correspondence may be in English. References have been filed. No. 28,342.

A man in France desires to secure agencies for the sale of rubber tires and automobiles. Correspondence should be in English. No. 28,345.

A man in France wishes an agency for the sale of automobile accessories. Correspondence may be in English. References have been filed. No. 28,422.

A man in France wishes to secure an agency for the sale of motorcycles with side-car attachment. References have been filed. Foreign Trade Opportunity No. 28,466.

A firm in Denmark desires the agency for automobiles and motorcycles and all accessories, including tires. Quotation should be made f.o.b. New York. Terms, cash. Letters may be in English.

An engineer in Italy desires an agency for the sale of farm tractors. Correspondence may be in English. Foreign Trade Opportunity No. 28,403.

A man in France wishes to represent American firms in the sale of farm tractors. Correspondence should be in French. No. 28,404.

A man in France wishes to secure an agency for the sale of automobiles and tractors. Correspondence should be in French. No. 28,411.

A commercial agent in Algeria desires an agency for the sale of farm tractors. Correspondence should be in French. References have been filed. No. 28,393.

A firm in Switzerland desires an agency for the sale of farm tractors. Correspondence may be in English. References have been filed. No. 28,399.

A man in France wishes to be placed in communication with exporters of farm tractor with a view to its introduction in that country. Correspondence should be in French. No. 28,488.

A man in Syria desires to secure representation of American firms for the sale of farm tractors in Armenia. Correspondence should be in French. No. 28,491.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 12

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MARCH 20, 1919

Fifteen cents a copy
Three dollars a year

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, N. Y., under the Act of March 3, 1879.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, MARCH 20, 1919—CHICAGO NO. 12

Proper Systems Reduce Labor Turnover

Wide Variation in Turnover Percentages Due to Factory Methods—Many Plants Have Over 500 Per Cent Yearly

WASHINGTON, March 13—If a worker remains in the factory for more than three months the chances are two to one that he will be permanent. Twenty-one per cent of the men hired in Detroit leave their jobs before they finish one week's work. Fifteen per cent work less than 2 weeks, 14 per cent less than one month, 17 per cent from 1 to 3 months, 11 per cent 3 to 6 months, 8 per cent 6 months to 1 year and after 1 year the percentage decreases rapidly from 6 per cent quitting their jobs after working less than 2 years to 1 per cent quitting after being employed 5 years. This indication of the heavy labor turnover that exists in Detroit is the result of an intensive investigation of this problem by the Department of Labor, which has examined the length of service of workers, the nature of their separations and the causes. A comparison was made between Cleveland and Detroit.

High Turnover in Detroit

Labor turnover was found to be considerably higher in Detroit, where more than one-fifth of the firms had a turnover exceeding 400 per cent and two-fifths a turnover exceeding 300 per cent, as compared with Cleveland, where more than three-fourths of the establishments had a turnover of less than 300 per cent.

The greater turnover in Detroit is due to the more intense competition for labor, especially during the war period, when Detroit concerns seemed most actively engaged in war work. There has, in addition, always been a more noticeable turnover of labor in those cities which confine their activities chiefly to one specific industry. In Akron, where the tire industry is the chief occupation, a similar class of migratory worker floating from one factory to another and back again is also noticeable.

Specially trained executives, welfare systems, well organized labor departments, fairness, good wages, and consideration of promotion and service for employees show definitely in the investigation of the Department of Labor that they tend to lower the turnover.

Considerations That Reduce Turnover

Table 1 shows in detail the extent of labor turnover in 37 Cleveland establishments.

This table shows that more than 60 per cent of the Cleveland firms had an annual turnover exceeding 200 per cent, while 25 per cent of the companies exceeded 300 per cent.

There are no companies listed with a turnover of less than 50 per cent, 4 are under 100 per cent, 5 under 150 per cent, 5 under 200 per cent, 7 under 250 per cent, 7 under 300 per cent, 5 under 350 per cent, 4 under 400 per cent and none over this figure.

Examination of the general causes for the extent of turnover shown was made by investigating those companies with the lower and higher turnover. Establishment No. 17, employing an average of 1004 persons daily, had the largest turnover, 368 per cent, and in this company it was found that there was no attempt made to operate a properly organized

TABLE 1—LABOR TURNOVER FOR YEAR ENDING JUNE 1, 1918, IN 37 ESTABLISHMENTS, CLEVELAND, OHIO

Establishment No.	Number Hired	Separations: Discharged	Separations: Laid Off	Separations: Entered Military Service	Separations: Quit	Separations: Total	Average Number Employed per Day	Per Cent of Turnover for Year	Industry or Nature of Business
[1]1	3,552	156	22	529	2,171	2,878	4,456	65	Automobile.
2	7,011	(2)	(2)	(2)	(2)	3,718	3,124	119	Metal products.
3	(2)	2,709	......	270	6,651	9,630	2,712	355	Metal products.
4	(2)	(2)	(2)	(2)	(2)	3,037	2,430	125	Metal products.
5	7,367	(2)	(2)	(2)	(2)	6,525	2,222	294	Steel manufacturing.
6	5,179	1,095	470	274	4,450	6,289	2,173	289	Automobile.
7	6,075	429	406	315	4,439	5,589	1,987	281	Storage batteries.
8	5,118	275	118	200	4,488	5,081	1,649	308	Metal products.
9	6,036	763	......	57	4,969	5,789	1,610	359	Storage batteries.
10	3,009	(2)	(2)	(2)	(2)	4,030	1,514	266	Woodwork.
[3]11	(2)	(2)	(2)	(2)	(2)	1,611	1,757	92	Clothing.
12	2,643	188	6	66	2,663	2,923	1,417	206	Automobile.
13	2,328	353	1	2	1,906	2,262	1,368	173	Telephone service.
14	2,200	20	513	147	2,209	2,889	1,267	228	Telephone service.
15	3,520	(4)	(4)	216	[5]2,340	2,556	1,263	202	Metal products.
16	(2)	320	......	(4)	[6]2,521	2,841	1,031	276	Steel (Canton).
17	3,378	(2)	(2)	(2)	(2)	3,698	1,004	368	Bags.
18	1,575	(2)	(2)	(2)	(2)	1,338	984	136	Metal products.
19	2,691	58	15	166	2,154	2,393	940	255	Storage batteries.
20	3,077	(2)	(2)	(2)	(2)	3,091	937	330	Iron castings.
21	1,286	11	26	42	1,307	1,386	917	151	Metal products.
22	(2)	(2)	(2)	(2)	(2)	2,076	770	270	Automobile frames.
23	(2)	(2)	(2)	(2)	(2)	573	753	76	Gas.
24	2,392	206	45	156	1,927	2,334	709	329	Wire and hot-rolled rods
25	1,510	96	18	79	1,327	1,520	699	217	Wire, rods, nails.
26	1,281	84	......	45	1,161	1,290	590	219	Metal products.
27	941	(2)	(2)	(2)	(2)	776	393	197	Electrical appliances.
28	1,455	167	552	132	432	1,283	384	334	Tractors.
29	1,016	(2)	(2)	(2)	(2)	1,038	344	302	Street-railway cars.
30	(2)	(2)	(2)	(2)	(2)	158	304	52	Gas.
31	568	50	......	20	478	548	267	205	Paint and varnish.
32	(2)	(2)	(2)	(2)	(2)	443	205	216	Brushes.
33	225	(2)	(2)	(2)	(2)	265	163	163	Printing.
34	(2)	(2)	(2)	(2)	(2)	232	149	156	Printing.
35	(2)	(2)	(2)	(2)	(2)	376	105	358	Paint and varnish.
36	132	23	......	9	108	140	102	137	Telephone service.
37	(2)	(2)	(2)	(2)	(2)	139	98	141	Molding.

[1]For year ending April 1, 1918.
[2]Not reported.
[3]The turnover information shown here is based upon the records of five individual establishments. It was obtained in connection with another investigation carried on simultaneously in the cloak and suit industry of Cleveland.
[4]Included in "Quit."
[5]Includes "Discharged" and "Laid Off."
[6]Includes "Entered Military Service."

TABLE 2—LABOR TURNOVER FOR YEAR ENDING 'UNE 1, 1918, IN 42 ESTABLISHMENTS, DETROIT

[1]1	14,924	169	110	3,122	11,230	[2]14,631	31,950	46	Automobile.
2	34,779	4,886	2,085	2,304	20,916	30,191	11,405	265	Automobile.
[1]3	41,174	5,115	3,799	2,727	34,167	45,808	11,125	412	Automobile.
4	16,696	(3)	(3)	1,496	[4]15,552	17,048	6,337	269	Automobile.
5	(5)	[6]4,948	(5)	(5)	10,182	15,130	3,379	448	Metal products.
[7]6	2,332	(5)	(5)	(5)	(5)	2,527	2,925	86	Coke and chemicals.
7	7,683	(5)	(5)	602	(5)	6,861	2504	274	Automobile.
8	3,347	548	4	(3)	2,463	3,015	2,167	139	Telephone service.
9	7,332	965	1,879	362	3,581	6,787	1,944	349	Automobile.
10	585	94	......	137	809	1,040	1,933	54	Gas, illuminating.
11	(5)	747	242	317	4,489	5,795	1,103	525	Metal products.
[9]12	2,427	634	406	(3)	1,227	2,267	850	267	Metal products.
13	1,629	116	306	63	1,638	2,123	783	271	Metal products.
14	3,591	713	......	(3)	[10]2,871	3,584	726	494	Metal products.
15	(5)	(5)	(5)	(5)	(5)	1,642	675	243	Metal products.
[7]16	1,037	112	......	95	924	1,131	668	169	Chemicals, drugs.
[7]17	1,781	(5)	(5)	(5)	(5)	1,714	637	269	Metal products.
18	1,773	113	......	130	1,190	1,433	630	227	Metal products.
19	2,682	65	......	......	2,600	2,665	591	451	Tobacco.
20	1,642	298	......	(3)	[10]1,467	1,765	511	345	Furniture.
21	834	44	(3)	41	[11]1,082	1,167	497	235	Metal products.
22	686	55	......	25	898	978	480	204	Clothing.
23	3,000	(5)	(5)	(5)	(5)	3,040	475	640	Paper.
24	(5)	365	......	45	1,464	1,874	456	411	Food products.
25	1,967	168	......	84	1,805	2,057	438	470	Metal products.
26	533	66	37	89	318	510	431	118	Telephone service.
27	1,296	63	24	67	912	1,066	390	273	Metal products.
28	628	51	26	106	450	633	331	191	Telephone service.
29	910	102	250	53	290	695	316	220	Metal products.
30	968	137	......	68	694	899	241	373	Metal products.
31	800	(5)	(5)	(5)	(5)	670	224	299	Metal products.
32	392	18	......	22	344	384	218	176	Metal products.
33	744	125	......	33	586	744	213	349	Electrical appliances.
34	(5)	(5)	(5)	(5)	(5)	710	187	380	Metal products.
35	543	43	27	15	482	567	161	352	Metal products.
36	104	15	3	20	68	106	161	66	Telephone service.
37	(5)	(5)	(5)	(5)	(5)	391	159	246	Electrical manufactures.
38	167	13	20	13	95	141	138	102	Telephone service.
39	477	52	260	42	183	537	135	398	Automobile manufacturing.
40	606	148	32	64	369	613	121	507	Automobile manufacturing.
41	(5)	120	......	30	273	423	114	371	Metal products.
42	(5)	(5)	(5)	(5)	(5)	298	86	347	Metal products.

[1]Year ending August 1, 1918.
[2]Excluding transfers.
[3]Included in "Quit."
[4]Includes "Discharged" and "Laid Off."
[5]Not reported.
[6]Includes "Laid Off" and "Entered Military Service."
[7]Year ending July 1, 1918.
[8]No males employed in establishment.
[9]Year ending February 1, 1918.
[10]Includes "Entered Military Service."
[11]Includes "Laid Off."

TABLE 3—NUMBER AND PE R CENT OF SEPARATIONS ATTRIBUTABLE TO EACH SPECIFIED CAUSE

SIXTEEN ESTABLISHMENTS IN CLEVELAND

Establishment No.	Number: Discharged	Number: Laid Off	Number: Entered Military Service	Number: Quit	Number: Total	Per Cent: Discharged	Per Cent: Laid Off	Per Cent: Entered Military Service	Per Cent: Quit
12	188	6	66	2,663	2,923	6	(1)	2	91
6	1,095	470	274	4,450	6,289	17	7	4	71
1	156	22	529	2,171	2,878	5	1	18	75
7	429	406	315	4,439	5,589	8	7	6	79
19	58	15	166	2,154	2,393	2	1	7	90
26	84	..	45	1,161	1,290	7	..	3	90
8	275	118	200	4,488	5,081	5	2	4	88
21	11	26	42	1,307	1,386	1	2	3	94
9	763	..	57	4,969	5,789	13	..	1	86
31	50	..	20	478	548	9	..	4	87
28	167	552	132	432	1,283	13	43	10	34
24	206	45	156	1,927	2,334	9	2	7	83
25	96	18	79	1,327	1,520	6	1	5	87
36	23	..	9	108	140	16	..	6	77
13	353	1	2	1,906	2,262	16	(1)	(1)	84
14	20	513	147	2,209	2,889	1	18	5	76
Total	3,974	2,192	2,239	36,189	44,594	9	5	5	81

TWENTY-FIVE ESTABLISHMENTS IN DETROIT

22	55	..	25	898	978	6	..	3	92
24	365	..	45	1,464	1,874	19	..	2	78
10	94	..	137	809	1,040	9	..	13	78
35	43	27	15	482	567	8	5	3	85
27	63	24	67	912	1,066	6	2	6	86
18	113	..	130	1,190	1,433	8	..	9	83
11	747	242	317	4,489	5,795	13	4	5	77
30	137	..	68	694	899	15	..	8	77
41	120	..	30	273	423	28	..	7	65
25	168	..	84	1,805	2,057	8	..	4	88
13	116	306	63	1,638	2,123	5	14	3	77
29	102	250	53	290	695	15	36	8	42
32	18	..	22	344	384	5	..	6	90
39	52	260	42	183	537	10	48	8	34
40	148	32	64	369	613	24	5	10	60
3	5,115	3,799	2,727	34,167	45,808	11	8	6	75
1	169	110	3,122	11,230	14,631	1	1	21	77
9	965	1,879	362	3,581	6,787	14	28	5	53
2	4,886	2,085	2,304	20,916	30,191	16	7	8	69
16	112	..	95	924	1,131	10	..	8	82
28	51	26	106	450	633	8	4	17	71
26	66	37	89	318	510	13	7	17	62
38	13	20	13	95	141	9	14	9	67
36	15	3	20	68	106	14	3	19	64
8	548	4	......	2,463	3,015	18	(1)	..	82
Total	14,281	9,104	10,000	90,052	123,437	11	7	8	73

[1]Less than 1 per cent.

employment department, maintain a trained employment executive or in any way give consideration to the workers. In the next largest turnover—359 per cent—which occurred in a storage battery plant employing 1610 daily, it was found that the general character of the work is disagreeable due to the use of odorous chemicals, fine powders and to conditions which of necessity are hot and dusty. The firm has a well organized employment department, but still allows time-keeping clerks and foremen the power of hiring and firing.

Firm No. 1, an automobile and motor truck manufacturer with a well balanced employment organization, where the power to hire and fire rests only with the highest labor executive and where sick benefits, insurance and other welfare schemes are practiced shows the lowest labor turnover—65 per cent per year. This concern employs 4456 daily.

Table 2 shows the extent of labor turnover in 42 Detroit establishments.

It will be noted that one concern has a turnover under 50 per cent, 3 under 100 per cent, 3 under 150 per cent, 3 under 200 per cent, 6 under 250 per cent, 8 under 300 per cent, 4 under 350 per cent, 5 under 400 per cent, 6 between 400 and 500 per cent, and 3 over 500 per cent.

Establishment No. 1, which is undoubtedly the Ford Motor Co., employing an average of 31,950 people daily, as is known, has a very comprehensive welfare scheme and treats its employees liberally and fairly. It will be noted that the Ford company discharges less than 1 per cent of the people leaving its employment each year—

Table 4—Number and Per Cent in Employ and Among the Separations of Specified Length-of-Service Groups of Employees in Each of 18 Establishments in Cleveland

Number in Each Classified Service Group

Establishment Number	On Payroll at End of Year											Separated During the Year											Industry or Nature of Business
	One Week or Under	Over 1 Wk. to 2 Wks.	Over 2 Wks. to 1 Mo.	Over 1 Mo. to 3 Mos.	Over 3 Mos. to 6 Mos.	Over 6 Mos. to 1 Yr.	Over 1 Yr. to 2 Yrs.	Over 2 Yrs. to 3 Yrs.	Over 3 Yrs. to 5 Yrs.	Over 5 Yrs.	Total	One Week or Under	Over 1 Wk. to 2 Wks.	Over 2 Wks. to 1 Mo.	Over 1 Mo. to 3 Mos.	Over 3 Mos. to 6 Mos.	Over 6 Mos. to 1 Yr.	Over 1 Yr. to 2 Yrs.	Over 2 Yrs. to 3 Yrs.	Over 3 Yrs. to 5 Yrs.	Over 5 Yrs.	Total	
6	69	59	121	351	353	247	105	88	63	42	1,498	249	255	504	1,516	1,256	1,263	438	378	252	178	6,289	Automobile and motor truck mfg.
1	95	85	58	488	390	783	705	533	785	772	4,694	135	88	135	652	600	559	307	240	96	72	[1]2,884	Do.
32	21	23	22	35	32	44	36	10	16	21	260	173	45	69	72	40	30	12	....	1	1	443	Brushes mfg.
27	22	30	32	89	58	53	76	54	9	55	478	64	103	119	256	103	69	35	9	7	11	776	Electrical appliances mfg.
21	9	27	15	36	34	87	122	93	77	313	813	202	399	203	240	137	92	46	19	12	36	1,386	Metal products mfg.
19	66	50	78	130	87	166	128	127	31	162	1,025	390	434	414	603	268	181	61	19	7	16	2,393	Storage batteries.
15	27	36	117	217	130	233	174	148	132	138	1,352	259	252	349	536	301	220	77	54	9	9	[1]2,066	Metal products mfg.
26	7	7	33	50	21	58	88	26	18	244	552	221	146	203	216	107	106	65	9	16	24	[1]1,113	Do .
20	17	21	66	63	51	113	111	54	84	152	732	1,724	653	439	43	42	31	43	31	42	43	3,091	Malleable iron castings
37	5	4	9	10	10	13	16	7	13	5	92	36	9	20	21	20	20	11	2	....	..	139	Molding machinery mfg.
31	8	17	14	33	15	25	30	10	5	80	237	202	59	52	100	65	43	12	2	5	8	548	Paint and varnish mfg.
39[2]	....	2	9	12	8	3	13	6	6	23	82	4	6	5	14	6	12	7	3	2	1	60	Printing.
29	21	9	28	61	32	46	40	37	34	12	320	74	67	309	345	108	78	27	21	8	1	1,038	Street-railway cars mfg.
9	57	88	97	314	271	300	284	106	106	261	1,884	1,766	674	765	1,114	527	322	129	19	31	25	[1]5,372	Storage batteries, carbon products, mfg.
36	5	6	6	13	20	13	12	2	2	28	107	5	9	21	30	28	22	15	3	3	4	140	Telephone service (clerical force.)
31	85	50	45	212	183	345	425	145	181	163	1,834	291	208	201	378	354	349	221	79	116	63	[1]2,260	Telephone service (operating force).
14	24	12	35	109	133	192	107	34	64	167	877	426	249	463	823	499	255	95	27	22	30	2,889	Telephone service (plant).
10	60	49	111	158	91	260	193	86	87	598	1,693	897	388	585	947	484	331	162	28	40	168	4,030	Woodwork, sewing-machine cabinets, etc.
Total	598	575	896	2,381	1,919	2,981	2,665	1,566	1,713	3,236	18,530	7,118	4,044	4,856	7,906	4,945	3,983	1,763	943	669	690	36,917	

Per Cent in Each Classified Service Group

Establishment Number	One Week or Under	Over 1 Wk. to 2 Wks.	Over 2 Wks. to 1 Mo.	Over 1 Mo. to 3 Mos.	Over 3 Mos. to 6 Mos.	Over 6 Mos. to 1 Yr.	Over 1 Yr. to 2 Yrs.	Over 2 Yrs. to 3 Yrs.	Over 3 Yrs. to 5 Yrs.	Over 5 Yrs.	Total	One Week or Under	Over 1 Wk. to 2 Wks.	Over 2 Wks. to 1 Mo.	Over 1 Mo. to 3 Mos.	Over 3 Mos. to 6 Mos.	Over 6 Mos. to 1 Yr.	Over 1 Yr. to 2 Yrs.	Over 2 Yrs. to 3 Yrs.	Over 3 Yrs. to 5 Yrs.	Over 5 Yrs.	Total	Industry or Nature of Business
6	5	4	9	23	24	16	7	6	4	3	100	4	4	8	24	20	20	7	6	4	3	100	Automobile and motor truck mfg.
1	2	2	1	10	8	17	15	11	17	16	100	5	3	5	23	21	19	11	8	3	2	100	Do.
32	8	9	8	13	12	17	14	4	6	8	100	39	10	16	16	9	7	3	....	([3])	([3])	100	Brushes mfg.
27	5	6	7	19	12	11	16	11	2	12	100	8	13	15	33	13	9	5	1	1	1	100	Electrical appliances mfg.
21	1	3	2	4	4	11	15	11	9	38	100	15	29	15	17	10	7	3	1	1	3	100	Metal products mfg.
19	6	5	8	13	8	16	12	12	3	16	100	16	18	17	25	11	8	3	([3])	([3])	1	100	Storage batteries.
15	2	3	9	16	10	17	13	11	10	10	100	13	12	17	26	15	11	4	3	([3])	([3])	100	Metal products mfg.
26	1	1	6	9	4	11	16	5	3	44	100	20	13	18	19	10	10	6	1	1	2	100	Do.
20	2	3	9	9	7	15	15	7	11	21	100	56	21	14	1	1	1	1	1	1	1	100	Malleable iron castings
37	5	4	10	11	11	14	17	8	14	5	100	26	6	14	15	14	14	8	1	....	..	100	Molding machinery mfg.
31	3	7	6	14	6	11	13	4	2	34	100	37	11	9	18	12	8	2	([3])	1	1	100	Paint and varnish mfg.
39[2]	....	2	11	15	10	4	16	7	7	28	100	7	10	8	23	10	20	12	5	3	2	100	Printing
29	7	3	9	19	10	14	12	12	11	4	100	7	6	30	33	10	8	3	2	1	([3])	100	Street-railway cars mfg.
9	3	5	5	17	14	16	15	6	6	14	100	33	13	14	21	10	6	2	([3])	1	([3])	100	Storage batteries, carbon products, mfg.
36	5	6	6	12	19	12	11	2	2	26	100	4	6	15	21	20	16	11	2	2	3	100	Telephone service (clerical force).
13	5	3	2	12	10	19	23	8	10	9	100	13	9	9	17	16	15	10	3	5	3	100	Telephone service (operating force).
14	3	1	4	12	15	22	12	4	7	19	100	15	9	16	28	17	9	3	1	1	.1	100	Telephone service (plant).
10	4	3	7	9	5	15	11	5	5	35	100	22	10	15	23	12	8	4	1	1	4	100	Woodwork, sewing-machine cabinets, etc.
Total	3	3	5	13	10	16	14	9	9	18	100	19	11	13	21	13	11	5	3	2	2	100	

[1]Period covered by separations is different from period covered in Table 1.
[2]This establishment lacked the data for Table 2.
[3]Less than 1 per cent.

169 having been discharged in the 12 months. Establishment No. 6, coke manufacturers, despite the unpleasantness and hazardous nature of the work, maintains a turnover of only 86 per cent a year. This record is the result of a carefully worked out liberal labor policy, the existence of an efficient employment department and the centralization of all functions relating to employment, promotion and service. More than 60 per cent of the employees earn $1,300 annually, ad less than 10 per cent less than $1,200. The firm maintains a medical staff, operates an employees' sick benefit and conducts a co-operative store. Workers with continuous service records are given bonuses. A profit-sharing plan allows for distribution of certain profits each year in proportion to the salaries. Filtered drinking water, lockers and showers, special shaving conveniences, em-employees' lunch room, club rooms, and a special housing plan are maintained.

Establishment No. 40, an automobile car and parts maker, pays no attention to his labor organization, allows foremen to hire and fire, and—the labor turnover is 507 per cent annually.

Nine per cent of the workers in Cleveland and 11 per cent in Detroit were found to have been discharged during the year, 5 per cent and 7 per cent respectively were lost in temporary lay-offs, 5 per cent and 8 per cent entered military service and 81 per cent in Cleveland and 73 per cent in Detroit quit their jobs, which indicates definitely that it is the restlessness of the worker or the offer of better wages or other similar inducements that cause the chief proportion of turnover.

Table 3 shows specifically the number and percent of separations and the causes.

The length of service, which was discussed in the opening paragraph of this article, is shown in tables 4 and 5. ***(Continued on page 667)***

Factors in High-Speed Engine Development

Forced Lubrication — High Mean Effective Pressure — Valve Areas—Inertia Problems—Valve Timing and Materials—Piston Material and Design, All Play Important Roles

D. McCall White Favors Cast Iron Pistons—Tells S. A. E. the Story of Cadillac Engine Development

Part I

By D. McCall White*

DIFFERENT firms have different ideas regarding engines of high efficiency and moderately efficient engines. For very high-speed engines, the designer must not lose sight of the fact that what the public requires to-day is a small engine which has good torque at low speeds and is capable of revolving efficiently at very high speeds.

These two points are difficult enough to attain together, as one is really opposed to the other in practice, due to the fact that in order to obtain high speeds with power, the valve areas, valve ports, carbureters, etc., must not be restricted in any way whatever; whilst, in order to obtain a good mixture at low speeds with heavy torque, means, firstly, a different valve setting and, secondly, more or less restricted port and valve areas, etc., in order to give high gas velocities.

If one adds to the above complications the fact that it is also required that the modern valve gear must be silent, the proposition is one which calls for considerable thought and ingenuity.

Briefly stated the fundamentals of high-speed engines are as follows:

High mean effective pressures at high speeds which depends on:

1—High volumetric efficiency.

2—High compression to help rapid combustion at high speeds.

3—Light reciprocating and rotating parts to obtain high mechanical efficiency.

It is only a few years ago since engines were designed with a maximum power of 1200 to 1500 r.p.m., although other designers had the forethought to consider that it was possible to attain very high engine speeds indeed, and to-day this is an accomplished fact.

The high-speed, high-efficiency engine of to-day must be designed very carefully in order to obtain good results, as one slip will spoil the whole design. We have all lengths of stroke-bore ratios, but the stroke-bore ratio should be from 1.5 to 1 to 1.625 to 1, because one can obtain all the power required without having a very unwieldy and heavy engine.

It should also be considered that there are more fastidious purchasers than ever to-day who buy cars, and therefore there must be no doubt whatever that the engine must be practically free from vibration and must be most sweet, silky and silent when transmitting power. In short, the salable article is the one which has small size coupled with great power and is neat and compact in design, with the requisite silence. There is nothing pleases the owner more than to have these combinations.

I believe I have mentioned many times that a bore of about 90 millimeters is about the maximum cylinder for high-speed work, and after that I certainly believe multiplicity of cylinders should commence.

Mean Effective Pressures

It is quite useless to think of designing an engine to cope with the present-day market unless it can develop power up to from 2500 to 3500 r.p.m. or over, smoothly and quietly. The power must be good and a touring engine of to-day must be capable of carrying a mean effective pressure from 80 to 100 lb. per sq. in., relative to the brake horsepower up to 2200 r.p.m. at least.

A power and mean effective pressure curve might be of interest—Fig. O. The curve shows the mean effective pressure and b.hp. on a 12-horsepower Napier engine designed around 1911 having one L head exhaust valve and

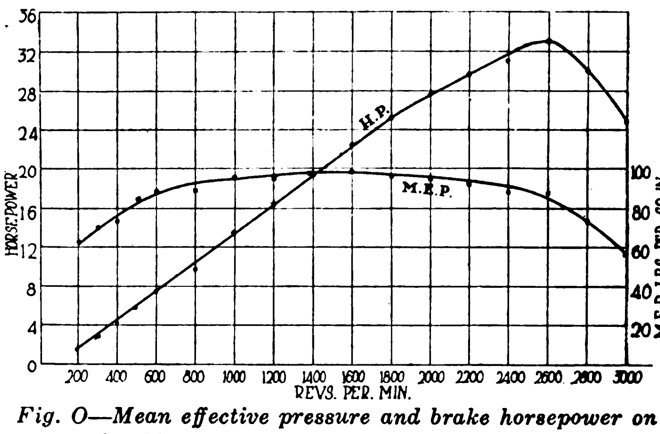


Fig. O—Mean effective pressure and brake horsepower on 12-hp. Napier four-cylinder engine, 2 11/16 by 5

*EDITOR'S NOTE—D. McCall White, vice-president of the Cadillac Motor Car Co., read this paper before the mid-winter meeting of the Society of Automotive Engineers in New York, February, 1919. Mr. White designed the Cadillac eight-cylinder engine, which was the pioneer in high-speed, multiple-cylinder engines in America. Previous to coming to America he was engineer with two or three leading European car makers.

one overhead intake valve immediately above. This engine was a four-cylinder, 2 11/16 by 5 in., and showed a mean effective pressure relative to the brake of 98 lbs. per sq. in., and a maximum power of 33 B. H. P. at 2600 r.p.m. The engine was fitted with a muffler but pulled more power, naturally, without the muffler and had a two-jet carbureter of my own design. The crankshaft had two bearings and had forced lubrication oiling system throughout.

A curve, Fig. 1, shows mean effective pressure and power curve of the standard Cadillac eight-cylinder engine run up to very high speeds of 3750 r.p.m., which is of considerable interest.

Relative to mean effective pressures the table below shows bore and stroke with revolutions per minute and mean effective pressures relative to the brake, which I obtained from seven different engines some few years ago:

Bore, mm.	Stroke, mm.	R. P. M.	M. E. P. Lbs. per Sq. In.
68	127	2400	89
68	127	2000	97.5
82.5	127	1200	82.5
89	127	1200	79.5
96	130	1200	127
80	130	3000	103
80	130	2400	104

Volumetric Efficiency

To design a successful high-speed engine, it is desirable that the compression should be fairly high in order to get rapid combustion at high speeds, and the ratio should approximate 21 per cent of the total volume. A compression curve, Fig. 2, shows how the compression is maintained in the Cadillac eight-cylinder engine.

Whilst on the subject of compression, a very simple and easy method of indicating the compression on the engine, as well as the maximum pressure, can be accomplished by the Okill indicator, an English instrument, and which we have found to be very satisfactory. Fig. 1-B shows this instrument attached to a Cadillac eight and it is easy to see the graduations on the outside cylinder of the instrument. This instrument consists of a cylinder containing a piston of about ½-in. diameter, the piston being held at the bottom of a cylinder by a coil spring.

The cylinder is screwed into a fitting which communicates by a small passage with the combustion chamber and a stop-cock is placed in the passage. The tension of the spring holding the piston on its seat can be varied by a knurled nut at the top of the cylinder, the motion of the piston being transmitted to a pointer at the side of the cylinder. When using this, the knurled nut is screwed down until a considerable pressure is put on the piston, the stop-cock being then opened and the knurled nut backed off until the piston just starts to lift each time the engine comes up on the compression stroke, thus indicating that the spring pressure just balances the compression.

The tension of the spring and consequently the compression indicated, is directly proportional to the number of turns required on the adjusting nut, and the motion of the

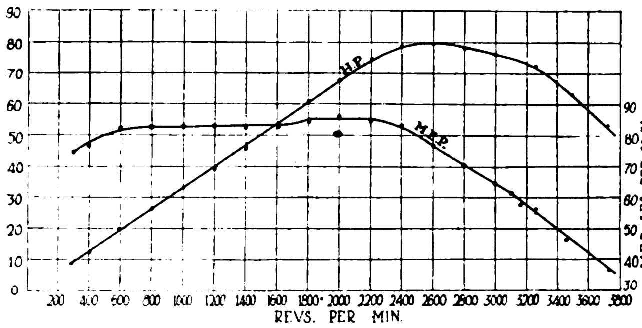


Fig. 1—Mean effective pressure and horsepower curve on Cadillac eight up to 3750 r p m.

nut is indicated in the same manner as the motion of the barrel of the ordinary micrometer, except that it is graduated to read in lbs. per sq. in.

High-Speed Characteristics

The high-speed engine might be likened to an air compressor, as the great point is to get the charge into the cylinders and thus obtain the highest possible volumetric efficiency, and much can be done by the shape of pipes, smoothness of same, lack of bends or elbows, particularly careful design of valve ports, seats, etc., together with the cooling of same.

The volumetric efficiency is entirely dependent upon port area, large carbureters, large valves, etc., but coupled with these advantages is the obvious disadvantage of carburetion and starting in cold weather, which former affects the acceleration to a very great degree. As cold weather is with us every year, it is highly important that precautions should be taken by the designers to see that their enthusiasm for maximum power does not overstep the bounds of proper carbureter size, etc. in order to get a combination of highly satisfactory running, both summer and winter.

A great deal has been done in heating intake manifolds and I propose to deal with this point later. The curve, Fig. 1-A, illustrates the difference on Cadillac eight-cylinder engine in 1915 when using 1¼-in intake manifold as against 1½-in. intake manifold. It will be noted that the power is increased right up the line from 1200 r.p.m. and was about the same at lower speeds.

On the matter of high volumetric efficiency, we have heard a great deal on the question of multiple valves and I do not know whether it is generally known that multiple inlet valves consisting of a group of three intake valves were used in the English Napier car in 1909.

A great deal has been heard of the overhead valve and many types of overhead valve systems have been used. We have seen racing cars with overhead camshafts driven by bevel gears, spur gears, spiral gears, etc.; other valve systems with the camshaft below and push rods with rockers operating the valves above.

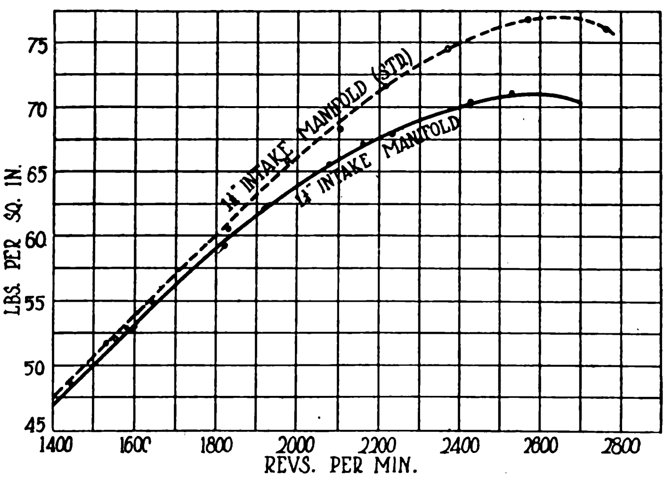


Fig. 1A—Difference in horsepower using 1½-in. manifold as compared with 1¼-in. size on 1915 Cadillac eight

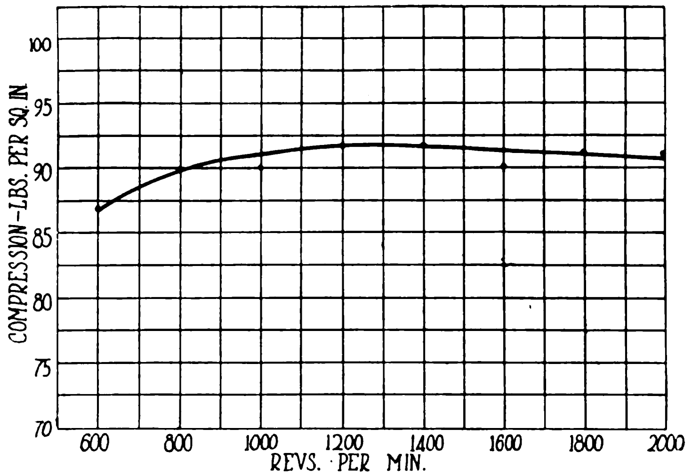


Fig. 2—Cadillac eight-cylinder engine compression curve up to 2000 r.p.m.

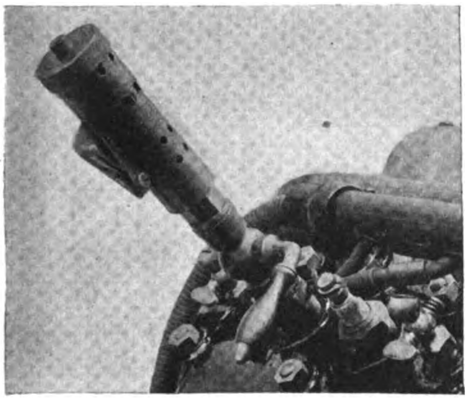


Fig. 1B—The O'Kill pressure indicator for engine tests

The Wimperis accelerometer used in road testing

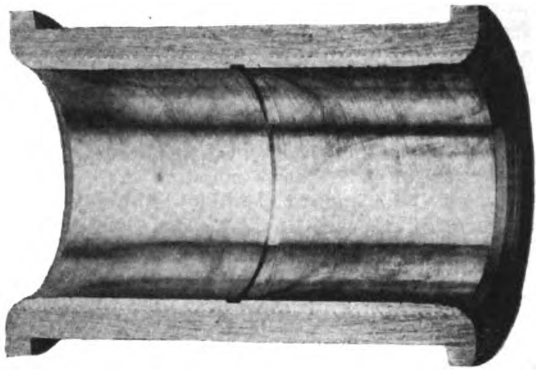


Fig. 8—Circular oil groove in the center of the bearing which serves as an oil reservoir

Much can be said regarding the different types, but I do not believe that it is possible to design a satisfactory and quiet overhead valve mechanism with a combination of rocker arms and overhead camshafts, because of the difficulty in obtaining quiet engines. On the other hand we have a quieter system having the camshaft below and push rods coupled with rocker arms operating the valves above, but I believe that the inertia of this valve mechanism would be so great as to almost put it out of count as the kind of a valve gear which should be designed into a high-speed engine.

Valve Gear Types

When all is said and done, there is a great deal to be said for the L-head type of engine, because the valve gear can be kept down very light indeed, very good sized valves can be used and it is a fact that this, up until the moment, is the quietest type of valve gear which can be used in the touring car engine. It is true that the engine fitted with overhead valves when properly designed should pass approximately 25 per cent more gas than the L-head engine, although a well designed L-head engine uses about 75 per cent of the circumference of the valve, whilst with the T-head engine only about 50 per cent of the circumference of the valve is effective. Where multiple valves are used, it is very easy to see by simple calculation that the frictional resistance offered by double valves and ports is approximately 30 to 35 per cent greater than that of a single valve and port of the same area.

On the question of the inertia of valve mechanism generally, in the Cadillac eight we are obtaining engine speeds on the road of well over 3000 r.p.m. and have records of 3550 and 3850 r.p.m. road performance. If one considers, referring to the valve mechanism, just exactly what this means on the matter of acceleration, which information can easily be obtained by simple figuring, that at 3000 r.p.m. the time taken to open and close one of the valves is .0125 second, at 3550 r.p.m. the time taken to open and close one of the valves is .0106 second, and at 3850 r.p.m. the time taken to open and close one of the valves is .0098 second. You will see, therefore, that the first thing a valve has to do, in a very high-speed engine, after it opens, is to close, and there is mighty little time allowed to do that.

Valve Seat Angles

At various times there have been discussions regarding the different angles for valve seats, and if one takes a seat of 50 degree angle having a supposed lift of ¼ in., this will give a valve area across the narrowest portion of only 72 per cent of ¼ in.; whilst if the valve seat having the same width of seat as the 50 degree seat is 30 degrees, this gives 87.5 per cent of ¼ in.; whilst the 30 degree seat narrowed down to around 1/16 in. gives the same amount of ¼ in., but, of course, gives a larger valve bore, thus decreasing the velocity through the bore itself.

Valve Timing Results

The valve timing of an engine has quite some considerable effect on the power, not only at low speeds, but at high speeds. We ran some power curves on the Cadillac 1916 eight at that time, all of these tests being run on the same engine,

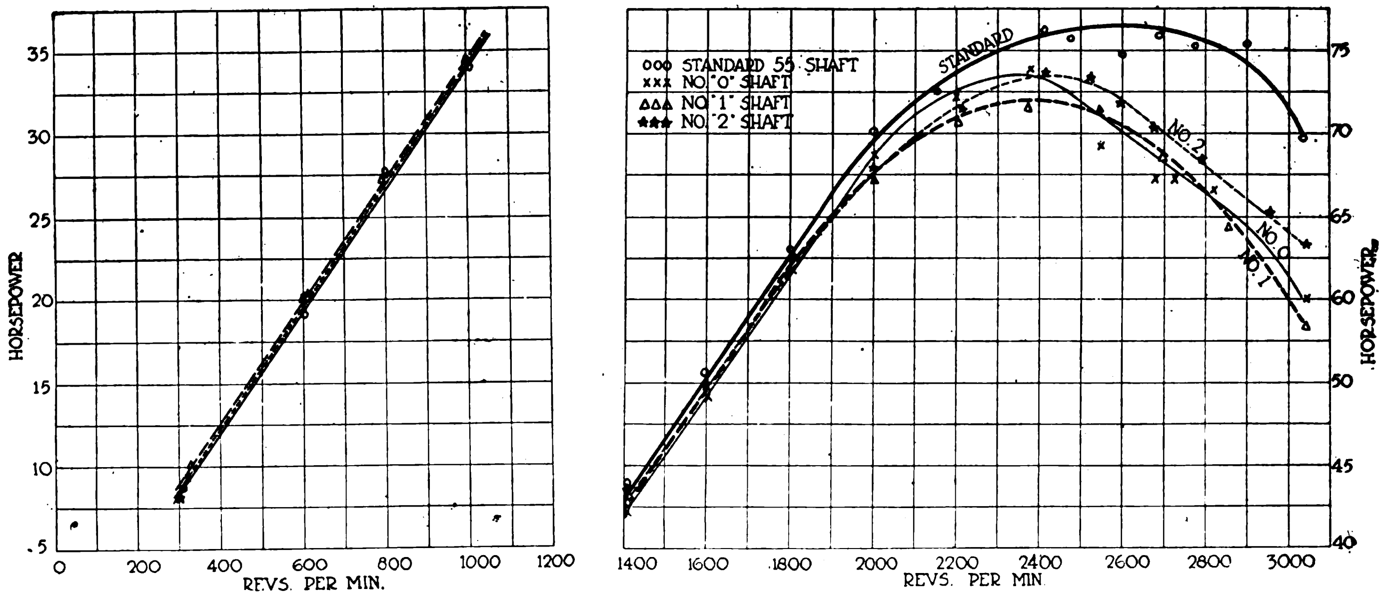


Fig. 3—Cadillac eight-cylinder engine power curves with different camshaft designs

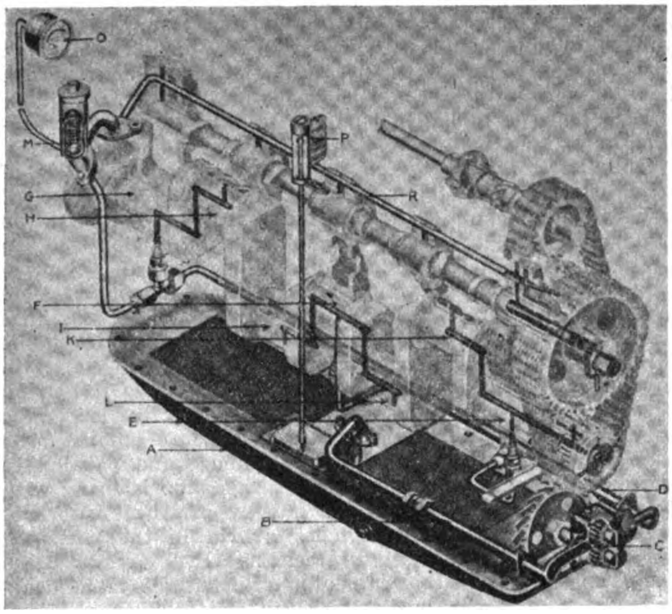


Fig. 7—Cadillac forced feed oiling system

and superimposed curves are shown in Fig. 3. Chart No. 1, which is known as Standard, is the following timing:

	Inlet Opens	Inlet Closes	Exhaust Opens	Exhaust Closes
Standard timing	3° 49′ (A)	47° 29′ (A)	46° 56′ (B)	3° 7′ (A)
No. 0 timing..........	1° 52′ (A)	31° 22′ (A)	47° 52′ (B)	1° 49′ (A)
No. 1 timing..........	2° — (B)	32° 19′ (A)	47° — (B)	1° 10′ (A)
No. 2 timing..........	1° 22′ (A)	33° 7′ (A)	43° 31′ (B)	2° — (A)

Under Fig. 3 is shown horsepower curves superimposed on one another, all of which are self-explanatory, and inspection will show a slight gain in power up to 1000 r.p.m. in favor of the shafts marked No. 0, No. 1 and No. 2, but after that point there is a slow and steady loss up to 2400 r.p.m., where there is a sudden break in the curves, whilst the curve run with the Standard timing shows practically no loss of power up to and around 2800 r.p.m.

Valve Material Specifications

In my opinion, the material used in valves is very important. In England around 1913 when running with engines turning up as high as 300 r.p.m., I used a material in the valves having the following analysis:

	Per Cent
Carbon	0.40
Silicon	0.14
Sulphur	0.03
Phosphorus	0.035
Manganese	0.65
Nickel	5.00

whilst for engines running around 3000 r.p.m. the following anaylsis was used:

	Per Cent
Carbon	0.32
Silicon	0.10
Sulphur	0.03
Phosphorus	0.037
Nickel	3.00

Whilst both these analyses were satisfactory, we always had more or less trouble with valves warping and consequent compression leakage. The analysis of the valves used in the Cadillac eight-cylinder engine should be of interest, as we practically do not know what trouble is, so far as our valves are concerned.

For the intake valves the following analysis is used:

	Per Cent
Carbon	0.69
Manganese	0.32
Sulphur	0.012
Chromium	1.08
Tungsten	2.15
Vanadium	0.08
Silicon	0.15
Nickel	0.15

whilst the exhaust valves have the following analysis:

	Per Cent
Carbon	0.56
Manganese	0.35
Sulphur	0.016
Nickel	0.12
Chromium	3.06
Tungsten	13.84
Silicon	0.17

I have already laid considerable stress on the weight of the valve mechanism, and it is well known that the pistons

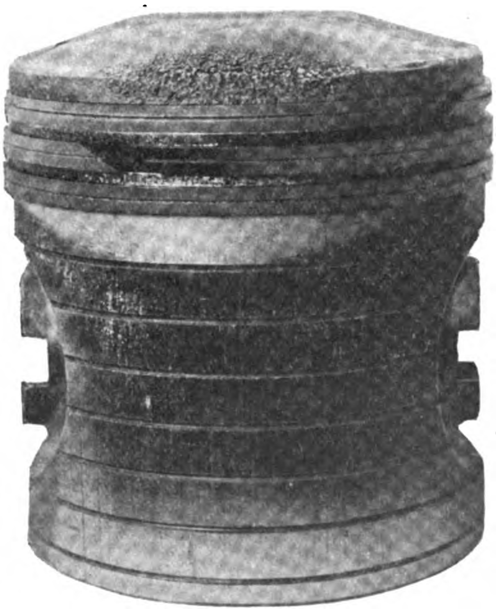


Fig. 4—Aluminum piston after 50-hr. test in Liberty engine, corroded due to changing quality of mixture and intense changes of temperature

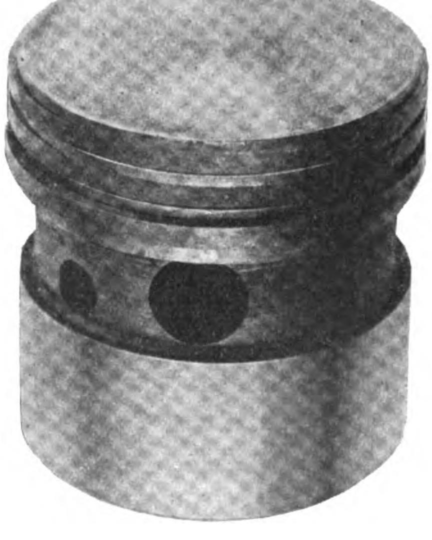


Fig. 5—A Cadillac piston that had not enough surface above the wrist pin and below the bottom groove

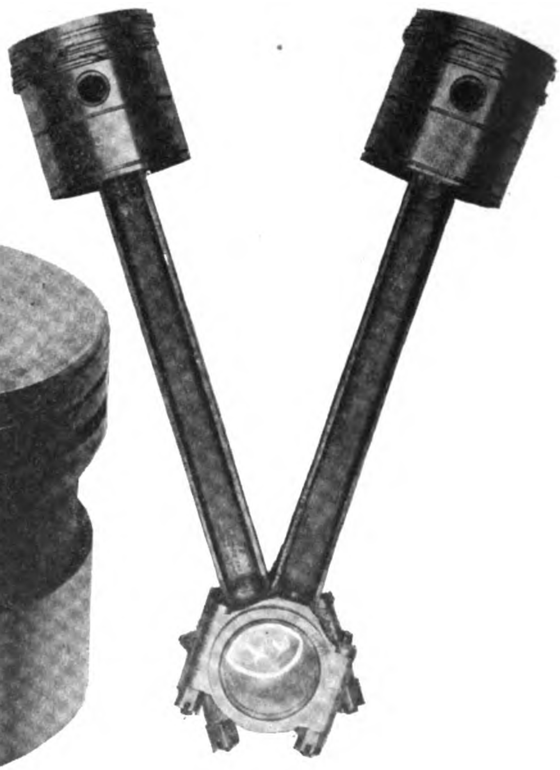


Fig. 6—Standard piston and connecting-rod on Cadillac eight engine

should be just as light as ever possible. I have tried various designs of pistons, including aluminum, steel and cast iron of all different shapes, and up until the moment of writing, so far as the touring car engine is concerned, I have not found either the aluminum or steel pistons to be satisfactory.

In the first place, it is necessary to give both the aluminum and steel pistons very much too great clearances in order to insure quiet running and satisfactory performance of the motor. Where aircraft engines or engines which are continually running at high speeds are concerned, it is possible so far as clearances are concerned that the aluminum pistons are entirely satisfactory, but there is no doubt in my mind that owing to the intense changes of temperature in any motor that the aluminum pistons are apt to be eaten away in very little time.

Fig. 4 illustrates an aluminum piston taken after a 50-hour test on a Liberty twelve, which is considerably corroded and is merely an example of continuous changing of temperature or quality of mixture and its effect on aluminum alloy.

Fig. 5 shows the lightest form of cast iron piston which I have been able to develop up to date, the weight of same being 15 ounces and the diameter being 3⅛ in. The surface above the wrist pin and below the bottom groove was insufficient and the piston wore rapidly at that point.

Fig. 6 shows assembly of Cadillac standard pistons and connecting rods.

Before leaving the pistons, let me mention that in multiple-cylinder, high-speed engines with relatively small bores and large superficial area of combustion chamber walls, it is highly important to prevent the water, which is ever present at combustion, and gasoline, when an enriching carbureter device is used for starting in cold weather, from getting past the pistons into the crankcase, thereby causing stoppage of lubrication by the water becoming frozen, corrosion of parts such as ball bearings, distributer breaker points, where this essential is designed into the engine, crankpin journals and main shaft bearings. This menace cannot be too seriously considered and the only remedy is the accuracy of piston and cylinder fits and proper piston lubrication, all of which goes hand in hand with cast iron pistons in cast iron cylinders. Later on in the paper is given a table of piston clearances which will be of interest also relative to the above points.

Forced Lubrication Essential

I believe it is a well known fact that high speeds or continued speeds under high power cannot be maintained satisfactorily without the use of forced lubrication. One example which we had before us not so very long since was in connection with the Liberty engine, where attempt had been made to feed the connecting rod crankpin end bearings by means of oil thrown from the main bearings. This proved entirely unsatisfactory after tests carried out by Messrs. H. M. Crane of the Wright-Martin Aircraft Corp., John Wilkinson of the H. H. Franklin Mfg. Co. and myself, and was substituted, in agreement with the Government engineers, by forced feed. It is highly necessary that large volume of oil should be pumped under pressure and not merely small volume under pressure, and there should always be reservoirs with separate leads to the bearings.

Fig. 7 shows a diagram of the Cadillac lubricating system, an explanation of the diagram being as follows:

The lubrication is by oil under pressure. A supply of oil is carried in the oil pan A. Oil is drawn from the oil pan by the oil pump C through the pipe B and forced to the main bearings E, F and G, through the supply pipe D. The pressure of the oil is regulated by an overflow valve or pressure regulator M containing a valve under spring tension. When the pressure is reached for which the valve is set, the valve is forced open and the oil overflows past the valve. A small hole drilled in the regulator housing allows oil to by-pass the valve when the valve is seated. Oil flowing through the by-pass and oil forced past the valve is carried to the camshaft bearings and power pressure pump in the gasoline system through the pipe R above and parallel to the camshaft. The forward end of this pipe is fitted with two nozzles from which oil flows into the camshaft sprockets and to the chains through holes drilled in the camshaft sprockets. The connecting rod bearings H, I, K and L, on the crankshaft, are lubricated by oil from the main bearings forced through holes drilled in the crankshaft. The hole is drilled in the crankshaft sprocket through which oil is supplied to the camshaft chain. The cylinders are lubricated by oil thrown from the lower ends of the connecting rods. There is one gauge and one indicator in the lubricating system. The pressure gauge O is located on the instrument board and indicates the pressure of the oil. The indicator P is attached to the upper cover of the crankcase near the carbureter and indicates the level of the oil in the oil pan A.

The Bellis high-speed, double-acting, steam engine, in which design was first incorporated the forced lubrication system, is described by Prof. Ripper in his book Steam Engine Theory and Practice as follows: "The Bellis engine will illustrate the possibility of running double-acting engines at high rotational speed without fear of excessive wear and knocking. It is claimed for it that its success is generally due to the application of forced lubrication, that is, supplying the lubrication to the moving parts under pressure. The pressure required for this proposition is not the maximum pressure on the bearings, but only a pressure sufficient to force the oil into the bearings on the return stroke, when the pressure is reduced on one side of the pin, while on the driving stroke the time is not sufficient to squeeze the oil between the surfaces before the pressure is again reduced and the supply renewed. The difficulty felt in running double-acting engines at high rotational speeds arises from the known necessity of close adjustment of the bearings to avoid audible knock and insure quiet running, and this necessary closeness of adjustment renders the pin and its bearing very liable to get hot and the pin to seize. This liability to seize arises from the fact that, owing to the necessary closeness of fit, any small increase of temperature in the pin causes sufficient expansion to make it overtake the small clearance permissible when cold, and trouble immediately follows from

Table No. 1

R. P. M.	300	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2500
Cast-Iron Pistons Without Extra Oil Supply						Brake horsepower						
Clearance 0.002 in.	3 4	9 3	12.2	15.5	18.7	20.7	22.4	23.2	23.2	19.4	18	17.4
Clearance 0.004 in.	3 7	8 8	12.8	15.9	18.9	21.6	22.8	23.4	22.6	23.4	21.3	20.2
Clearance 0.006 in.	4.4	9 5	13.1	16.5	19.4	22.2	23.2	24	24	24	20.2	20.9
Clearance 0.008 in.	4.2	9.7	13.2	16.5	19.1	22.2	24.8	25.1	23.9	22.4	20.6	19.5
Aluminum Pistons Without Extra Oil Supply												
Clearance 0.013 in.	4.05	9.2	12	15.2	18.2	21	21	22	20	17.5	15.6	15.2
Clearance 0.016 in.	3.6	8.5	12.1	15.1	18.7	20.7	22.7	25.3	25.2	24.5	21.4	21

Table No. 2

R. P. M.	300	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2500
Cast-Iron Pistons With Extra Oil Supply						Brake horsepower						
Clearance 0.002 in.	4.4	9.9	13.1	17.2	20.4	22	23.9	25.2	25.4	24.4	21	20.6
Clearance 0.004 in.	4.3	9.5	13.8	17.7	21	24	25.4	25.6	27	25.6	26.4	25
Clearance 0.006 in.	4.8	10.3	14.2	17.6	21.2	24.2	25.8	27.2	28	27	27	24.6
Clearance 0.008 in.	4.7	10.3	14.5	17.7	21	24	25.9	26.9	27.9	27.2	27	24.6
Aluminum Pistons With Extra Oil Supply												
Clearance 0.013 in.	4.7	10.3	14	17.5	21	24	25.6	26.3	26.6	27.2	26.6	25.4
Clearance 0.016 in.	4.7	10.3	13.3	16.8	20.2	23.6	25.8	27.2	27.3	27.8	26.6	24.6

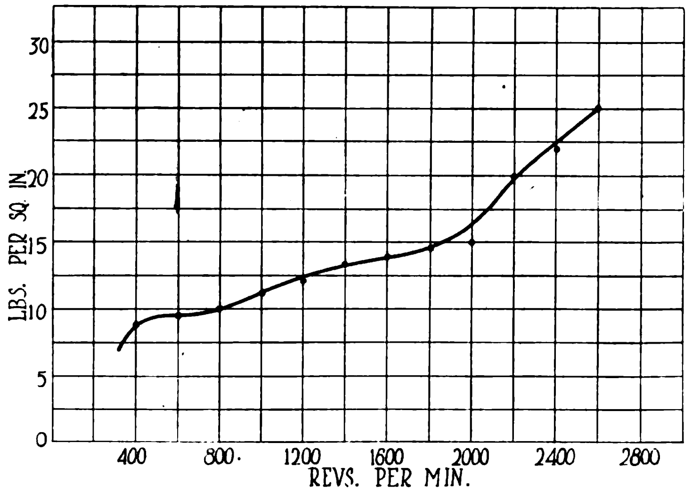


Fig. 9—Oil pressure in relation to revolutions per minute

seizure of the pin. There cannot, however, be any increase of temperature in the pin so long as the pin and its bearing are well supplied with oil between the surfaces—hence the value of forced lubrication."

Particular points in connection with forced lubrication are as follows: Saving in friction which occurs with forced lubrication. Tests were made with oil pressures of varying loads and it was found that the engine was quieter the higher the pressure and the frictional horsepower was, with high oil pressure, only 60 per cent of that without pressure, and 72 per cent with medium pressure of that without pressure.

Results of Bearing Tests

It is interesting to note that we have carried out some very extensive tests on the Cadillac engine at high speeds and have been able to maintain power for periods extending over 400 hours at 2000 r.p.m. without adjusting the bearings. In addition to this we have been able to maintain maximum power at 3000 r.p.m. for 12 hours without stopping, which I consider a triumph for forced lubrication.

Some years ago I carried out some tests having different clearances of pistons, both cast iron and aluminum, with and without extra oil supply to the pistons, and table No. 1 indicates the power developed without extra oil supply, whilst table No. 2 indicates the power developed with extra oil supply. The diameter of pistons was 3¼ in. and the tables themselves are self explanatory as to the results obtained.

On the matter of oil grooves, these should be conspicuous

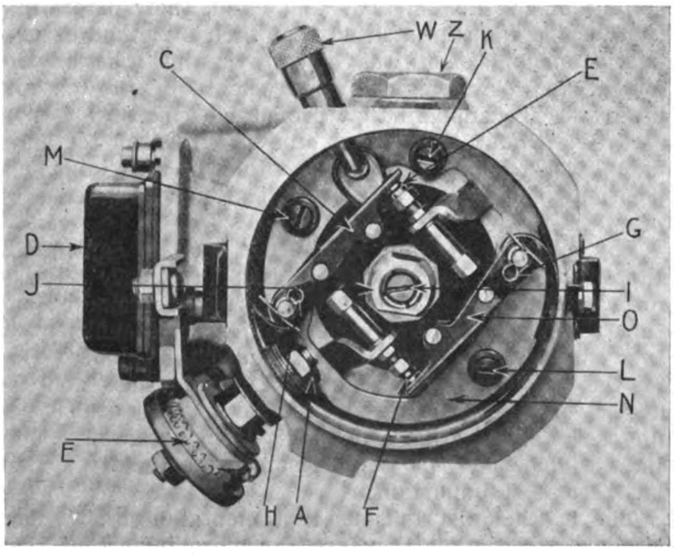


Fig. 10—Cadillac ignition with two sets of contacts arranged to fire alternately

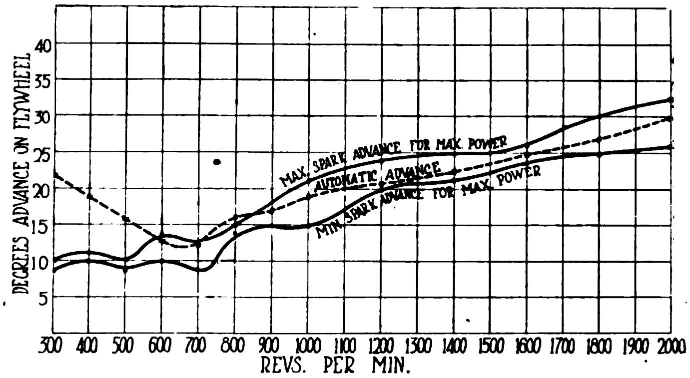


Fig. 11—Curves showing degree of spark advance on the flywheel relative to r.p.m.

by their absence so far as what is known as the ordinary kind of groove is concerned, the only type of groove which I would favor being one which is merely a circular groove around the center of the bearings, which is actually a reservoir and tends to have the oil right around the circumference of the bearing so that it can reach every part of it. Fig. 8 shows a Cadillac bearing with the groove described.

It is important that the oil pressure should be low when throttling, increasing as the speed increases, a system which I have found to be very satisfactory and which is incorporated in the Cadillac engine, a curve Fig. 9 illustrating oil pressure and r. p. m. which is self explanatory.

Ignition Developments

The most important factor in high-speed ignition is the time factor to energize the induction coil. To compensate for this, it is necessary to increase the flow of current or lower resistance in the primary circuit, and in doing this there is excessive sparking at low speed which oxidizes contacts and increases resistance, making it necessary to clean contacts at very short intervals somewhere varying from 1000 and 6000 miles. Duration of contact being very small due to the enormous number of sparks per second, agitated by oxidization, makes one set of contacts unsatisfactory when compared with the life of a well designed multi-cylinder, high-speed engine.

In view of this, therefore, around the beginning of 1915, my company started on three engines a continuous endurance run in order to see which part of the engine would wear out first. This endurance run was proposed to have a duration of 300 hours continuous running, and we found that it was impossible to run more than 13 hours at 2000 r.p.m. with the ordinary single arm breaker on the first type of eight-cylinder Cadillac engine. To overcome these serious objections, we built a distributer having two sets of contacts in parallel, or both closing and opening primary circuit simultaneously, each set carrying half the current, thereby reducing the arcing at the contacts to a minimum. Due to the tremendous inertia at high speeds, the contacts when closing are inclined to chatter, which causes the condenser to have a tendency to discharge, which in turn causes the arcing. This trouble is reduced to a minimum with two sets, as they do not chatter in synchronism and the adjustment of the two sets of contacts in parallel is not delicate, because in initial adjustment one set opens late and all arcing takes place on this one, causing it to waste away until it is in step with the one that opens first, so that they automatically come in step with each other. This arrangement makes it possible to operate an engine at a higher speed than any other arrangement at present developed, because it increases the time to build up the induction coil by decreasing the resistance.

After the above mentioned test, we were able to increase the speed of our engine up to 4000 r.p.m., which means 266 sparks per second, and after the installation of the two contacts in parallel, we were able to run 400 hours test without any ignition trouble, outside of occasional change in spark plugs.

(*Continued on page* 667)

What Is the Value of Rotation in Jobs?

Does Employer or Employee Benefit Most From Shifting Workers Frequently—or by Keeping Them Always at the Same Work?

By Harry Tipper

THE continual discussions which occur in regard to the increase of efficiency in production include, as a rule, statements concerning the necessity of increasing the efficiency of the human element, labor. It is not at all apparent from these discussions, however, that the same consideration has been given to the elements of human efficiency and the factors which must be taken into account in order to produce that.

It is true that a good many manufacturers have agitated for changes in the educational process in the schools and have instituted training schools in their own establishments for the purpose of securing a higher degree of skill from the workers, but these items merely indicate the general dissatisfaction with the present condition. They do not show that there has been any attempt to study the situation thoroughly, to make experiments in connection with it, in order to determine to what extent our present method of operation is based upon the proper conception of human interests, and to what extent it fails to take them into account.

The Human Element in Industry

The whole question of productive efficiency is concerned so intimately with that of education, the predisposition due to national tradition and social surroundings and political necessities, that it is hardly possible to consider efficiency from a manufacturing standpoint without, at least, understanding the deficiencies and tendencies of the rest of the worker's life. Even in respect to industrial surroundings it does not appear that we have studied the necessities of the case very seriously, and it is evident that we have concerned ourselves with the machine as the important factor in production, considering the human element as secondary and only to be regarded in order that the machine can fulfill its functions.

So long as we consider the human element secondary to mechanical equipment and only to be examined in relation to the machine, it is obvious that we shall not be able to determine the elements which enter into human efficiency from a productive standpoint correctly, and the discussions upon this matter must continue to be futile if not frivolous.

Specialization the Result of Factory System

In the growth of the factory system, with its machines constantly becoming more and more skillful and absorbing a larger proportion of the mechanical work of production, it was convenient to develop the worker for one particular piece of work. This method of operation required less supervision, that is, less intelligent supervision, and less preparation for manufacturing. It made it very much easier to train workers so that they arrived rapidly at a state of efficiency and it simplified the organization question. Some of these very advantages, however, were, in the nature of things, of negative value from the standpoint of human efficiency, and in some cases they were factors which actually reduced the capacity of the man.

Yet the system itself has not been questioned up to the present, and there is record of only one experiment in organization from a productive standpoint in an industry controlled by machinery. Discussion of the advisability of this system among engineers and manufacturers is fruitless, and this in itself is a symptom of the lack of study of the human element in production and, consequently, the almost total lack of understanding as to its requirements.

How do we know that one man, working on a gang of automatic screw machines for fifteen years, because his first training enabled him to be proficient in that work, can handle those machines to greater advantage than the man who has passed through a machine shop and knows the relative value of different machine operations and the relative proficiency required? How do we know that the skill of the fingers, and the co-ordination of the hand and the brain, are greater when the same operations must be performed by that co-ordination day in and day out for a number of years than where these operations are varied frequently.

The matter does not seem to have been discussed at all, but in view of the known variety of human interest, the known character of human aspirations and the recorded conditions of human production for the most part of its history, the practice is certainly open to question, and the assumed necessity a mere assumption of no greater value than that which attaches to a very brief tradition.

Psychology Shows Need of Variety

If the physiologist and the psychologist have secured any information in their scientific researches into the actions of the human body and mind, their determinations would indicate at least that such a method of productive organization was directly against the physiological and psychological requirements of growth and progress. To suppose that productive efficiency can be secured without the growth and progress of the individual worker, physically and mentally, is to indulge suppositions which are neither logical nor supported by practice.

Physiologists attempt to impress upon us continually that for good health and physical efficiency all the muscles of the body should be exercised reasonably, and that there should be a variety of exercise sufficient to take care of these necessities. The lack of balance—that is, the continual exercising of a few muscles and the neglect of others—is responsible for a great deal of the physical deterioration which has been observed among industrial peoples, particularly since the factory system has become so important.

The psychologist tells us that mental necessities are similar, except that they are far more important than physical necessities, because quickness of apprehension, understanding and mental sensitiveness, or the lack of

these qualities, influence the productive capacity, and also the point of view on all questions involved in social and economic life in an industrial country. The balance of mind and breadth of view are more important than any physical balance, necessary as that may be.

Some of the War's Lessons in Efficiency

During the war we have been taught some lessons upon efficiency in production which should indicate to us the necessity for fresh experimentation and for a deeper examination into our industrial organization, with the idea of discovering in what directions the present organization is weak and does not fulfill the requirements.

On the same machines with the same speed the incentive of patriotism expended in relation to the job improved production from 75 to 200 per cent in certain cases and improved it from 50 per cent in many other cases.

In the last few months a factory in England in the automotive field changed its procedure so that instead of holding a skilled mechanic to one job, his work is varied. The man who has been operating milling machines to-day may be assembling cars or motors next week, and contrary to all the traditional ideas upon this subject, this factory increased its production by three chassis a day with the same number of men, under the new system.

No man who has charge of supervision on any manufacturing work but has rebelled from time to time against the necessity of routine, the things which must be done each day in the same way. We strive to secure in all the other relations of life that variety which constantly keeps the intellect alive and quickens the apprehension by maintaining interest. Why, then, should it be supposed that there is greater efficiency to be secured by going contrary to this deep-seated human desire for variety of occupation and variety of interest?

Just because we accepted the tradition which began as a manufacturing convenience, and continued because there was no immediate problem to be faced, we have not thought it worth while to question the value of this tradition or to experiment with it to find out its necessity.

Routine Lessens Interest

The matter goes deeper than this, however, for where the routine has become so familiar that it has become subconscious, lack of interest follows as a logical consequence, and the possible efficiency is impaired by this lack of interest. Every manufacturer has noted the increase in productive capacity of the average individual under the stimulation of a new interest or the requirements of an emergency.

This productive capacity is not beyond ordinary possibility of the average human being, but there is no incentive to transfer to his regular work the energy which he has been willing to put forth under the stimulation secured from these causes. This extra effort, this unused or potential capacity, has shown itself of great importance during the war period, when it was stimulated into activity by the requirements of the war emergency and the demands of patriotism.

The question considered in this article is not provision of the incentive, which has been spoken about in previous articles and which relates to the responsibility of the worker in relation to the industrial organization of which he is a part, but it is a question of the reason for and the advisability of continuing the present type of industrial organization which trains a man for one piece of work and then keeps him at it continually without change.

The supposition that this method is necessary to secure the highest output per unit of cost is at present purely an assertion. No comparisons have been made with any other form of organization or with any other idea of production. It is not, however, in accordance with the known requirements of the individual in connection with his mental and physical growth, and it is not sufficient, therefore, to justify this organization by long and continued use nor to suppose it necessary because of the machine equipment.

It is obvious, of course, that the man who is working in a machine shop, running a milling machine, would be of no value running a loom. Neither would such a change increase his mental capacity in relation to his work. But there are good reasons for supposing the man who was grinding crankshafts to-day and fitting these crankshafts into the motor to-morrow, by grasping the importance of the previous piece of work and its relation to the motor efficiency, would be provided with an interest and an incentive in each piece of work that would not obtain to either by itself.

Whatever form of organization should be used from a production standpoint, it is obvious that the war has given us a glimmering of the importance of the human factor, that we are just beginning to understand the importance of the worker individually and as an organization, and it is being borne in on us that the present industrial system has not justified itself to the worker or to the general public.

This should encourage us to a new and deeper analysis of the human side of the case, to experimentation in production changes, especially those which involve the incentive and the interest of the worker, and above all, the rejection of all traditions and traditional forms of organization which cannot justify themselves except by tradition, so that we can either determine in how far they are valuable or sufficiently analyze them to be able to undertake changes that would make them valuable.

Make Them Property Owners

SOMEBODY has defined a Bolshevik as a man who has nothing and wants to divide it with everybody. Behind this more or less flippant definition there is an important germ of truth. A study of the records of what Bolsheviks we have known in this country, and those who have called themselves Bolsheviks or I.W.W.'s, or any other name which designates a more or less organized lawlessness, reveals the fact that very few if any own property.

When a man owns property he appreciates the necessity for well organized legislation, and for the necessity of enforcing laws. When the labor class as a whole in any community owns property, it is a law abiding and satisfied class. This is not only progressive in itself, but always carries with it a successful community.

Recent moves by great capitalists of the country to make the laboring man not only a profit sharer in the company in which he works, but also to make him an owner of property in the community in which he dwells, has met with marked success.

The dangerous element is always the floating element. As this is eliminated, stable conditions grow, and contentment reigns in place of discontent. The time has long gone by when large manufacturers and other employers of labor can merely satisfy themselves with paying the weekly wage and forgetting the general welfare of those who help to make their business a success.

The principles of profit sharing and of well organized and thoughtful welfare are becoming more and more firmly embedded in the minds of the executives of the country. No bigger step can be taken than to make the laboring man a property owner.

Radiator Cooling Fans*

Problems of Design and Mounting — Large Diameter vs. High-Speed Fans— Magnitude of the End Thrust on Fans — Means for Insuring Continued Dust-Proofness of Fan Hubs

By George W. Hoyt
Chief Engineer, The Oakes Co., Indianapolis

WHEN the subject of fans is investigated it is usually found that there is a great amount of doubt among engineers as to just what type, size and speed should be used for different motors. The decision should depend largely upon where the fan is to be used, whether on a passenger car, truck, tractor or stationary power unit. In connection with tractor fans, special attention should be given to dust-proofness of the bearings, and the packing retaining device should be adjustable. On passenger cars and trucks it is not so important to be able to adjust the pressure on the felt, though it is desirable there, too.

Most engineers will agree that the fan is given about as little attention as any part on the motor, until heating troubles appear. However, this condition is changing very fast. The first problem is to select a fan of the proper diameter and speed to work in connection with the other units of the cooling system. Too high a fan speed causes noise, while a fan that is too small will cause overheating. In the following, the various items of the cooling system are taken up in the order of their relative importance.

It is, of course, necessary to have the proper pump and radiator capacity to handle all of the water in the system and circulate it at an appropriate speed. After this has been settled, it is advisable to use the largest fan which will clear all radiator connections by at least ½ in., and will not overlap the upper or lower tank. If the fan's sweep were masked by the tanks, it would pull against a solid surface, which would decrease its efficiency.

Projected Area

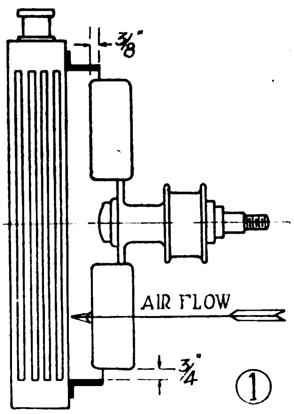
After the diameter of the fan has been determined by the above mentioned method, the projected area of the fan or the blade path should be considered, which largely determines the air delivery. The projected area varies from 1½ in. up to 2¼ in. in accordance with the size of the motor to be cooled. Sometimes it is impossible to get a large diameter fan back of the radiator, and then the next best thing to do is to use as large a blade path as possible and still clear the fan belt by ⅜ in.

Referring to the drawings giving the capacity of different size fans, suppose that a certain volume of air is to be passed and it is found that an 18 in. fan with 1½ in. projected area, running at 1800 r.p.m. will give this air delivery. If you cannot get an 18 in. fan back of your radiator, you may step down to a 16 in. fan with a larger projected area, running it at the same speed as the 18 in. fan. Thus it is possible with a smaller diameter fan, by increasing the size of the projected area, to carry the same volume of air at a given speed. However, the best practice is to use large diameter fans and slow speeds wherever possible.

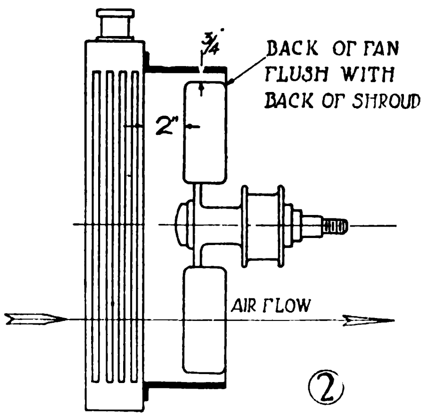
Size of Pulleys and Belts

After having determined the proper diameter and width of the fan blade, we next come to the width and diameter of the fan pulley. We have found by experiment that for fans up to 18 in. diameter, a belt 1¼ in. wide works very satisfactorily. In some cases, however, a manufacturer will drive the generator with the same belt, in which case a wider and heavier belt should be used. Fan diameters larger than above mentioned take belts up to 2½ in. in width. The proper belt width depends upon whether the fan is driven from a large or small pulley at high or low speed. Where the pulleys are small in diameter, and are run at fairly high speeds, a wide belt is necessary to avoid slippage. Sometimes it is not possible to get a large area of belt contact on the pulley, and a wide belt must then be used. It will always be found that, owing to the effect of weather conditions, water, oil and heat, the cost of a little extra belt width is money well spent. There is some doubt as to which is better, a crowned face pulley or a flat face pulley. This depends somewhat upon the width of belt. The flat pulley will work very well with a wide belt, that is, belts of such widths as mentioned above. However, tests made by us showed that a crowned face pulley is preferable, because it tends to keep the belt centered on the pul-

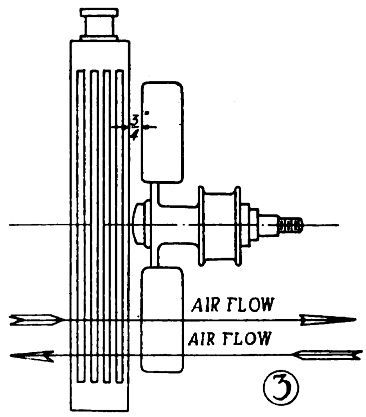
*From a paper read before the S. A. E. Minneapolis Section.



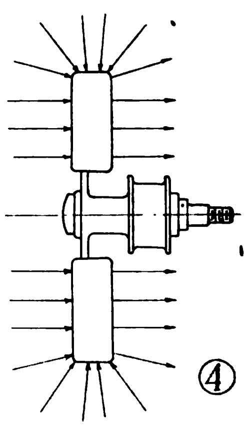
Location of fan in relation to radiator and shroud when blowing air



Location of fan in relation to radiator and shroud when drawing air



Location of fan in relation to radiator without shroud when blowing or drawing air



How a curved four-blade fan handles the air

ley, thereby getting the benefit of the full width of the belt. With flat, flanged pulleys, if the driven and driving pulleys are not absolutely lined up with each other, the edge of the belt tends to ride on the flange, which tends to decrease its pulling power. Another factor determining the necessary belt widths is the material of which the belt is made. Some belting material will stretch more than others, and cause slippage, and wide belts minimize this trouble. It all works out to this, that no matter how efficient the fan may be, if the belt is too small and there is slippage, the fan will be more or less of a failure.

Next it is necessary to determine the diameter of the fan pulley. This depends somewhat on the air delivery. Tests made in our laboratory, as well as by radiator manufacturers, have shown that for motors up to 50 hp. the air velocity through the radiator should be from 1500 to 1800 ft. p.m. depending upon the size of motor to be cooled. The pulley preferably should not be less than 2½ in. in diameter, as smaller pulleys are very apt to allow belt slippage, and decrease the fan speeds quite considerably. The fan speeds, of course, will vary, and in deciding upon this factor it should always be borne in mind that a large fan running at slow speed is the most efficient. This statement is corroborated by the volume curves and horsepower curves in Figs. 5, 6, 7 and 8. The fan pulley then must be of such diameter that, considering the diameter of the driving pulley and the speed of same, the fan will be rotated fast enough to carry the required volume of air, and the driving pulley should always be large enough to allow of a fan pulley diameter of at least 2½ in.

Fan Locations

We will next refer to the location of the fan. Some manufacturers use a fan shroud on the radiator, while others do not, and the proper location of the fan is very much affected thereby. Where a radiator is used without a fan shroud, the fan should be set with the front edge of the blades ¾ in. from the back of the radiator core, so that there will be a minimum loss. By referring to Fig. 4 it will be seen that when set farther away, the fan would pull the air from the top and sides of the hood, instead of through the corners of the radiator. This distance is also great enough to permit quiet operation, and allow for regular shop variations. This fan location, shown in Fig. 3, is satisfactory for blowing air as well as drawing air through the radiator without a fan shroud.

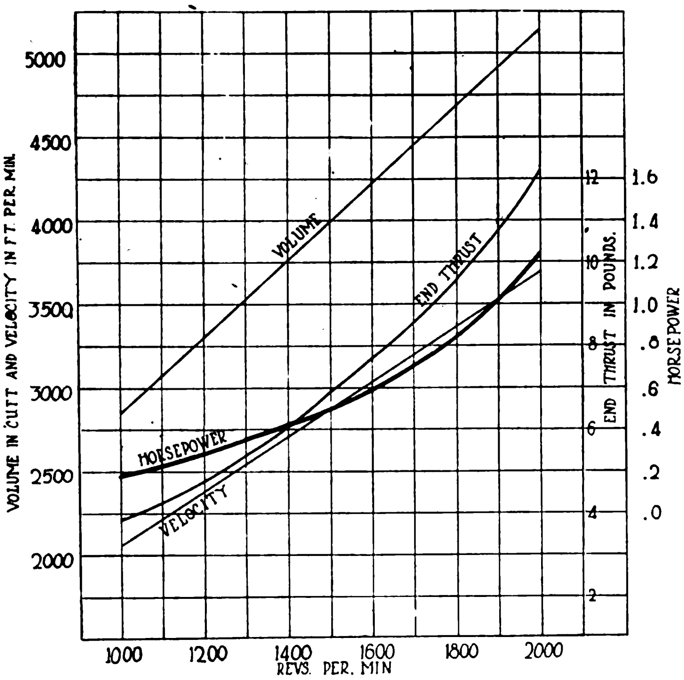


Fig. 6—Volume of free air handled, velocity of air, horsepower required to drive, and end thrust of an 18-in. diameter, 2¼ in. projected area, 4-blade pressed steel fan. Air tunnel diameter 16 in.

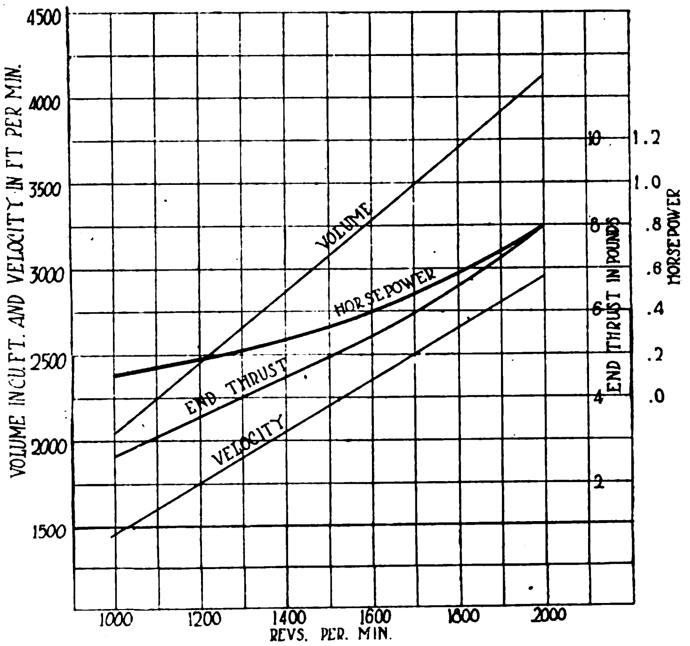


Fig. 5—Volume of free air handled, velocity of air, horsepower required to drive, and end thrust of a 16-in. diameter, 2¼ in. projected area, 4-blade pressed steel fan. Air tunnel diameter 16 in.

Fig. 2 shows the proper location of a fan when using a shroud and the air is drawn through the radiator. The front edge of the fan blades should be 2 in. away from the back of the radiator core, and the fan shroud should be so designed that its back edge will come flush with the back edge of the fan blades and that there will be about ¾ in. clearance between the shroud and the fan. If a fan is set closer than 2 in. to a radiator with shroud, it will be noisy, as with the fan operating in a shallow pocket the air gets no chance to spread and take a free course through the fan. Tests have shown that a fan located as shown in Fig. 2 gives very good results.

There should be a number of louvres in the side of the hood, of the proper size to allow the warm air to escape. Attention should also be given to the location of the floor boards and anything else that tends to increase the resistance against which the fan has to work, which parts should be so arranged as to allow the free escape of the warm air from under the hood.

Construction of the Shroud

The shroud should be made without sharp angles and corners, as these bank the air, holding it in the shroud and forcing it back through the corners of the radiator. This same effect is produced where a shroud overlaps the back of the fan blades, as it will not allow the air to get away from the fan. Quite often one-half of the blade width only is within the shroud, but this location is not the best, for the following reason: Fig. 4 shows that air is drawn in all around the end of the blade, and with the arrangement described half of the blade would draw warm air from under the hood, off the motor, and tend to keep this air circling around the end of the blade, thereby decreasing the true air delivery, as compared with the arrangement of Fig. 2.

When the radiator is in front of the motor the fan may be placed in front of the radiator. In this case the air should always be blown through the radiator, thus at the same time carrying the hot air off the motor. If the air were drawn through the radiator the hot air from around the engine would pass through and warm the water instead of cooling it. There is, however, one objection to placing a fan in front of the radiator, namely, that if not properly protected, the fan draws dirt and weeds that are lying loose in the field, and is apt to clog the radiator and interfere with its proper functioning. A front-mounted fan without shroud should be preferably located as shown in Fig. 3, with a view to forcing all the air possible through the radiator. Where it is neces-

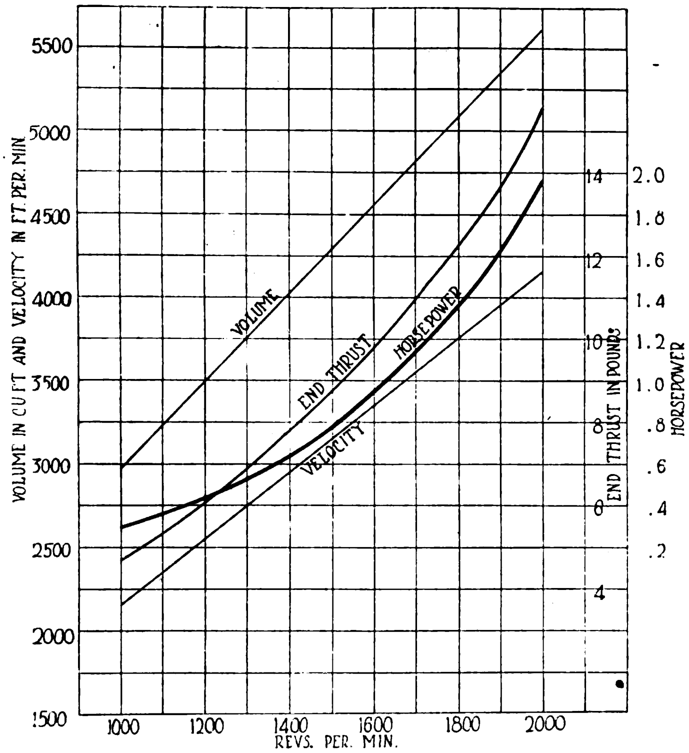


Fig. 7—Volume of free air handled, velocity of air, horsepower required to drive and end thrust of a 20-in. diameter, 2¼ in. projected area, 4-blade pressed steel fan. Air tunnel diameter, 16 in.

sary to use a shroud with the fan in front of the radiator, we have found it to be very good practice to locate the fan as shown in Fig. 1. The fan is located with the front edge ⅜ in. inside the shroud, to keep from spreading the air outside of the shroud, and at the same time leaving the largest portion of the blade out in the open air, in order to obtain the maximum amount of air. By locating the fan 1½ in. back from the radiator, enough space is left between the fan and radiator to spread the air so that it will pass through the corners of the radiator as well as the center.

For tractor purposes the use of a fan shroud is recommended, as great cooling capacity is necessary, and there is a gain of about 10 per cent from the use of a shroud, which is due to the fact that the air can be drawn through the corners as well as any other section of the radiator.

There is one other possible location of a radiator, viz., back of the motor and at the dash. In most cases it is necessary to place the fan back of the radiator, and drive it off the fly-wheel or propeller shaft, using the arrangements shown in Fig. 1 and 3, depending upon whether or not a fan shroud is used. The real objection to this fan location is that in most designs it is backed up so close by the toe boards that it is impossible to get the maximum efficiency out of the fan. However, the direction of air flow should be such that the warm air from the motor will not pass through the radiator.

In connection with the volume charts Fig. 5, 6, 7 and 8, it should be pointed out that in making the tests gasoline was used in the pitot tube and manometers. Both the static pressures and the velocity pressure were taken into consideration in reading the height of the gasoline column. The fans were driven by a 5-hp. motor and were located in an air tunnel tapered down to 16 in. diameter, the tunnel being 15 ft. long. The volume test was made at the same time. We are thus equipped to determine the end thrust of the fan and the horsepower consumed in driving it. The pitot tube is considered the most accurate means for determining air velocities and results obtained with it should not be compared with volume figures secured by the use of the anemometer, as the anemometer is only approximate for velocities as low as 1000 to 1500 ft. p.m., which with the average size fan corresponds to 800-1000 r.p.m.

We will now take up the choice of bearings, as the bearings are one of the most important parts. Quietness of operation, freeness of motion and the life of the fan all depend upon the type and quality of bearings used.

There are practically three types of bearings used for this purpose, namely, roller, annular, ball and cup and cone ball bearings. The latter is by far the most popular bearing for fan use, about 75 per cent of the fans on all of the trucks, tractors and passenger cars manufactured to-day being fitted with it.

Here some consideration should be given to the different loads on fan bearings. The radial load is due to the weight of the hub, blades, spider and all parts that revolve on the bearings, plus the tension of the fan belt necessary to secure a drive without belt slippage. In addition to this radial load, there is another load which is a very important factor. As the fan must draw or blow the air through the radiators, a great percentage of the load on its bearing becomes end thrust. In the past there has been a certain difference of opinion among engineers as to the amount of end thrust caused by different rates of air delivery. The end thrust depends upon three factors—the fan diameter, the projected area or the blade path, and the speed of the fan. A fan running in free air will produce a certain end thrust, but when this same fan is placed back of a radiator, between the radiator and the dash, and under a hood, the end thrust is increased about 25 per cent, depending upon the restriction of the air passage. The air will flow more easily through some radiators than through others, some motor hoods have better air outlets than others, but, in any case, there is plenty of end thrust, and this must be given serious thought.

We will now go back to the bearings. A straight roller

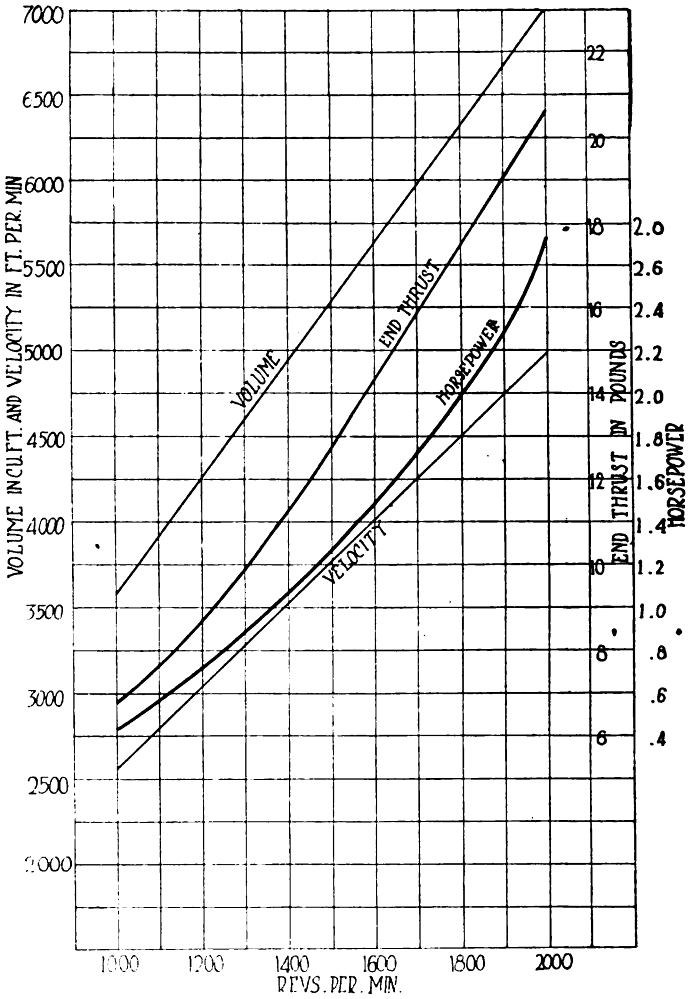


Fig. 8—Volume of free air handled, velocity of air, horsepower required to drive and end thrust of a 22-in. diameter, 2¼-in. projected area, 4-blade pressed steel fan. Air tunnel diameter, 16 in.

bearing designed to take radial loads only, when used with a hardened and ground outer sleeve and a hardened and ground spindle, will make a very satisfactory bearing for taking care of the radial load of the fan, but there must be some special arrangement made to take care of the end thrust. The amount of this end thrust is such that it should be taken care of by a ball thrust bearing. From Fig. 8 it can be seen that a 22 in. fan with 2¼ in. projected area, running 2000 r.p.m. and delivering 6890 cubic feet of air per minute through a 16 in. tunnel, will produce an end thrust of about 20 lb.

It can be safely said that not more than one out of every ten people driving cars ever oils the fan, and if a plain washer thrust bearing does not get oil, it will not be long before it gets loose enough to rattle. Ball thrusts, of course, also will wear out in time, but there is no question that there is not as much friction in the ball bearing as there is in the plain bearing, as the balls have only a line contact with the ball race, while the entire surfaces of plain thrust washers are rubbing together. I think I am safe in stating that there are very few engineers who have had experience with end thrust bearings who will not agree that the ball end thrust makes a higher grade construction.

As to the amount of end thrust, this can be found from Figs. 5, 6, 7 and 8 for different sized fans running at different speeds.

Referring to fans with annular bearings, this type does not need much of an introduction. When the proper size of bearing is used it will give satisfactory results, and carry both radial and thrust loads, but, of course, it must be kept properly oiled.

Next comes the cup and cone type bearing, and the popularity of this type is in itself proof of the efficiency of the bearing. The cup and cone type of bearing is adjustable both for radial load and for end thrust; when properly built and adjusted it will run longer under the abuse that a fan gets than any other type of fan bearing, with one possible exception, which is the annular bearing. These two bearings are very much alike, as far as carrying load is concerned, only that one is adjustable and the other is not. It is possible that the cup and cone bearing needs a rather delicate adjustment in order that it will work properly and be long-lived. However, this is true of any adjustable bearing, as, for instance, thrust bearings in the form of plain washers. These washers must not be clamped too tight, as they will then score and bind, and neither must they be too loose, as they will then rattle.

The one great secret of long-lived bearings is to make the hub as tight as possible, so that the oil can be kept in and the dust out. In order to do this, the hub must be designed to hold a good amount of oil or grease, and the felt washer retainers must be made adjustable so that oil can be kept in. A felt washer packing without adjustment will in time wear large around the shaft, and become oil-soaked to such an extent that it gets soft, when it is worse than no washer at all. With proper adjusting means the felt can be kept tight to the shaft, and the oil out of the felt, thereby making a much tighter fan hub. Why do we put adjustable felt washer retainers on our differential carriers on the rear axle, or on our front wheel bearings, or on our transmission bearings? We do it to keep the washers tight. There is the same need of a tight washer on a fan hub, which is the highest speed part of the motor.

The curves shown in Figs. 5, 6, 7 and 8 were drawn from tests made in the Oakes company laboratory and all except the end thrust figures were verified by the American Blower Co. of Detroit, which is recognized as an authority on fans.

The writer hopes that he has made clear the points which should be given special attention in order to lay out an efficient cooling system. He believes to have made it clear that any one unit cannot do all of the motor cooling, but all units must be designed to suit each other, and he would suggest that the manufacturers of trucks, tractors and passenger cars co-operate with the accessory manufacturers so that the latter can help solve the mechanical troubles met with.

Steam Power and Fuel Conservation

By Dr. C. P. Schwarz

REFERRING to your S. O. S. call for fuel economy, a handbook which I received while in London in 1914 states that a certain motor when operated on gasoline with specific gravity of 0.708 showed an efficiency of 27.5 per cent. The same motor when run on 0.745 gasoline showed an efficiency of 25 per cent. Evidently the constituents with a higher boiling point escaped—at least partly—without performing work. This would point to air-cooled engines.

Further economy could be effected by the use of smaller engines and 4-speed transmissions, less weight per unit of useful load, streamline bodies, etc.

It is perhaps not known generally that a steam engine working with steam at 600-700 lb. and having a proper valve gear has a theoretical efficiency of 28 per cent and even higher. It has been pointed out in a leading British engineering paper that 1 kilowatt has been produced with 8 lb. of steam in turbogenerators of no unusual size.

The well-known Swedish engineer, De Laval, constructed about 1894 a steam power plant which aimed in the direction of fuel economy; lack of funds stopped the development.

A properly designed steam plant, taking the thermal efficiency of the cycle at 28 per cent, the mechanical efficiency of the steam engine at 85 per cent and the thermal efficiency of boiler and furnace likewise at 85 per cent, would have a total efficiency of $28 \times 85 \times 85 = 20$ per cent or almost as great an efficiency as the average gasoline engine. (A Continental truck motor described in your paper 1919 shows 21 per cent.) But here is the rub: The efficiency of an internal combustion engine increases with the load, while a properly designed steam engine acts just the opposite. As most motor car power plants are over-engined they run a considerable time on part load and then their average efficiency is below 20 per cent, while the efficiency of the steam engine drops below the figure only on exceptional pulls.

As far as fuel is concerned the steam plant may be designed to take any fuel that will flow through pipes and contains a great deal of heat energy.

The comparison between gasoline and steam engines becomes very disadvantageous for the former if we look at it from a broader viewpoint, *i. e.*, from the conservation-of-natural-resources point of view.

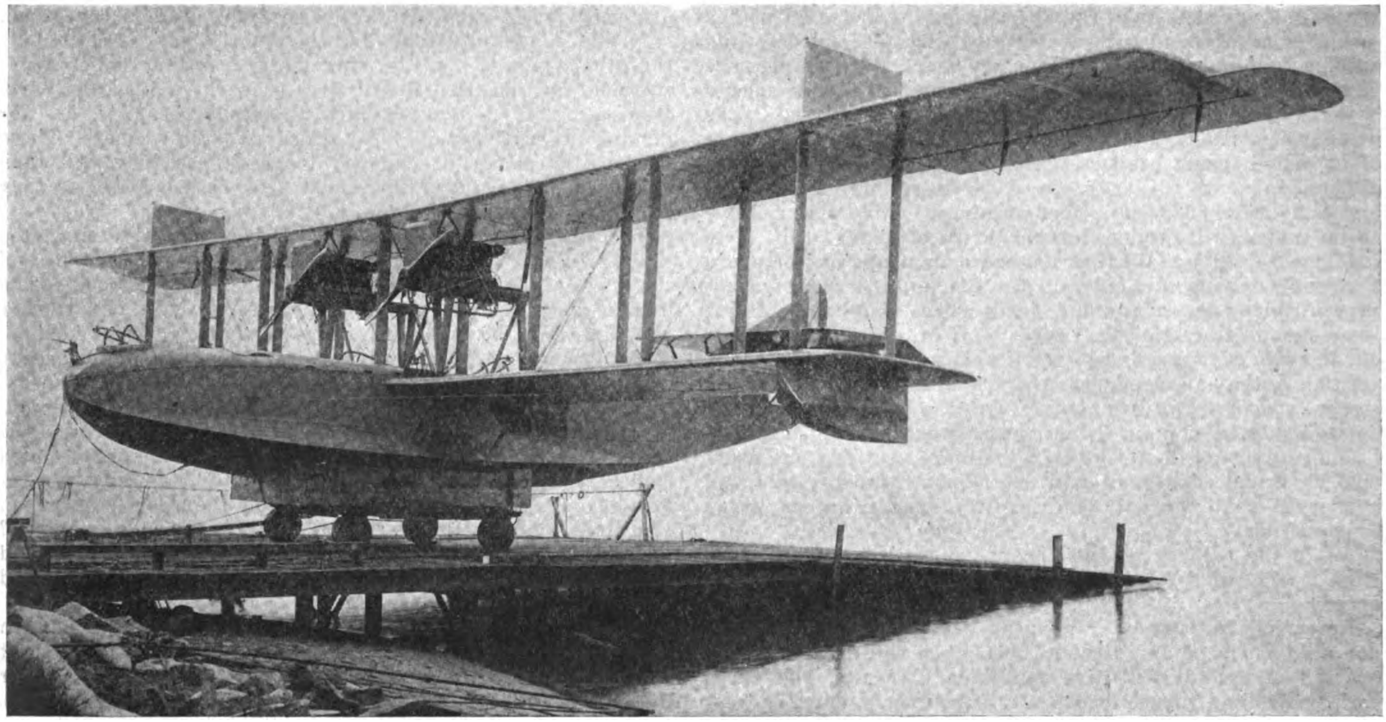
From a Government publication on the Rittman cracking process I see that oil free from natural gasoline will produce about 50 per cent cracked gasoline, 25 per cent residual fuel oil and 25 per cent non-liquefiable gas. This gas is an absolute loss from a motive-power point of view, and there the efficiency of the gasoline engine, viewed from this broader standpoint, is $75 \times 21 = 15\frac{1}{2}$ per cent, or considerably less than for a steam engine, which uses the 100 per cent of the oil drilled.

From a strictly thermal point of view the possibilities of the steam car are not to be sneezed at.

Substitute for Manganese

IN a recent article in the *Pester Lloyd*, reference is made to a new process by which manganese is largely superseded in iron-founding, according to a method discovered years ago, but abandoned owing to the plenitude of manganese.

In its improved form the process effects a saving of 50 to 75 cents per ton, as compared with the calcium carbide substitute of the Thomas process, used by the German-Luxemburg Mining & Ironfounding Co. The method, which requires only 4.5 lb. of 30 per cent ferromanganese per ton of iron, has been evolved by the Hasper Iron & Steel Works, and the owners have placed their discovery at the disposal of the Union of German Ironfounders, so that all German iron works may be enabled to husband their manganese reserves to the utmost.



Three-quarter front view of the F-5-L Navy flying boat, which has a wing spread of 103 ft., a boat hull 45 ft. long and 10 ft. wide, and weighs in fighting trim approximately 7 tons

F-5-L Navy Flying Boat

Twin-Motored Tractor Biplane with Total Flying Weight of 7 Tons—Cruising Radius as a Fighter, 10½ Hours—Normal Crew Four Men

Part I

By S. T. Williams
Assistant Chief Engineer, Naval Aircraft Factory, Philadelphia

LITTLE has been said and less printed concerning aircraft development by the Navy during the World War —but much has been done. Seaplanes, rivalling the Handley-Page and Caproni in size and performance, have been quietly built in large quantities and have had no little part in subduing the submarine and keeping our domestic commerce safe.

Of these the F-5-L boat seaplane is distinctive. It is a twin-motored tractor biplane, having a total flying weight of nearly 7 tons, a cruising radius of 10½ hours as a fighter, or 8½ hours as a bomber. It carries a military load of over 1400 lb., with a crew of four men. This machine is a formidable engine in naval war craft, and it is so designed that it may be quickly and efficiently made under war conditions.

In the case of this machine the Navy, as did the Army, took a foreign design and modified it to meet American production methods. It is interesting to note, however, that in this particular case the English design had been based upon an American model, the large Curtiss flying boat—the H-12 which was the forerunner of both the H-16 and the F-5-L.

The F-5-L is a somewhat larger machine than either the H-12 or the H-16 and is capable of carrying a greater useful load. It was developed at Felixstowe, and the name "F-5" was chosen to denote the English experimental seaplane factory at Felixstowe ("F") and the model number design in machine ("5"). The Navy added the letter "L," indicating that, as built here, it is driven by Liberty engines.

The lines, overall dimensions and main constructional features were worked out in England and an experimental plane was constructed there. The details with many modifications were worked out at the Naval Aircraft Factory, Philadelphia, to correspond to its production methods. The planes were then put into production at that and other factories, such changes from the first drawings being made as were found necessary by tests.

Fundamentally the plane is similar to our American Curtiss flying boats—particularly the H-16 model. But in size and details it is quite different, being larger and better fitted to emergency production. For example, with few exceptions the fittings are soft sheet steel, cut from flat patterns and bent to shape.

This obviated the necessity of dies and drop forgings, which are particularly difficult to obtain under war conditions. The struts, likewise, are uniform sections, that is, not tapered, so that they can be shaped with a minimum of hand labor. Throughout, the parts are such that duplication is easy, production methods possible, and readily available equipment suitable.

The specifications herewith will give some idea of the size and capacity of this seaplane. It will be noted that the lift per square foot of surface is from 9.3 to 9.5 lb. per square foot and is somewhat greater than land practice.

The F-5-L is the latest development of the boat type seaplane, having the tail surfaces carried on the fuselage construction and the fuselage entering into the hull of the boat. The Curtiss boat seaplane may be considered a forerunner of this type. The characteristics are a fuselage similar to that of a land machine, planked in to form a boat body and having planes or steps similar to a hydroplane at the forward end.

Streamline of Boat Noteworthy

The most noticeable feature in the F-5-L is the degree to which the hull or boat has been streamlined. The hull cover sweeps aft, broken only by the cockpit openings. From an aerodynamic standpoint this is more efficient than the construction of the H-16, where a raised cabin is used.

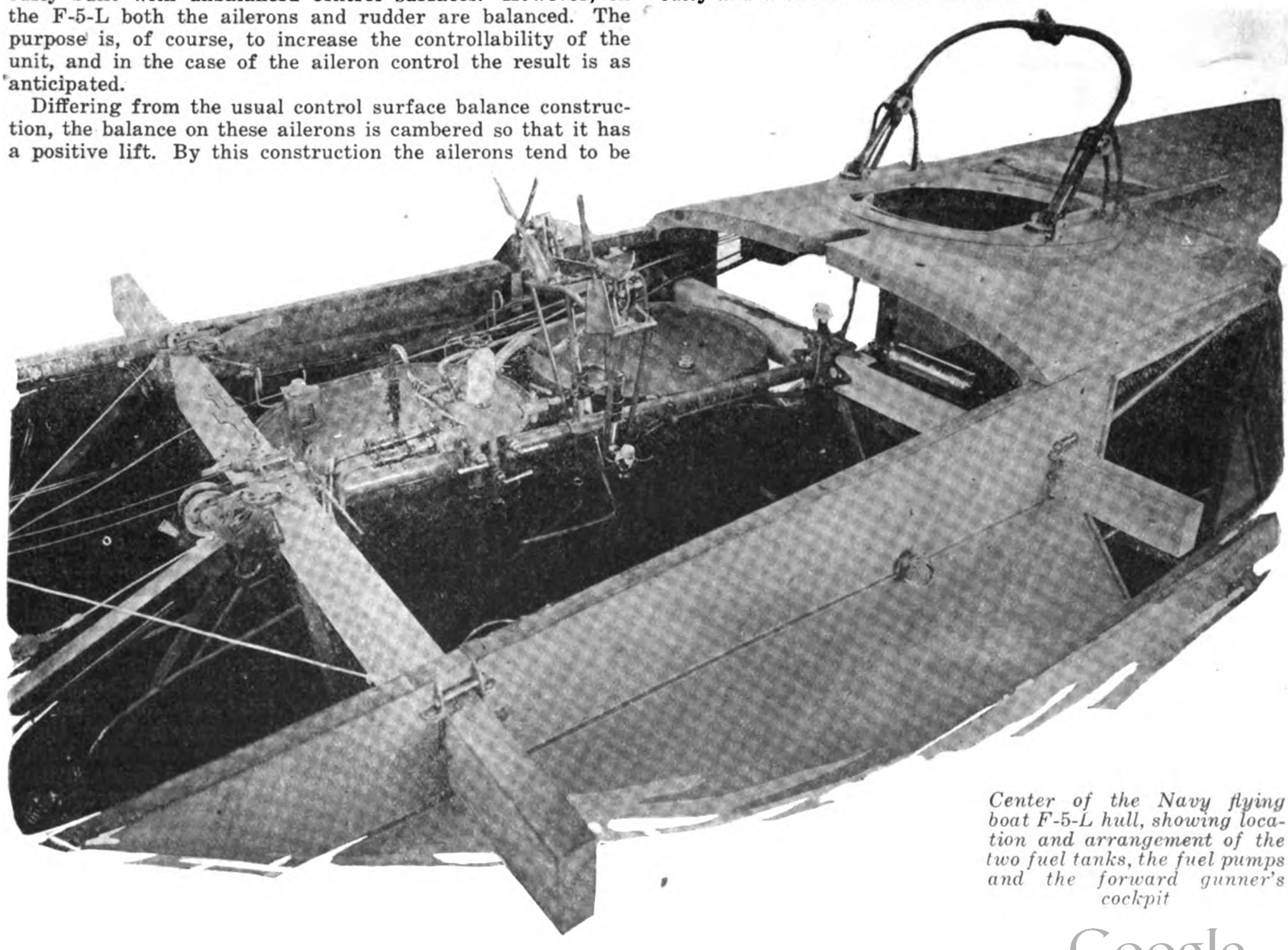
On this model, as on the H-16, the fin edges are continued aft and join into the lower longeron, giving a much stronger structure and better streamline form. Another feature in the hull construction that is noteworthy is the use of veneer instead of linen doped and painted on the after hull sides. It was found in practice that the linen failed in heavy seas or on a bad landing, but this failure was obviated by the use of veneer.

Specifications of Navy F-5-L Flying Boat

Overall upper wing (including ailerons)	103	ft.	9⅝	in.
Overall lower wing	74	ft.	4	in.
Overall length of boat	49	ft.	3¹¹⁄₁₆	in.
Overall height of boat	18	ft.	9¼	in.
Wing chord (H-12 curve)	8	ft.	....	
Gap between upper and lower panels C. L. beams	8	ft.	10½	in.
Angle of incidence of wings plus	3	deg.	40	min.
Dihedral of wing	1½	deg.	....	
Stagger of wings	None		....	
Angle of incidence horizontal stab. plus	2½	deg.	....	
Engine sect. panel	108	sq. ft.	....	
Interm. and upper outer panels (311 sq. ft. each)	622	sq. ft.	....	
Ailerons (59 sq. ft. each)	118	sq. ft.	....	
Sidewalks (33 sq. ft. each)	66	sq. ft.	....	
Lower wings (240 sq. ft. each)	480	sq. ft.	....	
Non-skid planes (15 sq. ft. each)	30	sq. ft.	....	
Horizontal stabilizer	121	sq. ft.	....	
Vertical stabilizer	35	sq. ft.	....	
Elevators (28 sq. ft. each)	56	sq. ft.	....	
Rudder	33	sq. ft.	....	
Total lift surfaces (including ailerons)	1394	sq. ft.	....	
Hull length	45	ft.	3¹¹⁄₁₆	in.
Hull width	10	ft.	....	
Hull height	6	ft.	1¼	in.
Pontoon length	7	ft.	....	
Pontoon width	..		20	in.
Pontoon height	..		35¾	in.
Power plant	2 Liberties			
Propellers (subject to change), 2-blade	10½	ft.	6¼	ft. pitch

With few exceptions, all large seaplanes have been previously built with unbalanced control surfaces. However, on the F-5-L both the ailerons and rudder are balanced. The purpose is, of course, to increase the controllability of the unit, and in the case of the aileron control the result is as anticipated.

Differing from the usual control surface balance construction, the balance on these ailerons is cambered so that it has a positive lift. By this construction the ailerons tend to be more sensitive in their action and to operate with less difficulty and with less balance surface.



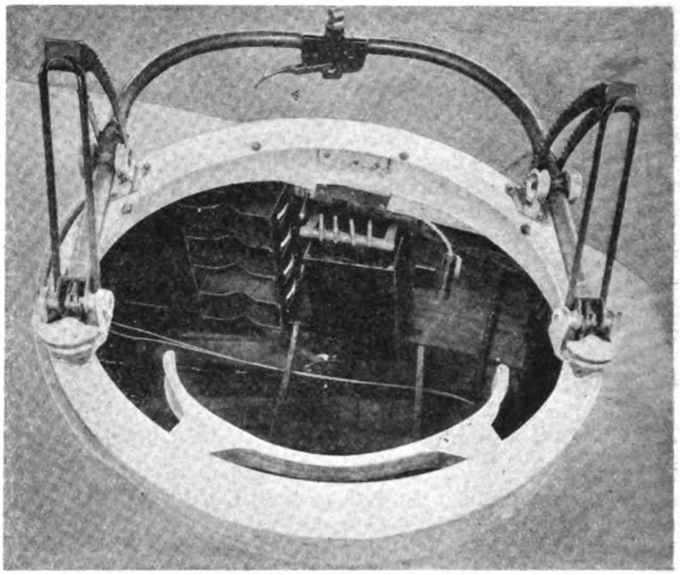
Center of the Navy flying boat F-5-L hull, showing location and arrangement of the two fuel tanks, the fuel pumps and the forward gunner's cockpit

The planing action is increased by the use of vents extending through the hull aft of the rear steps, similar to the vents that are used on the pontoons of the R-6 Curtiss model. It was stated that the hull swept aft in a perfect streamline, and the cabin top over the pilot's cockpit was eliminated. However, a certain amount of protection is afforded the pilot by small adjustable windshields.

Due to the fact that the pilot's head is about on a level with the hull cover, this serves to divert the air currents and protect the pilot with a minimum of air resistance. On straight flying it is possible to pilot the machine without the use of goggles, though caution demands their use.

Function of Seaplane

It might be well here to outline briefly the function of this seaplane, that the arrangement of the parts to carry out the duties of the plane may be described. Its chief use is patrol duty over harbors and main lines of ocean travel. Air stations are established along the coast and from these patrols are sent out at regular intervals, each going over a definite area, watching for submarines and possibly convoying transports or freighters. The machines are equipped with bombs and machine guns, the former being used on submarines and the latter on hostile aircraft and water craft on the surface. Special duties such as bombing an enemy harbor or city emergency calls to submarines discovered by other aircraft or water craft require an armament not much different from the above.



Forward gunner's cockpit on the F-5-L Navy flying boat, showing arrangement of gun mount and ammunition racks

A patrol crew usually comprises four men, the pilot, two mechanics and an observer. The observer has many duties—to watch for submarines, drop bombs, man the front machine gun, act as assistant pilot, and possibly be wireless operator. The pilot's duty is to direct the machine and he is first in command. The function of the crew is to handle the gasoline distribution, care for the engines, and man the aft machine guns in any fight that may occur. It is also their duty to have all parts of the machine under continuous inspection during flight and notify the pilot if any part is wrong.

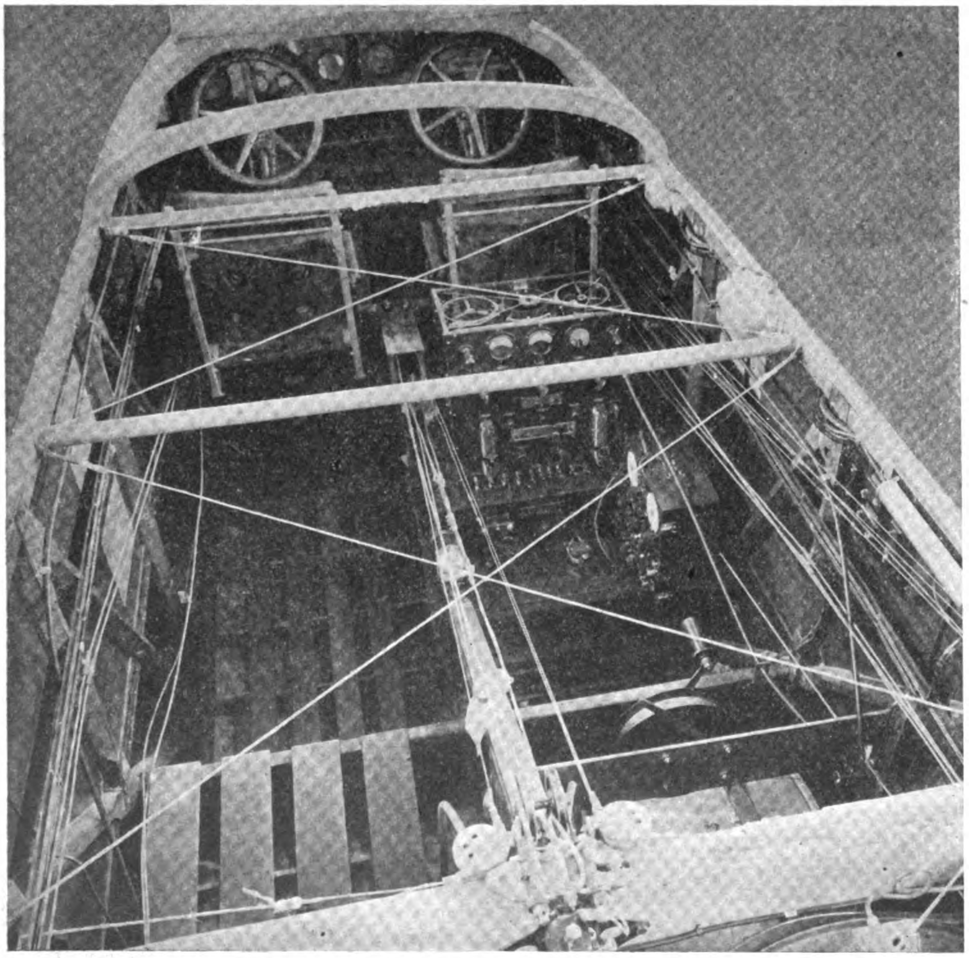
The whole layout of the machine is such that these duties may be most readily carried out. The observer's cockpit is in the nose of the machine and from it the widest range of vision is possible. At the bow is mounted the bomb sight and adjacent to it are the bomb release pulls, ammunition racks, signal pistols, binoculars, etc. A machine gun turret is mounted on the scarf-ring of the forward cockpit, so that the observer may aid in repelling aircraft attacks or, if necessary, sweep the deck of the submarine with machine gun fire.

The pilot's cockpit is just aft the observer's cockpit, and may be readily reached from it when the machine is in operation. The pilots are seated on comfortable seats, hinged on a bulkhead and attached to a transverse tube by means of a snap catch that may be instantly released. This permits the observer to pass aft at will without disturbing the pilot.

A wheel control of the dual type is used. It comprises a laminated ash yoke on which are mounted the two aileron wheels connected by an endless chain. An instrument board containing tachometers, altimeters, air speed indicator, oil pressure indicators, inclinometer, and pilot-directing bomb sight is mounted directly in front of the pilot.

On the starboard side of the hull are the individual engine switches, ammeters and emergency switches, together with the circuit breakers. The two compasses are mounted at some distance apart, so that they cannot interfere with each other. One is on the deck and the other on the floor. All instruments are self-luminous, but instrument board lights are provided.

The spark controls are at the



Looking into the F-5-L hull at the twin pilot's seats and the wireless operator's quarters and equipment

starboard side of the starboard pilot's seat, but the throttle controls are between the two pilots, so that either may operate them. Fire extinguishers are placed convenitnely at each station, those in the pilot's cockpit being attached to the bulkhead beneath the seat.

The wireless operator's station is on the starboard side just aft the pilots. The equipment is mounted on a small veneer table, and used in conjunction with a telescopic mast that is carried in the stern. A celluloid window in the hull side provides necessary light.

Mechanics Stationed Amidship

The mechanics' station is amidships by the gasoline tanks and pumps, and their main duty is to see that the plane is "trimmed" by pumping gasoline from the tanks alternately; to see that the engines do not overheat, and that all parts function properly. The water and oil thermometer are mounted on the sidewalk beam adjacent to the mechanics' station.

Aft the mechanics' station, or wing section, is the rear gunner's cockpit. Three guns are accessible from this station, and it also provides a good point of observation or position for aerial photography.

All machines are equipped with inter-communicating telephones, the receivers being incorporated in the helmets and connection effected by terminal boxes at each station. It is thus possible for all members of the crew to be in constant communication.

Voluminous Equipment Carried

In addition to the equipment indicated, the following are some of the miscellaneous items usually carried: Tool kits, water buckets, range and running lights, pigeons, emergency rations, drinking water, medicine chest, sea anchor, chart board, mud anchor, anchor rope, heaving lines, signal lamp, binoculars, Verys pistol, ammunition, life jackets, and possibly electric warmers. Included also are the priming cans, drinking cups and usually several personal items. All this is exclusive of the ordnance equipment of bombs, machine guns, etc.

Considering the size of the machine and the amount of material carried, the performance is quite remarkable. In fact, it compares very favorably with the performance of land planes having the same specifications and not hampered by the heavy boat construction.

The time required to get the machine from the water varies with the wind velocity, but with a 15-mile wind and the plane fully loaded, from 30 to 40 sec. is required. The speed at take-off is about 47 knots on the air speed indicator, and a machine of this design has made a climb of 4200 ft. in 10 min.

Horizontal Speed 85 to 90 M.P.H.

A horizontal speed of from 85 to 90 m.p.h. is attained, but on patrol duty they are generally flown at a more economical speed, such as 70 m.p.h. When geared Libertys were tried out in one of these machines a speed of 102 m.p.h. was attained, but this was a special power plant equipment.

The engine revolutions are about 1500, though this, of course, varies with the types of propeller used. At full speed the gasoline consumption is about 65 gal. per hour and the oil consumption about 2.6 gal. per hour. By throttling down the engine to 1350 r.p.m., or to a speed of about 60 knots, the gasoline consumption per hour is reduced to 44 gal., the oil consumption remaining the same.

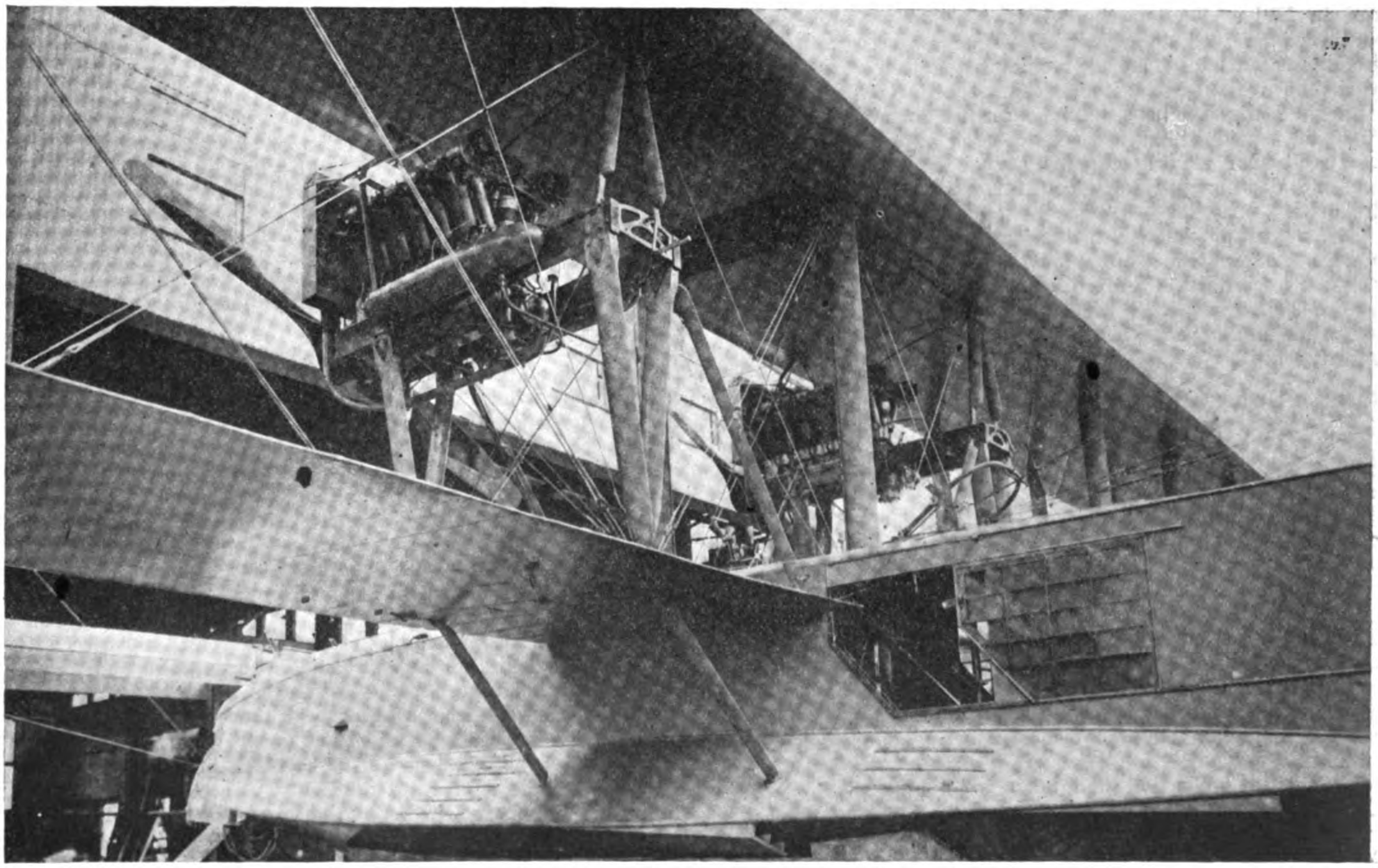
Maximum Cruising Radius 10.6 Hours

This gives a maximum cruising time of 10.6 hours with a light machine or 8½ hours fully loaded. The cruising time at full speed is 7.3 hours and 5.9 hours respectively.

The advantages of operating at cruising speed are many and it is at this speed that the plane is chiefly operated. Among the advantages are increased engine life, greater ease of control, longer cruising radius, less strain on plane parts, and time for more extended observation.

When running at full speed, control is not particularly easy, though under normal conditions one pilot can operate the machine without difficulty. However, the reserve control is necessary to lift the machine from the water, and in cases of emergency, though not ordinarily used.

(To be continued)



Method of mounting the two Liberty engines with which the F-5-L Navy flying boat is equipped. The large sliding window is for observation and permits the use of additional machine guns from this location

When Motor Trucks Saved Verdun

First Complete Description of the Motor Truck in the Greatest Battle of the Greatest War

By W. F. Bradley

THE story of how automobile trucks saved Verdun, and doubtless changed the whole face of the war, was first told in AUTOMOTIVE INDUSTRIES; but when this story was published the war was in progress and the French military authorities objected to the publication of figures and details. Now these restrictions have been removed, and Paul Heuzé in an interesting article in the *Revue des Deux Mondes* gives, for the first time, important statistics on this operation.

> **Motor Vehicles at Verdun**
>
> Hauled 2,000,000 tons of materials.
>
> Moved 2000 tons of ammunition daily.
>
> Transported 100 tons of food and other supplies to 20 divisions each day, a total of 2100 tons.
>
> Carried 15,000 men to and from front lines each 24 hours.
>
> Removed supplies from Verdun to prevent possible capture by the enemy.
>
> Operated over a 22 ft. road 45 miles long.
>
> Passed a given point on the highway at an average of one vehicle each 14 seconds.

During the year 1915 the French Automobile Service had been fully developed on its present and most satisfactory lines. One month after the outbreak of the war the French army possessed between 9000 and 10,000 trucks, of which 6000 were approved army types. The battle of the Marne showed that this number was totally insufficient.

During the whole of 1915 the French Automobile Service purchased trucks which were available in France, America and in Italy. During the whole of 1915 the development continued on well defined lines. Trucks were grouped into sections comprising 17 or 18 vehicles, together with a rolling workshop which was sometimes a truck and sometimes a trailer. Four of these sections united formed a group of 70 to 80 trucks under the control of a captain, and having a capacity for moving one infantry battalion or for carrying one day's supply of food for an army corps of two divisions.

These groups formed a tactical unit of the automobile service. After the groups had been formed, it was found necessary to unite these in companies of six, which were termed "groupments." These groupments had a capacity for transporting one brigade, which is the highest purely infantry unit.

Reserve Groupments

These sections, groups and groupments, consisting respectively of 18, 72 and 432 trucks, were attached to their respective armies and carried out the regular daily work of these armies. The idea had been developed, however, of forming reserve groupments which would be at the disposal of the General in Chief and used for whatever work he might indicate. This move had been rendered necessary by the fact that the army had found it important to provide for rapid movements of troops by means of automobiles. As the groups and groupments had their regular daily work with the army, they could not be relied upon for bigger movements of troops; hence, the formation of the reserve groupments, each groupment consisting of from 1200 to 1500 vehicles.

All this organization had been completed when, at 7.15 a. m., Feb. 21, 1915, the German army launched what has been described as the greatest battle of the greatest war. For 9 hours 2000 German guns shot several million shells of all kinds into the French front lines. Under such a deluge of shrapnel, high explosive, asphyxiating and tear shells, the French lines were flattened and the troops obliged to retreat. The German attack was skilfully organized, for the French line of supply was limited to one single-track railroad, having a capacity for not more than 2000 tons per day. When this line was cut—and naturally the first object of the German headquarters was to cut this line—the French had no other source of supply than the road; but, even here, the French were in a disadvantageous position, for, from Bar-le-Duc to Verdun, there was and still is but one road, and this only a fourth-class road just wide enough for three vehicles to run abreast.

As soon as it was realized that this was no ordinary local attack, orders were given to the automobile service to prepare to supply the Verdun armies with everything necessary to hold back the German invasion. This was the first occasion in the war, or in any war, on which an army had to rely exclusively on automobiles for its supplies. The task was as follows: to deliver from the railhead at Bar-le-Duc to the region of Verdun an average of 2000 tons of ammunition per day; to transport daily 100 tons of food and varied supplies for 20 divisions, making a total of 2100 tons; to carry up to Verdun, or bring back, from 15,000 to 20,000 men per day; to undertake the removal of supplies and varied army material which were then in Verdun and in danger of being captured by the enemy.

Roads Limiting Factor of Truck Efficiency

As already explained, the automobile service at this time was perfectly organized. The weakest point was the road and road regulations. Truck trains worked satisfactorily, but their limiting factor in very many cases was the road. This had been realized, and just before the Verdun battle developed a scheme had been completed, on paper, to get a maximum efficiency out of the road.

This scheme went into effect in the beginning of the Verdun battle. The 45 miles of road from Bar-le-Duc to Verdun was given over to automobile traffic exclusively. No horse or horse vehicle was allowed on this road under any circumstances. The stretch of road was split up into six zones or "cantons," which were organized in the same way as a railroad. An officer with a squadron of traffic police was made responsible for each zone. He had telephonic communications with posts placed along his road, and also with the chief of the other zones. He had orders to keep traffic moving at a regular rate. No vehicle was allowed to stop. If one broke down and could not be moved within five minutes, it was dragged off the road or even turned over into the ditch so that there should be no block in the traffic. The loss of a vehicle or even of a score of vehicles was a matter of minute importance when the safety of France and of the entire world was at stake.

It was during this time that an improvement, very slight in itself, but destined to have wonderful importance, was adopted. The trucks were split up into sections of not more

than nine and the last truck of each section carried a big red disk. No driver was allowed to approach to less than 100 yards of a red disk. By this means the trucks flowed along the road regularly in groups of nine with equally regular gaps of 100 yards between them. These gaps were made use of by touring cars which could pull into the openings thus formed and retain their positions until road conditions made it possible for them to move ahead.

The traffic on this 22-foot road was intense and continued day and night. Official papers show that 6,000 trucks passed a given point in 24 hours, this being an average of one vehicle every 14 seconds. At certain times of the day, and sometimes for several consecutive hours, there was a truck every five seconds. There were on this road more than 9000 automobiles, comprising about 3500 trucks, 2000 staff cars, 800 ambulances and about 200 meat-carrying trucks. In addition to these, there were various special automobiles belonging to the Engineering, Artillery, Air Service, Balloon Corps, Camouflage Sections, Telegraphic, Wireless, Photography, and others.

By the month of June the number of vehicles in use on this road had increased to 11,500. These automobiles carried an average of 9000 men and 15,000 tons of supplies every week. They totaled nearly 1,000,000 miles every seven days, or more than 25 times the circumference of the earth. The total tonnage carried by automobiles during the Verdun battle is rather difficult to estimate, for it comprised supplies, valid troops and wounded, frequently all mixed up, but the total is certainly not less than 2,000,000 tons. If the whole of this material were united it would cover an area of 12,000 sq. yd. and attain a height of 650 ft.

When the automobile service undertook to supply the Verdun army with everything it needed, the stipulation was made, first of all, that no horse should be allowed on this road. At that time, this seemed a very small matter, but there is no doubt that but for this stipulation the road service would have broken down, and as a consequence Verdun would have been lost. They also stipulated that the truck trains should carry their loads right through to destination instead of transferring them to horse-drawn vehicles for final distribution, as had been the custom in the French army up to that time. They insisted on authority being given them to organize the road in accordance with their own plan, and they claimed all necessary facilities in order to keep the road surface in condition.

Road Maintenance

One of the most difficult problems was the maintenance of the road. Within 48 hours of this automobile service being organized, large numbers of territorial troops were sent up for the sole purpose of road work. The number of men working at any time was generally about 1200. In ten months these men put on the road 700,000 tons of stone. The absolute necessity of keeping the traffic flowing steadily at all times made it impossible to use steam rollers. The road menders threw the stones down wherever necessary and the automobiles had to roll in this stone. Their orders were to keep the road in good condition but never, under any circumstances, to stop the flow of traffic.

In addition to this, along the roadside little refuges were established and stones brought to these and kept in readiness for placing on the road itself. The task of the road makers was hard. They had to work throughout the severe winter, to remain on the job in all weathers and had to throw in a shovelful of stones whenever there was a gap between two vehicles. Accidents happened at times, but it was the price that the road menders had to pay in the great struggle against the Kronprinz's forces.

Running day and night, without lights, over a rough road frequently shelled by the enemy, with drivers who had to remain on duty from 24 to 75 consecutive hours, it was not surprising that the automobiles soon began to show signs of breakdown. Tire usage was so rapid that at Bar-le-Duc children made a practice of gathering from the road chunks of rubber which had fallen or which had been torn off the tires of the trucks, and sold these at a penny a pound.

To overcome the difficulty, six hydraulic presses were installed at a convenient point behind the lines and were operated day and night, during the whole of the Verdun battle. Although tires were first to show signs of wear, it was not long before mechanical difficulties developed. The drivers had not time to lubricate chassis accessories frequently; all they could do was to add to the supply of oil in the base-chamber. It was impossible to change the oil. There was frequently no time to stop and add water to the radiator. If an engine ran hot, it had to be forced along until a period of calm made it possible to supply more water.

Under such conditions, defects soon began to develop. To make matters worse, the supply of spare parts for American trucks, large numbers of which were used in the Verdun battle, was stopped at this time. To meet this efficiently, the Automobile Park at Troyes had to arrange to manufacture parts for trucks.

On an average the total losses were 3 per cent per month. When the battle began, a repairshop was in operation in the city of Verdun. This was removed under very great difficulties and sent back to Ligny-en-Bellois, where it operated in conjunction with the main repair park, at Bar-le-Duc. In this park were 30 5-ton breakdown trucks, each one of which had two gangs of mechanics. Whenever an automobile was reported as broken down on the Verdun road, one of these trucks was sent out in order to repair it or, if necessary, to tow it home. This was dangerous work, for many of the trucks were broken down by reason of the enemy's action, and not a few of the mechanics who went out to bring in broken trucks paid for their devotion with their lives.

Truck Removing Service

Soon after the automobile service at Verdun had been efficiently organized, an attempt was made to save as much material as possible from the city of Verdun. When the attack began there were more than 6000 civilians in this town. With the city under shellfire and in danger of being captured by the enemy, these people were obliged to move away, but, at first, no vehicles of any kind were available, and it was on foot, carrying with them very meager baggage, that the old men and women and children abandoned their homes.

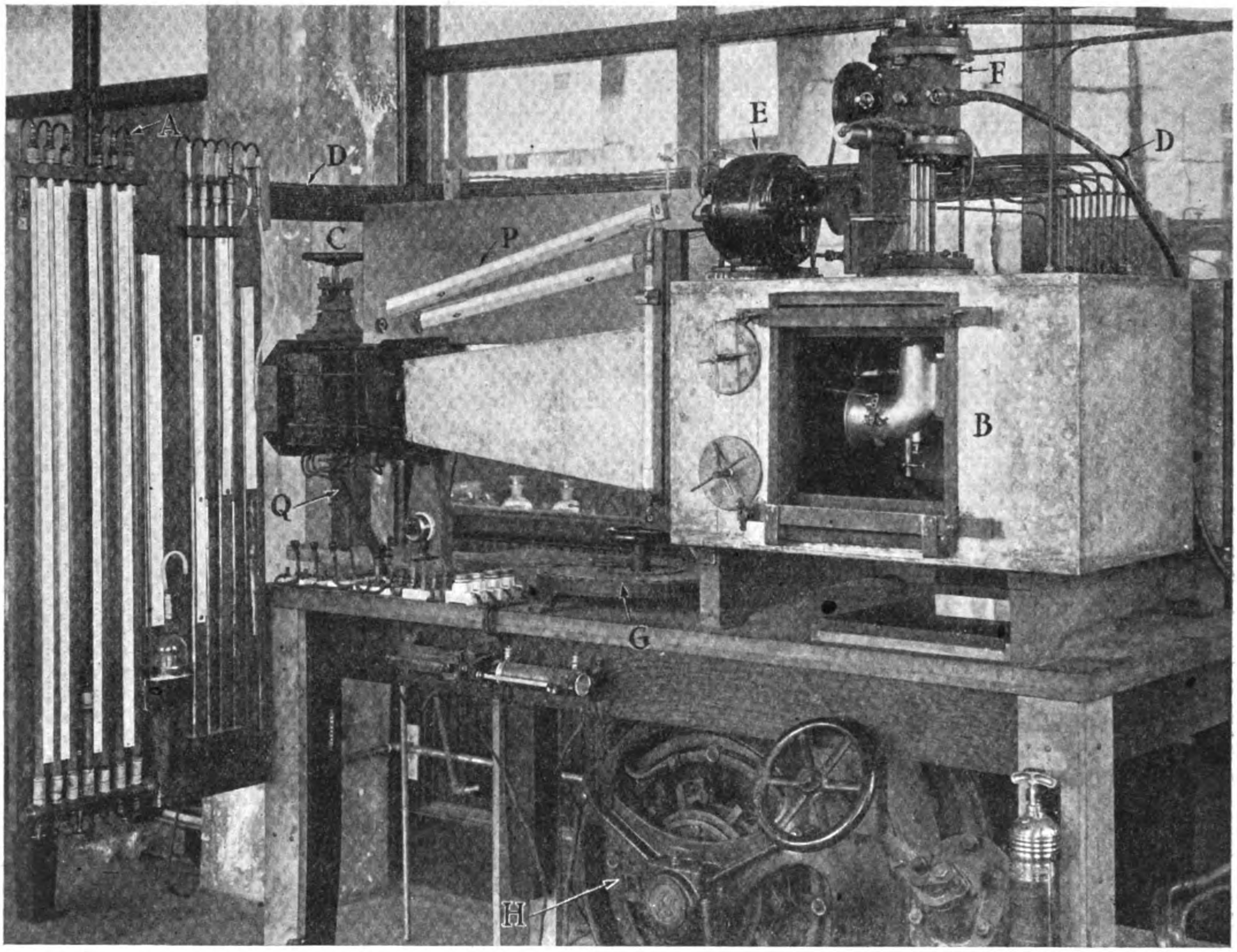
During the critical period, between Feb. 25 and March 8, a small number of trucks went into the town and removed important documents from the City Hall. By the end of the first week in March, there were not more than two or three civilians in the entire city. After the month of March, a regular truck removing service was organized. Fifteen trucks were turned over for this work, together with a company of soldiers who, in civilian life, had been professional removers. These men went into the city every day and removed furniture, machinery and other valuable material from Verdun to the railroad stations at Bar-le-Duc or other points. This work went on throughout the summer, and by the month of October everything which was worth saving and had not previously been destroyed by the German bombardment had been moved out of the city.

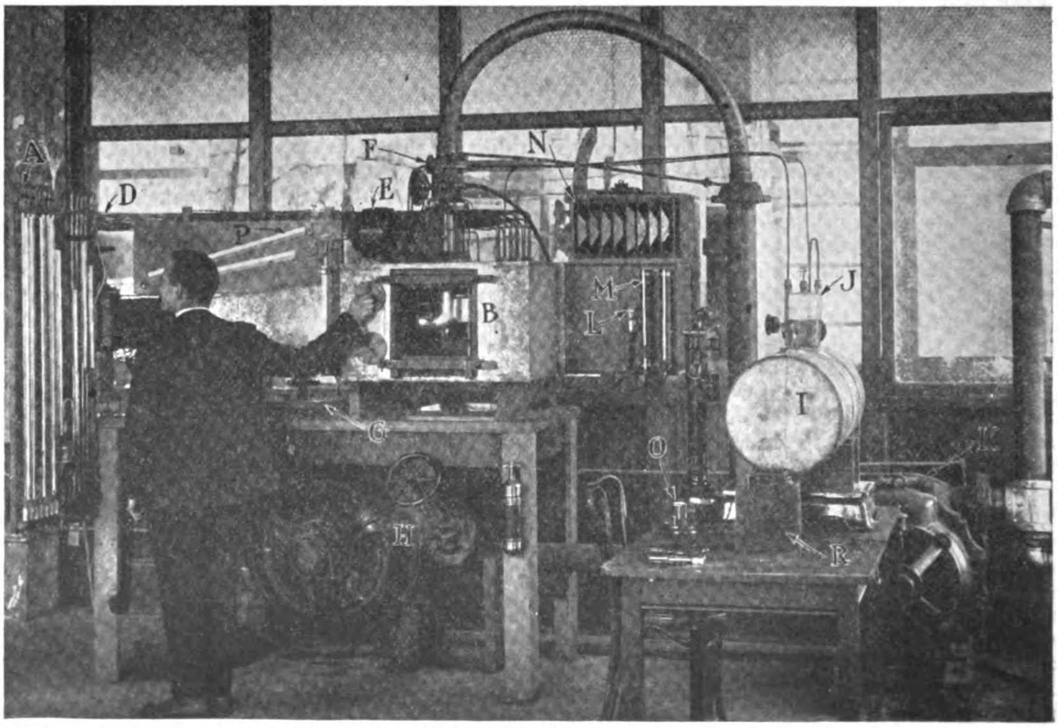
How many men of the automobile service lost their lives in the Verdun battle is not known. The number, however, is considerable, for the trucks took their supplies right up to the batteries and the drivers of ambulances went practically to the first line trenches under cover of darkness. This service had been carefully organized; drivers knew which roads were open to them and which roads could only be used at night time, or during daylight hours by vehicles running singly and at speed. Signs placed along the road showed where truck trains should stop, where vehicles should go through one by one, and where all traffic should stop during daylight hours.

The Altitude Laboratory—Correction

REFERRING to the article on the Altitude Engine Test Laboratory which appeared in the March 6 issue of AUTOMOTIVE INDUSTRIES, by the omission of several words from the sub-head a rather misleading sense was imparted thereto. The sub-head should have read: "Installed at the Bureau of Standards for the National Advisory Committee for Aeronautics."

Bureau of Standards Carbureter Testing Apparatus





Two General Views of Carbureter Test Installation

A*, *Manometer board; B. Carbureter test chamber; C, Gate valve; D, D. Connections to manometers; E, Electric motor operating pulsator; F, Pulsator; G. Rheostat for air-heating grids; H, Electric motor driving Nash turbine pump; I, Fuel tank; J, Vapor trap; K. Nash turbine pump; L. Rate of pulsation indicator; M, Field rheostat for motor E; N, Set of air-meter orifice plates; O, Stopwatch; P, Inclined manometers connected to opposite sides of air-meter diaphragm; Q, Connections to electric air heater; R, Storage battery for operating stopwatch and electric buzzer

Bureau of Standards Carbureter Test Plant

Designed to Determine Metering Qualities of Different Carbureters Under Varying Conditions of Atmospheric Pressure and Pressure Drop —Pulsating Suction Without Running Engine

By P. M. Heldt

ONE of the test plants built at the Bureau of Standards at the request of and in co-operation with the National Advisory Committee for Aeronautics for the immediate purpose of development work in connection with the Liberty and other airplane engines was designed for making carbureter tests. The object of this plant is to determine the metering qualities of a carbureter under different conditions of temperature, pressure drop and intake pressure, and to do so without having to make engine tests at the same time.

Tests can be made not only at atmospheric pressure, but at pressures as low as one-quarter atmosphere. The importance of this will be realized when it is stated that a reduction in atmospheric density has a powerful effect on the metering qualities, a reduction of 50 per cent in the atmospheric pressure ordinarily entailing an enrichment of the fuel mixture of about 45 per cent.

It must be considered that an engine of the size of the Liberty consumes from 30 to 35 gallons of gasoline per hour, and, counting depreciation of the engine and other expense items, it will be appreciated that a carbureter test with the instrument fitted to an engine involves a great deal of expense. As tests had to be made on different designs of carbureters under numerous different conditions, it was believed that a good deal of expense could be saved and at the same time a setup arranged for that would greatly facilitate the tests by installing a special carbureter test plant. Of course, it is realized that no test is so dependable as one carried out under actual service conditions, and it is admitted that the results obtained generally require checking by a test on an engine in operation, but such a check run is much less onerous than the complete test would be.

THIS is the fifth of a series of articles prepared by Mr. Heldt from the research records of the Bureau of Standards in Washington. Previous articles have covered:

1—*Dry Cell and Storage Batteries*

2—*Tests of Airplane Radiators*

3—*Altitude Engine Test Laboratory*

4—*Tests of Ignition Apparatus*

Additional articles covering other subjects will appear in subsequent issues.—EDITOR.

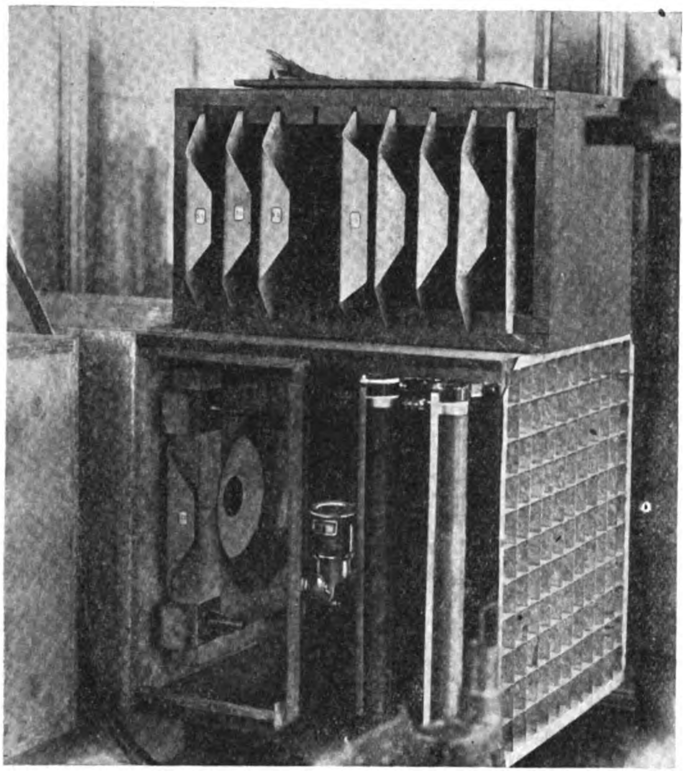
Engine Conditions Closely Approached

Most laboratory metering tests that have been conducted in the past, including the well-known series by Rummel some 10 years ago, were made under the condition of a steady suction. While it is generally believed that the results obtained under these conditions permit of valid conclusions being drawn regarding the action of a carbureter under the influence of the pulsating suction of an engine, it is certainly desirable that the suction effect of an engine should be reproduced as closely as possible in a laboratory test, and this is done in the Bureau of Standards carbureter metering test. The tests can be conducted under air intake pressures as low as one-third atmosphere, and the apparatus is arranged in such a convenient manner that one person can control the test and take all observations. As in an aircraft engine the air is generally heated before entering the carbureter, means are provided in the test plant equipment to raise the temperature of the air above atmospheric temperature to any desired degree. These take the form of electric heating grids in the air passage. The apparatus used comprises the following: An air meter, a throttle valve, an air heater, the carbureter chamber, a pulsator, an air pump, a fuel meter and pressure gage columns.

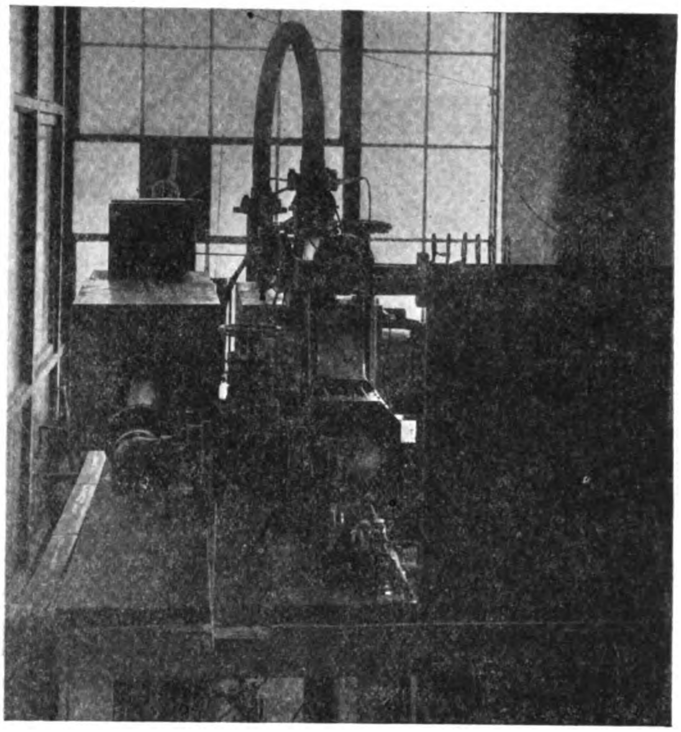
The air first passes through the air meter, then through the throttle valve, over the heating grids into the carbureter chamber, where it enters the carbureter under test. From the carbureter it passes through the pulsator to the blower pump, from which it is discharged into the atmosphere.

The air meter used is of a type first described by R. J. Durley in the *Transactions* of the American Society of Mechanical Engineers and is based on the flow of air through orifices in thin plates. One change that has been made from the Durley arrangement is that the direction of the flow is into instead of out of the chamber. With certain precautions taken in the tests, this has no effect on the accuracy of the measurements.

Means are also provided for protecting the air current as it enters the orifice from disturbance by stray currents in the room, the orifice being provided with an approach passage with a protecting grid. The orifices are bored in steel plates 0.057 in. thick, ranging in size from 3.5 to 0.5 in., by 0.5-in. decrements, with absolutely square edges. In addition there is a 5/16-in. orifice, and a blank plate is used for checking the tightness of the chamber and throttling valve. Rectangular gaskets of pure gum rubber ¼ in. thick form seatings for the orifice plates and insure absolute airtightness even though the plates may be sprung out of shape.

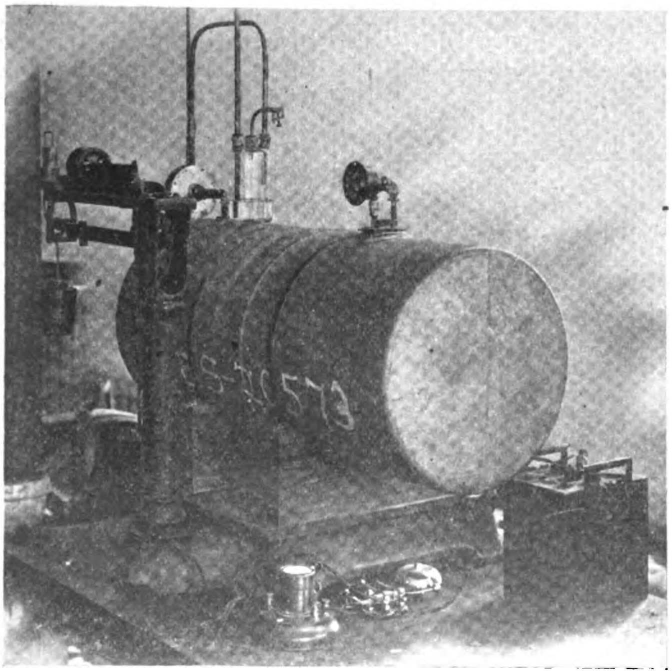


This illustration shows, on top, the set of Durley orifice plates and, below, the air meter. On the side of the air meter box are mounted the rate-of-pulsation indicator and field rheostats for the electric motor



End view of the carbureter test installation showing the air meter at the left, the carbureter test chamber in the center and the back of the manometer board on the right. The 3 in. pipe connection with gate valve from the air meter to the carbureter chamber and the flexible tube from the carbureter to the vacuum pump are plainly shown

Two inclined pressure gages of the pitot tube type are used for determining the pressure drop across the orifice. The tubes are provided with a millimeter scale, and in order to be able to obtain readings directly in inch measures, they are set at such an angle that each division of the scale is equal to a vertical rise of the column of 0.01 in. In this way readings can be made to within a limit of accuracy of plus and minus 0.0025 in. At the left of the carbureter chamber there is a vertical water column with a scale divided into fiftieths of an inch, which can be read through a magnifier, provisions being made to avoid errors due to parallax.



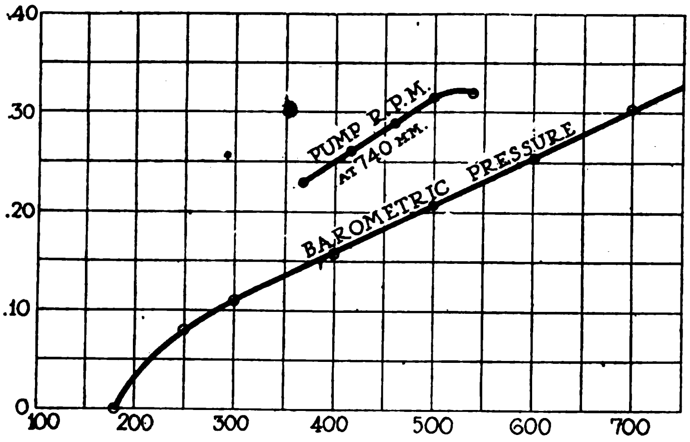
This view shows the fuel tank mounted on a weighing scale with tank pressure gage, vapor trap, stopwatch, electric control and electric buzzer which gives an audible signal when the predetermined weight of fuel has been withdrawn from the tank and the scale beam drops

For controlling the pressure within the carbureter chamber so as to permit of a study of carbureter operation under conditions similar to those encountered at high altitudes, a gate valve is inserted in the air line and connected to the orifice chamber by a piece of 3-in. pipe. The air, after having passed through this gate valve, is drawn through an electric heater consisting of a chamber within which there are frames carrying coils of electric resistance wire. These resistance coils are connected with controlling switches and a rheostat. Some of the resistance coils are connected directly across the 220-volt circuit; two are so arranged that they can have either 110 or 220 volts applied to them, and one of these in addition has a rheostat connected in circuit with it, so that the current flow can be further regulated. By means of the control switches and rheostat the temperature rise of the air can be closely regulated between the limits of 3 deg. and 45 deg. C. above atmospheric temperature, under conditions of maximum air flow. The temperature within the chamber can be read off from a mercurial thermometer mounted just inside the glass door.

Construction of Carbureter Chamber

From the heater the air flows through an approach, shaped like an inverted funnel, into the carbureter chamber, entering the latter through a grid similar to that provided in the approach to the air meter. The purpose of the grid and of the funnel-shaped approach to the carbureter chamber is to prevent the formation of eddy currents, which would be sure to result if the air entered the chamber in a small stream of high velocity.

The carbureter chamber consists of a box made of 2-



Curves showing the operation of the Nash turbine pump used in the carbureter tests

in. boards reinforced along the inside corners by lengths of angle iron. The outside dimensions of the box are 18 x 18 x 30 in. The door comprises a frame of square steel bars, to which is applied a galvanized iron sheathing, the edges of which are turned up at the door opening. The joint between the galvanized iron and steel bars is sealed by means of solder and an airtight joint between the door and the door frame is effected by the use of a rectangular gum rubber gasket. The glass door fitted is of ¾-in. plate glass and is held in place over the opening and against the gasket by a pair of steel bars.

Centrally in the top wall of the chamber there is a circular flange to which any carbureter to be tested can be secured by means of an adapter. To one side of the door opening there is a pair of control shafts which carry adjustable levers inside the chamber, from which connections can be made to the throttle lever and any other control devices with which the carbureter under test may be provided. The hub of the flange on the top of the carbureter chamber extends through the wall of the chamber and on the outside carries a large circular flange. In order to permit of studying the character of the mixture produced by the carbureter, the outlet is made in the form of a glass tube which is held in glands secured by 4 studs. Passing the mixture as it leaves the carbureter through a glass tube enables observation to be made of the quality of the mixture as regards fineness of division of the fuel, of any irregularities in the fuel discharge, of any swirling effect in the mixture stream and of any unequal division of the fuel in the stream or on the walls. The use of a glass tube and outlet pipe also serves as a check on the action of the float mechanism of the carbureter.

Pulsator

Considerable interest attaches to the device employed for creating a pulsating suction in the air passages, referred to as a pulsator, which is located directly above the carbureter, as this is probably the first time that such a device has been used in carbureter tests. This pulsator comprises a cast body with a rectangular passage for the fuel mixture. A butterfly throttle valve is located in this passage. Two opposite walls at the rectangular passage consist of plates of spring bronze, which are normally flat. These spring bronze plates are located directly over the throttle valve and permit of varying the effective area of the passage at the valve.

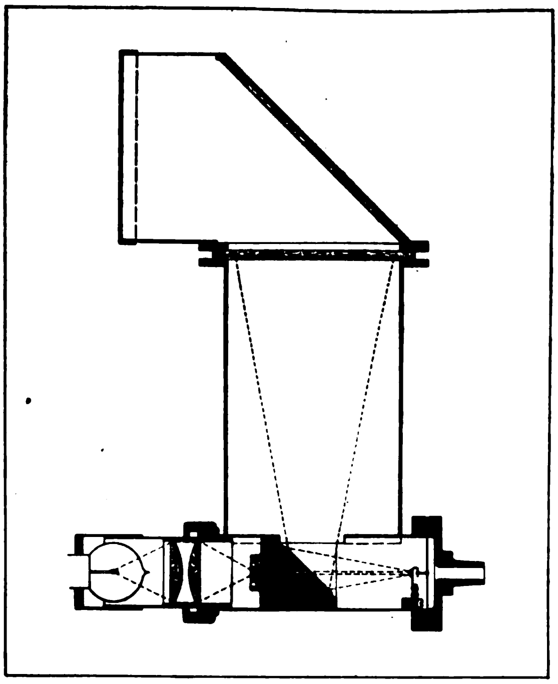
Pulsation of the suction is produced by rotating the valve by means of a 1/6-hp. electric motor which is mounted on top of the carbureter chamber and drives the throttle valve by belt. Stepped pulleys permit of varying the speed of the pulsator valve, and further speed control may be effected by means of resistances in the motor field circuit. In this way the rate of pulsation can be varied between the limits of 600 and 4000 per minute, which corresponds to a range of engine speed of 300 to 2100 r.p.m. for 4-cylinder engines and 400 to 2800 r.p.m. for engines in which one carbureter supplies three cylinders. A tachometer serves to indicate the speed of the pulsator valve. This is of the type designed to be fitted to the camshaft of an engine, and its indications are always equal to twice the number of revolutions per minute at which it is driven. As the throttle valve produces two pulsations per revolution, the tachometer indicates directly the pulsations per minute.

Optical Indicator

The amplitude of the pulsations can be varied by means of screws pressing against the spring bronze plates and forcing them more or less toward the throttle sweep. In this way it is possible to closely reproduce the pulsating suction characteristics of any engine in which explosions follow one another at equal intervals. Indications of the magnitude of pressure fluctuation are given by a simple form of optical indicator provided with a graduated screen. A line of light appears on this screen, the ends of which represent the pressure limits.

For creating the suction on the carbureter, use is made of a Nash vacuum pump which connects to the pulsator by means of a flexible metallic tube and which discharges outside the laboratory. Adjacent to the pulsator outlet, a throttling opening and trap is inserted in the line. This serves to prevent any effect upon the carbureter action of possible resonance in the flexible tube due to the pulsator action, and also to dispose of any liquid in the mixture above the pulsator, especially at low air velocities, which is passed from here directly to the pump intake (through a ⅜-in. inclined pipe).

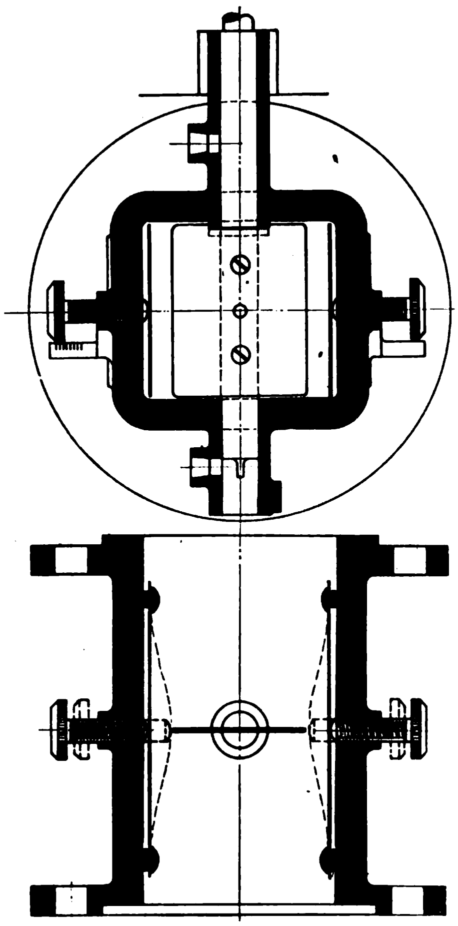
The fuel delivered by the carbureter is measured by weighing. From a 30-gal. tank on a platform scale it is



In the carbureter tests a pulsating suction corresponding to the strokes of a running engine is created by means of a vacuum pump. The magnitude of these pressure fluctuations is noted on the screen of the optical indicator shown above. A beam of light is reflected from a mirror, at the lower right of the device, connected to a diaphragm

forced under pressure to the carbureter float chamber, a gage on the tank indicating the pressure on the fuel (which is usually maintained at 2 lb. per sq. in. by means of a regulating valve in the pressure line). The pressure here referred to is the difference in pressure on the fuel in the tank and that in the carbureter chamber. Beyond the pressure regulating valve there is a vapor trap in the line, mounted on top of the tank, and thence the fuel passes through a copper tube to a valve and fitting in the top wall of the carbureter chamber, from which a length of airplane fuel hose connects to the carbureter.

The beam of the fuel-weighing scale is provided with a mercury contact device by means of which an electric circuit is completed which controls the stopping and starting of a stopwatch, and also the electric circuit of an annunciator, so that an audible signal is given to the operator when the run begins and ends. As the stopwatch is started and stopped automatically, the human equation is entirely eliminated in the determination of the fuel delivery. This method has the further advantages that it relieves the operator of the necessity of minding the fuel scales, leaving him free to devote all his attention to the other indicating devices and to the control of the carbureter.



Construction of rectangular pulsator and butterfly valve and plates for varying effective area of the passage

Twelve pressure gages are made use of in connection with this test installation. These extend into the carbureter chamber, the connections being made at the door, where union fittings are soldered into the galvanized iron sheathing, the connections being made by copper tube outside the chamber and by rubber hose inside. The scales of the water columns are so arranged that they can be adjusted vertically as a unit, in accordance with the level in the header from which the columns draw their water. This permits of resetting the scales during the run to allow for the displacement of the zero as water is transferred from the header to the columns. However, the tank is of such size that even if three of the columns should be in use simultaneously and should be entirely full of water, the error due to the change in the zero position would be less than 1 per cent. In addition to the six columns referred to and the main barometer for indicating the chamber pressures, there are mounted on the board a pair of mercury U tubes and a supplementary U-tube barometer. By means of T fittings and tubing within the chamber the various columns can be interconnected in different combinations.

The air pump is driven by a 25-hp. shunt motor which is provided with controlling resistances for the field circuit. When the pump is in operation the rate of air flow through the carbureter depends upon the position of the carbureter throttle, the position of the throttling valve adjacent to the air heater and the position of the gate valve on the pump intake. The gate valve determines the depression in the carbureter outlet, and hence the rate of air flow through the carbureter, while the throttling valve adjacent to the air heater exerts an influence upon the pressure, and consequently upon the density of the air in the carbureter chamber, and in this way has an effect upon the rate of air flow through the carbureter.

The chief object of the carbureter test plant is to determine quickly the ratio of air to fuel passed under any given conditions. First of all the outfit must be adjusted to pass the required quantity of air under conditions of predetermined atmospheric and carbureter outlet pressures. The first step when such a test is to be made is to select the proper air meter orifice and put it in position. This selection is facilitated by the use of graphs which have been prepared for each of the orifices regularly used, showing the amount of air in pounds passed per second as a function of the pressure difference. Next, the pump intake by-pass and the throttling valve are adjusted to give the required indication of the pressure gage, showing the orifice pressure at the predetermined pressure in the carbureter chamber. With a given setting of the throttling valve, subsequent adjustment of either the orifice pressure or the carbureter chamber pressure will automatically entail readjustment of the other. Then the carbureter throttle is adjusted to give the carbureter outlet pressure corresponding to the predetermined chamber pressure and drop in the carbureter.

The rate of air flow through the carbureter and conditions of inlet and outlet pressure being now fixed, the weights on the fuel scale are adjusted so the beam is about to drop. As a result of withdrawal of fuel from the tank by the carbureter, the beam soon drops and starts the stopwatch. Then a weight is removed from the scale corresponding to the amount of fuel it is desired to pass through during the test, and when this has been withdrawn from the tank the scale again drops, closing the electric contact and stopping the stopwatch. While the run is on, the operator observes and records the indications of the thermometric apparatus, the pressure gages, tachometer, pulsation indicator, etc. At the end of the run he has the amount of the air and fuel delivered and the time occupied in passing these quantities of air and fuel. This completes the run.

So far most of the development work that has been carried out in this carbureter test plant has been with large size aircraft engines which had been tested previously, so that the rates of air and fuel flow were rather closely known in advance. However, the plant has been designed to permit of a wide range of adjustment, a fact which will render it all the more useful now that lines of automotive work other than aircraft development will regain their pre-war importance.

THE Derbyshire (England) oil boring operations are said to have met with encouraging success recently. At Hardstoft much water has been met with, which has delayed progress, but several gushes of gas have been encountered which are associated with the presence of oil. At Brimington, following repeated gushes of gas, the first traces of oil have been encountered. It is of the rough character known as "farmers' oil," but gives off an odor of paraffin. Receptacles for conserving oil, if it is tapped in quantity, are being arranged on the spot.

New Golden, Belknap & Swartz Truck and Tractor Engine

Will Enter Production in March with L-Head, 3¾ by 5-In. Powerplant, Adapted to Low-Grade Fuel — Built for Truck and Tractor Service

THE Golden, Belknap & Swartz Co., Detroit, will be in production toward the end of this month on a new truck and tractor engine. This is a 3¾ in. by 5 in., four-cylinder model, known as the AA, designed to handle low-grade fuel and is a new product in every respect, arranged to have the most advanced practice in detail design.

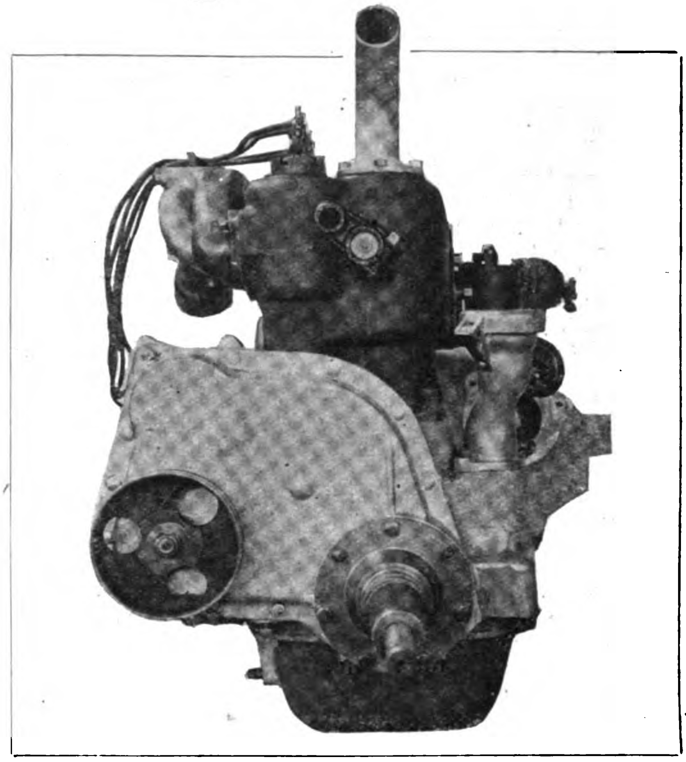
The engine is laid out generally to accommodate itself to the demands of truck and tractor manufacturers and to fit the requirements of their particular chassis. The carbureter, for example, can be mounted on the left or right side of the engine. Thermo-syphon or pump water circulation can be used and battery or magneto ignition is suitable, driving facilities being arranged to take care of either.

If the engine is used in tractor service, an oil cooler can be fitted, and if it is desired to mount a governor, there is a vertical shaft with a slotted end to take the governor drive and a flange face upon which to mount it. The engine is a fixed-head type with removable water header. Both halves of the crankcase are aluminum and the cylinders are cast in a block of gray iron.

The pistons are the three-ring type, with oil relief holes drilled circumferentially below the lower ring to prevent oil pumping into the cylinders.

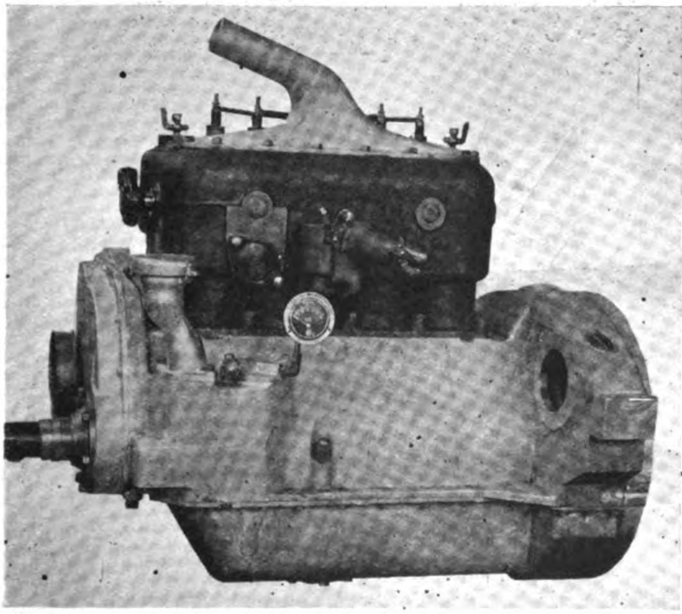
There are also two grooves at the bottom of the piston skirt which act as oil retainers. The piston pin is anchored in the boss and the weight of the piston complete with the wrist pin and rings is 3 lb. 1 oz. The length of the piston is 3¾ in. The wrist pin bearing is 1½ in. in width and 1 in. in diameter.

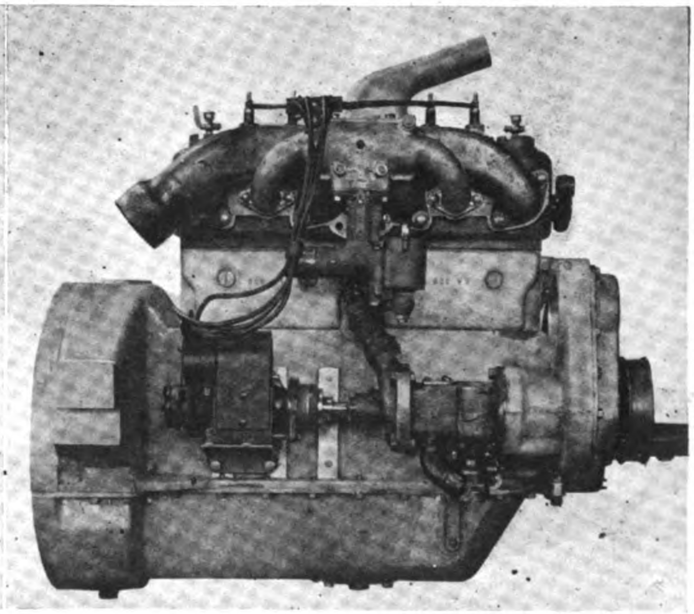
The connecting-rods are 10¼ in. in length, center to center.



Front end of new Golden, Belknap & Swartz 3¾ by 5 in. truck and tractor engine

They are machined quite closely for light weight. The weight of the connecting-rods is 2 lb. 4 oz. They are provided with lower bearings, 2 3/16 in. in width and 1⅞ in. in diameter. The crankshaft is 2¼ in. in diameter and is carried on three main bearings, the front being 3 in. in length, the center 2⅛ in., and the rear 3 in. Both the main bearings and the connecting-rod bearings are bronze-back, babbitt lined.





Left side of Golden, Belknap & Swartz engine, showing carbureter mounted on left side and detachable flange cover for thermo-syphon cooling; and right side, with carbureter mounted for hot spot manifold and magneto

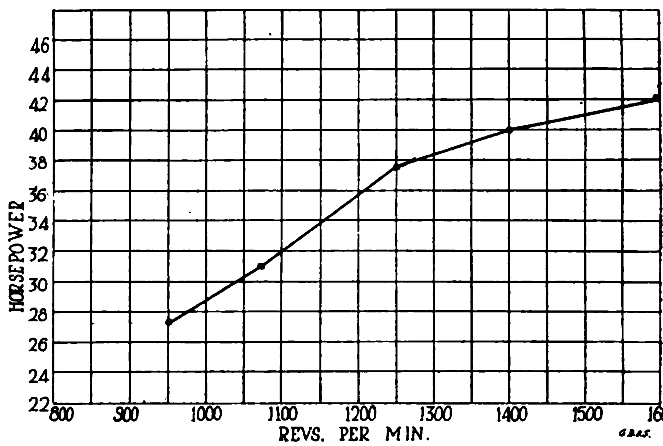
The three bearings for the camshaft are die-cast babbitt. The main and connecting-rod bearings have the new Muzzy Lyon babbitt adjustment in place of shims. This is a solid piece of babbitt metal of the thickness of the ordinary group of shims, but has the advantage that it can be inserted beyond the inside of the bearing and then burnished out to form a part of the true bearing surface, eliminating the ordinary outlet for the oil which exists in the shimmed bearing.

The babbitt is undercut at the center of the length of the bearing, so as to line up with the oil groove in the bearing, permitting the oil to have free flow at the bearing surface. When necessary to adjust the bearings, the babbitt can be filed down to any amount, thus permitting of very accurate settings on the bearings.

The main bearings are supported in the crankcase, the center bearing being very heavily ribbed to give the desired rigidity and continuity of alignment. Each of the main bearing caps is held in place by four alloy steel stub bolts with castellated nuts, cotter-pinned into position. The timing gears are helically cut and are steel against semi-steel. The camshaft is on the right side of the engine and is an integral forging with large bearings.

The valves are driven through mushroom tappets, the tappet guides being locked by spiders bolted to the crankcase. Adjustment is made by means of a stud screwed into the end of the tappet and locked by a locknut. The valves have a port diameter of 1 11/16 in., and have a lift of 23/64 in. The valve passages are clear and of ample size, as will be noted from the illustration showing the cylinder block with the valve ports exposed.

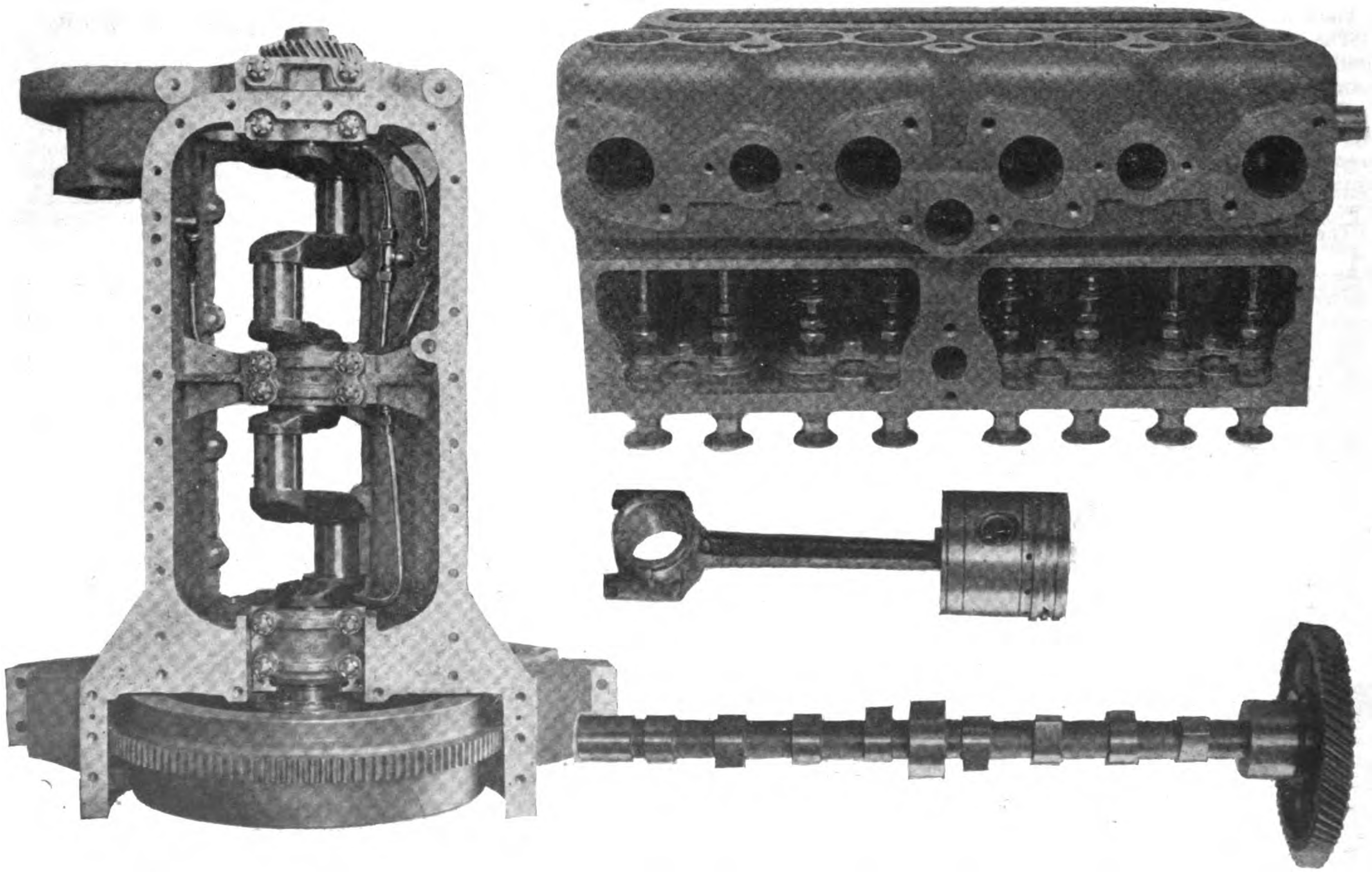
The course of the intake gases depends upon the side of the engine upon which the carbureter is mounted. When the mounting is as shown in the illustration herewith, the hot spot type of manifold is used with the intake partially integral with the exhaust, securing the desired preheating effect. The hot spot construction is used even if the carbureter is mounted on the opposite side, as the store is so arranged that the intake gases are drawn from the store between the cylinder blocks.



Horsepower curve of new Golden, Belknap & Swartz 3¾ by 5 in. truck and tractor engine

Lubrication is by full pressure system, with no splash. The oil pump is driven off the water pump shaft and is a gear type. It is mounted on the exterior and can thus be readily removed for inspection. Pressure can be regulated to suit requirements. There is provision for mounting a pressure gage on the dash, this gage being shown closely connected to the engine in the left-side view. The oil relief or pressure regulation is external, being readily made with a screwdriver and wrench. This adjustment is located on the outside of the engine at the point at which the oil filler neck leaves the crankcase.

Under ordinary conditions the oil is fed under a pressure of 15 lb. per sq. in. The oil leads are self-contained, taking the oil from the pump direct to each of the three main bearings, and another lead for pressure passes through the pressure gage. The crankshaft is drilled through the cheeks to



Cylinder block of Golden, Belknap & Swartz truck and tractor engine and piston and connecting rod and camshaft assemblies

the crank pin, which is also drilled to feed the oil to the lower connecting-rod bearing. As the oil is fed under pressure and since it is supplied in superfluous quantities, there is a marked spray off the lower ends of the connecting-rods which lubricates the internal walls of the cylinder.

In ordinary practice, the engine will be cooled by pump circulation. The water pump and the magneto are driven off the same shaft when magneto ignition is used, and this same longitudinal shaft also provides a drive for the oil pump, as well as for the governor when fitted. A study of the water outlet header will show that this is suitable for either pump or thermo-syphon circulation. Should the thermo-syphon cooling be used, the cap flange on the left side of the engine is removed and the water connection made here instead of at the pump.

No accessories are furnished with the engine. The mounting is designed for three-point suspension, and the overall dimensions are 34 1/16 in. in length, 31 in. in height and 23⅛ in. in width. The engine is produced with a No. 3 S. A. E. bell housing as standard, the starting motor mounting being in this bell housing. There is a generator mounting on the rear of the timing gear housing on the right side of the engine, if the magneto is used, or the generator may be mounted on the shelf in which the magneto is shown in the accompanying illustration. These various locations for mounting different accessories or auxiliary units give the engine a very elastic make-up.

The general power characteristics of the engine as shown from tests on the fan dynamometer give 42 hp. at 1600 r.p.m., with the maximum torque at 800 r.p.m. The governed speed is 1400 r.p.m. The weight of the engine without ignition system or carbureter is 410 lb.

British Papers on Motorcycle Design

ABOUT a year ago there was considerable discussion in the British press in regard to the need of some method of ventilating and discussing the difficulties with which designers of motorcycles were faced. The matter was immediately considered by the Council of the Institution of Automobile Engineers, and after a conference with technical representatives, of some of the motorcycle manufacturing firms, the Institution undertook to arrange meetings to deal specially with points in connection with motorcycle design, provided that sufficient support was forthcoming from those interested in that branch of the industry. A large number of motorcycle engineers have since joined the Institution, we are informed.

Two meetings were arranged in Birmingham, to form part of the regular Institution session, and the papers for these meetings deal specifically with points connected with the design of motorcycles. The first paper, which was read at the Birmingham Chamber of Commerce on February 20, by D. S. Heather, was entitled "A Survey of Current Motorcycle Design."

Mr. Heather wrote as a rider, rather than as a designer of motorcycles, and this was perhaps rather fortunate, for it is believed that it is just this point of view that the motorcycle manufacturers often lack. The criticism made by Mr. Heather was not entirely uninformed, however, as he has been connected with the motor car side of the industry for some time.

The second paper on the subject will be read on March 20, at the same place, by Eric Caudwell, and is announced to be composed chiefly of constructive criticism.

New Organization of the United States Air Service

WASHINGTON, March 17—Maj.-Gen. Chas. P. Menoher, Director of Air Service, has announced a new organization as follows:

Executive Staff

Executive Officer, Col. Milton F. Davis, A.S., A.
First Assistant Executive, Col. William E. Gillmore, A.S., A.
Second Assistant Executive, Maj. Horace M. Hickam, A.S., A.
Third Assistant Executive, Brig. Gen. William Mitchell, U. S. A.
Fourth Assistant Executive, Lt. Col. William F. Pearson, A.S., A.

Technical Advisory Staff

Supply

Chief, Air Service Property, Lt. Col. Augustine W. Robins, A.S., A.
Chief, Air Service Procurement, Col. Chalmers G. Hall, A.S., A.
Chief, Air Service Materials Inspection, Lt. Col. George W. Mixter, A.S., A.P.
Chief, Air Service Finance, Lt. Col. Alex. C. Downey, A.S., A.P.
Chief, Air Service Aeronautical Engineering, Col. Thurman H. Bane, A.S., A.

Training and Operations

Chief, Air Service Training (Detail to be announced later).
Chief, Air Service Operations, Lt. Col. Lewis H. Brereton, A.S., A.
Chief, Air Service Gunnery, Lt. Col. Harold E. Hartney, A.S., A.
Chief, Air Service Communications, Col. Clarence C. Culver, A.S., A.
Chief Air Service Balloons and Airships, Col. Charles DeF. Chandler, A.S., A.

Administrative Staff

Chief, Air Service Personnel, Lt. Col. Rush B. Lincoln, A.S., A.
Chief, Air Service Inspector, Lt. Col. Frank M. Andrews, A.S., A.
Chief Surgeon, Air Service, Col. Albert E. Truby, M.C.

The following named officers have been designated as an Advisory Board, Air Service:

Col. Walter G. Kilner, M.A., A.S.A.,
Col. Arthur L. Fuller, A.S.A.,
Col. Henry C. Pratt, A.S.A.,
Lt. Col. George B. Hunter, A.S.A.,
Lt. Col. Henry W. Harms, J.M.A., A.S.A.,
Maj. Charles R. Cameron, A.S.A., Secretary.

and the following named detailed for duty in the Office of the Director of Air Service, as indicated:

Assistant to Executive Officer, Lt. Col. Oscar Westover, A.S., A.P.

Assistant to Second Assistant Executive, Maj. John B. Reynolds, A.S.A.

Assistant to Third Assistant Executive, Col. Thomas DeWitt Milling, M.A., A.S.A.

Assistant to Fourth Assistant Executive, Maj. Walter H. Frank, J.M.A., A.S.A.

Assistant to Fourth Assistant Executive, Maj. Raycroft Walsh, J.M.A., A.S.A.

Assistant to Chief, Air Service Materials Inspection, Lt. Col. John D. Reardan, A.S., A.P.

Assistant to Chief, Air Service Finance, Lt. Col. Jacob E. Fickel, J.M.A., A.S.A.

Assistant to Chief, Air Service Finance, Lt. Col. William C. McChord, J.M.A., A.S.A.

Assistant to Chief, Air Service Aeronautical Engineering, Lt. Col. Byron Q. Jones, M.A., A.S.A.

Assistant to Chief, Air Service Training, Lt. Col. Herbert A. Dargue, M.A., A.S.A.

Assistant to Chief, Air Service Personnel, Lt. Col. Hollis C. Clark, A.S., A.P.

Legal Advisor to Director of Air Service, Maj. J. Gowan Roper, J.A.

The following chart explains the various functions of the Executive Staff:

Director of Air Service

Advisory Board ... { Executive Officer, Col. M. F. Davis } Foreign Representation (to be announced later)

Col. W. G. Kilner.
Col. A. L. Fuller.
Col. H. C. Pratt.
Lt. Col. G. B. Hunter.
Lt. Col. H. W. Harms.
Maj. C. R. Cameron.

EXECUTIVE STAFF

1st Asst. Executive,
Col. W. E. Gillmore.
Technical Advisory Staff, supply:
Chief, A. S. Property, Lt. Col. A. W. Robins.
Chief, A. S. Procurement, Col. C. G. Hall.
Chief, A. S. Materials Inspection, Lt. Col. A. C. Downey.
Chief, A. S. Aero. Engineers, Col. T. H. Bane.

2nd Asst. Executive,
Maj. H. M. Hickam.
Information,
Statistics,
Publicity.

3rd Asst. Executive,
Brig. Gen. William Mitchell.
Tech. Advisory Staff,
Training and Operations,
Chief, A. S. Training (to be announced later).
Chief, A. S. Operations, Lt. Col. L. H. Brereton.
Chief, A. S. Gunnery, Lt. Col. H. E. Hartney.
Chief, A. S. Communications, Col. C. C. Culver.
Chief, A. S. Balloons and Airships, Col. C. DeF. Chandler.

4th Asst. Executive,
Lt. Col. W. F. Pearson.
Administrative Staff:
Chief, A. S. Personnel, Col. R. B. Lincoln.
Chief, A. S. Inspector, Lt. Col. F. M. Andrews.
Chief Surgeon, A. S., Col. A. E. Truby, M.C.
Routine Executive. A. S. Functions.

Walker Automatic Gear Tooth Rounding Machine

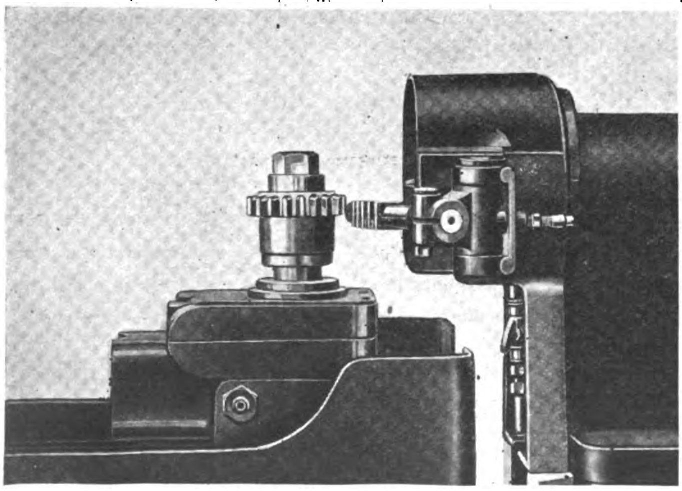
Can Be Set to Round Meshing Edges, or to Remove Burrs Left by Cutters or Hobs

ROUNDING the edges of teeth of sliding meshing gears, such as are used in gearsets, presents a peculiar problem in machining which necessitates the use of a special machine. The newest of these has been brought out by the Charles H. Walker Machinery Co., Detroit. This machine can be used either for rounding the meshing gear edges or it can be so set up as to efficiently remove the burrs left by the cutter or hob on spur gears, straight and spiral bevel gears, helical gears and worm wheels.

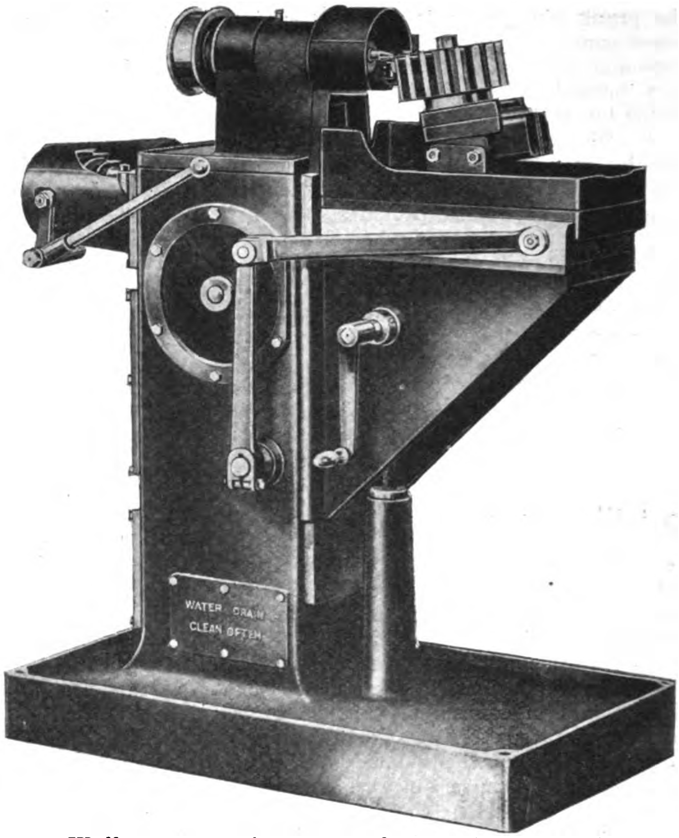
The machine has capacity for any gear up to 30 in. diameter by 12 in. face and of any standard or special pitch from 20 to 2½ pitch and of any number of teeth. When used for rounding purposes the machine will round the entire end of the tooth for 180 deg. at any desired radius. In rounding the tooth the cutter takes off the surplus metal at the root of the tooth, thus freeing the gear of burrs and eliminating the filing work sometimes necessary.

The gear is held rigidly during the cutting operation. The cutter starts at one side of the tooth and works around it, finishing on the other side. Owing to the fact that the gear is held rigidly during the cutting operation, there is no backlash and the cutter cuts both sides of the tooth equally. There is a quick return movement to bring the cutter back to its starting position rapidly. While the cutter is going back to starting position the table is moved out and in, bringing the next tooth to be rounded in mesh with the indexing rack, thus automatically indexing and centering the tooth in correct relation to the cutter.

The indexing rack is cut with teeth of the same pitch as the gear to be rounded. It meshes a trifle below the top of the gear so as not to interfere with the cutter, and due to its solid mesh the indexing rack holds the tooth being cut rigidly throughout the cutting operation. The indexing method is simple, getting away from change gears, ratchets and other devices.



Indexing mechanism, showing how indexing rack meshes with gear below its top surface



Walker automatic gear-tooth rounding machine

Owing to the automatic operation of the machine, one operator can handle a number, depending on the class of work. Ordinarily, an operator can handle three to four machines on a production basis. The cutter spindle is driven by an independent shaft and is mounted in a double eccentric, allowing the spindle to be offset to accommodate gears up to 2½ pitch.

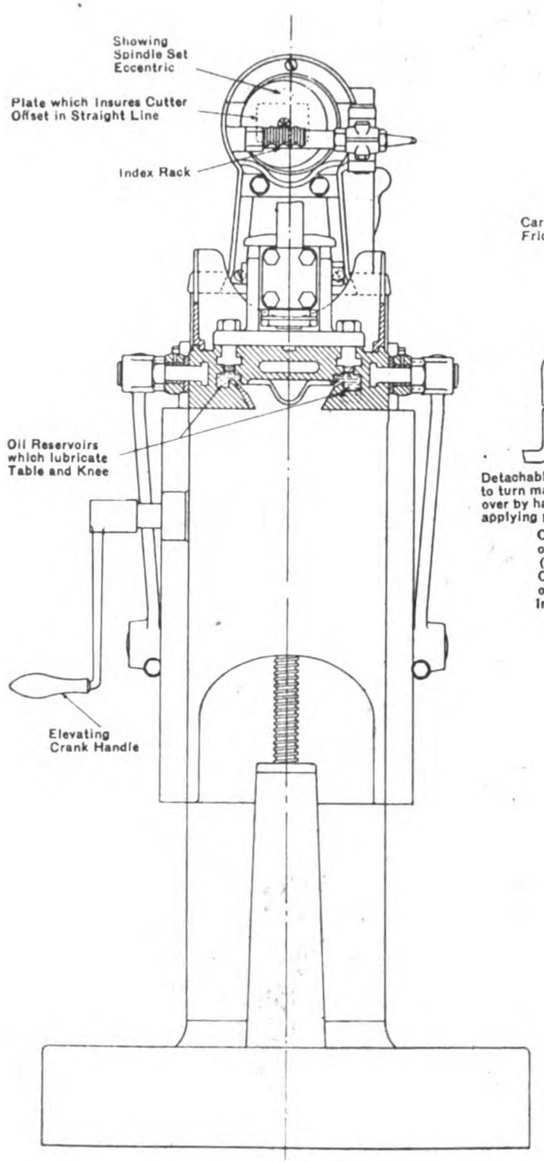
The driving mechanism is enclosed and includes a three-step cone pulley. There is a clutch shift lever to stop and start. The machine camshaft is driven from the powershaft by a worm drive, and the camshaft is lubricated by a belt carrying an oiler spring which picks up oil out of the reservoir in the sump below the camshaft in the main body of the machine. This oiler spring lubricates both the cams and cam rollers, worm and worm wheel. The drive from the camshaft controls the operation of the table and also the oscillation of the cutter.

For the motion of the table the cam operates through lever arms which are shown in the exterior view of the machine, and for the oscillation of the cutter the motion is imparted by a rack which is operated from the cam. The pinion operated by the rack is solid on the same shaft as the gear wheel, which meshes with the spindle sleeve. The upward motion of the rack revolves the pinion half way around, causing the entire spindle head to operate. The cam is so shaped that a quick-return movement is given to bring the cutter back to its original position.

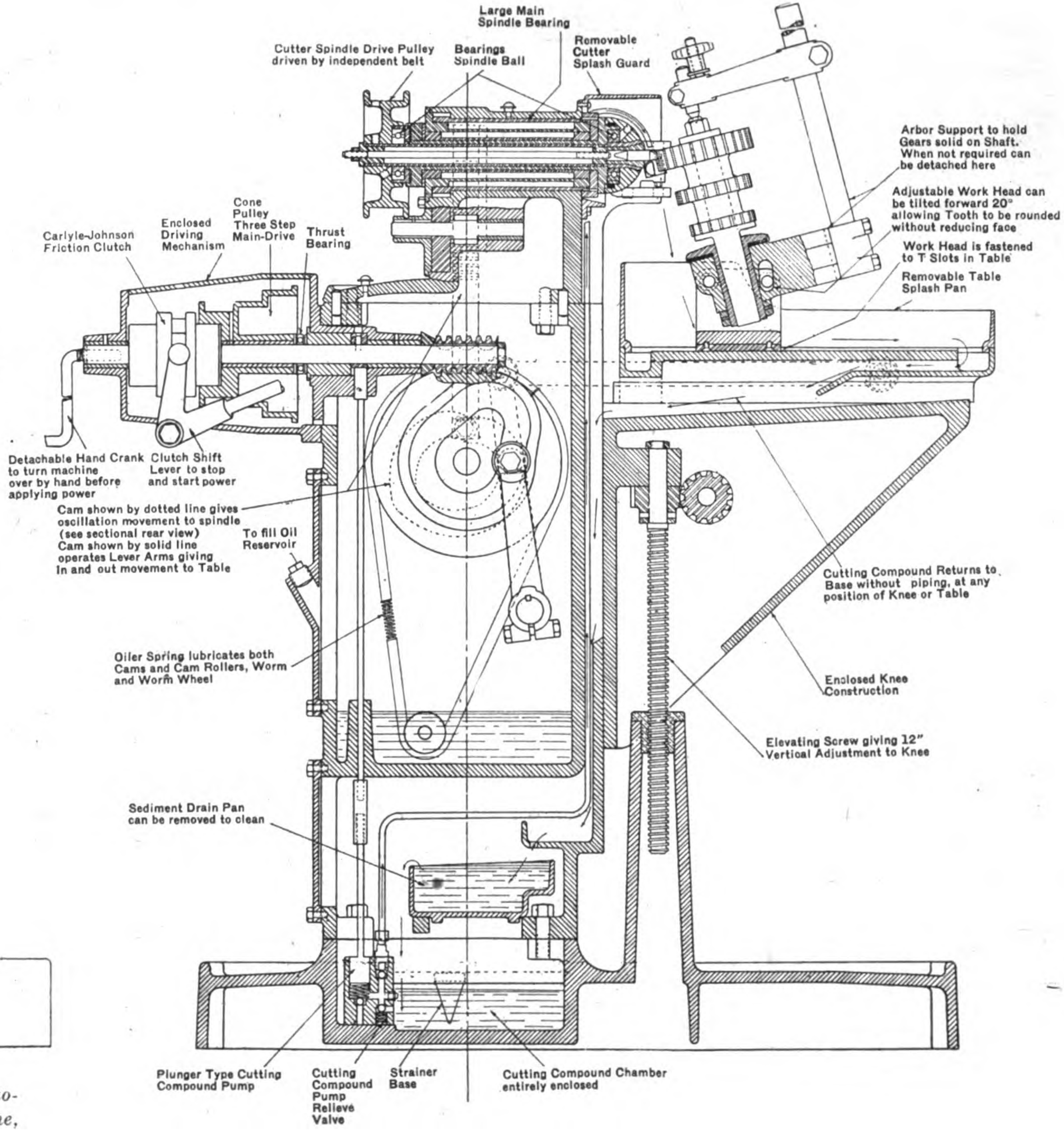
The machine is fully equipped with the customary adjustments. The elevating screw gives 12 in. vertical adjustment to the knee. The arbor support will hold the gears in any desired position, there being an adjustable work head which can be tilted forward 20 deg., allowing the tooth to be rounded without reducing its face, the angle of course being set to conform with the pressure angle of the teeth.

The work head is fastened to T slots in the table and there is a removable table splash pan. The cutting compound is carried in the base of the machine and is pumped by a plunger pump, operated by an eccentric off the powershaft. The cutting compound is carried to the work and guided by means of a removable cutter splash guard to the table splash

Sectional Views of Walker Automatic Gear-Tooth Rounding Machine



Sectional front view of Walker automatic gear-tooth rounding machine, showing eccentric spindle set and index rack



Sectional view showing the construction of the Walker automatic gear-tooth rounding machine

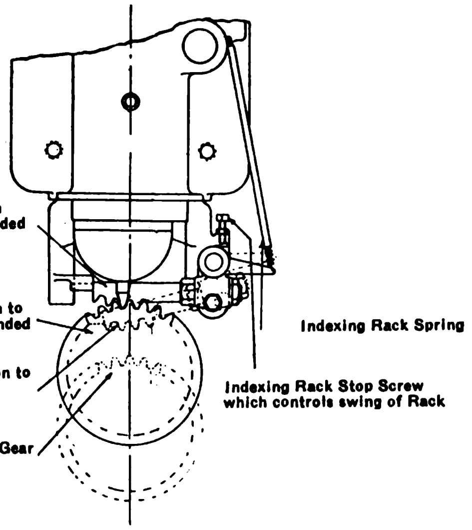
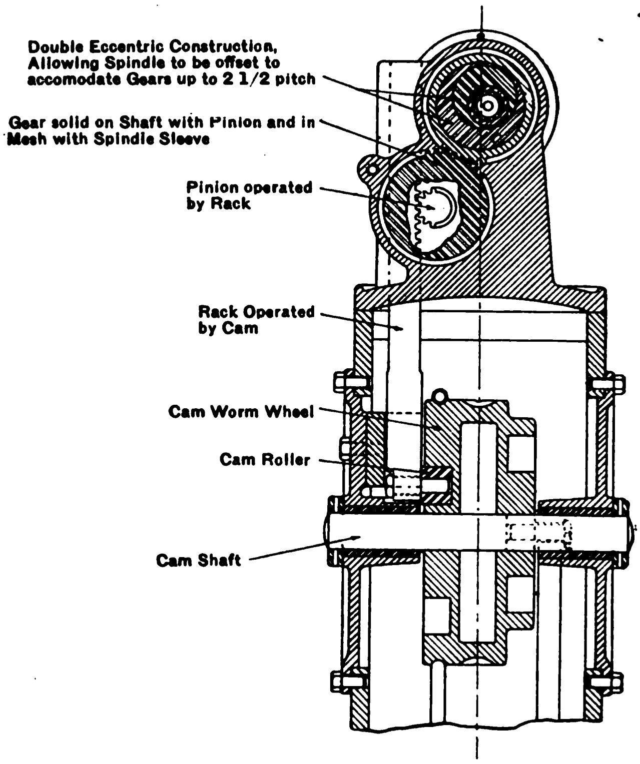


Diagram of indexing mechanism, showing cutter and starting position



Method of driving cutter by means of rack and pinion

pan, draining back to the base without piping at any position of the knee or table, owing to the enclosed knee construction.

The cutters are made with the same angle as the pressure angle of the tooth. The point of the cutter is cut off as much as possible, so that the cutter just fits in the tooth space. Therefore, the larger the pitch the larger and stubbier the cutter. The end of the cutter acts as an end mill and removes the surplus metal at the root of the tooth.

The present machine is based on the machine designed in 1912 by Fred Heal of the Detroit Standard Gear Co., Detroit. All of the patent rights on this type of machine have been assigned to the Charles H. Walker Machinery Co.

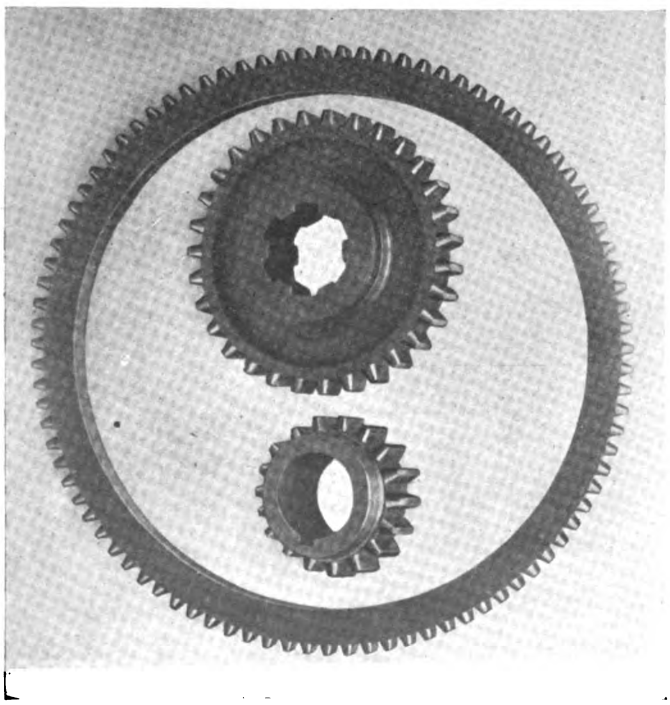
Norwegian Grinding Wheels

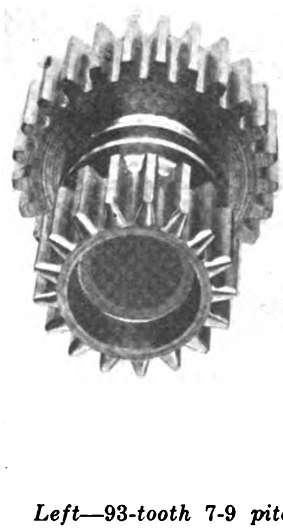
A NORWEGIAN company in Arendal is supplying grinding wheels produced in electric furnaces. Their "Sika" wheels, suitable for castings and coarse work, are made of fused carbide o fsilicon (SiC.), which produces gray-green crystals of great hardness, generally known as "carborundum." Their "Durabit" wheels (suitable for grinding hard steel) are made of aluminum oxide (Al_2O_3), known as artificial corundum, obtained by fusing bauxite into red-brown crystals.

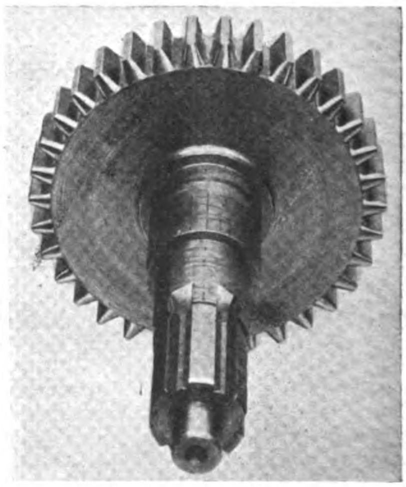
The crystals are ground to powder and sorted mechanically, ranging from No. 10, which is the coarsest, to No. 250, which is the finest polishing "flour." To produce grinding wheels, the powders are generally mixed with some binding medium as clay having a melting point of 2200 to 2500 deg. F. The discs are first formed in hydraulic presses, then exposed to the above temperature in an electric furnace, where the clay fuses and the whole becomes a hard, homogeneous mass. The hardness is proportionate to the quantity of clay used.

Shellac or water glass is also used as binding materials, in which case the temperature varies from 350 to 550 deg. F.

All wheels are provided with lead bosses and turned in the lathe after completion so as to be accurately centered. The elastic shellac wheels are turned with diamond tools, the others by rotating conical steel cutters.—*Teknisk Ukeblad.*







Left—93-tooth 7-9 pitch flywheel ring gear rounded in 3 min. 20 sec. The 32-tooth 6-8 pitch gear is rounded in 1 min. 6 sec.

Center—The 17-tooth 5 pitch cluster gear herewith was rounded in 1 min. 8 sec.

Right—This 33-tooth 6 pitch gear was rounded in 2 min. 10 sec. on the Walker machine

On Proportioning Engine Bearings*

An Analysis of the Crank-Bearing Loads in a Four-Cylinder, Three-Bearing Truck Engine Under Different Conditions of Operation

By Otto M. Burkhardt

Longer Center Bearings

In this article, Mr. Burkhardt, who is mathematical research engineer for the Pierce-Arrow Motor Car Co., shows that in a 3-bearing 4-cylinder engine, as commonly used on motor trucks, the load on the center bearing is very much greater than most designers realize, to judge by the dimensions they give to this bearing.

All the factors on which the load depends, viz., explosion and compression pressures, inertia forces of engine reciprocating parts and centrifugal forces on rotating parts, are taken into consideration, and the loads are determined for both low speed-full load and high speed-no load operating conditions.

Mr. Burkhardt finds that the center bearing should be considerably longer even than the rear end bearing, which, in addition to its other loads, has to carry the weight of the flywheel.

THERE exists considerable uncertainty among designers regarding the proper proportions for crankshaft bearings. The writer therefore has worked out a method for determining these proportions, based on the principle that the necessary dimensions are a function of the load the bearing has to carry. A separate analysis is required for each type of engine, and in this paper we will confine ourselves to the most popular of all types, the four-cylinder four-stroke engine. The analysis will be further limited by assuming the engine to be intended for motor truck work.

First of all, it is necessary to ascertain the bearing loads pertaining to the four limiting conditions of operation:

1—Engine running light at low speed.
2—Engine running at low speed under full power.
3—Engine running light at maximum speed (1000 r.p.m.).
4—Engine running at maximum speed under full power.

Case I.

In Case I, the loads acting on the crankshaft will necessarily be very small—in fact, negligible. We may, therefore, dismiss this case as of no consequence.

Case II.

In this case, on account of the low speed we may neglect the centrifugal and inertia forces. There are then left for consideration the pressures due to the gaseous mixture (expansion and compression strokes).

The mean pressure during the expansion stroke we will denote by P and the mean pressure during the compression stroke by p. The average pressure on any one crank pin during four consecutive strokes, *i. e.*, expansion, exhaust, suction and compression, is then

$$p' = \frac{P + O + O + p}{4} = \frac{P + p}{4}$$

From the diagram, Fig. 5, which is laid out for a particular engine to be specified further on, we obtain

$P = 2380$ lb. and $p = 272.5$ lb.

Hence for this specific case we obtain an average crank pin pressure of

$$p' = \frac{2380 + 272.5}{4} = 663 \text{ lb.}$$

The crank pin load is divided between the main bearings in definite proportions. Referring to Fig. 1, we note that these partial loads on main bearing I may be expressed as follows:

*From a paper read before the Buffalo Section of the S. A. E.

Load during expansion in cylinder I $= P \times \frac{a}{c}$ lb.
" " exhaust " " I $= O$ lb.
" " suction " " I $= O$ lb.
" " compression " I $= p \times \frac{a}{c}$ lb.
" " expansion " " II $= P \times \frac{c-a}{c}$ lb.
" " exhaust " " II $= O$ lb.
" " suction " " II $= O$ lb.
" " compression " II $= p \times \frac{c-a}{c}$ lb.

From this it follows that the average pressure on main bearing I during one complete cycle is

$$p' = \frac{P\frac{a}{c} + p\frac{a}{c} + P\frac{c-a}{c} + p\frac{c-a}{c}}{4} = \frac{P + p}{4}$$

Exactly the same loads as enumerated above are impressed on main bearing III in consequence of the forces acting in cylinders III and IV. All forces here under consideration act in the same direction. It is, therefore, evident that the average load on the central bearing is equal to the difference between the sum of the average loads on all four crank pins and the loads on the two end bearings. Hence, the average pressure on the central bearing during four strokes is

$$p'' = 4 \times \frac{P + p}{4} - 2 \times \frac{P + p}{4} = \frac{P + p}{2}$$

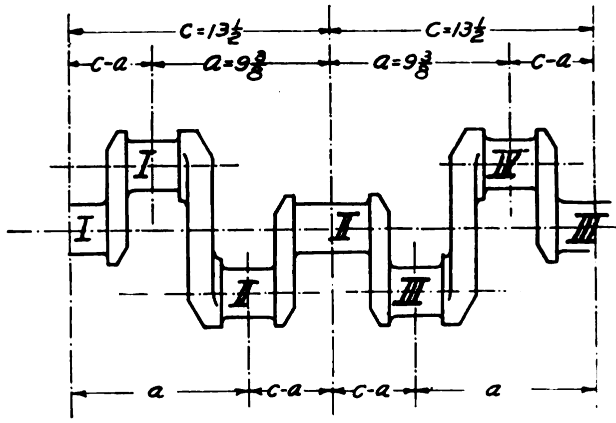


Fig. 1—Layout of crankshaft

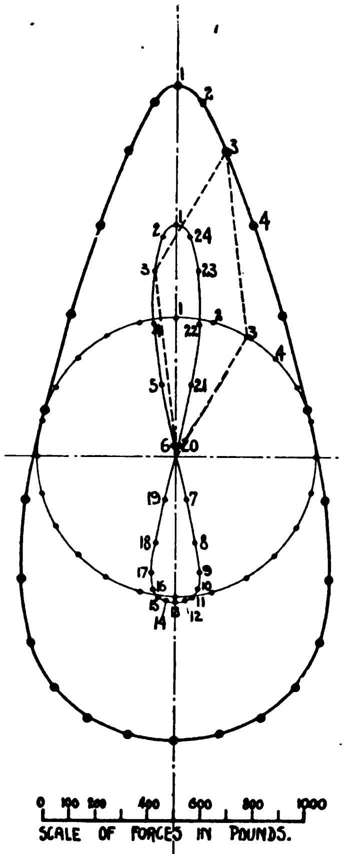


Fig. 2 — Crankpin pressure diagram for light load at high speed

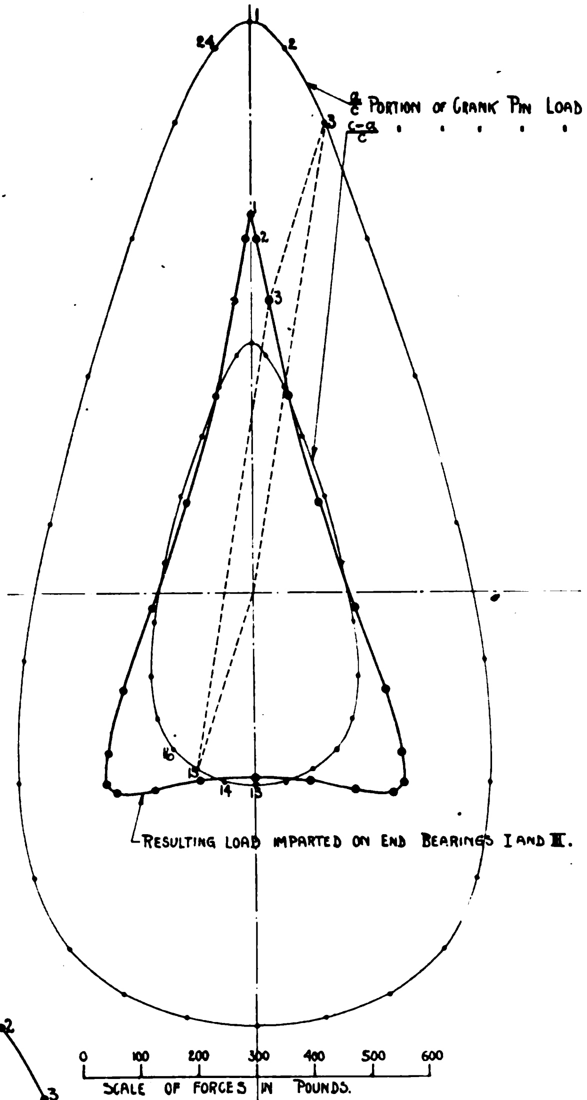


Fig. 3—Diagram showing distribution of crankpin loads between main bearings

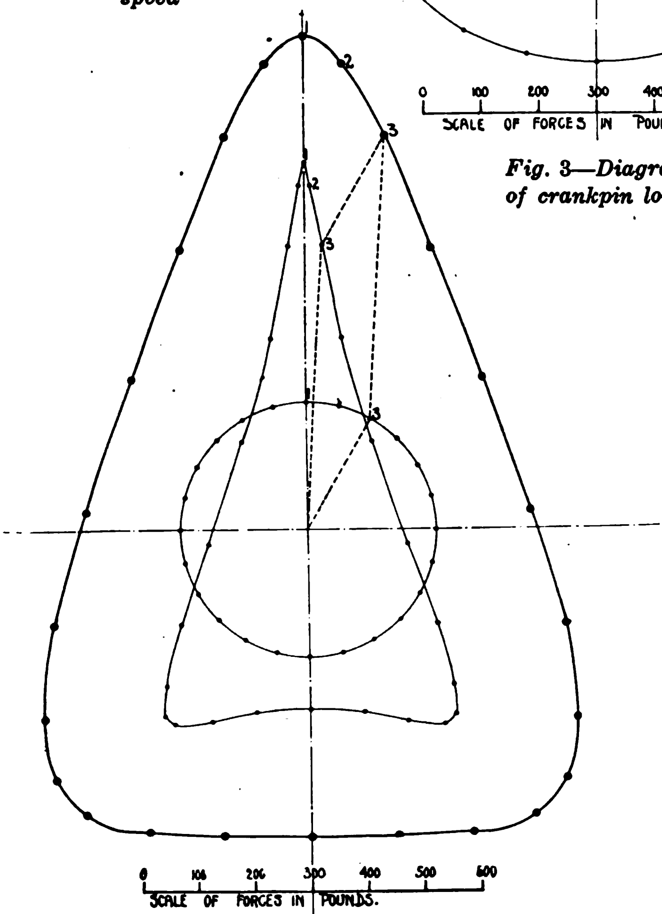


Fig. 4—Resulting loads on end bearings

In our particular example we obtain for the end bearings I and III an average pressure of

$$p' = \frac{280 + 272}{4} = 663 \text{ lb.}$$

and for the central bearing we obtain

$$p'' = \frac{2380 + 272}{2} = 1326 \text{ lb.}$$

Case III.

In this case, we may neglect the pressures due to the gaseous mixture. The only forces to be considered are those due to the inertia of the reciprocating parts and the centrifugal forces. Now, as the inertia forces are affected by the angularity of the connecting rod, and as the centrifugal force is continually changing in direction, no simple universally applicable formula can be evolved for magnitude and direction of the various mean pressures, as in the former case. We shall, therefore, confine ourselves to one particular example, that of a 4-cylinder engine of 4½-in. bore by 6¾-in. stroke. The total reciprocating weight, consisting of the piston with pin, rings, set screw and the small end of the connecting rod, is 7½ lb. The total rotating weight acting on one crankpin is 5½ lb. The inertia and centrifugal forces are all calculated for 1000 r.p.m. of the engine.

The inertia forces acting on the crankpin during one revolution are represented in magnitude and direction by the diagram, Fig. 2, which resembles a lemniscate. This diagram of forces includes certain horizontal component forces which have their origin in the angularity of the connecting rod. The concentric circle shown in the same figure represents the centrifugal forces (530 lb.) acting on the crankpin. If now the inertia forces are combined with the centrifugal forces as indicated by dotted lines for one crank position, we obtain a diagram of elliptical shape which represents magnitude and direction of the resulting loads on the crank pin.

From this latter diagram we find that the maximum load on the crank pin is 1415 lb., the minimum load is 530 lb. and the average load is 940 lb.

These crank pin loads are divided between the main bearings in a definite proportion, as already explained. The partial loads, in the proportions indicated in Fig. 1, are graphically represented in Fig. 3, where they are designated as fractions $\frac{a}{c}$ and $\frac{c-a}{c}$ of the total crank pin load. (Note that a larger scale has been chosen.)

To determine the load on the end bearings, we have to combine components 1, 2, 3 and so on to 24 of the $\frac{a}{c}$ diagram with simultaneously acting component forces of the $\frac{c-a}{c}$ diagram, *i.e.* with 13, 14, 15 and so on to 12. This yields the diagram of resulting forces which is marked "Resulting Loads on End Bearings I and III."

The same principle of combination must be followed in determining the loads on the central bearing. However, since the central bearing is affected by the loads on all of the four crank pins, it is evident that the resulting loads are all twice as large as those acting on the end bearings.

In the present case, we must, further, consider the centrifugal forces due to the crank pins and the adjacent crank cheeks. The crank pin and those portions of the adjacent crank cheeks which are not balanced in their own plane weigh, for the engine under consideration, about 6 lb. The centrifugal force due to this mass is 575 lb. at 1000 r.p.m. If we denote this centrifugal force by C we find by reference to Fig. 1 that each of the two main bearings I and III receives the partial load:

$$L_e = C\frac{a}{c} - C\frac{(c-a)}{c} = C\frac{(2a-c)}{c}$$

Substituting the dimensions given in Fig. 1, we obtain

$$L_e = 575 \times \frac{2 \times 9 - \frac{3}{8} - 13 - \frac{1}{2}}{13 - \frac{1}{2}} = 225 \text{ lb.}$$

Again the load on the central bearing is twice as large as the load on either end bearing, that is, 450 lb. We may now determine the total load on the end bearing which, by virtue of the existing symmetry, at the same time represents one-half of the total load acting on the central bearing.

In Fig. 4 the triangular thin line diagram represents the loads due to connecting rods I and II, III and IV, respectively, on the two end bearings, while the concentric circle represents the centrifugal force of 225 lb. If corresponding forces of these two diagrams are combined, taking account of their phase relation, as indicated by dotted lines, we obtain the resulting forces acting on the end bearings. The resulting diagram (heavy lines) shows a maximum load of 875 lb. and a minimum load of 385 lb., and by summation we obtain the average load of 600 lb. While these loads have been calculated for the two end bearings, we can find from them the loads on the central bearing by simply multiplying them by two. This gives a maximum load of 1750 lb., a minimum load of 730 lb. and an average load of 1200 lb.

Case IV.

In this case we have to deal with the forces due to the gaseous mixture as well as with centrifugal and inertia forces. While the writer does not underestimate the difficulty of determining exactly the forces acting during the expansion and compression strokes, a fair estimate of these forces may be made from the diagram Fig. 5. This diagram has been drawn to conform as nearly as possible to indicator diagrams obtained in practice. It represents a total of 1040 ft. lb. of work, which in the case of a 4-cylinder engine when running at 1000 r.p.m. would mean.

$$\frac{1400 \times 4 \times 500}{33000} = 63 \text{ indicated horsepower.}$$

If we allow about 14 per cent for engine friction, we obtain an effective output of 54 hp. This in turn corresponds to a mean effective pressure of 100 lb. per square inch of piston area. This may be somewhat higher than what is generally obtained with truck and tractor engines; it is, however, less than the rather desirable standard set by aircraft engines which we endeavor to approach.

With this mean effective pressure as a basis, the horsepower output at 1000 r.p.m. can be determined for any similar engine by means of the simple formula:

$$HP = \frac{b^2 s n}{10} \text{ where}$$

b = bore in in.
s = stroke in in.
n = number of cylinders.

The pressure due to the gaseous mixture throughout the stroke, as determined from Fig. 5, together with the inertia forces and certain horizontal components due to the angularity of the connecting rod, are graphically represented by the irregular thin line diagram of Fig. 6. Of course, during the expansion stroke there are gaseous forces of considerable magnitude, while during the next three strokes the inertia forces predominate. This accounts for the reappearance of the same force diagram which was shown in Fig. 2. The circle shown in Fig. 6 represents the centrifugal force acting on the crankpin. If now we combine corresponding forces as before, we obtain the total load on the crankpin as represented by the heavy line diagram.

From the latter we obtain the following characteristic loads:

Maximum = 4075 lb. Minimum = 530 lb. Average = 1230 lb.

These loads are divided between the main bearings in the proportion of $\frac{a}{c}$ to $\frac{c-a}{c}$ These partial loads are represented in Fig. 7. Now, to obtain from these the load on the end bearings we have to combine forces 1, 2, 3 and so on to 24 of the $\frac{a}{c}$ graph with forces 13, 14, 15 and so on to 1 of the $\frac{c-a}{c}$ graph. This yields the irregular thin line diagram shown in Fig. 8. If the resultant forces so obtained are now combined with the centrifugal forces shown in the same figures, we obtain the heavy line diagram which represents the resulting forces acting on the end bearings.

The characteristic loads obtained from this diagram are:

Maximum = 2945 lb. Minimum = 380 lb. Average = 1000 lb.

To obtain the loads on the central bearing due to crankpins 1 and 2, we have first to combine forces 1, 2, 3 and so on to 48 of the $\frac{c-a}{c}$ diagram with 13, 14, 15 and so on to 1 of the $\frac{a}{c}$ diagram. This yields the diagram shown in Fig. 9. This diagram also represents the forces on the central bearing due to crankpins 3 and 4. We must, however, bear in mind that the latter are in phase 360 degrees behind the former. If we, therefore, combine forces 1 to 24 of the diagram in

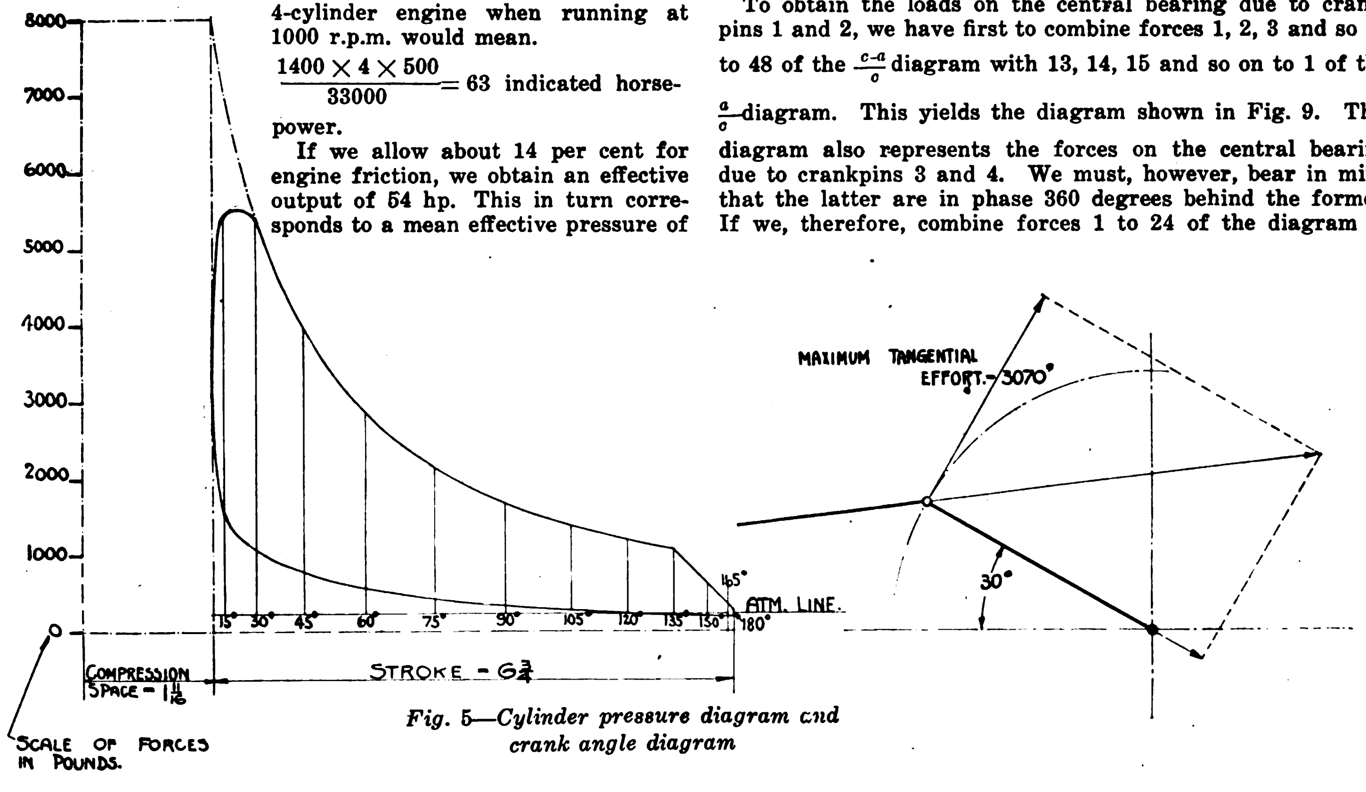


Fig. 5—Cylinder pressure diagram and crank angle diagram

Fig. 9 with forces 25 to 48 of the same diagram we obtain the irregular thin line diagram shown in Fig. 10.

If these forces are in turn combined with the centrifugal forces also shown in Fig. 10, a final diagram is obtained which represents the total load on the central bearing.

We obtain from this diagram the following characteristic bearing loads:

Maximum = 2690 lb. Minimum = 580 lb. Average = 1500 lb.

The same force diagram is obtained whether the firing order is 1-3-4-2 or 1-2-4-3.

The various bearing loads so far obtained are compiled in Table I, in which are also given certain figures representing the proportional lengths required for the different bearings. The crankpin length has been taken as unity. These relative figures presuppose that the crankpins and the main bearings are of equal diameter, which is considered good practice for three-bearing shafts.

TABLE I.

Running condition of engine	Condition of load	Crank-pin	End bearings	Center bearings
Low speed	Maximum	5200	3600	3600
Full power	Average	663	663	1326
	Relative bearing length	1	1	2
High speed	Maximum	1415	875	1750
Zero power	Average	940	600	1200
	Relative bearing length	1	.64	1.28
High speed	Maximum	4075	2945	2690
Full power	Average	1230	1000	1700
	Relative bearing length	1	.812	1.38

From the first group of forces pertaining to low engine speed and full horsepower output, we note that the effective lengths of the crankpins, the end bearings and the central bearing should be in the proportion of 1 to 1 to 2 respectively. From the second group of forces we note that for high engine speed and zero power output the effective bearing lengths should be made in the proportion of 1 to 0.64 to 1.28. Finally, for high speed and maximum power output the bearing lengths should be made in the proportion of 1 to 0.812 to 1.38.

To make the best use of these figures we must compromise. For instance, the engine here under consideration will run at high speed (near 1000 r.p.m.) about 80 per cent of its life, under which condition it develops power varying from zero to the maximum output. The limiting conditions are Case III and IV. The bearing lengths required to conform to this running condition are the mean of the lengths determined for the limiting cases, hence,

$$\text{Relative end bearing length} = \frac{0.64 + 0.812}{2} = 0.726;$$

$$\text{Relative center bearing length} = \frac{1.28 + 1.38}{2} = 1.33.$$

We are at present concerned with the problem of minimizing the unavoidable wear and preventing uneven wear which causes unnecessary stresses in the structural parts. This requires that adequate attention also be given to the remaining 20 per cent of the engine's life, during which it is running at low speed developing full power, as investigated under Case II (acceleration and hill climbing).

This consideration leads to the following final proportions:

Relative crankpin length = 1.

Relative end bearing length = 80 per cent of 0.726 + 20 per cent of 1 = 0.78.

Relaitve central bearing length = 80 per cent of 1.33 + 20 per cent of 2 = 1.46.

Let us choose for our example an effective crankpin length of 2½ in. We then obtain end bearings of

$$0.78 \times 2\tfrac{1}{2} = 1\ 15/16 \text{ in. length}$$

and a central bearing of

$$1.46 \times 2\tfrac{1}{2} = 3\tfrac{5}{8} \text{ in. length.}$$

The front end bearing should be lengthened about 5/16 in. to allow for the load due to the timing gears, whereas at least 1 in. effective length should be added to the rear end bearings to compensate for the effect of the clutch and the flywheel. Allowing further ⅛ in. for each fillet we obtain the following compilation:

TABLE II.

Bearing	Nominal length	Allowance for fillets	Other allowances	Actual length
Crankpin	2½	2 × ⅛ = ¼		2¾
Front end	1 15/16	⅛	5/16	2⅜
Rear end	1 15/16	⅛	1 1/16	3⅛
Central	3⅝	2 × ⅛ = ¼		3⅞

Some consideration may now be given to the diameters

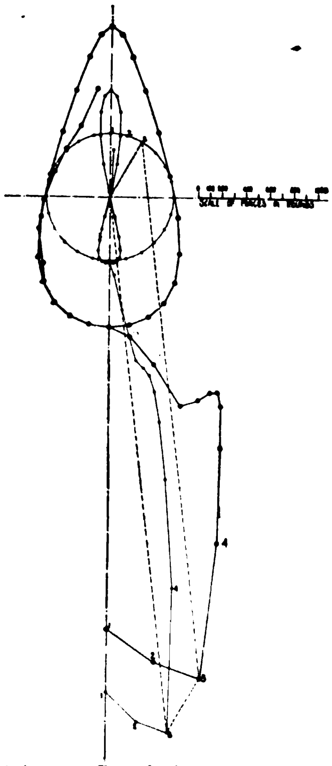


Fig. 6—Crankpin pressure diagram for full load

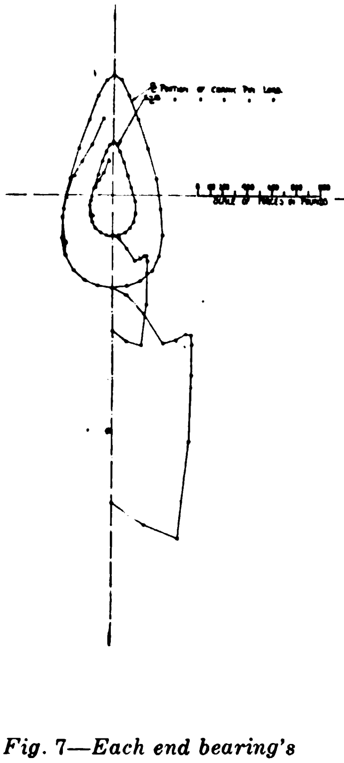


Fig. 7—Each end bearing's share of the crankpin pressures

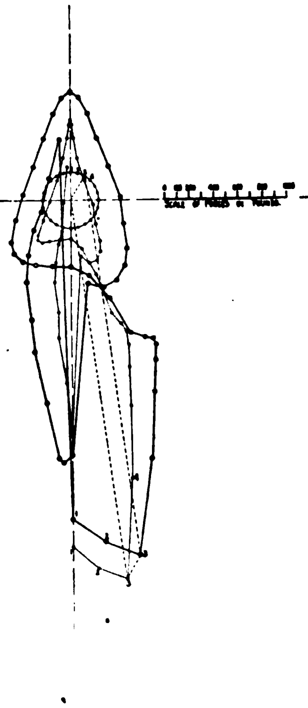


Fig. 8—Pressures shown in Fig. 7 combined with centrifugal force on crankshaft

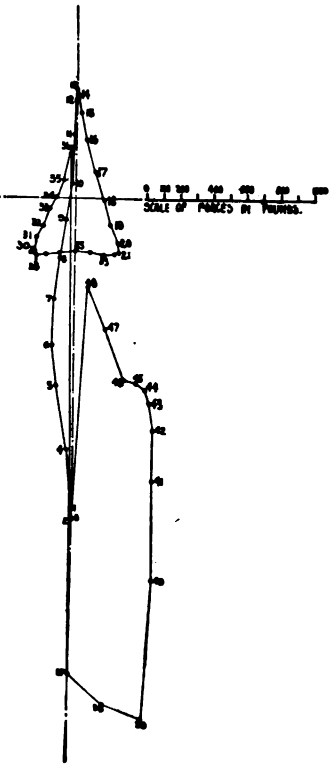


Fig. 9

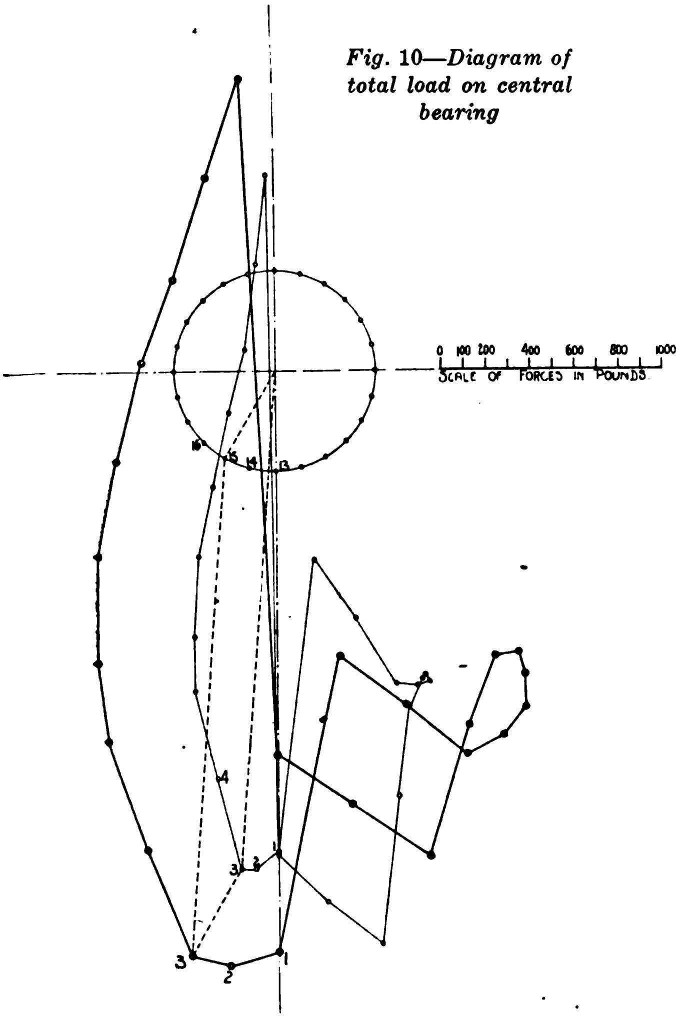


Fig. 10—Diagram of total load on central bearing

of the crankpins and the journal bearings. In Fig. 5 it is shown that the maximum tangential effort is 3070 lb. This force when exerted on crankpin I or III can be resisted only through forces set up in crankpins II and IV respectively. The lever arm on which the force of 3070 lb. acts is the distance between the centers of the crankpins. Consequently, crankpins II and IV are subject to a twisting moment of

$$3070 \times 6\tfrac{3}{4} = 20700 \text{ lb.-in.}$$

The elastic limit of the crankshaft material may be taken as 80,000 lb. per square inch. The factor of safety desired is 10. Denoting by d the diameter of the crankpin, we have the following equation:

$$20700 = \frac{J}{16} \times d^3 \times \frac{80,000}{10}$$

Hence

$$d^3 = 13.18 \text{ or } = d = 2.36, \text{ say } 2\tfrac{3}{8}.$$

Let us now compare our results with others advanced by a highly esteemed authority. This authority states: "The average lengths for the three main bearings, taking the length of the connecting rod big end bearing as 1, are 1.21 for the front, 1.17 for the middle and 1.48 for the rear." These results deviate considerably from those arrived at above, which is due to the fact that they were obtained by measuring up the bearings of a number of engines. Now, it is a fact that of these engines only one or at most a few had their bearings even nearly properly proportioned, and the influence of the great amount of data from engines with improperly proportioned bearings spoiled the results.

Another rule of thumb is to the effect that the crankpin diameter should be $0.4 \times b + \tfrac{1}{4}$ in. With this formula we would obtain for our engine a diameter of 2.05 in. By substituting this in our equation for d we find the factor of safety from the equation—

$$20700 = \frac{J}{16} \times 2.05^3 \; \frac{80000}{F}$$

or

$$F = 6.5.$$

This is obviously too small for so important a part as the crankshaft.

Liberty Carbureter Air Intake

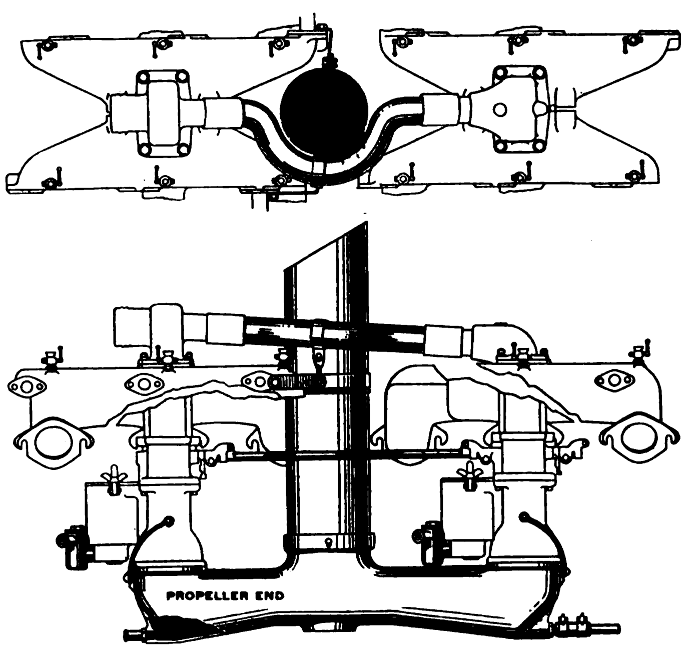
TOWARD the closing days of the war a number of tests were conducted at Detroit and McCook Field, Dayton, to determine the best way of modifying the carbureter air intake on the Liberty engine to decrease the fire hazard. The accompanying illustration shows the design which was found to be the most satisfactory for this purpose. It consists of a T-shaped casting, with the air intake extending upwards, in the form of a pipe stack, through the top of the engine bonnet. Drain tubes are provided at either end to carry the gasoline waste outside of the fuselage.

Dynamometer and flight tests made at McCook Field demonstrated the new arrangement to be fully as efficient, as regards its effect on engine output, as that of the old, while the fire hazard has been greatly reduced, as all gasoline drippings are conducted away from the hot engine V, and the carbureter back-fire flame is carried out of the hood. This thorough gasoline drainage and consequent absence of combustible vapor also protects the pilot against the fire hazard due to incendiary bullets passing through the bonnet.

With this construction it is not difficult to make an inspection or a change of jets. By sliding up the pipe stack, springing off the attaching bails and disconnecting the drain tubes, the manifold can be moved forward or backward, as desired, to reach the jets of either carbureter.

The changes necessary in making this installation consist of replacements to provide clearances for the new intake stack and its parts. These changes consist of a new offset or curved intake header water outlet extension, and a new offset or curved carbureter throttle control connection. New and larger drain tubes are also included.

A hole had to be cut in the engine bonnet to provide for the exit of the air intake pipe stack, which is cut at an angle above the top of the bonnet, so that pressure may be produced in the air intake by the propeller slip stream.



Two views of the new carbureter air intake developed for Liberty aircraft engine to reduce fire hazard

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, March 20, 1919 No. 12

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 2727

Cable Address - - - - - Autoland, New York
Long Distance Telephone - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - One Year, $3.00
Canada - - - - - One Year, 5.00
Foreign Countries - - - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Crankcase Breathers on Tractor Engines

DUST is the bane of tractor engines and tractor mechanism in general. It gets into the cylinders, the crankcase and gear case, and works havoc with bearings and joints. Much attention has been paid to the problem of keeping it out of the cylinders. The carbureter air inlet is provided either with a sort of periscope which draws the air from above the normal height of the dust cloud, or, more frequently, with an air cleaner or an air washer designed to abstract all of the dust from the air before it enters the engines.

There is, however, another breathing organism in the engine, namely, the crankcase. A few engines are operated with absolutely closed crankcases and, therefore, cannot accumulate any dust in their oil pans. Unfortunately this system is impossible where splash lubrication is used, as the oil would be forced out through the bearings and through joints in the crankcase walls. The oil, of course, is also forced out with other systems of lubrication by the excess pressure in the case, but when it is not intended to use the oil over, this does not matter, except for the fact that the machines will probably be mussed up considerably.

Closing the crankcase absolutely can hardly be considered a general solution of the difficulties referred to in the foregoing. In a two cylinder opposed engine, for instance, there is a very strong fluctuation of pressure with the simultaneous inward and outward movement of the two pistons respectively, and in a four cylinder engine there is a moderate fluctuation in pressure due to the unequal velocities of the upward and downward moving pistons.

There are, generally speaking, two types of breathers. In one design the flow of air both into and out of the crankcase is practicaly unobstructed, but there are a series of inclined, staggered partition walls extending part way across the passage. The oil particles, striking these walls, adhere to them, and when a sufficient quantity collects it flows to the lower edge of the wall and is carried back into the crankcase by the inflowing current of air. This type of breather is used on almost all automobile and a majority of tractor engines.

The other type of breather contains a valve, either positively or pressure-operated. If the valve is pressure-operated it will open only when the crankcase pressure exceeds the atmosphere pressure, when a slight amount of air will be forced from the case. As soon as the pressure within the case falls to atmospheric the valve closes, and during the greater part of the time the pressure within the crankcase is below atmospheric; that is, there is a partial vacuum in the case. If the valve is operated mechanically it is timed to open and close at about the same periods as the pressure-operated valve, and a breather of this type would seem to be much better suited to a tractor engine than the common design with oil separating partitions. It gives substantially the advantages of a closed crankcase without the tendency of forcing the oil out through the bearings. If in addition the breather were provided with a standpipe extending beyond the usual height of the dust cloud it should be quite possible to keep the crankcases of tractor engines tolerably free from dust and grit.

"Ready for the Road"

PREVIOUS to the war practically all of the so-called automobile constructors of France sold to their customers not complete automobiles but chassis without body, without tires and without such articles of essential equipment as lights, horn, tire pump, etc. One reason advanced in justification of this practice was that the French public has an artistic temperament and loves individuality. They do not want machines built to a pattern, like coffee grinders, but prefer to have their bodies built to order and to purchase for their cars those articles of equipment which appeal to them the most. The wastefulness of building bodies to individual designs

had never been strongly impressed on the French purchaser, and up to the outbreak of the war the plan seemed to work satisfactorily.

One of the radical changes which the war has brought about in the French industry is that in future all automobiles will be sold as complete machines ready for the road. Not only the chassis, but the body as well, will be a quantity production job. Even before the war the competition of certain low-priced American cars had somewhat disturbed the French makers, but they consoled themselves with the thought that Frenchmen would not buy a machine with a body that did not please their artistic sense. During the war these makers had plenty of opportunity to observe the behavior of these low-priced vehicles in service. Their experience evidently was such as to lead them to the conclusion that it would be impossible in future to sell to the customer a French chassis at about the same price that he can buy an American car with complete equipment for. The cost of the French chassis often was only about 50 per cent of the total outlay for a car. Something had to be done to reduce the cost of the complete machine, and the item which offered the greatest opportunity for economy was the body. The body formerly fitted to French chassis was a hand-made product, often made from individual designs. When the bodies are made in large quantities, of standard designs, greatly improved manufacturing processes can be introduced, and the cost can be materially cut. Therefore, the French makers almost without exception have decided in the future to sell complete cars with standard designs of bodies.

As regards accessories, the situation has a somewhat different aspect. It is impossible to say whether production methods will be much affected by the change in selling plan. However, the offer of a machine completely equipped to take the road cannot fail to appeal to the purchaser. Moreover, if the manufacturers of such accessories as lamps, pumps, jacks and horns sell to the car manufacturer instead of to the ultimate consumer they can materially reduce their selling cost, and thus a future economy be effected.

The Motorized Farm

IT is evident that before long a somewhat broader view will have to be taken of the substitution of mechanical power for animal power on the farm. The farmer cannot dispense with his horses unless he can buy equipment that will do all of the work which he is now doing with horses. The conventional farm tractor is designed principally for plowing; it serves tolerably well for such other farm operations as disking, harrowing, grass cutting, hay loading, etc., and for belt work.

But there is other work on the farm, ordinarily done by horses, to which the tractor is ill suited. This includes cultivating, corn harvesting and general haulage work. With the ordinary type of clearance tractor it is absolutely impracticable to do cultivating; and even if the tractor is built with sufficient clearance, the use of, say, a 3-plow tractor to pull a 2-plow cultivator would be very uneconomical. Cultivating must be provided for, and the line of the future power farming equipment manufacturer therefore will include a cultivator.

Another line of farm work to which the tractor does not lend itself is corn harvesting. In husking corn use is generally made of a two-horse wagon. The horses will follow the rows of their own account and do not need to be guided, hence the men accompanying each wagon can devote all their time to husking. If the horse is to be displaced in corn harvesting, some mechanical method of husking must be at the same time adopted. Pullers are already in use which pull the ear with the husk off the stalk and transfer it by means of a belt conveyor to the wagon. No doubt, such a puller could be attached to a motor truck.

For all the general haulage work on the farm a motor truck is the best vehicle if the roads in the neighborhood are good.

Motor trucks have already been sold to farmers in considerable numbers, and the statement has been made that the sale of every farm tractor opens the way to the sale of a truck. It is quite possible that the ordinary motor truck, designed with a view to its use in the city, is not best adapted for farm service. Several makers are now looking into the farm truck problem, and there is a possibility that as a result a special farm truck will be developed.

Radiator Fans

UNTIL recently it has been the custom for engine manufacturers who sell their product to passenger car or truck makers to furnish a radiator fan with it, but this practice is now being abandoned. This is merely a further step in the movement to make fan manufacture an independent branch of the automotive industry. Originally most engine builders, whether they were specialists or manufacturers of complete cars, produced their own fans. The fan looked like such a simple proposition that it seemed a shame to buy it and pay some one else a profit on it. But it was soon discovered that the problem of fan design and manufacture was not such a simple one after all. There are frequent cases of inadequate cooling due to improper fan design, and trouble with fan bearings has been common.

As fan manufacture becomes specialized, the various problems involved in the design of this fitting will receive closer attention. Competition between the different makers in this particular field will be a strong factor compelling refinement of details. By consulting with the experts of a fan manufacturing concern the car manufacturer will be able to make a more intelligent choice of fan diameter, blade width and fan speed. The problem of durable bearings and of efficient, non-slipping drives is being investigated by the fan makers, and there is no doubt that before long, as a result of the specialization in manufacture, the radiator fan will have reached a degree of perfection commensurate with that of other engine fittings.

Latest News of the

Parts Shortage Ties Up Production

Makers Waiting for Steel Prices to Drop—Car Sales Ahead of Manufacture

DETROIT, March 18—Automobile production in the Detroit district will not reach normal until the iron and steel market is stabilized. The big companies themselves are not affected so much as are the parts makers who are withholding their steel and iron purchasing for a price reduction which all seem to be expecting. As a result there is a curtailment of parts production which is reacting on the car makers who need all parts material available to meet their production demands.

Price reductions in the various steel lines are regarded as assured by the rank and file of consumers, and they are holding back orders except where guarantee against decline is given. The steel market has been sluggish for some weeks and this air of expectancy is slowing it up more than ever.

Big Demand for Cars

Another big element in sub-normal production is the failure to settle war contracts. Here again it is the parts maker who is hit the hardest. He has not been able to collect from the companies who cannot collect from the Government, and as a result a big portion of his working capital is tied up.

Most of the companies have switched from war to peace conditions and are all ready for normal production work. There is a demand for more cars than the companies are able to produce. Nearly every automobile company sales department is from 30 to 90 days ahead of production. This brilliant business future has offset to a large degree timidity of the manufacturer caused by the government tie-up of his working capital, and most of them have secured more money and are going ahead.

As already seen, production in February was nearly double that of the preceding month, and March statistics, already issued by some firms, are going to show an increase in almost every instance of from 10 to 40 per cent. Besides the number of new accessory companies who have placed or are about to place new devices upon the market, the next few weeks will see several new car, truck and tractor concerns start in business.

Labor conditions in Detroit and Michigan are almost normal. There is a small surplus of unskilled labor, but this is being rapidly absorbed by the companies. In skilled lines, mechanics, machinists, etc., the surplus is changing to a shortage. Many companies find it necessary now to advertise for such men, which is something they have not done since December.

Statistics compiled by the various banking interests of the city, who made an exhaustive investigation of business conditions, show that on March 1 approximately 50 per cent of the business in the city was below normal. This is a slight increase over the preceding month. On the same date 30.01 per cent of the companies reported normal business, while 19.99 per cent declared conditions were above normal.

The Chamber of Commerce declares there is a great shortage of factory buildings in Detroit, and consequently has launched a campaign which it hopes will result in the erection of many new structures. Two score firms are unable to begin operations until their needs for floor space are met.

Saxon Financial Reorganization Plans

DETROIT, March 15—A special meeting of the stockholders of the Saxon Motor Car Corp. will be called soon to allow them to vote on a plan for clearing up the company's indebtedness, either through an assessment or through a reorganization. Plans for the financing of this company have been completed by a creditors' committee composed of Detroit and Chicago bankers.

Under one plan to be submitted the stockholders will be asked to vote on an assessment against them for the full amount of the indebtedness of the company. Under the second plan a complete reorganization will be asked which would virtually wipe out the $6,000,000 stock of the company.

It is proposed under the second plan to issue $2,000,000 in bonds, $1,250,000 preferred stock and $3,200,000 in common stock. The creditors feel confident of the future of the company under the plan and are willing to take common stock in return for their obligations at par, provided they are given option on the remaining common stock.

Claims against the company total $2,400,000. The creditors therefore will obtain an option on $800,000 common stock. The bonds and preferred stock would be purchased by a banking syndicate and offered for public sale.

The Saxon Co. erected a plant on Ford Road and Western Avenue, north of Michigan Avenue. The plant was never occupied by the company and is under lease to the government. It will be utilized, however, when the new financing is completed.

Harvester Adopts Council Plan

All But Three Works Vote in Favor—17,558 Vote for It, 10,150 Against

CHICAGO, March 17—On Monday, March 10, the International Harvester Co. submitted to its seventeen American and three Canadian works the "Harvester Industrial Council" plan of employee representation which was printed in full in AUTOMOTIVE INDUSTRIES last week. Elections were held on Wednesday, March 12, by the employees at all plants to decide by majority vote whether or not it should be adopted.

The vote by plants is fully set forth in the table herewith. It shows that all but three of the works decided in favor of the plan, these three being the McCormick works, the McCormick twine mill and the tractor works, situated on Chicago's west side. Bulletins were posted at all works announcing the result.

At the works which rejected the plan the notices stated that no further action would be taken in the matter there except upon request of the employees. Soon after the results of the election were made known, the employees at these three plants began circulating petitions asking that the plan be re-submitted.

At the plants where the plan has been adopted preparations began at once to organize the Works Councils, which are the outstanding and fundamental feature of the plan.

The total vote—28,611, including 903 spoiled ballots—was one of the surprises of the election. There were present on election day 29,125 eligible employees and no effort was made to stimulate voting or to urge adoption; all employees were perfectly free to vote for or against the plan, or to refrain from voting. The total vote thus evidences a much deeper initial interest in the plan among employees than has been developed in other industrial establishments in similar circumstances.

The plan is a progressive development of the company's industrial policy which has heretofore led to the inauguration of the weekly pay system and the basic 8-hour day, and still earlier to voluntary adoption of a workman's accident compensation plan antedating American legislation on that subject, as well as the Harvester Pension plan, wholly supported by the company, under which 523 employees have been retired on pension; also the Employees' Benefit Association, which has paid out in 10 years more than $3,000,000 to employees and their families.

The cornerstone of the plan is the Works Council, charged with the duty of considering and making recommendations to the management as to working conditions, health, safety, hours of labor, wages, recreation, education and other similar matters of mutual interest.

Equality of voting power between the representatives freely elected by the employees and those appointed by the management; the unit rule of voting in the Council; the right of all employees to present suggestions, requests or complaints; the assured independ-

(Continued on page 663)

Automotive Industries

British Import Rule Still Undecided

Neither Detroit Manufacturers Nor Canadian Authorities Have Official Word

NEW YORK, March 20—No authoritative word has been received as yet from England regarding the removal of import restrictions on British-made products from British colonies. Early last week it was reported that Great Britain had let down the import bars to the extent that products produced in British colonies would be permitted entry into England. Detroit manufacturers are still expectantly awaiting authentic information, in view of the importance of the matter to those of them who maintain Canadian plants.

Customs authorities in Windsor, Canada, across the river from Detroit, have not yet received official word from their government, and until they receive such information the whole matter will remain in a chaotic condition. Windsor officials have communicated with government authorities in Ottawa and almost momentarily expect word.

Dispatches purporting to come from official sources have let it be known that such Canadian plants are as merely assembly plants and are not in reality Canadian factories, producing their merchandise complete, will not benefit; it is intimated that only products manufactured complete in British colonies will be permitted entry under the ruling.

The War Trade Board in Washington has just issued a ruling, under the terms of which all import restrictions covering raw materials of all character are rescinded, and such products will now be permitted to enter Great Britain freely.

Partial Foreign Trade Convention Program

NEW YORK, March 20—The Sixth National Foreign Trade Convention, which is to be held next month in Chicago, will be devoted to a considerable extent to questions involving export matters and export shipping. Eugene Meyer, Jr., managing director of the War Finance Corps, will talk on "Financing Our Excess of Exports"; William S. Culbertson of the U. S. Tariff Commission will cover the "Bargaining Tariff." In a session on the American Merchant Marine, Homer L. Ferguson, president of of the Newport News Shipbuilding & Drydock Co., will present a paper on "Shipbuilding," and this will be followed by one on "The Future of the American Merchant Marine on the Pacific," by Frederick J. Koster, president of the Associated Chambers of Commerce of the Pacific Coast. James A. Farrell, president of the U. S. Steel Corp., will discuss "An American Maritime Policy." The program of the meeting is in an embryo state as yet.

Publicity for Trailer Makers

DETROIT, March 20—The Trailer Manufacturers' Association of America, which met here March 18, shortly will inaugurate an aggressive publicity campaign to bring the advantages of trailer transportation more prominently before industry. Twenty manufacturers were represented at the meeting and all have subscribed to a publicity fund. Harry W. Perry, up to the present with the National Automobile Chamber of Commerce, has been elected secretary of the association and its manager. General offices will be opened in New York City as soon as suitable quarters can be obtained.

Parke Heads Olympian Motors

DETROIT, March 20—Fred K. Parke was elected president of the Olympian Motors Co., Pontiac, at its annual meeting, and it was voted to increase the capital stock to allow of needed expansion. Other officers elected were: Vice-president, St. Clair Couzens; secretary, C. E. Callender; treasurer, William Passmore.

N. I. & V. A. to Hold Convention in Chicago

CHICAGO, March 19—The twenty-sixth annual convention of the National Implement and Vehicle Association will again be held here in October, according to the decision of the executive committee. This city is considered the most advantageous place for the meeting, as the general offices of the association are here.

Speeding Up Canadian Production

DETROIT, March 18—Canadian production of Maxwell cars has reached 300 passenger cars and 50 trucks monthly. The Chalmers Co. of Canada is turning out 60 passenger cars monthly and is preparing to run up production as soon as the material situation makes it easier to obtain steel and automotive parts.

Wilson Army Trucks for Post Office

DETROIT, March 18—The J. C. Wilson Co., makers of the Wilson trucks, has just concluded its contract with the Government and is now on a peace-time basis. The last trucks for the Government were shipped direct to the postmaster at York, Pa., and Columbus, O.

Tax Tangle Before Government

N.A.C.C. and M.A.M.A. Daily Expecting Rulings and Official Interpretations

NEW YORK, March 20—Definite rulings and interpretations of the new War Revenue Bill insofar as it applies to automotive products are still being awaited by the industry. Following conferences last week between representatives of the National Automobile Chamber of Commerce and the Internal Revenue Bureau, the Motor and Accessory Manufacturers' Association has taken up the matter through similar channels.

Last week the M. A. M. A. representatives presented their case before the Internal Revenue Bureau and this bureau now has before it the subjects which the M. A. M. A. wants definitely covered. Particular difficulty has arisen over the definition of the term "parts and accessories," and this is one of the matters which it is hoped may be cleared up. At present the matter is before the law division of the Internal Revenue Bureau and it is expected that definite rulings and interpretations may be received before the end of the week.

Sherman Heads Air Training

WASHINGTON, March 20—Lieutenant-Colonel William C. Sherman has been detailed from the Engineers Corps as chief of the air service training. This will include heavier-than-air training at both the ground schools and training fields under Brigadier-General William Mitchell, last week appointed director of military aeronautics. Colonel Sherman will carry on the work for which Professor Herman Bingham of Yale University was brought into the service at the outbreak of war. Professor Bingham organized the various ground schools.

Factories Increase Working Forces

LANSING, March 17—Since the first of the year factories here have added a very noticeable per cent to their production force. The largest increase noted is in the Auto Body plant, which was very short on war contracts. The first of the year this plant was employing 200 men. The first week of March over 700 were on the pay-roll. Its officials declare 1000 men will be needed soon to keep production up to schedule.

The Prudden Wheel Co. is now giving employment to 1000 men, a big increase since the first of the year. The number of men now employed equals the number

employed by this company before the war.

The Olds Motor Works readjusted quickly from war-work, and is now in the automobile and truck game full blast. The company has taken on many more men and its daily production of cars is about 125. The company is increasing its force daily.

The Reo Motor Car Co. added 200 men to its force in February. The pay-roll now shows 4000 men. Many more will be needed in March to care for the proposed production increases.

There is a big demand here for unskilled labor. Local industries, although held up by readjustment plans and anticipation of settlement with the government, are absorbing labor freely, and employment officials declare there are very few unemployed.

Aeronautic Committee Sails for Europe

WASHINGTON, March 18—A Congressional committee to study aeronautics in Europe has sailed with Secretary Daniels. The committee comprises W. R. Green, Iowa; A. T. Smith, Idaho; W. A. Ashbrook, Ohio; John E. Raker, Cal.; C. W. Ramseyer, Iowa; B. L. French, Idaho, and H. W. Sumner, Texas.

Daniels to Undertake Aircraft Development

WASHINGTON, March 17—Secretary Daniels, who sailed from New York late last week, announced that while abroad he will investigate aircraft development, and on his return to the United States, about May 1, he will begin preparation of an outline of experimental work in aircraft for submission to Congress, with the request for an appropriation to carry it out.

Oldfield Suspension Reconsidered

NEW YORK, March 20—At a meeting of the Contest Board of the A. A. A. yesterday, the board reconsidered the question of suspending Barney Oldfield for unsanctioned driving, and in lieu of permanent suspension substituted a fine of $1,000.

Hupp Increasing Production

DETROIT, March 18—High steel prices are curtailing the operation of parts makers, but despite difficulty in securing parts and other materials, the Hupp Motor Car Co. is now running 65 cars daily, which is an increase of 10 cars a day over February production.

Haskelite Co. Is Increasing Force

GRAND RAPIDS, MICH., March 18—The Haskelite Mfg. Co. is getting into peace production and is now employing 50 people. The factory has been employed to capacity on war work. The contract cancellation brought a suspension of operations, but production has been resumed and is increasing daily. The company is making pressed veneer automobile tops. As soon as the Grand Rapids plant nears capacity production the Ludington branch will be started again.

Outlook Excellent in New England

Boston Show Draws Bigger Crowd Than Last Year and Everyone Is Prosperous

BOSTON, March 18—Good business in cars, trucks and automotive equipment in New England is assured for the coming season if the show is any standard by which to judge. The attendance is larger than a year ago and the public interest is keen.

New England has made a lot of money this year. Her farms and forests have been productive and Central New England has been very busy with munitions and other work. Many of the emergency factories erected will be continued with peacetime products and there is every indication that the prosperity will continue.

Distributers say that dealers out through the territory are already getting good business and that the retail trade in Boston began to come back about the first of the year. January and February were pretty good months.

The show, as usual, is held in Mechanics' Building, and it is decorated in its typical Boston way. This year it is a victory show. Statues of victory and flags of the Allies are worked in profusion.

In previous years the truck show has always been a feature of the Boston exhibition and were space available Boston could put on this year one of the best truck shows that has ever been held. The truck show used to be held in the basement, but this year this space is taken up for the storage of government goods, and there are no trucks at all in the show.

In place of this a large bulletin board has been erected at the entrance, carrying the names and addresses of all the Boston truck dealers. The dealers are doing considerable newspaper advertising and endeavoring to hook up their business with the passenger car show.

The truck dealers say that their business has not been as active during recent weeks as it will be in from 30 to 90 days. All of them state that they see a big future ahead for truck selling in New England and they expect this market to open up actively in a very short time.

There are no tractors in the show, because there is no room, but the dealers are interested in this subject and are investigating it. One of the things they are investigating is what type of tractor will best operate on hilly New England farms.

Durant Wins Santa Monica

SANTA MONICA, March 15—Cliff Durant, driving a Chevrolet, won the Santa Monica Road Race here to-day from fourteen starters. His time for the 250.24 miles was 3 hrs., 4 min., 45 sec., which is at the rate of 81.6 m.p.h. Hearne (Chevrolet) was second in 3:11:59, and Lecocq (Newman) was third in 3:15:8. Only three other drivers in addition to these finished the race. Pullen (Hudson) was fourth in 3:20:40.

Durant and Hearne started in first and second places and remained there throughout the race. Hearne completed the distance without a stop, but Durant was forced to stop twice for tires, losing about 1 min. in all. Al Melcher (Duesenberg) died as a result of an accident in which his car was overturned in the early stages of the race.

Prior to the start Ralph De Palma drove an exhibition circuit of the 7.396-mile course in 4:45 1/5, which is at the rate of 93.38 m.p.h. He drove the same Packard car with which he recently established records of from one kilometer to 20 miles on the Daytona Beach. His car was barred from the race because it had no place for a mechanic.

Motor Trucks for Health and Post Office Departments

WASHINGTON, March 18—An allotment of 1500 motor trucks has been arranged for by the War Department for the Post Office Department, in addition to the 1200 which were recently transferred, as announced in a previous issue. These trucks are being used for rural mail truck routes. Few have as yet been actually operated, but plans are being perfected and it is expected that the 2700, and additional trucks, will be used soon. Arrangements have also been made to supply 1000 commercial type trucks to the U. S. Health Department, which will use these in various cities for the transfer of supplies.

Campaign to Avoid Double License

DAVENPORT, IA., March 17—The question of getting uniform application of motor vehicle laws in Iowa and Illinois to eliminate the necessity for double licensing of commercial vehicles plying between the two states has resulted in the inauguration of a campaign by the various Tri-Cities civic bodies. The controversy has been on for several months. The interpretation of the present laws by both the Rock Island and Davenport authorities has been that a motor vehicle owned by a firm in one state, doing business or making deliveries in another state, must be licensed in both states. Backing the campaign are the Rotary Clubs of the Tri-Cities, the Greater Davenport Committee, the Davenport Advertising Club, the Retail Merchants Bureau of Davenport and the Chamber of Commerce and Retail Merchants Assn. of Rock Island.

Wolverine Back in Production

KALAMAZOO, March 18—The Wolverine Motor Car Co., whose plant has been idle since 1917, has been reorganized and has just resumed operation. The new company proposes to manufacture 600 passenger cars this year, and the first machines are now in the process of production. The Wolverine cars will be

made in three models, the roadster to sell for $3,500, and four and six-passenger touring cars to sell at $3,750. A four-cylinder Duesenberg engine is used in all models.

The company is making its own bodies, fenders, gas tanks and a large number of smaller parts. Only one or two departments of the present plant are now in operation, but the rest will be started as soon as production increases. The company proposes to put up a new factory building this year.

The officers of the reorganized company are: President, A. H. Collins; vice-president and chief engineer, Harry A. Scott; secretary, W. H. Scott; treasurer, G. M. Bush. The board of directors is composed of the officers and J. W. Rider, Charles A. Blaney and J. P. Upjohn.

Kerosene Prices Go Up

NEW YORK, March 18—Kerosene oil prices have to-day been increased 1 cent a gallon by the Standard Oil Co. of New York. This applies only to domestic consumption. The price of 150 test oil is now 18½ cents in barrels, and 12½ cents in tank wagons. Gasoline prices still remain unchanged.

Firestone Heads New Rubber Co.

AKRON, O., March 18—R. J. Firestone, vice-president of the Firestone Tire & Rubber Co., is instrumental in the organization of a new rubber company which has already acquired the property of the Standard Tire & Rubber Mfg. Co. at Willoughby. Mr. Firestone will be president of the new company. Other officers are: Vice-president, C. A. McCulloch of the Parmalee Co., Chicago, and T. A. Palmer, former Diamond official, secretary and treasurer. Pneumatic and cord tires will be manufactured. The plant has a capacity of 250 tires a day.

Ford Tractor Production Growing

DEARBORN, March 17—Henry Ford & Son have begun using the new shops south of the tractor plant. Within three months it is expected the production of the factory will be doubled. The new building, which was started for the production of small tanks or whippets on government account, affords 121,600 sq. ft. of floor space, and a building connecting it with the old plant gives 58,800 additional sq. ft. The plant is now producing 250 machines daily. Since the first tractor was produced 46,226 machines have been made.

Urges Oil Industry to Co-operate with Government

WASHINGTON, March 17—A message urging continuance "in some effective way" of the co-operation between the nation's oil industry and the government, and emphasizing the value to the Allies of such co-operation during the war by the petroleum industry, was contained in a letter sent to-day by the United States fuel administrator, H. A. Garfield, to the National Petroleum War Service Committee.

Working Standards for Women

Recommended by Labor Department to Regulate Time and Pay

WASHINGTON, March 18—The Department of Labor recommends eight working standards for female labor which it expects will be incorporated and converted into national legislation some time in the near future.

The standards recommended are as follows:

1. An eight-hour day, no more than 48 hours in any one week.
2. Half holiday on Saturday.
3. One day of rest in seven.
4. At least three-quarters of an hour for a meal.
5. A rest period of ten minutes should be allowed in the middle of each working period without thereby increasing the length of the working day.
6. No woman should be employed between the hours of 10 P. M. and 6 A. M.
7. Women doing the same work as men shall receive the same wages with such proportionate increases as the men are receiving in the same industry. Slight changes made in the process or in the arrangement of the work should not be regarded as justifying a lower wage for a woman than for a man, unless statistics of production show that the output for the job in question is less when women are employed than when men are employed. If a difference in output is demonstrated the difference in the wage rate should be based upon the difference in production for the job as a whole, and not determined arbitrarily.
8. Wages should be established on the basis of occupation and not on the basis of sex. The minimum wage rate should cover the cost of living for dependents and not merely for the individual.

More Case Business With Less Profit

RACINE, March 19—Although sales of the J. I. Case Threshing Machine Co. were $25,162,769 in 1918, which is an increase of $7,505,016 over 1917, net profits for the year were only $2,539 ahead of last. On Dec. 1, 1918, $274,000 first mortgage 6 per cent gold bonds matured and were paid. The company also retired during the year $2,532,000 of bonds not yet due, as well as writing off $807,076 European assets and reducing the inventory of second-hand machinery by $376,811.

Income account for the year ended Dec. 31, 1918, compares as follows:

	1918	1917	1916
Gross sales ..	$25,162,769	$17,657,753	$13,047,257
Net earnings	5,992,023	4,066,854	2,658,997
Interest	572,622	726,540	737,389
Dep. & amort.	807,246	290,933	273,887
Federal taxes.	850,000	275,000	......
Bond pr. etc.	225,032	......	......
Extra charges	*1,183,888	417,608	......
Net profits	$2,353,235	$2,356,773	$1,647,721
Preferred div.	850,500	850,500	850,500
Year surplus.	$1,503,735	$1,506,273	$797,221

Brown Heads New York Dealers

NEW YORK, March 17—C. M. Brown was re-elected president of the Automobile Dealers' Assn. at its directors' meeting on March 10. W. C. Poertner and William Parkinson were re-elected vice-president and treasurer, respectively. The new board of directors consists of H. R. Bliss, Colt-Stratton Co.; C. M. Brown, The Winton Co.; H. J. DeBear, Maxwell Motor Car Co.; R. J. Gilmore, Packard Motor Car Co.; C. H. Larson, Cutting-Larson Co.; William Parkinson, William Parkinson Motor Sales Co.; W. C. Poertner, Poertner Motor Car Co.; A. G. Southworth, Buick Motor Co.; W. D. Stewart, Willys-Overland, Inc., and W. A. Woods, Van Cortlandt Vehicle Co. The association is planning to locate in headquarters suitable to be run on a club plan, with restaurant, reading and meeting rooms. It is also planned to have other automotive organizations use the rooms for their meetings, etc.

Entries for Ascot Speedway Race

LOS ANGELES, March 18—Seven drivers have notified the Contest Board of the American Automobile Association of their intention to enter the 150-mile speedway race to be held on the Ascot Speedway here on March 23, in special cars. They are:

Driver	Car
E. J. Murray	Murray
John D. Harloe	Mercer
L. Melcher	Duesenberg
Roscoe Sarles	Roamer
A. H. Patterson	Hudson Super-6
Fred Newman	Newman
Omar Toft	Miller

Chicago Pneumatic Tool Has $535,833 Surplus

CHICAGO, March 17—The financial statement of the Chicago Pneumatic Tool Co. of Dec. 31, last, shows a surplus of $535,833 after necessary deductions were made. Net profits after war taxes were taken out amounted to $1,283,213, as compared with $2,006,372 in 1917 before war taxes were charged off.

Balance sheet of Chicago Pneumatic Tool Co., as of Dec. 31, 1918, compares as follows:

ASSETS	1918	1917	1916
Real estate, plant, etc..	*$7,662,177	$7,277,169	$7,190,686
Investments..	58,309	1,191,370	1,191,370
Treas. stock.	......	37,000	37,000
Treas. bonds.	......	42,000	89,000
Liberty bonds	46,308	......	......
Cash	674,627	286,044	256,371
British Gov't securities...	592,484	......	......
Accounts and bills receivable	2,799,373	2,428,911	2,023,612
Deferred charges ...	393,306	......	......
Inventories...	4,961,094	4,291,553	2,873,910
Sink fund....	31,161	1,719,434	1,116,596
Total	$17,218 839	$16,773,483	$14,778,545

LIABILITIES			
Capital stock	$6,448,800	$6,485,800	$6,485,800
Bonds	3,250,000	2,500 000	2,500,000
Dividends payable ...	96,732	127,213	124,863
Accounts and bills pay'ble	2,175,401	2,549,894	1,685,760
Dividends unclaimed .	1,224	......	......
Sinking fund reduction .	......	1,219,434	1,116,596
Accrued interest	56,413	......	......
Reserves	408,162	243,078	28,677
Surplus	4,782,107	3,648,063	2,836,849
Total	$17,218,839	$16,773 483	$14,778,545

*After reserve for depreciation.

The company formerly manufactured the Giant truck, but has been gradually getting out of this line.

Requirements of Tractors for Use in Southern States

Protection of Parts from Dust and Sand of Greatest Importance—Inclosure of Parts and Fitting of Dust Separator to Carbureter Necessary

(*By a Class Journal Staff Correspondent*)

MACON, GA., March 17—TO SUCCESSFULLY COMBAT SOUTHERN SOIL CONDITIONS, TRACTORS MUST BE EXCEPTIONALLY WELL PROTECTED FROM THE DUST EVIL. FOR RELIABLE, EFFICIENT SERVICE AND LOW UPKEEP EXPENSE THERE MUST BE A BETTER INCLOSURE OF WORKING PARTS THAN MANIFESTED ON CERTAIN MAKES OF TRACTORS.

A drive through the country surrounding Macon, Atlanta and other cities of Georgia convinces one that the sandy condition of the soil is going to play havoc with tractors if not guarded against. The general lay of the land and soil characteristics are ideally suited for working with the tractor, as was shown at the recent Dixie demonstration.

Nothing will make a tractor short lived so much as exposure of working parts to sand. It does not mean that only the engine parts should be inclosed, but those subjected to abnormal wear, as the steering gear, drive pinions, bull gears, wheel spindles, etc.

Air Cleaners Imperative in Southeast

Air cleaners are imperative on Georgia soil; in fact, in any of the soil of the Southeast. Although the demonstration field at Macon was not entirely dry while the plowing was going on, the dust at times was terrific.

If the tractor maker is going to stand behind his distributer and dealer in Dixie he will make sure his tractor is fitted with the best possible means for cleaning the incoming air on the carbureter, if service and maintenance cost are going to be stripped to bed rock.

Questioning the motor car dealers in this vicinity one finds the sandy condition of the soil gets in its destructive work on passenger car and truck engines to a greater or less extent. Thus there is considerable cylinder reboring going on throughout the cotton states.

Georgia sand when mixed with the oil in the crankcase of the tractor engine makes a cutting compound second only to emery and oil itself. Obviously bearing life under such influences is short.

But it is not only the engine we must go after. It is highly important that gears be inclosed as far as possible and provision made that sand will not come in contact with the surfaces of the bull pinion and gear if the tractor is of this type. The bull pinion and gears are subjected to very heavy loads as it is and their tooth surfaces will be rapidly cut down when sand gets between, no matter how well they are made or how hard the surfaces.

A cover should be put over the engine valve mechanism, with a good heavy gasket underneath, so that sand cannot get at the working parts. This also holds true of the governor parts. Rocker arms and such mechanism as may be employed for valve action travel very fast, and when sand gets into the bearing surfaces the resultant cutting action is just that much faster.

Owing to the hilly condition of the Southeast generally there is bound to be considerable pressure on the wheel bearings in addition to that set up by the pull of the plow, weight of the machine and other factors. IT MEANS THAT IF THE TRACTOR IS OF THE WHEELED TYPE, THE SPINDLES MUST BE PROTECTED BY SUITABLE DUST CAPS OVER THE HUBS. There must be a copious use of felt washers also, not only to keep the dust out but the lubricant in.

The bearing surfaces of the steering gear must not be overlooked, and makers might do well to fit leather boots over the joints of the tie rod and drag link, unless the tractor is operated by cables or chains.

Keep Sand Out of Gearsets

Inspection of some of the present day tractor transmission layouts shows that not sufficient thought has been put on the question of keeping sand out of the gearsets. On some designs the gear shifting shafts are exposed when the lever is in certain positions and at other times housed within the case. The result is sand collects on the ends of the shifting shafts and is carried into the case ultimately.

The combination of grease and sand on the shafts makes a gritty substance that enlarges the hole in the case through which the shafts work and gives the sand all the more chance to get in. A suitable cover of some kind, a light stamping or sheet iron cover with a gasket between it and the case will go a long ways toward eliminating transmission troubles from sand.

The above are some of the major things to be considered in the design of a tractor for the Southeast.

Government Investigates Tractor Use

WASHINGTON, March 17—The Bureau of Farm Management, Department of Agriculture, has compiled a pamphlet dealing with farm tractor experiences in North and South Dakota which will be ready for distribution within the next few weeks. Several hundred tractor owners in the Dakotas were asked these questions:

"What do you find to be the principal advantages of the tractor for farm work?"
"What are its principal disadvantages."

Saving in time, thus making it possible to cover the desired acreage within the proper season, is put first among the advantages by a large percentage of farmers. Other advantages mentioned are: Ability to do thorough work, especially in hot weather, when horses are at a disadvantage; saving in man power, doing away with more or less hired labor and enabling one man to farm larger acreage than he can with horses.

This last advantage is mentioned by a larger percentage of Dakota farmers than of farmers in other states where similar investigations have been made. This is doubtless because the system followed in the Dakotas is such that the tractor can be used to advantage for more of the farm work than in most other parts of the country.

The principal disadvantage of the tractor, according to the reports, is its injurious effect on moist soil. This difficulty is a serious one in districts where the soil is heavy and where it is necessary to do a considerable amount of work in early spring.

Difficulty of operation seems to rank next as a disadvantage. A large percentage of farmers emphasize it. Other disadvantages mentioned are expense of operation, undue increase in investment and delays on account of engine trouble.

In comparing the reports upon which this bulletin is based with those obtained from tractor owners in various parts of the corn belt several years ago it appears that less stress is laid upon the disadvantages of the tractor than in the older ones.

Tractors for Road Work

HARRISBURG, March 15—Twenty-three tractors purchased by the State Defense Commission last spring to aid the farmers in plowing during the war have been turned over to the State Highway Department, to be used to drag the roads. This step has been taken by Frank B. McClain, executive director of the State Commission. He also has turned over twelve State-owned tractors, with plow attachments, to State institutions, for use on farms owned by the commonwealth. The remainder of the implements will be sold by the State. This means that the tractor leasing proposition was all very well last spring, to speed up the crops for war purposes, but there has been so little general response to another year of leasing the State's tractors on the part of the rural communities that the idea was abandoned.

May Hold Next Detroit Show in March

DETROIT, March 15—The Detroit Automobile Dealers' Association at its next meeting will entertain a proposition to make the March date for the Detroit show permanent.

Savage Arms Doubles Earnings

Plant Quadrupled and Outstanding Bonds Purchased —War Work Is Finished

NEW YORK, March 17—During the year 1918 the Savage Arms Corp. doubled its net earnings, despite the fact that in that time more than $2,000,000 was expended for plant extensions and additions, all outstanding bonds as of Dec. 31, 1918, have been purchased and retired, amounting to over $3,000,000, and dividends amounting to $537,000 were paid. At the present time the ratio of current assets to liabilities is approximately 10 to 1; of $22,000,000 total assets, $15,000,000 are current.

In the company's annual report, President A. E. Borie points out that with the close of 1918 the war business of the company is practically at an end, and adds that of the various products made in the last 3 years the one which has contributed to the largest degree to the success of the company has been the Lewis machine gun. In these 3 years the company has more than quadrupled its plant facilities. Herewith is the annual statement:

SAVAGE ARMS COMPARATIVE INCOME ACCOUNT FOR THREE YEARS

	1918	1917	1916
Total earnings after deducting all expenses incident to operations, including those for ordinary repairs and maintenance of plants, ordinary taxes and ordinary depreciation charges which includes amortization of Patents, etc.	†$7,859,121.13	$5,227,749.31	*$3,289,710.75
Interest for year on outstanding bonds	24,397.33	63,630.35	88,827.67
	$7,834,723.80	$5,164,118.96	$3,200,883.03
Reserve for State and Federal taxes and contingencies	6,460,237.76	3,669,000.00	2,425,127.00
Balance	$1,374,486.04	$1,495,118.96	$775,756.08
Dividends	537,051.00	459,147.50	740,264.50
Added to surplus	$837,435.04	$1,035,971.46	$35,491.58

*Ordinary depreciation omitted.
†Includes super depreciation.
Note.—The operations for the year 1916 were carried on under the name of Driggs Seabury Ordnance Company.

CONDENSED BALANCE SHEET

Assets

Plant:			
December 31, 1915		$3,950,213.22	
Additions and extensions to December 31, 1918		5,589,898.77	
		$9,540,111.99	
Less—Depreciation and amortization		3,956,061.95	$5,584,050.04
Patents, licenses, rights and good will		$7,142,248.07	
Less—Amortization		5,948,669.53	1,193,578.54
Investments			155,000.00
Current:			
Cash		$1,646,908.47	
Accounts and notes receivable—Less reserve		3,549,519.98	
Inventories—Less reserve		8,227,269.19	
United States Government certificates and bonds		1,830,750.00	
			$15,254,447.64
Deferred			39,141.43
			$22,226,217 65

Liabilities

Capital stock:			
First Preferred	$500,000.00		
Less—Acquired and held in treasury	490,000.00	$10,000.000	
Second Preferred		260,700.00	
Common	$9,239,300.00		
Less—Acquired and held in treasury	1,281,300.00	7,958,000.00	
			$8,228,700.00
Current			1,592,507.40
Advances on contracts			362,927.15
Reserves:			
Taxes, royalties, insurance, etc		$7,917,617.63	
Special fund for contingencies		2,048,292.96	9,965,910.59
Surplus			2,076,172.51
			$22,226,217.65

Council Plan Adopted by Harvester

(*Continued from page* 658)

ence of action of employee representatives: the right of employees to recall unsatisfactory representatives—these are among the guarantees that the Works Council shall fulfill its intended function with even-handed justice.

VOTE ON HARVESTER INDUSTRIAL COUNCIL

Plant	Present and Eligible	Total Vote	For	Against
Deering	4103	4069	2100	1910
McCormick	5956	5795	2260	3056
Keystone	201	201	191	10
Auburn	1313	1291	1100	177
Akron	1069	1059	614	383
Milwaukee	4420	4387	3207	1096
Tractor	2244	2234	1005	1176
Springfield	544	540	480	54
Chatham	131	131	122	5
Plano	1051	1045	707	329
Weber	666	660	578	79
Hamilton	1855	1820	1849	152
Plow Works	743	732	623	86
Deering Twine	718	649	398	245
McCormick Tw.	831	781	308	432
Auburn Twine	364	364	332	25
St. Paul Twine	244	244	203	35
Steel Mills	1873	1863	1125	712
Iron Mines	*155	*149	128	21
Coal and Coke Works	644	597	428	167
	29,125	28,611	17,558	10,150

*Estimated.
Total spoiled and blank ballots, 903.

Petroleum Institute Organized

Oil Men of Three Countries Form Association to Promote Industry

NEW YORK, March 15—The American Petroleum Institute, in which membership is restricted to residents of the United States, Canada and Mexico, and which has for its objects the promotion of the petroleum industry throughout the world, and co-operation with the United States Government in matters relating to the development of crude oil production, was formed at a meeting held yesterday at the Biltmore Hotel.

The new body represents a development of the organization of the American petroleum industry for war service and it is intended that the association will be to its industry what the American Iron and Steel Institute is to the steel trade. For the first year the directors of the new body will consist of the 35 members of the National Petroleum War Service Committee.

At set forth in the by-laws adopted, the objects of the association are to afford a means of co-operation with the government in all matters of national concern, to foster foreign and domestic trade in American petroleum products, to promote in general the interests of the petroleum industry in all its branches, the mutual improvement of its members and the study of the arts and sciences connected with the petroleum trade.

S. A. E. To Meet With Detroit Engineers

DETROIT, March 12—The Detroit Section of the Society of Automotive Engineers will hold a joint meeting on March 21 with the Detroit Engineering Society, an organization made up of engineers in all industries. Elmer A. Sperry of the Sperry Gyroscope Co., Brooklyn, will deliver an address on the gyroscope in modern warfare. The meeting will be held at the Board of Commerce Auditorium, at 8 p. m.

Public Meeting of National Highway Association

NEW YORK, March 11—A public meeting of the National Highway Traffic Assn. will be held at the Automobile Club of America, 247 West Fifty-fourth Street, on Friday, March 21, at 8 p. m. The program includes talks on the following:

"Qualifications for Operators of Motor Vehicles and Revocation of Licenses," by the Hon. Francis M. Hugo, secretary of the State of New York.

"Regulation of Pedestrian Traffic," by Dr. Shirley W. Wynno, assistant registrar of Records, Department of Health, New York City.

"Sign Posting for Detours and Through Routes in Municipalities," by Elmer Thompson, secretary of the Automobile Club of America.

The report of the Committee on "Gen-

eral Highway Traffic Regulations for Drivers with Directions for Pedestrians" will be presented by William P. Eno, chairman, who is also chairman of the Highways Transport Committee, District of Columbia.

An informal dinner at $1.50 a cover will be served in the grill room of the club at 6:30 p. m.

New Motor Fuel Evolved

WASHINGTON, March 13—Development too late for use in war time of a motor fuel which adds 10 miles an hour to the speed of airplanes, and has possibilities for use in automobile racing was announced yesterday by the Bureau of Mines. The liquid, a combination of benzol and cyclohaxane called hector, costs about $1 a gallon. While of military value, it is not regarded as practical for commercial purposes at present.

Another combination developed by the bureau, consisting of benzol and gasoline, has been found to be more powerful than gasoline alone, and is expected to prove of value in industry. The comparative scarcity of benzol makes its production to supplant gasoline on a large scale improbable in the near future.

Process for Motor Fuel on Market

ST. JOSEPH, MO., March 15—The Motor Fuels Co., which has a process for producing motor fuel for internal combustion engines from fuel oil, developed by S. M. Herber, president of the company, is placing its process on the market. The fuel, it is claimed, can be made at a cost not to exceed 6.5 cents per gal. from fuel oil valued at 80 cents per bbl. at the refinery and which tests from 24.5 to 28 gravity Baumé, after all kerosene and gas oil products have been distilled out by the usual methods, or from crude oil of the same character. This motor fuel, it is said, will stand as high in a test of efficiency as the 58 to 59 gravity gasoline now sold and used by the general public. Mr. Herber is willing to conduct demonstrations and tests as may be mutually agreed upon at the model plant here, and is ready to enter into contracts to demonstrate the process.

To Reduce Freight Rates

WASHINGTON, March 13—Complete co-operation with the manufacturer for the purpose of encouraging and promoting export trade is forecast by the announcement of the Railroad Administration that new decreased rail rates to the Pacific, South Atlantic, and Gulf ports will soon be made public. This Shipping Board will, at about the same time, announce lower ocean shipping rates. The Department of Commerce, United States Shipping Board and the Department of State have worked hand in hand in this matter and are conferring with important exporters.

The object of the reduction in ocean and railroad rates is to meet the competition of Great Britain, which can only be done by substantial reductions in these charges.

Jobbers Want Tax in Price List

Pass Resolution for Price Revision—Makers Hand Tax on to Jobbers

CHICAGO, March 17—Dealers and jobbers of automobile accessories are beginning to get fairly well set on how they should handle the new revenue tax. The tax, of course, must be passed on to the consumer where it is not absorbed by the manufacturer. However, the government does not desire that the additional amount should be passed on to the dealer by the jobber or to the consumer by the dealer as a tax item, but rather that it be included in the list price. An incomplete census of the accessory manufacturers by the Automotive Equipment Association, formerly the National Association of Accessory Jobbers, seems to show that very few manufacturers are absorbing the tax. Most of them are passing it on to the jobber, as a tax item, and the jobber is supposed to change his prices accordingly.

COLUMBUS, March 17—The Ohio Automotive Equipment Jobbers' Association to-day recommended that the manufacturer of equipment pay the war tax. The jobbers do not want the job of passing it along in the form of a tax. If the present list prices are not high enough to permit the manufacturer to pay the tax the jobbers request that the lists be revised to cover the increase. The tax is 5 per cent, and is laid on the manufacturer. Some manufacturers have passed it along in tax form, which procedure has not generally met the approval of the jobbers.

Those represented at to-day's meeting at the Hotel Virginia were: Justus & Parker Co., Columbus; Griswold-Sohl Co., Columbus; J. I. J. Cooper Rubber Co., Cincinnati; Ohio Rubber Co., Cincinnati; Dine-DeWees Co., Canton; York Supply Co., Greenville; Pennsylvania Rubber & Supply Co., Cleveland; C & D Auto Supply Co., Cincinnati; Union Supply Co.. Toledo; Ohio Rubber Co., Cleveland. The president is H. M. Dine, Canton, and the secretary, H. S. Bender, Toledo.

NEW YORK, March 18—Supplementing a resolution passed by the Eastern automobile accessory jobbers at a meeting here on March 10, in which it was recommended that automotive accessory manufacturers absorb the 5 per cent Federal excise tax and make returns direct to the government, the following resolution has been unanimously passed:

Resolved, That the jobbers of the metropolitan district recommend that the manufacturers of automobile accessories absorb the 5 per cent Federal excise tax, and if necessary, revise the selling schedule to enable the jobber and dealer to resell goods without any mention of the tax.

At that meeting an open discussion was held at which some sixty representatives of manufacturers of automotive accessories were present. A number of them decided to absorb the tax without changing the prices. Others decided to absorb the tax and revise the selling schedules by increasing the prices. Another decision was to the effect that the 5 per cent tax would be simply added to the invoices as a tax.

The following jobbers were present and in favor of the resolution: Auto Supply Co., Beckley-Ralston Co., Julius Bindrim, Economy Auto Supply Co., Farrell Auto Supply Co., King Tire Co., Lowe Motor Supplies Co., Martin Evans Co., Motor Car Equipment Co., Oriental Rubber & Supply Co., A. J. Picard & Co., Inc., W. E. Pruden Hardware Co., Ready Auto Supply Co. and the Whittemore-Sim Co.

Labor Board Decisions Favor Employees

WASHINGTON, March 13—That the government recognizes the right of employees to organize and bargain collectively is indicated in a recent decision of the National War Labor Board in the cases of the machinists versus the Russell Motor Car Co., Buffalo; the Detroit Forging Co., Detroit; American Wood Rim Co., Oanway, Mich., and the International Association of Machinists versus the Linderman Steel and Machinery Co.

In the Linderman company findings the Board decided that the machinists have the right to organize as well as the employers and may bargain collectively through their chosen representatives. Employers cannot discharge workers because of membership in trade unions or for legitimate trade-union activities.

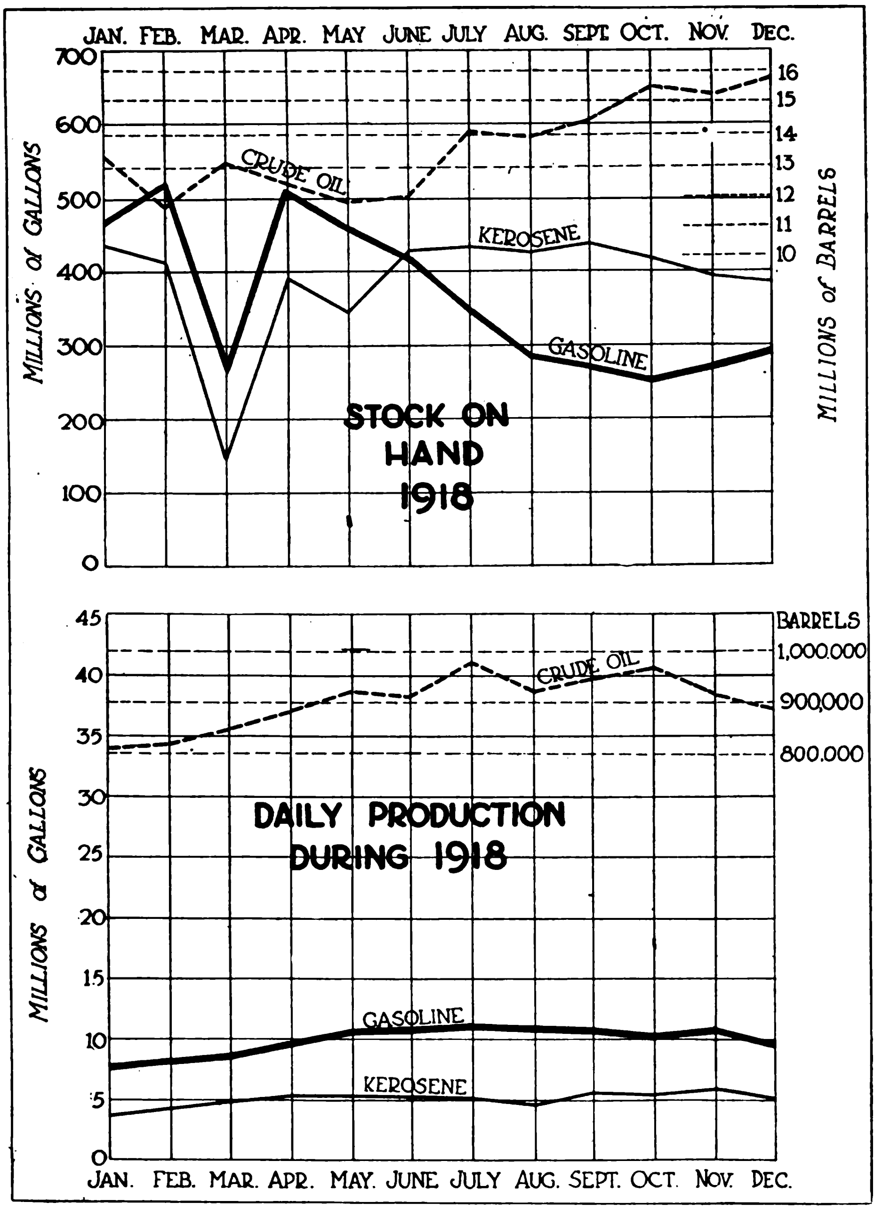
In the case of the American Wood Rim Co., recognition to organize and to bargain collectively was granted, and the company was instructed to recognize and deal with the workers. A like finding was made in the case of the Detroit Forging Co.

In the case of the machinists versus the Russell Motor Car Co., the National War Labor Board ordered the company to recognize the right of the employees to organize and to reinstate several employees, with full pay, who had been discharged for refusing to accept the piece-work system. The company agreed to abolish the piece-work system if so demanded by a majority of the workers.

General Motors to Help Build Lincoln Highway

NEW YORK, March 17—W. C. Durant, president of the General Motors Corp., will contribute $100,000 out of the company's funds for the construction of the last remaining bad stretches of the Lincoln Highway. These are east of Fallon, Nev., in Churchill County. There is one stretch of 12 miles in the Fallon sink which will require an expenditure of $60,000, together with a similar amount from the government. Another stretch of 8 miles at New Pass, Nev., in White Pine County, will take the remaining $40,000 for repairs. With the completion of these repairs, all of the bad stretches between Cheyenne, Wyo., and Reno, Nev., will have been abolished.

Petroleum Products Stock and Production for 1918



25 Per Cent Gain in Gasoline

1918 Figures Show Increases in Production of Kerosene and Crude Oil

PRODUCTION

	November, 1918	December, 1918
Crude oil (bbl.)	27,411,636	26,958,157
Gasoline (gal.)	312,968,640	291,744,465

	Stocks on Hand Nov. 30, 1918	Stocks on Hand Dec. 31, 1918
Crude oil (bbl.)	15,222,401	15,749,771
Oils purchased to be re-run (bbl.)	1,373,740	1,300,018
Gasoline (gal.)	270,072,011	297,326,988
Kerosene (gal.)	397,804,012	380,117,829
Gas and fuel (gal.)	583,777,918	359,001,357
Lubricating (gal.)	132,923,478	138,853,574
Wax (lb.)	190,953,158	199,657,542
Coke (ton)	22,005	22,605
Asphaltum (ton)	74,955	76 858
Miscellaneous (gal.)	466,887,345	477,783,740

NEW YORK, March 17—Gasoline production increased 25 per cent in 1918. The latest figures from the Bureau of Mines show an increase of 719,766,540 gal. in 1918 over 1917. Crude oil production increased 3 per cent, or a gain of 10,892,949 bbl. over 1917. Kerosene production was 5 per cent higher, or 98,-591,161 gal., more than in 1917.

The average daily increases show 2,136,349 gal. for gasoline, 270,112 gal. for kerosene and 29,870 bbl. for crude oil.

The gasoline production for the entire year of 1918 was 3,570,312,963 gal., that of kerosene was 1,825,360,137 and of crude oil 326,024,630 bbl.

The greatest production occurred in the months included between April and October. These figures include production of gasoline, kerosene and crude oil.

The average daily production of gasoline, kerosene and crude oil in December, 1918, kept pace with the previous month. Though there is a slight decrease, this is explained by the fact that there is one more day in December. Comparing the December daily production figures with

Output of Refineries in the United States by Months During 1918

Total Output of Refineries in the United States for 1917

1917	Crude (bbl.)	Other Oils (bbl.)	Gasoline (gallons)	Kerosene (gallons)	Gas and Fuel (gallons)	Lubricating (gallons)	Wax (pounds)	Coke (tons)	Asphaltum (tons)	Miscellaneous (gallons)	Losses (bbl.)
January	24,839,772		203,618,724	137,248,370	469,596,208	60,941,062	39,558,627	44,627	49,894	27,331,019	941,924
February	23,083,433	no account	184,602,595	129,074,504	446,964,925	54,631,765	36,370,297	42,047	40,619	23,685,686	941,110
March	26,230,138	1st 6 mo.	220,523,571	159,028,978	494,855,838	64,345,221	40,868,930	48,839	52,823	26,977,334	870,380
April	25,994,938	1917	228,945,164	157,826,945	462,846,339	63,218,215	41,037,511	46,099	52,849	30,959,901	957,538
May	27,253,391		238,816,209	147,894,846	504,859,695	65,926,007	38,686,364	43,535	67,612	31,086,377	979,245
June	26,453,210		233,671,746	151,477,383	496,742,434	61,045,757	38,075,280	42,513	67,931	30,205,172	1,011,568
July	26,776,856	2,435,533	244,145,292	161,679,058	599,454,966	64,335,905	40,158,033	42,641	65,272	92,359,401	1,111,511
August	27,900,623	2,376,580	254,464,491	149,528,513	632,151,971	64,107,817	38,999,341	46,240	73,878	92,708,312	1,286,141
September	27,529,022	2,632,988	256,132,050	143,203,644	629,914,572	60,757,049	48,300,033	42,986	62,520	80,386,471	1,182,560
October	27,698,023	2,863,518	271,891,234	140,559,542	621,492,374	68,516,071	41,181,400	48,849	73,886	91,804,160	1,355,219
November	26,215,979	2,519,700	264,888,709	125,893,202	592,490,037	64,861,375	39,694,595	45,815	73,289	87,115,002	1,203,110
December	25,155,996	2,069,351	248,846,638	123,354,046	561,954,921	61,090,596	38,269,670	45,175	58,852	87,548,408	1,283,528
Total	315,131,681	14,897,670	2,850,546,423	1,726,768,976	6,513,324,280	753,776,840	481,200,081	539,366	739,425	702,167,243	13,073,829
January	23,842,587	2,300,334	242,632,044	119,358,184	547,866,248	56,623,425	39,238,858	41,216	54,854	70,995,829	1,078,181
February	23,386,676	2,298,333	234,324,619	121,218,320	510,165,397	58,300,914	35,087,337	42,371	42,033	75,134,088	983,992
March	26,239,662	3,696,872	269,627,968	151,228,007	587,985,804	69,308,351	43,597,019	44,248	56,901	94,865,148	1,097,489
April	26,201,544	3,956,244	293,396,162	153,703,682	578,255,341	71,022,204	40,173,524	45,674	51,242	89,242,012	1,182,020
May	28,510,698	4,112,023	319,391,202	160,590,760	631,586,209	79,589,735	42,544,633	48,864	60,449	88,627,491	1,269,281
June	28,140,479	3,483,270	315,023,445	151,840,252	628,842,033	74,420,996	41,317,794	46,605	50,321	81,110,922	1,282,177
July	29,170,718	5,951,537	332,022,095	156,828,826	658,439,682	79,303,107	41,691,551	48,914	58,433	159,374,139	1,338,304
August	28,534,275	6,376,353	330,335,046	149,678,850	671,113,871	72,892,879	41,829,516	51,759	59,715	163,345,034	1,337,327
September	28,390,431	5,485,747	314,595,959	164,963,798	653,085,050	70,593,079	42,704,894	48,052	49,157	138,201,963	1,236,834
October	29,237,767	5,571,847	314,251,318	164,928,640	661,780,441	72,244,633	43,470,132	48,820	51,878	166,109,867	1,161,545
November	27,411,636	3,857,754	312,968,640	169,278,105	604,403,494	72,178,602	49,642,007	51,393	35,387	75,430,160	1,236,818
December	26,958,157	3,474,890	291,744,465	161,742,713	587,873,987	64,987,842	43,847,092	41,747	37,596	84,273,730	1,352,657
Total	326,024,630	50,565,204	3,570,312,963	1,825,360,137	7,321,397,557	841,465,767	505,144,357	559,663	607,968	1,286,710,383	14,556,625

those of the same month in 1917, there is disclosed the fact that our production is now on a much higher scale. Our kerosene and gasoline stocks on hand, however, still remain in an unsatisfactory condition, as compared with 1917. The figures, however, for December show a 10 and 4 per cent increase for gasoline and kerosene, over November, 1918. The production of crude oil in December, 1918, though lower than November, was still at a higher level than the year previous.

This winter has been so favorable for motoring that an increase in the consumption of gasoline and oils can be expected. As a result the figures for January, February and March will probably not compare favorably with those for the same months in 1917.

Prices of British Cars Increase

LONDON, March 4—(Special Correspondence)—The prices of British cars are steadily increasing. The Austin, which recently sold for $2000, is now $2,475, with no deliveries promised until August. The average pre-war British car selling at about $1750, is being continued in its pre-war design in order to use up old stocks and also as an easier proposition for re-starting manufacture at prices varying from $2250 to $2375. The Rover Co., which produces the most popular medium-priced car, answers inquiries with regard to post-war production and prices with the statement that no information is available at present, and that the company cannot speak with regard to deliveries or prices.

The fuel situation is still obscure. On some sides it is claimed that there are ample supplies of fuel, but that the complicated system of government control, under which gasoline can be purchased only by means of a license, is to blame. However, inasmuch as licenses for almost unlimited quantities are granted to practically everyone, it would seem that there is no question of a shortage of supplies.

Licenses cost at the rate of 12 cents a gallon. Up to Feb. 4 the same license was required for the purchase of benzol, but on that date the government rescinded the order requiring such a license, and in consequence there has been great rush by everyone to obtain supplies. At present the price of benzol is artificially raised and kept at the same level as gasoline.

May Sell Army Trucks

WASHINGTON, March 15—In view of the decreased size of the Motor Transport Corps and the entire army, as provided for by proposed legislation, it is now considered possible that a number of war trucks may be sold. The National Automobile Chamber of Commerce has already informed the War Department that it desires first knowledge of any proposed sales and the opportunity to work out some scheme whereby the manufacturer will be protected. The Motors Vehicle section of the army has assured the N. A. C. C. that it will co-operate with the industry.

Cancellations and Suspensions of Aircraft Contracts

The following is a summary of cancellations and suspensions of aircraft contracts to Feb. 7:

	Value	Per Cent of Total
Engines and spare parts	$250,107,551	53
Planes and spare parts	163,231,790	35
Chemicals	*13,181,285	3
Balloons and balloon supplies	*9,877,356	2
Instruments and accessories	*$9,864,238	2
Fabrics, lumber and metals	*5,954,726	1
Miscellaneous	16,631,047	4
Total	*$468,847,993	

*Reductions due to revision in cancellations of contracts.

SUSPENSIONS OF PLANE AND ENGINE CONTRACTS

The value of planes and engines delivered during the week ended Feb. 7 was nearly $2,000,000, leaving a balance on order valued at over $10,000,000.

	Balance on Order Nov. 11	Suspended Nov. 11 to Feb. 7	Per Cent Suspended	Per Cent Delivered	Per Cent Remaining
Planes:					
Service	$124,818,750	$113,968,750	91	8	..
Advanced training	12,203,600	9,677,700	79	18	3
Elementary training	5,400,000	4,187,358	77	23	..
Total	$142,422,350	$127,833,808	90	9	..
Engines:					
Service	$227,010,000	$193,452,000	85	14	..
Advanced training	31,377,500	14,926,295	48	27	25
Elementary training	2,864,200	....	..	93	7
Total	$261,251,700	$208,378,295	80	17	3

331 Liberty Motors Remaining on Order

During the week ended Feb. 7 a total of 189 Liberty motors were delivered, leaving 331 still on order. To date 20,147 have been produced.

The status of contracts on Feb. 7 is shown below:

	Balance on Order Nov. 11	Suspended Nov. 11 to Feb. 7	Delivered Nov. 11 to Feb. 7	Per Cent Suspended	Per Cent Delivered	Per Cent Remaining
Nordyke-Marmon Co.	4,548	4,000	548	88	12	..
Lincoln Motor Corp.	13,228	10,500	2,728	79	21	..
Packard Motor Car Co.	7,373	5,600	1,473	76	20	4
General Motors Corp.	3,430	2,472	927	72	27	1
Ford Motor Co.	1,947	1,050	897	54	46	..
Total	30,526	23,622	6,573	77	22	1

42 De Haviiland 4 Planes Remaining on Order

Deliveries of De Haviiland 4 planes during the week ended Feb. 7 were 5, leaving 42 still on order. A total of 4600, exclusive of 204 shipped without engines, have been produced.

The status of contracts on Feb. 7 is shown below:

	Balance on Order Nov. 11	Suspended Nov. 11 to Feb. 7	Delivered Nov. 11 to Feb. 7	Per Cent Suspended	Per Cent Delivered	Per Cent Remaining
Standard Airc. Corp.	421	360	61	86	14	..
Fisher Body Corp.	3,031	2,400	631	79	21	..
Dayton-Wright Airplane Co.	2,623	1,900	681	72	26	2
Total	6,075	4,660	1,373	77	22	1

WASHINGTON, March 15—Cancellations of aircraft contracts aggregating $468,847,993 have been made by the War Department. Liberty engine production amounted to 20,147 and 331 are still on order.

When the armistice was signed there were 30,526 on order, and since that time contracts for 23,622 of these have been cancelled.

Deliveries from Nov. 11 to Feb. 7 totaled 6573, distributed as follows: Nordyke & Marmon Co., 548; Ford Motor Co., 897; General Motor Corp., 927; Packard Motor Car Co., 1473, and Lincoln Motor Corp., 2728.

Production of Haviland 4s, exclusive of 204 shipped without engines, amounted to 4600. There are still 42 on order. Deliveries between Nov. 11 and Feb. 7 were 61 from the Standard Aircraft Corp., 631 from the Fisher Body Corp. and 681 from the Dayton-Wright Aircraft Co.

Airplanes in Storehouses

WASHINGTON, March 19—Eight hundred and twenty-nine airplanes and 7315 engines have been shipped to storehouses since the date of the armistice by the Bureau of Aircraft Production. Types include the Liberty, OX-5, LeRhone, Hispano 180 and Hispano 150 engines, and DeHaviland, JN6-H and JN4-D planes. Following is the tabulation:

Liberty 12-service engines	4,806
OX-5 elementary training engines	1,261
Le Rhone advanced training engines	994
De Haviland 4 observation planes	524
Hispano 180 advanced training engines	343
Hispano 150 advanced training engines	254
JN6-H advanced training planes	174
JN4-D elementary training planes	131

Aeronautic Convention Starts May 1

NEW YORK, March 18—The second Pan-American aeronautic convention and exhibition will be held at Atlantic City, N. J., on May 1 and will last until June 1. The convention will be under the auspices of the Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation. A program outlining each day's activities has been issued.

Air Mail Service for France

PARIS, Feb. 20—Aerial mail service for Paris and other important French cities has started. The fliers carry mail between Paris and Bordeaux, Marseilles, Toulouse, Brest and St. Nazaire.

U. S. Ships Are Back on High Seas

Shipping Board Gives Figures Showing Positions as on January 31

NEW YORK, March 17—According to tables prepared by the Shipping Board's Division of Planning and Statistics, there were employed in overseas service under the American flag a total of 752 vessels, having an aggregate capacity of 1,961,239 gross tons. At that date American ships represented 46 per cent of all the shipping plying between United States and foreign ports, as against 9.7 per cent at the opening of the war. Although the following table represents the grouping of these vessels as at Jan. 31, 1919, it is understood that there has been considerable rearrangement and diversion of routes since that date, owing to the pressing need for foodstuffs in Europe.

Service	No. of Vessels	Gross Tons
Trans-Atlantic:		
West African	13	14,034
South African	24	33,793
East African	1	3,350
British	13	58,685
French	23	89,462
Belgian Relief	4	23,213
Italian	25	119,587
Swiss	1	1,965
Spanish	3	7,271
Portuguese	7	23,142
Other Mediterranean	9	16,974
Northern neutrals	2	12,606
Other trans-Atlantic	1	2,246
Trans-Pacific:		
East Asian	49	162,304
East Indian	5	13,279
British Indian	3	12,502
Australian	71	83,423
Hawaiian	17	43,416
South American:		
Amazonian	27	22 830
Central Brazilian	44	87,385
River Plate	39	99,488
West Coast	70	193,018
Carribbean and Mexican:		
West Indies	168	400,055
Caribbean	63	147,419
Mexican Pacific	2	2,262
Mexican Gulf	42	211,516
Alaskan	14	30,891
Canadian:		
Pacific	9	20,860
Atlantic	3	24,263
Overseas total	752	1,961,239

Factors in High-Speed Engine Development

(*Continued from page* 627)

Two sets of contacts arranged to fire alternately have been used, but this makes it necessary to re-time or adjust contacts frequently, as half of the cylinders might be late in firing, which would cause a heated engine and the other half of the cylinders early in firing, would cause premature or spark knocking.

It would be impracticable to enlarge the contact area, because of the inertia at high speeds, as even the lightest contact arrangement is too heavy for high-speed work.

If there is any eccentricity of cams and looseness of bearings with one set of contacts, those errors are very noticeable in the firing balance of the engine, but with the two sets of contacts 180 degrees apart, the ignition is perfectly synchronized, a fact which is very noticeable indeed in the firing balance of the Cadillac engine on block test.

I believe that the ignition as applied to the eight-cylinder Cadillac engine, which is patented, has been brought to a higher state of perfection than any other ignition, as so synchronized is this ignition that my company gladly loaned it to the Government for use on the Liberty engine, as without this system, I do not believe that the Liberty engine would have been so successful as it has been. Fig. 10 shows the system, the patent number being 1,286,803.

Some curves showing degrees of spark advance on the flywheel relative to r.p.m. are shown in Fig. 11 and are self explanatory.

One can appreciate some points in connection with the inertia of the contacts, because when running an eight-cylinder engine at 3000 r.p.m., an examination of the time taken between contacts is interesting, consuming the vast time of .005 seconds; at 3550 r.p.m. the time taken is 0.0042 seconds; at 3850 r.p.m. the time taken is 0.0039 seconds. With this in view it can readily be understood that very little variation can be allowed so that we prescribe an error of only one degree between the cylinders on our engines at all speeds.

Proper System Reduces Labor Turnover

(*Continued from page* 621)

Summarizing the turnover, we find four principal causes of separation—discharges, lay-offs, military service and quits, with the latter accounting for approximately 75 per cent of the evil. Inquiring into the causes for quits, it was found that 33 per cent were dissatisfied with wages, 27 per cent dissatisfied with "too hard work," 20 per cent declared the working conditions disagreeable, 8 per cent left to accept another position, 2 per cent quit because of monotony of work, 2 per cent for military service, and 8 per cent for miscellaneous reasons.

Causes for discharges included 27 per cent for insubordination, 24 per cent for laziness, 20 per cent for misconduct, 11 per cent for incompetence, 10 per cent for trouble making, 3 per cent for general unreliability, 3 per cent for drinking, and 2 per cent for other causes.

France Subsidizes Farm Machinery

PARIS, March 15—To encourage the use of agricultural tractors, the French government offers a subsidy of 50 per cent of the purchase price on all tractors and steam or electric plowing mechanism which are purchased by co-operative groups of farmers or by municipal authorities for general use. This 50 per cent subsidy is only granted when a purchase is made of not less than five tractors, or equivalent mechanical plowing material. When the purchase is less than five tractors the subvention cannot exceed a quarter or one-third of the price of the material, according to the condition of the persons making the purchase. An exception is made for farmers living in the devastated regions who can, under certain circumstances, receive 50 per cent subsidy.

Films an Incentive to Foreign Trade

Motion Picture as Trade Stimulator Urged by Department of Commerce

WASHINGTON, March 18—The use of moving picture films for the development of American industries in foreign countries has been taken up by the Department of Commerce. An appropriation of $69,000 for this work asked for by the department failed to go through Congress during the recent filibuster. Requests have already been received from American attachés for films, especially from China. Reports say that the use of motion pictures in that country would aid extensively in developing American trade there. Suggestions from the American office there include films showing American highways, farm tractors, passenger cars and motor trucks, including complete production of tractors, cars and trucks, and their operation on farms and roads.

Effective Method for Chinese

"The motion picture is one of the very effective ways of impressing American standards, material, equipment and methods on the Chinese," says the report received, "and films would be welcomed, showing construction and completion of American roads. A good film showing the entire process of the manufacture of automobiles and vividly picturing the advantages to the purchasing public of quantity production could be advantageously exhibited."

Owing to the fact that the bill did not pass, the Department of Commerce is asking manufacturers to supply it with films which will be at once forwarded to China and other countries. A translator and film expert are located at the department, who will adapt films for the particular countries to which they are sent.

Advantages to Great Britain and Canada

In discussing this subject with the Congressional Committee, the Department of Commerce pointed out that other nations, and particularly Great Britain and Canada, have found the motion picture an excellent means of promoting trade. Canada expended $40,000 for this work during February. As far back as 1913 Great Britain exhibited moving pictures of leading British industries in Europe, Canada, United States and South America.

Many, and in fact most, of the moving picture films exhibited throughout the world showing the United States are of the "Wild West" character, and instead of giving a fair representation of existing conditions they distort foreign impression. To counteract, and at the same time develop American foreign commerce, the department is urging this motion picture propaganda.

How Germany Sells Her War Vehicles

Organization of Manufacturers to Help Stabilize Motor Industry

WASHINGTON, March 17—In Germany, according to a consular report, twenty automobile manufacturers organized in 1915 for the purpose of taking over motor vehicles released by the army, and disposing of them so as to create the least disturbance to the automobile industry. The organization was known as the Feldkraftwagen Aktien-Gesellschaft, or Feldag.

It was generally expected that the automobile market would be flooded after the war, but according to an article in the Frankfurter *Zeitung* for Dec. 20, 1918, of which this is a summary, there is not the slightest danger of any immediate flooding of the market, in view of the great scarcity of repair parts. Even in the case of passenger vehicles, the present supply, especially of the lighter models, is far below the demand, and sales are now restricted to customers who need the vehicles for the performance of their professional duties, like physicians and veterinarians.

Some of the passenger vehicles of foreign makes were disposed of to neutral countries during the war, on account of the difficulty of securing duplicate parts. The Feldag is endeavoring to sell the vehicles only after having put them in good running order. But as under the present labor conditions repairs require much more time than under normal conditions, and in view of the scarcity of storage facilities, it was found necessary to sell limited numbers of unrepaired vehicles.

Private Orders Annulled

The apprehended drop in prices has also failed to materialize, especially in the case of commercial vehicles. A 3-ton truck which sold for about 16,500 marks ($3927) before the war and which may now be obtained for not less than 30,000 marks ($7200), with tires of iron and wood, is now sold by the Feldag, after a thorough overhauling, for 12,000 ($2880) to 14,000 ($3360) marks.

The fact that army contracts for about 10,000 trucks are still outstanding has also a steadying effect on the market.

Under the circumstances it is not surprising that private firms find it difficult to purchase trucks at reasonable prices. It is recalled that a few months ago the association of automobile manufacturers decided to annul all private orders for vehicles received prior to Dec. 31, 1916, on account of the abnormal increase in wages and materials. While orders are now accepted again by the manufacturers, the scarcity of raw materials and the general uncertain conditions make it necessary for them to stipulate a delivery period of several years and to protect themselves thoroughly in regard to prices.

Prior to the war it is estimated Germany had probably about 7000 to 8000 trucks in use. At the outbreak of the war most of them were taken over by the army, and during the war only about 2000 to 3000 vehicles assigned to the home forces were available, partly for public and partly for private use. An increase through return of army trucks is not to be expected, in view of the fact that their number was much smaller than it was generally anticipated, and also because of the armistice provision for the surrender of 5000 trucks to the Entente.

—

Mexico Breaks Oil Pact

WASHINGTON, March 12—President Carranza has demanded immediate payment of "royalty taxes" on oil produced in Mexico in January and February despite his agreement with the United States to take no further action in Mexican oil matters until the Mexican congress could act on a new oil law.

—

France May Import Tractors

WASHINGTON, March 15—The French Government will allow the importation of farm tractors from the United States provided commercial credits for one year can be arranged. Details of the plans are not yet known. The only advice received so far is a cablegram from Bernard M. Baruch stating: "The French Government is willing to allow sales to French merchants of $40,000,000 worth of machine tools and all agricultural implements if commercial credits for one year can be arranged."

—

Copper Producers to Market Government Surplus

WASHINGTON, March 18 — Copper producers have arranged with the War Department to market the government surplus copper at the prevailing market prices, charging the government the actual cost of so doing. It will be distributed with the producers in connection with their own products, the minimum monthly amount being fixed, and the actual amount disposed of being a certain percentage of total sales exceeding the minimum amount. It was also agreed that the copper be entirely distributed within 15 months.

—

Permanent Exhibit of War Materials

WASHINGTON, March 17—The Engineering and Standardization Branch of the Purchase, Storage and Traffic Division of the Army will establish and maintain an exhibit of standard war equipment and supplies. The exhibit will contain samples of all varieties of standard articles necessary for war, and is especially intended for the information of manufacturers, and in order to have available at all times approved samples or specifications of samples needed to facilitate production. A list of the articles which will be placed in this permanent exhibit will be made public later.

Improve Wood for Aircraft

New Methods for Seasoning and Testing Developed by Forest Laboratory

WASHINGTON, March 18—The use of plywood in aircraft construction and the development of improved kiln-drying are reported as a result of experiments by the Forest Products Laboratory, Department of Agriculture. One of the most important achievements was the discovery of a method to dry spruce in 30 days as compared with the two years heretofore required.

At the time our aircraft program was launched practically no seasoned spruce stock was available. To air-dry green spruce 3 in. thick, such as is used in airplanes, requires from one to two years. The Forest Products Laboratory specified a method of kiln-drying by which green spruce airplane stock can be dried in from 20 to 40 days to the proper moisture content. Kilns were designed for the Army and Navy and for commercial companies capable of properly drying airplane stock, and men were furnished to operate them until operators could be trained at the laboratory. Seasoned stock was thus insured equal, if not superior, to air-seasoned material.

A relatively slight advantage in lightness and strength over the best substitute makes spruce the preferred airplane wood and warranted the organization of a Spruce Production Division. The same importance attaches to any saving in strength, however slight, that is accomplished through proper methods of seasoning. Exhaustive tests are showing that the Forest Service specifications produce better material than can be secured by drying in the air.

Strength of Airplane Woods

Over 300,000 tests made on about 130 species of wood afforded basic information for aircraft design. From these data the relative suitability of various species of wood, the influence of defects, the relation between strength and density, and the influence of moisture can be determined. A table of strength values at 15 per cent moisture was prepared by the forest products laboratory, and adopted by the Army and Navy as a basis for the design of the wooden parts of aircraft.

Tests of Beams and Struts

On account of the difficulty in securing suitable pieces for manufacturing the larger airplane parts and the necessity for conserving material, several series of tests were conducted at the laboratory on built-up beams and struts of various designs and also on various types of splices. Present specifications of the Army and Navy for laminated and spliced beams and laminated struts are based on the results of these tests.

Automotive Conditions in England

War Has Opened Question of Air and Road Transportation and Government Control

LONDON, March 1—Pending a definite ending of the war, certain regulations of the Defense of the Realm Acts (commonly styled D. O. R. A.) continue to be operative. Under these powers the competent authorities have placed a temporary embargo on certain arranged for and other tentative and more or less experimental efforts to commercialize services by aircraft.

The Position of Aircraft Manufacture

One of the problems of the hour concerns the future of aircraft manufacture. For some time to come no stable commercial output of aircraft seems possible, if only for lack of data and experience of the sort of machines required. Aircraft for the naval and military forces and for postal work has a recognized place, and forms part of the Government's program for land and sea defense.

There is a rumor that certain aircraft factories will remain more or less under control of the state; though possibly not wholly excluding private trading. This rumor finds some strength in the better established report that certain accessories factories are now a state monopoly. One of these is concerned with ball bearings and has supplied all its war time output to the Government. If the rumor be correct, it will be helpful to the legitimate and orderly setting up of aircraft manufacture on a commercial basis, and it was largely because of the absence of this powerful help before the war that much of the languishing state of practical aeronautics in this country was due. The British government virtually has created and indirectly influenced the capital of this new industry, and it is fitting for it to continue its aid, just as years ago the torpedo and high-speed water craft were developed principally at national cost.

Reference to ball bearings prompts the remark that American interests are being increasingly felt here, and it looks as though the German pre-war monopoly here in these bearings is likely to be transferred, though not to the same extent, to the United States. Two or three makes are well known here, the tractors being the machines which seem to have drawn most attention to them. At present there seems to be a dearth of British makes of ball and roller bearings and an over-production of British magnetos.

Need National Highway System

One of the biggest, probably the largest development, concerned with the British motor industry, centers in the reorganizing of a national road system of motor transport. The railways, it is stated, will be nationalized, and virtually they are so already, in common with the canals or internal waterways, most of which the railway interests acquired years ago and have done nothing to develop or even continue the use of. Already the upkeep of the roads has become a national charge though the control was not unified.

Matters are shaping to a complete control by the state, both as regards the better use of the roads, for reducing congestion of railway traffic, and in respect of their cost of upkeep. Moreover it is known that there is a big scope of development of road traffic in perishable produce. Hitherto something like $95,000,000 was spent yearly on British roads by some 2500 local authorities, and now it is estimated that $500,000,000 is required to fit them to carry motor traffic of the sort intended.

Big Field for Road Development

A big field of development is promised which may be summed up as—

Extension of tractor farming and fruit and vegetable culture.

Increased speed of road traffic, especially for perishable stuff.

Development of rural and urban passenger traffic.

Encouragement for soldiers and others to settle on the land.

Encouragement of short and medium distance motor goods traffic of the heavier sort, this provision carrying with it the corresponding one of assured return journeys with adequate remunerative loads.

On this score it may be said that during the second half of the war period, government controlled efforts were made through the local chamber of commerce in some of the chief goods centers to develop motor road traffic for distances up to 100 miles. It has been stated by one traffic expert that railway transit is cheapest for distances exceeding 50 to 100 miles, and motor transit cheaper for distances under those limits, but this view may be modified where a better organization for return loads has been established on a sound basis. At the moment there is some important opposition to the government's scheme regarding the ministry of transport. there being a fear lest the railway interests may predominate in the working of the system.

Schemes for light railway lines corresponding to the roadside railways of Belgium are being discussed as supplementary means, and there is also the bigger prospect of a national electrification scheme to supply current at from one to two cents per unit from giant power stations erected near the coal pits and metallurgical gas furnaces. If a national system of motor road transport with roads adequate to the loads were available, direct use for 50,000 motor trucks could be found for the rural development hoped for.

There is and has been much criticism of the government's action in not declaring its intentions regarding the disposal of war trucks and in building a central truck repair depot near London. This depot has exceeded the provisional estimate of $5,000,000 by $3,750,000 and if completed doubtless will cost still more. It had its origin in two circumstances—the increasing number of idle vehicles "held up" for lack of repairing facilities, while the factories from which they came were daily adding to the number of new ones, and the issue accentuated by the mishap on the Western Front in March and the fears of a possible further "set back"; the effect being to reduce the available repair bases and depots.

The truck industry offered to deal with these vehicles at about 1/7 of the cost of the government scheme, under certain conditions, intended to recoup them for the outlay required. The virtual cessation of hostilities, of course, may, or may not, affect the utility of this scheme, but there can be little doubt that its necessity, if ever warranted on the grounds of urgency and economy, is now much reduced.

Both the manufacturers' and the public's points of view must be considered in this matter. The government has some 50,000 to 60,000 trucks in a generally repairable and usable condition. The manufacturers urge that they should have these vehicles of their own make returned to them to be repaired for re-sale to the public. One suggestion on this score was for the manufacturer to buy them back from the government, and another was for them to repair them at the national cost and be reimbursed at a scheduled rate.

From the public standpoint it is urged that these vehicles are national property and should not be accorded different treatment than is traditional with other army and public service stores listed for disposal.

Rigid Airships for Commercial Use

There has been published an official memorandum by the Air Ministry which sets out the merits of the airship against those of the airplane, regarded from the commercial standpoint. It is lengthy and its conclusions are in favor of the airship of the rigid type, on the following, among other, grounds:

Greater capacity and radius of useful flight of the airship for long distances and time in the air.

Greater capacity (the latest rigid German airship carrying over 38 tons gross, and has a cruising speed of 45 miles an hour, for 177½ hours, or seven days, and a gross distance capacity for 8000 miles in that period, with a maximum attainable speed of 77.6 miles an hour.

Relatively lower cost of the airship from the superior capacity denoted under the foregoing heads.

The objection that the airship is a fair-weather machine is replied to by the observation that during 1918 there were only nine days on which no airship flight could be made in the British Isles, which are recognized as one of the worst weather areas in the world.

Am-pe-co in New Plant

MARSHALLTOWN, IA., March 19—The American Machine Products Co. has moved into its 3-story plant and has changed its trade-mark from Ampeco to Am-pe-co so that the pronunciation cannot be mistaken.

A. & B. Mfg. Co. To Make Hurlburt Trucks

NEW YORK CITY, March 17—The affairs of the Hurlburt Motor Truck Co., which went into the hands of creditors last month, seem to be working out satisfactorily through an agreement submitted to the creditors in open court on March 14, whereby the American & British Mfg. Co., Providence, will be licensed to manufacture 1,000 Hurlburt trucks in consideration of which it will pay the receiver of the Hurlburt company approximately $176,000 in cash as the trucks are sold. The A. & B. company will also purchase the Hurlburt parts on hand which are roughly estimated to be worth $150,000. The 1000 trucks will be sold by the Hurlburt Sales Co., a new corporation to be formed for the purpose.

The creditor's committee, consisting of H. G. Banta, Edward C. Striffler, Inc.; M. L. Bayard, Keystone-Hindley Gear Co.; and E. H. Brodwell, Fisk Rubber Co.; has reported that the business operations of the Hurlburt company from January 22 to March 4 produced a revenue of $124,716 at an expense of $110,796.29, leaving a profit of $13,919.71 to which should be added profit on work in process of $9,811.60, and profit on the service department of $5,292.18, making a total profit for the period of $29,023.49. The committee has been unable to estimate the liabilities to date but indicates that they will be between $850,000 and $1,000,000. All claims must be sent to the creditor's committee at once for consideration.

Wire Wheel Brings Suit for Patent Infringement

NEW YORK, March 15—Suit has been brought by the Wire Wheel Corp. of America against the Budd Wheel Corp. The plaintiff claims infringement of the Pugh patent, No. 1,030,428, for the process of indenting and perforating the rims; of the Duffy patent, No. 1,125,498, for an automatic locking hub construction; of the Pugh patent, No. 903,608, for a protected lock, and of the House patent, No. 1,166,130, for a radially swinging lock.

The Wire Wheel Corp. of America has granted licenses to the Standard Roller Bearing Co., Philadelphia, which employs only the Pugh patent, No. 1,030,428; to the Hayes Wheel Co., Jackson, Mich., and the Dayton Wire Wheel Co., Dayton, which uses all four patents. The suit has been opened in the Eastern District of Virginia.

Old Chandler Officers Re-elected

CLEVELAND, March 17—The officers of the Chandler Motor Car Co. were reelected at the company's annual meeting as follows: President, F. C. Chandler; first vice-president, C. A. Emise; second vice-president, W. S. M. Mead; third vice-president, J. R. Hall; secretary, Isadore Grossman; treasurer, J. M. Regar. The only change in the company's directorate was the election of J. R. Hall, factory manager, to succeed J. V. Whitbeck, whose work as chief engineer interfered with his service as director. Mr. Whitbeck remains as chief engineer. Other directors, besides the officers, are: John Sherwin, Charles A. Otis and James A. Fayne.

Premier Motor Corp. Appoints Executive Committee

INDIANAPOLIS, March 18—A committee of three has been formed to take over the active management of the Premier Motor Corp. This committee is just another name for the manufacturing committee which has been in control of several phases of the company's activities for some time, and is composed of the same members, C. S. Crawford, F. T. Nehrbas and E. F. Schaeffer. The manufacturing committee has been changed to the executive committee, so that it can take over some of the duties of the company's president, A. C. Flowers, who is unable at this time to devote all of his attention to Premier affairs.

Buick Expansion

FLINT, March 17—The Buick Motor Car Co. has orders for every machine it can produce up to July 1. The company is now producing over 400 cars daily, and notwithstanding the set-back caused by war reconstruction hopes to equal its 1917 production of 135,000 cars. More men are now employed than when the armistice was signed.

A warehouse and loading dock have been completed, which can accommodate 1000 cars. By a double decking arrangement an additional 1000 machines can be stored. A new bronze and aluminum foundry is just being finished and will be in operation soon. The present foundry building, which adjoins the sheet metal plant, will be used for the further expansion of sheet metal work. A three-story building, designed and built for the manufacture of Liberty motors, has been completed, but inasmuch as peace has brought aircraft engine work to a halt, the new structure will house the tool designing department.

Automobile & Supply, Ltd., New Canadian Incorporation

TORONTO, March 15—W. S. Smith and associates took over stock, trade, assets and good-will of the Automobile & Supply Co., Ltd. The new firm is being incorporated with the name of the old company shortened to Automobile & Supply, Ltd., and continues at the present premises. Automobile & Supply, Ltd., are distributers for Pierce-Arrow, Paige, Hupmobile and Gray-Dort passenger cars and Federal and Pierce-Arrow trucks.

Tube Co. Buys $300,000 Site

DETROIT, March 18—The Detroit Seamless Steel Tube Co. has purchased a $300,000 site for its proposed $2,000,000 plant to be built within the next year. It is at West Warren and Wyoming Avenues and contains 60 acres.

Detroit Tractor Corp. Making $750 Tractor

DETROIT, March 18—The Detroit Culto-Tractor Corp., a newly organized concern, capitalized for $1,500,000, is about to place a $750 tractor on the market. The first machine has been completed and production will start on the first thousand about April 1. The company has completed arrangements for a manufacturing plant. H. M. Jerome, formerly chief engineer of the Allis-Chalmers Mfg. Co., is production manager as well as vice-president. S. R. DuBrie is chief engineer and secretary. Joseph A. Rowe is president, and E. H. Kramer treasurer.

Specifications of Tractor

The new tractor is a one-wheel drive machine. It is balanced by a side-wheel. The motor is V-type, 4 x 6, low compression, equipped with Bosch magneto, impulse starter, Stromberg carbureter, Pearce governor and air-washer. The gear ratio is 30 to 1, having a working speed of 2½ miles per hour with a drawbar pull of 1200 lb.

The water in the radiating tank is below the cylinders, so as soon as the motor stops all the water drains back into the tank. This eliminates all chance of the operator forgetting to drain the motor and prevents the cylinders from freezing. The arch straddling the rows has a clearance of 46 in. so corn that high may be passed over without injuring it. The total weight of the machine is 1800 lb. The company proposes to establish assembly plants in Seattle, Minneapolis, Kansas City and Dallas, and states that orders for 2500 machines are on hand.

Standard Parts Now in Own Building

CLEVELAND, March 18—On the first of the month the Standard Parts Co. moved its central offices, which include the executive and supervisory staff, bookkeeping, advertising and contracting departments, to the Standard Parts Building on Walnut Avenue at East Eleventh Street, which has just been completed.

National Wire Wheel Enlarges Plant

GENEVA, N. Y., March 17—The National Wire Wheel Works, Inc., maker of Pasco Wire Wheels, has arranged for additional factory equipment at Hagerstown, Maryland. With this and the present factory the company will be prepared by June 1 to manufacture 3000 wheels per day, and will arrange the equipment to still further increase this production as required. During the past year the concern has been practically entirely devoted to government production on airplane wheels and airplane parts. Direct factory selling branches have been opened in New York, Chicago, San Francisco, Kansas City, Dallas, Seattle and Minneapolis, as well as nine of the largest cities in Canada. Service stations have been equipped also in the larger cities.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

A. O. Smith Building Rumors

MILWAUKEE, WIS., March 17—That the A. O. Smith Corp. is preparing to double the size and capacity of its plant at 27th Street and Keefe Avenue is the basis of well-defined rumors current here. Color has been lent to the reports by applications made in the last few days to the public land commission of Milwaukee seeking the vacation of certain streets adjacent to the present Smith works. At the general offices of the company it was stated that no statement was available at this time. Reports concerning the project are to the effect that construction work will begin as soon as technical matters on street vacation are adjusted. It is said that the additions will be ready for occupancy by Sept 1, at which time the Smith working force will be increased to 4,500 or 5,000 operatives.

Madison to Make Trucks and Tractors

ANDERSON, IND., March 15—The Madison Motors & Tractor Corp., capitalized at $1,200,000, has been formed for the purpose of making tractors and trucks. This company is an outgrowth of the merger last fall of the Bull Tractor Co., Minneapolis, and the Madison Motors Corp., Anderson, formed for the purpose of making tractors and trucks for the United States Government during the period of the war. With the cessation of hostilities, however, the financial interests back of the companies determined to incorporate, and have added $500,000 of new capital, bringing assets and cash up to a sum in excess of $1,750,000. The company will build 1500 Bull tractors and 1000 Madison engines during the present year. C. E. Gibson is president, the directors including the president and L. N. Rosenbaum, manager; A. H. Ebert, C. H. Jockmus, eastern bankers, and J. F. Green, formerly president of the Bull Tractor Co.

U. S. Tractor Co. to Build Plant

MENASHA, WIS., March 17—The reorganization of the United States Tractor Co., Chicago, as a Wisconsin corporation, styled the United States Tractor & Machinery Co., preparatory to the transfer of the works and general offices to this city, has been completed. The new company has a capital stock of $250,000 and the following Menasha men are incorporators: Joseph G. Sailor, George G. Barlow and Dr. A. B. Jensen. The first unit of the new plant will be erected at once. It will be a 1-story fireproof building, 60 x 150 ft.

Nash Production Reaches 100 Mark

KENOSHA, WIS., March 15—The Nash Motors Corp. has completed its contract, which called for 1600 Quad trucks for the Government, and is winding up its war work. It is now devoting 90 per cent of its attention to its regular car production. In February 65 cars were produced daily. In March production will be increased to 90 cars, while the 100 mark will be reached early in April.

New Dodge Four-Door Sedan

NEW YORK, March 17—Dodge Brothers dealers are expecting deliveries within the next two weeks of a new four-door sedan which will sell for $100 more than the present two-door model, making the price of the new model $1,876. The chassis will be the same as at present.

Baker R. & L. Co. to Make Custom Bodies

CLEVELAND, March 17—The Baker R. & L. Co., makers of the Rauch & Lang electrics and the Owen magnetic car, has entered the custom body field. Several years ago this company established a special body department, but until recently has confined its efforts to special designs for manufacturers and dealers, individual custom work not being solicited. Now, however, facilities have been expanded, and the company is producing original designs to meet the wishes of individual owners.

Airplane Factory Will Close

MARBLEHEAD, MASS., March 17—The Burgess Co. airplane manufacturer, which employed 2000 people at its plant, will be closed Saturday. It turned out many of the training planes used by the government during the war.

Flechter Opens Los Angeles Branch

NEW YORK, March 15—L. V. Flechter & Co. has opened a branch in Los Angeles. It is in charge of M. J. Siebert, who for ten years has been road salesman for the Neptune Meter Co., a subsidiary of the Flechter company. J. J. Frank has been appointed district manager of sales for the Metropolitan district.

Frost Gear Adds

JACKSON, MICH. March 15—The Frost Gear & Forge Co., at the annual stockholders' meeting, increased its capital stock from $350,000 to $750,000, and approved plans for an addition, to be of steel construction, 75 x 150, with concrete basement, south of its present plant. The heat treating department will be located in the new building. All old officers and directors were re-elected.

Gillette Rubber Takes Eau Claire Mfg. Co.

EAU CLAIRE, WIS., March 15—The Gillette Rubber Co. has taken over the plant and business of the Eau Claire Mfg. Co. for manufacturing machinery and equipment for the tire trade.

General Motors Drive on Trucks

LANSING, MICH., March 18—W. C. Durant, head of the General Motors Corp., has disclosed the general plan for the expansion of that company's property in Michigan. It provides for improvement in the Olds Motor Works as well as the embodying of the Reliance Engineering Co. plant into the General Motors unit in this city. The nature of the product it will turn out has not been revealed.

A substantial part of the General Motors appropriation for 1919 will be spent here. The general plan calls for additions to present factory buildings to care for proposed increased production, and a great increase in the working force.

The General Motors Corp. will go in extensively for trucks this season, a manufacturing adjunct not heretofore attempted in the Olds Motor Works plant.

Making Ford Truck Bodies

OXFORD, MICH., March 18—Henry Houck & Son have organized here for the manufacture of truck bodies for Ford cars.

Elgin Distributing Co. Opens

NEW YORK, March 17—The Elgin Motor Distributing Co. has been formed to take over the Metropolitan distribution of the Elgin. It is located at Broadway and Fifty-seventh Street. The company consists of: President, M. W. Sanger; vice-president, E. L. Sanger; secretary, Henry Weiss; treasurer, Harry Sanger, and assistant secretary, David Sanger.

Velie Production Calls for 15,000

MOLINE, ILL., March 18—The Velie Motors Corp. is back from war to peace work, and is turning out on an average of 45 machines daily. The company aims to manufacture 15,000 cars this year.

Produce Six Roamers Daily

KALAMAZOO, March 15—The Barley Motor Car Co. is at present producing at the rate of 6 cars a day and plans to increase this production at once. Recently the company's buildings have been completely rearranged with this increase in production in mind.

Napoleon on 1 and 1½-Ton Trucks

TRAVERSE CITY, MICH., March 17—Active production of 1 and 1½-ton trucks has been started by the Napoleon Motors Co. The original plans of the company were to turn out about 864 Model 9 1-ton trucks and 136 Model 11 1½-tonners for 1919. The company, however, has now planned a larger production, ranging from eight to ten trucks daily, and, in order to facilitate this increase, has asked the Michigan Securities Commission for permission to sell the remaining $350,000 worth of the unsubscribed common stock. The 1-ton model sells for $1,285 and the 1½-tonner at $1,485. Both models have

overhead valve 35 hp. four-cylinder engines, 3½ by 5 in. With the exception of a difference in gear ratios, tire sizes and weight, the two models are alike. Other features include thermo-syphon cooling, Hotchkiss drive, Stromberg carbureter, Connecticut ignition and single unit Auto-Lite starter.

Republic Sales Amount to $15,749,628

NEW YORK, March 17—Gross sales of $15,749,628 are reported in the financial statement of the Republic Rubber Corp. for the year ended Dec. 31. The net amount carried over as surplus for the year is $602,913.

The balance sheet for 1918 and 1917 is as follows:

Assets

Land, buildings, equipment, etc.	$4,606,973	$5,323,540
Investments in other companies	375,836	128,370
Inventories	6,843,245	5,159,268
Cash	493,885	483,759
Accounts and notes receivable	2,043,036	2,445,582
Due from officers and employees	126,817	29,797
Deferred stock subscriptions	512,780	......
Stock contract with officers	......	100,000
Unadjusted balance of proprietary selling companies	......	232,618
Patents	2	1,054,601
Unpaid stock subscriptions	1,500,000	......
Liberty bonds	61,070	......
Miscellaneous investments	8,198	......
Deferred items	146,645	402,287
Expenses applicable to future operations	109,425	......
Total	$16,827,915	$15,359,822

Liabilities

Common stock	$1,634,010	$4,164,453
Preferred stock	8,867,400	6,755,400
Notes and accounts payable	6,088,718	3,291,715
Salaries and wages payable	......	115,355
Accrued taxes, interest and preferred dividends	173,634	114,745
Reserves	37,093	918,154
Other liabilities	27,060	......
Total	$16,827,915	$15,359,822

Dividends Declared

Willys-Overland Co., Toledo, regular quarterly dividend on preferred, $1.75 per share, payable April 1 to stockholders of record March 20.

Firestone Tire & Rubber Co., Akron, quarterly on common, $1.50 per share, payable March 20 to stockholders of record March 10.

The Stutz Motor Car Co. of America, Inc., declared its regular quarterly dividend of $1.25, payable April 1 to stockholders of record March 22.

The Michigan Drop Forge Co., Pontiac, has declared a monthly dividend for March of 15 cents a share on common stock, payable April 1, to common stockholders of record March 15.

Keystone Tire & Rubber Co., Erie, Pa., declared a stock dividend of 15 per cent, payable May 20 to stockholders of record May 1; also the regular quarterly dividend of 3 per cent on the common stock, payable April 1 to stockholders of record March 21.

Aviation School in Peru

WASHINGTON, March 18—A military aviation school will be established in Peru, according to a recent decree by the president of the country.

Studebaker Earns $3,884,195

Production Curtailed by Government Orders — New Plans Discussed

SOUTH BEND, March 17—The Studebaker Corp. of America shows net profits of $3,884,194 for the year ended Dec. 31, after all deductions were made, as compared with $3,500,741 in 1917.

The balance sheet of the Studebaker Corp., as of Dec. 31, 1918, compares as follows:

ASSETS

	1918	1917	1916
Plant, etc.	$17,922,076	$15,477,186	$13,437,983
Good will	19,807,277	19,807,277	19,807,277
Cash	2,875,005	2,528,555	3,196,703
Liberty bonds	980,750	......	......
Investments	796,371	847,672	1,142,044
Accounts and notes receivable	6,261,300	9,325,499	9,428,391
Due from U. S. and Brit. Gov.	8,205,829	......	......
Inventories	17,555,797	21,322,134	21,477,657
Deferred charges	268,918	358,684	235,493
Total	$74,673,923	$69,667,007	$68,725,549

LIABILITIES

	1918	1917	1916
Preferred stock	$10,775,000	$10,965,000	$10,965,000
Common stock	30,000,000	30,000,000	30,000,000
Notes payable	9,525,000	7,400,000	4,000,000
Deposits on sales contr.	214,352	......	......
Accounts payable	2,229,693	2,030,086	3,542,886
Advances	......	285,212	342,111
Dealers' rebate reserve	......	......	689,320
Federal tax reserves	637,754	588,589	......
Sundry creditors	771,149	543,389	1,964,694
Contingent reserves	1,358,237	1,358,237	1,358,237
Reserves for subcontractors' orders	749,101	......	......
Special surplus	2,835,000	2,548,654	2,548,654
Surplus	15,578,137	13,947,838	13,314,647
Total	$74,673,923	$69,667,007	$68,725,549

A. R. Erskine, president of the corporation, in his remarks to stockholders, explains the cutting down of production due to war orders, and the proposed enlargement of the company's plant. In 1918 the company produced 18,270 cars and 58,830 horse-drawn vehicles, of which about 50 per cent were delivered on war contracts. When the contract was given on May 18 for 155 millimeter shells at the rate of 4000 per day, $4,250,000 was provided for increased plant facilities. Complete war contracts called for:

Government	Ordered	Invoiced
United States	$30,792,221	$17,140,341
Sundry U. S. contractors	187,195	187,195
Total U. S.	$30,979,416	$17,327,536
British	18,946,135	14 962,385
French	1,351,250	1,351,250
Russian	3,801,551	3,801,551
Total	$55,078,353	$37,442,723

Of these government contracts, $8,200,000 is still due from the United States and Great Britain. From the standpoint of profits it is said that war contracts only netted 4.8 per cent. on sales.

Of the increased plant facilities undertaken to take care of war orders, one-half of a new machine shop was completed when the armistice was signed, two-thirds of a forge shop and the 8000-hp. power house. When finally completed the plant will have an annual capacity of 100,000 cars. In order to complete the new plant as soon as possible, the directors authorized the sale of $15,000,000 of 7 per cent ten-year serial gold notes, to provide funds for the floating debt of the company and to finance the plant extensions planned for this year. About one-third of the plant will be finished this year and by February, 1920, it will be producing 3000 cars a month.

The Detroit plants will continue in production of the more expensive cars and this city will take over the small model. The production schedule for 1919 calls for 40,000 cars. Plant No. 1, Detroit, heretofore used for car production, will be given over to manufacture, storage and shipping of parts. Plant No. 2, leased, used for parts storage only, will be given up. Plant No. 3, Detroit, will be used for car manufacture exclusively this year with castings, bodies, springs and some forgings supplied by the plant here. In the first quarter of this year 6500 cars will be produced and 4000 per month thereafter. Neither the company nor its dealers has a stock of cars on hand. By the end of December all war contracts were cancelled and the company is now back in steady commercial production.

Lee Rubber & Tire Profits $200,348

NEW YORK, March 17—Net sales of the Lee Rubber & Tire Corp. were $4,609,924, or $536,029 ahead of 1917, according to the financial statement of the company for the year ended Dec. 31, 1918. Net profits, after all the necessary deductions were made, amounted to $200,348, or $177,759 more than $22,589 made last year.

The balance sheet for the last three years compares as follows:

Assets

	1918	1917	1916
Cash	$379,977	$155,960	$258,560
Accounts receivable	622,214	576,670	358,191
Liberty bonds	47,220	......	......
Inventories	1,322,794	1,576,729	1,601,442
Working funds at branches	3,000	9,142	112,312
Accrued interest	367	....	....
Deferred Chrgs.	9,259	27,781	28,540
Tire Sales stock	....	500	500
Plant and equipment	1,124,955	1,346,704	1,206,229
Patents, trademarks, etc.	376,770	400,300	400.300
Total	$3,886,556	$4,094,147	$3,966,078

Liabilities

	1918	1917	1916
Capital	2,433,591	2,433,591	2,433,591
Notes and accounts payable	675,203	1,150,911	1,075,814
Rent rec'd in advance	....	500	....
Reserve for depreciation	291,661	231,661	191,661
Reserve for adjustment of tire claims	40,250	38,500	38,633
Employes stock option acct.	4,471	....	....
Income tax	......	....	9.982
Surplus	241,380	38,984	16.395
Total	$3,886,556	$4,094,147	$3,966.078

Dividend Besides Profit Sharing

TOLEDO, March 18—Following an announcement recently of a $400,000 dividend on preferred stock, payable April 1, Clarence A. Earl, first vice-president of the Willys-Overland Co., stated that this dividend has no reference to the company's recently inaugurated 50-50 profit-sharing policy.

He explains that the dividend represents a return on invested capital, and that the profits to be divided with employees are those in excess of such dividends, and also legitimate compensation for labor. The dividend is the regular quarterly payment and is to be $1.75 on all preferred stock of record March 20. The Willys-Overland Co., as already stated, proposes to distribute to its employees one-half of all its profits over and above a fair return on invested capital.

Hayes Sales Increased $230,820 Over 1917

DETROIT, March 18—The Hayes Manufacturing Co. has placed on sale $800,000 cumulative preferred stock, bearing 8 per cent interest. Dividends are payable quarterly on the first days of February, May, August, and November.

Sales for 1918 increased $230,820 over 1917. Last year's sales totaled $3,753,381 as compared with $3,512,460 for 1917. During the last of 1918 about 40 per cent of production was war business, all of which has now been closed. These contracts are now being settled. Completed orders now on the company books total $1,250,000 for delivery before May 15.

The balance sheet, as of Dec. 31, 1918, is as follows:

Assets

	Dec. 31, 1918	Aug. 31, 1917	Mar. 31, 1916
Inventories	629,413	889,589	771,375
Notes and accounts rec'ble.	573,590	379,364	469,592
Investments	......	39,317	95,675
Liberty Bonds..	73,500	......	......
Cash	129,726	......	......
Other assets.....	......	16,589	18.211
Total	$2,761,462	$2,226,983	$2,295,677

Liabilities

Capital stock...	$2,300,000	$1,500,000	$1,500,000
Accounts and notes payable..	225,141	607,455	358,698
Accrued payroll.	24,682	44,473	67,447
Reserve for depreciation	......	......	131,913
Surplus	241,638	75,055	238,619
Total	$2.761.462	$2.226.983	$2.295.677

—

Hart-Parr Report Shows $113,402 Net Loss

CHARLES CITY, IA., March 17—The annual report of the Hart-Parr Co. for the year 1918 shows net loss of $113,402. Comparison with previous reports is difficult because of a change in fiscal year, but the accomplishments of the company during the year were surprisingly favorable and are not all reflected in the balance sheet. Current liabilities were but 58.8 per cent of current assets, as compared to 79.7 per cent in the previous year. There was a charge off of $993,037 for bills receivable, obsolete inventories and other possible losses. Real estate was charged off to the amount of $577,649. The company has claims of $120,000 against the Government for work done during the year.

—

Nash Reclassifies Capital

KENOSHA, WIS., March 17—In accordance with action taken by stockholders earlier in the year to enable employees to participate in the ownership of the company, the Nash Motors Co. has amended its corporate articles to the effect of reclassifying certain shares. The total capitalization is not increased by the change. The authorized capital includes 198,000 shares of preferred, par value $100, and 52,000 shares of common, without par value, or a total of 250,000 shares.

United States Exports of Automobiles and Parts by Countries, During January, 1919

Countries	Commercial Number	Commercial Dollars	Passenger Number	Passenger Dollars	Parts of Dollars
Denmark	...	......	11	28,839	130
France	244	1,224,830	28	128,619	1,176
Greece	1	700	6	8,806	19,310
Iceland	...	......	...	......	584
Italy	...	......	2	2,000	33,822
Netherlands	...	......	6	27,618	......
Norway	7	15,800	...	......	10,477
Portugal	1	2,044	11	20,977	4,672
Spain	...	......	9	11,976	2,844
England	17	34,176	5	5,795	150,130
Scotland	...	......	...	......	2,335
Ireland	...	......	...	......	2,423
British Honduras	...	......	1	781	169
Canada	64	98,215	78	84,471	650,702
Costa Rica	...	......	...	......	4
Gautemala	4	9,900	5	4,300	368
Honduras	...	......	...	......	249
Nicaragua	1	4,000	...	......	1,507
Panama	1	1,430	3	2,180	2,740
Salvador	...	......	2	3,300	1,061
Mexico	73	113,019	163	217,934	50,853
Newfoundland	...	......	1	893	606
Barbados	1	3,000	1	1,800	1,785
Jamaica	...	......	3	5,400	5,133
Trinidad	...	......	1	1,276	4,677
Other British West Indies	...	......	1	936	14,122
Cuba	82	154,016	91	197,856	181,342
Virgin Islands	...	......	...	......	3,927
Dutch West Indies	...	......	...	......	184
French West Indies	2	1,233	2	2,250	14,440
Haiti	...	......	22	18,558	4,314
Dominican Republic	1	2,523	11	16,598	1,468
Argentina	28	60,800	232	247,388	345,854
Bolivia	...	......	...	......	5,592
Brazil	...	......	48	70,659	46,019
Chile	1	3,282	73	139,064	42,372
Colombia	...	......	17	29,068	9,757
Ecuador	2	3,900	2	2,925	1,339
British Guiana	...	......	2	2,250	6,587
Dutch Guiana	...	......	...	......	1,125
French Guiana	...	......	...	......	77
Peru	...	......	31	58,413	16,261
Uruguay	1	2,600	44	108,673	45,969
Venezuela	...	......	20	34,396	4,181
China	11	7,065	175	221,984	18,669
Chosen	...	......	...	......	4,970
British India	...	......	1	985	35,858
Straits Settlements	11	12,156	7	8,432	2,195
Other British East Indies	3	4,000	...	......	3,185
Dutch East Indies	16	38,554	79	116,632	42,649
French East Indies	...	......	4	5,652	1,138
Hongkong	...	......	16	22,033	3,176
Japan	273	462,217	229	310,684	121,665
Siam	...	......	6	7,808	850
Australia	8	18,635	308	282,053	223,330
New Zealand	18	35,497	72	79,333	16,844
Other British Oceania	...	......	3	2,535	344
French Oceania	...	......	...	......	618
German Oceania	...	......	...	......	667
Philippine Islands	13	32,116	156	211,147	148,208
British West Africa	...	......	1	1,075	2,872
British South Africa	23	29,886	129	144,614	82,637
British East Africa	...	......	19	15,415	4,038
French Africa	...	......	...	......	170
Liberia	...	......	...	......	13
Total	907	2,375,584	2,137	2,916,381	2,406,783

This table supplements the one which appeared in the March 6 issue of AUTOMOTIVE INDUSTRIES, *and gives figures for all of the individual countries including those generally grouped under the collective heading "Other Countries."*

20 Per Cent Increase in Hood Rubber Sales

BOSTON, March 19—Net sales of $22,341,081 are reported in the annual statement of Hood Rubber Co. for 1918. Compared with $18,573,765 in 1917, it is an increase of 20.2 per cent, and with $11,666,501 in 1916 is an increase of 91.5 per cent and 145.9 per cent over $9,083,693 in 1915. Of the 1918 sales about $5,000,000 were tires and $17,000,000 rubber footwear. Dividends of 12 per cent were paid on the $3,000,000 common stock in addition to 7 per cent on the $4,000,000 preferred, leaving $354,000 to be added to the surplus after deduction of taxes and depreciation. On Dec. 31 last the company had a working capital of $5,380,000, the largest in its history, and an increase of 64 per cent over 1916.

Following is its comparative balance sheet:

Assets

	1918	1917	1916
Plant	$4,000,000	$4,000,000	$2,900,000
Merchandise..	8,$12,862	4,075,021	1,846,308
Accounts receivable	1,202,350	4,323,933	3,381,810
Cash	1,022,877	930,680	318,180
Stocks in other companies ..	285,400	184,400	159,400
Patents	1,000	1,000	1,000
Liberty bonds	521.020	233 096	......
Total.....	$15,045,509	$13,748,131	$8,606,700

Liabilities

Common stock	$3,000,000	$3,000,000	$2,500,000
Prefer'd stock	4,000,000	4,000,000	2,750,000
Notes payable	4,725,000	4,150,000	2,280,000
Accounts payable	148,904	......	......
Surplus	2,666,605	2,312,291	1,076,700
Liberty bonds.	505,000	285,840	......
Total.....	$15,045,509	$13,748,131	$8,606,700

Manly Resigns from Curtiss

BUFFALO, March 18—Charles M. Manly, who has been vice-president of the Curtiss Aeroplane & Motor Corp., has resigned and will return to New York, where he will devote his attention to the development of the Manly Hydraulic Transmission System for motor trucks and will also open general engineering offices. Mr. Manly is president of the Society of Automotive Engineers.

J. O. Hofbauer, formerly general sales manager of the Paige-Detroit Co., New York, has joined the Lexington Motor Co., New York, in a similar capacity. A. J. Wise will succeed him at the Paige-Detroit Co.

Brigadier General B. P. Disque, who has had charge of spruce production for airplanes on the Pacific Coast, has been honorably discharged from the army.

Captain V. K. McBride, Ordnance Department, who was at Jackson during the war and transferred to Detroit after the armistice, has been made assistant to E. W. Hurd, sales manager of the Premier Motor Corp., Indianapolis.

Frank Shaw, traffic manager of the Harroun Motors Corp., has resigned. Previous to joining the Harroun Co. he was connected with the Studebaker and Maxwell companies.

Major H. W. Alden has received his discharge from the army and has returned to Detroit. He is vice-president of the Timken-Detroit Axle Co. and will be active as consulting engineer.

H. L. Frost has been appointed production manager of the Parrett Tractor Co., Chicago Heights, Ill. He was formerly connected with the Ford Motor Co.

J. W. Flannery will be Eastern representative of the Corcoran Mfg. Co., Cincinnati.

Robert E. Page, for four and a half years assistant foreign sales manager for Dodge Brothers, has joined the Commerce Motor Car Co., Detroit, to act as a district sales manager in Canada.

Claude Greenhoe has been appointed chief engineer of the motor bearings division of the Hyatt Roller Bearing Co., Detroit, to succeed R. G. Wells, who has been promoted to chief engineer of the Hyatt factories at Newark, N. J. Mr. Greenhoe comes to the Hyatt company from the Militor Corp. Prior to that he was connected with the Republic Motor Truck Co., the King Motor Car Co. and the American Gear & Mfg. Co.

H. A. Goddard, former representative in Michigan for the Standard Parts Co., has resigned to take charge of the sales and advertising of the Militor Motors Corp., Jersey City, N. J.

Men of the Industry

Changes in Personnel and Position

Pomeroy Leaves Vauxhall Motors for America

NEW YORK, March 18—Laurence H. Pomeroy, technical director of the Vauxhall Motors, Lt., Luton, England, and engineer of the Vauxhall automobiles, is expected to arrive in America in a few days. Mr. Pomeroy has practically severed connections with the Vauxhall company, but retains the right to manufacture his design of car in the United States. His latest innovation is a valve-in-the-head 4-cylinder design known as the 30-98 Vauxhall, which has quite extraordinary performance records.

Mr. Pomeroy's paper on the value of valve-in-the-head engine design appeared in AUTOMOTIVE INDUSTRIES in two installments in the issues of Feb. 20 and 27. It was presented before the British Institution of Engineers.

J. H. Malone, advertising director of the Chilton publications, Philadelphia, has resigned to become vice-president and general manager of the William F. Hudson enterprises, Philadelphia, which include the Hudson Motor Specialties Co., Hudson Motor Axle Co., Precision & Thread Grinder Mfg. Co., and the Hudson Peck Machine Products Co.

S. A. Host has resigned as director of publicity of the Lincoln Highway Assn. to become connected with the Lincoln Motor Co., Detroit, under Frank G. Eastman, advertising manager.

Conroy Fiero, Washington, D. C. representative for the Buda Co., Harvey, Ill., has recently gone to Europe and will visit England, France, Belgium, Italy and, if possible, Russia, to investigate conditions for marketing Buda engines.

J. J. Callahan is in charge of the eastern branch office of the Moltrup Steel Products Co., Beaver Falls, Pa., which has recently been opened in the Woolworth Building, New York.

J. E. Duffield has been elected vice-president in charge of sales of the Essenkay Products Co., Chicago, and will assume his new duties immediately. Until recently he was general manager and treasurer of the Bailey Non-Stall Differential Corp.

M. H. Blank has been appointed chief engineer of the Lynite Laboratories of the Aluminum Castings Co., Cleveland. He was recently honorably discharged as captain in the army. Previous to entering military service he was assistant engineer of the Premier Motor Corp.

Wills Out of Ford

DETROIT, March 17—C. Harold Wills, one of the designers of the Ford automobile and a member of Henry Ford's organization for 18 years, has severed his connection with that company and will engage in business for himself. He was chief engineer of the Ford Co. and became associated with Mr. Ford two years before the present company was organized. He expects to open temporary offices here. The nature of his new business is not announced, but it is understood he will remain in the automotive field.

Danish Firm to Represent American Industries

NEW YORK, March 15—Paul Fridericksen, representing Bendix Bros., Copenhagen, Denmark, is in America arranging for certain lines of motor cars, tractors, trucks and accessory representation. Bendix Bros. is a large firm which has handled farm machinery in Denmark, and has distribution through 300 or more dealers. Mr. Fridericksen is looking for two lines of motor cars and several accessories, such as tires, ignition apparatus, etc.

Frank W. Hammond, formerly with the Bates Tractor Co. and for a number of years connected with the sales department of the Lansing Wagon Co., has been placed in charge of the passenger cars agencies in eastern territory by the Reo Motor Car Co., with headquarters in Lansing.

John O. Munn, assistant advertising manager of the Willys-Overland Co., Toledo, has become advertising manager and assistant sales manager of the Republic Motor Truck Co., Alma, Mich.

E. S. Leonard, Detroit, connected with the Garford Motor Truck Co., Lima, O., has been appointed sales manager of the White motor truck division of the Simons Sales Co., Detroit.

Fred C. Warner, president of the Oakland Motor Car Co., Pontiac, has been elected president of the Chamber of Commerce of that city.

Ralph C. Chestnutt, formerly with the Willys-Overland Co., is now assistant chief engineer for the North American Motors Co., Pottstown, Pa.

E. W. Snyder, for many years with J. B. Sipe & Co., is now with the Hilo Varnish Corp., Brooklyn. He will make his headquarters in Pittsburgh and represent the company in western Pennsylvania, eastern Ohio and northern West Virginia.

$2000 for Heinze Tractor

BOYNE CITY, MICH., March 17—The retail price of $2000 has been fixed on the Heinze four-wheel drive tractor by its manufacturer, the Traction Engine Co. of this city.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb. .... .02 -.03
Phosphoric (85%).. .35 -.39
Sulphuric (60%), lb. .008

Aluminum:
Ingot, lb. .... .31
Sheets (18 gage or more), lb .... .42
Antimony, lb. ...... .07 -.07⅛

Burlap:
8 oz., yd.......... .06¼
10½ oz., yd........ .08½

Copper:
Elec., lb. .... .14⅝
Lake, lb. .... .15½

Fabric, Tire (17¼ oz.):
Sea Is., combed, sq. yd. 1.50
Egypt, combed, sq. yd. 1.25
Egypt, carded, sq. yd. 1.15
Peelers, combed, sq. yd. 1.10
Peelers, carded, sq. yd. 1.00

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
Ceylon, lb. ....90 .22
Madagascar, lb. .... .10 -.15
Mexico, lb. .... .03¾

Lard:
Prime City, gal...2.15-2.20
Ex. No. 1, gal.....1.10-1.15
Linseed, gal. 1.45-1.48

Petroleum (crude):
Kansas, bbl. 2.25
Pennsylv'a, bbl.......4.00
Manhaden (dark), gal. .... .95

Lead, lb. .... .05 -.05¼

Leather:
Hides, lb. .... .24 -.39½

Nickel, lb. .... .40

Oil:
Gasoline:
Auto, gal. .... .24½
68 to 70 gal...... .30½

Rubber:
Plantation:
First latex pale crepe, lb. ...... .53
Brown crepe, thin, clear, lb. ...... .47
Smoked, ribbed sheets, lb. ..... .52

Para:
Up River, fine, lb. .56
Up River, coarse, lb. .... .34½

Island, fine, lb...... .48

Shellac (orange), lb. .60 -.64

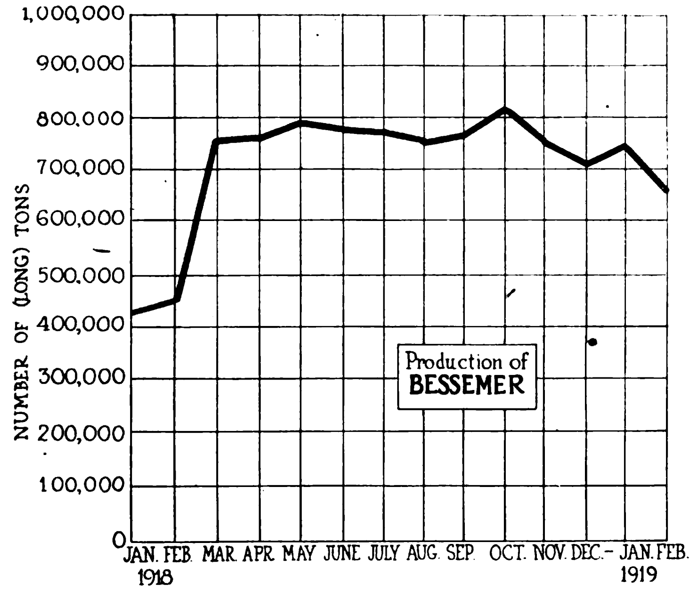
Spelter, lb. .... .06¼-.06½

Steel:
Angle beams and channels, lb. .... .03
Automobile sheet (see sp. table).
Cold rolled, lb..... .0625
Hot rolled, lb...... .039

Tin .... .71 -.72

Tungsten, lb. 1.50-2.10

Waste (cotton), lb.. .12¾-.17



Production of Bessemer has been well maintained during the period from March, 1918, to January, 1919, inclusive. February, 1919, although showing a drop, is distinctly better than February, 1918

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock................	$5.95	$5.85
Automobile body stock, deep stamping.	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6 35
Hood, flat, fender, door and apron, or splash guard stock..............	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping........	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent. less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close March 15

	Bid	Asked	Net Ch'ge
Auto Body Company	8	9¼	+1¼
Briscoe Motor Car com....	10	..	..
Briscoe Motor Car pfd....	50	65	+10
*Chandler Motor Car......	126⅞	128⅞	+2⅞
Chevrolet Motor Car......	189	191	+25
Cole Motor Car Co........	90	105	..
Continental Motors com..	7¾	8¼	..
Continental Motors pfd....	97	..	..
Edmunds & Jones com....	15	20	..
Edmunds & Jones pfd.....	75	90	..
Electric Storage Bat......	59	62	+7
Federal Motor Truck......	35	37	+3
Fisher Body Co., com.....	57	57½	+7
Fisher Body Co., pfd......	92	97½	—3
Ford Motor of Canada.....	300	310	..
General Motors com......	165½	166½	+9
General Motors pfd.......	87⅝	89⅝	+2¾
Hupp Motor Car com.....	8¾	9½	+1½
Hupp Motor Car pfd......	90	..	..
Kelsey Wheel Co. com.....	40	44	..
Kelsey Wheel Co. pfd.....	94½	96½	..
Manhattan Electric S. com.	..	48	..
Maxwell Motor com.......	39½	40½	+4
Maxwell Motor 1st pfd....	67⅞	68⅞	+6¾
Maxwell Motor 2d pfd.....	30½	31½	+4¼
McCord Mfg. com.........	30	34	..
McCord Mfg. pfd..........	91	94	—2
Mitchell Motor Co....... ..	27	32	..

	Bid	Asked	Net Ch'ge
Motor Products Corp.......	..	35	..
Nash Motors Co. com.....	215	230	..
Nash Motors Co. pfd.......	95¼	100	..
National Motor Co.........	15	20	..
Packard Motor Car com...	114	118	..
Packard Motor Car pfd...	100	102	..
Paige-Detroit Motor com.	28	29	..
Paige-Detroit Motor pfd..	8¾	9¾	..
Peerless Motor Truck......	23	24	+2
Pierce-Arrow M. Car com.	44⅜	45⅝	..
Pierce-Arrow M. Car pfd.	104½	106	+1
Premier Motor Corp com..	5	..	..
Premier Motor Corp. pfd..	..	75	..
Prudden Wheel Co........	18	19	+ ½
Reo Motor Car Co........	23	24	+ ½
Republic M. Truck com...	35½	37½	..
Republic M. Truck pfd....	87	90	..
Saxon Motor Car com....	9¼	11¼	— ⅜
Scripps-Booth Corp.	21	25	..
*Stewart Warner S. Corp..	90	92	— ½
Stromberg Carburetor Co..	40	40¼	+1
Studebaker Corp. com.....	63	64	+2¾
Studebaker Corp. pfd......	94	97	+4
Stutz Motor Car Co.......	52½	53½	+3
United Motors Corp.......	43¾	44¾	+1½
*White Motor Co..........	53½	54½	+ ½
*Willys-Overland com.....	27¼	28¼	..
Willys-Overland pfd.......	92	93	+ ½

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co...........	74¼	75	..
*Firestone T. & R. com....	142	147	+2
Firestone T. & R. pfd.....	99	101	..
Fisk Rubber Co. com.....	104½	106½	— ½
Fisk Rubber Co. 1st pfd...	100	105	—5
Fisk Rubber 2d pfd.......	101	105	+1
Fisk Rub. 1st pfd. conv...	99	101	—2
Goodrich, B. F., Co. com..	68¾	69¾	— ⅜
Goodrich, B. F., pfd......	106¼	106½	..
Goodyear T. & R. com....	275	280	+20
Goodyear T. & R. 1st pfd..	106	107	+1
Goodyear T. & R. 2d pfd..	106½	107½	+1½
Kelly-Springfield com.	119½	120½	—3
Kelly-Springfield pfd.	95	97	..
Lee Tire & Rubber Co....	25	26	— ½
Marathon Tire & Rubber..	55	75	..
Miller Rubber Co. com....	166	170	..
Miller Rubber Co. pfd.....	101	102	..
Rubber Products Co......	127	130	+5
Portage Rubber Co. com..	160	164	+28
Swinehart T. & R. Co....	80	85	..
U. S. Rubber Co. com......	82½	83	..
*U. S. Rubber Co. pfd.....	111½	112½	..

*Ex dividend.

Calendar

ENGINEERING

April 2—Minneapolis Section, S. A. E. — Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

SHOWS

March — Scranton, Pa. Thirteenth Regiment Armory, Scranton Automobile Assn.
March 15-22 — Boston, Mass. Boston Automobile Dealers' Assn. Passenger cars only. Chester I. Campbell, Manager.
March 15-22 — Harrisburg, Pa. Harrisburg Motor Dealers' Assn., Overland Warehouse. J. Clyde Myton, Manager.
March 17-22 — Great Falls, Mont. Montana Automobile Distributors' Assn.
March 17-22—Philadelphia, Pa. Motor Truck Assn., Commercial Museum.
March 18-22 — Zanesville, O. Third Annual, Zanesville Motor Car Dealers' Assn., City Hall and Market House. Edward B. Roemer, Manager.
March 19-22 — St. Joseph, Mo. St. Joseph Automobile Show Assn., Auditorium. John Albus, Manager.
March 19-22—Norfolk, Neb. Norfolk Automobile Show Assn.
March 19-22—Warren, Pa. Third Annual, Warren Automobile Dealers' Assn.
March 19-22—Charleston, W. Va. Kanawha County Auto Trade Assn., Armory. John B. Crowley, Manager.
March 20-22 — Champion, Ill. Truck show, Gymnasium of University of Illinois.
March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.
March 24-26 — Harrisburg, Pa. Trucks, Harrisburg Motor Dealers' Assn.
March 24-29—Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.
March 24-29—Utica, N. Y. Utica Motor Dealers' Assn.
March 25-29—Wilmington, Del. Fourth Annual, Wilmington Rink.
March 26-27 — Clinton, Ia. Fourth Annual Clinton County Automobile Dealers' Assn.
March 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.
March 27-29—Holdredge, Neb. Third Annual, Holdredge Automobile Dealers' Assn.
March 28-30—Peru, Ill. Illinois Valley Auto Show.
Third week March—Trenton, N. J. Trenton Auto Trade Assn. John L. Brock, Manager.
Last of March — Harlan, Ia.* Southwestern Iowa Motor Exhibit.
March 29-April 5 — Passenger Cars. April 8-12—Trucks, Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkman, Manager.
March 31-April 5—Cumberland, Md., Automobile Dealers' Assn., Armory.
March 31-Apr. 5—New Orleans, La. Henry B. Marks, Manager.
April 1-5—Denver, Col.—Denver Automobile Trades Assn. Stadium.
April 3 — Macon, Ga. Motor Truck Demonstration, Macon Automobile Chamber of Commerce.
April 5-12 — Bridgeton, N. J. Fourth Annual, Automobile Dealers' Assn.
April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.
April 8-12—Deadwood, S. D. Seventh Annual, Cars and Tractors, Deadwood Business Club.
April 16-19 — Waynesburg, Pa. Automobile Dealers' Assn. of Greene Co., Armory. Frank L. Hoover, Mgr.
April—Little Rock, Ark. Second Annual, Little Rock Automobile Dealers' Assn., Liberty Hall.
May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.
Not decided—Bridgeport, Conn. Auspices of City Battalion. B. B. Steiber, Manager.
Not decided—Indianapolis, Ind. Indianapolis Auto Trade Assn. John B. Orman, Manager.
June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.
*Oct. 15—Paris. Grand Palais. International Automobile Mfrs. Congress.
November—London — Olympia—International Automobile Mfrs. Congress.

TRACTOR SHOWS

March 26—Elmwood, N. J., Tractor Demonstration.
April 15—Walla Walla, Wash. Sectional Tractor Demonstrations.
May 5—Sacramento, Cal. Sectional Tractor Demonstrations, Demonstration Field.
June — Denver, Col. Sectional Tractor Demonstrations.
July—Wichita, Kan., Automotive Committee of National Implement Assn.
Aug.—Aberdeen, S. D. Sectional Tractor Demonstrations.

RACES

†March 23—Los Angeles. Ascot Speedway Assn., Ascot Speedway, 150 miles.
†May 17—Uniontown, Pa., probably 112½ miles.
†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.
*July 5—Cincinnati, O., Speedway.
*July 19—Uniontown, Pa. Speedway race.
*July 26—Sheepshead Bay, L. I. Speedway race.
*Aug. 22-23—Elgin, Ill. Speedway.
*Aug. 23—Sheepshead Bay, L. I. Speedway race.
*Sept. 1—Uniontown, Pa. Speedway race.
*Sept. 20—Sheepshead Bay, L. I. Speedway race.
*Oct. 1—Cincinnati, O. Speedway race.

†Sanctioned.
*Tentative dates.

CONVENTIONS

April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.
April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

Foreign Trade Opportunities

WASHINGTON, March 15—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has received requests for automobile or parts agencies of business from individuals and companies in foreign countries. These are listed below. For further information address the Bureau of Foreign and Domestic Commerce and specify the Foreign Trade Opportunity number.

A man in France desires an agency for the sale of motor cars. Correspondence may be in English. References have been supplied. No. 28670.

A firm in Norway wishes to purchase automobiles and supplies, and rubber goods. Payment, banker's confirmed credit in New York. Correspondence may be in English. References supplied. No. 28680.

A man in Algeria desires an agency for the sale of medium grade automobiles selling for about $1700. Correspondence may be in English. No. 28682.

A man in Mexico desires the sole agency for the sale of automobiles and supplies. References have been filed. Foreign Trade Opportunity No. 28364.

A man in France desires an agency for the sale of farm tractors. Correspondence should be in French. No. 28366.

An agency is desired by a man in Venezuela for the sale of automobiles. References have been filed. No. 28367.

A man in France desires an agency for the sale of motor cars and accessories. Correspondence should be in French. References have been filed. No. 28372.

A company in Australia wishes to secure an agency for the sale of all motor accessories and supplies. References have been filed. No. 28375.

An agency is desired by a man in France for the sale of farm tractors. Correspondence may be in English. References have been filed. No. 28384.

A man in France desires an agency for the sale of farm tractors. Correspondence may be in English. References have been filed. No. 28386.

An agency is desired by a man in Algeria for the sale of automobiles and farm tractors. Correspondence may be in French or Spanish. References have been filed. Foreign Trade Opportunity No. 28473.

A business man in France desires to purchase separate parts for engines and motor cars; and motor car and truck chassis. Correspondence may be in English. References have been filed. No. 28476.

A man in Spain desires to secure a general agency for the sale of farm tractors of from 10 to 12, 14 to 16 and 18 to 20 hp., operated by petroleum, gasoline and wood fuel. Quotations should be given f.o.b. New York. Correspondence should be in Spanish. No. 28477.

A man in Belgium wishes an agency for the sale of automobiles, trucks and farm tractors. Correspondence should be in French. No. 28485.

To Dispose of Surplus Acids

WASHINGTON, March 15—Surplus stocks of acids owned by the War Department are to be disposed of in co-operation with the acid committee and in such a way as not to affect the market. Approximate quantities held by the Government are as follows: Sulphuric acid, 4400 tons; oleum, 300 tons; nitric acid 1000 tons; mixed acid, 2600 tons; spent acid, 700 tons.

AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Vol. XL
Number 13

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MARCH 27, 1919

Fifteen cents a copy
Three dollars a year

Stewart CUSTOM BILT NECESSITIES

"They're More Than Accessories"

2847

CAUTION

This tag is attached to all genuine Stewart Repair Parts.

LOOK FOR IT!

If you don't find this tag, you are getting imitation substitute parts. Refuse to accept them.

The use of imitation parts on any Stewart Product, at our option, invalidates the Stewart guarantee.

For your own protection demand genuine Stewart Parts.

STEWART-WARNER SPEEDOMETER CORPORATION

"Handle Only Genuine Stewart Parts and It Will Be Very Profitable"

—Miss Stewart Custombilt

"The only kind of repair parts for Stewart Products that will give genuine Stewart Service are **genuine** Stewart Parts.

"Due to the fact that over 4,000,000 Stewart Products are in use, it is natural that the parts business has become quite large. So much so, in fact, that several outside firms have been tempted to offer inferior imitations of Stewart Parts.

"Now, I know that consciously you would not consider for one moment giving any one of your customers a counterfeit, that can never be as good as the original. You value their trade too highly, for your success depends upon its continuance.

"However, that's exactly what you do when you sell them any part for a Stewart Product that is not made by the Stewart-Warner Speedometer Corporation, that does not bear the name Stewart and has not attached to it one of our red tags.

"When a customer comes in, needing some part for a Stewart Speedometer, Vacuum System, or any other Stewart Product, it's natural that he expects to get a genuine Stewart Part. If you offer him anything else an explanation is necessary, time is lost for you and there is a mighty big chance of your **customer** being lost for you.

"Now, I am personally interested in every single one of my 4,000,000 Stewart users. I am going to make it my business to see that they get only genuine Stewart Parts. So in all of my big Saturday Evening Post ads this year, I am going to use perfectly good and valuable space to tell them to demand the genuine, with the red tag attached.

"Here's a real tip—if you handle only the genuine, you can make a mighty valuable business out of the sale of Stewart Parts."

Yours for the genuine always,

Miss Stewart Custombilt

(Posed by Miss Marilynn Miller)

The Stewart-Warner Speedometer Cor'n, U. S. A.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL — NEW YORK—THURSDAY, MARCH 27, 1919—CHICAGO — NO. 13

New Models at Lyons Fair

Citroen, Fiat and Delage Have Post-War Types Ready—Fiat Four-Cylinder 2.5 by 4.3 Gives 34 M.P.H.—Citroen Four, 2.5 by 3.9 Four-Cylinder, for $1470

Electric Equipment, Detachable Cylinder Heads, Unit Engine and Gearbox Are Features—Both Production Models

By W. F. Bradley

LYONS, FRANCE, March 10—Some idea of the several post-war models to be shown at the Lyons Fair has been obtained by a recent visit to French and Italian factories, and while the majority of the French and Italian makers have not post-war models ready, the work of Fiat and Citroen is indicative of what may be expected. The new Fiat, with 105 in. wheelbase, has a touring equipment weight of 1800 lb. The four-cylinder engine is designed to give 23 hp. at 2800 r.p.m.

Andre Citroen has created nothing short of a sensation in Paris manufacturing circles by his determination to produce 100 cars per day. He is one of the first to have produced a car with left-hand control and the gearbox controls mounted in the center.

The size of the small Fiat and of the Citroen is very nearly the same. Both use a four-cylinder engine of the L-head block type. The Fiat has cylinders 2.5 by 4.3 and Citroen cylinders are 2.5 by 3.9. The Fiat uses a 50-in. thread.

Editor's Note—W. F. Bradley, European correspondent for AUTOMOTIVE INDUSTRIES, *has in the last three months visited most of the French automobile factories. Previous to the opening of the Lyons Trade Fair he obtained engineering details and photographs of the new Fiat, the new Citroen and the post-war Delage. Mr. Bradley's cable message from Lyons on the opening of the fair appeared in* AUTOMOTIVE INDUSTRIES *March 6, page* 509.

Fuel consumption has been looked after in both of these models. The Citroen has a fuel consumption of 31 miles to the American gallon, traveling at 40 m.p.h.

Four Fiat Models

Four models are comprised in the Fiat post-war program. These cars, which are all new design, comprise a light four, a medium four, a good-quality six, and an ultra-select six. The first model to be offered to the public is the light-weight four, officially known as Model 501, which was uncovered at the trade fair here.

It is evident that Fiat has profited much by war experience, for, while continuing to remain in the high-class field, changes in design have been made in order to simplify construction, to reduce upkeep and to get weight down as low as possible.

Weighs 1800 Pounds

Model 501 is a four-seater with a four-cylinder engine, 65 by 110 mm. (2.5 by 4.3 in.) bore and stroke, the reduced track of 50 in., wheelbase of 105 in., and total weight with full touring equipment of 1800 lb. The car is offered complete with electric lighting and starting, detachable steel spoke wheels of 700 by 90 mm., speedometer drive off gearbox, tools, and all accessories.

A speed of 44 miles per hour is claimed for this car with full touring equipment. This is not exaggerated,

tests showing that the average car can beat this figure. The engine revolves up to 2800 r.p.m., at which speed the power developed is 23. The power curve, however, shows that at 1400 r.p.m. the engine develops more than 15 hp., and that the maximum torque is obtained at 1000 r.p.m. With a final gear ratio of 1:4.8, the car is an excellent performer at moderate engine speeds and has a very lively pick-up. Standard bodies are built in the Fiat shops, but provision is made for custom bodies when desired.

The engine is a unit construction with clutch and gearbox, this unit being secured by three-point suspension: to the side frame members and to the forward transverse frame member. Cylinders are L-head type, moderately offset, with waterjacket extending to the base of the casting, and are mounted on an aluminum base chamber divided horizontally. The lower portion of the base chamber acts as an oil reservoir. The second housing bolted to the engine contains the clutch, the gearset and the universal.

Detachable cylinder heads make their appearance for the first time on a Fiat. Experiments, however, extend back nearly 3 years, and it was only after exhaustive comparative tests that the engineers decided the balance of advantages lay with the detachable rather than with the fixed head.

The forward transverse shaft driving magneto at one end and water pump at the other is an old Fiat feature which has been maintained.

The adoption of chain drive for the camshaft and the electric generator is new, however. There is a single chain for these three shafts, adjustment being made by rotation of the electric generator, the shaft of which is set eccentrically.

Three-Bearing Crankshaft

Although such a small and compact engine, the crankshaft, which has a diameter of 1.4 in., is carried in three plain bearings. Connecting rods are I-section, machined all over, and pistons are cast iron, with three compression rings and a bevelled oil return groove. The skirts of the pistons are drilled considerably. The wrist pin is hollow and is locked in the connecting rod, the piston being equipped with bronze bushes.

Lubrication is under pressure through a hollow crankshaft to the main bearings, the connecting rod bearings and to the camshaft bearings. Formerly the oil pump was on the end of the camshaft; now it is in the base of the engine, but driven off the camshaft. In addition to a fine gauze filter the whole length of the base chamber, there is a filter around the pump. There is a dashboard pressure indicator, as well as a float in the center of the base chamber, with dial on the side of the engine.

Electric Equipment Mounting

An interesting feature of the engine is the neat manner in which the electric generator and the starting motor are mounted. Both of these are of cylindrical section mounted in cylindrical extensions of the crankcase casting. The generator is on the upper portion of the engine base chamber, just below the water pump. The bolt which passes through the split portion of the housing serves not only to hold the generator in position, but also acts as chain adjuster. The thread on this bolt meshes with a worm cut on the circumference of the generator, and serves to rotate the latter, thus tightening or slackening the driving chain, as the case may be. When the correct tension has been obtained, the whole is locked in position by a nut on the bolt.

The electric starting motor is carried in a similar manner on the lower portion of the engine base chamber.

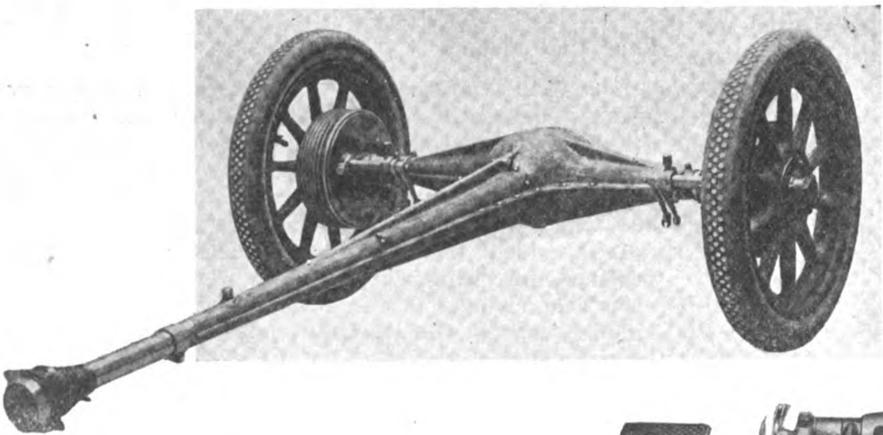
Unit Powerplant Design

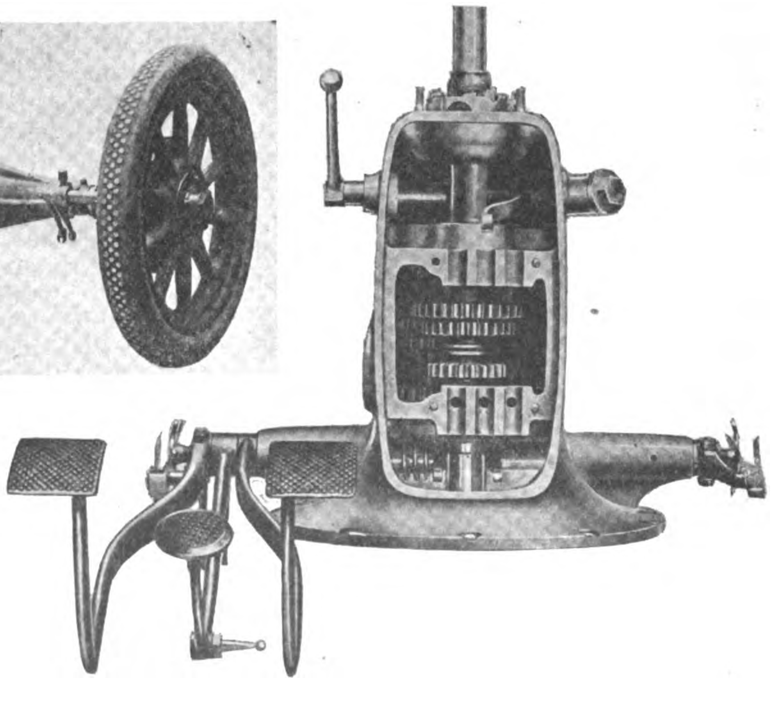
The second portion of the unit is an aluminum casting which contains the clutch, the gears and the universal, and has all the pedals mounted on it. An interesting feature of this housing is that it is divided into three distinct compartments. The forward compartment, which is 13 in. overall length, contains the clutch and the clutch withdrawal mechanism.

In the center is the gearbox proper, which is 6 in. long and $5\frac{1}{2}$ in. wide.

The rear compartment receives the universal joint and the selector lever for the change speed mechanism. A lid, held down by two nuts, uncovers the entire box. But inside this there is a second lid over the gearbox only, this lid holding in position the three selector rods. On the side of this casting there is a filler by means of which oil is fed to the universal.

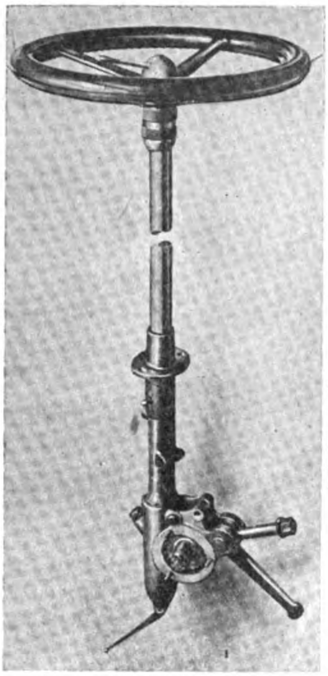
For a number of years the Fiat rear axle design has



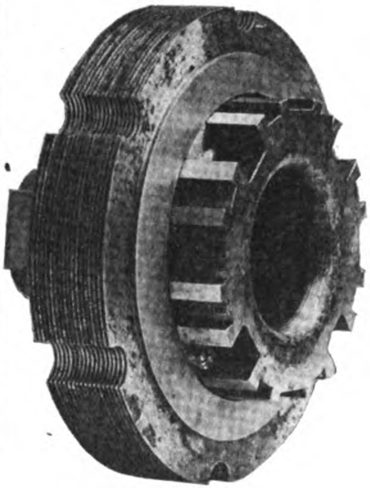


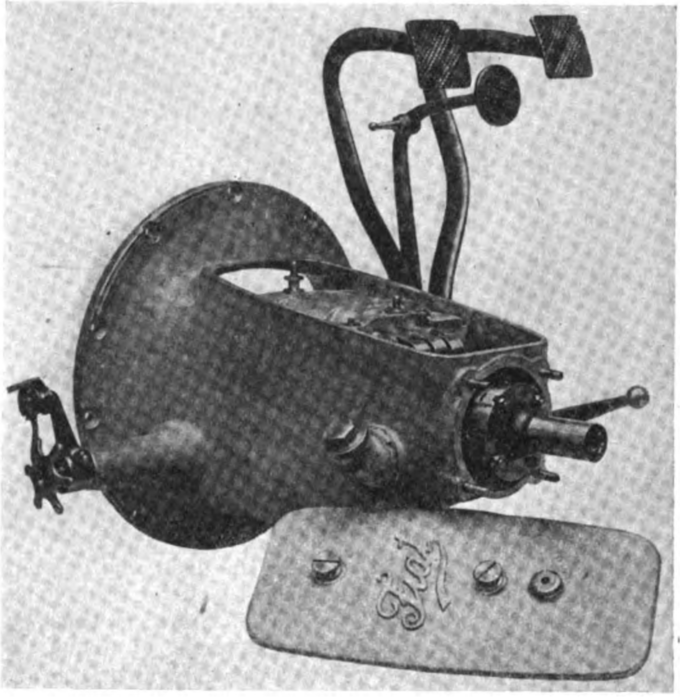
Above—Simple but rugged construction of the rear axle housing and brakes of the new Fiat

Right—Gearset and universal joint housings on the new Fiat, showing also the method of attachment of the clutch, brake and accelerator pedals. Note filler on the gearbox



Left — Fiat steering column with carbureter controlled by an outer revolving sleeve
Lower—Type of disk clutch used on the new Fiat
Right—Combined gearset, clutch and housing





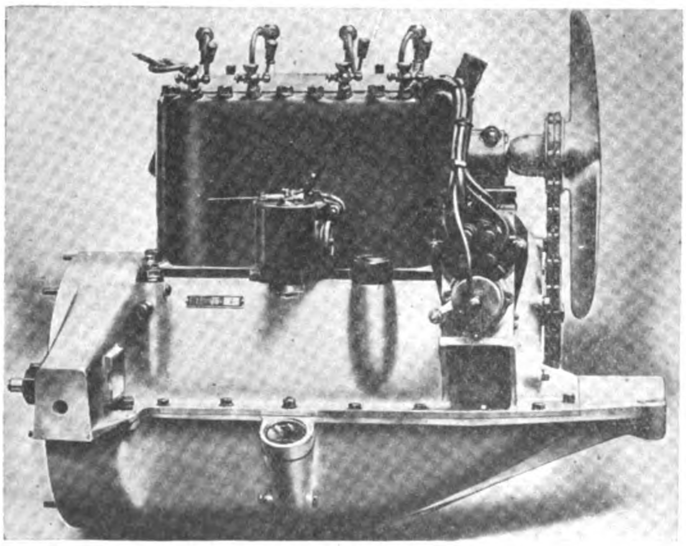
been a couple of steel stampings bolted together in a horizontal plane. These two stampings are retained, but instead of being bolted they are welded together, and a big cover plate is fitted on the rear of the differential housing. This type of axle is very light and possesses considerable strength. Formerly it had the disadvantage of calling for considerable labor in dismounting. Now it is only necessary to disconnect the universal and pull the differential shafts out of engagement in order to withdraw the entire differential, crown wheel and pinion and propeller shaft. The differential shafts carry the load as well as transmit the drive. As the propeller shaft is of considerable length, there is a white metal bearing at the center of its length, merely to steady it and prevent whip when taking up the drive.

Brakes are side by side on ribbed rear wheel drums, the diameter of the drums being 11½ in. and the width 3.1 in. Brake liners are cast iron on aluminum.

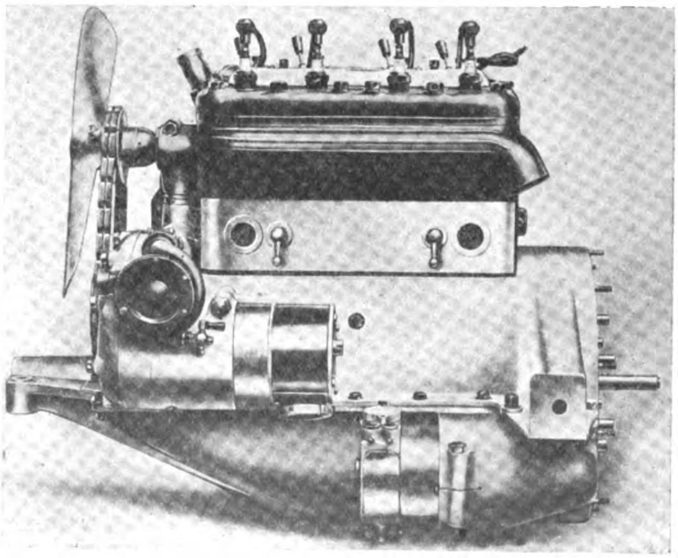
Final drive is by means of spiral bevel cut on Gleason machines. Fiat has been making use of this for about 3 years on all staff cars supplied to the Allied armies, and has decided on its adoption for all touring models.

Changes have been made in the attachment of the propeller shaft housing. Formerly this terminated in a heavy fork, which was connected up to a heavy cross-frame member. The end of this housing now terminates in a sphere, which is bolted up to the end of the gearbox. The drive and the torque are taken through this organ, the springs, which are underslung semi-elliptics, having no other duties than to take care of the suspension of the car. Rear springs are 2 in. in width and are fitted with a reversed leaf above the main leaf, this acting as a damper to prevent rebound.

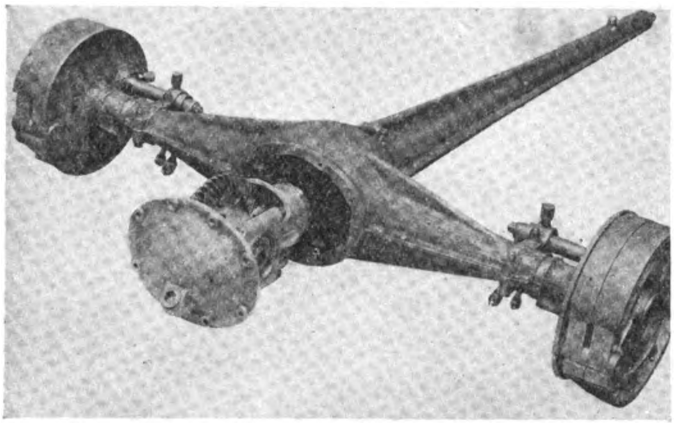
Steering is worm-and-wheel type, and not worm and sector, and is mounted on the forward face of the right-hand crankcase hanger. A ball thrust bearing is fitted on the steering column. Ignition is controlled by a lever on the top of the steering column, and minimum carbureter setting is carried out by turning the sleeve on the steering column.

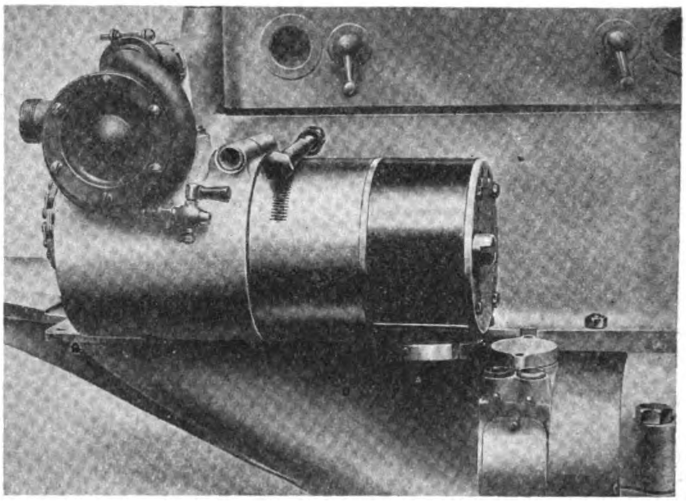


Carbureter side of new Fiat engine. Cylinder head is detachable



Exhaust side, showing neat arrangement of starting-lighting equipment





Above—New rear axle construction of the Fiat light car, showing Gleason gears
Right—Fiat generator, showing method of adjustment

The gas tank is carried through the dash, one portion of this tank being on the engine side and the other portion on the body side of the dash. Flow is thus by gravity. There is a reserve compartment of about 1.5 gal. inside the main tank, and this can be drawn from by a three-way cock on the engine side of the dash.

Care in Equipment

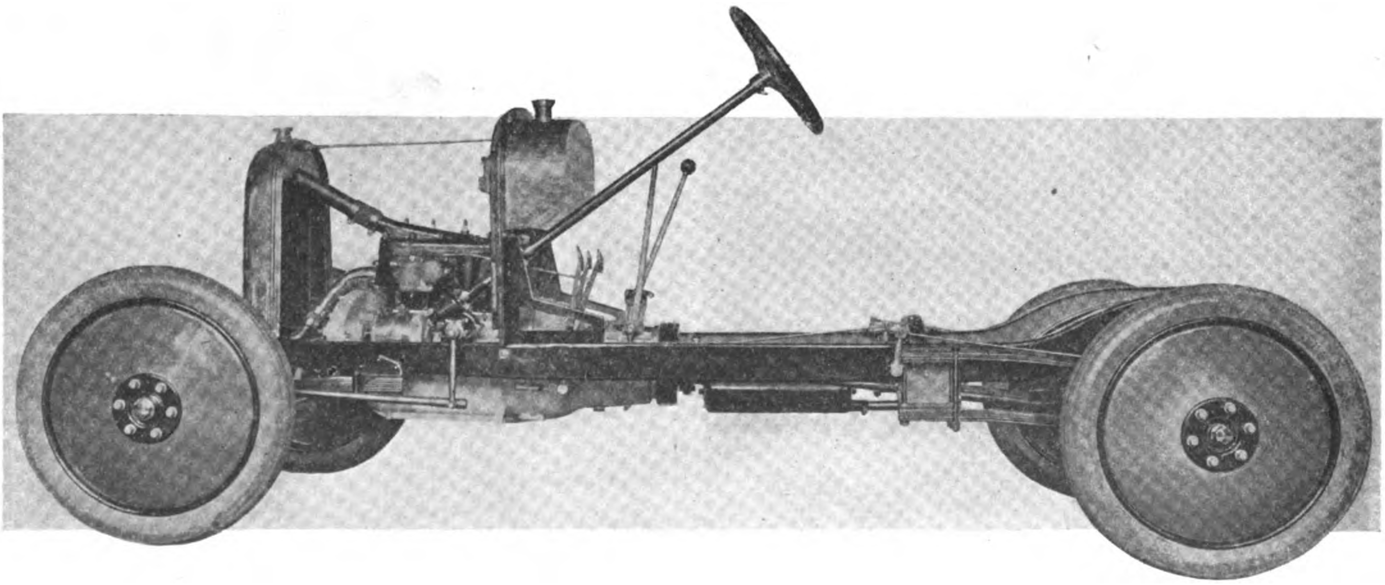
All the electrical equipment of this car is built in the Fiat shops. Although this model is a popular type and ought to be a big seller in all European countries, there has been no skimping on details. As an instance, all the electric wires are carried in metal conduits, all joints are lapped; in every case provision has been made to prevent all oil leakage either by means of washers or more commonly by oil return spirals; the wearing surfaces in the steering gear can be renewed by turning the wheel; the front wheels are carried in an inner double ball bearing and an outer spherical and thrust bearing, while careful provision has been made by means of a special guard to prevent dust entering or oil leaking; provision is made for driving the speedometer from the gearset; wheels are steel, hollow spoke type, with a spare carried in a bracket on the side of the body.

In addition to this light-weight car, other Fiat models to be produced at an early date are a full-sized touring model with four cylinder engine of 75 by 130 mm. (2.9 by 5.1 in.), a high-class six with the same bore and stroke, and a super-de-luxe six of about 85 hp., details of which have not yet been issued.

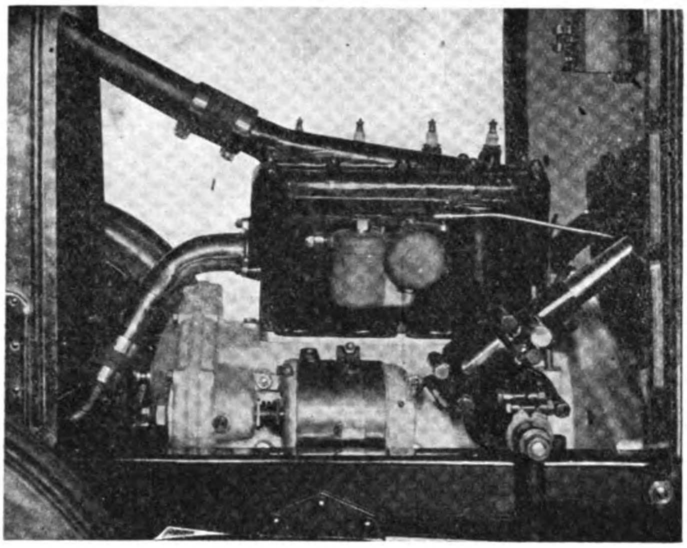
Citroen Four-Cylinder Car

DURING the war the biggest shell-producing factory in France was the establishment owned by André Citroen, in Paris, where 50,000 projectiles were turned out every 24 hours. Before the armistice, Citroen had decided that his post-war activities should comprise the construction of automobiles, bicycles and sewing machines. Within 3 months of the signing of the armistice he had his new car ready, and within 5 months of the cessation of hostilities he will be producing at the rate of 100 complete cars per day.

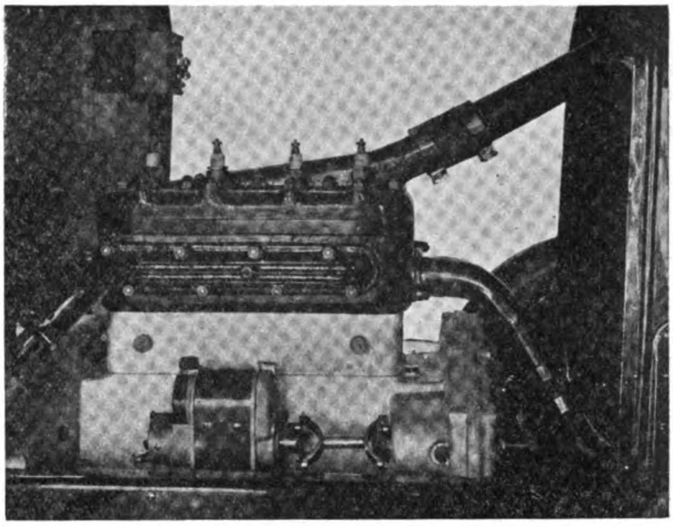
On an average the automobile factories of France, which have not entirely been taken off the work of building cars, will not have their new models out before the month of June or July. Citroen, who never did build a complete car before this year, claims that he will be in full production before the end of April. His figure of



Chassis of the new Citroen light car, which is equipped with Michelin steel disk wheels



Carbureter side of Citroen engine, showing generator and the mounting of the steering gear on the frame



Valve side of the Citroen engine, showing the location, mounting and method of drive of the magneto and attachment of exhaust pipe

100 per day astounds the trade, for no other firm in France, or in Europe, has risen to such an output. Citroen's methods of marketing and advertising are so aggressively American that they have aroused quite a lot of controversy. Admirers see in them wonderful business and organizing ability and critics profess to look askance at a car which needs so much booming. In the meantime Citroen is showing his advance models everywhere, is establishing service depots throughout France, and is continuing to promise deliveries for April.

The Citroen is decidedly a light car, of French design, with a lot of American ideas incorporated into it. The engineer responsible for its production was for a number of years responsible for a French light car which had local success but was not built on a big enough scale to become known far from Paris. When he linked up with Citroen, the engineer had to think in big numbers, with the result that he had to pay a lot more attention to production methods than was ever before thought necessary. Citroen has not yet got into production, but he claims that in a few months his factory will be able to show points to the best in America.

The engine is a four-cylinder one, 65 by 100 mm. (2.5 by 3.9 in.) bore and stroke, and the car is intended for people who will consider operating costs very closely, and with gasoline costing $1.20 per gallon and likely to continue at this price for some time there is no room for big bore engines if the work can be done equally well by a small engine.

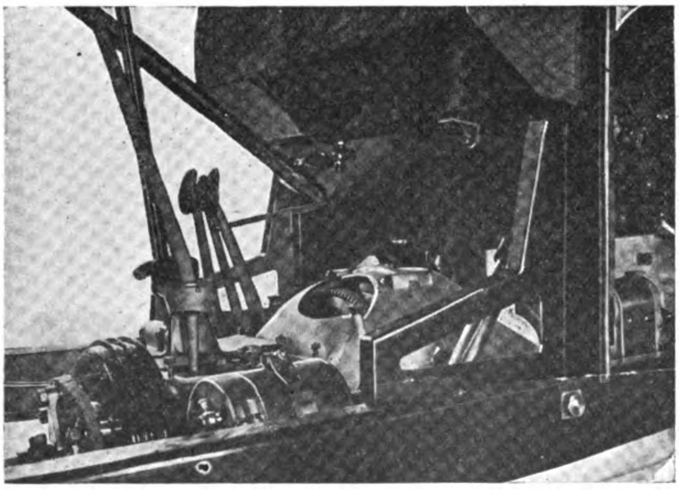
The detachable cylinder head has been adopted partly because of the facility for carbon removal, but more largely on account of ease of production.

Left-hand steering with central control has been decided on entirely on account of simplification in construction and assembly.

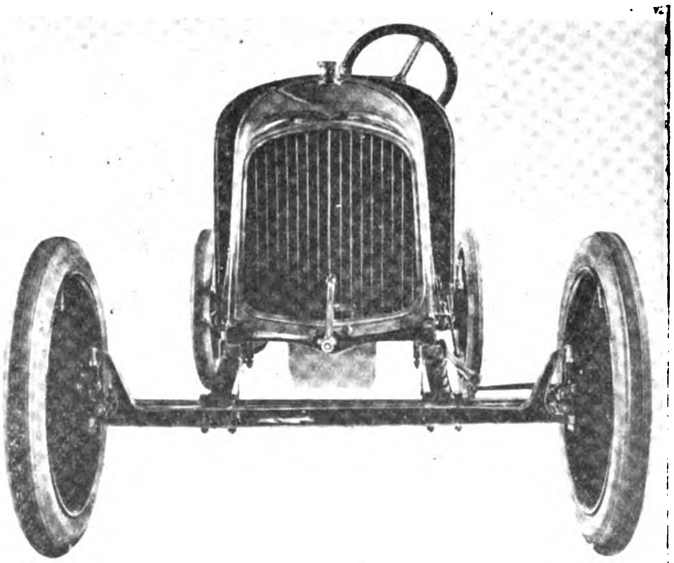
Michelin steel disk wheels have been adopted as standard. These are fitted with tires of 710 by 90, and give a clearance of 8½ in. Wheelbase is 100 or 112 in., with a track of 46 in. A speed of 40 miles an hour is claimed for this car, with a gas consumption at the rate of 31 miles to the American gallon.

This car is being put on the market as a two or four-seater touring type, also two or four-seater closed model. Present price for the fully equipped four-seater is $1,470. It is intended to use the same power plant in a heavier chassis as a taxicab and as a 1000 lb. truck.

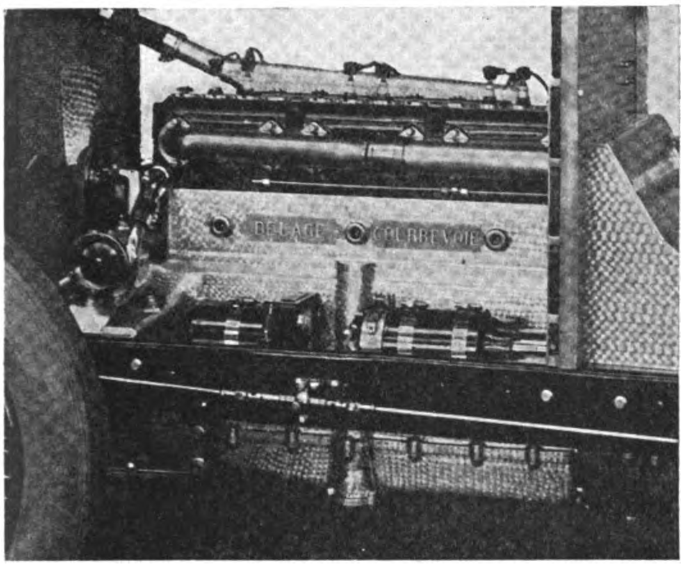
Although the engine, clutch and gearbox form a unit, Citroen has not adopted the American method of cast-



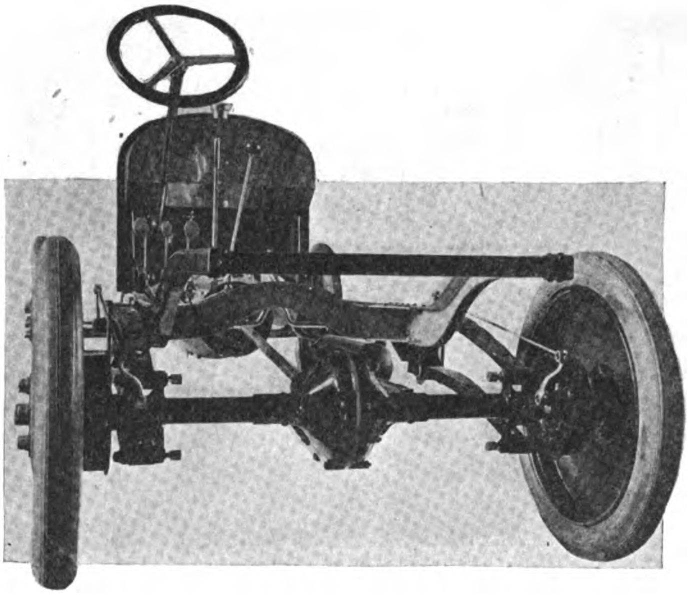
All pedals are attached to the top of the gearbox in the Citroen. The clutch housing has been cut away to show the gear on the flywheel



Front view of the new Citroen light car, showing the spring suspension



Valve side of the Delage engine, showing generator and starting motor



View of the rear of the Citroen car, showing the method of rear spring support

ing cylinder and upper portion of crankcase in one. The cylinder block is mounted on an aluminum base chamber divided horizontally, the lower portion forming an oil pan. The clutch housing and gearbox are separate aluminum castings bolted up to the engine crankcase, the unit thus formed being attached in the frame at three points. In doing this the crankcase bolts to the two side members, and at the front there is a trunnion attachment to the first transverse frame member. Within a very short time engine base, clutch housing and gearbox will all be produced by die casting, the big production contemplated justifying this initial expenditure.

Provision has been made for the withdrawal of the entire power plant without disturbing any portion of the body. After the radiator has been taken off, the forward universal disconnected, and such auxiliaries as gasoline line and exhaust pipe detached, the entire unit can be pulled forward, passing under the dashboard, and lifted free without touching the body.

L-Head Engine Type

There is no great departure from standard practice in the engine. It is of L-head type, with valves on the right-hand side. The crankshaft is carried in two plain bearings, which are lubricated under pressure by means of a pump in the base chamber.

The magneto is placed fore and aft on the valve side, and the electric generator in a similar position on the opposite side. The two, together with the camshaft, are driven by means of helical gears.

Cooling is by thermo-syphon water circulation through a gilled-tube radiator, the inlet pipe being branched from the two sides of the radiator and entering the cylinder jacket on its forward face. There is no fan, although a fan bracket is carried in case it should be necessary to use a fan in tropical countries. The engine is declared to develop 18 hp. at a maximum speed of 2100 r.p.m.

The Solex carbureter fitted has the distinctive feature that by unscrewing one nut the whole device comes to pieces, exposing float, counterweights, jet and tube.

All the electrical apparatus is built in the Citroen factory, and comprises a 6-volt, 10-ampere dynamo; the battery is carried inside the chassis, and the electric starting motor is to the right of and alongside the gearbox.

The clutch is single-plate type, lined with fiber fabric and running dry in a closed housing.

There are three forward speeds and reverse, with oscillating type of change speed lever mounted directly on the gearbox cover.

Hotchkiss drive has been adopted, with a rubber disk coupling at the front and a plunger type universal at the rear. Final drive is by means of Citroen herringbone gears.

Quarter Elliptic Suspension

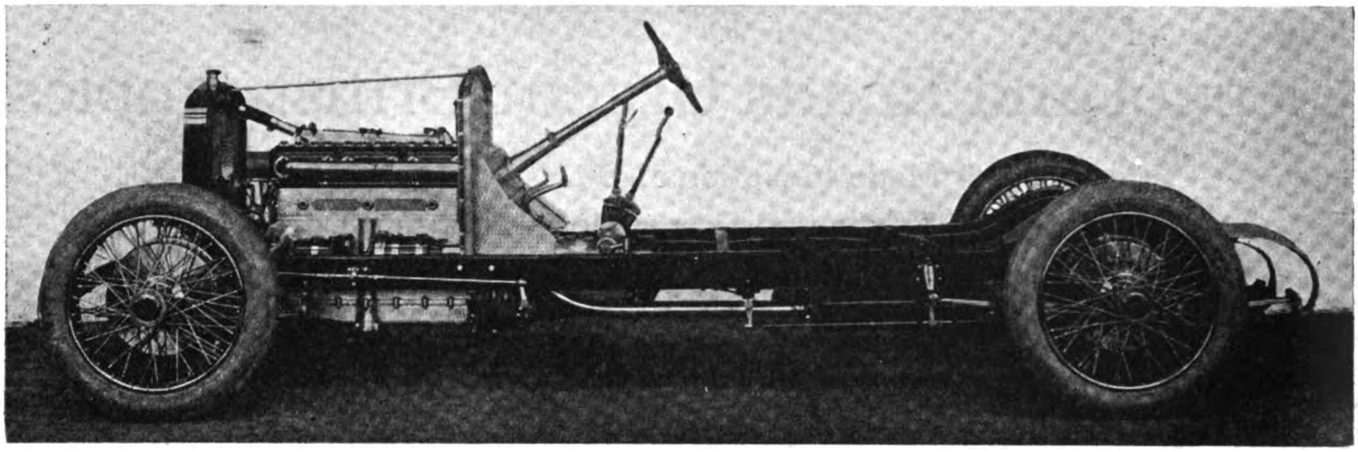
Undoubtedly the most unusual feature of the car is the springing. At the front this consists of quarter elliptic springs bolted under the frame members and attached to the straight axle. At the rear double quarter elliptics are employed, these being attached at their forward end outside the frame members, and at the rear one is mounted above and the other below the axle housing, the attachment being by means of a forged bracket fitted on the axle tubes and heavy and hardened and ground bolts provided with adequate lubrication. This rear suspension forms a parallelogram which assures the axle being kept parallel to the chassis at all times, and, while reducing the unsprung load, gives an ideal construction for transmitting the drive and the torque through the springs.

New Delage Six

DELAGE has stepped out of the light-weight, medium-powered car class into what may be termed the luxury field, by the production of a high-grade, fast, six-cylinder model. Louis Delage has been working toward this class for a number of years, and although he has specialized in cars of medium power his experiments and his extensive racing have been carried out with a view to the production of a really high-class job. The war has given the opportunity desired, and after building several hundreds of his new six for the French army, he is now putting it on the market in a modified form.

Unit Power Plant Design

The engine, a block six of 80 by 150 mm. (3.1 by 5.9 in.) bore and stroke, is rated at 24 hp. but develops 70 hp. at 2000 r.p.m. It forms a unit construction with clutch and gear-



Chassis of the new six-cylinder Delage

box, is carried in a chassis of 135 in. wheelbase, fitted with front and rear wheelbrakes and capable of a speed of 70 miles an hour with touring equipment, and 65 miles an hour with closed body.

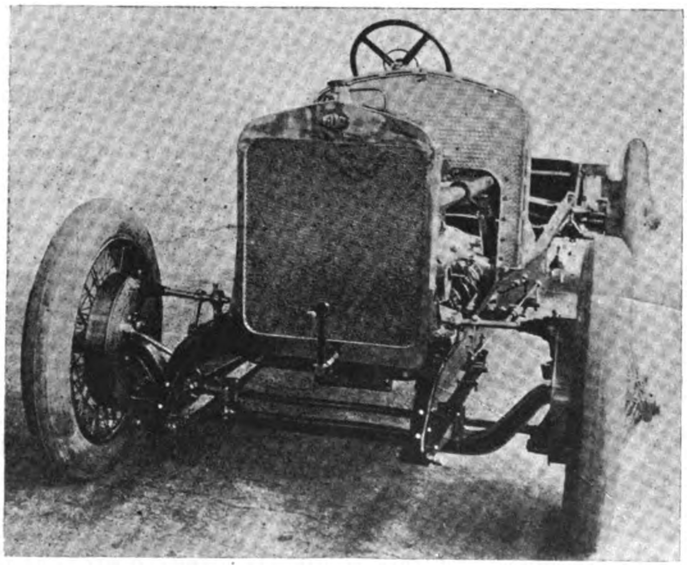
The speed of the six-cylinder Delage with full touring equipment is easily 70 m.p.h. With closed body the car can do 65 m.p.h. Gas consumption is at the rate of 14 miles to the American gallon. During the war it has been necessary to make frequent trips from Paris to Grenoble, a distance of 360 miles. Driving fast, it was found that an average speed of 43 m.p.h. could be made for the entire distance, including all roadside stops, with a gas consumption of 11.2 miles to the gallon. Fixing the maximum speed at 47 m.p.h., this speed never to be exceeded however tempting the road might be, the average worked out at 37 miles an hour, and gas consumption averaged 14 miles to the American gallon. This indicates rapid pick-up and high speed on the hills, for a portion of this road is through a mountainous district.

Delage is building this chassis in three wheelbases, 132, 136 and 145 in., to take respectively a runabout, a touring body, and a big closed body. Track is standard 56 in. for all. Final gear ratios are 3.6, 3.4 and 3.27 to 1. Detachable Rudge-Whitworth wheels are standard.

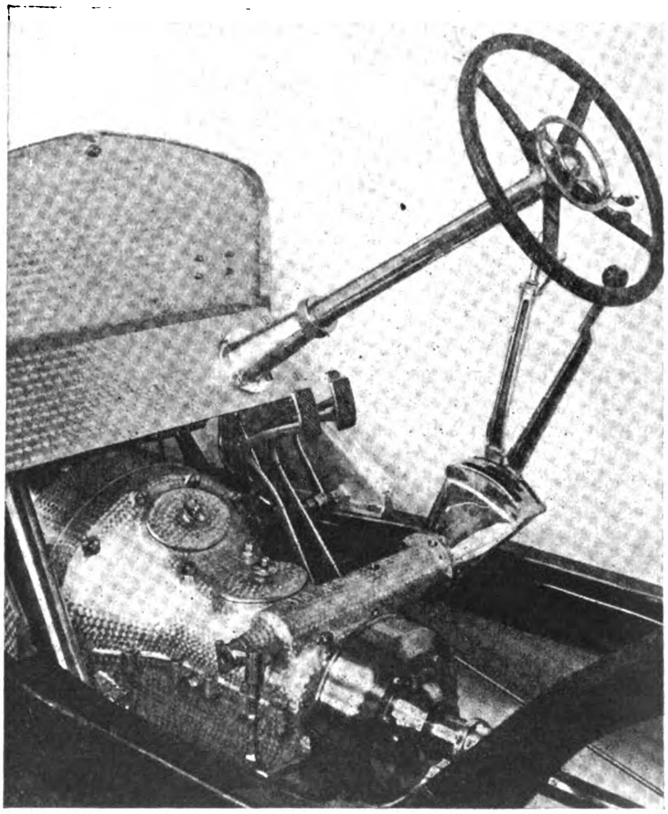
Interchangeable brakes are fitted on all four wheels. The front wheel brakes are built under Perrot license, Perrot being a French engineer who first specialized on front wheel brakes and secured patents on many of their details. He first applied his brakes to the cars built by the now defunct Argyll company. Delage used these brakes for 2 years on his racing cars and was so satisfied with the results that he decided to apply them to his touring models. Front and rear drums are the same size, diameter being 15½ in. and width 2.3 in. The four brakes are operated together by the pedal and at a speed of 60 m.p.h. are capable of bringing the car to a standstill in 100 yd. This means that 60 m.p.h. is a safe speed so long as the driver has an open stretch of 120 yd. ahead of him. There is a hand brake on the gearbox.

The L-head engine type has inclined valve stems, intake manifold cast with the cylinders, and exhaust manifold separate. The layout has been designed to give complete accessibility. Thus the pump and magneto are driven from a transverse shaft; the electric generator and the starting motor are fore and aft on the left side, just below the valve stem chamber; on the right the two Zenith carbureters are bolted up direct to the cylinder casting and are fed by the vacuum system; on the same side, and at the forward end of the engine is the combined breather and crankcase filler, and at the opposite end is a three-way tap which gives level, overflow and emptying of the base chamber. The crankcase webs

(*Continued on page* 709)



The new Delage is equipped with front wheel brakes interchangeable with those on the rear wheels



Clutch housing and gearbox, foot brake and control levers on the new Delage

Benzol and Roads Urgent British Topics

Efforts Being Made to Nationalize Gasoline Substitute As a Home Production Proposition—Notes on Car and Truck Output

Special London Correspondence

LONDON, March 7—Just now the two topics most interesting to the British motor trade and prospecting motorists are the benzol situation and the future of the roads. As regards benzol the interest centers in efforts being made to nationalize it as a fuel of home production and to prevent its handling becoming a monopoly of the oil and gasoline trusts.

I made reference to the matter in a former note, but since then a meeting has been held under the auspices of the new National Benzol Association at which some interesting information was disclosed relative to the development and present position of the British benzol industry.

At the close of the war British gas companies were producing 11,000,000 gallons of benzol a year and the annual output of the coking ovens amounted to 21,000,000 gallons—a total of 32,000,000 out of the estimated total of 200,000,000 of motor spirit annually required by Great Britain.

Gas companies, by a slight diminution of the calorific value of gas, it was urged, would increase their annual production of benzol to about 40,000,000 gallons if the authorities permitted, inasmuch as its deprivation only affects the quality of gas to the extent of 5 per cent. It was stated that in a few weeks some twenty London motor buses would be running on a mixture of 25 per cent benzol and 75 per cent duty free industrial alcohol.

National Control of Industrial Transport

As regards the future of British roads, interest centers in the government's new scheme under a bill now before the legislature entitled the Ways and Communications bill for nationalizing practically everything connected with industrial transport within the country, including also the electricity supply in bulk. Many motorists are opposed to the control of the roads being vested in this body; this opposition being accentuated probably because of the almost certainty that the railways will be nationalized, and it is feared that a single body with an ex-railway officer at the head, and vested with powers over transit by rail, roads and internal waterways, will be dominated by railway interests.

Personally, I do not share these fears, because the bulk of people recognize that the interests concerned are not intrinsically antagonistic, but complementary one to the other, and, also, as far as motor transport of roads is concerned, because the government is committed to a national electricity scheme which when developed will involve a wholesale electrification of rural districts and almost certainly, too, will lead to a wide use of electricity about farms for lighting, traction of implements over the land and of produce to the markets, or at least to the nearest convenient railhead.

Ideas embodying this form of development find more favor now than former schemes for light or roadside railways after the Belgian model. Our experience with this class of construction is that it is expensive relative to its capacity and benefits, and of course any rail service must be circumscribed and limited as compared with road transport.

Generally speaking, the chief drawback to British internal betterment has been too much parochialism. For instance, we have 2100 separate roads and highways authorities in the country, and the proposed measure referred to is intended to sweep the lot into a single control with departmental administrators.

London Motor Buses

The Associated Equipment Co., Ltd., of Walthamstow, London, is the largest producer of gasoline truck-chassis in the country, and is now listing its products to the public. At present it is building a 6000-7000 lb. truck-chassis which is largely a development of the famous B type chassis of the London General Omnibus Co., whose headquarters are at Walthamstow. The A. E. C., the short title of the chassis company, is about to introduce a 4000-5000 lb. chassis, which will place the company in a very favorable position to compete on the truck market at home and in the British Colonies.

As builders of the L. G. O. bus-chassis this company will shortly be introducing a new model which, it is expected, will be about 1500 lb. lighter than the present bus chassis. This weight reduction is largely the outcome of the action of the local street traffic authorities in insisting that the fare must be reduced. It happens fortuitously that this change is being made at a period when it is necessary to replace the L. G. O stock of buses, which had become depleted from 2742 before the war to under 2000, its present number.

During the war 230 of the 1093 buses sold to the government have been replaced. It is stated that it will cost over $13,875,000 to replace the entire number to the pre-war standard of 2742 vehicles, this estimate being based on an allowance of not less than $2,000 per vehicle above the pre-war price.

The A. E. C. output resources are up to 140 vehicles per week, but probably this number will be increased when the factory has been completely modernized, or, to be more correct, Americanized by the Works Director, Samuel Wallace, who came to us from the General Electric in America.

The Dunlop Rubber Co.

The Dunlop Rubber Co. is probably the only British tire making company which owns its own tire fabric making plant. For years Rochdale in Lancashire and in particular the mills of John Bright & Co. have supplied tire fabrics, but some time back the Dunlop interests decided to be their own exclusive providers of fabrics.

They are spending about $7,500,000 on a new mill for weaving the tire fabric. It will employ some 3000 workers.

A Birmingham paper states that the local Wolseley works are in a position to produce 20,000 cars yearly

as a result of war-time developments in the factory buildings and plant. Almost 2000 vehicles a year was the reputed pre-war capacity of this factory, which shared with Daimler at Coventry the credit of having the largest organized potential output capacity among British factories. At present reputed prices it may be doubted if there will be anything like so large a demand for Wolseley and other high-priced models, as at present listed, but the Wolseley interests are associated with the production of a neat light car—the Stellite, which is fairly popular and if concentrated upon could readily find purchasers at the comparatively high prices asked for vehicles of its class. I have not found many persons hopeful of there being any large market here for average British cars at present reputed prices. The fact is the cost of living and taxation won't leave much for motor car buying at present prices.

It is rumored that Wolseley will shortly be declaring for a world trade on a quantity production basis. My informant states that it is likely that three sizes of cars will be listed, to suit the three chief categories of buyers and class of body most in demand. Of these the medium grade car is likely to be the chief attraction, provided that the price of materials and labor charges do not advance. The Wolseley factories now cover about 100 acres, and having regard to the company's already notable decision to concentrate on cars to the exclusion of trucks, which before the war were a joint line in the much smaller factory than has now to be filled, it seems obvious that will only be possible to meet the situation with a car which shall eclipse all competition by combining value and price on a scale hitherto not attempted in Great Britain. What that price will be can only be conjectured now, but it must not exceed $1,750 to permit of the British colonial trade being recovered. Moreover, it will be necessary to set aside a much larger capital in spare parts which must be stocked where most convenient for distribution in the territories concerned. The war has taught our makers lessons on this score, chiefly because of the Aircraft authorities insisting on a fixed percentage of spares—practically so many complete engines—per batch of engines ordered. The alternative course to cheapen manufacture here, of course, will be to manufacture of the larger colonies, after the model of Fords, but this, of course, demands putting down capital in assembly buildings and plant. The new 1919 Buick Six has just arrived at the London premises of General Motors. It was imported under license of the Board of Trade and is one of the first American models to arrive. At the price it is hoped to be able to list it, even allowing $500 for the cheapest body to be fitted her, and allowing also 33 per cent ad valorem for import duty, I doubt if any British four, let alone a six, in the corresponding category, will be found to approach this new Buick for real value.

It is reported that two of our oldest British motor companies are joining interests. The companies concerned are White & Poppe, Ltd., engine specialists, Coventry, and the Dennis Co., Guilford, makers of trucks. Dennis came in from the cycle trade twenty years ago, passing through the stage of motorcycle making to car and truck making, but more recently have concentrated exclusively on trucks. They were pioneers as users of the worm-axle drive for trucks at a time when only the Lanchester-Hindley hour-glass form of worm was being used for cars, and have consistently used the worm-axle and also the engines of the White & Poppe Co.

While this fusion is quite in order so far as it concerns these two companies always associated in the way stated, another issue is raised by this sort of combination. When the Bosch interests here were taken over by a subsidiary company, one of the Vickers group, some people in the trade looked askance at it on the score that now the Vickers Co., as owners of the Wolseley car business, were going to enter into competition with their own likely customers for magnetos, etc.

Timken Solving Difficult Production Problem

Daily Production Conference and Use of Simple Chart Keep Manufacture Up to Schedule

By J. Edward Schipper

PART I

TIMKEN axle production presents a problem in manufacture which differs materially from that ordinarily encountered in an automobile factory or in any plant where but two or three models, at most, are produced.

The Timken-Detroit Axle Co. builds a great many varieties of axle, and since the number of each variety is apt to change suddenly, being greatly decreased or increased in accordance with the desires of the manufacturer of the finished car or truck, it has been necessary to lay out the plant so that the greatest amount of elasticity prevails as regards the handling of the axles in such a way that the production stream is constant, whether the number of one model drops off or increases in production.

To meet this situation, the progressive methods, such as would be provided by a traveling chain or some other arrangement of a similar nature, would not be possible because the forms of the carriers to handle the different parts would have to be changed to take care of the different models coming through.

Since it is not possible at any time to calculate for a long time ahead the number of a particular model coming through, this phase must be eliminated, and a method has been designed to overcome difficulties of this nature. Timken axle manufacture is strictly a group or departmental proposition.

All axles have similar parts. They all have housings, carriers, tubes, shafts, and in the case of front axles, they have knuckles, etc.

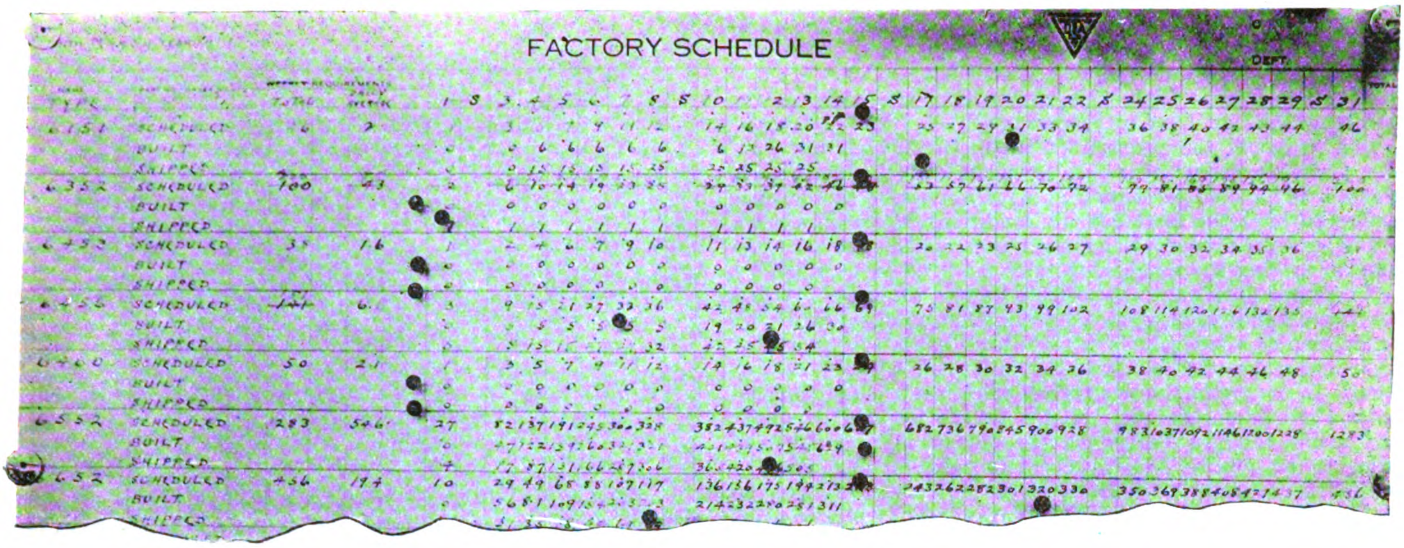
Based on this idea the Timken factory is divided into departments to coincide with the common parts possessed by axles. There are a housing department, a carrier department,

A good example of the segregation of departments. This is the axle housing department and, as will be noted, work on all types of housings is passed through here

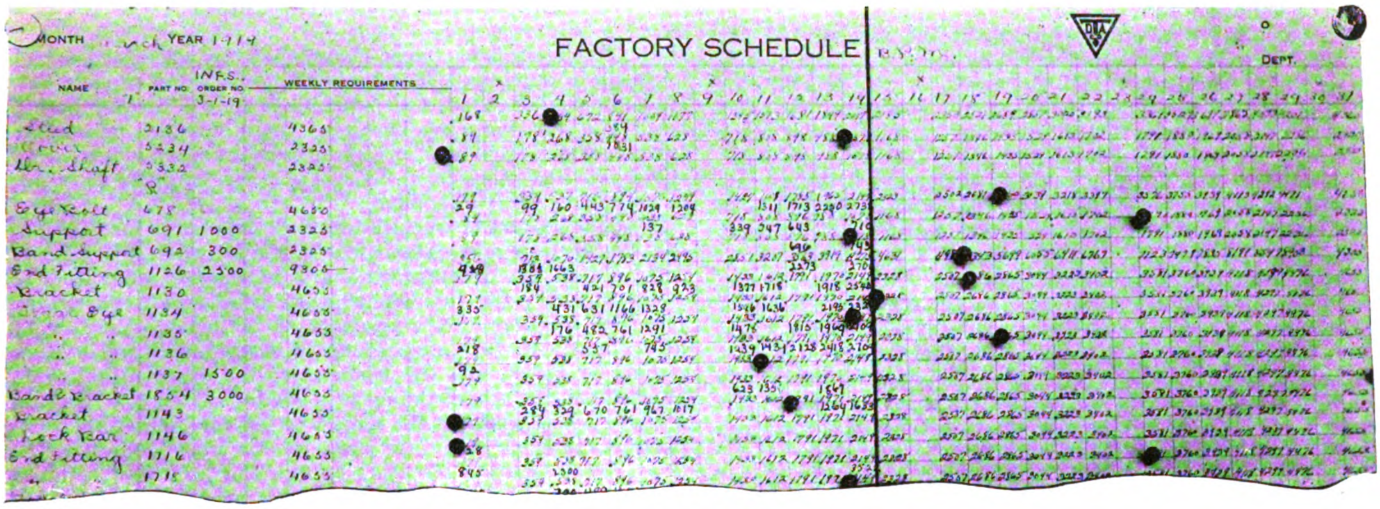
and other departments grouped similarly for rear axle manufacture, and for the front axle manufacture there is a knuckle department and other departments for front axle parts.

Distributed all through the factory, which comprises a large number of buildings, varying in size, are these departments, each specializing on one particular part of several models of axles. There may be going through each department a varying number of each axle every day. If there are twenty-five different model axles being produced in this particular plant, then through each department there will be twenty-five different styles of parts unless the parts happen to be identical for different models of axle, as sometimes occurs.

Forgings for all types of axles are handled in the same forging shop. This view gives an idea of some of the many types of forgings handled in this shop. A number of the various front axle forgings are shown in the foreground

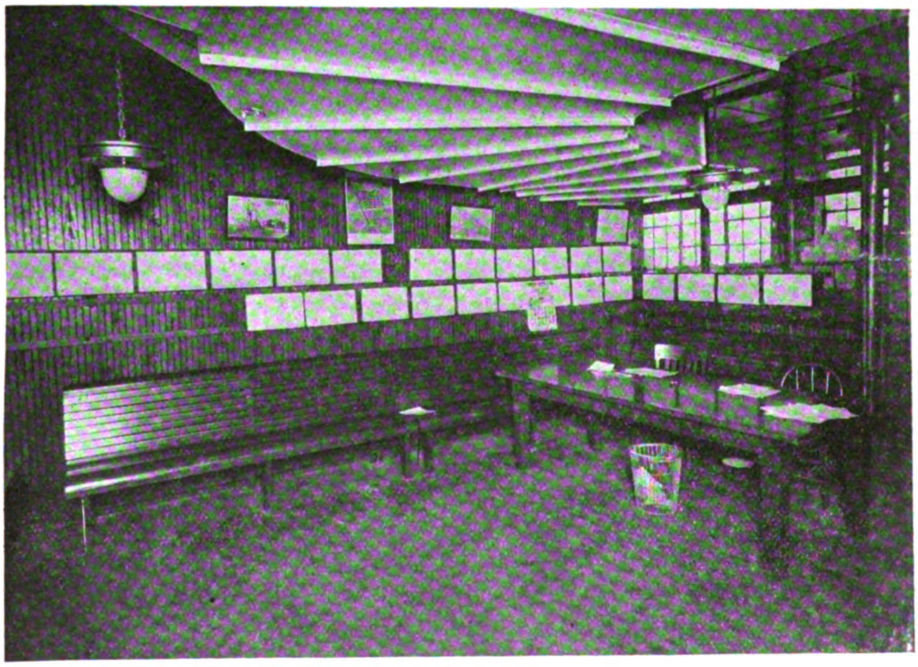


Factory schedule pinned on wall of production manager's office. The solid vertical row of pins under date of March 15 shows the present date. These pins are moved along one column every day. The other pins indicate the dates corresponding to the number shipped or built



This chart shows the department schedule. A rubber band slipped around the card indicates the date (March 15), and all pins to the left of this line indicate jobs behind schedule; all pins to the right indicate jobs ahead of schedule

The foreman whose department has held back production is voted the "goat"



Conference room in which the production conference is held. The foremen of all departments gather here daily and the factory schedules are gone over

It is evident that in order to keep up with production a department will have to run ahead and store some of its production in finished stock, or else it will have to vary its machine set-ups quite frequently in order to take care of the different jobs that have to go through.

This presents the problem of production which the Timken planning department has to meet, and the manner in which it is handled presents a great object lesson of efficiency under, perhaps the most difficult conditions of manufacture.

The general production manager is supplied with an order number stating the number of axles required on that job for as long time ahead as it is possible to give the order. Working from this information, the production manager plans his production on a monthly basis. He then divides this on a daily basis and makes that quantity the daily quota of each department. In the production manager's office is a production chart upon which is entered the number of the job and its name, and under columns headed by the date are the number of axles to be produced each day. In this factory schedule under the current date there is placed a vertical row of black-headed pins, and under the daily dates is placed a pin on the date corresponding to the number of axles produced and another showing those shipped.

Before the parts get into the finished part stockroom they are given a careful inspection, so that all parts drawn from the finished stockroom are ready for manufacture and have been certified by the inspection department

Explanation of Production Chart

The explanation is:

If a certain job is going through at the rate of 100 per day and 100 axles should be finished on the first of the month, 200 on the second, 300 on the third, 400 on the fourth, etc., and the date of the month is the tenth and only 500 axles have been produced and 400 shipped, the vertical row of black pins would be under the tenth, indicating that it is the tenth of the month. The red pin would be under the fifth, indicating that production only up to that day's schedule had been completed, and a yellow pin under the fourth showing that shipments were only up to those scheduled for the fourth.

A glance at the chart would show that on this particular job the production is 5 days behind. On the other hand, if by the tenth 1500 axles had been produced, the red pin would be in advance of the black line under the fifteenth; so that production is 5 days ahead, or if there is enough of that axle in finished stock to complete the month's order, the pin might be out to the end of the month, showing that the order was complete on that axle for the month.

Thus the chart tells the production manager at once just what jobs are lagging behind schedule, which are even with schedule, and which are ahead.

The same scheme is followed in the departments. Each has its chart with a black line formed by a row of black pins, or a rubber band slipped around the chart at the current date. Each has the orders listed upon the chart and pins showing the date corresponding to the amount produced indicated by red pins. All red pins to the left of the vertical black line indicate jobs that are behind; all those to the right indicate jobs that are ahead and tell the foreman of that department immediately what jobs to push and what jobs upon which he has a safe margin. These production charts telling the status of the complete axles in the production manager's office and of the different parts in the foreman's office of each department handling that part furnish the key to the entire production situation in the factory.

Hold Daily Production Conferences

Every day a production conference is held. After the day's work is complete each foreman takes his chart to the conference room, where it is hung upon a hook designated for it, as shown in the illustrations. As these boards are hung in place they form a row around the conference room which indicates the condition of any job at a glance. The foremen go over the charts, one by one, and thus readily see what condition of affairs exists in other departments, and they then get an estimate on the entire situation and know what to concentrate upon.

If a job is exceptionally late the foremen of the departments in which the pins for that job are lagging are called upon to explain why they are not up to schedule. If it is because material is not at hand the follow-up department is called in to explain why they have not secured the material. If the follow-up department shows that the material has not as yet been purchased, it is up to the purchasing department. If, on the other hand, the material is in the factory but is lying idle for want of machines, the production managers take machines from a job which is in advance, as indicated by the chart, and place them upon this order, in order to hurry it up and bring it into line.

A bonus system is worked out so that lateness on the part of a department may cause a cut in the bonus, and it is quite certain that the foremen who are well up in advance are going to hurry the foremen who lag behind on a particular job, thus threatening the payment of the bonus, or reducing its amount. In fact, at the end of every month an election is held by ballot, and the foreman of the department which has delayed the others the most is elected as the goat, and on a board which contains the names of the foremen of each department a goat is pinned opposite his name and remains there for a month. Needless to say, the goat is careful to remove the symbolic animal from his name on the succeeding month.

This gives the follow-up phase at the Timken plant. There is another phase, however, which is of equal importance and which will be discussed in Part II.

Book Review

AERONAUTICS MADE EASY, by Capt. W. A. Aston. Published by Iliffe & Sons, Ltd., 20 Tudor St., London, E. C. 4, England. Price, 4/6d.

The remarkable progress which has been made in aeronautics during the war has brought the airplane almost to the commonplace level of the motor car, but owing to the secrecy with which it was necessary to veil this development during the war, general knowledge of aeronautics has not kept up with the progress of actual practice.

Students of aviation, and all who take an intelligent interest in flying and flying machines, will therefore welcome the new text-book on the subject, which has been prepared by Captain Aston. The author deals with a fascinating subject in a very interesting manner. His object has been to show how an aeroplane flies, rather than why it flies, and he accomplishes this by first explaining how the underlying principles of flight are applied, and then giving the details of the airplane itself, and showing what functions each part is called upon to perform.

Among the subjects dealt with are the influence of streamline formation on speeds, the shape and angles of planes and other surfaces, the stability, the functions of the propeller, loading and control, air-cooling and water-cooling, etc., The advantages and disadvantages of pusher and tractor models are set out, and the capabilities of the various types compared.

Industrial Development Depends Upon Partnership of Capital, Management and Labor

By Harry Tipper

AT a meeting of industrial engineers, which occurred in this city 2 days ago, a great deal of the time of this convention was spent in the study of the labor question and the human side of industry. This is as it should be, and it is an encouraging sign when engineers turn from the examination of machine production, motion study, and other items of a like mechanical character, to the study of the most important factor in production, the human being, and to the complex forces which are behind the difficulties observed in present production.

Of the papers which were presented, the paper by C. E. Knoeppel, of C. E. Knoeppel & Sons, New York, contains so much which is of value to the study of present conditions and the means that ought to be taken in order to overcome the difficulty, that we are quoting liberally from this paper, the whole of the paper occupying too much space to give it in full.

War Due to Workings of Progress

"Was this all an accident? Was the ambition of one man, or one class, or one nation to blame for this world catastrophe? Yes, but only indirectly. As I review the past, it seems to me that the world war was the result of the workings of a law of progress, which has been in evidence since the beginning of time, a law to the effect that while progress is ever upward, it is never in the form of a straight line, but a series of curves or cycles, made up of four steps:

"1. Conflict. 3. Refinement.
2. Development. 4. Retrogression."

"In life we find a conformity to the law above mentioned. Study the child, his relation to his parents and his teachers, his combative and sometimes savage nature, his days of the gang period, his recklessness and tempestuousness in his first years of school life, and you will find an excellent illustration of the conflict period in human progress. The youth becomes serious. He studies, goes through college, and begins his career in business. This is his development period. Then follows the period of refinement, in which the man builds well on the training he receives, becomes successful in his work, perhaps amasses a fortune. Finally at the height of his power, he begins to wear out, his energies begin to fail, and he is in the retrogression period, from which none of us can escape."

"What is the world situation to-day? People tired and weary after years of fighting; depleted treasuries; enormous debts requiring years, generations perhaps, to pay off; a world hungry for the food necessities of life; the most gigantic destruction of property the world has even seen, making rebuilding a task which staggers the imagination; millions of crippled, blind and helpless who must be taken care of in some manner; other millions who were directly or indirectly engaged in warfare, suddenly without occupations or immediate means of earning a livelihood.

"To fill depleted treasuries, feed the hungry, pay heavy taxes, replace and rebuild destroyed and damaged property, and care for the sick and helpless, money in huge quantities is going to be needed, and money can only come through trade at home and abroad. The nation that can win the most trade will be the most prosperous. The one that is the most efficient will win the most trade. This applies to nations, to industries and to plants in the same industry."

Something Certainly is Wrong

These paragraphs indicate Mr. Knoeppel's basis for argument, and while there might be some controversy as to his statement that these things are economic in their character, nevertheless, the conditions which he describes are here, and his examination of the subject is informing and suggestive.

Much more suggestive, however, in connection with the present condition, is the statement in respect of industry and the fact that there is something wrong with our industrial system from an observation of its present results, not only in connection with the warfare and dissatisfaction between the different departments of industry, but in connection with the final result of this whole industrial development which are stated in his paragraphs:

"Something is certainly wrong, when prices should be on the continual advance, in an age of the most improved machinery, the most advanced shop practice, the best that can be devised in the way of management methods, and the latest in industrial devices. Something is wrong with conditions which makes the dollar less in value to-day than a year ago an dmuch less to-day than it was five years ago.

"Trace if you will the transition from basic raw materials to the product in the hands of the consumer. A raise in wages at the start increases total cost, on which profit is figured, so that the concern which purchases the product, *as material*, pays both for the raise in wages and the profits on the raise as well. The concern that buys this material is forced to raise wages, we will say, and the next man who buys this product, as material, not only pays for the extra cost, a slabor and profit, of the first step in the progress, but the second as well, it does not require much imgaination to realize that by the time the ultimate consumer gets the finished product, it is loaded up with a series of consistent raises in wages and additional profits.

The User Pays the Bills

"The user pays the bill. Who is the user? Worker, manager and capitalist. Which is the largest class? The working class. Consequently, while the worker receives more money in wage increases, he is no better off; in fact, worse off, because prices increase in greater proportion than his wages increase, due to the successive stages through which the work goes from raw material to finished product, and the addition of profit to total cost, the cost including wage increases. The load, therefore, falls on the shoulders of the ones who, while causing the conditions to a great extent, are the least able to bear it. Does labor realize this? It does not."

There is an interesting point for manufacturers to consider in connection with their responsibility for the

outlook of the worker, a responsibility which has been considered very rarely in our industrial work, and a responsibility which can only be discharged by measures of education that have not been considered up to the present.

"I was recently discussing the business situation with a Pittsburg manufacturer. He was protesting most strenuously because his labor was producing less and costing more than ever before, and that it would be a good thing if we had some bad times to teach labor a lesson. I asked him what he had ever done to disabuse the minds of labor as to over-production, the introduction of labor-saving machinery and the like. I asked him further what his fellow manufacturers had ever done to place before the workers fundamental principles of 'industrial economics.' He had to admit that what he had done was conspicuous by its absence. Further, I wanted to tell him that he needed to take the beam out of his own eye before removing the mote from that of his brother. Capital has much to undo before it can go to Labor and teach it economic truths."

Getting down to the development of the argument, as it relates to present conditions, there is a concise statement which we have quoted below as to the fallacies which are common in the ranks of labor management and capital, and fallacies which must be eliminated if we are to work out the industrial system so that it will be permanently of advantage to all parties, and so that the present strife will be decreased instead of increased.

These fallacies, placed alongside the things which must be done in order to offer the solution of the present difficulties, give a pretty clear picture of the situation, and indicate that thoughtful men in industry are studying these subjects without the atmosphere of prejudice which has prevented an understanding of their significance heretofore.

No Room for These Fallacies

"Here are the fallacies which must have no part in our new industrialism:

"A—*On the part of labor*—(1) That production should be retarded and the introduction of labor-saving machinery frowned upon and fought against, in order to make more work for more people and guard against over-production.

(2) That it creates wealth and should therefore enjoy the fruits of such creation, the argument being that in the last analysis the products of industry are the work of labor.

(3) That Capital is opposed to it, because it gives it no say in management nor a share in the profits of industry.

"B—*On the part of management*—(4) That it is the boss and that its decision is final because responsible for results.

(5) That labor is commodity to be purchased according to the law of supply and demand the same as material.

(6) That it is only accountable to capital.

"C—*On the part of capital*—(7) That it is the controlling factor because it supplies the funds.

(8) That it has no further obligation beyond supplying the funds.

(9) That all the profits belong to it.

(10) That labor is opposed to it because of strikes and agitation.

"In this present era of conflict, of industrial unrest and general dissatisfaction, welfare plans, shorter hours, higher wages, union recognition, bonus and incentive plans, lower cost of living and the like are not going to satisfy the desires of the masses. These things without others, more important and fundamental, will leave them no better off than they were before, simply because they do not meet the economic demands, nor do they provide for self-expression of our people, for 'industrial democracy,' for a say in the conduct in industrial affairs, for real human development.

"The world wide tendency toward revolution is not due so much to desire for *political* changes, as to demand for *economic* changes. The clash we see on all sides is not aimed at kings, queens, emperors and presidents, but at unfairness, autocratic domination, inequality, unemployment and the like. What the masses the world over have in mind are houses, food, farms, clothes, jobs, wages, participation, representation in affairs and the like.

"Labor claims that it has had no say in the determination of shop rules; the rate of wages; whether labor shall be paid by the bonus, premium, differential piece work system or some modification of these; what shall be the time allowed for the perfromance of a task or the accomplishment of a so-called standard of efficiency; hours of labor; industrial education that should be given the workers; what methods should be established by which the workers might receive a hearing; what should be the basis of hiring and the grounds for discharging; what facilities should be provided for performing the work; whether bargaining should be collective or individual.

Real Partnership Necessary

"There will never be a real democracy in industry until we take steps to give Labor a say in matters that had to do with their side of things. If a partner in business, it should have a partner's voice. If there are two sides to a question, we will not get very far if we hear but one side.

"Labor wants its say in the conduct of affairs, both political and industrial. It should have this way. Capital and Management want the same say. They should also have it. The consent of the governed, representation in affairs, liberty and the pursuit of happiness, are the basic principles in political democracy, and they should and must become the foundation of the industrial democracy that will come sooner or later.

"If we want industrial democracy to be a living, breathing reality in our lives, then the only answer is that Labor along with Management, should be given a share in the conduct of business. I do not care so much whether the plan adopted is the shop committee or conference plan, the House of Representatives and Senate plan, Labor on Board of Directors plan, or some other plan, so long as opportunity is given for frank and open discussion of matters of mutual interest."

This discussion does not, of course, take into account the changes which must come about in the social and political aspect, in view of these necessities in industry. It does not take into account the result of the neglect by industry of this responsibility for educational matters in the primary schools for the proper development of housing and for its share of responsibility in political development.

It does, however, suggest some of the things which are necessary from an industrial standpoint, and it is important for its suggestions, and also as an indication of the tendency of the industrial conception at the present time.

Testing Pyrometers

THE pyrometer has three parts independently liable to error, viz., the thermo-couple, the measuring instrument and the lead wires. In testing pyrometer installations, provision should be made for the maintenance of a standard of temperature and for the convenient comparison of this standard with the instruments to be tested. The standard should consist of at least one platinum-platinum-rhodium thermo-couple previously calibrated to an official standard and a potentiometer. This standard may then be used for checking the secondary instruments, which should be done frequently enough to ensure against faulty calibration.

The standard couple should be used with a potentiometer, which is the recognized instrument for electromotive force measurements. It should be able to accommodate with full sensitivity both platinum and base metal couples. For use with the thermo-couples and potentiometers there should be a large electric furnace having a zone of uniform temperature extending at least 12 in., throughout which temperature variation is not in excess of 20 deg. Fahr. The furnace should have an internal cross section of not less than about 2½ in. in diameter.

Tests of Aeronautic Instruments

Need for Many New Instruments by Air Forces Led to Great Expansion of One Section of the Bureau of Standards—Classes of Instruments Required, and Some of the Difficulties Met With

By P. M. Heldt

THIS is the sixth of a series of articles prepared by Mr. Heldt from the research records of the Bureau of Standards in Washington. Previous articles have covered:

1—Dry Cell and Storage Batteries

2—Tests of Airplane Radiators

3—Altitude Engine Test Laboratory

4—Tests of Ignition Apparatus

5—Carbureter Testing

Additional articles covering other subjects will appear in subsequent issues.—EDITOR.

AT the time the armistice was signed the Aeronautic Instrument Section of the Bureau of Standards comprised about forty technical men, of which about one-half were on the Bureau staff while the rest were assigned to work in this section by the military departments. The enlisted men acted in the capacity of assistants.

While the section, as a separate branch of the Bureau of Standards organization, was established at the beginning of the war, it was really an expansion of a section which had been in existence for 6 years previous to the war and which concerned itself with altitude measurements chiefly in connection with ballooning and aeronautical work, but also in connection with mountaineering.

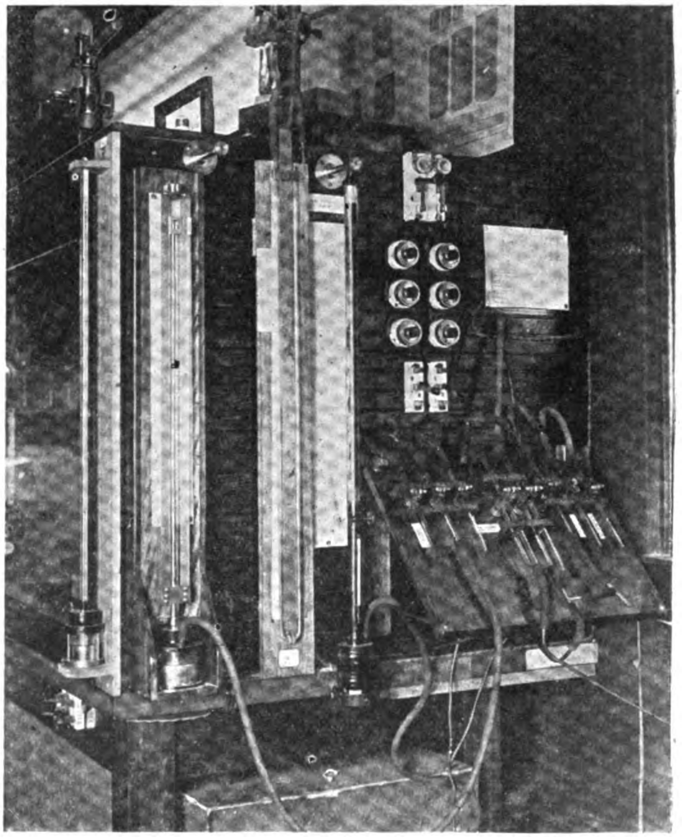
The men who conducted this work formed the only small group of technical experts in altitude measuring instruments in the country, and all of the altimeters used by the Army and Navy for 6 years previous to the war had been tested there. Another thing that rendered this section of the Bureau of Standards of considerable value to the Services when the war broke out was that these men were familiar with the status of the instrument industry throughout the country and were able to give the Army authorities data as to the capacity of the different instrument makers and their special experience.

Low Temperature Problems

While previous to the war the activity of this section had been confined to the development of altitude instruments, upon the outbreak of hostilities its field of activity was widened to include other aeronautic instruments. A special reason for entrusting this section with the work connected with the other instruments used in flying was that there are three particular difficulties with which all manufacturers of aircraft instruments have to contend and with which these experts of the Bureau of Standards had become familiar in their pre-war experience. These difficulties are due to the extremely low temperatures in the upper atmospheric regions, to the vibration of the engine and to the strong centrifugal force to which all instruments on an airplane are subject while banking. Provisions for compensating for the effects of these factors must be made in all kinds of airplane instruments.

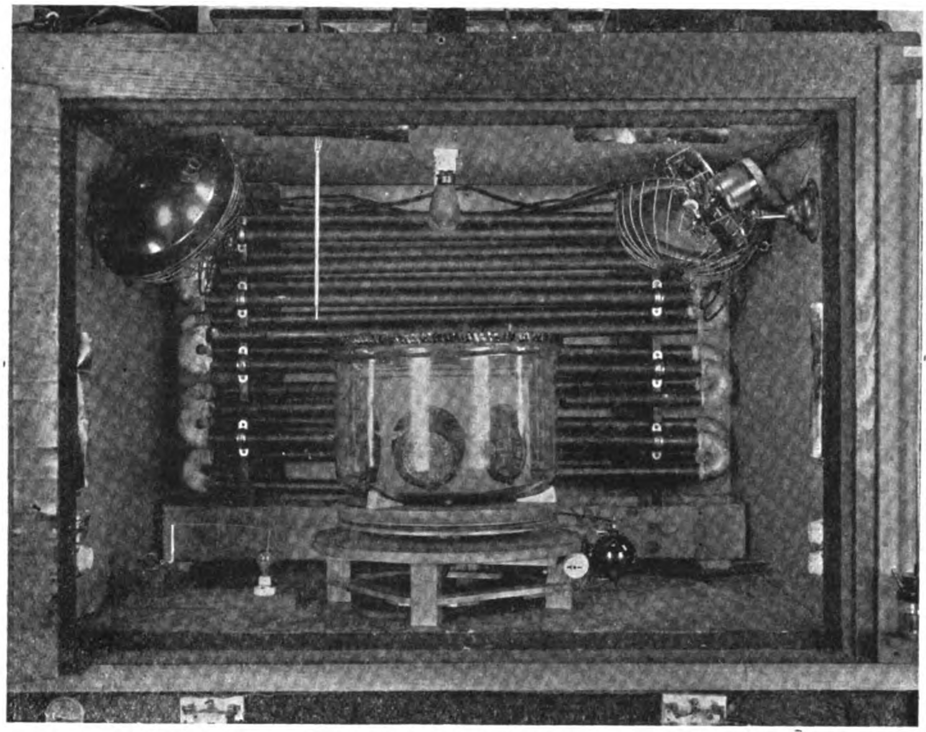
Following is a list of instruments that are commonly used on airplanes and in connection with which the Bureau has done research and testing work: Altitude measuring instruments, including the ordinary altimeters, recording altimeters and statoscopes, the latter used in balloons to tell whether these are rising or falling when it is desired to keep them at a constant level, and in airplanes under test when it is desired to fly in an absolute horizontal plane; rate-of-climb indicators; speed indicators, including instruments for determining the air speed or the rate of progress of the airplane through the atmosphere, which also tells the pilot whether he is going fast enough not to be in danger of stalling; tachometers giving the speed of rotation of the engine shaft; inclinometers, of which there are two types, namely, the liquid and the gyroscopic, which show the angle of inclination of the plane; pressure gages for showing the pressure on the lubricating oil and the pressure on the gasoline in the fuel tank; also gasoline tank gages and radiator thermometers.

As pointed out, the reason for the expansion of the altimeter section of the Bureau at the beginning of the war,



Mercurial standards and vacuum control board of aeronautic instrument test chamber

so as to take in other aeronautic instruments, was the fact that the technical problems arising from conditions of flight are the same for all kinds of instruments. The work which has been done by this section during the period of the war may be briefly summarized as follows:



Viewing the aeronautic instrument test chamber. Note that conditions of low temperature and centrifugal action are simulated

What the Section Has Done

1. The section furnished the authorities a list of manufacturers who would be in a position to take up large scale production of aeronautic instruments.
2. The section prepared technical specifications for the instruments which were to be produced. These specifications were in most cases adopted by the Army without any important changes so far as the technical features were concerned.
3. It tested a certain small fraction of all instruments delivered to see that no new sources of error were creeping in, and also tested samples of any new types of instrument to determine whether they were suitable for the work for which they were intended. Practically all contracts for airplane instruments were based on these tests.
4. The section developed some improvements in instruments and continually kept in touch with the manufacturers to help them to keep up their product to the standard of the specifications laid down.

The writer asked those in charge of this work whether any practical instrument had been developed for determining the absolute rate of progress of an airplane or its speed relative to the ground, and was told that there were two kinds of instruments for this purpose.

One kind is limited to use during the day and when there is no fog, when the ground can be seen. The use of this kind of instrument is based on a process of triangulation. The altitude of the plane being known, and an object on the ground being observed at the beginning and end of a certain interval, it requires only the solution of a problem in triangulation to determine the absolute speed of the plane.

The production of the other kind of an instrument, namely, one which will give the absolute speed of a plane when the ground cannot be seen has not been satisfactorily solved except in theory. It is one of the great outstanding problems in connection with aircraft instruments, as is also that of a non-magnetic type compass.

Quantity Production Methods

Owing to the rapidity with which results had to be obtained and the fact that our allies had been engaged in the war for over 2 years when we entered it, American manufacturers in the majority of cases contented themselves with the adaptation of British and French designs. In doing so, the Bureau with its extensive collection of foreign instruments, was of assistance.

When the war broke out here the only instrument in production in the United States was the altimeter, which is a type of aneroid barometer with a flat circular corrugated diaphragm. What developments were made in the United States in connection with instruments of foreign origin were mainly with the object of reducing the cost of manufacture.

All foreign instruments, and especially those built in France, involve a great deal of hand work, and the number of workmen in this country experienced in work similar to that required on these instruments was very limited, hence quantity production methods had to be worked out. The great trouble which has been experienced with aircraft instruments so far has been insufficient accuracy, which is largely a matter of quality of materials and adjustment of the different levers, cams, springs, diaphragms, etc. A case in point is furnished by the ordinary altimeter, the characteristics of which vary a great deal according to whether the diaphragm is flat or slightly concave or convex, when first assembled with the pointer standing at zero on the altitude scale.

Tachometer for Aircraft

AN illustrated description of the Morel electric tachometer, which has been largely used on German airplanes, is printed in *Der Motorwagen* for Dec, 10, 1918. It consists of the combination of a direct-current generator driven from the engine by suitable means and a moving coil galvanometer which is graduated in r.p.m.

In a magnetic field, formed by a number of magnets of high tungsten alloy steel, a drum armature revolves having a commutator and a number of spring contacts for collecting the current. The magnets are so constructed as to give a constant field. The transmitter in the latest design is driven through an intermediate shaft and flexible coupling. The whole of this transmitter is contained in a casing fitted with a special dust-proof bayonet-joint cap, while the armature is driven through gearing. For airships, motor boats, etc., the transmitters are fitted with bases.

The receiver galvanometer comprises the moving coil, wound on a pressed copper frame, and fitted with spiral springs which serve at the same time as current leads from the transmitter. The movements of the coil are transmitted by teeth to a pointer fixed to the indicator spindle.

German Engineering Standards

THE Council of the German Industrial Standards Committee has agreed to the following conditions becoming standard practice:

(a) The uniform temperature of reference for gages, etc., shall be 20 deg. C.

(b) In view of practical and theoretical advantages, the "zero" line shall be taken as the "limiting line" in connection with standard systems of fits.

(c) The S. I. (System International) and Whitworth systems of standard screw threads shall both be considered as standard.

The Lubrication of Motor Cars

Engine Lubrication Systems Dependent on Engine Load—Test Results from Crankcase Lubricant After 100 Hours' Use — Lubrication of Clutch Pilots and Transmission Boxes—Loss in Efficiency Due to Too Much Oil in Gear Case

By Capt. G. W. A. Brown

IN this paper, presented to the Institution of Automobile Engineers of Great Britain, Capt. Brown discusses chiefly problems in the lubrication of chassis components, as the lubrication of the engine has, according to him, received a great deal of thought and care, which cannot be said of other important parts of car mechanism. Each part is taken up in turn, and the problem of its efficient lubrication is discussed, various conventional practices being strongly criticised. The author does not believe in the common method of filling the transmission box and rear axle with grease, holding that oil lubrication is much more satisfactory. Only enough oil should be put into the cases so the gears will dip into it. Otherwise the efficiency will be lowered, owing to the unnecessary churning of the oil.—EDITOR.

WHEREAS a great deal of thought and care has been lavished on the lubrication of the engines of motor cars, the lubrication of the remaining components of the chassis, such as the gear box, universal joints, live axle, steering gear, etc., has been, to a great extent, neglected. As 90 per cent of the failures of cars are caused through wear, the author is emboldened to put before members of this Institution a few suggestions for the improvement of the oiling of these parts as an incentive to further experiments and to stimulate research, which would result in much benefit to both the manufacturer and the user.

The investigation of this question may be conveniently divided into six parts:

I.—The engine.
II.—The transmission, including:
- Clutch bearings;
- Flexible connection between clutch and gear box;
- Gear box;
- Universal joints, with particular reference to those of the Hooke's type;
- Propeller shafts and torque tubes;
- Back axle reduction and differential gear.

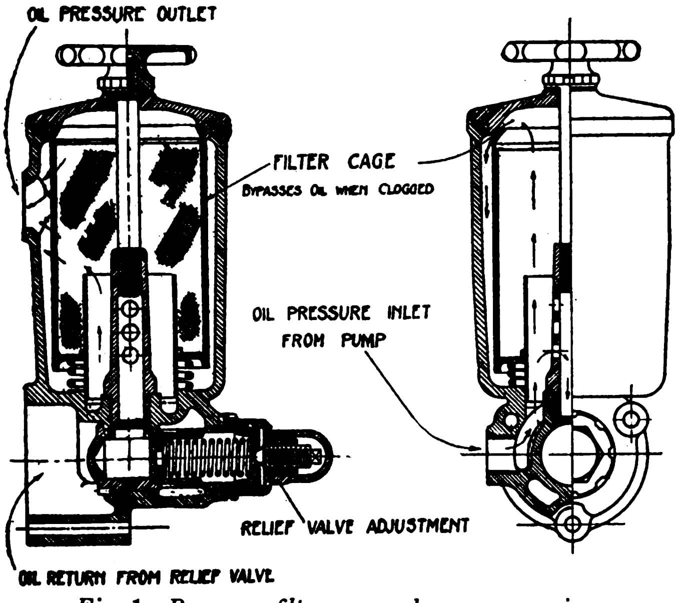


Fig. 1—Pressure filter as used on aero engines

III.—The steering gear.
IV.—The suspension system.
V.—Road wheel bearings.
VI.—Oil retaining devices.

I. The Engine

As previously stated, the engine is the only portion of a car in which the question of lubrication has been at all seriously considered. There are, perhaps, two exceptions to this generalization, and the author proposes to deal with them at a later stage. These exceptions are the Fergus car and the Marmon car.

There are two basic methods by which engines are lubricated:

(a) The pressure system;
(b) The splash system.

Other systems of lubrication are based on one or other or a combination of these two methods. The author does not propose to enter into any lengthy discussion of any of these systems, but will content himself with a few remarks upon some examples of the latest practice.

Two features of aero engine design may usefully be mentioned, namely, the dry sump and the pressure filter—the dry sump because it enables the oil to be kept at a lower temperature than would be the case if it were always stored in a portion of the crankcase; the pressure filter because its use permits of a very fine gauze without danger of starving the supply. Fig. 1 shows the general features of a type used in aero engine practice. The possibility of any reduction in circulation owing to the gauze becoming clogged is obviated by making it act as a by-pass valve in the manner shown by the right-hand view. With reference to the dry sump, it should be mentioned that this principle was first employed on at least two well-known types of British racing cars which competed in Continental races and competitions at Brooklands prior to the war.

Some designers have provided means of varying the oil supply at different engine speeds and loads, but all the systems of this kind that the author has come across are interconnected with the throttle. The tilting trough of the Knight engine is familiar to all of us. Messrs. Rolls-Royce adopt a method of opening a by-pass in the oil pressure pipe after a certain throttle position in order to give an extra supply of oil direct to the cylinders, while the Marmon oiling system is provided with a piston valve which is operated by the depression in the inlet pipe. At low engine speeds this piston valve uncovers a by-pass valve, so reducing the pressure throughout the whole of the oiling system. These devices are

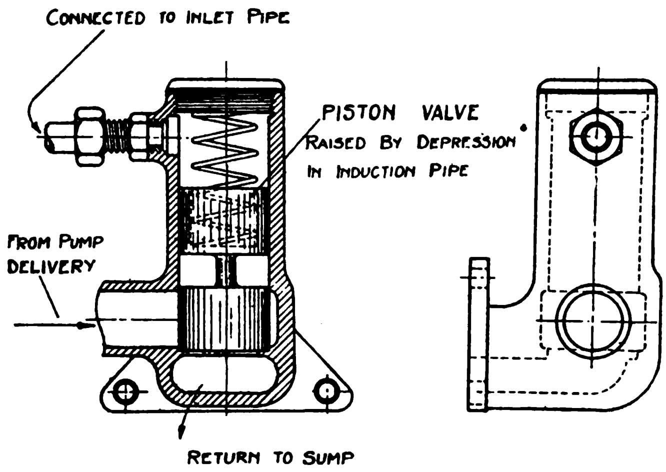


Fig. 2—Marmon oil pressure control valve

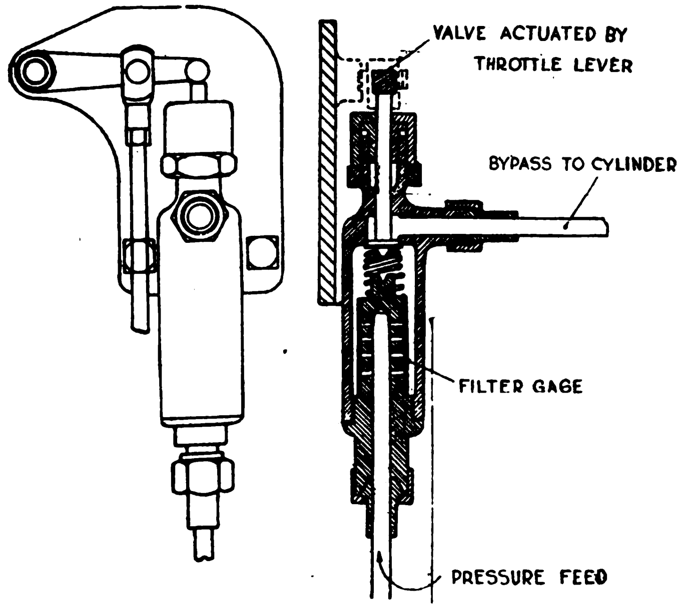


Fig. 3—Rolls-Royce throttle-controlled oil feed to cylinders

illustrated in Figs. 2 and 3. The author is not satisfied that any of these systems are correct, for the reason that it is possible to have extremes of engine speeds and loads for any given throttle position.

The usual practice in engine lubrication is to fill the sump with a given quantity of oil, which, according to most instructions, remains in use up to two or three thousand miles' running. It will be generally accepted that the longer the oil is used the thicker and darker it becomes, and, in order to ascertain the degree of deterioration caused by long periods of running, analyses were taken from:

(a) A standard proprietary brand of lubricating oil as delivered by the makers;

(b) A quantity of the same oil after 100 hours' running in an aviation engine of high power under full load.

There is very little difference in the actual test figures, but, as a slight reduction is shown in the co-efficient of friction, it is reasonable to suppose that this will continue to increase with the age of the oil. The original lubricating oil was of a yellow-green color and free from sediment, while after 100 hours' running it became deep black. On examination, this oil was found to contain a considerable quantity of carbon specks or particles in suspension. These particles, magnified fifty diameters, gave a dimension of 0.001 mm., and were so fine as to pass all the usual methods of filtering. We were able, however, to separate the carbon specks by filtering through 3 per cent Fuller's earth or with animal charcoal. The solid carbon particles so extracted amounted to 0.1 per cent, carrying also traces of iron and copper.

Samples of the oil were tested on a Thurston machine, and the general data and characteristics are shown in Table I. It will be noticed that the figures given prove the theory that the specific gravity is entirely independent of the viscosity, as, after use, the specific gravity has increased, while the viscosity has decreaed.

TABLE I

Analysis of Lubricating Oil Before Use and After 100 Hours' Running in Aero Engines

Specific gravity at 60 deg. F. before .... = 0.893
Specific gravity at 60 deg. F. after .... = 0.907
Specific gravity at 60 deg. F. used and filtered ...... = 0.892
Viscosity (Boverton Redwoods):

Standard refined rape oil	50cc.	Time, 7m. 7⅘s.	T. 60° F.
Unused oil	50cc.	Time, 49m. 20s.	T. 60° F.
Used oil	50cc.	Time, 47m. 16⅘s.	T. 60° F.
Used oil, but filtered		Time, 50m. 47s.	T. 60° F.
Unused oil	50cc.	Time, 9m. 5s.	T. 112° F.
Used oil	50cc.	Time, 7m. 35s.	T. 112° F.
Used oil, but filtered		Time, 10m. 31s.	T. 112° F.

Percentage of acid:
Before use .... = 0.211
After use .... = 0.250
Saponification figures:
Before use .... = 17.60
After use .... = 19.24
Co-efficient of friction:

Taken on Thurston's machine with white metal bearings

	Temp.	Revs. per Min.	Pressure per In.	Total Pressure	Co-efficient of Friction
Unused clean lubricating oil	50° C.	1,800	60	225 lb.	0.035
Dark oil after 100 hr. running	50	1,800	60	225 lb.	0.044
Filtered oil (carbon particles removed)	50	1,800	60	225 lb.	(0 041) (0.0380) 0.039

It is the practice of one well-known enemy engine builder to use a small auxiliary plunger driven from the main oil pump, which is continually drawing a supply of clean oil from the tank, and forcing it into the circulation along with the oil already in use, thereby making up for wastage and preventing, or, at least, reducing, the deterioration of the oil.

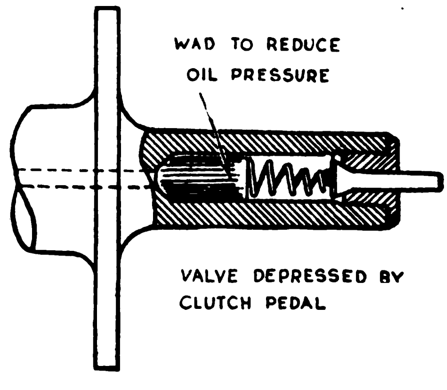
II. Tranmission

Clutch Pilot.—Lubrication of the clutch pilot is, with few exceptions, a matter of chance, or a Stauffer, which is much the same thing. In cars in which the engines are lubricated on the pressure system, however, some makers fit a non-return valve in the clutch end of the hollow crankshaft in such a manner that depression of the clutch pedal opens this valve and liberates a small quantity of oil. Fig. 4 shows such a device.

Flexible Connections.—Except, possibly, in engines and gear boxes of unit construction, it is necessary to have a flexible connection between the clutch and the first motion shaft. These connections are usually of the types illustrated in Figs. 5, 6, 7 and 8.

It is the author's complaint that there is no recorded case

Fig. 4—Non-return valve fitted in the clutch end of the hollow crankshaft to reduce oil pressure



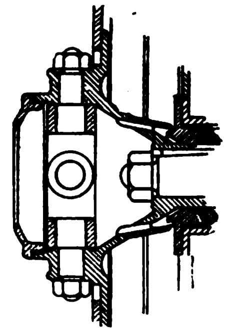


Fig. 5

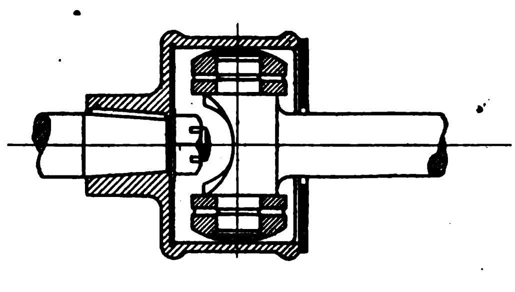
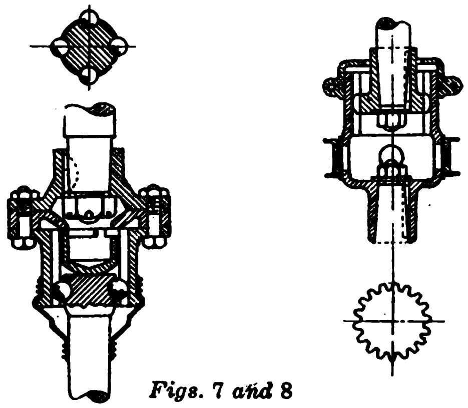


Fig. 6



Figs. 7 *and* 8

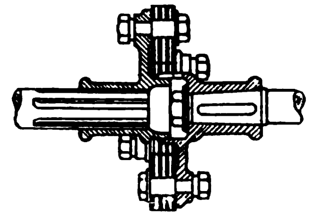
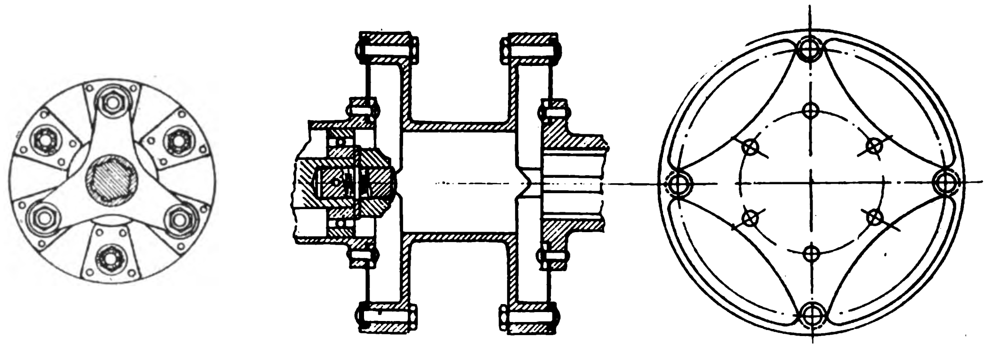


Fig. 9



Lubrication of universal joints *Fig.* 10

of any considered scheme for the lubrication of such connections. It may, of course, be argued that leather, fabric, or flexible metal joints may be used for this purpose, and Figs. 9 and 10 show those in most common use, but on account of their diameter and weight, for any reasonable torque, they render gear changing difficult, and, with high-speed engines, are apt to cause vibration on account of lack of balance, which increases with their age. In fact, so poor an opinion has the author of this kind of joint that, although he is the inventor of one of the best-known forms of it, he does not advocate its use.

Gear Box.—It is astonishing that the crude method of lubricating the gear box by filling it with a mixture of grease and oil has persisted so long. To the author's mind, this method should be classed with what an eminent member of this Institution has cleverly called "the unmechanical legacies of our designer-forefathers." The result of this scheme is an immense loss of power and sometimes of lubricant as well. Piles of grease can often be seen in the undershield or surrounding the gear box of many cars after a few hundred miles' running, not always due to design or workmanship, but simply because the over-zealous owner-driver has been too liberal in refilling the box, with the result that the lubricant has been literally forced out by the churning action of the gear wheels inside the casing, which in many cases embraces the gears and other mechanism generally far too closely. In these cases it can safely be assumed that the efficiency losses are even more serious than if the casing was filled only with its proper quantity.

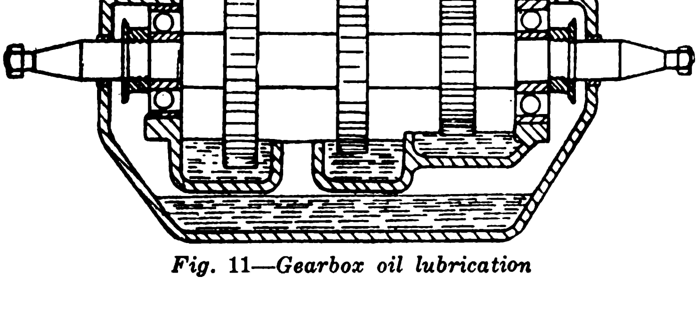


Fig. 11—*Gearbox oil lubrication*

A test of the 32 hp. "Leyland" gear-box was undertaken by the National Physical Laboratory (Report N.P.L., 1914-15, pp. 99-100), which gives the efficiency of the direct drive as being only 74 per cent when the box was full of oil, while, when a quarter full, the value was 97.5 per cent. It is evident that, had grease been the lubricant, the efficiency would have been lower still.

It is to be regretted that no tests with this gear-box were made with any other than the direct gear. Further figures as to efficiency on the different gears would be appreciated should any members have any data on the matter.

A method of oiling the wheels of a gear-box by making each dip into a trough in which oil is maintained at a constant level by a pump is illustrated in Fig. 11.

It has always been the author's practice to put only sufficient oil into the gear-boxes of racing cars that the teeth of the largest wheel alone would dip, but the best method would appear to be to cause a jet of oil to play upon the intersection of the gears on the side of engagement, as shown in Fig. 12. It will be noted that, in this design, white metal bearings are fitted for the shafts, and they are oiled under pressure: it is the author's experience that these are preferable to ball or roller bearings, making, as they do, a quieter and sweeter-running gear-box, without diminishing efficiency. In any case, it seems an unnecessary refinement to fit ball bearings to a device which, as usually lubricated, is more fitted for determining the mechanical equivalent of heat than anything else.

It will be seen on again examining Fig. 12 that this system, like the engine, is self-contained, and the quantity of lubricant is capable of being controlled by a suitable level gage, while at the same time, the pressure feed renders it possible to apply efficient and certain lubrication to the clutch bearing and universal joints on either side of the gear-box, wastage being prevented by gravity return to the sump, and the provision of effective oil retainers.

In those cars in which the engine and gear-box are combined in a single unit, the lubrication of the clutch pilot, gear-box, and universal joint is a more simple matter. In the "Morris-Oxford," for instance, the oil is circulated by the flywheel to the engine on the one hand, and to the gear-box and universal joint on the other. The Fergus car has a pressure system in which an engine-operated gear-wheel pump supplies oil to almost every moving part on the chassis.

It is debatable whether it is better to supply the different

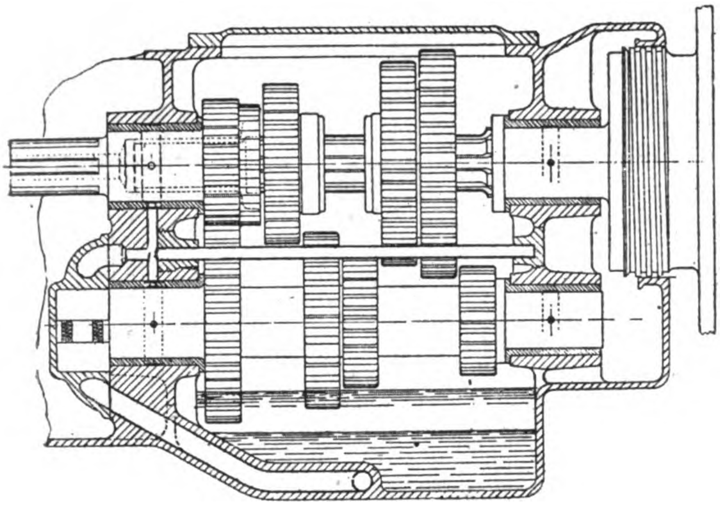
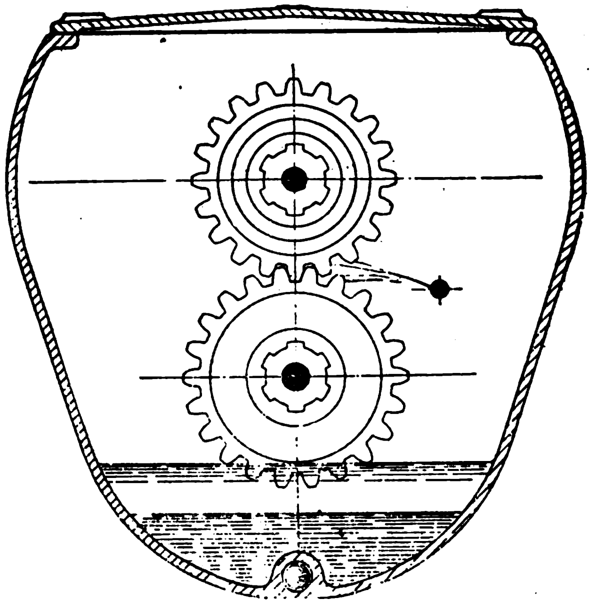


Fig. 12—Pressure oiling of transmission plain bearings



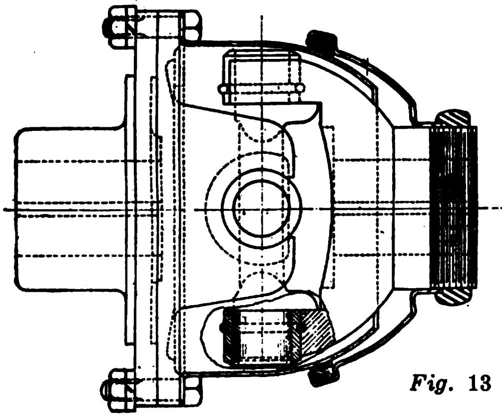


Fig. 13

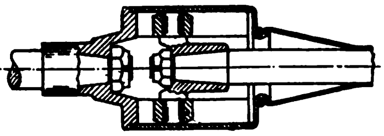


Fig. 14

Figs. 13 and 14—Housings of grease-lubricated universals

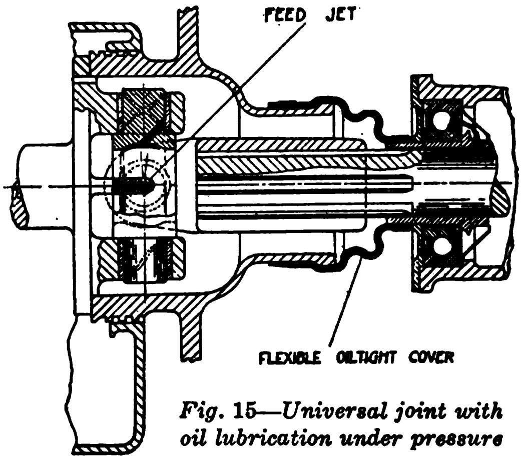


Fig. 15—Universal joint with oil lubrication under pressure

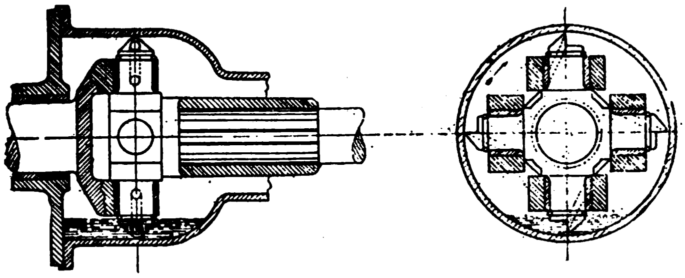


Fig. 16—Universal joint with splash lubrication

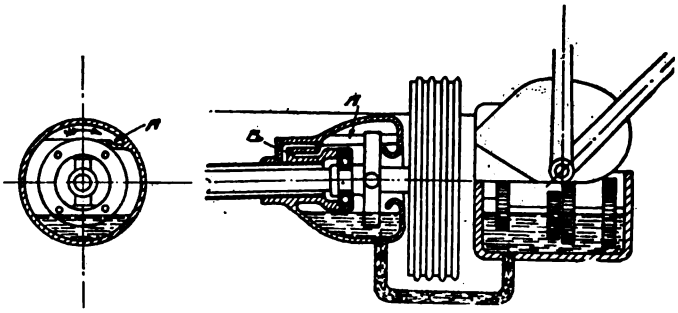


Fig. 17—Means for maintaining oil level in universal

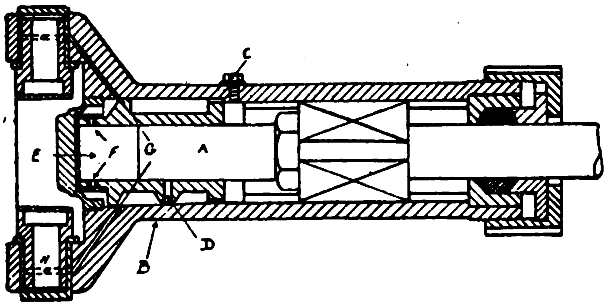


Fig. 18—Oiling universal by plunging action of propeller shaft

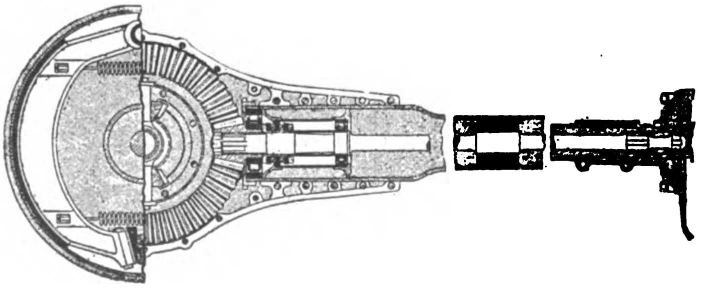


Fig. 19—Fergus rear axle lubrication system

components of the chassis from one source, as just explained, or to arrange a self-contained system of lubrication to each of the important units, as outlined by the author. Although in the latter case the pumps are duplicated, they are simple and nearer their work, and the extensive system of pipes and jointing necessary for the former scheme is avoided, thereby decreasing the risk of leakage and rattle through loose or broken pipe junctions.

Universal Joints—Where universal joints of the Hooke's type are employed, the author finds that their bearing surfaces are commonly loaded to pressures exceeding in some cases 3000 lb. per sq. in. Yet it has been thought sufficient to lubricate them by putting them into an articulated spherical housing in the best examples, or, in the worst, a part-metal and part-leather covering, and filling the casing with grease (see Figs. 13 and 14). The net result is that, when some of the lubricant has worked its way out of the casing, as it invariably does, centrifugal action takes place and the bearings soon run dry. On account of this action, it is essential that Hooke's type universal joints be lubricated from the inside. Fig. 15 shows a method which is favored by the author. In this scheme, oil is supplied under pressure to the center of each flexible joint by a suitable tube or jet. The oil issues from this and is caught by the hollow centre of the trunnion or star-piece. Holes are drilled from the centre to a point near the mouth of the bearing in each pin, and the bush is suitably grooved, so that, as long as the jet is delivering oil, centrifugal force will convey it to all bearings. The outer ends of the bushes are left open to allow of the used oil being thrown on to the casing, from whence it is returned to the sump by gravity.

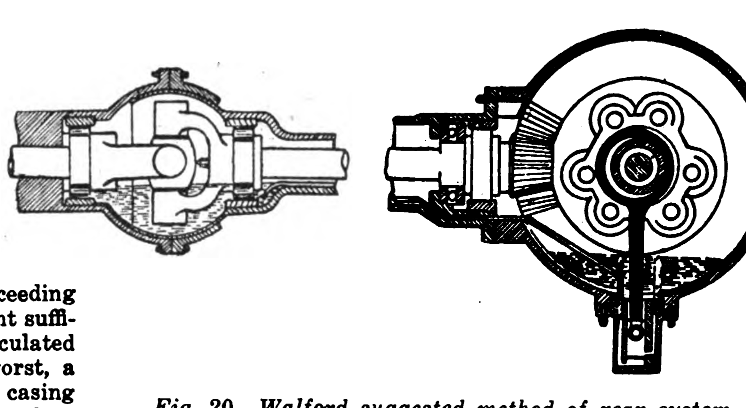
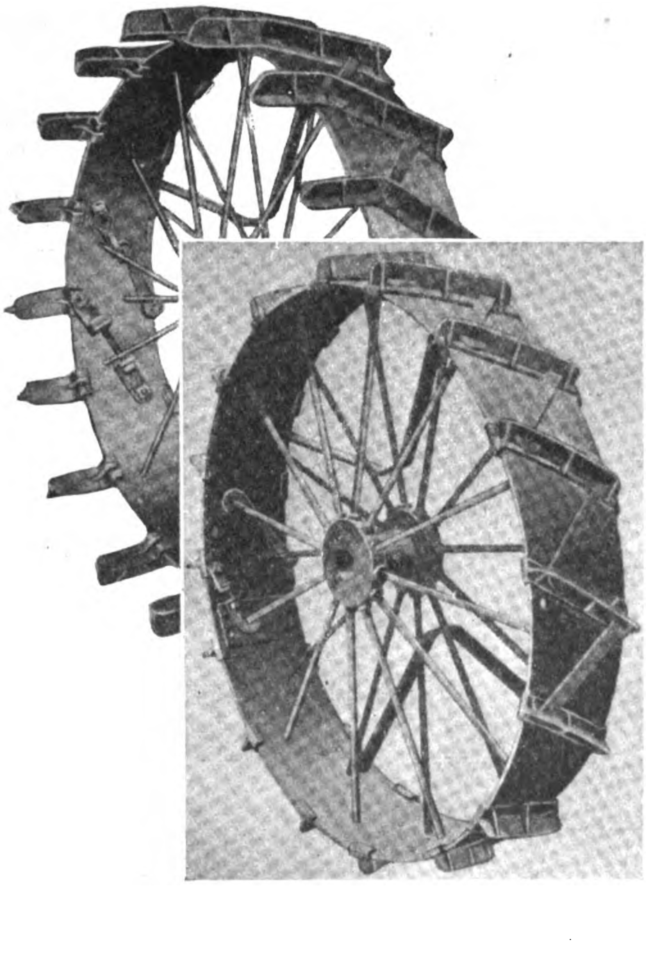


Fig. 20—Walford suggested method of rear system lubrication

Fig. 16 illustrates a scheme where the joint revolves in a stationary casing. It will be seen that the arms of the star-piece are hollow, and are fitted with scoops which dip into the oil contained in the casing as they revolve. The oil level is maintained by a pump, or by such a device as is illustrated in Fig. 17; Fig. 18 depicts an ingenious method of oiling the universal joint by the plunging action of the propeller shaft.

Propeller Shaft and Torque Tube—The oiling for the front bearing of the propeller shaft and the torque tube is susceptible of varieties of treatment. Fig. 19 represents that adopted in the "Fergus." Fig. 15 is a design of the author's, while Fig. 20 was suggested in an article by Capt. E. W. Walford in *The Autocar*. *(To be continued)*

Loxon Lugs for Tractors



PRACTICALLY all lugs which have been used on tractor wheels so far require bolting to the wheel rim. This is a tedious operation, and rather than spend the time necessary to remove the lugs, the farmer is apt to leave them on whether they are needed or not. When the tractor is doing only light work it is much better to run without the lugs, as the use of the latter always entails some loss of power. For driving on improved roads the lugs must be removed.

A design of quick detachable lug has recently been placed on the market by the Universal Lug Co., Cicero, Ill. There are two principal kinds of parts, the lugs proper, and links. The lug is made in T form, in various heights and sizes. On both ends of each lug is a hook or clamp which fits the thickness of the rim. The key lug, which is placed on the rim first, has a swivel arm attached to one of its rim hooks, this arm fitting into the eye of the rim keeper. After one lug has been placed on the rim, a link is inserted, then another lug is put on, then another link, and so on. The lock lug has a small bracket fastened to one of its rim hooks, with a hole bored through it for a bolt. A rim bracket is permanently secured to the inside of the rim and the locking bolt is then inserted in the lug bracket and the rim bracket, and its nut is drawn up.

It will be seen that the lugs extend across the rim at an angle. Different spacings are used, from 9 to 12 in., according to the size of lug, etc. The general form of the lugs is T shaped, and a number of ribs stiffen the web of the T. Both the ordinary lugs, extending only across the rim, and extension lugs are furnished. While the major portion of the lugs extends across the rim at an angle of 45 deg., the extension part extends parallel to the wheel rim.

Loxon lugs are made in malleable iron, and it is claimed that they can be put on and removed in 5 minutes.

Factors in High-Speed Engine Development

Solution of Carburetion Problems—Making Thermal Efficiency and Horsepower Tests on the Road

By D. McCall White

(Part I—*Continued*)

IT is highly important that when engines are turning fast that the maximum stiffness should be obtained in the cylinders, connecting rods, crankshafts, and above all the crankcase should be extremely stiff and rigid in order to prevent weaving, bearings going out of line, etc., and thus causing vibration and other evils. Fig. 12 illustrates the Cadillac crankcase and method of webbing up for maximum rigidity.

Carburetion Problems

Carburetion is a difficult subject, difficult because of the quality of gasoline, which is becoming worse day by day. As the public becomes more critical of the performance of an automobile, the difficulties presented to the engineer become more acute. Undoubtedly, more heat must be applied to the manifolds to get proper and satisfactory carburetion, assuming that distribution is correct. We keep our manifold temperature around 170 deg. F. by means of thermostatic control, the thermostats being located in the water pumps, causing valves to close or open as the ease may be, thus preventing circulation of water through the radiator should the temperature be low. This has been very satisfactory indeed, but with poor grades of gasoline, more than this has to be developed. Much has been talked about exhaust heated manifolds, but this requires extensive study, as too much heat is as bad as too little and it is possible to lose great power at the higher engine speeds unless great care is taken.

An interesting development is shown in Fig. 13, the illustration being the design for a cylinder having exhaust cast integrally with the cylinder block, completely surrounded with water except the wall next the intake manifold, same being located above the exhaust manifold, the idea being that as the gasses whirled, the heavier molecules were thrown against the intake manifold walls, and, falling to the bottom wall, were immediately volatilized by the heat from the exhaust impinging thereon, the remainder of the gases being at normal water jacket temperature. I designed this engine in 1915 and it was extremely successful, although was never put into production on account of increased radiator capacity being necessary. This layout savors a little as the forerunner of the much advertised hot spot manifold.

Many other devices are in use, such as combined intake and exhaust manifolds, but many of these are, in my opinion, merely an excuse to try to get rid of bad distribution, which is so prevalent, unfortunately, in many of our engines to-day.

The shuttered radiator is also quite a satisfactory layout, but requires considerable development yet owing to danger of freezing shutters shut, wind pressure causing shutters either to remain full open or shut, rattles, etc.

In the Cadillac four-cylinder 1914 type engine, there was used in the carbureter an electric heating element, Fig. 14, consisting of nichrome ribbon between mica sheets, which was attached to the upper surface of the diaphragm, that is, the plate which supports the venturi tube. The gasoline which condensed in the intake pipe and mixing chamber dropped down on to this diaphragm and was vaporized by the heater. In operation, current was put through the heater for a short time before starting, so that this diaphragm and the metal of the venturi tube were heated and any fuel on the diaphragm was vaporized. Fig. 14 shows general assembly of this device.

Horsepower on the Road

The need has often been felt for some instrument to measure the road resistance and horsepower, and a very interesting instrument was developed some years ago in England and has been used by my company since the advent of the eight-cylinder car for this purpose. Fig. 15 shows this instrument, known as the Wimperis accelerometer. It can be used to measure:

1—The road resistance of different kinds of roads or tracks, under various weather conditions.

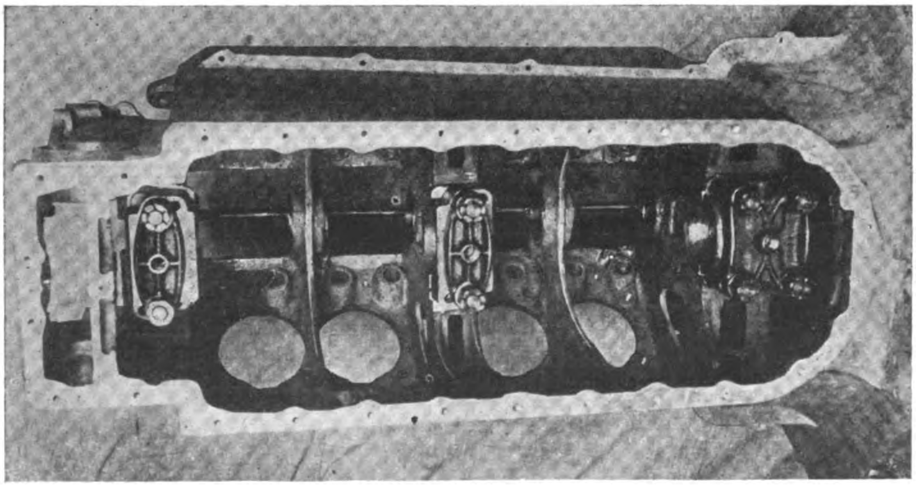


Fig. 12—Construction of the Cadillac crankcase, illustrating the method of webbing up for maximum rigidity

Fig. 15—Wimperis accelerometer used in making acceleration tests

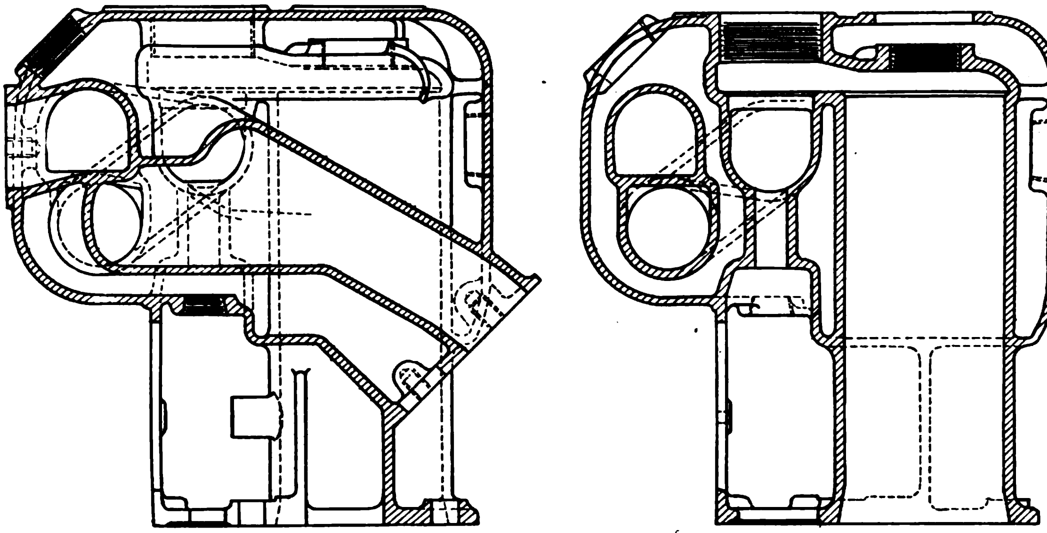


Fig. 13—Design of cylinder having exhaust cast integrally with the cylinder block

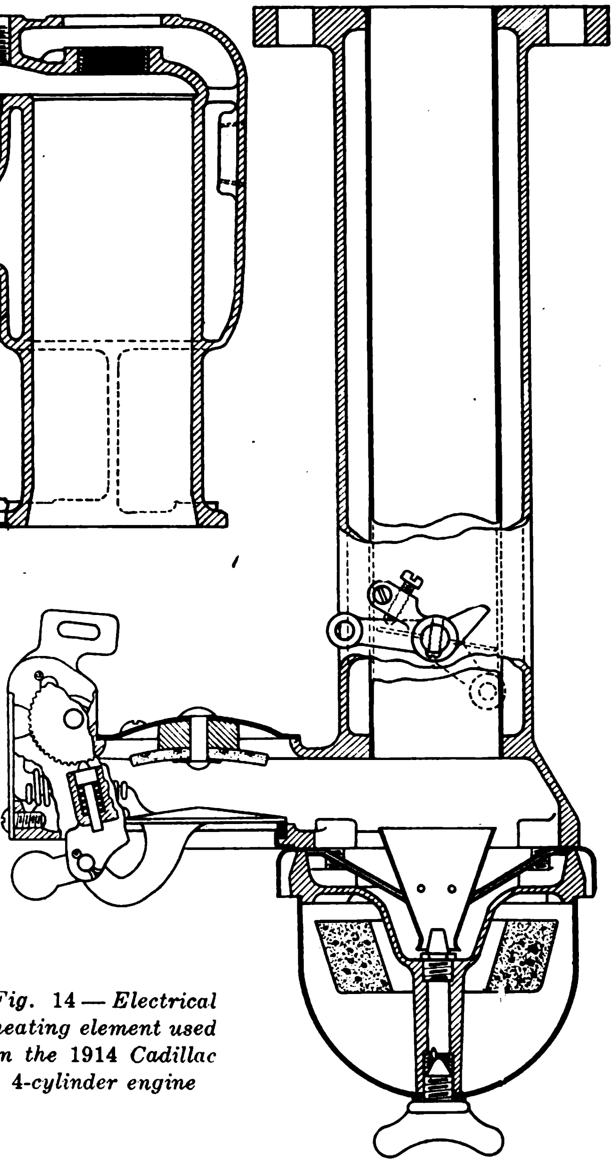


Fig. 14 — Electrical heating element used in the 1914 Cadillac 4-cylinder engine

2—The amount of air resistance due to various forms of vehicles.

3—The mechanical and thermal efficiency of the engine at various speeds under real working conditions.

4—The brake horsepower exerted by the engine when running at various speeds on the road.

5—It is possible to trace step by step losses of power in transmission.

Since the advent of aircraft engines much has been learned regarding weight reduction. I am doubtful if many of the materials used in aircraft engines will ever be used in automobiles, for commercial production, but we have aluminum engines before us and there does not seem to be much doubt but what, perhaps in time, we will see many of these on the road and that possibly automobile engines will come down around 4 or 5 lb. weight per horsepower. We used to dream of 7 and 8 lb. with the accessories and I am in great hopes of seeing good development in this line.

In 1909 I designed a high-speed, four-cylinder engine weighing without flywheel 5¼ lb. per brake horsepower. The 2½ litre Crossley engine weighed 8¾ lb., neglecting flywheel, whilst the 3-litre Vauxhall in similar condition weighed 7¼ lb. per brake horsepower and the Prince Henry Vauxhall 5 lb., whilst the standard Cadillac eight-cylinder engine complete with generator but without flywheel weighs 8 lb. per brake horsepower.

Application of High-Speed Engines to War Uses

Part II

LAST week the general fundamental factor entering into problems of high speed engine design were analyzed and in Part II, this week, a few examples are given of the use to which the high speed Cadillac 8-cylinder engine was put during the war. The following illustrations are of war apparatus using this engine.

Fig. 16 shows a searchlight outfit developed by the General Electric Co. through its engineer, Henry S. Baldwin, working in conjunction with my company, to whom I am indebted for the pictures. A generator having sufficient capacity to operate a 60-in. searchlight for war purposes was mounted on the chassis.

We believe that this is the largest lamp that has been produced, and the car has been thoroughly tested both in this country and for about 6 weeks in France prior to the signing of the armistice. We have records before us that it is a fact that it has never failed to meet any demands upon it as to power and structural features, and taking it all in all, it is

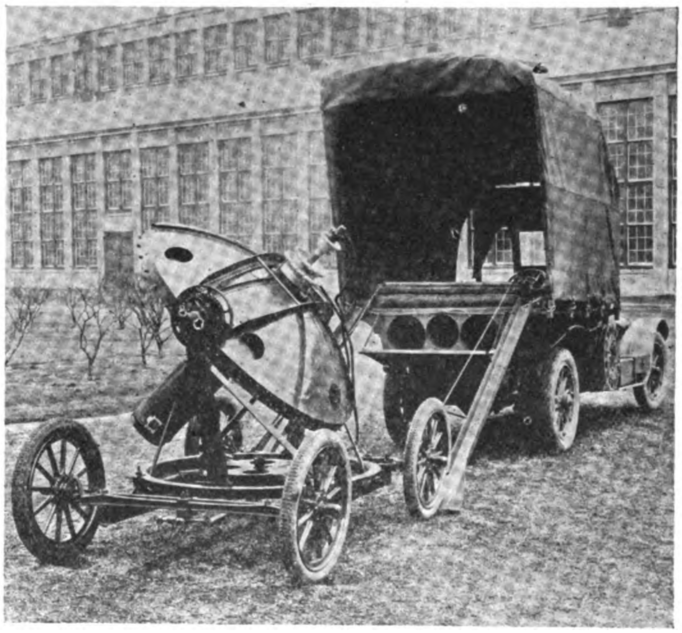
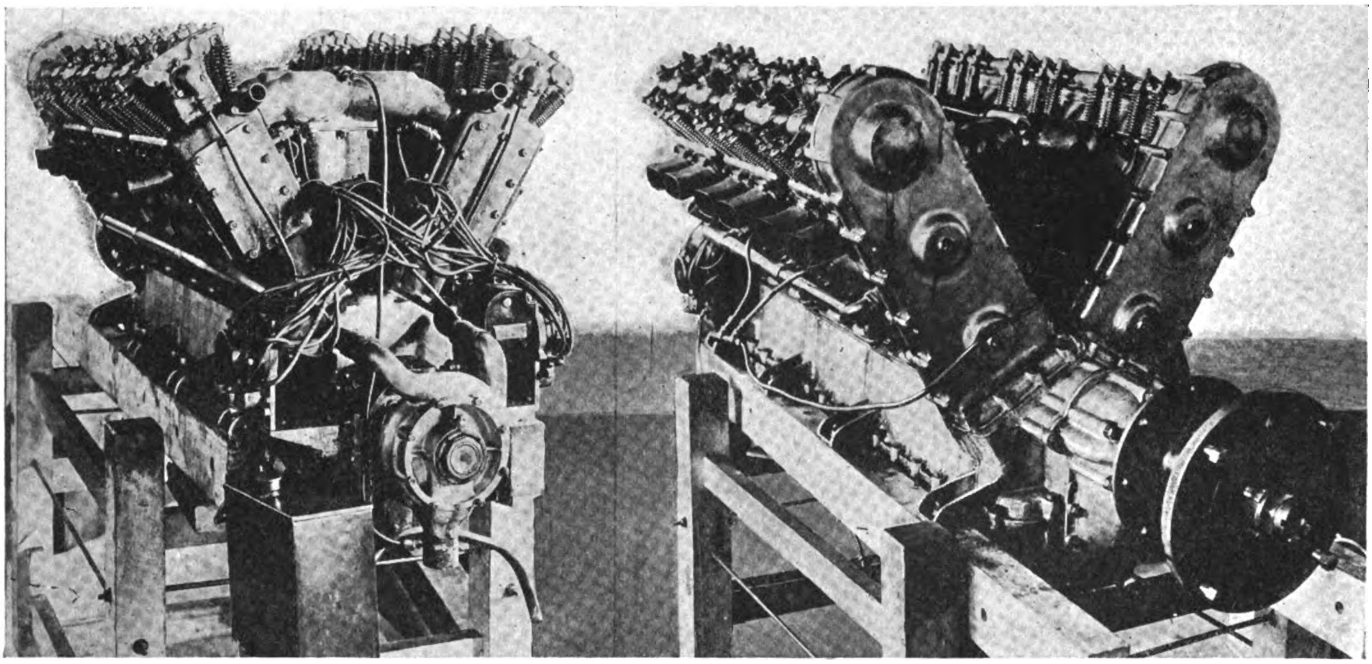


Fig. 16—Searchlight outfit developed by General Electric Co. It has a speed of 45 to 50 m.p.h.



Figs. 19 and 20—Twelve-cylinder high-speed aircraft engine designed by the author in 1915. The bore and stroke are 4 3/16 x 6, and it has twin exhausts and intakes for each cylinder and three carbureters mounted in the center

probably one of the most ingenious and successful devices which have been turned out, weighing about 11,000 lb. less than the outfit which was previously used for the same purposes and having a speed of 45 to 50 m.p.h. against a former speed of 15 to 20 m.p.h.

Another example of the use of the high-speed engine is in connection with tractors. Fig. 17 is a drawing of the 2½ ton U. S. A. artillery tractor, into which was fitted the Cadillac eight-cylinder engine. This tractor was capable, at a maximum burst, of traveling at the rate of 21 m.p.h., which is an engine speed of 3500 r.p.m. Its normal speed is around 12 m.p.h., the engine speed on high gear being 2000 r.p.m., the gears at these revolutions being as follows: First speed, 3.86 m.p.h., and second speed, 7 m.p.h.

The gear rations are as follows, the total reduction being between the engine and the track drive sprockets:

Direct, or high speed	13.01 to 1
Intermediate, or second speed	22.25 to 1
Low, or first speed	40.50 to 1
Reverse	48.65 to 1

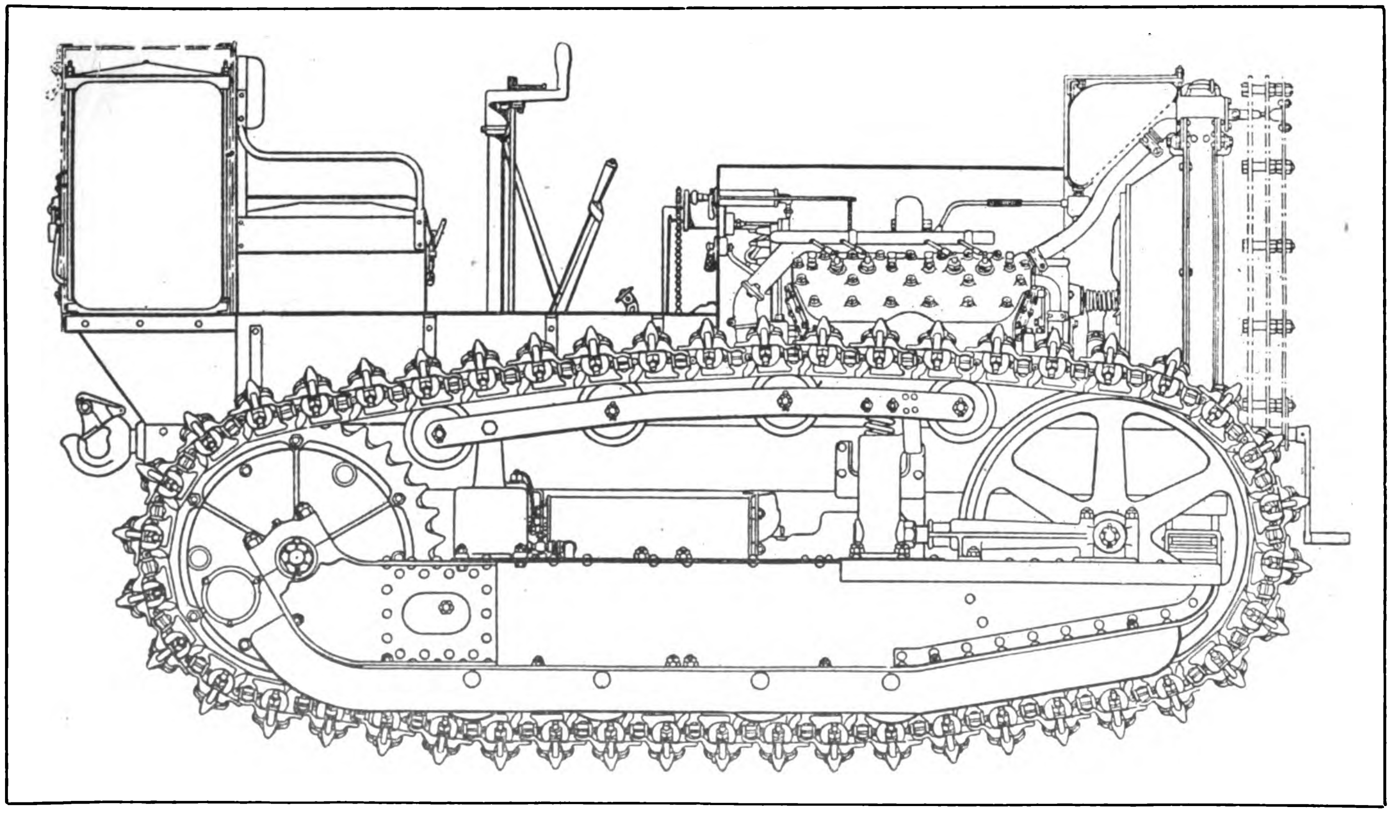


Fig. 17—Application of a Cadillac 8-cylinder engine to a 2½-ton U. S. A. artillery tractor. The normal speed of the tractor is 12 m.p.h., but it was capable at a maximum burst of 21 m.p.h.

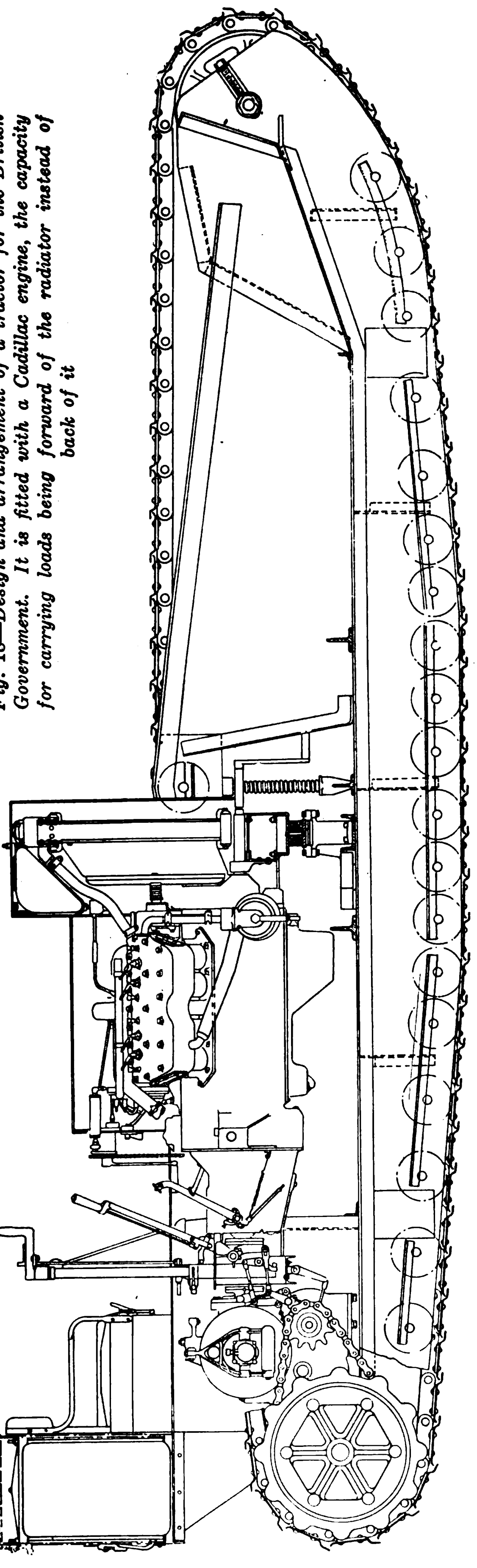


Fig. 18—Design and arrangement of a tractor for the British Government. It is fitted with a Cadillac engine, the capacity for carrying loads being forward of the radiator instead of back of it

Fig. 18 shows a layout of the Cadillac engine fitted to a tractor for the British Government, its capacity for carrying loads being forward of the radiator instead of behind it as was the case in the 2½-ton U. S. A. tractor.

Figs. 19 and 20 show a high-speed aircraft engine designed by myself in 1915. This engine had twelve cylinders, 4 3/16 by 6, having two exhausts and two intakes per cylinder, three carbureters mounted in the center, and owing to inability to obtain battery ignition, the engine was tested out with two twelve-cylinder magnetos. The design had a dry crankcase so far as oil was concerned, having two oil pumps with a cooling system and geared-down propeller, as the engine was designed to pull 350 horsepower at 2400 r.p.m.

The weight with cast iron cylinders was 1000 lb., which of course amounts to 3⅓ lb. per horsepower, which weight could, with steel cylinders, have been very considerably reduced.

Chromium Steel for Permanent Magnets

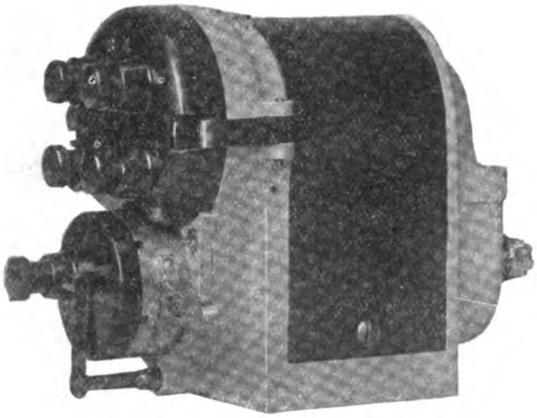
A GOOD deal of research work on magnet steels has been conducted at the Reichsanstalt during the war; only part of it has, so far, been published in the *Wissenschaftliche Abhandlungen.* One of the points investigated is the substitution of chromium steel for tungsten steel. Bar magnets of chromium steel, stored for a year without being exposed to any disturbance, kept their magnetic moment constant within 0.3 per cent and less; in all the cases the changes observed were within the limits of the experimental error in the second half of the year. As regards constancy to heat variations and concussions and temperature coefficient the chromium steel proved equal to tungsten steel; in coercive force and remanence the best chromium steel did not come up to the best tungsten steel. The temperature coefficient of the magnetic moment diminishes with increasing content of dissolved carbon and was found to be zero in a 1.4 per cent carbon steel. To investigate the suitable ratio of length to diameter in the case of bar magnets a chromium steel originally 22 cm. in length and 0.6 cm. in diameter was gradually shortened to a length of 2.4 cm.: this shortening raised the temperature coefficient from 2.4 per cent up to 4.2 per cent. The ratio of length to diameter l/d was also found not to be without influence on magnetometer determination of the coercive force. When the value of l/d fell below 10, these determinations gave too low values; practically this point is not important.

Benzol as a Motor Fuel

NOW that war demands have ceased, says the *American Gas Engineering Journal,* the producers of benzol are hoping to put a large proportion of their output on the market as motor fuel. The defects of benzol for that use, which defects need no longer exist, are of four kinds: (1) The valves and valve-stems of the engine become coated with a gummy substance which causes them to stick in the guides; (2) the valve faces become in time deeply corroded and pitted; (3) in cold weather the benzol may become frozen, and (4) the benzol contains water, which collects in drops, and finds its way into the carbureter, where it prevents a free flow of the fuel to the jet. The causes of these troublesome circumstances are now well known to benzol producers, and they may be easily removed. The gummy deposit is due to insufficient washing with strong sulphuric acid. Pitting of the valve-seats results from using benzol which contains an excessive amount of sulphur. Freezing is due to the presence of too high a proportion of benzine. Water is usually found in benzol which has not been sufficiently matured. The water, always present in the distillate, takes some time to settle out. The benzol should therefore be left to stand several days in the storage tank before being transferred to drums. To run off the water, all storage tanks should be fitted with drain-cocks at their lowest point. Attention to these matters will insure a good motor fuel. When filling drums and tins, all benzol should be run through a fine gauze. It has been proved that bulk for bulk benzol gives more power, and therefore greater mileage than gasoline.

Kliesrath Magnetos

Made in 1, 2, 4 and 6-Cylinder Models by the Simms Magneto Co.—Of Water-Proof Construction and Provided with High Speed Interrupters



Kliesrath model K-4 magneto. Base and end plates are a single casting

THE Simms Magneto Co., East Orange, N. J., is continuing some of its earlier models, the 4 and 6 cylinder open type, and in addition has recently brought out several new models, from designs by V. W. Kliesrath, who for many years was chief engineer of the Bosch Magneto Co. When Mr. Kliesrath joined the Simms company, the first work he did was to design 4 and 6 cylinder water-proof models, known as models K-4 and K-6, which have end plates conforming to the shape of the horse-shoe magnets, with grooves running around the edges which are packed with felt soaked in grease. Another improvement introduced by Kliesrath was to provide the interrupter with a rubber bumper to make its operation at high speed more nearly positive. The interrupter arm is held against the cam by a spring, and at high speed, when the cam strikes the arm a severe blow, there is a tendency for the arm to be thrown from the cam, and for contact between the points to become unreliable. The rubber bumper limits the distance the points can separate, and, therefore, enables the interrupter to work reliably at higher speeds.

Mr. Kliesrath also developed 8, 12 and 16 cylinder aircraft magnetos, all structural parts of which are made of aluminum. Tie rods are used for holding the end plates to the magnets, this construction being more secure than the use of screws. Small single cylinder and two cylinder magnetos have also been developed for use on stationary, marine and tractor engines.

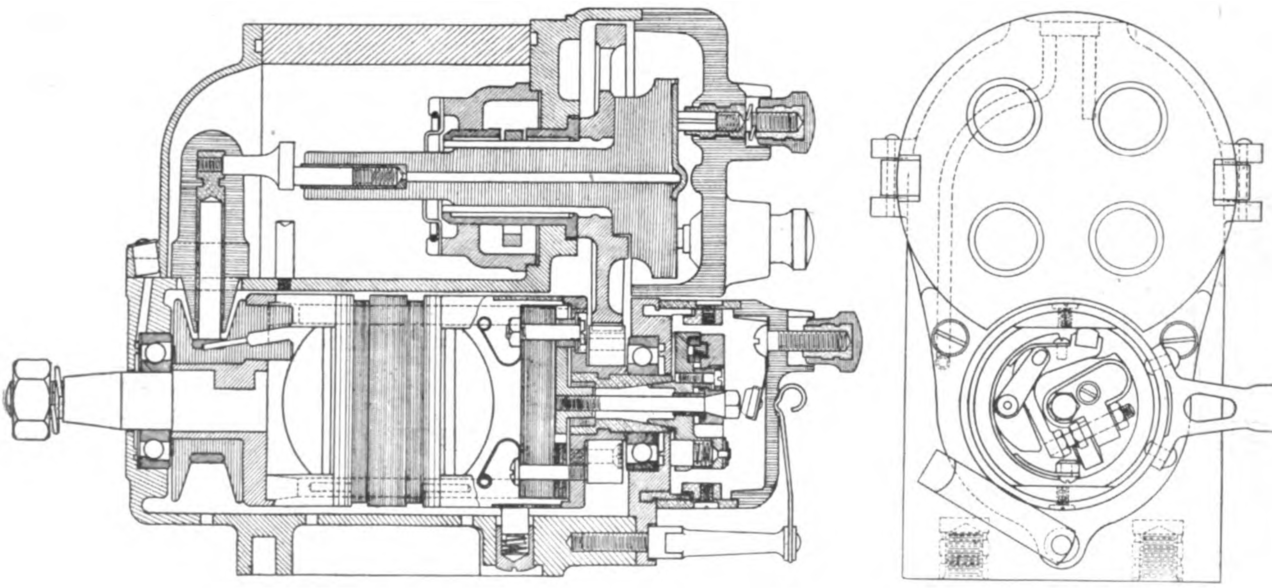
The new Kliesrath 4 and 6 cylinder types have straight lines, and are of compact design. They have been designed throughout with a view of allowing manufacture of a high-grade instrument, at less cost than has been possible heretofore. Special attention has been given to a proper balance between the amount of magnetic and conducting material in the armature, the object being to obtain greater output from an instrument of a given weight. The distributer gear is made from a material manufactured by a new process, and meshes with a composition noiseless gear on the armature shaft. This material has a great tensile strength, and is particularly adapted to withstand the abuse which is unavoidable with an impulse starter. Large Norma ball bearings are used at both ends of the armature, while the distributer shaft is mounted in a plain bearing, lined with frictionless metal. The gear teeth are so designed as to withstand the excess load due to the recoil on the impulse starter. The characteristics of this instrument are such as to make it possible to obtain a full strength spark at 34 r.p.m. with the timing lever set in the most advantageous position, and at 85 r.p.m. when set at full retard. An ample timing range (35 deg.) is provided.

The Simms company also has recently placed on the market an automatic impulse starter, the main feature of which is that it goes into the same space ordinarily occupied by the magneto coupling. This enables manufacturers to provide for an impulse starter without making a change in their designs. This starter is fully automatic and requires no attention from the operator. It is completely protected from dust, and does not have to be oiled. The design is such that it can be said to cut in and out automatically, at any speed desired, by the manufacturer. It is self-contained, and is mounted as a unit on any standard type of Simms magneto.

—

Editor AUTOMOTIVE INDUSTRIES—I note that the tables of airplane radiator performance, from my paper on this subject, which were reprinted in the March 13 issue of AUTOMOTIVE INDUSTRIES have been copied from the advance copy of the paper gotten out by the S. A. E.

As the printers of this advance copy added two and three zeros to my original figures I would appreciate it if you would insert a small note in some coming issue to warn designers that the accuracy is not carried to the extent implied by some of the figures.—ARCHIBALD BLACK.



Cross section and end view of Kliesrath 4-cylinder magneto

F-5-L Navy Flying Boat

Details of the Hull Construction—Design and Materials of Various Fittings—Panel and Strut Layout

By S. T. Williams
Assistant Chief Engineer, Naval Aircraft Factory, Philadelphia

Part II

IN the previous issue the general description, construction and performance of the model F-5-L Navy flying boat was described. It was shown, briefly, to be a twin Liberty motored biplane, having a wing span of approximately 104 ft., mounted on a hull or boat, permitting it to ascend or light upon the water. The general features of the plane were mentioned—namely, the fine streamline form of the hull, design permitting speedy production under war conditions, and the extensive use of veneer and laminated construction. The major details of this construction exclusive of the powerplant and controls will now be described.

Considering first the hull, either of two general statements are true—it may be termed a speed boat to which wings are attached, or it may be described as a standard airplane fuselage to which a V-bottomed substructure has been added in the place of the land plane's undercarriage and wheels. In either case, it serves the dual duty of carrying the crew, gasoline, etc., and as a landing device.

Hull Has Planked V-Bottom

The hull is built up around four longerons, as is a land plane, and has in addition a keel and a planked V-bottom that is flared out to present more landing surface. The flared out portions are called fins, and in this plane are an integral part of the hull structure, and are continued aft, and streamline into the hull sides. This is not the case in many previous seaplanes, namely, the H-12 and the HS-1 and 2, where the fins are stopped abruptly about one-third the hull length aft from the bow, and the advantage is increased strength and better streamline form.

Before entering into a detailed description of the hull construction, it may be well to define some of the terms used. The following defines them roughly and is the order in which they enter into the hull construction:

Keelson—A wide thin plank extending from near the bow to the stern, above the keel.

Keel—The bottom-most longitudinal member forming the backbone of the hull.

Floor Frames—The transverse planks jointed at right angles to the keelson.

Longerons—All longitudinal members extending from the bow to the stern with the exception of the keel.

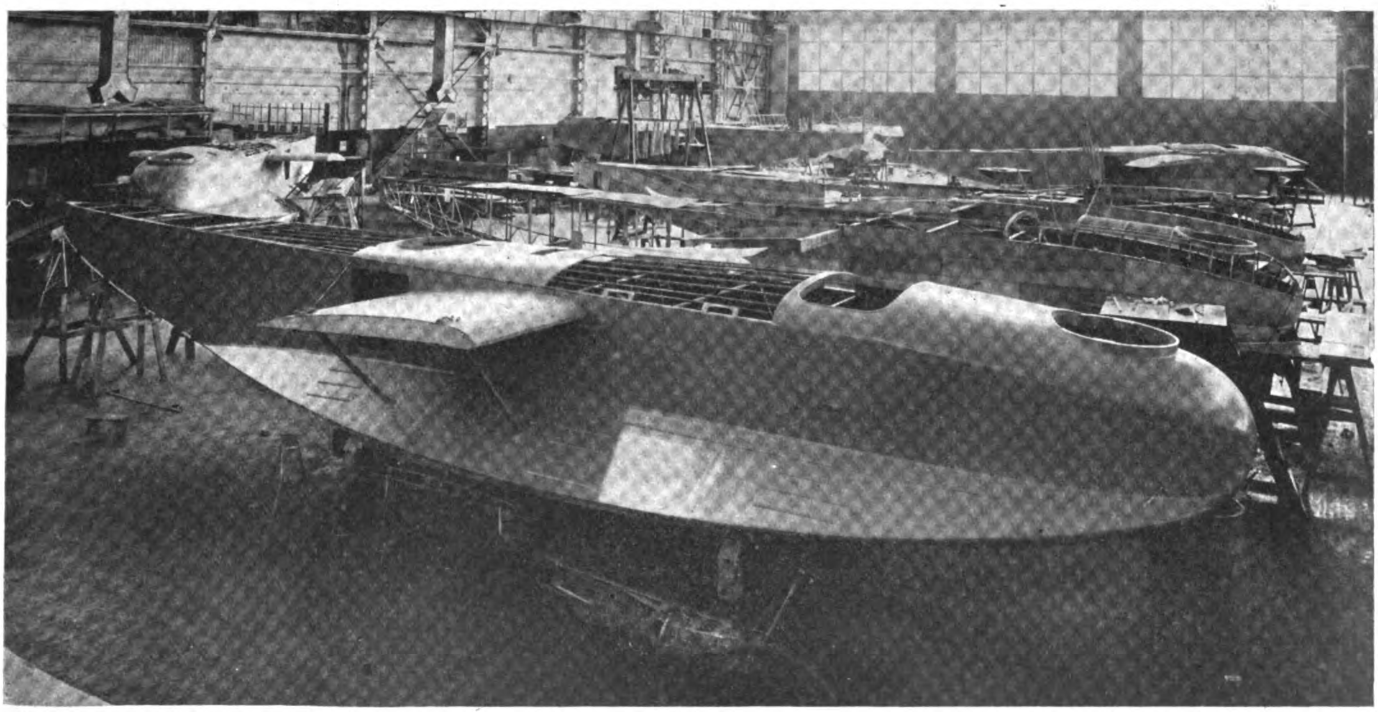
Fin Edges—The two outside longitudinals of the fins.

Stringers—The longitudinal strips connecting the floor frames on the bottom and the strips on the fins.

Bulkheads—All transverse veneer structures dividing the hull framing.

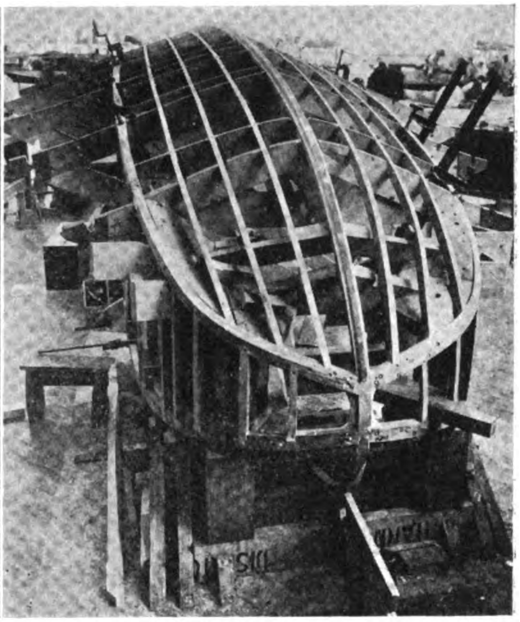
Transverse Bracing—The central structure connecting the hull to the two wing beams extending through the hull.

The keelsons are ½ in. basswood, built in not more than 5 sections, having at least a 9 in. scarf at the joints and held together with copper rivets. To this the floor frames, also ½ in. basswood, are notched and securely riveted by two corner stringers. Throughout it will be noted that built up members are used, permitting the use of readily available material.

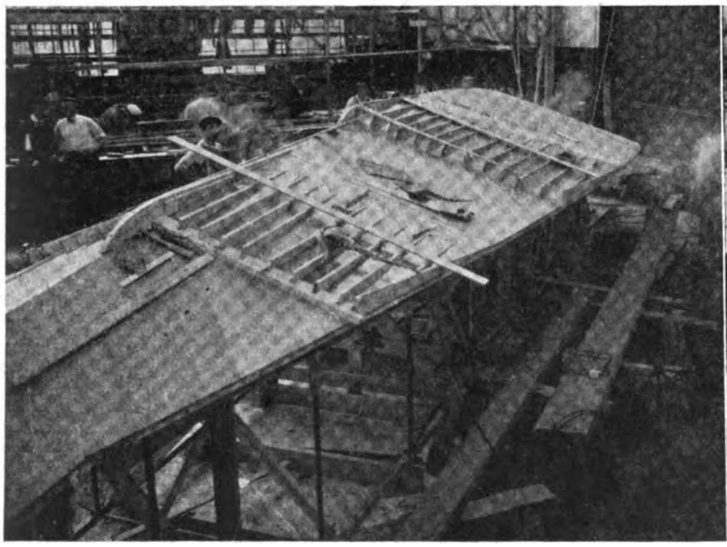


Complete hull assembly for the F-5-L Navy flying boat. This is a twin Liberty-engined tractor biplane and the hull measures 45 ft. in length and 10 ft. wide. The total flying weight of the boat is 7 tons

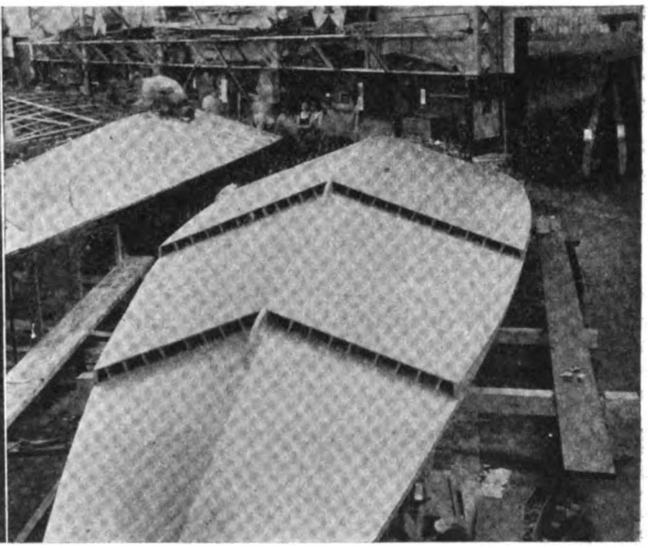
Building up the hull of the F-5-L flying boat, showing the frames in places ready for keel and stringers



Front view of the boat hull frame somewhat further along in construction



Three-quarter aft side view of the under side of the hull, showing the method of building up the steps



The hull bottom completed, showing the two steps, their location and depth as compared with the width

White ash is used for keel, longerons, fin edges, and the bent ends of the stringers. These two may be built up or spliced, but not more than four sections may be used. The scarfs in the keel must be at least 18 in. long, and are copper riveted. Formerly a straight scarf was used, as it was considered a better production proposition, but now a stepped scarf is used, as it was found that the time saved in making the straight scarf was lost in assembly.

Similar methods of splicing are used in the case of the longerons, fin edges and stringers, and here the joints are served and doped. Care is taken in the location of all splices in longitudinal members, so that a number of splices will not occur in any one section, causing a weak section and failure. For example, not more than two longeron splices may appear in any one bay, and these must both appear in either the upper pair—to balance each other.

By this method of splicing ash longitudinals, and the careful location of joints, short lengths of ash can be used. And this is important, as airplane ash under any condition is not easy to secure.

All ash members are steam bent to assembly shape before assembly on the hull forms. This bending and the splicing of the complete longitudinals are done in a separate part of the shops. Likewise the keelsons and floor frames, stringers, bulkheads, posts, struts, braces, etc., are sub-assembled, and when delivered to the hull erection floor are ready for assembly but with little fitting. This idea is carried out even to the bottom planking, which is delivered in amounts sufficient for one hull. But a detailed description of this subassembly construction is too involved for comment here.

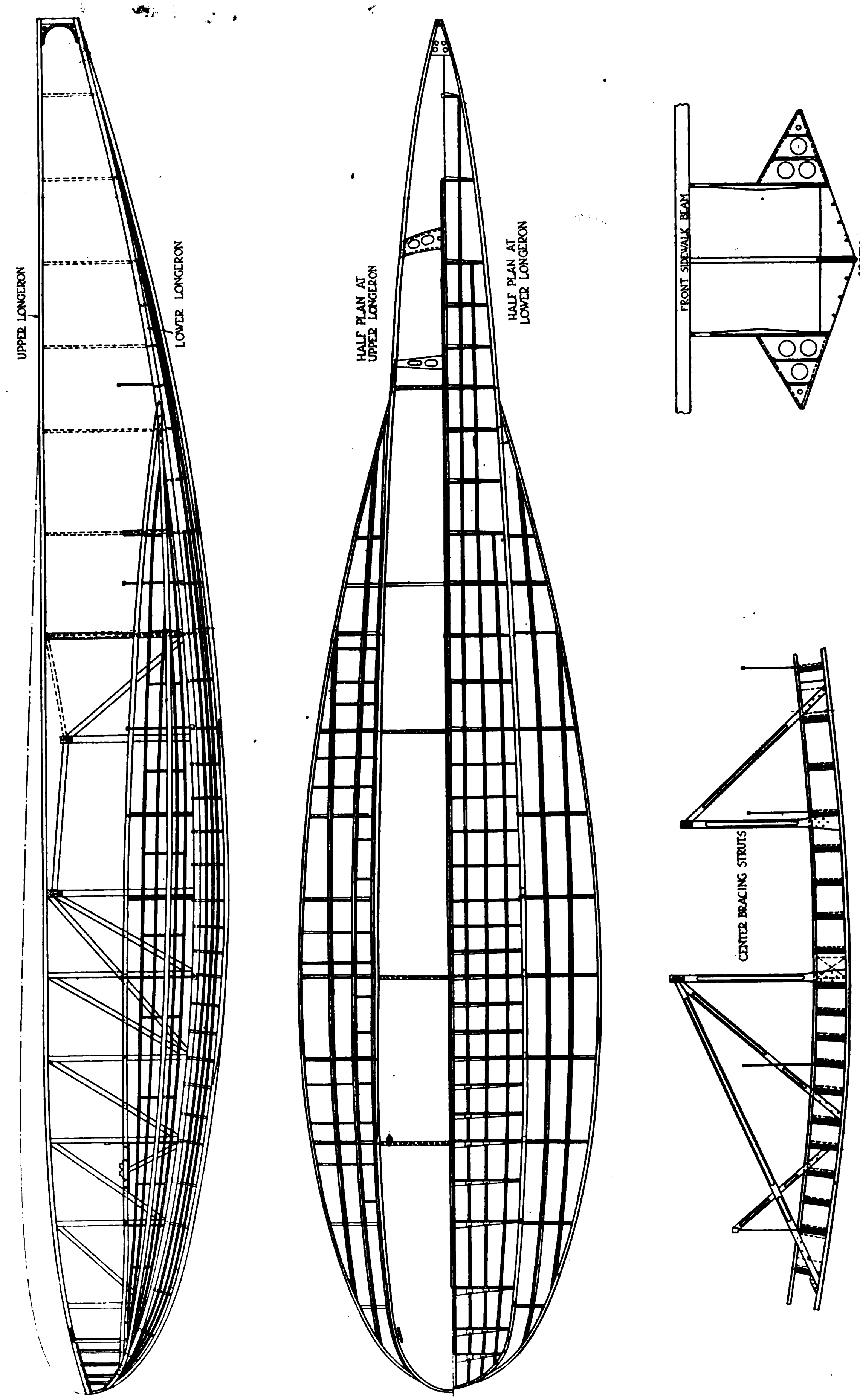
Throughout the hull construction all parts are tied together by metal fittings—and concerning these metal fittings three points are noteworthy as aiding increased production. The first is a choice of material used. One generally considers the steel entering into airplane construction as being the best possible, and heat treated to the greatest strength. But fittings on this plane are in general soft or mild carbon steel.

The reasons for this are that such steel can be procured almost anywhere, is easily worked and welded—and loses little of its strength through abuse in brazing, welding or forming. Its analysis (sheet steel only) follows:

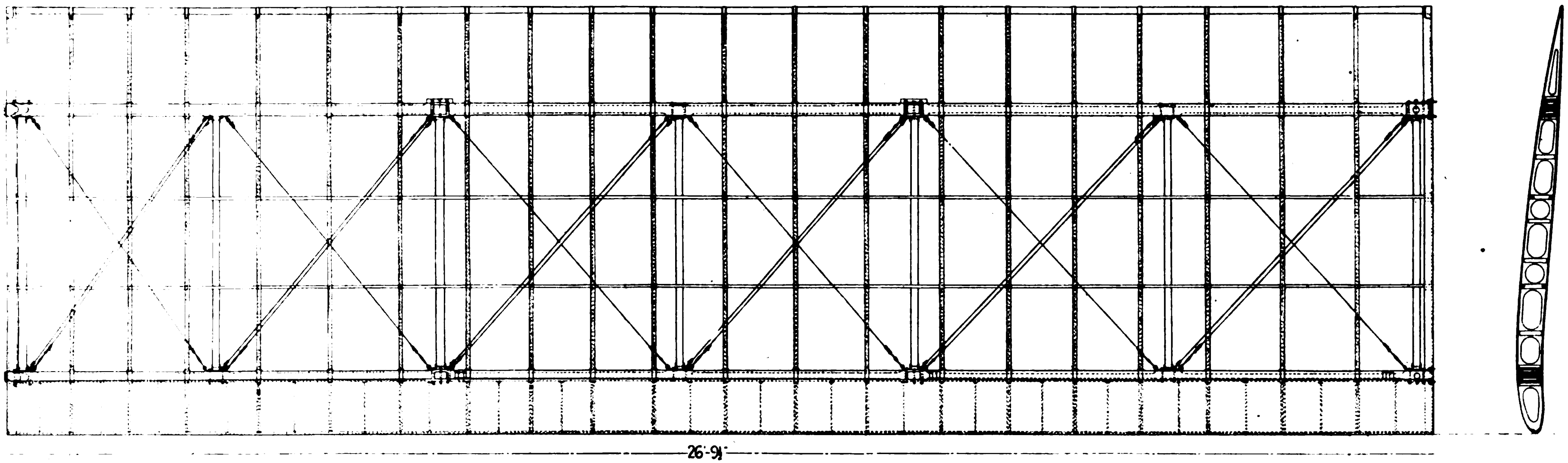
Number	Carbon	Manganese	Phosphorous	Sulphur
1020	.15.... .25	.30.... .60	.045 max.	.050 max.
1025	.20.... .30	.50.... .80	.045 max.	.050 max.

The second point to be noted in the fittings is that, with few exceptions, they are built up from flat patterns bent and brazed or welded. This eliminates drop forgings, which were

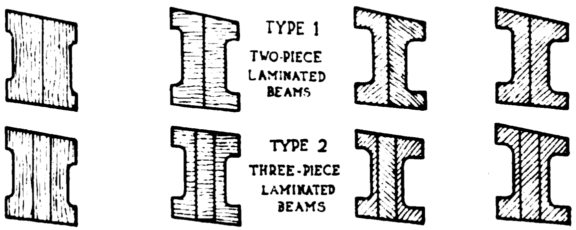
Hull Construction Plans of the F-5-L Navy Flying Boat



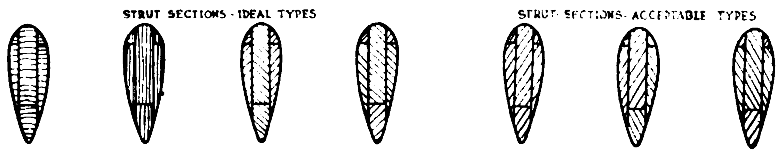
Wiring Diagram and Strut Sections of F-5-L Flying Boat



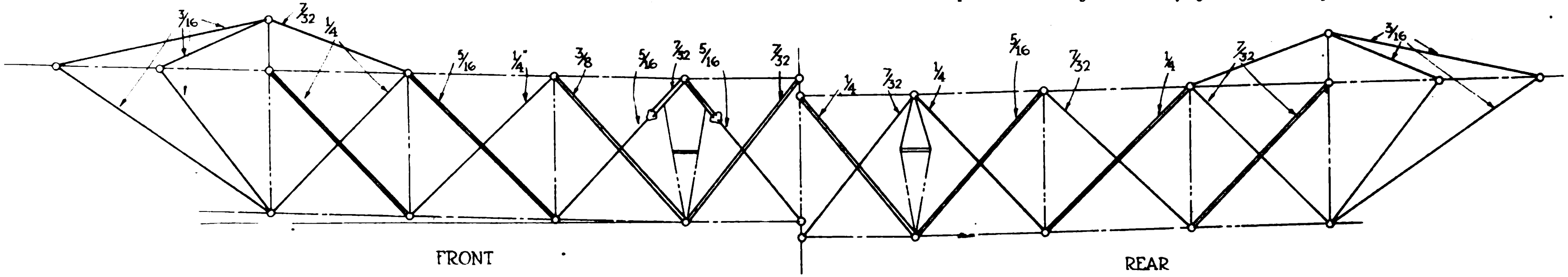
Wiring diagram of intermediate panel of the left wing



Wing beam laminations, showing only allowable grain arrangements



Acceptable arrangements of grain in six-piece F-5-L struts



Front and rear wiring diagrams of wing panel

so difficult to secure, and permitted production to go ahead without waiting on the construction of dies.

In fact many planes were built before it was possible to get dies made for punching out the flat patterns—these being sawed, ground, profiled and finish-filed to shape by hand. Hand labor was expensive, but waiting on equipment was more so, and the construction of the fittings is such that hand labor was placed to the best advantage.

The third feature of the fittings is the use of identical fittings in many places. For example, throughout the hull, the junction of the posts and the longerons; the point of attachment of the floor frames to the longerons, and the plates covering the joints of the hull bracing—fittings differed only slightly at the different stations.

However, originally each similar fitting differed slightly, necessitating a separate template, a separate print, part number, operations, etc., throughout the whole construction. But a study was made and an "average fitting" made that would suffice for several similar stations. The fact that such fittings did not exactly fit anywhere, or had lugs that were not needed other places, amounted to less than they saved time in production. And they were structually as good.

Ash Tie Strips Displace Riblets

A further difference in the construction of this hull and that of similar hulls of its predecessors is to be noted. On previous models, riblets were used to connect the keel with the fin edge stringers. These riblets were about ½ x ½ in. ash, spaced at distances varying from 9 to 15 in. transversely across the boat bottom. To bring their bottom surface flush with the stringers, lower longerons and fin edges, it was necessary to notch keel, stringers, longerons and fin edges that they might be set in. And it was a slow tedious job.

On this unit, the riblets are omitted, though several ash tie strips are used to connect the keel with the fin edges. It is considered that these, together with the planking, provide transverse strength in abundance.

Another feature in the construction is the extensive use of steel tubing as struts and posts in the body bracing. This is particularly noticeable in the tail, where the parts are under no great strain, and are not used for the attachment of other parts. Steel tubing is readily procured, and ready for use by simply cutting to length.

The central or transversal bracing unit is a complete unit in itself, and is set up as a separate assembly previous to installation in the hull. This differs from the usual construction and permits the use of templates to assure accuracy.

The transverse bracing connects the hull to the wings and the hull may be said to be built around this unit. By making all transverse bracings identical, any set of F-5-L wings, engine mountings, etc., may be more readily installed.

It is also to be noted that the wing beams passing through the hull are spliced at the center. These beams, styled the sidewalk beams, as they carry a short veneer covered wing section at each side of the hull that is used as a sidewalk for the mechanics to reach the engine, may be removed when the hull is packed for shipment. This permits the use of a much smaller shipping crate, permitting the shipment of more planes, and the use of less material in crate construction.

The bottom planking comprises an inner and an outer skin, each of 7/32 in. cedar. The inner skin is placed at right angles to the keel, differing from usual practice wherein both layers are at an acute angle to the keel. As riblets are eliminated, the right angled inner planking tends to replace them as strength members. This inner planking is either Port Oxford or Spanish cedar in random widths of from 4 to 10 in.

The outer planking is placed at an angle of 45 deg. to the keel, the acute angle being on the aft side. All pieces are from 4 to 5 in. wide, Spanish cedar, and are screwed to all longitudinals. The two layers of planking are secured together by brass clinch nails.

Courtrai, a special fabric, is laid in marine glue between the two layers of planking, and is used extensively in rendering all joints tight. All planking is laid with a slight clearance to allow a go-and-come resulting from moisture changes.

The bottom steps are secured in place after the hull is planked. They are two layers of 7/32 in. mahogany planking, fabric and marine glue between, screwed and clinch nailed together, and secured to the hull bottom by copper rivets, being separated from it by triangular ash strips. The forward ends of these steps is scarfed and set into the hull planking, a thick brass strip being set in flush over the joint.

Veneer is used extensively throughout the balance of the hull covering. This comprises the top fin edge planking, the nose planking, and the side planking. Formerly the side of the hull aft of amidships was covered with linen, taped, doped, and painted, with the exception of a narrow washboard. But in severe service, the linen covering proved too weak, and ⅛ in. 3-ply waterproof veneer is now used.

An extended technical description of the panel, strut and tail construction could be expanded to many volumes. But the outstanding features of these are laminated beams, simple strap type wing and strut fittings and laminated uniform section struts.

At one time laminated or spliced beams were not in favor but the shortage of long spruce necessitated the use of laminated and spliced beams. And it is found that the laminated beam is better than the unlaminated one. Outside of the economy of material, the ease of drying pieces of small cross section and the resulting dependability of built up beams more than offsets any additional expense in manufacturing.

Two types of laminated beams are used—the two-piece and the three-piece. The former is simply two pieces placed back to back, and glued together. The two halves are of equal thickness, and are lightened as was the solid beam except at splice positions. Scarfed splices are used, and staggered in the two halves. The two-piece beam may be used anywhere, and must be used in the following places: All front beams (except engine section), horizontal stabilizer beams, and rear aileron beams.

The three-piece beam comprises a thin piece sandwiched between two thicker outside pieces, glued together, and lightened similar to the solid beam, except at splices. This construction is used in the sidewalk and engine section, or for rear beams. Of the two types, the two-piece is considered stronger, and hence the above distinction of their use.

The idea of using strap fittings and the elimination of forgings and machined fittings extends to the strut and wing fittings. Here also mild carbon steel is used, cut from flat patterns and bent to shape.

Details of the Fittings

The base wing fitting is a U-strap, bent around and bolted to the beam. From it lugs are bent for interwing wiring, and the interplane side has a cloverleaf extension for the attachment of the struts and wire terminals. These are reinforced by washer plates to provide bearing for the bolts.

Roughly, the beams are secured to the strut ends by a bolt passing through the central cloverleaf and the strut end, and the usual strut socket is eliminated. In detail, the strut end is squared down, drilled to mate with the central cloverleaf hole, and a steel tube fitted in the end to give greater bearing and prevent the strut end from being crushed when the throughbolt is tightened.

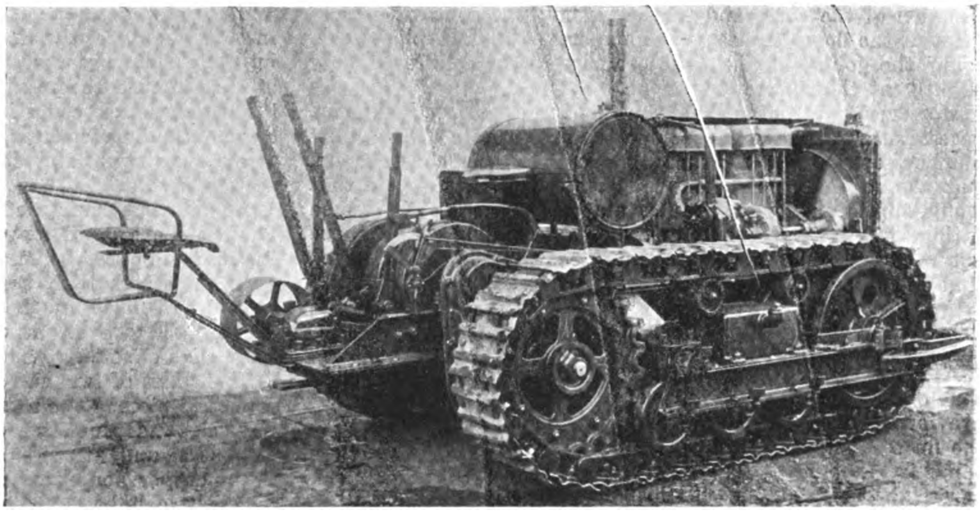
The throughbolt has a standard eye head, permitting the attachment for the drift and anti-drift wires, where a single wire is used. When double drift wires are used, the throughbolts holding the flying and landing wire clevises are made with an eye. Bearing for the strut ends on the beam is secured by means of a thin bearing plate between the strut and the beam.

It was observed that considerable time was lost in shaping the tapered streamline section struts, and furthermore, these being in two-piece construction, required thick material that was difficult to obtain. Hence, a three-piece uniform section strut was chosen.

As stated, this strut is three-piece, and all the lightening is done in the central portion. In the rough it is a flat board, the length and width of the strut, with a series of oval holes cut out of the central portion on a vertical spindle shaper. The cheek pieces are then glued on each side, and the strut rough machine planed to a streamline section. It is then finished to the desired section by hand. *(To be continued)*

Laughlin Husky Tracklayer Type Tractor

Has Low-Speed Engine Delivering 20 Hp. on the Belt—Steered by Applying a Brake to the Driving Mechanism of One Track or the Other



Laughlin tracklayer type tractor, showing steel chain tread

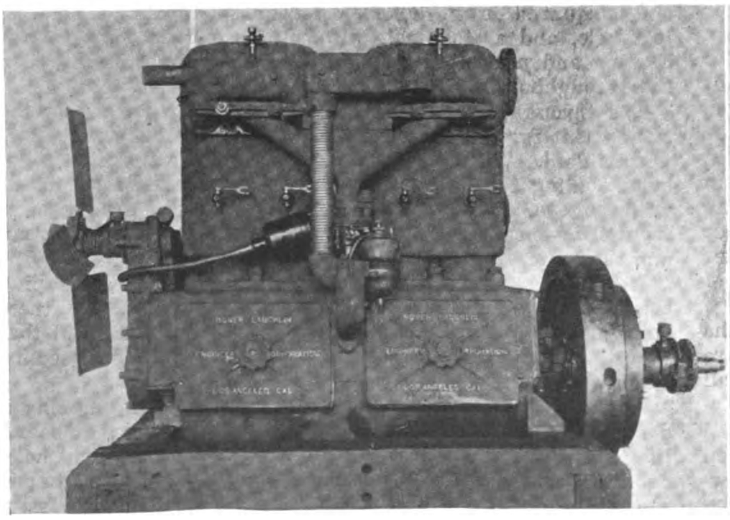
A NEW tractor for farm and orchard work has been placed on the market by the Homer Laughlin Engineers Corp., Los Angeles. It is of the creeper or tracklayer type, and one of its special features is a patented chain tread, which is made from hardened steel claimed to be tough and durable. Ten tractors equipped with this tread have been in use for over three years, and show no appreciable sign of wear, we are informed. The chain has no loose spools or pins, the principle being similar to that of a train coupling. The shoes are made of ¼-in. hot pressed plow steel, 10 in. wide, and are bolted to the track links.

The engine used on this tractor is the Laughlin heavy duty, slow speed design, of 4⅜-in. bore by 5⅛-in. stroke. It is rated to deliver 20 hp. at the belt pulley, operating at a governed speed of 700 r.p.m. The cylinders are cast in pairs, with detachable cylinder heads. The crankcase is a one-piece casting, with removable splash pans.

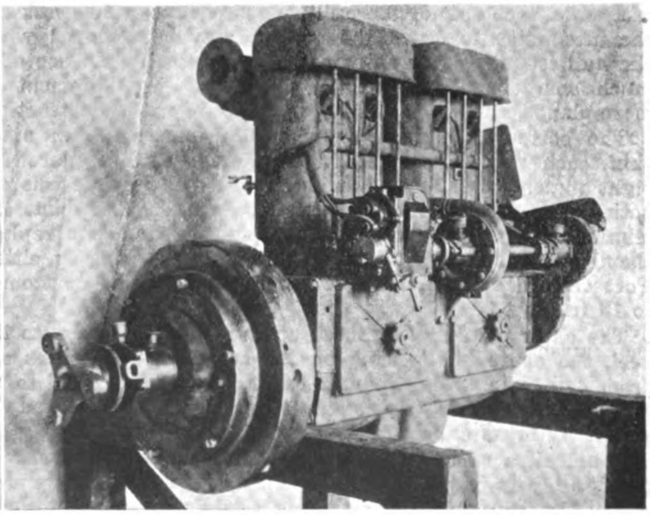
The valves are located in the cylinder head; they are drop forged from nickel steel and have a clear diameter of 2 in. The piston pin is 1 7/16 in. in diameter, hollow, hardened and ground. Its bearings measure 1 7/16 x 2¼ in. The crankshaft is supported in three bearings, of the following dimensions (front to rear): 2½ x 3¼ in., 2¼ x 3¾ in., 2¼ x 4⅞ in. The connecting rod bearings are 2¼ x 3 in.

A governor of the centrifugal type is fitted, and is entirely enclosed. It insures close regulation of engine speed. Ignition is by a Dixie high-tension magneto with impulse starter. Cooling water is circulated by a large centrifugal pump with enclosed driving gears. The radiator is of unusually large surface, and is provided with a positively driven fan.

The transmission is of the sliding gear type, and gives two forward speeds and one reverse, the two forward speeds being 1.7 and 2.7 m.p.h. respectively. All gears



Side view of engine. Note carbureter mounting on crankcase, and flexible inlet pipe



This view of the engine shows the valve rods, magneto and pump

are made of forged steel, hardened, and their shafts are mounted in ball bearings. The gear is fully enclosed and runs in a bath of oil.

Each track of the tractor is operated independently through a friction clutch. The friction clutches are of the expanding segment type and are faced with maple blocks. A clutch brake is applied automatically when the clutch is disengaged. The sprocket rims are cast in chills, which gives them a hard, long wearing surface. These sprocket wheels are demountable. There is one sprocket on each side, and they are driven by large external cut gears, fully enclosed.

The tractor has an independent track frame. The pivoting axle is located just ahead of the track sprocket. It is claimed that this new feature takes all strain off the driving gears. There are three track wheels on each side, these being mounted on Hyatt roller bearings. The track shoes are of pressed steel, 10 in. wide. The tracks have a bearing area of 12,000 sq. in., making the unit pressure 5 lb. per sq. in., as the total weight of the tractor is 6000 lb.

The power take-off pulley is located in the rear in such a way that the belt can be easily tightened.

Searchlight Arrangement on Italian Aircraft

AN article in the *Oesterreichische Flug Zeitschrift* describes the arrangement used on Italian aircraft to illuminate the ground on starting and landing during night flying. Two kinds of power sources are used—first, an accumulator battery, seldom employed because of its high weight for the required capacity, and, secondly, a dynamo, sometimes in conjunction with a battery. The dynamo is either driven by a fan or connected direct to the engine, both having their advantages and disadvantages. The first is independent of the motor, but its efficiency is low. The second is more efficient and is the one that in future will be most employed. In both cases the revolutions per minute are not constant, and therefore the voltage alters, and, accordingly, the dynamo must be fitted with a voltage regulator. The voltage is regulated by increasing or decreasing the current in the shunt winding of the motor. The voltage of the lighting system is usually about 14 volts and current 9.1 amps (125 watts). The energy, loss, etc., in various parts of the system is discussed at some length and the efficiency for a fan-driven motor system given as 125 watts/411 watts $\times 100 = 30.8$ per cent. The weights of the parts in this case are:

Dynamo, together with propeller and support	13.5 kg.
Light reflector and lamps, etc.	6.0 kg.
Controlling apparatus and lead	2.05 kg.
Accumulator	8.0 kg.
Total	29.55 kg.

Measuring Noise Electrically

A METHOD of measuring the intensity of noise, which may prove of use in demonstrating the silent operation of passenger cars is described in *Electrotechnik und Maschinenbau* for Dec. 15. According to the article, it is possible to measure the intensity of a noise by measuring the current in a circuit inductively coupled to a circuit containing a microphone exposed to the sound waves. The measuring instrument may be either an oscillograph or a baretter. Oscillograms produced in this way by an automobile and by an airplane are reproduced in the article. Small differences in the intensity of a noise are best obtained by a baretter in a bridge connection that is suggested. In other cases resonance methods are recommended. The methods should be of use in experiments with the object of reducing the noise produced by airplane engines, says the author. He thinks it should be possible to silence the engines by causing an interference to take place between the waves emitted by the different exhausts.

New Models at Lyons Fair

(*Continued from page* 683)

are carried right out to the frame members, thus avoiding the use of an underpan, and the oil pump, driven off the camshaft can be withdrawn complete with its gears, its shaft, housing and pinion, these forming one unit.

With this general arrangement everything is getatable. There is nothing whatever in front of the valve stems. The magneto contact breaker and distributer are facing outwards. The electric generator and starting motor are slightly above the top of the side frame members and there is nothing to interfere with the accessibility of the carbureters.

A three-stage aluminum crankcase has been adopted; the upper portion, which is bolted to the frame members at four points, receives the cylinder casting, the central portion is a girder construction receiving the bolts for the main bearings, and the lower part is merely an oil pan having a filter along its whole length and receiving the oil pump.

The crankshaft 2 in. in diameter is carried in four plain bearings. It is machined all over, balanced by three counter weights, and is drilled for forced-feed lubrication.

The connecting-rods are I-section machined all over, attached to the crank pins by four bolts each, and to the forged steel pistons by means of a hollow wrist pin, which is locked in the piston bosses in a manner shown in the illustration. There are three compression rings of the stepped type.

The camshaft and accessories are driven by two silent chains.

The design of the exhaust manifold reveals racing experience. This organ is in two parts to allow for uneven expansion; it broadens as it nears the rear and is divided down the center so that the exhaust from the forward cylinders will not meet those of the rear and cause back pressure. The exhaust ports are big and so shaped as to liberate the gases with the least amount of friction. The entire arrangement gives the free release of the gases as effectively as with separate exhaust pipes, while having the advantage of a neat single organ which does not interfere with the accessibility of the valve stems.

Bolted up to the engine base chamber is another housing containing the dry-disk clutch, alternative plates of which are lined with ferodo fabric.

There are four forward speeds and reverse, and the whole of the pedals and control levers are mounted on the gearbox casting independently of the frame.

Delage has always been a partisan of Hotchkiss drive and has maintained it in this model, with of course, a universal joint at each end of the propeller shaft. Rear axle is full floating type, with a wealth of ball bearings both for the driving couple and for the differential shafts. As the drawings show, the driving pinion shaft is carried in double radial and double thrust ball bearings at its forward end, and in double radial bearings at its rear end. The differential shafts at their inner ends are carried in big radial and thrust bearings and at the outer ends there are big diameter radial bearings well spaced so that all the load is carried between the two bearings. Except that final drive is by means of Gleason gears, this rear axle does not differ in any essential features of design from the special axles used on Delage racing cars.

The underslung rear springs are three-quarter elliptic type, with a width of 2½ in. and a length for the main leaf of 51 in.

The front axle is also the outcome of racing experience. The steering knuckles are castor type, the pivots being so inclined that if their axis were extended it would cut the vertical axis of the wheel at the point of contact of the tire with the road. The steering pivots have double ball bearings top and bottom, as well as a thrust bearing, while the front wheels have widely spaced spherical radial bearings, with a double thrust bearing between the two.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, March 27, 1919 No. 13

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 2727

Cable Address - - - - Autoland, New York
Long Distance Telephone - - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - One Year, $3.00
Canada - - - - One Year, 5.00
Foreign Countries - - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.
Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.
Member of the Audit Bureau of Circulations.
Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Training Operatives

DURING the continuance of the war the National Government was vitally interested in having every factory engaged in an essential industry, operate at the highest possible efficiency. Consequently, the U. S. Department of Labor organized a training service, the object of which was to teach factory workers the best and most productive methods of doing their particular job. It is claimed that most remarkable results were achieved in some instances. Operatives who had been doing a certain task for years in some instances, turning out a certain number of pieces per hour, by being trained to improved methods for a week, increased their production 30, 50, 70 and even 100 per cent. According to H. E. Miles, who was in charge of this work and who spoke on it at the National Conference of the Society of Industrial Engineers in New York last week, the usual method of the service consists in segregating a certain amount of equipment for training purposes and schooling operatives in improved methods. Inasmuch as the increased productivity leads to increased earnings, the operatives usually take to the plan with avidity. In cases where the operator is on piece work his earnings will increase in the same ratio as his output, while the employer will be benefited by a decrease in the overhead charges on his product.

This training service was a war activity and will be discontinued after June 30. We understand, however, that the service still has available considerable funds, which it is endeavoring to spend to the best advantage of the Nation. We believe that manufacturers in the automotive industries will be glad to take advantage of this opportunity. There is particular need for bringing our productive capacity up to the highest possible pitch in view of the approaching sharp competition in the world's markets. America pays higher wages than any other nation and in order to be able to compete in foreign markets it is necessary that its workmen should turn out more work in a day than those of other nations.

Proper training of operatives with a view to increasing their productivity, therefore, would seem to be a step in the right direction.

It will help the manufacturer in reducing his percentage of overhead, the employee in increasing his earnings and the country in meeting foreign competition in the world's export markets.

Don't Shackle Brains

TOO often a concern will search the country for the best bit of human brain power that it can secure along certain specialized lines, and then, after it has secured it, at a high price, will shackle it.

If you are sick and know how to cure yourself, you do not hire a doctor and pay him to listen to your diagnosis and method of cure.

If your business is sick or failing in a certain department and you secure the best man in that line to head that department, you must remember that you have not paid him to listen and to put into effect YOUR method of running that end of the business.

You had your chance before you called the specialist in. You needed him or else you would not have called him in. After you have got him, do not hog-tie his mentality and experience. Give him free rein. He has a reputation to make and support and he is going to do that by building up YOUR business in his particular department.

When you fail to allow your specialist to use his knowledge, when you make him subject to another who could not hold down his job before the specialist came, you are in a worse position than you were before, because you have secured little or no improvement and have the added expense of your new man. You have probably added the damaging feature of internal friction to your organization, and this is costly.

It pays to hire the best men you can get. They are your tools and the quality of work is closely governed by the quality of the tools that produce it.

After you have gotten your men, let them use the qualities which led you to employ them.

Imaginary Spring Wheel Losses

IN spite of the many agencies at work spreading enlightenment on mechanical matters, certain fallacies seem to have a very deep-rooted hold on the public mind. One of these is that a spring wheel in which the spokes are free to expand and contract lengthwise, and in which when the load is applied the axle is eccentric to the rim or tire, is hard rolling, producing the same effect on the level as when a vehicle with rigid wheels is ascending an endless hill. The supposition is that the spring wheel will be similar in its action to a rigid eccentric wheel when it is attempted to move the wheel out of the position in which it will naturally come to rest on account of its eccentricity.

Now, the spring wheel and other elastic wheels have proven a rather mediocre success, and undoubtedly as at present constructed they possess many defects, but that of a continued serious loss due to the eccentricity of the wheel is not one of them.

As one contractible spoke after another nears the lowest position, it is, of course, compressed by the load, and a certain amount of energy is stored up in it. As it is the forward motion of the wheel that causes this energy to be stored up, it is supposed that this energy has to be supplied either directly by the engine or from the kinetic energy of the vehicle, which would justify considering these spring spokes a drag on the vehicle. However, as soon as the spokes pass the lowest position they expand again, the energy stored up in them is released and is expended in moving the vehicle ahead. The effect is the same as when a rigid eccentric wheel seeks its natural position of rest. The energy thus gained is equal to the energy previously lost in compressing the springs.

Another way of looking at the matter is as follows: The amount of energy stored up in the spring spokes of the wheel always remains the same, as the compression and extension of springs goes on simultaneously and always at the same rate. There is therefore no need for drawing energy from an outside source. The only possible loss would be that attending the compression of springs. Steel, if worked within the elastic limit, is an almost perfectly elastic medium, and whatever molecular friction there may be is negligible from a practical point.

Motion Picture Commercial Propaganda

THE plan of the Department of Commerce to exhibit motion pictures of American industries abroad is an excellent one and should receive the co-operation of every manufacturer with foreign commerce ambitions. Great Britain and Germany have both realized the value of the motion picture abroad, and the time is ripe now for American manufacturers to immediately adopt similar methods. Before the war the Germans were commercially well established in Japan, due chiefly to the display of motion pictures of their industries, while no propaganda was made for the United States, and American trade suffered accordingly.

Reports from abroad indicate a keen interest in industrial pictures and state that films devoted especially to road construction and the manufacture and uses of automotive products will be welcomed. In fact, when the American Association of China recently displayed industrial films in Shanghai the theater was filled to overflowing despite unfavorable weather. Possibly the National Automobile Chamber of Commerce, acting for the majority of the manufacturers, can take this matter up directly with its members and act as the medium for securing motion-picture films for the Bureau of Foreign and Domestic Commerce.

Pressed Steel in Trucks and Tractors

IN passenger car manufacture pressed steel parts now occupy an important place. Frames, rear axles, tanks, mufflers, oil pans and many other parts are very generally made of this material, and the application of pressings is constantly gaining ground. The chief advantage of pressings is that they permit of lighter construction than parts made by other methods at equally low cost. It has therefore been a question whether in other branches of the automotive industry, where low weight is not such an urgent requirement as in trucks and tractors, there would be a field for pressed steel parts. It will be remembered that it took a very long period before the pressed steel frame obtained a firm footing in truck construction. Structural steel was said to be much better, possessing greater ultimate strength, partly owing to a higher carbon content and partly to the improvement of the molecular structure by the rolling operation. However, to-day the pressed steel frame is firmly established in the truck field, and it is even being used on tractors. Probably the next step will be the production of pressed steel axles for trucks. At the present time most truck axle housings are made of cast steel. If pressed steel is superior to cast steel for passenger car axles, why is it not superior for truck axles also? The only possible reason that occurs to us is that the thickness of metal required in the former is below that which can be successfully cast in steel, while that required in the latter is not. It does not require much foresight, however, to predict that the problem of pressed steel truck axles will be attacked and successfully solved, not only technically, but commercially as well.

Latest News of the

3227 De Haviland 4's Produced

457 in Front Lines on Day of Armistice — Cancellations of $480,000,000 to March 19

WASHINGTON, March 25—Up to the signing of the armistice 3227 De Haviland 4 planes were produced, of which number 628 were in actual service at the front, 1885 floated for delivery to the A. E. F., and 1025 assembled over seas for service. Four hundred and fifty-seven were in actual front line duty on the day the armistice was signed.

Aircraft contract cancellations up to March 19, 1919, exceeded $480,000,000, of which 52 per cent were for engines and spare parts and 35 per cent for airplanes and spare planes, the balance being for accessories, balloons and supplies.

Following is the tabulation showing the number of De Haviland planes produced and in service, and the various values of contracts canceled and suspended.

	Number	Per Cent of Total Production
Produced	3,227	100
Floated	1,885	58
Received at French ports*	1,185	37
Assembled overseas	1,025	32
Put into service overseas	984	30
Put into service at front	628	19
In commission at front†	457	14

*To Nov. 1, 1918.
†To Nov. 3, 1918.

VALUE OF CONTRACTS CANCELED AND SUSPENDED TO MARCH 19

	Value	Per Cent of Total
Engines and spare parts	$250,409,982	52
Airplanes and spare parts	167,554,386	35
Chemicals and chemical plants	19,852,370	4
Instruments and accessories	13,832,902	3
Balloons and supplies	10,071,035	2
Fabrics, lumber and metals	7,968,324	2
Miscellaneous	11,041,132	2
Total	$480,730,131	

Oil Exports Decrease

WASHINGTON, March 26—The effect of the armistice on oil exports is readily displayed by the export figures for February, 1919. Gasoline exports total 26,964,764 gal. in February, 1919, as compared with 35,396,038 gal. in the same month of 1918. Kerosene and lubricating oils increased in February, 1919. Mineral oil exports for February, 1919, total 165,889,425, as compared with 221,579,890 gal., worth $24,031,982, which were exported in February, 1918. The greatest decrease, as compared with 1918, is noticeable in the exports of fuel oil, which decreased from 118,863,438 gal. in February, 1918, to 36,710,850 gal. in February, 1919.

Will Sell Copper for War Department

WASHINGTON, March 26—The United Metal Selling Co., representing the copper producers, has arranged with the War Department to sell 100,000,000 lb. of copper belonging to the department, and also whatever copper scraps the army has to dispose of. Not less than 5,000,000 lb. of copper will be delivered by the Government to the copper producers each month for a period of 10 months, and then 10,000,000 lb. per month will be delivered for a period of 5 months.

No Action on Saxon Plan

NEW YORK, March 27—A meeting of stockholders of the Saxon Motor Car Corp. was held yesterday to vote upon a proposed re-organization plan prepared by the creditors. Inasmuch as only 6000 shares of the total of 60,000 shares outstanding were represented, no formal action was taken.

New British Commercial Organization

WASHINGTON, March 26—British Manufacturers' Association has organized a Federation of British Industries numbering 16,000 firms which will cooperate with its members on foreign trade. The organization will appoint overseas trade commissioners. A beginning has been made in Spain. These commissioners are to be men of commercial qualifications, conversant with the customs and commercial needs of the countries to which they are appointed.

233,881 War Motor Vehicles Ordered

90 Per Cent Delivered to Government Included 96,551 Trucks and 20,037 Cars

WASHINGTON, March 24—Ninety-six thousand, five hundred and fifty-one motor trucks were delivered to the United States Army up to Feb. 1, 1919, according to figures made public to-day by the War Department. Of this number 51,784 were shipped to France and 44,767 have been distributed in the United States.

Included in the total number delivered were 37,891 class B 3-ton standardized trucks, 15,084 Class A 1½-ton trucks and 24,095 four-wheel drive trucks. Eleven thousand B trucks remained on order, of which number all but 7348 have been canceled. In addition 5137 four-wheel drive, 3772 Class AA ¾-ton and 2329 Class A 1½-ton trucks still remain on order.

Highest per Cent of Cars Delivered

In all there were 233,881 trucks, passenger cars, ambulances, motorcycles, trailers and bicycles ordered by the Government, of which 90 per cent were delivered, the highest delivery per cent being that of passenger cars, of which 20,038 were ordered and 20,037 were delivered. Fifty-six per cent of the 37,891 B trucks delivered were shipped to France.

Following is the complete tabulation showing the status of motor vehicle contracts delivered up to Feb. 1, 1919:

MOTOR VEHICLES DELIVERED AND REMAINING ON ORDER
FEBRUARY 1, 1919

Type	Total Orders Less Cancellations	Delivered	Remaining on Order	Per Cent of Ordered: Delivered	Per Cent of Ordered: Remaining
Trucks					
Light delivery and repair	13,209	13,209	0	100	..
"A" 1½ to 3-ton	17,413	15,084	2,329	87	13
"B" 3 to 5-ton	45,239	37,891	7,348	84	16
"T" F. W. D. 2 to 3-ton	29,232	24,095	5,137	82	18
"AA" ¾ to 1-ton	10,044	6,272	3,772	62	38
Motor cars	20,038	20,037	1	100	..
Ambulances	14,073	13,321	752	95	5
Motorcycles	39,239	36,832	2,407	94	6
Trailers	27,223*	23,913	3,310	88	12
Bicycles	38,917	33,217	5,700	85	15

*Not including 4847 Ordnance Department trailers.

DISTRIBUTION OF VEHICLES DELIVERED

Type	Overseas	In U. S.	Per Cent of Total Delivered: Overseas	Per Cent of Total Delivered: In U. S.
Trucks				
Light delivery and repair	10,849	2,360	82	18
"B" 3 to 5-ton	21,388	16,503	56	44
"T" F. W. D. 2 to 3-ton	11,782	12,313	49	51
"A" 1½ to 3-ton	6,235	8,849	41	59
"AA" ¾ to 1-ton	1,530	4,742	24	76
Bicycles	28,419	4,798	86	14
Ambulances	8,633	4,688	65	35
Motorcycles	22,133	14,699	20	40
Motor cars	9,193	10,844	46	54
Trailers	5,949	17,964	25	75

Automotive Industries

Steel and Iron Prices Reduced

Expected to Stimulate Buying—Pig Iron Reduced $4.25, Billets $5 and Rails $10 a Ton

NEW YORK, March 21—Basic prices of iron and steel have been reduced considerably below previous current prices, though the reduction is not as great as was expected in some quarters. The reductions range from $4.25 per ton on pig iron and $5 on billets to $10 on standard rails; they amount to $7 per net ton on plates, shapes, bars, wrought pipe, sheets and tin plate, and to $5 on wire, wire nails, hoops and light rails. The new prices become effective at once and amount to 10 to 14 per cent.

It is expected that the lower prices, which are minimum, though the prices set by the War Trade Board were maximum, will stimulate buying. For the past 6 weeks the iron and steel markets have been weak due to the holding up of orders on the part of purchasers in anticipation of the reduced price. On this score *Iron Age* says:

"The opinion is general in the steel trade that the reduced prices will bring out in the near future a moderate amount of new business which buyers have held up since the stabilizing movement loomed up about 6 weeks ago.

"Willingness to co-operate with the Government to secure a stable market and the largest possible operation of iron and steel mills is shown both by producers and manufacturing consumers. It is yet to be developed how far the reductions will go in stimulating a demand over and above what has accumulated, and whether the new prices can be maintained as minimum through the year, as proposed in the Washington program."

No Heavy Steel Buying in Detroit

DETROIT, March 27—The new steel prices have not stimulated any heavier buying by Detroit manufacturers as yet. They are still purchasing what they need, from day to day, and are awaiting further developments. They declare that steel must come down lower, but can hardly see any hope of a further reduction for some time to come. There seems to be some apprehension as to whether the new prices are in violation of the Sherman anti-trust law, and it probably will be some time before the true sentiment in and around Detroit can be gaged.

Klingensmith on Vacation

DETROIT (Special Telegram)—March 26—F. L. Klingensmith, vice-president of the Ford Motor Co., has left Detroit to take a long vacation. It is rumored that he has either severed his connection with the company, or that he will do so shortly.

Coffin Leaves France

PARIS, March 1—Howard E. Coffin is leaving Paris this week for New York via England. Mr. Coffin has been on this side for the past 3 months and has travelled extensively in England, France, Italy and occupied portions of German territory. Mr. Coffin has been particularly interested while in Europe in everything concerning aviation development, and particularly the role which America will play in the coming conference to decide on international agreements regarding air navigation.

It is understood that Mr. Coffin will spend but a short time in America in order to attend to his private business matters and then will return to Paris.

Will Control Air Equipment Sales

WASHINGTON, March 25—The Salvage Branch, Supply Section, Division of Aircraft Production, has been charged with complete responsibility in all matters pertaining to the sale of surplus and obsolete air service equipment, and no sales will be made in the future until the salvage branch authorizes them.

U. S. Chamber Aids Employment for Soldiers

WASHINGTON, March 24—The United States Chamber of Commerce is asking for the co-operation of all commercial organizations to assist in placing returning soldiers and sailors in employment. The chamber plans to establish a bureau for the purpose of expediting the co-operative work of the various organizations toward alleviating the existing employment problem.

February Exports Are Excellent

January's Figures Were Good, but They Are Surpassed by Last Month's

	Cars	Value	Trucks	Value	Parts
Feb.	3,041	$3,719,485	1,403	$4,270,542	$2,699,741
Jan.	2,137	2,916,381	907	2,375,584	2,406,783
			1918		
Feb.	3,584	3,079,191	766	1,917,638	1,962,797

WASHINGTON, March 26—In AUTOMOTIVE INDUSTRIES of March 6 it was pointed out that our automotive exports for the month of January, 1919, augured well for the future of our overseas trade. The February figures given herewith tend to confirm that prophesy—they show appreciable advances in cars, trucks and parts when compared with the totals for the previous month.

For the time being our exports to the United Kingdom are in bad shape, due, doubtless, to the embargo which is in force. It is not anticipated, however, that the present restrictions will be maintained for any considerable time, and there is ample evidence of a strong demand for American cars and trucks in Great Britain.

In view of statements made recently to the effect that Australia would give preference to automotive products of British origin it is satisfactory to observe that during February Australia was our best customer for passenger cars.

Truck exports are practically double those of January, but the distribution is far from satisfactory, in the sense that many countries capable of buying commercial vehicles from us — countries which have industries needing up-to-date road transport — are not purchasing regularly.

(*Continued on page* 716)

New Schedule of Iron and Steel Prices

	Nov. 11 Price	Present Price	New Price	Reductions From Nov. 11	Reductions From Present
Pig iron, basic	$33.00 G. T.	$30.00	$25.75	$7.25	$4.25
Billets, 4-in.	47.50 "	43.50	38.50	9.00	5.00
Billets, 2-in.	51.00 "	47.00	42.00	9.00	5.00
Sheet bars	51.00 "	47.00	42.00	9.00	5.00
Slabs	50.00 "	46.00	41.00	9.00	5.00
Skelp, sheared	3.25 cwt.	3.00	2.65	12.00 N. T.	7.00 N. T.
Skelp, universal	3.15 "	2.90	2.55	12.00 "	7.00 "
Skelp, grooved	2.90 "	2.70	2.45	9.00 "	5.00 "
Merchant bar, base	2.90 "	2.70	2.35	11.00 "	7.00 "
Sheared plates	3.25 "	3.00	2.65	12.00 "	7.00 "
Structural, base	3.00 "	2.80	2.45	11.00 "	7.00 "
Wire rod	57.00 G. T.	57.00 G. T.	52.00 G. T.	5.00 G. T.	5.00 G. T.
Plain wire	3.25 cwt.	3.25	3.00	5.00 N. T.	5.00 N. T.
Nails	3.50 "	3.50	3.25	5.00 "	5.00 "
Black sheets No. 28	5.00 "	4.70	4.35	13.00 "	7.00 "
Blue annealed No. 10	4.25 "	3.90	3.55	14.00 "	7.00 "
Galvanized sheets No. 28	6.25 "	6.05	5.70	11.00 "	7.00 "
Tin plate, 100-lb. box	7.75	7.35	7.00	15.00 "	7.00 "
Tubular products	3½ points more off card				7.00 "
Hoops—Base	3.50 cwt.	3.30	3.05	9.00 "	5.00 "
Light rails	3.00 "	2.70	2.45	11.00 "	5.00 "
Rails, standard Bessemer	55.00 G. T.	55.00 G. T.	45.00 G. T.	10.00 G. T.	10.00 G. T.
Rails, standard open hearth	57.00 "	57.00 "	47.00 "	10.00 "	10.00 "
Ore	No change				

Abbreviations: G. T., gros ston; N. T., net ton; cwt., hundred pounds.

General Motors Buys Another Plant

Takes Over Inter-State Buildings and Land—For Parts Manufacture

MUNCIE, IND., March 22—General Motors has bought the fiscal property of the Inter-State Motor Co., including the plant and 40 acres of land adjoining it. It is expected that this property will not be used for the manufacture or assembly of cars, but of parts, although the plant readily would lend itself either to the manufacture of assembly of cars or the building of bodies. However, there is no doubt that with the plant and adjoining property General Motors has acquired the nucleus of another large unit of its vast activities. This also is taken to mean that there will be no more Inter-State cars and the company automatically will cease to do business.

The Inter-State company was one of the first to discontinue the manufacture of cars for the duration of the war early in 1918. It was announced at that time that the company would place on the market 1 and 1½-ton trucks instead. However, the company took on contracts for artillery tractors and had only tooled up for production when the armistice was signed. As a result peace found it totally unprepared to resume commercial work, and it notified its distributers and dealers that they should not depend on deliveries for several months to come. It was expected then, however, that when the company had completed the 15 or 20 per cent of the Government orders, which it planned to do, and had re-converted the plant back to cars, a much improved car would be marketed.

—

Germany Preparing for World Markets

WASHINGTON, March 19—German manufacturers realize and are preparing for a new and hard commercial war to follow the signing of peace, according to advices received here, and a network of organizations has been created to assist German industry. The Technikische Meese G. m. b. H. (Technical Fair) has been organized in Leipzig to promote the interests of numerous makers of tools, machinery, factory equipment, etc., and will develop German inventive genius.

The Company for Home and Foreign Undertaking, Hamburg, with a capital of $5,950,000, plans a series of measures to revive trade abroad, and especially in the Balkans, the Caucasus and Persia. The Austro-German division of this company plans to develop Turkey for German trade. Likewise the Institute of Navigation and World Business, with a membership of 4300 manufacturers, and the United League (Die vereinigten Verberde) are planning world-wide advertising and selling activities.

Technical magazines published in English and other languages are planned to stimulate foreign business, and will be especially devoted to extolling German manufacture and the low prices of German made goods.

—

Sarles Wins Ascot

LOS ANGELES, CAL., March 23—If the Santa Monica Road Race a week ago and the Ascot Speedway to-day are taken as indications, racing this year will attract more persons than ever, for fully 50,000 saw Sarles take the 150 miles at better than 71 m.p.h., which was a new track record. He drove his Roamer Special and won in 2 hr., 7 min., 2 sec. Hearne in a Chevrolet won second, Pullen third in a Hudson, and Durant in a Chevrolet fourth. The fourth man finished less than a minute after the winner. Toft and Lewis were still running at the end, but Lecocq, Elliott and Thomas had been eliminated by mechanical trouble. There were no accidents.

The new track record is considered very good indeed in view of the fight Sarles had to put up. Three stops for tires delayed him as he was using re-treaded tires that for a time littered the track, but he finally changed to others.

DePalma had intended to try for the track record, but in practice yesterday he damaged his steering gear so to-day he only drove a 5-mile exhibition.

—

Transatlantic Flight Rumored

WASHINGTON, March 21—Many reports are current here of possible flights across the Atlantic, some to the effect that these will be tried shortly, and one that France is even now preparing to send a pilot across. Great Britain, it is reported, has a huge plane with a 375 hp. engine already at St. Johns, Newfoundland, and will make the trial to Liverpool —about 1300 miles—in the next few days. Several American pilots are said to be making tests preparatory to making the trip, and it is said that Lt.-Com. P. L. Belinger, in charge of the air station at Norfolk, will try to negotiate the long distance flight within the next 10 days in one of the big navy flying boats. There is no definite news, however, on this subject.

—

Oregon to License Mechanics

SALEM, ORE., March 21—Automobile mechanics hereafter will be licensed in the State of Oregon. The State Legislature has passed Senate Bill No. 280, which creates a "board of auto mechanics examiners" before whom those who would work as mechanics must appear, be examined, passed and properly licensed—for a fee of $5; the license is good for a year, when it can be renewed and "the board may at any time revoke a license . . . for incompetency on the part of the holder . . . and for any other good and sufficient cause."

—

Republic Trucks for Canada

ALMA, MICH., March 24—The Republic Motor Truck Co. is about to enter the Canadian automotive field. B. D. Jones resigned as sales manager to become general manager for Canada. The company will locate its plant in Windsor, Walkerville or Toronto.

Stephens Distributers Set Policies

Men Who Sell Given a Voice in Design and Production—Co-operative Spirit

FREEPORT, ILL., March 21—It is not an uncommon belief among dealers that there is too little attention paid by the engineering and designing departments of the motor car factories to suggestions from the distribution end of the business. This feeling is not unwarranted in some cases. Too often the designing department forgets that the distributers' and dealers' suggestions reflect the ideas of the owners.

More frequently, however, there are production and material difficulties which prevent the practical carrying out of the suggestions, but which the factory does not trouble itself to explain to its dealers.

Sometimes, also, the distribution is not a unit as to what it wants. Local conditions frequently reflect themselves in a demand for a certain feature in one territory, a feature which is directly opposite to the needs of another section.

Close co-operation between its distributing and manufacturing departments seems to have been worked out by the executives of the Stephens Motor Branch of the Moline Plow Co. in a way which gives the factory the benefit of the dealers' and distributers' first-hand information as to the needs of their territories and at the same time shows that their suggestions are given thorough consideration.

This was shown forcibly in the annual distributers' conference at the factory this week. Having a comparatively small number of distributers, each representing a large number of dealers, it is possible for the distributers to get together with the representatives of all the different departments of the factory and thresh out the pros and cons of all suggestions in open meeting. Consequently a feature of the three-day meeting was a series of "round-table conferences" in which all hands participated, with Sales Manager Clough in the chair.

They were really round-table conferences, for there were provided a number of small round tables with pads and pencils on each for the conferees to make notes. Each distributer was called on in turn to give his ideas on the point at issue—say, the color of the wheels—and when the distributers themselves did not agree the meeting was turned over to them until they decided what they did want. If what they wanted was not feasible from a factory standpoint they were told frankly why.

Also, they got first-hand information from the factory. Not only was Stevens' Plant Manager Leonard there, but the body man, the service manager, the engineman, etc., were on hand. In addition representatives from the factories making the units from outside were on the job to help out.

When, after the conferences, the distributers left town, they knew that the factory was doing everything possible to meet their ideas. Incidentally, it is only fair to say that AUTOMOTIVE INDUSTRIES' representative never attended a dealer's meeting at a factory at which there was less kicking. This, it is believed, is due in a measure to the fact that the distributers were taken into the confidence of the factory.

Nebraska Legislates for Tractor Maintenance

LINCOLN, March 24—Legislators in Nebraska have introduced two bills which at least have novelty if nothing else, but which if passed would cause a lot of trouble.

The first of these is "Nebraska S.F. No. 86." Under its terms every person selling farm tractors in Nebraska must carry within the confines of the state a stock of repair parts sufficient to keep such machines in repair. Failure to do so makes any selling transaction void. The same provisions cover sales of motor cars.

The other, which is styled "Nebraska H. T. No. 85," provides for official tests of all tractors and would compel the maintenance of adequate service stations. According to the bill, every make and model of tractor offered for sale in the state must be officially examined and tested and passed upon by a board of three competent engineers under the control of state university management. Tests would be made of endurance, official rating of horsepower and fuel consumption per acre plowed. The bill also requires that an adequate stock of repair parts be carried, and failure to comply with the provisions bars offenders from doing further business in the state.

Lists of Automobile Importers

WASHINGTON, March 24—The Department of Commerce has received lists of importers of automobiles and accessories who are interested in communicating with American manufacturers. They are located at Batavia, Dutch East Indies; Bombay, India, and Hongkong, China. Manufacturers can secure the lists and further information by addressing the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, and referring to file numbers 9504, 9521 and 9510.

Kearns Has New 1½-Ton Chassis

BEAVERTOWN, PA., March 24—The Kearns Motor Co. is now building a 1½-ton truck with a Continental four-cylinder 3½ x 5 engine. Standard parts are assembled in the job, and the specifications include high tension magneto, Borg & Beck clutch, Hotchkiss drive, Muncie three-speed gearset, semi-elliptic springs, 136-in. wheelbase, solid tires 34 x 3½ in. front, 34 x 5 in. rear. The drive is internal gear, and roller bearings are used in the front wheels.

English Tractor Trial Rules Defined

Exhibition Planned for August by Motor Manufacturers and Traders

LONDON, March 14 (Special Correspondence) — The Society of Motor Manufacturers and Traders has decided to hold its annual farm tractor trial during the month of August. Rules have been drawn up which differ slightly from those in previous years. The complete regulations follow:

Resolved, that not more than two machines of any type should be entered, and that each machine should be observed by local farmers.

(a) Draw bar pull to be taken by dynamometer. Load to be added till dynamometer records "Stop." The technical adviser to settle speed at which pull to be taken.

(b) Fuel consumption in connection with price to be observed. Fuel, lubricating oil and water to be booked out daily.

(c) Ease of handling to include time in starting after machine left in open over night, uncovered. Also steering and distance in turning.

(d) Weight re drawbar efficiency to be taken in full working order on weighbridge.

(e) Reliability—All time lost in a working day to be recorded, except in stops for accident to plow, etc.

(f) Cost to be declared and a guarantee to be given of supply during current season at price declared. (Technical adviser to work out cost per drawbar-horsepower—not brake horsepower.)

(g) General design—Simplicity of construction and accessibility to all parts.

(h) Facility for use of any other fuel than gasoline. Entrants to notify amount required in advance, and supply to be controlled by the society.

Plows—Resolved to invite plow manufacturers to offer facilities for demonstration by the entrants, informing them that nothing beyond 12 in. wide would be acceptable and that the depth of plowing would be 6 to 8 in.

Dynamometer tests to be made 2 days before trial to show how many furrows could be drawn.

To Make War-Born Products

NEW YORK, March 21—The Aircraft & Motor Products Co. has been formed here, with offices at 299 Madison Avenue, and will manufacture products for aircraft and motor vehicles that have been developed primarily from successful war products. The company has developed a spark plug, has a line of cup greases and gear oils, a bronze bearing metal and will manufacture aluminum castings, bronze castings and gears. Rayburn Clark Smith of Philadelphia is president, other officers being: Vice-president, H. Allen Dalley, Philadelphia; general manager, Major Harry A. Budd, New York. Branches have been established in Philadelphia and Chicago. The company will brand its products "A-A."

New United States 1½-Ton Truck $1,995

CINCINNATI, March 20—The United States Motor Truck Co. has added a 1½-ton truck to the United States line, and with the new addition the line comprises capacities from 1½ to 5 tons. This smallest model is to sell for $1,995 in chassis with seat, solid tires and regular equipment. The name will be Model N. The engine is a four-cylinder block type with 3¾-in. bore and 5-in. stroke. Cooling is by a centrifugal pump, a vertical tube radiator having cast tanks and a cast frame. The engine is three-point suspended in the frame, the third point being around the starting-crank housing and the rear support arms having recoil springs. The engine is designed to take an electric starting and lighting system, and this may be had at extra cost. The dry-plate clutch and the three-speed gearset are a unit with the engine.

Internal gear drive is used in the axle and all the brakes are on the rear wheels. The steering wheel is on the left side with the control levers in the center. Tires are 36 x 3½ front, 36 x 5 rear. Wheelbase is 120 in.

New Reliance Production Plans

APPLETON, WIS., March 24—The Reliance Motor Truck Co., which recently reorganized its board of directors and official personnel, has perfected the organization of its engineering and production staff. Beginning with the delivery of its first truck to-day, the company is now on a regular production basis of one chassis a day.

Oscar Stegeman has assumed the position of chief engineer. H. F. Vahl is the new production manager. The present output of Reliance trucks is confined to a 1½-ton model, but after July 1 a new 2½-ton design will be put into production, and later a 3½-ton design will be included in the line. The company also has arranged to engage in the output of a truck axle, which is being marketed under the name of Badger external spur gear drive axle, in 1½, 2½, 3½ and 5-ton types. The same axle is used in Reliance trucks. John M. Balliet, Appleton, is president and general manager of the Reliance company.

Kelsey Wheel Has $2,067,904 Surplus

DETROIT, March 22—A surplus of $2,067,904 is shown in the Kelsey Wheel Co.'s financial statement for the year ended Dec. 31 last, after all necessary deductions were made and $355,022 put aside as provision for federal taxes. This amount is $583,229 ahead of 1917 surplus. $1,565,625 is still due from the government for war contracts.

Consolidated balance sheet of Kelsey Wheel Co., Inc., and subsidiaries, as of Dec. 31, 1917 and 1918, compares as follows:

Assets

	1918	1917
Plant equipment, etc..	$2,457,577	$2,519,509
Patents, good will, etc.	10,000,000	10,000,000
Investments in other companies	59,000	....
Inventories	2,104,089	2,212,839
Notes and accounts receivable	841,970	932,508
Cash	222,474	383,830
Due from U. S. Government	1,565,625	....
Liberty bonds, etc.....	176,083	65,347
Insurance premiums ..	14,644	10,475
Deferred charges	88,257	49,454
Total	$17,529,719	$16,123,960

Liabilities

	1918	1917
Preferred stock	$2 909,000	$3,000,000
Common stock	10,000,000	10,000,000
Notes payable	1,090,000	290,000
Accounts payable	832,338	788,315
Sundry creditors, etc..	275,455	234,383
Provision for taxes....	355,022	326,587
Surplus	2 067,904	1,484,675
Total	$17,529,719	$16,123,960

Gray & Davis Make Up Dividends and Retire Stock

BOSTON, March 26—The remaining dividend of $1.75 in arrears on preferred, and the regular quarterly dividend of $1.75, will be paid by Gray & Davis, Inc., on April 1 to stockholders of record March 21. The directors of the company have also voted to carry out the agreement made in February, 1918, with the preferred stockholders' committee to purchase on April 1 all preferred stock deposited with the committee at 103 a share and accrued interest. At the date of the directors' vote $439,400 out of a total issue of $600,000 was deposited with the committee. At present about $440,000 has been deposited with the committee, and will be retired on April 1. As there is only $600,000 preferred outstanding, by April 1 only about $150,000 will remain outstanding.

A few weeks ago a merger with the American Bosch Magneto Co., Springfield, was seriously considered, but called off at the last minute by mutual consent.

Prepare for Trans-Atlantic Flight

WASHINGTON, March 25—That the final preparations for a trans-Atlantic flight under the direction of the United States Navy are being completed is evidenced by the present search for a starting field by the Navy Department. A destroyer has been sent out to locate a suitable harbor or starting field, and Lieutenant-Commander Bellinger, who was detailed to assist in the project, is co-operating with the destroyer. It is now expected that there will probably be a fleet of four flying boats in the attempt.

$998,887 Aviation Equipment Sold

WASHINGTON, March 26—Airplanes valued at $319,000 and airplane equipment valued at $679,887 were sold between March 8 and March 14 by the War Department, through the Director of Sales. The Motors and Vehicle Section sold equipment, accessories and a kitchen trailer for $1,298.10 during the same period. No trucks or passenger cars have been sold. Other sales made during this period were: Oils, greases, etc., valued at $35,228.48; machinery and machine tools, together with engineering equipment, $224,824.85; ferrous metals, $71,977.96, and non-ferrous metals, $34,591.83.

Steele Goes With Dominick

NEW YORK, March 27—Charles M. Steele, who for some years has been out of active touch with the automobile industry, and who was formerly vice-president of the Carl M. Green Co., has associated himself with Dominick & Dominick, financial brokers in this city.

Dividends Declared

Goodyear Tire & Rubber Co., Akron, first preferred, quarterly dividend of 1¾ per cent, payable April 1 to stockholders of record March 15; second preferred, 2 per cent, quarterly, payable May 1 to stockholders of record April 15.

Edmunds & Jones Corp., Detroit, 1¾ per cent, quarterly, preferred, payable April 1, to stockholders of record March 20.

MacDonald in Charge of Federal Road Work

WASHINGTON, March 26—Thomas H. MacDonald, chief engineer of the Iowa State Highway Commission, has been appointed by the Secretary of Agriculture as engineer in immediate charge of the work under the Federal Aid Road Act, which provides for co-operation between the states and the Federal government in the construction and improvement of roads. Mr. MacDonald will assume his new duties as soon as he can close up his work in Iowa.

He will supervise and direct all the activities of the Bureau of Public Roads under the Federal Aid Road Act, including the expenditure of the additional appropriation of $209,000,000 provided by the Post Office Appropriation Act for the extension and development of highway construction during the present and the next two fiscal years.

For the time being he will devote his energies to the problems arising under the Federal Aid Road Act incident to the sumption and extension of road work.

Not to Take Over New Process

NEW YORK, March 24—In a news item last week it was stated that "The Meecham Gear Corp. has been organized to take over the New Process Gear Corp." The statement was incomplete and misleading due to the inadvertent omission of a word. It should have read "The Meecham Gear Corp. has been organized to take over *from* the New Process Gear Corp. the manufacture of rawhide pinions," etc.

Exports of Automotive Equipment for February and Seven Previous Months

(*Continued from page* 713)

	Month of February				Eight Months Ending February			
	1919		1918		1919		1918	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	2	$15,000	5	$31,155	43	$577,600	18	$192,620
Airplane parts	......	276,129	......	633,652	......	9,493,241	......	4,740,247
Commercial cars	1,403	4,270,542	766	1,917,638	7,711	21,283,362	9,229	24,967,225
Motorcycles	1.298	289,867	602	152,511	5,539	1,308,633	6,823	1,482,570
Passenger cars	3,041	3,719,485	3,584	3,079,191	19,523	22,333,972	37,630	31,672,242
Parts, not including engines and tires	......	2,699,741	......	1,962,797	......	22,451,148	......	21,298,655
Total value (cars, trucks and parts)	......	$10,689,768	......	$6,959,626	......	$66,068,482	......	$77,938,122
ENGINES								
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas	522	$105,449	2,450	$275,217	15,755	$2,473,026	25,296	$2,885,725
Marine, gas	457	315,085	310	153,383	3,770	2,100,886	5,231	1,640,258
Stationary, gas	1.599	305,538	1,955	286,765	15,154	2,213,037	16,368	1,885,019
Tractor, gas	2,245	2,145,152	1,368	1,121,535	14.568	16,169,936	11,851	12,157,018
Total value	......	$2,871,224	......	$1,836,900	......	$22,956,885	......	$18,568,020

	EXPORTS BY COUNTRIES FEBRUARY, 1919				EIGHT MONTHS ENDING FEBRUARY, 1919			
	Passenger Cars		Trucks		Passenger Cars		Trucks	
	No.	Value	No.	Value	No.	Value	No.	Value
Denmark	36	$48,289	......	....	143	$232,544	......	....
France	82	281,131	670	$3,035,379	605	740,894	2,939	$12,271,544
Norway	26	28,874	......	....	213	427,140	......	....
Russia in Europe	......	....	......	....	6	6,605	......	....
Spain	36	43,665	......	....	504	666,485	......	....
United Kingdom	3	2,836	9	14,247	96	142,733	858	2,509,692
Canada	281	290,788	128	132,873	1,984	1,837,035	1.087	1,423,921
Mexico	203	149,536	......	....	1,136	1,161,084	......	....
Cuba	213	290,807	34	92.429	1,175	1,784,148	395	785,515
Argentine	213	324,193	11	21,794	1.004	1,280,434	47	86,688
Chile	64	152,919	......	....	810	1,301,947	......	....
Uruguay	25	38,106	......	....	487	454,000	......	....
British India	44	58,428	......	....	72	102,169	......	....
Dutch East Endies	72	72,911	......	....	1,229	1,549,354	......	....
Russia in Asia	......	....	......	....	3	11,734	15	18,200
Australia	493	447,408	......	....	2,383	2,222,360	......	....
New Zealand	222	225,262	......	....	933	912,402	......	....
Philippine Islands	131	125,943	......	....	890	953,527	......	....
British South Africa	140	159.483	......	....	810	835,048	......	....
Other Countries	757	978,906	551	973,820	5,040	5,712,329	2,375	4,187,802
Totals	3,041	$3,719,485	1,403	$4.270,542	19,523	$22,333,972	7,711	$21,283,362

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb. .... .02 -.03
Phosphoric (85%).. .35 -.39
Sulphuric (60%), lb. .008

Aluminum:
Ingot, lb. .... .31
Sheets (18 gage or more), lb. .... .42
Antimony, lb........ .07 -.07¼

Burlap:
8 oz., yd.......... .06¼
10½ oz., yd......... .08½

Copper:
Elec., lb............ .14¾-.15
Lake, lb. .... .15½

Fabric, Tire (17¼ oz.):
Sea Is., combed, sq. yd. 1.50
Egypt, combed, sq. yd. 1.25
Egypt, carded, sq. yd. 1.15
Peelers, combed, sq. yd. 1.10
Peelers, carded, sq. yd. 1.00

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
Ceylon, lb. .... .90 -.22
Madagascar, lb.... .10 -.15
Mexico, lb. .... .03¾

Lard:
Prime City, gal....2.40
Ex No. 1, gal......1.10 -1.15
Linseed, gal. ....1.45 -1.48
Petroleum (crude):
Kansas, bbl......2.25
Pennsylva'a, bbl.4 00
Menhaden (dark), gal. .... .95

Lead, lb. .... .05 -.05¼

Leather:
Hides, lb........... .24 -.39½

Nickel, lb. .... .40

Oil:
Gasoline:
Auto, gal. .... .24½
68 to 70 gal...... .30½

Rubber:
Plantation:
First latex pale crepe, lb....... .52
Brown crepe, thin, clear, lb. .... .46
Smoked, ribbed sheets, lb....... .51

Para:
Up River, fine, lb. .55½
Up River, coarse, lb. .... .34
Island, fine, lb..... .47½

Shellac (orange), lb. .60 -.64

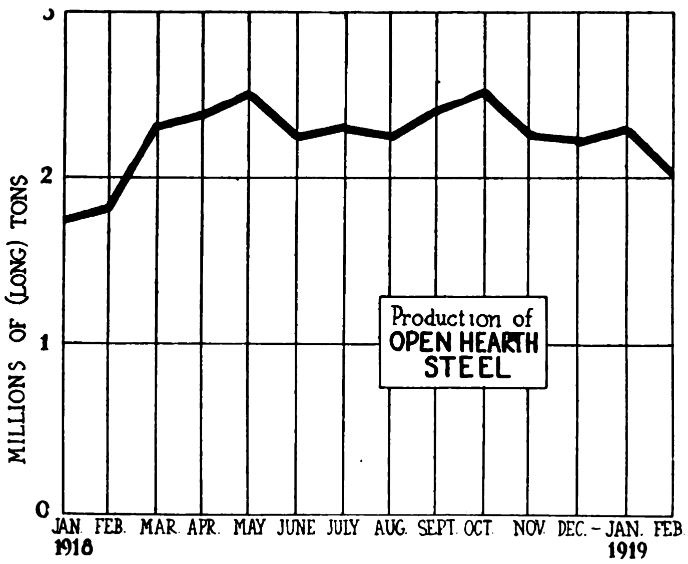
Spelter, lb............ .06¼-.06½

Steel:
Angle beams and channels, lb...... .03
Automobile sheet (see sp. table).
Cold rolled, lb..... .0625
Hot rolled, lb...... .039

Tin .... .71 -.72

Tungsten, lb.........1.50 -3.10

Waste (cotton), lb... .12¾-.17



Production of open-hearth steel is being fully maintained. Figures for January and February, 1919, show substantial gains over those for a similar period in 1918

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock................	$5.95	$5.85
Automobile body stock deep stamping.	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock................	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping..........	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping................	6.30	6.20

Automobile Sheet Extras for Extreme widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent. less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close March 22

	Bid	Asked	Net Ch'ge
Auto Body Company......	8	9¼	..
Briscoe Motor Car com....	13	..	+3
Briscoe Motor Car pfd....	50	65	..
*Chandler Motor Car......	125	127	—1⅞
Chevrolet Motor Car......	189	191	..
Cole Motor Car Co.........	93	105	+3
Continental Motors com...	7¾	8¼	..
Continental Motors pfd....	97	..	..
Edmunds & Jones com....	15	20	..
Edmunds & Jones pfd.....	75	90	..
Electric Storage Bat......	64	67	+5
Federal Motor Truck......	34	36	—1
Fisher Body Co. com.....	48	49	—9
Fisher Body Co. pfd......	95	98	+3
Ford Motor of Canada....	300	310	..
General Motors com.......	162½	163½	—3
General Motors pfd........	89	91	+1¾
Hupp Motor Car com......	8¼	8¾	—½
*Hupp Motor Car pfd......	95	100	+5
Kelsey Wheel Co. com....	39	41	—1
Kelsey Wheel Co. pfd.....	94½	96½	..
Manhattan Electric S. com.	..	48	..
Maxwell Motor com.......	35⅜	36⅜	—3⅞
Maxwell Motor 1st pfd....	63	64	—4⅞
Maxwell Motor 2nd pfd...	28⅜	29⅜	—2⅛
*McCord Mfg. com........	32	35	+2
*McCord Mfg. pfd.........	90	93	—1
Mitchell Motor Co.........	27	32	..
Motor Products Corp.......	..	35	..
Nash Motors Co. com.....	220	235	+5
Nash Motors Co. pfd......	95	100	—¼
National Motor Co........	15	20	..
Packard Motor Car com..	114	118	..
Packard Motor Car pfd...	100	102	..
Paige-Detroit Motor com..	28½	29½	+½
Paige-Detroit Motor pfd..	8¾	9¾	..
Peerless Motor Truck.....	22	24	—1
Pierce-Arrow M. Car com.	44¼	45¼	—⅛
Pierce-Arrow M. Car pfd.	104½	106	..
Premier Motor Corp. com.	5	..	..
Premier Motor Corp. pfd..	..	75	..
Prudden Wheel Company..	18	19	..
Reo Motor Car Co........	23¾	24½	+¾
Republic M. Truck com...	36	37½	+½
Republic M. Truck pfd...	87	90	..
Saxon Motor Car com.....	6½	8½	—2¾
Scripps-Booth Corp.	21	25	..
*Stewart Warner S. Corp.	90¾	92¾	+¾
Stromberg Carburetor Co.	37	39	—3
Studebaker Corp. com....	62	63	—1
Studebaker Corp. pfd.....	94	97	..
*Stutz Motor Car Co......	51	52	—1½
United Motors Corp.......	43½	45½	—¼
*White Motor Co..........	52½	53½	—1
*Willys-Overland com. ...	28½	29½	+1¼
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co...........	74¼	75	..
*Firestone T. & R. com...	149	152	+7
Firestone T. & R. pfd.....	99½	101½	+½
Fisk Rubber Co. com.....	103	105	—1½
Fisk Rubber 1st pfd.......	100	105	..
Fisk Rubber 2nd pfd......	101	105	..
Fisk Rubber 1st pfd. conv.	99	101	..
Goodrich, B. F., com......	68¾	69¾	..
Goodrich, B. F., pfd.......	106	106½	—¼
Goodyear T. & R. com....	272	276	—3
*Goodyear T. & R. 1st pfd.	106½	107½	[illegible]
Goodyear T. & R. 2nd pfd.	107	108	+½
Kelly Springfield com.....	119½	120½	..
Kelly Springfield pfd......	95	97	..
Lee Tire & Rubber Co....	25	26	..
Marathon Tire & Rubber..	55	75	..
Miller Rubber Co. com....	175	178	+7
Miller Rubber Co. pfd.....	101½	103	+½
Rubber Products Co.......	133	135	+6
Portage Rubber Co. com..	163	165	—8
Swinehart T. & R. Co.....	80	85	..
U. S. Rubber Co. com....	82½	83	..
*U. S. Rubber Co. pfd....	111½	112½	..

*Ex dividend.

Hemingway Succeeds Bradley as Manager of M. A. M. A.

NEW YORK, March 24—L. M. Bradley, who since October, 1916, has been manager of the Motor Accessory Manufacturers' Association, has resigned. Early in December he was granted a three months' leave of absence because of illness and immediately left New York for Sea Breeze, Fla., where he is at present. M. L. Hemingway, who about a month ago was appointed assistant manager, will succeed him. Prior to his connection with the M. A. M. A. Hemingway was with the Rubber Association of America.

—

Price New Safety Council Manager

CHICAGO, March 24—C. W. Price has been elected general manager of the National Safety Council to succeed W. H. Cameron, who has resigned to become manager of Industrial Relations for the Eastman Kodak Co. Mr. Price has been field secretary for the council for some time.

—

John F. Koch, treasurer of the Evinrude Motor Co., Milwaukee, died March 17 at Los Angeles, where he went late last fall for his health. Mr. Koch was 45 years of age.

—

E. L. Moorman, Beloit, Wis., has become manager of the sales department of the Highway Trailer Co., Edgerton, Wis. He has been sales manager of the Beloit Gas & Electric Co. for many years.

—

W. P. Berrien, formerly with the Firestone Tire & Rubber Co., and the Batavia Rubber Co., and also with the Star P. & V. Corp., which has recently merged with the Allied Industries Corp., will devote all his time to the automotive lines in the new relation.

—

P. E. Barker, who was formerly experimental engineer of the Northway Motor Manufacturing Co., and more recently research engineer at the Aluminum Castings Co., Cleveland, is now in charge of the truck and motor equipment department of the Van Dorn Iron Works Co., Cleveland.

—

Dale E. Eller, who has been a lieutenant in the field artillery, and **Howard M. Benedict**, who has been a lieutenant in the air service, have been honorably discharged, and have returned to their positions with the Oakes Co., Indianapolis. Mr. Eller is connected with the sales-engineering department, and Mr. Benedict with the pressed steel stamping department.

—

Lt. E. A. Wales, formerly chief of production, motors division, Quartermaster Corps, Cleveland, has re-entered the employ of the Raybestos Co., Bridgeport, Conn., and will resume his pre-war duties as manager of its Detroit office at 1713 Dime National Bank Building.

Men of the Industry

Changes in Personnel and Position

Lawrence W. Enos, until recently a lieutenant in the Quartermaster Corps, has joined the Firestone Steel Products Co., Akron, as manufacturers' representative in the Detroit district. Before entering service he was with the Steel Products Co., Cleveland.

—

Walter P. Hanson has joined the Haynes Automobile Co., Kokomo, as assistant advertising manager. Before his enlistment in the navy he was a newspaper and magazine writer.

—

C. H. Breaker has been appointed sales manager of the Diamond Chain & Manufacturing Co., Indianapolis. For the past year he has been in the air service, and for 9 years previous was with the Larkin Co.

—

H. S. Benjamin, for some time advertising manager for the Holley Kerosene Carburetor Co., Detroit, has resigned and has been succeeded by Earl Holley. Mr. Benjamin's future plans have not been announced.

—

W. S. Butler has received his discharge from the army and has joined the district sales manager's staff of the Commerce Motor Car Co., Detroit.

—

G. E. Wirsching, formerly with the General Motors Export Co., has been made assistant to E. F. Sayers, general manager of the export division of the Garford Motor Truck Co., Lima, O.

—

Harry J. Sproat has been made secretary and factory manager of the New Way Motor Co., Lansing. He was formerly manager for the Olds Motor Works.

—

G. B. Sharpe, New York, has been appointed assistant sales manager in charge of advertising for the Cleveland Tractor Co., effective April 1. He has been in charge of the advertising and sales promotion for the De Laval Separator Co.

—

J. R. Hall, for seven years production engineer with the Chandler Motor Car Co., Cleveland, has been appointed production manager for the Cleveland Automobile Co.

—

G. B. Sharpe has been appointed assistant general sales manager of the Cleveland Tractor Co., Cleveland. He will have charge of advertising and sales promotion.

—

F. A. Falkenbach, sales manager of the Modern Tool Die & Machine Co., Columbus, died at Youngstown on March 14.

Ford Organization Shaken by Recent Resignations

DETROIT, March 24—John R. Lee is the latest official to resign from the Ford Motor Co. His resignation came Thursday, following closely that of Harold Wills, chief engineer and production head, who severed his connections earlier in the week. Mr. Lee has not made known his future plans, but states he will probably remain in the automotive industry.

Ever since Norval A. Hawkins, sales engineer, quit the Ford company several weeks ago, automotive circles have been full of rumors concerning administration changes at the Ford company, and, needless to say, these changes are coming with startling rapidity, and the Ford organization is said to be quite seriously shaken.

John R. Lee worked out the profit sharing and wage adjustment policy of the Ford company. He was also the head of the sociological work, which attracted the attention of manufacturers and large employers of labor everywhere. When this country entered the war Mr. Lee represented the Ford Motor Co. in Washington, being the point of contact between his company and the government. He was a member of the Automotive Industries Committee created to represent the motor car industry and to assist both the government and the manufacturers in placing and executing ammunition contracts. He was a member of the executive committee of the Ford Motor Co.

Before joining the Ford organization eight years ago, he was president of the John R. Keim Mills, Inc., Buffalo, manufacturers of pressed steel products. This company was purchased by the Ford company and moved to Detroit.

—

W. H. Diefendorf, Syracuse, has resigned his position as chief engineer and director of the New Process Gear Corp. and is now with Weeks-Hoffman Co. of that city.

—

I. B. Meers has been appointed general sales manager of the Panhard Motors Co., Grand Haven, Mich. He will handle export affairs as well as American sales.

—

A. E. Vinton, connected with the National Motor Car & Vehicle Corp., Indianapolis, for the past 12 years as assistant sales manager and later as export manager, has been appointed general sales manager for the New Jersey Car Spring and Rubber Co., Jersey City, N. J.

—

F. X. Newman has resigned his position with the Wright-Martin Aircraft Corp., New Brunswick, N. J., to become vice-president and sales manager of the Automatic Safety Tire Valve Corp., Long Island City.

—

Lou J. Sackett, a car salesman for the past 23 years, has resigned from the Cadillac Co. of New England, but has not as yet announced his future plans.

Exports of Automobile Tires by Countries, for the Last Half of 1918

	July	August	September	October	November	December
France	$68,000	$2,351	$48,744	......	$102,365	203,689
Belgium	......	......	......	......	......	$28,718
Italy	585	......	......	......	......	......
Norway	......	......	......	......	4,396	2,272
Portugal	1,437	......	400	537	2,014	......
Russia in Europe	......	211	......	......	......	......
Spain	......	......	176	......	......	20,723
Sweden	......	......	......	......	......	18,825
Switzerland	......	......	......	......	......	......
England	36,032	3,100	25	535	38,881	......
Bermuda	......	......	......	......	......	......
British Honduras	73	503	316	54	1,059	498
Canada	38,086	110,757	89,697	27,619	20,861	63,325
Costa Rica	......	917	621	70	579	2,318
Guatemala	1,045	3,683	6,845	2,877	764	428
Honduras	1,264	3,304	775	949	763	1,758
Nicaragua	243	389	650	348	383	730
Panama	15,731	8,462	4,287	3,395	13,867	6,217
Salvador	783	3,423	897	3,409	3,113	5,411
Mexico	78,033	115,305	118,873	55,419	135,558	63,254
Newfoundland and Labrador	1,144	525	1,023	874	3,940	1,446
Barbado	490	275	10,040	1,434	4,043	4,103
Jamaica	17,312	20,816	5,538	3,696	715	28,022
Trinidad and Tobago	6,522	9,397	2,826	5,291	17,760	8,042
Other British West Indies	3,282	2,662	1,440	3,400	3,225	6,778
Cuba	161,952	116,376	213,575	104,443	235,057	98,393
Danish West Indies	463	141	2,882	1,122	660	821
Dutch West Indies	836	1,615	1,533	2,802	328	1,076
French West Indies	504	3,382	2,309	422	5,176	20,700
Haiti	985	4,198	1,295	3,152	3,462	3,281
Dominican Republic	3,202	161,500	7,622	6,699	5,792	17,940
Argentina	174,177	278,432	95,930	8,370	154,904	147,446
Bolivia	2,479	......	165	......	14,662	5,252
Brazil	20,556	6,054	2,842	32,419	40,584	9,095
Chile	48,344	52,981	106,090	55,198	85,589	133,717
Colombia	1,620	2,667	6,274	5,428	3,427	860
Ecuador	790	4,059	4,174	2,878	4,221	3,930
British Guiana	......	7,386	13,289	1,643	12,546	4,624
Dutch Guiana	2,628	38	79	......	640	......
French Guiana	75	......	......	......	......	......
Paraguay	......	264	......	......	......	......
Peru	18,524	14,043	11,077	24,423	29,226	58,939
Uruguay	14,913	48,937	8,885	......	......	......
Venezuela	10,429	14,826	2,044	11,347	12,200	16,719
China	3,518	8,749	5,580	11,613	15,306	8,770
Chosen	......	......	......	1,388	......	......
British India	47,879	36,784	......	4,144	5,658	38,681
Straits Settlements	62,053	32,416	226,602	10,582	......	21,018
Other British East Indies	12,507	3,052	......	2,340	......	2,337
Dutch East Indies	85,619	47,659	95,091	38,592	43,011	106,064
French East Indies	......	......	......	......	......	1,514
Hongkong	310	1,746	......	90	7,847	5,296
Japan	12,736	10,844	2,647	16,189	9,365	5,660
Russia in Asia	......	......	......	8,806	......	......
Siam	4,848	7,584	......	12	......	......
Turkey in Asia	......	......	......	1,067	......	......
Australia	152,424	116,541	77,108	29,047	76,706	45,056
New Zealand	43,773	159,469	55,422	38,835	38,010	19,206
Other British Oceania	96	60	49	240	172	......
French Oceania	710	1,588	735	2,615	145	280
German Oceania	......	400	......	1,552	298	604
Philippine Islands	51,735	132,475	58,707	123,438	29,168	28,045
British West Africa	6,837	4,040	......	25	......	14,308
British South Africa	......	203	25,787	266,770	79,577	269
British East Africa	......	......	......	......	165	......
Madagascar	......	......	......	......	565	......
French Africa	......	......	......	......	......	131
Portuguese Africa	......	......	......	2,606	92	......
Totals	$1,217,584	$1,566,689	$1,320,966	$930,204	$1,268,845	$1,281,534

Pros and Cons of British Import Restrictions

LONDON, March 10 (Special Correspondence).—Although no definite action has been taken by the British Government in regard to removing the prohibition of automobile imports, present indications seem to point to the adoption of some sort of a rationing plan on the basis of 1914 imports. In other words, taking the 1914 imports as about 1800 cars, it is expected that the government will permit some percentage of this amount to be imported.

British manufacturers are strongly against complete removal of this prohibition. It is their contention that the British industries require 12 to 18 months to resume pre-war status, and that American products should be kept away at least for the remainder of this year, or, if the rationing plan is adopted, only about 50 per cent of the number of cars imported in 1914 should be permitted to come in.

The importers point out that if it is the object of the government simply to prevent American importers having an unfair advantage over British manufacturers, the industry should be put back on the basis of 1914, and 100 per cent imports permitted.

—

South American Shipping Preferences Canceled

WASHINGTON, March 21—Ocean shipping preference procedure for the East Coast of South America has been canceled, according to an announcement made to-day by the War Trade Board. Steamship companies have been instructed to disregard any outstanding preferences heretofore granted.

This action has been taken because of information received that the allotment of shipping made by the Shipping Board for the East Coast of South America trade will be sufficient to take care of all the cargo now offered or which will be offered in the immediate future for these markets.

—

Automotive Restrictions in Holland

AMSTERDAM, HOLLAND, Feb. 27 (Special Correspondence)—Late in 1918 and early this year a shortage of gasoline in Holland, due to the exhaustion of supplies and the lack of imports, prohibited the use of passenger cars, trucks and motorcycles except for military purposes. In some of the big towns it was permissible to use cars for conveying sick persons to hospitals and for official business connected with the various foreign legations. Under ordinary circumstances oil and gasoline are comparatively cheap inasmuch as they are not taxed and supplies are received by tank steamer from America, India and Roumania principally.

In consequence of the impossibility of importing tires due to war restrictions, a tire industry has been started, and one factory, the Rubberfabrick "Vredestein," at Loosduinen (near The Hague), is bringing out what is described as a fair tire. This company is making only pneumatics and has not as yet attempted solids.

There are very few motor trucks in use in Holland. The greatest use of such vehicles is made by the war office. Private industry and commerce possess only a small number of trucks, and these cannot be used at present. Most of them are about 2-ton capacity, with a few 4 and 3½-ton vehicles. Light delivery trucks and those of 1-ton capacity are few.

—

Russian Buying Agency Established

SAN FRANCISCO, March 24 — The All-Russian Central Union of Co-operative Societies has been formed, with offices at 167 Post Street, to buy automotive products, etc., on behalf of Russian distributers, dealers and consumers, and to promote commercial intercourse generally through the control of that country's stocks of raw material. A request is made for duplicate catalogs and price lists.

—

France Lifts Import Restrictions

WASHINGTON, March 21—France has removed import restrictions from many commodities, including the following: Petroleum oils, crude and refined; heavy oils and other mineral oils; iron ore, copper ore, lead ore, tin ore, zinc ore, nickel ore, iron scrap, iron filings and copper sulphate, and wooden handles for agricultural implements.

Names of Foreign Consignees Unnecessary

WASHINGTON, March 22—Names of foreign consignees need no longer be included on the export bills of lading according to an announcement by the War Trade Board. It is believed that exporters are now thoroughly familiar with the enemy trading act and hence will not need to be checked up.

Exports of Cars, Trucks and Parts During the Calendar Year 1918

	Passenger Cars No.	Passenger Cars Value	Trucks No.	Trucks Value	Parts Value
Azores and Madeira Islands	....	....	....	....	$1,793
Denmark	98	$159,516	....	....	5,296
France	1,003	1,134,818	3,356	$12,920,029	5,069,426
Gibraltar	....	....	27	58,325	....
Greece	1	2,000	14	32,000	13,415
Iceland and Faroe Island	40	34,062	1	2,245	5,268
Italy	99	82,957	78	115,632	67,677
Norway	198	430,514	108	320,574	65,585
Portugal	168	215,062	16	56,804	25,890
Russia in Europe	10	8,325	2	5,454	177
Spain	808	1,042,789	55	141,883	116,691
Sweden	1	2,800	....	....	....
Switzerland	1	1,646	....	....	54
England	398	997,342	2,080	5,999,541	6,951,699
Scotland	25	85,000	182	667,413	154,686
Ireland	....	....	2	4,276	....
Bermuda	....	....	....	....	4
British Honduras	7	5,450	3	4,534	3,696
Canada	8,543	7,141,406	1,596	2,035,464	11,617,494
Costa Rica	41	20,100	....	....	2,772
Guatemala	15	21,914	1	1,312	6,336
Honduras	11	15,443	4	2,017	10,262
Nicaragua	69	51,829	3	8,251	6,305
Panama	65	55,187	45	44,573	56,855
Salvador	62	77,184	3	10,561	9,970
Mexico	1,915	1,539,263	397	524,035	506,747
Miquelon, Langley, etc	....	....	....	....	94
Newfoundland and Labrador	84	97,861	6	6,247	7,257
Barbados	21	12,506	7	15,192	14,254
Jamaica	142	104,595	12	7,575	61,236
Trinidad and Tobago	86	64,995	12	19,893	49,765
Other British West Indies	43	26,192	9	6,304	13,840
Cuba	1,780	2,638,001	557	1,109,368	1,065,816
Danish West Indies	149	13,069	....	....	3,105
Dutch West Indies	7	4,233	....	....	3,584
French West Indies	75	63,150	14	22,836	44,575
Haiti	92	59,098	10	9,664	21,650
Dominican Republic	220	169,285	19	16,497	59,120
Argentina	1,628	1,673,137	45	40,707	2,100,114
Bolivia	15	29,187	16	41,116	7,303
Brazil	1,108	856,374	37	42,481	221,835
Chile	1,734	2,315,386	154	239,621	659,544
Colombia	126	95,677	4	7,385	26,864
Ecuador	63	73,953	6	10,420	8,558
British Guiana	62	45,467	8	7,700	41,985
Dutch Guiana	2	730	1	1,000	2,445
French Guiana	3	1,236	....	....	213
Paraguay	....	....	....	....	719
Peru	626	823,762	100	246,392	116,721
Uruguay	1,351	799,787	15	13,512	187,991
Venezuela	118	104,942	7	7,100	57,134
Aden	6	5,049	....	....	227
China	874	896,728	42	65,085	70,654
British China	1	824	....	....	....
French China	1	775	2	5,490	....
German China	....	....	....	....	290
Japanese China	58	29,335	....	....	855
Chosen	5	3,595	....	....	10,943
British India	72	70,254	11	22,043	226,131
Straits Settlements	76	72,075	81	120,338	111,984
Other British East Indies	1	1,255	2	5,900	20,646
Dutch East Indies	1,260	1,567,766	154	335,536	404,048
French East Indies	17	24,254	1	1,800	2,458
Hongkong	129	119,958	9	10,970	13,219
Japan	2,699	2,877,692	605	895,125	429,543
Persia	10	5,673	4	2,712	4,170
Russia in Asia	3	11,734	15	18,200	198
Siam	85	75,860	4	6,342	9,199
Turkey in Asia	6	3,965	....	....	3,764
Australia	3,826	3,271,317	38	66,254	1,613,333
New Zealand	1,418	1,228,864	84	128,215	375,715
Other British Oceania	25	19,192	1	1,835	4,622
French Oceania	10	8,655	5	6,600	6,950
German Oceania	10	7,035	4	4,213	5,123
Philippine Islands	1,690	1,462,571	152	205,519	311,257
British West Africa	128	80,908	30	25,946	48,330
British South Africa	1,205	1,070,570	36	44,254	472,356
British East Africa	77	59,992	....	....	11,894
Canary Islands	2	730	....	....	1,144
French Africa	130	74,144	12	9,817	20,929
Liberia	....	....	....	....	18
Madagascar	1	854	....	....	215
Morocco	....	....	....	....	1,415
Portuguese Africa	12	8,598	4	7,725	1,122
Egypt	6	20,850	....	....	473
Totals	36,936	$36,278,292	10,308	$26,814,952	$33,607,050

SHIPMENTS TO NON-CONTIGUOUS TERRITORIES

	Passenger Cars No.	Passenger Cars Value	Trucks No.	Trucks Value	Parts Value
Alaska	8	$7,590	7	$15,469	$37,071
Hawaii	81	107,064	38	76,930	333,720
Porto Rico	188	264,475	20	58,487	241,562
Totals	277	$379,129	65	$150,886	$612,353

This table supplements the monthly tables of exports given singly for the last six months in AUTOMOTIVE INDUSTRIES, *and gives figures for all of the individual countries, including those generally grouped under the collective heading "Other Countries"*

Specifications for Trinidad Purchasers

WASHINGTON, March 22—A wheel track of 56 in., ground clearance not less than 8 in., wheel base between 108 and 125 in. and a turning radius of 20 ft. are the specifications demanded by the Trinidad automobile purchasers, according to the Trinidad Automobile Association, Trinidad, British West Indies. These specifications were the result of questions asked by the Association of British Motor and Allied Manufacturers of England, who are apparently planning to capture this trade.

New Zealand Ready for Car and Truck Imports

CHRISTCHURCH, NEW ZEALAND, Jan. 10—New automobiles are in great demand in New Zealand but are difficult to obtain, American cars being the only new ones on the market. As in America, automobiles are largely utility vehicles, 99 per cent of them coming under this classification in the country districts and 90 per cent in the towns and cities.

It is questionable what will be the attitude in New Zealand with regard to American and English cars after the war. There is a strong feeling that British cars will sell at better prices than American cars as soon as they are on the market, because the medium-priced British car retains its mechanical condition, finish, upholstery and smoothness of running much longer than the correspondingly-priced American car.

Farm tractors are not making much headway except in such areas as Canterbury Plains and one or two other parts of the South Island, where there are cultivated areas of fairly good size. In North Island the country is hilly and broken, and wet soil conditions have not proved suitable for tractor use. In a recent demonstration over such soil the tractor bogged on the first trip across the field, and as farmers here expect the tractor to be practically the same as a horse, there is not much prospect for its speedy advance.

One of the greatest difficulties in New Zealand is the shortage of good repairmen. The average motor mechanic, as he is styled here, is usually a half-trained person whose work is of low order.

Electric trucks are making great headway here due to the cheap current obtained from the government's water power system. In North Island, dairy companies are installing their own electric charging plants and using electric trucks for collecting cream from farmers. The use of the electric truck is accelerated because of the high price of gasoline, which is selling at 90 cents per imperial gallon.

Belgium Wants Heavy Import Duty

PARIS, Feb. 17—Automobile import duties in Belgium are still at pre-war rates, which is from 10 to 15 per cent of the value. Although France and England are free of duty it is believed that this will shortly be replaced by an import duty of 76 per cent in France, and 80 per cent in England, as a temporary measure which may remain in effect for one year.

Belgian manufacturers are not satisfied with this and have taken steps to bring it to the attention of the government, with the hope of obtaining an import duty about equal to that of France and England.

An endeavour has been made by Belgian automobile dealers to obtain licenses for the importation and sale of cars, to be given only to those persons who were actively engaged in the auto-

mobile industry before the war. It is claimed that large numbers of newcomers, who have absolutely no connection with the automobile industry, are now importing cars, to the detriment of men who have been in this business for a number of years.

—

Passes Oil Leasing Bill

WASHINGTON, March 22—The House to-day adopted the conferee report on the Oil and Mining Land Leasing bill which was described in a past issue of AUTOMOTIVE INDUSTRIES and which makes possible the leasing of 6,000,000 acres of oil lands owned by the Government. In payment for the leases by companies or individuals the Government will receive royalties and rentals and reserves the right to control and regulate the development.

—

Oil Found in England

WASHINGTON, March 22—The United States Fuel Administration has received information by cable of the reported discovery of oil in England. The cable states that considerable gas has been found, but no oil has yet been struck.

—

International Exhibits Scheduled

PARIS, March 10 (Special Cable)—At the first meeting of an International Automobile Manufacturers' Congress, held during the progress of the Lyons Fair, a circuit of automotive exhibits was arranged and dates set for the forthcoming French and English shows. The congress, which includes a branch representing America, has set the following dates:

Paris (Grand Palais)	October 15
London (Olympia)	November
Brussels	December
New York	January
Chicago	February

—

Air Director's Authority and Functions Defined

WASHINGTON, March 24—To enable Maj. Gen. C. T. Menoher, director of the Air Service, to exercise the necessary supervision, control and direction over the Bureau fo Aircraft Production and the Division of Military Aeronautics, with which he is charged by the Secretary of War, the following was announced by the Chief of Staff:

The Director of Air Service will carry out the duties of the Chief of the Air Service, as prescribed in Article LXXXI, Army Regulations, 1913. He will exercise, under the direction of the Chief of Staff, full and complete supervision, control and direction over the Bureau of Aircraft Production and the Division of Military Aeronautics, in all that pertains to administration, supply, instruction, training and discipline.

General Orders, No. 80, War Department, 1918, have been amended by striking out the words, "the Directors of Military Aeronautics, of Aircraft Production," and substituting the words, "the Director of Air Service."

Germany Increases Automobile Output

Many Companies Add to Their Capital — Dividends Also Enhanced, Some 16%

WASHINGTON, March 24—The difficulties of wartimes have affected the German automobile industry but very slightly, according to a report received here by the Department of Commerce. Nearly all companies have greatly increased their production and their equipment. The typical factor in this industry has been that during the war, owing to the excess of demand over supply, the manufacturers have not been concerned with the finding of markets, as a result of which production has been intensive.

A measure of the increase of motor producing capacity during the war is clearly illustrated by the figures given in the German press of the increase of capital of companies concerned in that production. Thus the Daimler and Bayersche Motorwerke A-G. during the past two years have increased their capitalization by 15,000,000 marks. A considerable increase in the working capital is also noticed, as for example Nationale Automobile Gesellschaft and Hansa Lloyd, the latter increasing its capitalization from 4,400,000 to 20,000,000 marks. The pre-war value of a mark was 24 cents.

The unprecedented flow of money into this industry is remarked on by the German press as not found in other industrial lines and this condition has attracted the attention of the German government, arousing it to oppose any plans looking to a further increase in the capital of these stock companies.

Parallel with the growth of working capital and the increase in the scale of production, there is also a considerable increase in the dividend. Companies which before the war made no profit are now making as much as 16 per cent net. The German press considers that the industry has opportunity for large development after the war.

—

U. S. May Trade with Germany and German Colonies

WASHINGTON, March 22—The War Trade Board will now issue licenses for the importation of ferromanganese from all countries where it has been shown by conclusive evidence that such ferromanganese was contracted for by American consumers prior to April 6, 1917.

It is now permissible for persons in the United States to trade and communicate with persons residing in the colonies owned or controlled by Germany on August 1, 1914, subject to the rules and regulations of the War Trade Board. Individual import licenses will be required for importations into the United States from such territory, and individual export licenses for exports to such territory. No official advices have been received as to what the import regulations in this territory will be, if any.

—

England-Belgium Air Freight Service Planned

WASHINGTON, March 24—An aerial freight service is contemplated between Folkestone, England, and Ghent, Belgium. English manufacturers have been finding it next to impossible to ship goods to Belgium by ordinary transport, owing to the congestion of the docks in that country, and the Aircraft Transport & Travel Co. was quick to realize the opportunity thus offered to demonstrate the possibilities of aircraft for commercial purposes. The company has entered into negotiations with British manufacturers interested in the forwarding of goods to Belgium by air.

The governments of Great Britain and Belgium have been approached in the matter, and the Belgian government has already issued the special certificates necessary for this form of transport. The British Air Ministry has given its consent also to the main scheme proposed by the Aircraft Transport & Travel Co., but stipulates that pilots of the Royal Air Force shall undertake all the aerial trips made.

The load carried will be about 2 tons of foodstuffs, clothing and other necessities. The extension of this service to Antwerp and Brussels is planned.

—

Canadian Municipalities May Impose License Fee

QUEBEC, March 24—Power to impose a tax or license fee on owners of motor vehicles used to carry on the business of cabman or common carrier is given to municipalities in a bill which Hon. Walter Mitchell, provincial treasurer, has introduced in the Legislative Assembly. When a man in the cartage business gave up horses and bought a truck to transport materials, he paid a tax to the Provincial Government under the Motor Vehicle act, but nothing to the municipality. Thus the municipality lost the revenue it had obtained from him when he had used horses.

The municipalities are also given power to make by-laws for the locating of cab stands and to put into force a tariff of fares which may be charged by motor and other vehicles.

—

Mechanics' License Bill to Be Pushed Next Session

TOPEKA, KAN., March 22—The Kansas law regarding the licensing of mechanics has been killed in committee, and those actively engaged in disposing of this pernicious legislation were warned that two years hence this bill would be again proposed, with the further warning that they were going to put it across.

The labor unions are very actively engaged in trying to have this proposed bill made a law, and the president of the Kansas Automobile Trade Association was given to understand that a real fight would be made two years hence, at the next session of the legislature.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Gillette Rubber Sales $1,810,000

EAU CLAIRE, WIS., March 22—The Gillette Rubber Co. expects to reach a daily production of 1000 tires and 2000 inner tubes within a short time, according to the annual report of President S. P. Woodard, New York, at the annual meeting.

Sales in 1918 amounted to $1,810,000, compared with $455,000 for the eight months of actual production in 1917, the first year the new plant was operated. January sales this year were $197,557, compared with $72,520 in 1918; February, $260,000, compared with $108,421 in the same month last year. The production of 1918 was 91,000 pneumatic casings and 77,500 inner tubes.

Western Carburator Reorganizes

ALMA, MICH., March 21—The Western Carburator Co. is being reorganized and will resume operations soon. The capital stock of the company, which is $120,000, will not be increased for the present. Henry Prescott is superintendent and sales manager for the company.

Emerson-Brantingham Expands

ROCKFORD, ILL., March 20—In 1918 the Emerson-Brantingham Implement Co. bought from the International Harvester Co. the Osborne line of harvesting machinery, consisting of grain and corn binders, reapers, mowers and hay rakes. The manufacture will continue at Auburn, N. Y., until some time this summer, when it will be moved to this city. The company has opened an office at 66 Broadway, New York, for export trade.

Prudden Wheel on 100 Per Cent Peace Basis

LANSING, March 22—The Prudden Wheel Co. is back to 100 per cent peace production, having been operating at the time the armistice was signed on 100 per cent war work basis. The company's production is back to normal, requiring the services of 1110 employees. About $60,000 worth of special machinery used in the manufacture of government war products has been returned to the Ordnance Department. The company has $750,000 invested in canceled war contracts, but a settlement with the government has practically been reached.

Canadian Studebaker Plans 50 Daily

WINDSOR, ONT., March 21—The Canadian plant of the Studebaker Corp. is now turning out 15 machines daily, but this production will shortly be run up to the 50 mark. This plant assembles the car only from parts received from Detroit and Canadian parts makers. About 50 per cent of the material is manufactured by Canadian concerns.

Canadian Ford Making 100 Cars Daily

WINDSOR, ONT., March 21—The Ford Motor Car Co. of Canada, Ltd., is now producing 100 cars daily and anticipates greatly increasing her output within the next month.

$5,000,000 Auto Sales Co. Organized

DETROIT, March 22—The Federal Motor Finance Corp. has been incorporated here with $5,000,000 capital to finance dealers in the sale of cars, trucks and tractors. The organization will be national in scope, but will have its home offices here. Branches will be established in all parts of the country. Its directorates, the personnel of which will be made public in a few days, include bankers and automobile men.

Michigan Stamping Co. Earns $501,062

DETROIT, March 22—Net earnings of the Michigan Stamping Co. for 1918 were $501,062, of which $331,062 was credited to profit and loss, and $170,000 paid out in dividends. Sales for the year totaled $3,767,784.54. Assets are placed at $2,517,907.83.

New Tractor Works for Allis-Chalmers

MILWAUKEE, March 24—The new tractor works which the Allis-Chalmers Mfg. Co. is erecting and equipping in connection with its main works at West Allis, a suburb of Milwaukee, will be three stories, 110 x 325. It is expected to be ready in about thirty days, when the tractor department will be moved there from its Reliance works on Clinton Street. The output will be more than trebled. The Allis-Chalmers tractor is now being produced in three types.

Commerce Building

DETROIT, March 24—Plans have been approved for the new addition to the plant of the Commerce Motor Car Co. With this building the company will have 100,000 sq. ft. of floor space. The addition will be of brick and steel and will have 285 ft. frontage on Mackie Street.

New Cleveland in Production July 1

CLEVELAND, March 21—The new plant of the Cleveland Automobile Co., recently organized by Chandler Motor Car Co. officials to produce a $1,300 motor car, will cover approximately 200,000 sq. ft. of floor space, and will cost $650,000. The plant will be completed and the company in operation by July 1. The site of the new factory has not been definitely decided upon.

Acason Making 80 Trucks Weekly

DETROIT, March 22—The Acason Truck Co., since completing war contract work a few weeks ago, has tripled production and is now turning out 80 trucks of all models a week. From now on this company hopes to increase production until full capacity is maintained.

First Annual Report of Oak Tire & Rubber

TORONTO, ONT., March 21—The annual statement of the Oak Tire & Rubber Co., Ltd., for its first year of operation, 1918, revealed net profits of $32,735. At the close of the year its total assets were $462,178. Out of the net profits $14,500 has been set aside as reserve.

The following directors were appointed at the annual meeting: Frank Law, Toronto; T. E. Finlay, Norwood; J. H. L. Patterson, Toronto; A. E. Willar, Galt, and William Seward, Baltimore, Md.

Oneida Truck Co. Increases Capital and Changes Personnel

GREEN BAY, March 24—The Oneida Motor Truck Co. has increased its capital stock from $300,000 to $600,000 as the forerunner of a general expansion plan which will probably make necessary the erection of additions to the plant built about two and a half years ago. At the annual meeting Lafayette Markle, for several years president and general manager of the Republic Motor Truck Co., Alma, was elected president and general manager of the Oneida company.

Dividends Declared

The McGraw Tire & Rubber Co., East Palestine, O., quarterly dividend, 3 per cent on common stock, paid March 1.

Flower Valve Mfg. Co. to Add

DETROIT, March 22—The Flower Valve Mfg. Co., formerly the Flower-Stephens Mfg. Co., has completed the sale of $450,000 7-per cent first mortgage serial bonds to local bankers. The company's plant covers 6½ acres, employing over 400 men, and with its additions the number of employees will be largely increased. This company made propeller wheels and ship sets for the Emergency Fleet during the war in addition to its regular business.

Nash Production Reaches 100 Car Mark

KENOSHA, WIS., March 22—The Nash Motors Corp. has completed its contract which called for 1600 Quad trucks for the Government and is otherwise winding up its war work. The company is now devoting 90 per cent of its attention to the manufacture of its regular car production. In February this company produced 65 cars daily. In March production will be increased to 90 cars, while the 100 machine mark will be reached early in April.

Automatic Products for 500,000 Cars

DETROIT, March 24—The Automatic Products Co. will this year devote its entire capacity to the automobile industry, and has completed a production schedule which calls for the manufacture of its parts for 500,000 cars. During 1918 over 65,000,000 pieces were produced, a large percentage of which were used in the assembly of airplanes.

Detroit Truck Makers Use Pneumatics

Discernible Tendency Toward Use of Cord Tires for 1½- and 2-Ton Vehicles

DETROIT, March 21—The pneumatic cord tire is being adopted by Detroit truck makers as standard equipment on 1½- and 2-ton trucks. For some time the pneumatic tire has been standardized on lighter models, but a tendency is now prevalent to increase the use of pneumatics in the heavier truck field. While no truck makers have gone so far as to equip 2-, 2½- and 3-ton machines with pneumatic tires as standard, they are turning out a large number of such jobs, pneumatics having been requested by purchasers. Every local truck company is feeling an increasing demand for pneumatic tires instead of the solid variety.

Sales engineers declare the day of the pneumatic tire is coming and that the next year will see it standardized on all jobs up to 2½ and 3 tons by the majority of the big manufacturers.

Practically every tire company in the country has been working on pneumatic cord tires. The last 60 days have brought the sales engineers of all of the big Akron plants to Detroit. The companies have launched extensive advertising campaigns urging the more extended use of the cord product, and it is now apparent that their sales and publicity enterprises are beginning to bear fruit. They are overcoming the one big objection to cord tires—the greatly increased initial tire cost.

This objection has been raised by both the truck maker and the owner, but it is being beaten down at both ends by the sheer mass of statistics compiled in favor of pneumatics. The tiremakers are successfully pointing out many advantages, chief of which is a longer life of both tires and trucks obtained by the use of pneumatics.

All new 1½-ton trucks of the Commerce Motor Car Co. have 36 x 6 pneumatic cord tires as standard equipment. The Acason Motor Truck Co. is about to bring out a new 1½-ton model similarly equipped. Packard, Wilson, Federal, Republic and others are seriously considering the pneumatic tire and are placing it on their lighter machines when desired by purchasers. It is not unusual here in Detroit to see a factory experimental truck with four pneumatic tires, all of different make, and the company whose new cord product best withstands these road tests is the one going to get the tire business of the manufacturer.

The Commerce Motor Car Co. is pushing pneumatic equipment. Both Commerce, Acason and other engineering authorities declare they cut vibration and relieve road-strain to such an extent that the load capacity can be increased 50 per cent. This company is advancing this as an unusual selling feature. Its engineers advocate overloading if the tire equipment is pneumatic. This company has numerous 1½-ton machines which are carrying 2 tons.

From the manufacturing standpoint, the builders find that machines equipped with pneumatic tires may be built of much lighter units inasmuch as the jar and strain, which the solid tire truck must be built to withstand, is largely eliminated.

In 1911 the Commerce people and a number of other companies produced pneumatic tire jobs. The Commerce product was a ¾-ton machine weighing 2000 lb. At that time pneumatic tires were an uncertain proposition, and they soon gave way to the hard-rubber type. In order to use the hard rubber tires, however, this company found it necessary to practically rebuild the truck on much stronger lines. Every important unit, springs, axles, etc., had to be built much sturdier. When this job, with hard rubber tires, was ready for the road, it weighed 2950 lb.

The government was the first to realize the value of the cord pneumatic tire on the larger size trucks, and specified that its 1½-ton war truck be equipped with 36 x 6 pneumatics. While use of these tires increased the truck cost, the government found that by using them the trucks could get more capacity, withstand greater hardship, save on oil and gasoline and had many other advantages which offset the extra tire expense.

—

Accessories Branch of National Hardware Assn. Meets

DETROIT, March 21—The annual meeting of the Automobile Accessories Branch of the National Hardware Association, which closed Friday night, was more of a convention of accessory manufacturers than it was of accessory jobbers. Over three hundred members were present when the gathering convened at Hotel Statler, and of this number the great majority represented factory organizations.

In connection with the convention proper, the first annual accessory show was held. This show will be a regular feature hereafter, although the question has arisen as to the advisability of staging it in connection with the annual meeting. The chief objection of holding the two events at the same time lies in the fact that the show had a tendency to keep the interest of the members from centering entirely upon the convention.

The two days of the meeting were crammed full of addresses and discussions.

The manufacturers centered their effort in convincing the hardware men that the hardware store was the logical place to handle accessories, just as logical as the garage or automobile shop, and they went the limit in urging the dealers to not only hanlle accessories, but to push their sale to a greater degree than they have been doing.

On the price question the convention took a definite stand against the "price cutter," and as a result the man who "undersells" the market is going to find it harder going in the future than in the past.

$14,000,000 In Orders Uncompleted

Few War Contracts for Tanks, Tractors and Trailers Now Being Finished

WASHINGTON, March 22—War orders for $14,929,502 worth of tanks, tractors and trailers still remain to be completed for the army. This includes:

392 6-ton tanks at $4,508,000, needed to give a working stock.

628 10-ton tractors at $4,082,000, not needed, but can be used.

450 2½-ton tractors at $1,561,950, needed to motorize 75 mm. guns.

216 20-ton tractors at $1,521,720, needed.

100 30-ton tanks at $500,000, needed as a working stock.

262 5-ton tractors at $1,181,620, needed to motorize reserve artillery.

108 3 in. gun auto-trailers at $575,000, needed for guns already completed.

In some few instances orders are being completed because there is no termination clause in the contracts, but in most cases, as will be seen above, there is still a need for some numbers of tractors, trailers and tanks.

All 5-ton and 10-ton tractors now in France are reported in use and spare parts and tops are being shipped overseas in quantities. Experimental work is being done with the 2½-ton tractor to make it suitable for motorizing the 75 mm. gun regiments.

Following is the total number of tractors that have been delivered or will be delivered on contracts:

Tractors:

2½-ton	1,000
5-ton	4,000
10-ton	2,800
15-ton	267
20-ton	400

Tanks:

3-ton	15
6-ton	950
30-ton	100

Status of Contracts Outstanding Nov. 11.

Tractors	Canceled or ordered suspended	Delivered Nov. 11 Feb. 27	Remaining Feb. 27
30-ton (tank)	2,850	0	100
2½-ton	5,079	45	450
6-ton (tank)	3 490	436	392
5-ton	7,150	2,269	262
20-ton	765	59	216
10-ton	3,823	793	628

—

Pennsylvania Plans Huge Road Outlay

HARRISBURG, March 24—Plans are now completed, and some of the contracts have already been let, for the greatest program of road building and maintenance in the history of the State. Within the next 4 years a total of $130,000,000 will be spent for road work, and for the balance of this year alone more money will be spent than was spent in the last eight years. A bond issue of $60,000,000 has been passed by the legislature, $6,000,000 is available from state aid and $12,600,000 from other sources.

During the present year it is planned to build 3500 miles of primary road system, paid for by the State. All primary roads are to be constructed along perma-

nent lines, and will be built with concrete foundations. All new roads are to be built by the contract system, and some 234 companies have been bidding. After the roads are completed they will be taken over by the state and the state highways department will keep them in order. For this purpose 23 tractors, which were used last year to help farmers open up new grounds, have been transferred from the Department of Agriculture to the Department of Highways, and these will be used to drag the existing roads and keep them in shape.

There are approximately 90,000 miles of roads in Pennsylvania. The state is bearing the entire cost of extending the primary system. The counties are expected to raise the money to build and maintain the secondary routes or feeders.

—

Millions for Central West Roads

WASHINGTON, March 22—Additional details of highway construction received here indicate that the entire nation is awake to highway value.

Colorado has 51 miles of highways under construction at a cost of $300,000; 91 miles ready for contract to cost $360,000; and 30 miles and 3 bridges contemplated, to cost $350,000. Maintenance on 4000 miles will amount to about $500,000, while local road and bridge expenditure will amount to about $2,200,000.

Idaho has 87 miles, costing $720,000, under contract; 45 bridges, costing $425,000, ready for contract; and about $1,800,000 worth of additional work is contemplated during the season.

Iowa will expend $15,000,000 on the road system of the state, of which about $11,000,000 will be for road and bridge construction.

Missouri has 666 miles under contract, costing $1,785,100; 888 miles, costing $3,104,000 ready for contract; and about $3,000,000 additional construction is contemplated. Local road and bridge expenditures in the state will amount to about $7,000,000.

Nebraska has 173 miles, costing $431,000, under contract; 145 miles, costing $550,000, ready for contract; and about 610 miles, estimated at $1,310,000, contemplated. Local road and bridge expenditures will amount to about $3,000,000.

Nevada has 4 miles, costing $54,666, under contract; 102 miles, costing $657,412, ready for contract; 123 miles, costing $523,000, contemplated. Local expenditures on maintenance will amount to $600,000.

Oklahoma has 178 miles, including 80 bridges, costing $1,360,000, under contract. Additional construction of 165 miles, costing $2,500,000, is contemplated. Local road and bridge work will amount to about $2,200,000.

These amounts will be supplemented by increased Federal Aid appropriations and later, it is hoped, by national construction of main trunk lines under the supervision of a Federal Highway Commission, as provided in the Townsend bill, which will come up for consideration by the next congress.

Expect British Trade to Be Free

Detroit Makers Still Await Official Confirmation of Lifting of Import Embargo

DETROIT, March 21—Counteracting the stimulus given Canadian manufacture of Detroit automobiles by the reported lifting of the British embargo on Canadian made automotive products is a prevailing belief here that Great Britain will very shortly lift her embargo against United States products, thus opening the British empire to American automotive export trade. Not a word of information regarding Great Britain's action concerning the Canadian embargo has reached this city from either Washington or London, and customs officials at Windsor, Ont., have received no official word of such a ruling.

J. A. Smith, Collector of Customs at Windsor, has taken the matter up with Canadian officials at Ottawa, however, in behalf of a number of American car makers as well as Canadian parts concerns located in the border cities.

He declares regulations are changed so frequently that it is difficult to give out definite information. He is of the belief, however, that Britain is not making any distinction whether a car is manufactured or merely assembled complete in the Dominion and thinks that an assembled car, even if assembled from American-made parts, is a Canadian product. There is a 33 1/3 per cent duty on goods manufactured in the United States.

There is no question but what American manufacturers are going after British Empire trade through the expansion of Canadian manufacturing plants, but expansion plans are being held up on the belief that the embargo against the United States will soon be lifted.

The demand of the British trade for cars, a demand already greater than Britain can possibly supply, is going tc be the big factor in expected action which will permit American cars to go to England duty free, the manufacturers here declare. They point to the fact that British plants have been on a war work basis for 4 years and it will be some time before they can resume their commercial work again. The British people are buying low priced machines and that country cannot possibly produce enough such cars this year to meet requirements without import aid from the United States.

About the only information relative to Britain's embargo action comes from Ottawa, where the War Trade Commission has received two cables from the Canadian Mission in London. The first reads:

"Effect has now been given to Government decision to allow importation of Empire goods by issue of open license allowing import of all goods from British Empire, except gold and articles containing gold, unless consigned to Bank of England, spirits other than brandy or rum."

The second is:

"British Board of Trade regulations will insist only goods of Empire origin free from import restriction. Making definite announcement and asking government to provide necessary machinery to prevent foreign manufactured goods reaching England through Canada."

In the first it appears that it will only be necessary for the British agents of Canadian automobile manufacturers to apply for the necessary open license. Obviously, the policy as outlined in these cables, if adhered to or even if modified simply to an Imperial preferential tariff, will result in practically all the large American automotive manufacturers establishing plants in Canada, as it is clearly indicated that they must at least do this if they desire to compete on even terms with the automotive manufacturers who now have plants in the Dominion.

However, the tariff situation generally in so far as Canada is concerned is far from stable. The farmers, especially the western grain growers, are demanding a radical downward revision of the existing tariff. The present political split in eastern Canada practically gives the west the balance of power and consequently the demand of the western grain growers carry considerable weight. On the other hand, almost without exception, the western members of the government, while advocating downward revision of the tariff, are unanimous in declaring allegiance to the Union government.

The chief demands of the western grain growers are:

An immediate and substantial all-round reduction of the Custom's tariff.

Complete free trade between Great Britain and Canada in five years.

The acceptance of the reciprocity treaty with the United States which was rejected by Canada in 1911.

That any further reduction of the tariff of the United States towards Canada be met by a similar reduction of the Canadian tariff towards the United States. (That is free trade with the United States at any time the United States is ready for it).

Obviously, this program is heading directly for free trade between Canada and other countries and the manufacturers are vigorously opposing it in Parliament on the platform and in the newspapers. They contend that free trade or any approximation to it for Canada would immediately result in making the Dominion a dumping ground for the world, thus sounding the death knell of Canadian industry, with the consequent unemployment and depression.

—

No Discussion at Buffalo S. A. E. Meeting

BUFFALO, N. Y., March 21—The future use of airplanes was the subject of a meeting of the Buffalo Section of the Society of Automotive Engineers held here last evening. The speaker was Douglas Wardrop, who spent practically all of last summer near the western front.

That a regular airplane transatlantic schedule would be in operation before the end of this year was predicted by the speaker, who bases his conclusions on the proposed flights of the United States Navy, the British flying boat en route to Nova Scotia and a large Caproni developed for the same purpose.

No discussion developed at the meeting, although in view of the attendance of C. M. Manly, president of the S.A.E., and one of America's foremost airplane pioneers; David Fergusson, chief engineer of Pierce-Arrow; E. T. Larkin, chief engineer of the Sterling Engine Co., and other prominent engineers, it was confidently expected that some interesting discussion would develop along engineering lines. Mr. Manly occupied the chair and adjourned the meeting immediately after Mr. Wardrop had finished his lecture.

The meeting was held under the auspices of the Buffalo engineering Society, which is a joint organization of the local sections of the large national engineering societies. About 100 were in attendance.

Automobile Engine Exports for Six Years

	1913	1914	1915	1916	1917	1918	Totals by Countries
Austria-Hungary	......	5 $748	......	......	......	......	5 $748
Bulgaria	......	1 $106	......	......	......	......	1 $106
Denmark	......	......	......	......	5 $870	1 $92	6 $962
Finland	......	......	2 $689	......	......	......	2 $689
France	......	25 $3,379	27 $7,688	485 $92,169	1,395 $400,408	1,499 $211,068	3,431 $714,712
Germany	......	10 $1,707	......	......	......	......	10 $1,707
Greece	......	......	1 $462	1 $500	......	......	2 $962
Italy	27 $5,664	47 $7,618	......	1 $550	103 $25,270	10 $1,200	188 $40,302
Netherlands	......	......	......	5 $1,500	2 $697	......	7 $2,197
Norway	4 $929	1 $235	......	6 $1,413	21 $6,177	......	32 $8,754
Portugal	......	......	1 $400	1 $227	......	......	2 $627
Roumania	10 $1,945	......	......	......	......	......	10 $1,945
Russia in Europe	12 $2,689	7 $790	3 $329	641 $137,108	220 $50,000	162 $17,287	1,045 $208,203
Spain	......	......	......	......	......	10 $695	10 $695
Sweden	4 $712	......	......	3 $1,699	2 $725	......	9 $3,136
England	2,425 $959,819	3,345 $1,296,368	8,812 $1,313,076	11,019 $1,283,995	4,858 $508,174	3,714 $411,365	34,173 $5,772,797
Scotland	......	......	1 $500	......	......	1 $305	2 $805
Ireland	......	......	......	1 $79	......	......	1 $79
British Honduras	......	......	......	1 $225	1 $169	24 $2,741	26 $3,135
Canada	8,906 $753,702	353 $71,070	465 $70,597	8,426 $1,094,354	16,668 $1,805,698	175 $927	34,993 $3,796,348
Costa Rica	......	......	......	......	......	1 $750	1 $750
Honduras	......	......	1 $310	2 $455	......	......	3 $765
Nicaragua	......	......	......	1 $99	......	1 $180	2 $279
Panama	......	......	......	1 $50	......	......	1 $50
Salvador	......	......	......	......	......	1 $23	1 $23
Mexico	1 $260	3 $300	1 $149	4 $1,478	8 $2,198	19 $2,907	36 $7,292
Newfoundland and Labrador	......	......	1 $104	1 $77	3 $319	21 $1,531	26 $2,031
Jamaica	1 $500	......	2 $146	......	......	......	3 $646
Trinidad and Tobago	......	1 $202	1 $221	......	......	1 $168	3 $591
Other British W. I.	......	......	......	......	1 $120	....	1 $120
Cuba	5 $718	2 $265	3 $705	24 $5,047	2 $439	13 $3,926	49 $11,100
Dominican Republic	......	......	......	2 $833	1 $400	6 $459	9 $1,692
Argentina	......	......	2 $708	......	2 $153	6,075 $714,857	6,079 $715,718
Brazil	......	......	2 $240	1 $393	......	......	3 $633
Chile	......	2 $970	......	......	1 $325	19 $2,408	22 $3,703
Colombia	......	1 $170	1 $155	1 $458	......	1 $61	4 $844
Ecuador	......	......	1 $692	9 $2,291	1 $300	......	11 $3,283
Guiana—British	......	......	......	6 $894	......	40 $4,660	46 $5,554
Peru	......	......	......	3 $620	1 $112	1 $186	5 $918
Venezuela	1 $230	......	5 $289	1 $125	1 $172	......	8 $816
British India	2 $175	4 $1,756	......	2 $267	4 $551	2 $318	14 $3,067
China	......	......	......	......	......	1 $364	1 $364
Dutch East Indies	......	......	......	......	3 $623	1 $180	4 $803
Japan	......	......	6 $345	......	1 $490	7 $1,213	14 $2,048
Siam	......	1 $675	......	......	......	......	1 $675
Straits Settlements	1 $197	......	......	......	......	......	1 $197
Australia	2 $756	24 $3,243	30 $2,499	16 $3,021	31 $3,774	51 $6,998	154 $20,291
New Zealand	......	3 $615	9 $1,456	4 $515	10 $1,663	2 $300	28 $4,549
French Oceania	......	......	......	......	1 $150	......	1 $150
Philippine Islands	1 $300	5 $1,125	......	......	6 $1,934	2 $341	14 $3,700
British South Africa	......	2 $301	3 $465	3 $550	21 $4,726	20 $1,708	49 $7,750
Egypt	......	1 $250	......	......	1 $1,134	......	2 $1,384
French Africa	......	......	......	1 $462	1 $150	......	2 $612
Morocco	......	......	1 $109	......	......	......	1 $109
Totals	11,402 $1,728,596	3,843 $1,391,893	9,381 $1,402,334	20,672 $2,631,414	23,375 $2,817,921	35,831 $4,127,257	104,404 $14,099,415

Foreign Exchange and Trade Restrictions Modified

WASHINGTON, March 22—Restrictions placed on foreign trade affecting foreign exchange transactions and financial and commercial cables have been modified by the Federal Reserve Board. Dealers in foreign exchange can now transfer funds to persons who are not enemies or allies to enemies in Roumania, Serbia, Syria, Mesopotamia, Finland, Bulgaria, Turkey in Asia and in Europe and all the Black Sea ports.

Foreign exchange dealers in the future need not secure approval for issuing travelers' letters of credit in excess of $5000. Great Britain, Canada and France are acting coincidentally with the United States in the measures outlined. Until further notice the exportation or importation of Russian rubles for the transfer of funds for their purchase by persons or dealers in the United States is prohibited.

Spain Supervises Gasoline

WASHINGTON, March 24—The restrictions on the sale of gasoline and the substitutes, known as A. N. C. No. 2 and A. N. No. 1, manufactured by petroleum refiners in Spain, have been removed by a royal decree published Dec. 14, 1918, special permits being no longer required.

Gasoline and the substitutes mentioned will be sold at prices fixed or to be fixed by the Ministry of Supplies, which will dictate measures for the distribution of gasoline, the monthly quantities which may be put on sale by the refiners, and will exercise all necessary vigilance in regard to consumption, inspection and supplies to the different provinces.

A royal order published on the same date provides that petroleum refiners must submit to the Ministry of Supplies on the 1st and 15th of each month a statistical statement covering crude petroleum, gasoline and derivatives manufactured; that the refineries arrange their depots in all the provinces; that all merchants registered under the industrial tax may sell gasoline and the substitutes A. N. C. No. 2 and A. N. No. 1; that the sale of these substitutes is authorized by the refiners of petroleum, giving preference to public utilities, and that the maximum selling price at the factory be fixed.

The refiners are authorized to put on sale any quantities of A. N. C. No. 2 and A. N. No. 1 up to 1,000,000 liters.

Tin Importers Association Protests

NEW YORK, March 24—The Tin Importers Assn. has enlisted the cooperation of the National Association of Purchasing Agents to remove the restrictions on the sale and price of tin. The latter association has a membership of 1800 industrial purchasing agents, a large percentage of whom are direct buyers of tin. The basis of the complaint of the tin importers is that pig tin can be purchased abroad at 25 cents per pound cheaper than here.

Calendar

ENGINEERING

April 2—Minneapolis Section, S. A. E. — Hotel Radisson. "Implements Designed for Tractor Belt Power and Their Characteristics."

SHOWS

March 22-29—Pittsburgh Automobile Dealers' Assn. of Pittsburgh. John J. Bell, Manager.

March 24-29—Greenfield, Mass. Greenfield Automobile Dealers' Assn., State Armory. James J. Callahan (Pittsfield) Manager.

March 24-29—Utica, N. Y. Utica Motor Dealers' Assn.

March 25-29—Wilmington, Del. Fourth Annual, Wilmington Rink.

March 26-27 — Clinton, Ia. Fourth Annual Clinton County Automobile Dealers' Assn.

March 26-29—Watertown, N. Y. Tenth Annual, State Armory, Automobile Dealers, Inc. Arthur E. Sherwood, Manager.

March 27-29—Holdredge, Neb. Third Annual, Holdredge Automobile Dealers' Assn.

March 28-30—Peru, Ill. Illinois Valley Auto Show.

Last of March — Harlan, Ia. Southwestern Iowa Motor Exhibit.

March 29-April 5 — Passenger Cars. April 8-12—Trucks, Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I. C. Kirkman, Manager.

March 31-April 5—Cumberland, Md., Automobile Dealers Assn., Armory.

March 31-Apr. 5—New Orleans, La. Henry B. Marks, Manager.

April 1-5—Denver, Col.—Denver Automobile Trades Assn. Stadium.

April 3 — Macon, Ga. Motor Truck Demonstration, Macon Automobile Chamber of Commerce.

April 5-12 — Bridgeton, N. J. Fourth Annual, Automobile Dealers' Assn.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

April 8-12—Deadwood, S. D. Seventh Annual, Cars and Tractors, Deadwood Business Club.

April 16-19 — Waynesburg, Pa. Automobile Dealers' Assn. of Greene Co., Armory. Frank L. Hoover, Mgr.

April—Little Rock, Ark. Second Annual, Little Rock Automobile Dealers' Assn., Liberty Hall.

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.

November—London — Olympia—International Automobile Mfrs. Congress.

TRACTOR SHOWS

April 15—Walla Walla, Wash. Sectional Tractor Demonstrations.

May 5—Sacramento, Cal. Sectional Tractor Demonstrations, Demonstration Field.

June — Denver, Col. Sectional Tractor Demonstrations.

July—Wichita, Kan., Automotive Committee of National Implement Assn.

Aug.—Aberdeen, S. D. Sectional Tractor Demonstrations.

RACES

†May 17—Uniontown, Pa., probably 112½ miles.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 22-23—Elgin, Ill. Speedway.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Oct. 1—Cincinnati, O. Speedway race.

†Sanctioned.
*Tentative dates.

CONVENTIONS

April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

May 1-June 1 — Atlantic City, N. J.—Pan-American Aeronautic Convention and Exhibition — Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

New Dart Officers

WATERLOO, IA., March 24—C. C. Wolf was elected president of the Dart Truck & Tractor Corp. at its annual meeting. Other officers elected were vice-president and general manager, W. H. Johnson, formerly chief engineer; vice-president and sales director, M. D. Herron; secretary and treasurer, E. L. Stover. H. H. Henry, the retiring president, has accepted the vice-presidency of the Maxim Munitions Corp., the Atlantic seaboard and export distributers of the Dart line.

Wichita Motor Co. Officers Elected

WICHITA FALLS, TEX., March 24—At the annual meeting of the stockholders and directors of the Wichita Falls Motor Co., J. A. Kemp, who has been president of the company since its organization, was elected chairman of the board of directors. J. G. Culbertson, who has been secretary, treasurer and general manager, was elected president and re-elected treasurer. A. G. Savelli was re-elected vice-president in charge of export and G. S. Brenemann, secretary. Two new buildings have recently been completed.

Youngstown Tube Re-elects Directors

YOUNGSTOWN, OHIO, March 24—All directors of the Youngstown Sheet & Tube Co. were re-elected. The annual report showed total earnings of $25,925,118 and net products profit of $14,589,488 after charges of depreciation, adjustment of inventories and in cost of construction for war purposes. The net surplus profits after dividends was $10,194,767. During the year the company paid $22,157,000 in wages against $16,396,000 in 1917, while sales decreased $5,000,000 from the previous year because of reduced tonnage and government price control. The company has inaugurated a plan of co-operation of employees in the settlement of labor differences.

American Bronze Corp. Elects New Officers

BERWYN, PA., March 24—At the annual meeting of the Board of Directors of the American Bronze Corp. the following officers were elected: President, Harry Porter; vice-president, general manager and treasurer, Mathew Dittmann; secretary and sales manager, Edward Anderson.

Northway Motors Starts Production

NATICK, MASS., March 24—The Northway Motors Corp. has the first series of its buildings completed and the machinery installed. They are one-story structures. Foundations for other buildings have been commenced.

Work has been begun on trucks and cars. The machines will have four-cylinder engines. The company has floated a $1,000,000 stock issue to begin business.

Denby Buys Wolverine Brass Plant

CHATHAM, ONT., March 24—The Denby Motor Truck Co. has purchased the factory of the Wolverine Brass Co.

Carlisle Cord Tires on Peace Basis

NEW YORK, March 21—At the annual meeting of the Carlisle Cord Tire Co., the following officers were elected for the year: President, J. S. Bretz; vice-president, C. A. Gilbert; treasurer, Lewis H. Homer; secretary, F. R. Serles; assistant secretary and treasurer, C. V. Tuthill.

Since the company has been relieved from war contracts its factory has been working continuously to make up on production.

Hayton Co. Takes Over Killen-Strait Tractor Plant

APPLETON, March 22—The plant of the defunct Killen-Strait Tractor Co., recently sold at receiver's auction, has been taken over by the Hayton Pump & Blower Co., incorporated, with a capital stock of $50,000, to manufacture centrifugal pumps, blower systems, etc. T. R. Hayton is president and general manager. E. D. Rasmussen, for twenty years connected with the pumping engine department of Allis-Chalmers Mfg. Co., Milwaukee, is secretary and general superintendent.

Miller Rubber Officers

AKRON, March 22—The new officers of the Miller Rubber & Tire Co. elected for the year, are: President, Jacob Pfeiffer; secretary and treasurer, W. F. Pfeiffer. J. M. Doran, C. T. Grant and F. B. Theiss, together with the officers, form the board of directors.

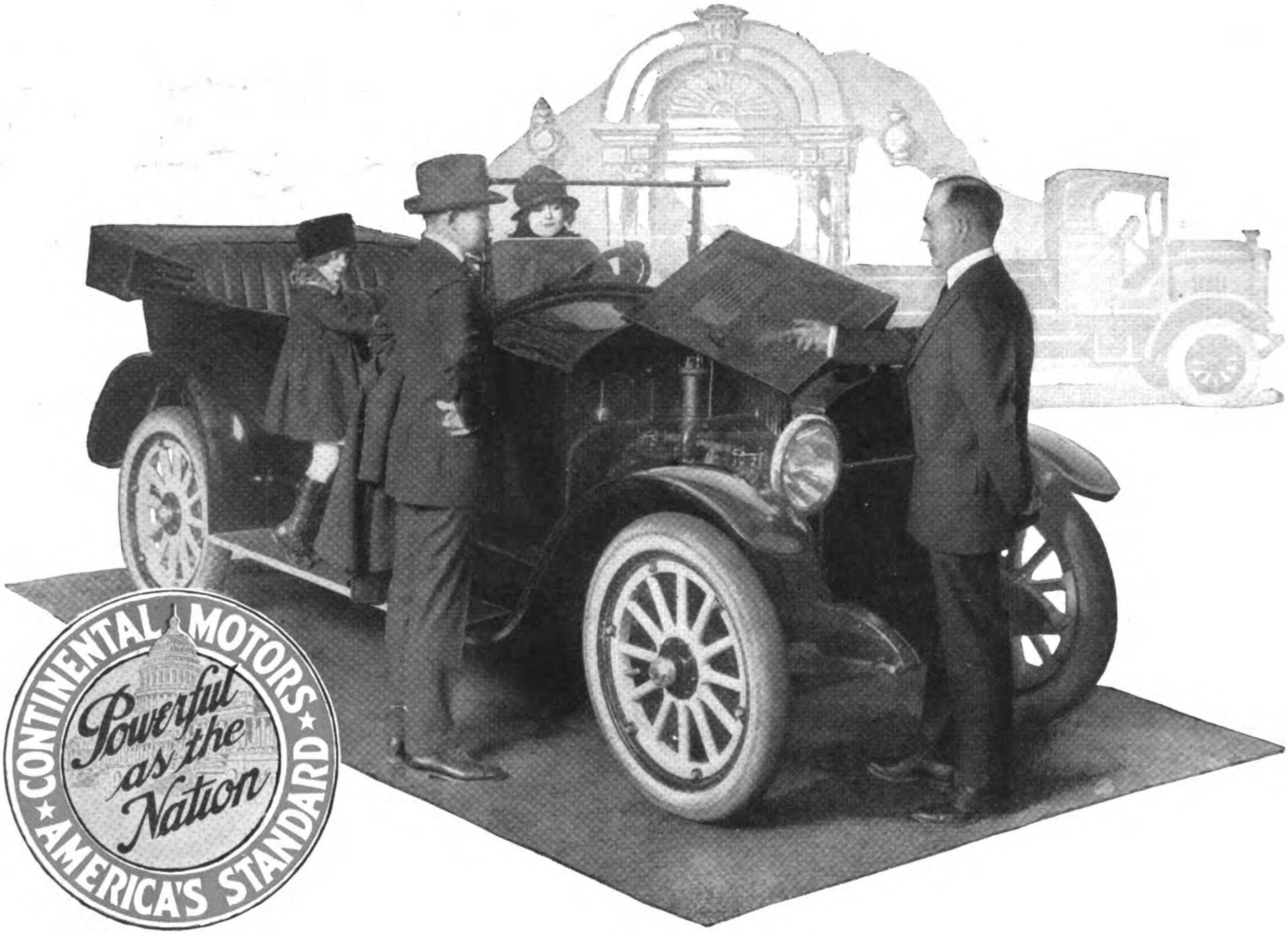
AUTOMOTIVE INDUSTRIES

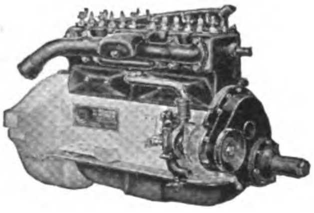
The AUTOMOBILE

Vol. XL
Number 14

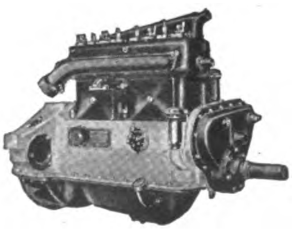
PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, APRIL 3, 1919

Fifteen cents a copy
Three dollars a year





America's Standard Passenger Car Motor. Look for the Red Seal Nameplate.



America's Standard Truck Motor. Look for the Red Seal Nameplate.

His Strongest Selling Point is the Red Seal Continental Motor

The argument that most often clinches the sale of an automobile or truck is the Red Seal Continental Motor.

For there is hardly a man who is not familiar with the record of *past performance*—the infallible test of motor worth—which has distinguished this motor for well over a decade.

On hundreds of thousands of automobiles and trucks, under every conceivable condition of service, the Red Seal Continental Motor has *proved* its 100% dependability. In the supertasks of war, in the vigorous tasks of peace, it has stood the test of service.

Today upwards of 15,000 dealers have signified their belief in the Red Seal Continental Motor by entrusting their business prosperity to Continental-equipped cars. And their choice is the Continental because of its proved record for power, for speed, for economy, for reliability.

Today more than 160 successful manufacturers of automobiles and trucks equip their output with Red Seal Continental Motors. The judgment of these manufacturers is vindicated by tens of thousands of owners who will have no other motor.

Look for the Red Seal on the motor in the car or truck you buy—and *be sure.*

Continental Motors Corporation

Offices: Detroit, Michigan **Factories:** Detroit—Muskegon

Largest Exclusive Motor Manufacturers in the World

Continental Motors

STANDARD POWER FOR TRUCKS, AUTOMOBILES AND TRACTORS

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, APRIL 3, 1919—CHICAGO NO. 14

America Influences Europe's New Cars

Left-Hand Steering Is Here—Two-Unit Electric Units Popular—Vacuum Fuel Feed Adopted—Many Double Rear Wheel Brakes—Quieter Colors—New Berliet, Peugeot, Fiats and Others at Lyons Trade Fair

By W. F. Bradley*

LYONS, FRANCE, March 10—The trade fair which is being held here unites 4700 exhibitors with $4,000,000 worth of goods, and has become so big that it has been decided to split it into two parts, one to be held in the spring and the other in the fall. The automobile section, which has its own special building in the fair, will be included in the spring meeting.

The automobile section this year is just sufficiently big and important to give an indication of what is going to happen in France during the next 6 months. An interval of rather less than 4 months has elapsed since the signing of the armistice, this being too short a time to allow more than a few makers to get out new models. But while the majority of the cars are pre-war types, with the addition of electric lighting and starting, there is quite enough revealed or announced to allow an accurate summary to be formed of coming activities.

*Editor's Note—Mr. Bradley attended the Lyons Fair for the exclusive service of the Class Journal Company. Previous to the opening of the show he visited many of the French factories.

Entirely new cars have been built by Delage, Berliet, Fiat, A.S.S., Peugeot, Rochet-Schneider, Citroen and Sigma. All the others are intermediate models.

European Ford Wanted

While the number of entirely new cars on exhibition is small, plenty of information was available at Lyons regarding the immediate program of automobile concerns and on the general tendency of design. There is undoubtedly a great demand in France for what may be termed a European Ford; this is a car as near as possible to the Ford price, carrying four passengers comfortably, but having a better appearance and a lower gas consumption than the Ford. Up to the present there is no such car on the market, nor clearly in view.

The tendency has been toward a very small, light car, of the Citroen type, which is very satisfactory as a two-seater, but not so suitable with a four-seater body. It looks as if the new Peugeot will get very near this class, for one of the Peugeot factories will be given over en-

The new four-cylinder, four-passenger Peugeot which has been designed for quantity production. It has a unit power plant, is equipped with electric lighting and starting system and is driven from the right side

tirely to the production of this car, and it is evident that the design has been worked out with a view to low production costs.

France's Assembled Car

A group of ten French automobile manufacturers has been formed to build a joint cheap car. Each factory will build the component for which it is best equipped; a special erecting shop will be established, and the car will be marketed to the benefit of the ten firms concerned. At present it has not been decided what price this car will be sold for, nor what its main characteristics will be. In all probability it will not get as low as the Ford price in America, but it should be possible to sell it at an unheard of price for France. French manufacturers as a whole are not disposed to get down to the grade of production of the cheaper American cars.

Progress in Production

Simplified methods of construction and labor saving devices are coming along fast, but the idea of the rough finish which is associated with all the cheap American lines is distasteful to the French maker. Present prices must not be taken as a criterion, for raw material is still high and even scarce. A very big drop is expected within one year.

Very few factories are going to build a single model. Quite a number, however, will be satisfied with two types, while it is generally accepted that there is no need for any firm to build more than four models.

Peugeot's Quadrilette

In addition to its 10-hp. light car, Peugeot will put on the market a 12-hp. medium, four-cylinder, five-passenger type and a high-class, six-cylinder, valveless seven-passenger car.

An entirely new venture is what is known as a quadrilette, this being a machine intended to take the place of the motorcycle and side-car. It will have a four-cylinder engine and worm drive.

Renault's Fall Model

Next October Renault will put out an entirely new model four-cylinder car of 2.9 by 4.7-in. bore and stroke, with three-speed gear-set, left-hand steering, detachable wood wheels, with tires of 760 by 90 mm., electric lighting and starting. The price of this chassis will be $1,350 complete with everything except lamps.

New Renault Factory

Renault has the biggest automobile factory in France, and the second biggest in Europe, his regular staff being 25,000 workpeople. Recently he has laid plans for the erection of a new factory at Le Mans, 150 miles southwest of Paris, where 5000 workpeople will be employed. Here he will build trucks, agricultural tractors, trailers and some railroad material. A large number of houses are being erected for the workpeople and a big hotel for the unmarried men. There will be three clubs, baths, swimming pool, infants' school, nursery, a medical hall, a theater, picture hall and music kiosk.

Gnome Builds Cars

The Gnome and Rhone aviation motor company has entered the automobile field and will build Piccard-Pictet cars under license in their two factories near Paris. The models to be produced are a 10-hp. and a 14-hp., four cylinders, as well as a 28-hp. eight cylinders. All three models are to be equipped with electric lighting and starting, mechanical tire pump, speed indicator and accessories. It is understood that the size of the eight-cylinder car will be 85 by 130-mm. bore and stroke, and that this model will be fitted with front-wheel brakes. At the Lyons Fair the Piccard-Pictet Company exhibited the Argyll type of single-sleeve-valve engine.

Dietrich Six and Twelve

Lorraine-Dietrich, who has specialized on aviation motors during the war, will produce two six-cylinder cars and one twelve, all being high-class jobs.

General European Trends

THE general tendency of European construction is now very clearly defined. The four cylinder engine is holding its own, but for high-class jobs the six will predominate. Eights will come next in line, with twelves last on the list. Up to the present only one eight has been produced commercially in France, this being the original De Dion Bouton. In addition to the Gnome eight, it is very probable that an eight-cylinder engine will be brought out by Darracq.

Fiat Uses Detachable Heads

Detachable cylinder heads are making their appearance slowly, but will certainly become more popular during the next 12 months. Fiat has been the first to make a

decided move in this direction, by adopting detachable heads for all models, from the cheapest to the most costly. As Fiat has always been very proud of the cleanness of its design and has never made a mechanical change without long preliminary tests, it is certain that this example will be followed.

Battery Ignition Appears

The tendency to drop the magneto and rely on the batteries for ignition is being manifested very slowly. Engineers, particularly those who have an eye to low cost of production, are convinced of its soundness, but the sales organizations are rather afraid of offending the public, which has been educated to believe that the only reliable ignition is by means of high-tension magneto. Nevertheless, some high-class cars to be shown at the Paris Salon next October will be minus a magneto.

L-Head Engine Continues

The L-head type of engine holds its own without any difficulty. Engineers have given attention to the overhead-valve type, but where in favor state that it will not be brought out for 2 years yet.

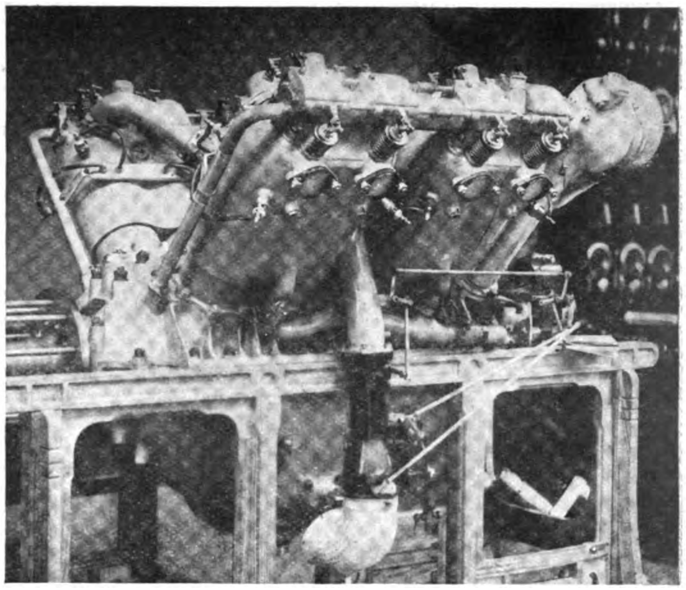
The most popular method of driving the pump and the magneto is by means of a transverse shaft. This is found on all the Fiats, on the new Delage, on the new Cottin-Desgouttes, on the Renault (in this case, of course, there is no pump). The position tends to complete accessibility by putting the business ends of these two organs outwards, where they can be readily reached.

There is nothing to indicate that thermo-syphon is ousting the pump. Where the engine has less than 3-in. bore natural water circulation is in a slight majority, but above this size the water pump is nearly always used, the only important exception being Renault, who refuses to fit a pump whatever the size of the engine or whatever the work it has to perform. The reasons for this are of a personal and not of an engineering nature.

Front Radiators Gain

The practice of placing the radiator back of the engine has lost ground. Th. Schneider and Charron, who before the war had radiators at the rear, have dropped this position for the more conventional one in front. Renault is now practically alone in this style of construction.

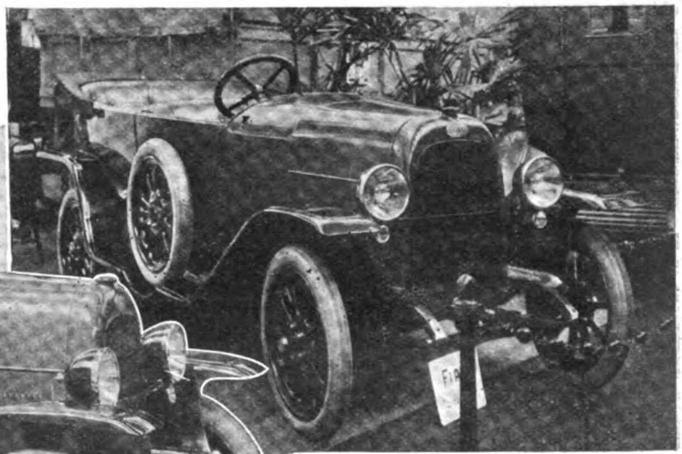
On the new Cottin-Desgouttes engine the transverse shaft drives not only the magneto and water pump at each end, but the fan and a two-cylinder tire pump. This is one of the few cars fitted with a power inflator.

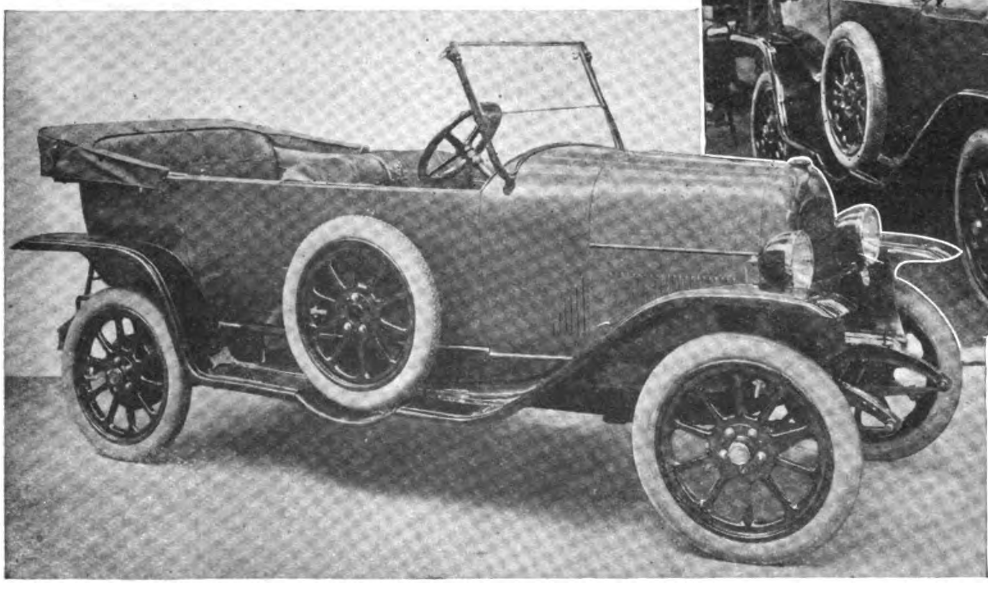


Carbureter side of the eight-cylinder Lorraine-Dietrich aviation engine, showing the overhead valve mechanism

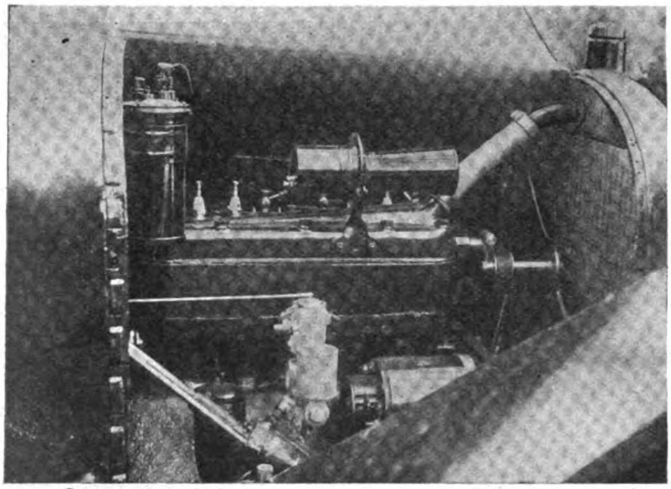
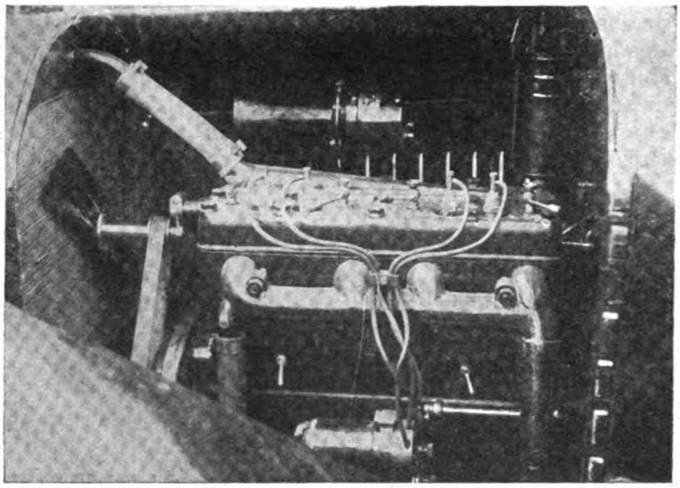
Vacuum Fuel Feed

The tendency everywhere is to bolt carbureters direct up to the cylinder casting on the side opposite to the valves and to feed gasoline to the carbureter by the vacuum system. The pressure system has practically gone out of existence, while gravity feed is only being used for small cars where a tank on the dashboard is not of sufficient size to cause any inconvenience. Makers of high-class cars have had two years' experience with the vacuum system, and in their opinion it is most satisfactory, provided the apparatus is individually tested for the car to which it is fitted. They find that as received from the manufacturers the outlet from these appliances vary considerably, and it is necessary to





These are the two new Fiat models, the one at the left being the 12-16-hp. model and the one above the 10-hp. model

Both sides of the new Berliet four-cylinder engine, which in many respects closely follows accepted methods of American design and construction, notably in the use of detachable cylinder head and the mounting of accessories

test them for individual cars to get really satisfactory results.

Forced-feed lubrication with a drilled crankshaft, oil being supplied under pressure to the main bearings, the camshaft bearings and to the connecting-rod ends, other parts being fed by the overflow, is the system most extensively employed. More attention has been paid to the ready removal of filters and pumps, and with this object in view many makers who formerly placed the pump on the end of the camshaft now locate it in the base chamber. As the tendency is to get away from a mud pan, and to fill in the space between the crankcase and the frame members, this adds further to accessibility. Several makers carry a supplementary oil tank in the engine or in the chassis. Hispano-Suiza has done this for a considerable length of time. Cottin-Desgouttes has a 1-gal. supplementary oil tank cast on the side of the crank chamber, and communicating with the base by means of a passage and screw-down needle valve. Chenard-Walcker and La Buire both provide systems of renewing the oil supply without pouring direct into the base chamber.

Unit Powerplant Gains

Unit construction of engine and gearbox is being adopted by practically everybody. Very few makers indeed are casting cylinders and crankcase together; in some cases the reason for not doing this has been the difficulty of getting good castings. The cylinders are thus mounted on an aluminum base chamber, and to this latter is attached the clutch and gearbox housing.

There is no uniformity in the method of attaching this unit to the frame. Some have a four-point attachment for the engine, which therefore tends to stiffen the frame at the front. Others bolt to the side members and to a forward cross member, while a certain number have a true three-point suspension, with rigid attachment to the frame and trunnion attachment to the front cross member.

On the lighter chassis the tendency is to have only three cross-frame members; one at the rear, one at the front, and another at the forward point of attachment of the rear springs.

The only really high-class job which departs from unit construction is the Rochet-Schneider. Here the engine is on a subframe and the gearbox carried on two cross members in the center of the chassis. While the details are well carried out, the feature of this design is quite contrary to the general tendency.

Left-hand steering, with center control, is coming along. Renault is going to adopt it for his new popular model. Citroen has already adopted it. The real objection now is that left-hand steering will not be accepted by English buyers, and as there is little possibility of convincing the English nation of the advisability of changing its singular rule of the road to that of the rest of the world, French firms who count on selling cars in England keep to right-hand steering so as not to have two different types.

Spiral Bevel Strong

The change from bevel and worm to spiral bevel gears is really remarkable in its unanimity. This type of gear is already used, or going to be used, by Fiat, Renault, Panhard, Delage, Darracq, Hotchkiss, Unic, Berliet.

There is a tendency to use lower final gear ratios than was the case four years ago. Thus 4 or 4¼ to 1 is common where 3½ to 1 was formerly used. In some of the very small, light, speed engines, for which a big final gear ratio is necessary, worm drive has been adopted The small Peugeot is an example of this. Another firm which has a very small engine, turning at 3000 r.p.m., maximum, has also adopted worm because of the low reduction required. These seem to be the only cases in which worm is made use of in France.

Many Cantilever Springs

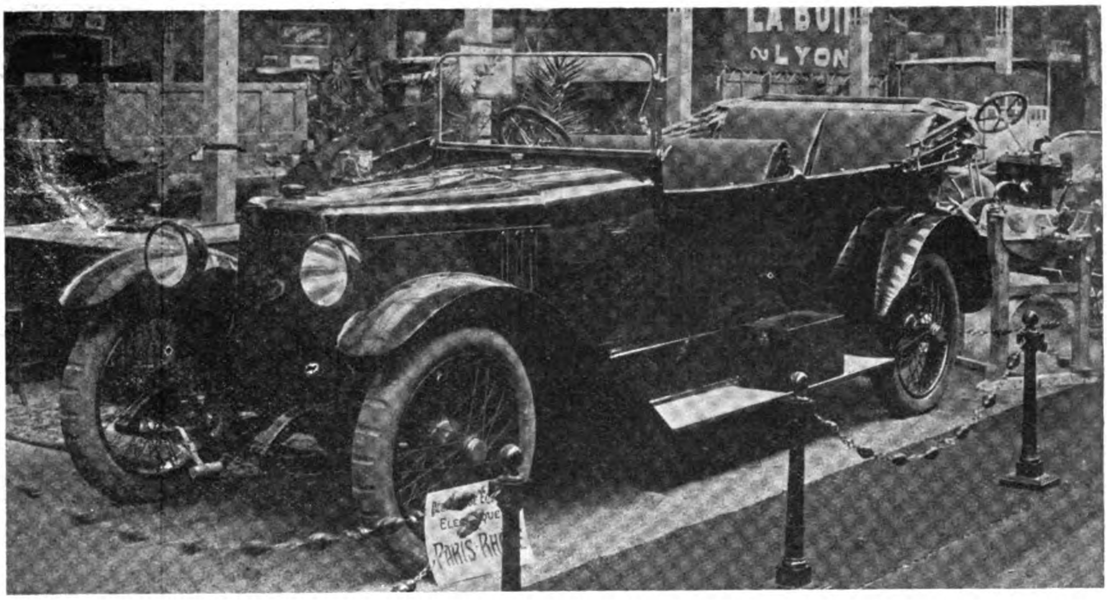
There is an equal unanimity in the use of cantilever rear springs, which have been adopted by Berliet, Rochet-Schneider, Renault, Unic, Peugeot, Zebre, to mention only a few.

More Rear Wheel Brakes

In more cases than ever brakes are all on the rear wheels. Experiments have been made with brakes on an extension of the propeller shaft, back of the differential, but these have not been followed up.

Peugeot adopted this type of brake on an intermediate type of car, but has dropped it on the latest model in favor of two pairs of shoes inside a single drum, each shoe covering practically a quarter of the circumference of the drum. This has been adopted in order to avoid the use of side-by-side brakes, and in working out the details the smallest amount of space has been lost by the brake pins and operating cams. With this Peugeot system practically the entire circumference of the drum is used as a braking surface.

The great majority of makers are satisfied to place



In the newest type of Rochet-Schneider the radiator is placed in front of the engine instead of behind it, and the body is fitted with upholstery which is completely detachable

the two brakes side by side. There are no external contracting brakes. Brakes on the front wheels promise to come along in increasing numbers for high-class cars only. Delage has set the fashion in this respect, and others who seemed inclined to follow are Hispano-Suiza and the Gnome Company with the Piccard-Pictet type car. Delage has exceptionally large braking surfaces, the size of his drums being 15.7 in. in diameter and 2.3 in. in width. In addition to the four brakes of this size on the wheels there is a hand brake on the transmission.

Sober Color Schemes

It is probably owing to the war that there is quite a sober tendency in color schemes. Dark blues, grays and blacks predominate; very few cars, indeed, are seen with gaudy color schemes.

The only novelty in bodies shown so far is the use of detachable upholstery. The back cushion, instead of being fixed in, is made detachable, just the same as the seat. This applies also to the side arm rests.

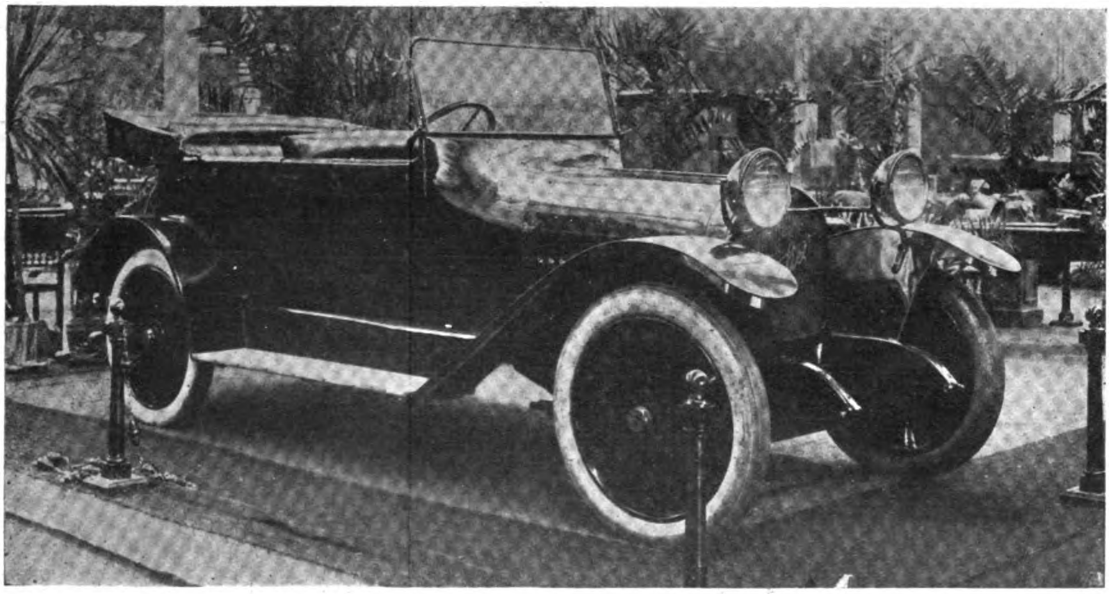
Where right-hand steering is retained the levers are always inside the body. It has not always been an easy matter to get them in, and on the new Brasier the brake lever is carried up much higher than the change-speed lever, and the handle placed at hight angles to the body of the lever.

Polished aluminum dashboards are being rather extensively used for high-class cars, with a polished-wood board for carrying the instruments only.

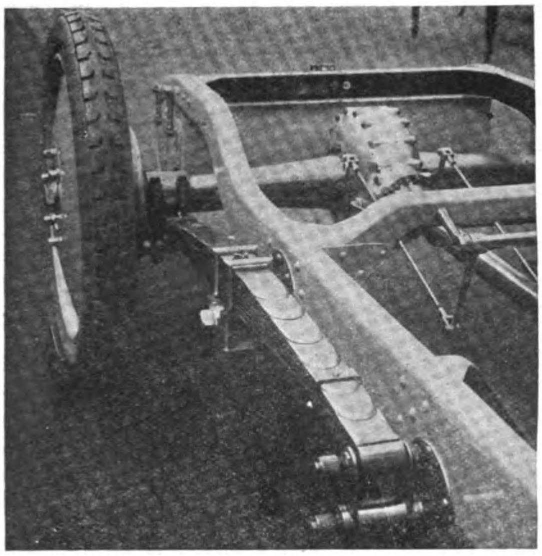
Two-Unit Electric Sets

Two-unit sets predominate for lighting and starting. So far as can be ascertained, the single unit is only employed by Berliet and Cotton-Desgouttes. There is no great amount of uniformity in the placing of the electric generator. Where the pump and magneto are driven from a cross shaft, the generator is generally put fore-and-aft on the valve side, as is the case with Delage and Fiat.

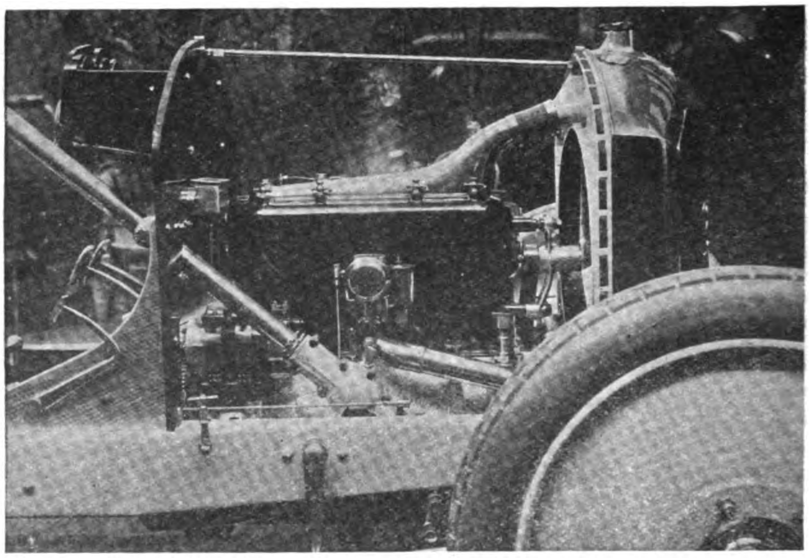
The only big firm building its own electric equipment appears to be Fiat. The others apply to specialists, of whom there are now a large number in France. One of the biggest companies is the S. E. V., of which Renault is a big stockholder. This company took over the small Bosch factory, abandoned in 1914, and in it built the Bosch-type magneto. The works have grown enormously since 1914, and now produce all kinds of electrical material for automobile use. Other big producers of elec-



The Berliet, which is produced by one of the most important manufacturers in the Lyons district, has been designed to approximate very closely the appearance of the average American car. It is equipped with a four-cylinder engine, North-East lighting-starting system and has disc wheels with detachable rims



Rear cantilever springs on the Rochet-Schneider



Carbureter side of the Rochet-Schneider four-cylinder engine

trical equipments are Bleriot, Grouvelle & Arquembourg, Nilmelior, and Lavalette.

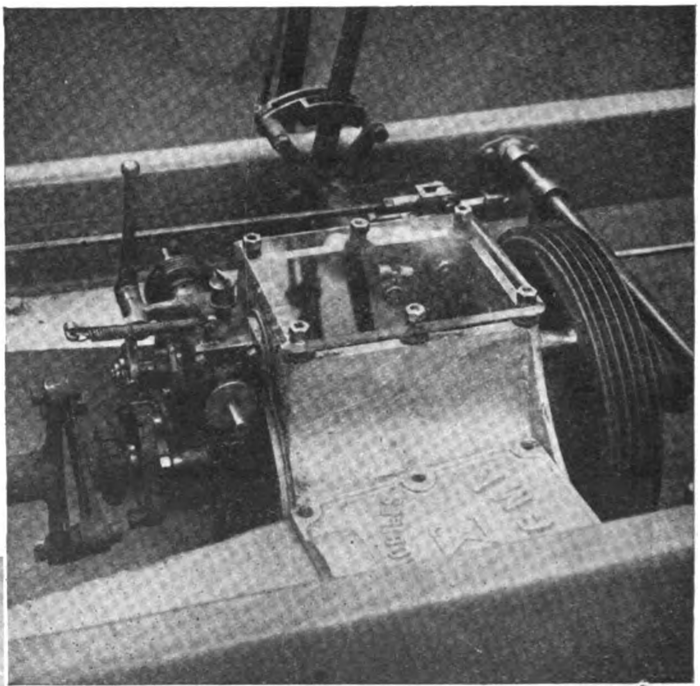
Michelin is making a great effort to popularize steel disk wheels for use on passenger cars. It looks as if these will become popular, for they have the advantage of elegance, easy cleaning, and great strength. The only point that can be brought against them is that they are a little heavier than wood. The two biggest makers, Fiat and Renault, are not adopting Michelin wheels. The former will make use of Sankey type steel-spoke wheels, while the latter is using his own type of detachable wood wheel. There is no doubt, however, that wood is losing ground rapidly, even for touring cars.

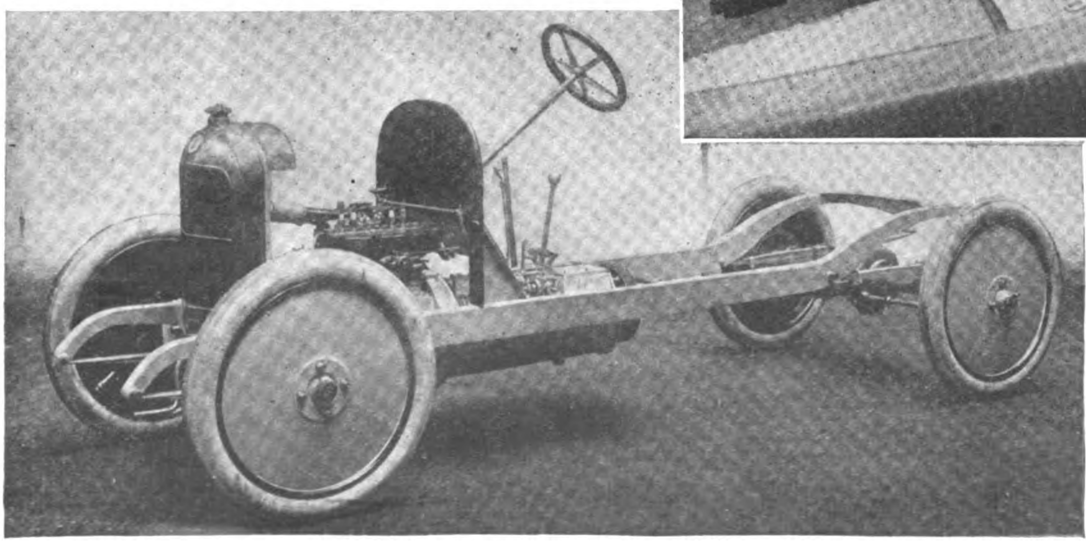
Berliet Brings Out New Car

Berliet, who is the most important automobile manufacturer in the Lyons district, with a factory employing 10,000 workpeople, has come out with a new five-passenger car entirely on American lines. The engine is a four-cylinder, 3.5 x 5.5-in. bore and stroke, with detachable head, North-East electric generator and starter, a Berliet carbureter and a French magneto. It has cone clutch, three-speed gearset with center control, left-hand steering, spiral bevel gears with Timken bearings in the rear axle, and is sold complete with all accessories, including an American horn and speedometer.

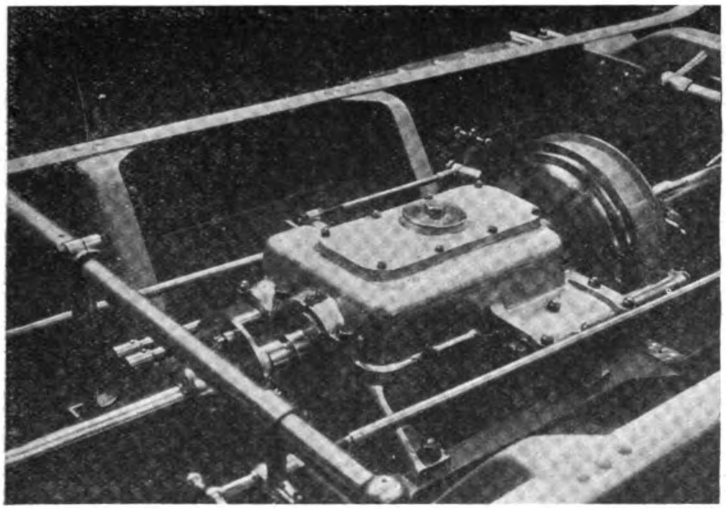
Where it departs from American practice is in the use of cantilever springs at the rear and steel disk wheels with detachable clincher rims.

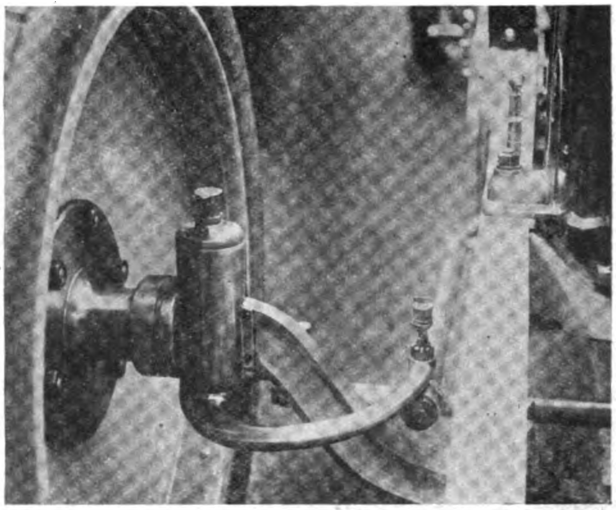
The finish is all black, and with the exception of the name on the radiator, the car looks like an American production. It is being sold complete at $2,350. According to a statement made at the Berliet factory, this will be the big production job of the works; in addition, a high-class car will be marketed.





Left—Chassis of the Sigma light car, which is equipped with Michelin disc wheels. Above—Gearbox of the Sigma, showing location of the tire pump


Centrally located gearset in the Rochet-Schneider


Application of dust covers to the steering pivots on the Rochet-Schneider

Berliet has capacity for production on a big scale. The original factory has been considerably enlarged during the war, but in addition to this an entirely new factory has been erected a few miles from Lyons, where the whole staff of 10,000 workpeople could be employed. The works are up to date and fitted with the most modern machinery. For the last 2 years Berliet has kept an engineer constantly in America for the purpose of buying machinery. In addition to this M. Berliet has himself made numerous visits to America so as to keep himself thoroughly acquainted with the latest production methods.

The factory is run entirely by electricity generated from water power in the French Alps and delivered at a very low price at Lyons. All iron, steel, aluminum and bronze are cast in the factory buildings, and the company makes its own forgings. During the war Berliet produced twenty-five trucks a day, in addition to 250 tanks of the Renault type every month, also shells and machine guns.

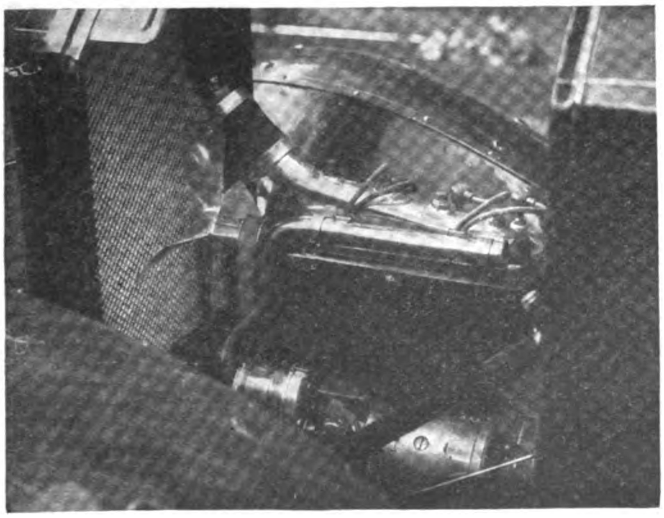
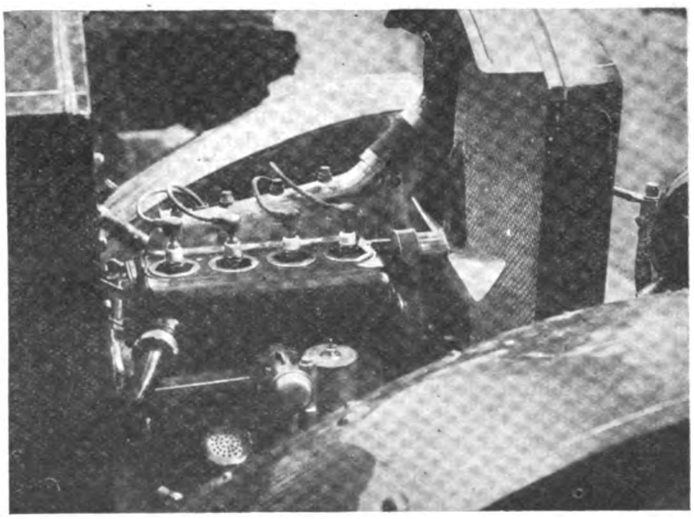
New Small-Size Peugeot

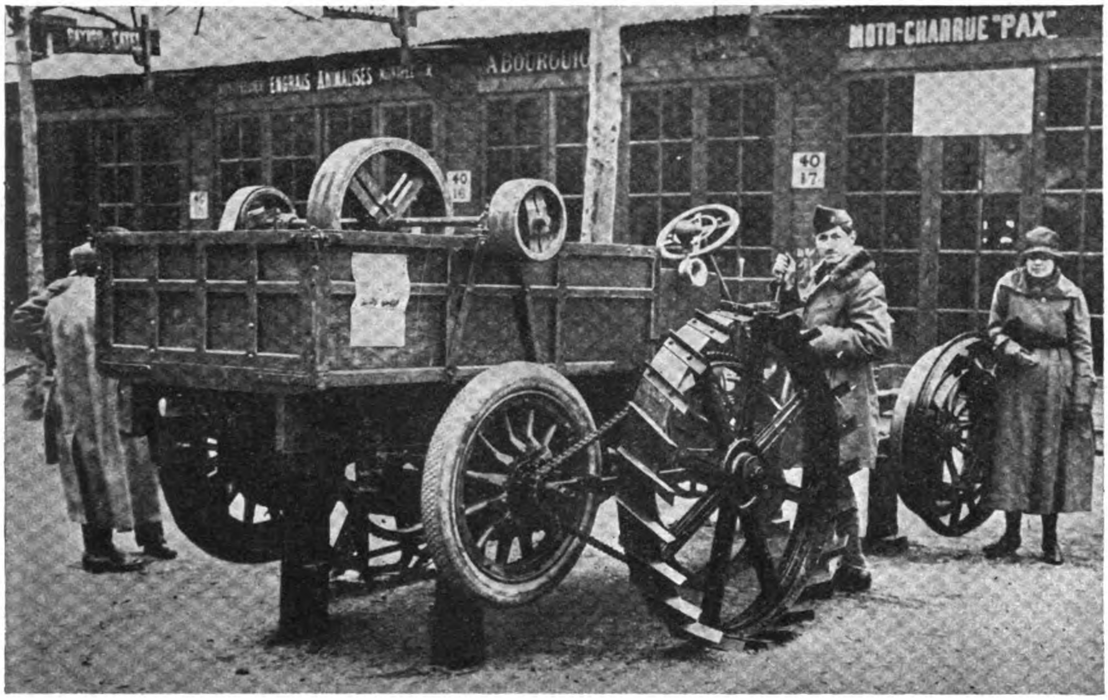
PEUGEOT has one of its new models ready, this being a light four-cylinder, four-passenger, evidently designed for cheap production. The selling price was not announced at the show. The engine has its cylinders, 66 by 105 mm., cast with the upper half of the crankchamber, and the crankshaft is carried in two ball bearings. Valves are on one side, with a single cap for each pair. The carbureter, a Zenith horizontal, is bolted up direct on the valve side, and exhaust manifold is cast with the cylinders. A single chain, placed at the rear, drives the camshaft and the magneto and electric generator shaft, and provision is provided for taking up slack by means of an idler pinion mounted eccentrically, with a lever on the outside of the casing for moving it and locking it in position. The electric generator is just ahead of the timing gear housing, and the magneto on the same shaft as the generator. The electric starting motor is placed down on the right-hand side of the engine.

This engine forms a unit construction with the clutch and gearset, the former being disk type and the latter giving four speeds and reverse, with center control. Steering is on the left side, and is of worm-and-nut type.

Engine cooling is by thermo-syphon, with the fan driven by belt off the crankshaft.

It is not known whether the French S.E.V. lighting set or the American Bijur will be used. Peugeot has adopted final drive by means of underneath worm, the final gear ratio being 4.6 to 1, with which the car has a speed of 36 m.p.h. Cantilever suspension is fitted at the rear with semi-elliptic in front.



Both sides of the new Peugeot four-cylinder engine, which has a ball-bearing crankshaft. Note the mounting and arrangement of the magneto and starting motor and the location of the carbureter



A French method of converting a touring car or light truck into a farm tractor. This is the Paz

Wheels are wood detachable with 710 by 90 mm. tires. Weight of this car, with four-passenger body, top, wind screen and all accessories, is 1670 lb. Gas consumption is stated to be 24 to 25 miles to the American gallon. Peugeot will market this car with six standard color schemes. Tread is 47 in., wheelbase 98 in. and body space 86 in. in length.

Peugeot Has Ten Factories

Peugeot will also get into big production at an early date. This company is now running ten distinct factories. At Beaulieu it has two factories for bicycles, motorcycles and light cars; at Mandeure it will build bodies only; passenger cars will be built at the Audincourt factory; at Sochaux two factories will be devoted to trucks, agricultural tractors, and steel, iron, bronze and aluminum castings; all the forges are at Montbeliard; at Lille there is a special factory equipped for bolts and nuts and general turning; at Issy-les-Moulineaux, near Paris, the company will produce aviation engines and spare parts; and at Levallois-Perret, near Paris, there will be the central repair establishment and storerooms for spare parts.

Peugeot has followed American construction methods very closely, and quite recently has commissioned Engineer Oliveau to remain permanently in America in order to keep the factory abreast of developments there. During the war Engineer Oliveau was chief technical instructor, detached from the French Army, at the American Motor Transport School No. 1, at Decizes. Previous to that he was engineer with Delahaye.

FIAT'S first post-war model to be offered to the public is a high-class, light car with four-cylinder engine, 65 by 110 mm., developing 23 hp. at its maximum speed of 2800 r.p .m. This is a type of car which it is believed will meet European conditions, where cost of maintenance has to be closely considered. So much more attention has been paid to workmanship and detail finish on the Fiat that it is interesting to know how it will compare in the matter of price with its French rivals. Up to the present Fiat has not made any announcement on price, stating that this cannot be settled until import duties are known.

Technically the Fiat engineers have made several changes.

The use of detachable cylinder heads is new.

Electric generator and starting motor are both cylindrical and carried in cylindrical extensions of the crankcase.

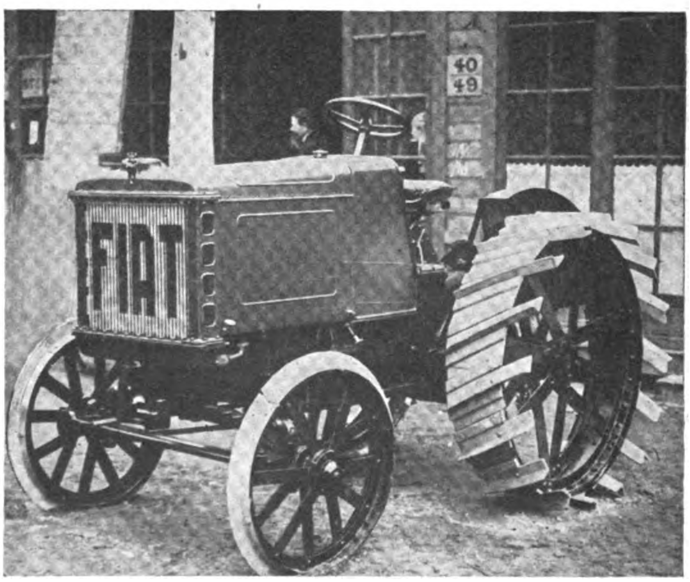
The engine and gearbox form a unit with three-point attachment to the frame, and the housing which carries the clutch and gears also acts as an oil reservoir for the universal.

The rear axle and propeller shaft housing is composed of two steel stampings welded together in a horizontal plane, with a cover plate on the rear of the differential housing, allowing the whole differential and propeller shaft to be withdrawn.

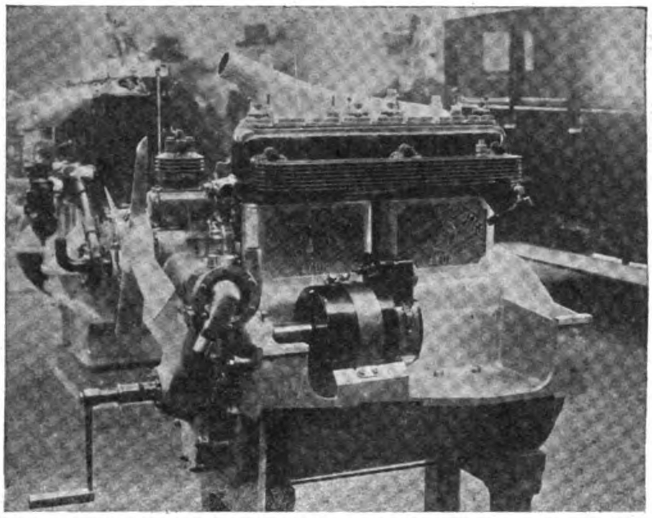
Spiral bevel gears are used.

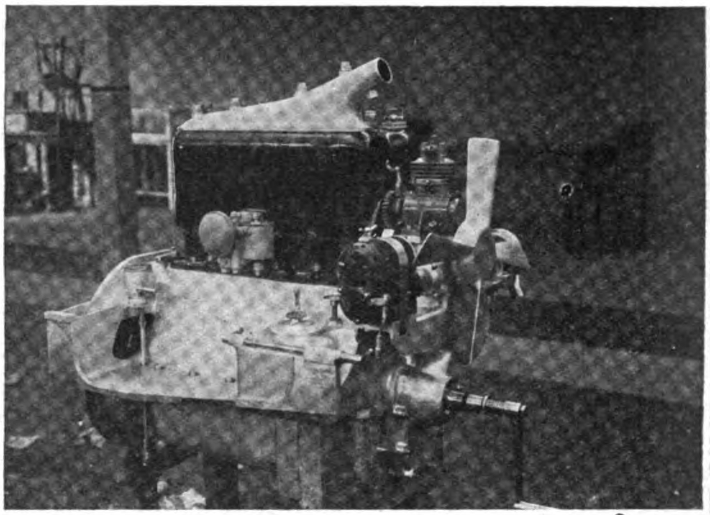
Two sets of brakes are side by side on the rear wheels, which are detachable steel spoke type.

Pressure fed gasoline has given way to a dashboard



The Fiat agricultural tractor appeared for the first time in France at the Lyons Fair





Both sides of the Cottin-Desgouttes four-cylinder engine. A characteristic is the use of a transverse shaft at the front to drive the water pump, magneto, fan and tire pump

tank. Right-hand steering is maintained, but the change speed and brake levers are inside the body.

Fiat has easily the biggest automobile factory in Europe, with a staff of 40,000 workpeople on the payroll, and a total of 70,000 people dependent on the factory. During the war the factory was producing 100 trucks and passenger cars a day, in addition to aviation motors, guns and special military material. Very close attention has been paid to export business, and production methods have been closely studied. At the present time Fiat has in America a commission composed of one of its chief engineers and five heads of departments. Fiat's program is two fours and two sixes, and although these are going to be high-class jobs, the factory is of such a size that it must produce on a big scale.

CITROEN, as reported in AUTOMOTIVE INDUSTRIES last week, who during the war was one of the biggest shell producers in France, is also putting on the market a light four-cylinder two or four-seater, with an engine of 65 by 110-mm. bore and stroke. The feature of this is the suspension, which consists of an inverted quarter elliptic spring above and one below the axle, these springs taking the drive and the torque. Other builders of light cars, these being two-seaters only, are Sigma and Philos.

France's Cheapest Car

THE cheapest car in the show, and in fact the lowest-priced car ever offered in France, is the A.S.S., offered complete for $950, with four-passenger body, electric lighting and starting, detachable steel disk wheels and all accessories. On this price it is declared that a reduction of $20 will be made if orders for 1000 cars are received before the end of March, and a further reduction if 10,000 are ordered before the end of the year.

The company responsible for this car constructed airplanes during the whole of the war, and is now transforming the airplane factory into an automobile establishment. Nothing more than a sheet metal body with four detachable seats was on view, it being declared that the complete chassis would be ready before the closing of the Fair. While there was a reluctance to give many technical details, it was learned that the engine will be a two-cylinder, two-cycle, of 75 by 120 mm. (2.9 by 4.7 in.).

A two-speed epicyclic gear is used and Ford-type steering. Springs are semi-elliptic in front and cantilever at the rear. A very extensive use is made of pressed steel, for not only the frame members but the two axles are of this construction. Interchangeable steel disk wheels are used with detachable clincher rims and tires of 765 by 105. Wheelbase is 112 in. and tread 56 in. Total weight is 1300 lb., and maximum speed 42 m.p.h., with a declared gasoline consumption of 25 miles to the American gallon. The lighting and starting systems are produced by the maker of the car; the lighting set comprises two headlights with dimmers.

The price of this car is attracting much attention. A two-cycle engine is not looked upon with a great amount of favor, and, as the firm has no past history of importance, it is difficult to judge whether the venture will be a success or not.

Delage has stepped right out of the small and medium-priced car into the exclusive type, with a six-cylinder, 3.1 by 5.9-in. bore and stroke, carrying all modern refinements and fitted with brakes on all four wheels. This is a high-class job and is listed at $5,700, chassis complete, with five wire wheels and tires, lighting and starting set.

Exhibition of Trucks

IN the truck section of the Lyons Fair not much new material was shown. Renault put on exhibition a 7-ton truck which had been produced to carry tanks. During the war it was desired to carry tanks up to the line aboard trucks, but as it is very rarely that a load of more than 5 tons is carried on one vehicle in France, the only means of moving the tanks was by means of heavy steamers. Renault therefore decided to build a special gasoline truck which would carry a tank, the total load of which is 6½ tons.

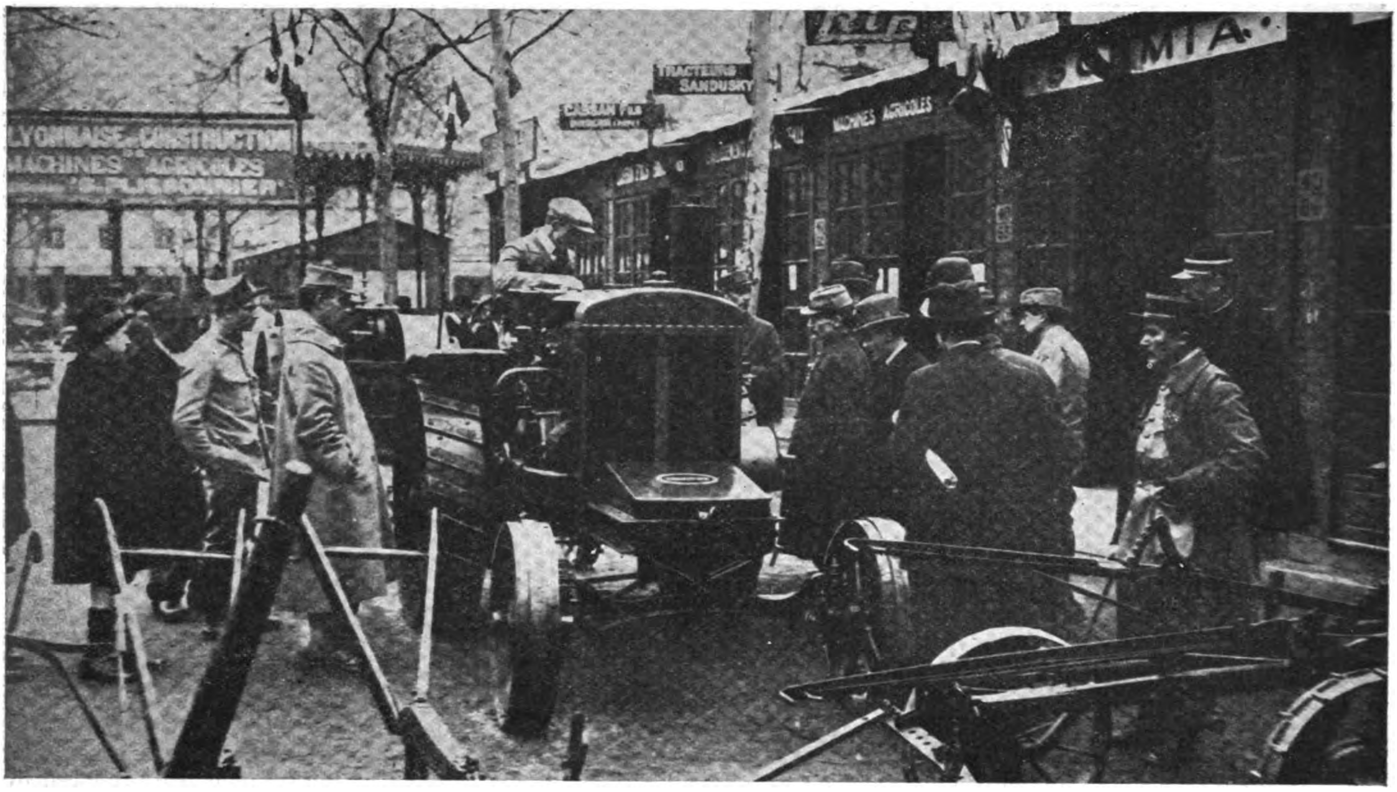
The engine is exactly the same design as that used on smaller trucks, but has a bore and stroke of 5 by 6.3 in. The radiator is back of the engine, inverted V type (the point of the V being toward the rear), and is composed of gilled instead of plain copper tubes. These changes had been made in order to give the bigger radiating surface necessary for an engine of this size.

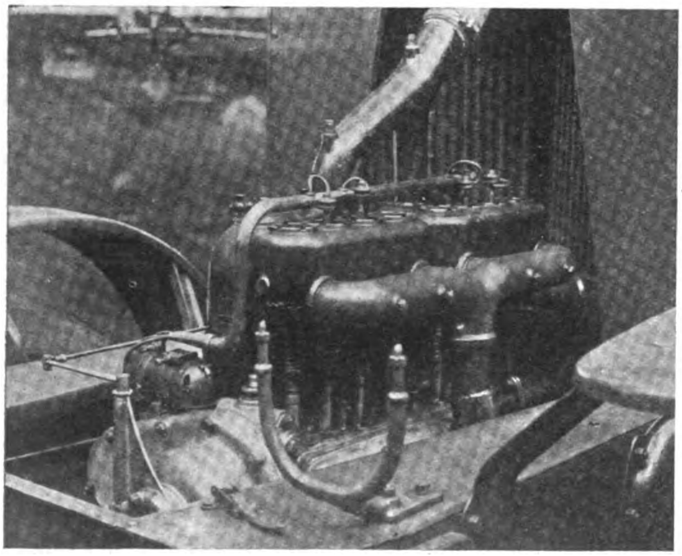
The only other feature of real interest was the final drive to the rear wheels, this being of the internal-gear type within cast-steel wheels, instead of a double reduction in the axle as on other Renault trucks.

Rear springs were underslung, and had a face width of 6 in.

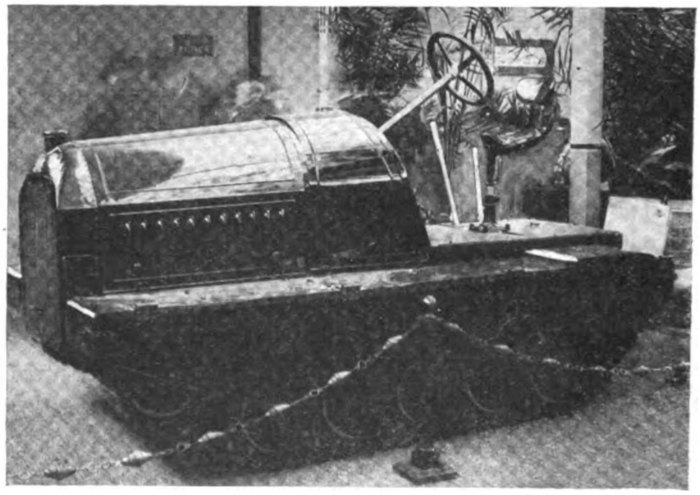
An extensive use was made of pressed steel for fender brackets, running-board brackets, etc.

Tires on this truck were 38 by 7, being singles in front

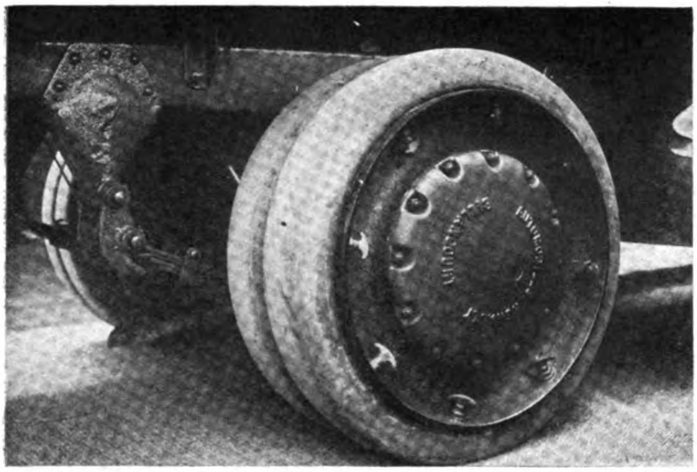


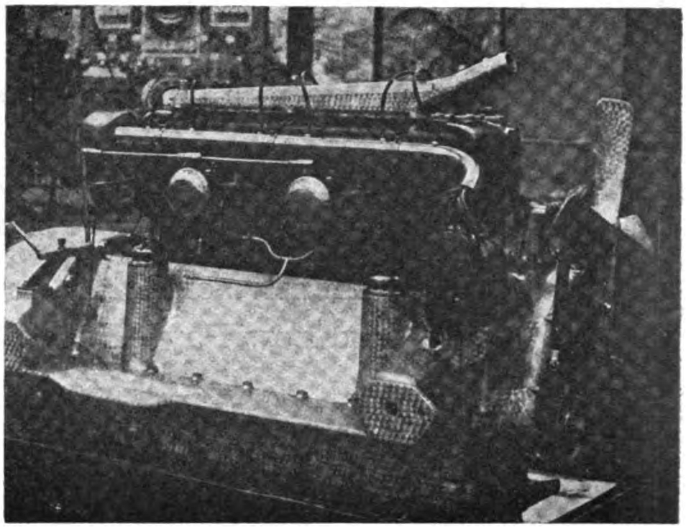


Top—General view of part of the Lyons Fair, with a tractor built by the Paris General Omnibus Co. in the foreground. Below—Peugeot tracklaying tractor



Above—Engine used in the Renault 7-ton truck. Right—Side view of the new Renault 7-ton truck, designed primarily to carry tanks





Above—Cast-steel wheel used on the internal-gear driven, 7-ton Renault truck. Right—Carbureter side of the Delage six-cylinder engine

and duals at the rear. These are the biggest solid tires seen on a French truck.

Agricultural tractors formed a separate branch of the Fair. The Fiat made its appearance for the first time in France. Other newcomers were the English Austin, which, like the Fiat, has a close resemblance to the Fordson, and the English Alldays & Onions all-purpose tractor.

The Paris General Omnibus Co. showed its own tractor, built under license from the Saunderson company of England. Peugeot put on view a self-track-laying tractor driven by means of a 35-hp. truck engine. This tractor has three speeds and reverse, main clutch control by means of pedal, and steering wheel which gives clutch control for the two tracks.

Renault also announced the production of a self-track-laying tractor, although the vehicle was not on exhibition. Having built tanks for about 2 years, Renault has had considerable experience in this class of construction. His tractor weighs 5900 lb., has a drawbar pull of 4400 lb., and exerts a pressure of 8 lb. per square centimeter. The tractor is listed at $5,600.

The claim is made by Michelin that the steel disk wheel allows tires to run cooler than the wood type. He states that there is a radiation of heat from the tire to the disk, this being quite noticeable after a long run, when it is found that the outer circumference of the wheel is hot, gradually decreasing in temperature as the center is reached. The Michelin wheel is carried by means of six studs, and is centered by the nuts on these studs. The six holes drilled in the wheel have beveled edges, and the base of the nut is also beveled, thus a wedging effect is obtained which assures a proper centering of the wheel and prevents the nuts working loose. Right-hand thread is used for the right-hand wheels and a left-hand thread for the opposite side. To facilitate fitting the wheels a tubular lever is supplied, this being passed through one of the holes in the wheel and placed on one of the studs, thus enabling the wheel to be levered up into position with a minimum of effort. The brace supplied for tightening the wheel nuts is also designed to fit the end of the jack handle, so as to enable the jack to be operated without bending. The jack is a new production Michelin is about to put on the market.

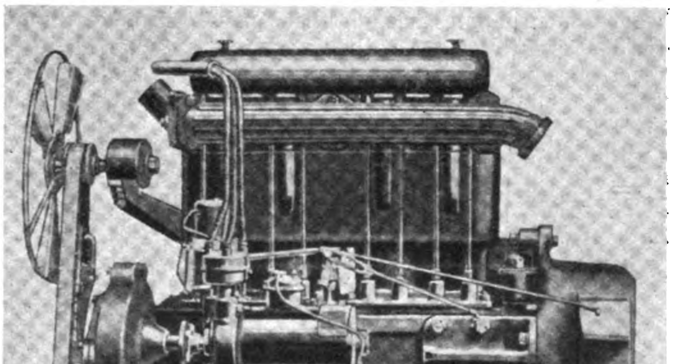
Mathews Four-Cylinder Power Plant

FOR 18 months the Mathews Engineering Co., Sandusky, Ohio, built for the U. S. Government equipment for war service in light houses, wireless stations, on docks, transports, etc. The requirements of the Government having ceased, the Mathews Co. now has placed on the market a four-cylinder engine known as Model F. This is recommended for use on passenger cars, trucks and tractors and for general power purposes in the machine shop, garage, etc. It is a four-cylinder, four-cycle engine of 3½ in. bore by 5 in. stroke, the total piston displacement being 192.4 cu. in. The S. A. E. rating of the engine is 19.6 hp. but the actual brake horsepower runs considerably above this.

The engine is made both in the open type and with a bell housing, the former weighing 400 lb. and the latter 440. It can be furnished with either three or four-point support. If the four-point support is desired, cast steel arms are used.

Lubrication is by the circulating splash system. The pump delivers oil to each of the splash troughs and also to the timing gears. The capacity of the system is 6 qts. All oil leads are external and a float indicator is provided.

While the engine is designed for thermo-syphon cooling and has large water connections, for some classes of work pump circulation may be desired, in which case a centrifugal pump is mounted on the left-side, and is driven from the accessory shaft. The magneto is then driven from the pump shaft.



Mathews engine built for U. S. Government for war service in lighthouses, wireless stations, docks, etc.

Foreign Competition Feared in England

Industry Apprehensive of Return to Old European System of Long Hours and Low Pay—U. S. Greatest Source of Worry

Special London Correspondence

ONE of the sources of fear for British trade on the part of some British motor firms has reference to the possibility of their European competitors returning to the low wages and long working hours which were common in Europe before the war. Belgium is the most cited instance, and certainly the labor conditions there before the war were the worst as compared with France, Germany and Italy, though the last named country was open to improvement on this score compared with France and Germany. The French motor works had a longer working week than the Germans and the rate of pay, though better than the Belgian, was lower than in Germany. The wage conditions in Germany now approximate more nearly to the British, but a longer week is normal, and if the movement toward the 44-hour week in England succeeds—and it is likely that such will be the case in the engineering trades—the discrepancy will be greater and more threatening to our competitive chances.

However, as regards Belgium, the following information may interest your readers, used to big earnings and a proportionately large output. I quote from a recent letter in the *London Times:*

"Previous to the war wages were always low in Belgium as compared with this country, and it was impossible for us to compete with many articles which were turned out in Belgium. The wages paid to skilled men in those times were from 65 to 70 centimes per hour for a good turner or tool maker, whereas a fitter would only get 50 centimes per hour. Girl labor was paid for at 30 centimes and extra efficient girl labor on heavy machines at 45 centimes. A special award of 75 per cent on all wages of mechanics has just been passed to meet the extra cost of living, so that the wages to-day for an ordinary mechanic are 1.25 franc per hour and for a skilled tool and gauge maker 1.50 franc per hour. The wages of the ordinary laborer have been increased to the round figure of 1.00 franc per hour, so that the laborer in a sense is not very far below a mechanic. Girl labor is now fixed at a minimum of 43 centimes per hour and a maximum of 55 centimes per hour."

Let us compare these figures with what we are at present paying in the engineering trades in England. Our very lowest price for skilled labor at present is 10d. (20 cents) per hour, plus 5½d. (11 cents), plus 12½ per cent., which is equal to 1.85 franc per hour.

Our highly skilled labor, *i.e., tool* and gauge makers, in many cases is paid as high as 1s. 6d. (30 cents) per hour, plus 5½d., plus 12½ per cent, or 2.75 franc per hour.

Ordinary laborers now get 7½d., plus 5½d (26 cents), plus 12½ per cent, or 1.55 franc per hour. Girls over eighteen get 5½d., plus 4d. (20 cents), equivalent to 1.00 franc per hour. If we compare these figures with those given above for labor in Belgium we shall see the difference in the cost of labor is from 50 per cent to 80 per cent more.

The British trade unions are well aware of these discrepancies on wage rates and their economical bearing on competition, but their officers point to the recent rapid development of industrial upheaval in these foreign countries as evidence of the trend toward a leveling up of conditions of pay and hours of labor and deduce from it the consolation that it is the knell of the unfair preferential conditions referred to. All of which deduction will be tested and the results demonstrated during the next two or three years. It is curious, however, that so far as concerns competition in the motor trade, there is far more anxiety as to American competition than regarding the combined total of European motor trade competition with British products, and this despite the fact that the rates of wage are much higher in the U. S.

General Instability Reflected in Car Market

The present instability of the motor manufacturing trade is shown by the fact that so many tenders for rough parts are subject to alteration and cancellation because of the further demands of labor for higher pay and the general state of industrial unrest, and it is felt that unless and until there is a substantial price drop in food and other necessaries, this instability will continue. Meanwhile precious time is being wasted in getting a start on normal products. Cars of good make are being listed privately at even $500 premium for early delivery, and in most cases these cars are merely pre-war models made up of materials already in stock when the war started. They are being modernized by being fitted with a dynamo and flywheel, electric starter and minor alterations in detail, but in few cases is there a genuinely new post-war model expected before July. The dealers, too, have to be considered, and as the manufacturers have told them what models they have in hand and the number for which material is available, so they have promised them not to list anything new, particularly appertaining to "popular" cars, until the pre-war stocks have been cleared.

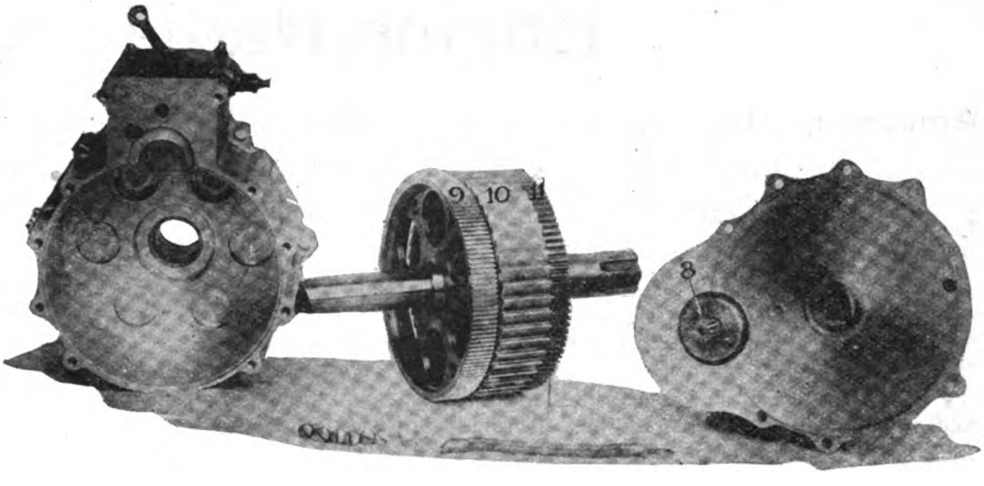
It is reported that a group of French motor chassis makers have combined to pool, as it is called here, when purchasers of raw material. This is apparently the "comptoir" system extended to the motor industry, a system which flourishes over the Continent and in some places is identical with the German Kartel system. If British motor makers were less individualistic, or jealous of one another, as some would express it bluntly, they would pursue a similar policy having regard to the necessary limited scope of many of them.

Ministers continue to be questioned in Parliament as to their intentions in the matter of imports and the present embargo on certain articles, but eliciting statements

(*Continued on page* 774)

Liberty Starter for Aircraft Engines

Combines a Gear Reduction for Hand Cranking with an Electric Starter with High Reduction Ratio



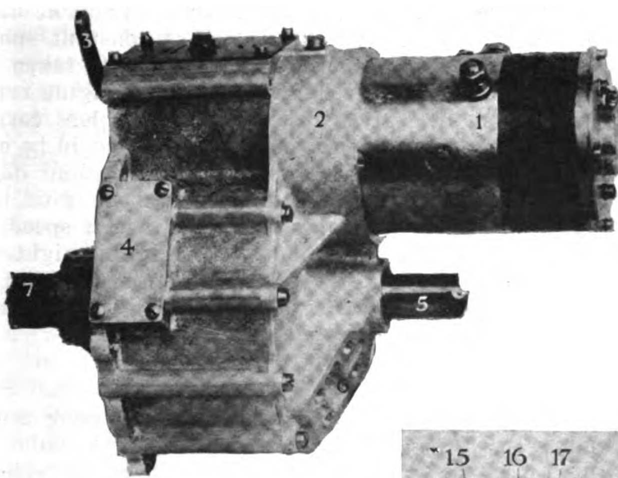
Assembled reduction gear removed from housing

A NUMBER of features of interest are to be found in the new Liberty starter for aircraft engines, which is said to be also adapted to automobile engines. This starter was submitted to the Bureau of Steam Engineering of the Navy Department at Washington some months ago, and we understand that it passed all preliminary tests satisfactorily. As a result, the Navy placed an order for a number of starters which were delivered.

This starter forms a single compact unit, which combines both a hand starting gear reduction and the electric starter. The device aligns directly with the crankshaft on the engine, hence throws no extra strain upon the engine bearings, and the starting unit is practically a part of the crankcase. As it is mounted on the end of the crankshaft (opposite the propeller end), the head resistance is reduced, and the need for radiators of unusual shape is obviated. This starter with hand cranking attachment is said to weigh about one-third less than a separate hand and an electric starter together.

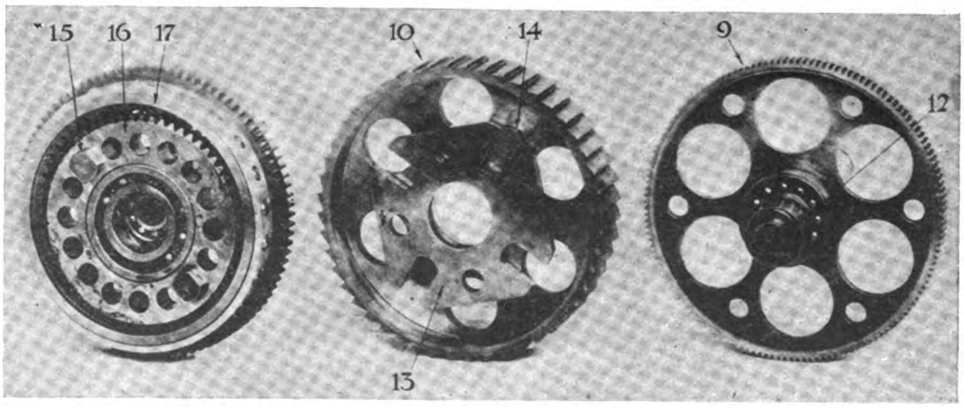
A factory is now building for the Liberty Starters Corp. in Poughkeepsie, N. Y., and when this is completed the manufacture of starters for the Navy and Army, as well as for export, will be continued. It is believed that as airplanes come into civilian use starters will be found just as necessary as on motor cars. Starting an airplane engine, however, has proven to be a much more difficult problem, because the latter has no flywheel, and the starter therefore must be attached directly to the crankshaft. In the Liberty starter, a double reduction gear is used, giving a reduction of 21:1 for hand starting and 240:1 for electric starting. An eccentric gear is used in order to obtain this high reduction ratio in a compact space. The Liberty starter weighs less than 29 lb. and is said to be capable of developing a starting torque of nearly 2000 lb.-ft. on the crankshaft.

The starter is entirely self-contained, and when it has performed its function as a starting device, it acts as a small flywheel, avoiding the necessity of meshing and unmeshing gears or engaging clutches. Provision is made on the starter case for the attachment of synchronizing gears, a generator or starting magneto (in case the engine is fitted only with magneto ignition). By the attachment of the generator, current can be supplied for recharging the starting battery as well as for lighting and wireless service.



Liberty starter with reduction gear assembled

1, electric starting motor; 2, gear reduction housing; 3, switch lever; 4, plate covering opening over end of crankshaft; 5, starting ratchet; 6, pads for mounting a bevel gear bracket if the starting crank is to extend at right angles; 7, shaft which is coupled to crankshaft by means of external splines; 8, on armature shaft of starter which meshes with gear; 10, ratchet wheel; 11, gear for driving accessories; 12, eccentric on hand cranking shaft; 13, universal plate; 14 and 15, studs on ratchet wheel and eccentric gear respectively, which engage with the universal plate 13; 16, eccentric gear; 17, internal gear



Parts of the reduction gear

The Principles of Cooling of Airplane Engine Radiators

Amount of Heat Which Radiator Must Dissipate—Law of Heat Transmission from a Surface to a Fluid Flowing Over the Surface—Horsepower Expended in Overcoming Head Resistance of Radiator

By H. B. Irving, B. Sc., A. F. Ae. S.

WITH the advent of the airship and airplane the problem of the cylinder cooling of light weight internal combustion engines has taken on a new and more complex aspect. In the case of the automobile the main consideration is simply to provide for the requisite amount of cooling of the cylinders; the questions of weight and head resistance do not, as they do in the case of the airplane, assume any very great importance. In the case of the automobile, too, the question as to the relative advantages or disadvantages of air cooling over water cooling is now scarcely ever considered, and water cooling is generally adopted as being the only practicable method. The relatively high speed at which an airplane moves, as compared with the speed of most automobiles, makes it necessary for the feasibility of air cooling, even in the case of the largest engines, to be reconsidered.

Cylinder Dimensions of Aero Engines Increasing

During the past few years the power and cylinder dimensions of air-cooled aero engines have been steadily increasing. With engines of moderate power there does not appear to be any very decided preference for either one or the other type. On the one hand, the air-cooled engine is generally lighter than the water-cooled engine. but, on the other hand, it usually is not so economical in running as to fuel and oil,* and, therefore, has to carry a greater weight of these for a given radius of action. In addition, the water-cooled engine probably scores on the whole on the point of reliability. When one comes to really large power units, however, there does not appear to be any doubt but that the water-cooled engine holds the field. The present article is chiefly concerned with the principles governing the design of radiators for water-cooled engines, but these principles apply to a certain extent also to air-cooled engines.

The question which arises at the outset is: How much cooling will the radiator have to perform? or at what rate will heat have to be dissipated for a given engine?

Now, all internal combustion engines as at present constituted, if they are to run satisfactorily and not give trouble due to overheating, must dissipate heat at a certain minimum rate. This rate of cooling is for water-cooled engines generally referred to as the "jacket loss," and does not include the heat lost in the exhaust gases. Many tests have been carried out in order to determine both its amount and its manner of dependence on the various factors involved, such as strength of explosive mixture, revolutions of engine, compression ratio, etc. In the case of most aero engines the following simple rule is probably quite sufficiently accurate for the purpose of radiator design:

The "jacket loss" is equal to the heat equivalent of the b.hp. developed by the engine.

If the engine is enclosed so that heat loss by convection and radiation from the various engine surfaces is small, then practically all the heat equivalent of the b.hp. of the engine is contained in the water leaving the cylinder jacket and has to be dissipated by the radiator. On the other hand, however, if, as is often the case in airplanes, the engine is exposed to more or less strong currents or eddies of air, a considerable proportion of the total amount of cooling required is done by the cylinder jacket and other surfaces of the engine, thus leaving much less cooling to be done by the radiator. The amount of this auxiliary cooling for a given engine will depend upon the disposition of the engine relative to the airplane, and upon the speed of the airplane. The data available at present are only sufficient to allow of a very rough estimate as to its magnitude, and further information on this point is much to be desired. Valuable data might be obtained from test flights at constant speed with engine at full power, observations being taken of the inlet and outlet water temperatures and engine revolutions. From block test results the jacket loss corresponding to the revolutions (at full power) could be obtained and compared with the amount of cooling done by the radiator. The difference would then give the auxiliary cooling of the engine parts at the air speed at which the test was carried out. This again might be compared with the auxiliary cooling obtained with the engine placed on a test stand in a current of air produced by a fan.

Laws of Heat Transmission

From the foregoing it would at first sight seem to be advantageous to leave the engine exposed to the wind as much as possible, so as to reduce the cooling required to be done by the radiator to as small an amount as possible and so to save weight by needing only a small radiator. But here the question of resistance comes in, and it has to be decided whether the extra resistance incurred by not enclosing or fairing off the engine does not counterbalance the saving in weight and resistance due to the smaller radiator.

Before going into the cooling of the radiator as a whole, it will be as well to consider the general laws of heat transmission, in so far as they enter into the problem of the cooling of the airplane engine or radiator.

Consider, then, a hot surface over which a gas is flowing with velocity v, and let the difference in temperature between the surface and the gas be θ. The law of heat transmission for such a case was first enunciated by Os-

*While this statement is absolutely correct, we believe that it is susceptible to the wrong interpretation that air cooling tends to decrease the fuel and oil economy. We believe it should be pointed out that the high fuel and oil consumption of most air-cooled aero engines is due to the fact that these engines are rotary engines.—Editor.

bourne Reynolds in 1874.* If h is the rate of heat transmission per unit area of surface the law states that

$$h = a\theta + b\rho v^{n-1}\theta$$

where a and b are constants, ρ is the density of the gas, and n is the index of v in the expression for the resistance of the surface. Usually $n = 2$, that is, the resistance varies as v squared, in which case

$$h = a\theta + b\rho v\theta$$

It will be seen that the term $a\theta$ represents the cooling which is obtained when the velocity v of the gas over the surface is zero; it may be called the "convection" term, in distinction from the velocity term $bv\theta$. For a given difference of temperature θ, the "convection" term remains constant with increasing velocity, while the velocity term increases in proportion to the velocity, and it may be assumed that, in the case of the airplane radiator, at air speeds above 20 miles per hour, the "convection" term becomes negligible in comparison with the "velocity" term. The law of heat transmission, as generally applicable to airplane radiators, then becomes

$$h = b\rho v\theta,$$

thus signifying that the rate of heat transmission is proportional to

(1) The density of the gas
(2) The velocity of the gas
(3) The temperature difference between gas and surface.

As a matter of interest, it may be noted in passing that, although to us at the present time it may seem perfectly natural, and, in fact, almost obvious, that the rate of cooling of a hot body should depend on the velocity of the wind blowing past it, only in recent years has the dependence of rate of heat transmission on velocity of gas become generally realized by engineers—if indeed it is generally realized even to-day. As before stated, the law of heat transmission was laid down as early as 1874. But until comparatively recently designers of boilers have used in their calculations empirical formulæ which did not contain any velocity term. It was only as late as 1909 that the late Professor Nicholson of Manchester, increasing the velocity of the flue gases in a Cornish boiler to 330 ft./sec., astonished engineers by obtaining from 8 to 10 times the usual rate of heat transmission.

Radiator Types

Modern airplane radiators are in most cases developments of certain types of motor car radiator. They may be broadly classified as

(a) Those in which water flows from top to bottom through tubes, the air flowing around or in between the tubes;

(b) Those in which the air flows through an assembly of horizontal tubes over and around which the circulating water passes. The tanks or containers at the top and bottom of the radiator are generally called the "header" and "well" respectively.

The second type, commonly known as the "honeycomb" type, has come into increasing use for airplane engines in recent years, as it lends itself to being made very light and able to withstand vibration. But in both types, and indeed in practically all modern radiators, the aim is to provide in as small a volume as possible and with the least weight the requisite amount of hot surface, *tangential to the direction of motion of the airplane*, over which the air can flow and carry away heat. The cross-section of the radiator, projected along the direction of motion, is made as small as possible, so as to reduce head resistance to a minimum, the resistance of the radiator then being mainly due to skin friction on the sides of the radiator tubes. Thus the type of radiator, often found on commercial automobiles, in which the upper and lower tanks are connected by a series of vertical circular tubes, has been modified for aero engine work, the tubes now being made either very thin and flat or of fine stream-line section.

*Proceedings of the Manchester Literary and Philosophical Society.

Returning now to the consideration of the law of cooling for a hot surface, the law

$$h = b\rho v\theta$$

will apply to each element of surface of the radiator, but it must be remembered that in an actual radiator the difference of temperature between surface and air will vary from top to bottom and from back to front of the radiator, since the temperature of the water falls as the water travels from top to bottom of the radiator, and since the temperature of the air rises slightly in passing through the radiator. If t is taken to be the difference between the mean of the water inlet and outlet temperatures and the temperature of the outside air, it will not be quite correct to say that the heat dissipated is proportional to t, but it will be very nearly correct. Also, the statement that the heat dissipated varies as ρ and as v (t constant) may be expected to apply to the whole radiator as well as to an elementary surface.

General Conclusions

Assuming that the resistance of a radiator varies as the square of the speed (an assumption which will in practically all cases be very near the truth), it is now possible to draw some very important general conclusions from the foregoing law of cooling. If S is the total cooling surface:

Rate of cooling of radiator varies as ρSVt
Resistance of radiator varies as ρSV^2
or varies as $(\rho SVt)V/t$
Horsepower expended in cooling varies as $(\rho SVt)V^2/t$

Now for a given motor at a given altitude—that is to say, at a given air density—the rate of cooling required for a given forward speed of the airplane with the engine all out is constant, and, therefore, ρSVt is constant. It follows, then, from the above, that the horsepower expended in cooling a given motor—

(a) Varies inversely as the temperature difference between radiator and air, and

(b) Varies directly as the square of the speed of the air passing through the radiator.

Conclusion (a) means simply that the higher the temperature difference between the radiator and the air, the less the horsepower expended in cooling. From the point of view of efficiency in water cooling, it is unfortunate that the boiling point of water is not higher than it actually is, or that no suitable liquid with a higher boiling point can be found to take the place of water in radiators. Another point in this connection is that in respect of temperature difference air-cooled engines are cooled more efficiently than water-cooled engines.

Conclusion (b) is of far-reaching importance. It places the designer on the horns of a dilemma; he has the choice between a small, light radiator of high resistance placed in free air, and a large, heavy radiator of low resistance, so placed or cowled that the speed of the air through it is low.

The advantages of the small radiator are fairly obvious. Its lightness is reflected in improved rate of climb, and it offers a small target for bullets. The latter of these is purely a war time advantage, and the former will probably be not so important in peace time as it was in war time, when a big rate of climb was of paramount importance. The disadvantage of the small free air radiator lies in its high resistance and consequent reduction of the speed of the airplane; the weight of the big

low resistance radiator, although reducing rate of climb, scarcely affects the speed of the airplane. If it were not for the entering in of considerations other than those which have just been mentioned, it would appear to be very doubtful whether the advantages of the small free air radiator will outweigh the advantages of the large radiator—especially in peace time, when the demand will probably be for efficiency, and when rate of climb will probably become relatively unimportant.

The adoption of the big low-speed radiator at once involves the problem as to how to obtain a low speed of air through it without the introduction of resistance other than that of the radiator itself. For instance, a common place for a radiator is in the nose of an airplane body, the air passing comparatively slowly through the radiator into the fuselage and out by vents in the side or bottom. Now, the additional resistance due to such a radiator cannot be considered to be only the resistance of the radiator proper, but it must be remembered that if the radiator were placed in the free air position, the nose of the body could be made streamline in shape and the resistance of the body reduced considerably; so that for the comparison of resistances to be just, it must be made between a streamline body with free air radiator and a more or less bluff body with nose radiator. Only experimental data could decide which is the better arrangement.

One method of reducing the speed of the air through a radiator suggests itself. The radiator could be placed in the free air and cowled, so that the areas of entrance or exit are less than the frontal area of the radiator. Here again it is uncertain whether or not the decreased resistance of the radiator due to the lower speed of air through it would be counterbalanced by the resistance which would certainly be added by the cowling itself, and the need for experimental data on this subject is emphasized.

The effect of altitude on the question of cooling is of interest. It is a well known fact that both the density and the temperature of the air decrease with increase in altitude. Also, the power of the engine usually decreases roughly as the density, but, by making special provision the power may be maintained constant up to considerable altitudes. Taking first the case in which the power is supposed to remain constant for all altitudes, suppose an airplane to set out on a climb at optimum climbing speed, the cooling being just adequate at ground level. At the same time as the rate of cooling is being reduced owing to reduction in density of the air, it is being increased owing to the increase in temperature difference between radiator and air. Generally these two effects are roughly equal, and the cooling remains the same. In practice the speed of optimum climb increases with altitude, and the cooling would increase in consequence. In this case, then, if the cooling is adequate at ground level, it is ample at altitudes, and, *à fortiori*, it would be ample if the power of the engine decreased with increase in altitude. In fact, the trouble usually experienced in practice is that there is too much cooling at altitudes, and the modern radiator is often provided with adjustable shutters for preventing—partially or almost completely—flow of air through the radiator. There is sometimes a danger—as for instance, in a prolonged glide at high altitude with engine shut off—that the water in the cooling system will freeze, or that the engine will become so cold that it will not "pick up" when the throttle is opened.

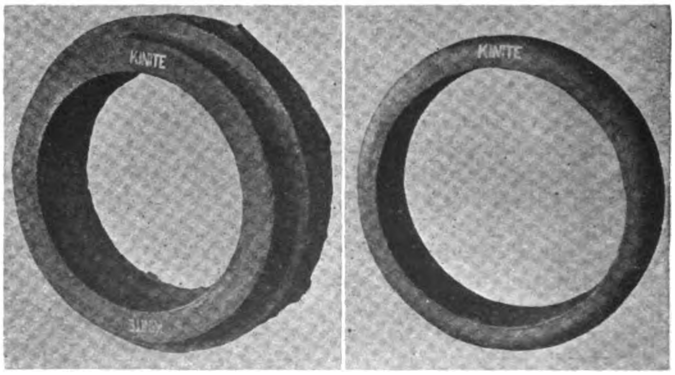
In conclusion, the present article has aimed only at presenting the general principles on which the design and location of radiators should be based. A large amount of experimental work on the subject has been carried out, but owing to the war the results are not yet available for publication. A grasp of the general principles, however, will lead to a ready understanding of the true significance of the data which will no doubt appear in due course.

Kinite—A Tungstenless High-Speed Tool Steel

A TOOL steel that is cast directly into the shape of the tool or die desired and which is claimed to possess the unusual quality of not changing shape or size during hardening, is one of the new developments in the steel industry. This new steel, known as Kinite, is made by the Kinite Co. of Milwaukee, and the following information regarding it is furnished us by the manufacturers:

Kinite is cast in specially prepared molds and has the appearance of a good smooth forging. A peculiar property is that it does not elongate under tensile strain nor decrease in cross-sectional area. It retains the shape and size that is desired until the breaking point is reached. Castings made from it are free from the defects and blow holes usually found in a casting. Unlike all other high speed steels it contains no tungsten. It will harden better than many forged products and when hard is very uniform and close grained, being one of the densest products of the steel family. It is high in heat resisting qualities and does not scale in the fire. These qualities make it an ideal material for making milling cutters, dies, taps and other tools having multiple cutting edges. As Kinite castings do not change their form during the hardening process, it is possible to make them so near the desired shape and size of the finished tool or die that very little machining or labor is necessary for completion. Dies requiring one hole or more are made with the holes cast in, thus saving the purchaser the cost of waste material and the labor of working the holes.

The unusual characteristic of not changing shape or size during hardening makes it possible to produce large dies in one single piece instead of many small pieces where ordinary die steels are used; and also saves from 20 to 70 per cent of the labor necessary to finish such dies after they are cast.



Rough Kinite castings just as they came from the fire

Some of the many kinds of tools that require hardening after finishing and which must retain their original shape and dimensions after hardening are: Blanking, stamping, forming, perforating, drawing and threading dies; plug, surface and snap gages. Kinite is also valuable for making machine parts that must resist heat and wear which are subject to great abrasive action while in service. It has been found that annealing boxes can have much thinner walls when made of this material and that they retain their shape and original weight through many more firings than when cast or malleable iron is used.

Castings made from Kinite can be annealed and rehardened many times without losing any of their properties.

The FORVM

Life of Fabric Disc Universal Joint

By F. R. Blair

IN view of the very general interest and curiosity among members of the engineering profession as to the performance of the so-called "fabric disc" type of universal joint, we believe the inclosed illustration will be of interest to your readers.

It is an un-retouched photograph of a Flexite Disc, one of two used in a coupling between the type B Quartermaster's truck motor and test dynamometer.

This particular disc had run a trifle over 3000 hours of actual service when it was photographed. It will be seen that the holes are round and true, that the fabric is nowhere cut but bears plainly the marks of the buckle plates and distance plates.

The depressions made by the radial teeth of the buckle plates (name given to the heavy plates opposite the spider arms) are approximately 1/32 in. deep, those made by the corrugated spacing plates being somewhat shallower, but in neither case is the surface of the disc in any degree broken.

Couplings of this construction in use on the rear propeller shaft of a 5-ton truck have been operated in excess of 20,000 miles in miscellanueous traffic with the discs showing similar condition at the end of that time.

Fuel Economy

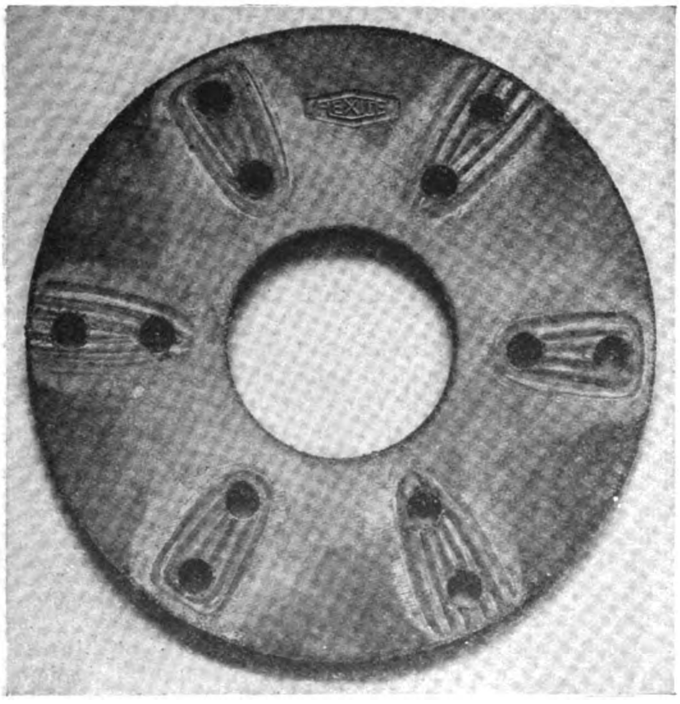
By R. M. Gaston

MR. POMEROY'S engine tests as given on page 432 in the issue of Feb. 20, 1919, permit comparison with American results. His tests are unusually complete in that they cover a wide range of loads at a speed range of 3 to 1. The accompanying curve shows the results of engine B with full size valves. The left-hand vertical scale shows the fuel consumption per brake horsepower hour, while the right-hand vertical scale shows the approximate thermal efficiency.

The curves illustrate clearly the falling off in efficiency at light loads regardless of the speed. In fact, it is somewhat surprising to find such small differences in efficiency at any particular horsepower output at the various speeds.

The Franklin car can easily cover 40 miles per gallon, and if the distance is covered in two hours, the consumption is only 4 pints per hour. Assuming the tractive effort to average 50 lb. and the mechanical efficiency between the engine and rear tires to be 50 per cent, the horsepower is only 5. The fuel consumption under these conditions is 0.8 pint per horsepower-hour, which corresponds to about 21 per cent thermal efficiency. Mr. Pomeroy's tests do not even approach this as the 5-horsepower efficiency at 800 r.p.m. would be about 1.2 pints per horsepower-hour. The output of the two engines is so similar it would be reasonable to install them on cars of the same size. The Franklin is apparently able to perform the same work on about two-thirds of the fuel.

The mechanical efficiency is taken considerably too low. In fact, tests made by the Franklin company itself have shown that the transmission efficiency on direct drive may be as high as 98 per cent and the rear axle efficiency 96.5 per cent, making the combined efficiency about 95 per cent. While this is the very limit, the transmission efficiency in a car in good condition can never drop to anything like 50 per cent.—Editor.



Universal joint disc dismounted after long use

Auxiliary Motor Trucks

THE Benzwerke Gaggenau supplied to the Spanish War Department at the beginning of the war a number of military trucks, which were designed to go with the mobile motor truck column. These auxiliary vehicles are used for various purposes such as carrying additional fuel for the trucks, portable workshops for field repairs, or the motor trucks themselves in case of a bad breakdown, to prevent them falling into the hands of the enemy. They are driven by four-cylinder gasoline motors, rated at 44-50 hp. The cooling arrangements are made so large that they will keep the engine cool even when running free with the truck standing for a considerable length of time.

The bodies are used for four main purposes. The first is a reservoir truck divided into several compartments, and is made up of riveted sheet-iron tanks. The front part is for oil, and the back part for water, the central part which is much the largest being for the gasoline supply. Suitable gages enable the driver to see the amount contained of each kind of fuel. Pumps are provided by means of which the fuel, water, or oil can be fed into the tanks through detachable flexible hose pipes.

The second type is fitted up as a store for spare parts which are contained in cupboards and drawers. All requisites even up to spare tires and complete axles are carried.

If the transport truck is so damaged that it is beyond the assistance of the spare-part store, the auxiliary salvage truck comes into service. On the chassis there is a bed with railings on each side which are so arranged that they can be converted into a ramp from the back of the vehicle to the ground, up which the damaged vehicle is hauled by means of a rope windlass provided on the front of the truck. When in position, the damaged truck is held by means of the closed-up railing. If the vehicle is so badly damaged that it cannot be hauled, a revolving crane is erected on bearings which are provided for that purpose, and the damaged wagon is lifted up bodily.

The fourth auxiliary truck is a complete portable workshop which is of the greatest use, not only to the transport service, but also to the air service and other corps. It contains a 6.6 kw. electric dynamo, lathe, drilling machine, milling machine, grinding machine, band saw, forge, anvil, and work benches. The lower parts of the side walls can be opened and fixed in a horizontal position to increase the working floor space, the corresponding upper halves of the walls being folded upwards to extend the roof.

Production Involves Intensive Study of Human Side

Volumes Printed on Industrial Management, but None on the Human Side of Business Affairs

By Harry Tipper

IT is significant as indicating the times in which we live that we should find in a page advertisement in the New York *Times* of March 24 the following paragraphs:

Quotation No. 1

Life was hopeless and miserable enough for most working people in Russia to make them easy victims of Bolshevism. But their revolt is not only against material conditions. It goes deeper than that—it is a great outbreaking of hatred and despair against the industrial system itself, and against all who have helped to make such a system possible.

Quotation No. 2

Rational hours, good wages, a comfortable material environment—these things are necessary, but these things alone will not do it. These are great masses of people whom these things alone will not satisfy today.

Quotation No. 3

The thing they are seeking is a new spirit in industry; a spirit that will recognize and respect the personality of each man, so that each man may have freedom of self-expression through his work.

ANY man who puts together the things which are exhibited in the newspapers and other periodicals, day by day, must be impressed not only with the importance of the labor problem and the necessity for its thorough examination, but also with its imminence and the necessity for action of the right kind; if we are to avoid either the turmoil which is enveloping Continental Europe or the defiance of government and the demand for nationalization which is occupying the attention of Great Britain.

It is significant that back of all the political turmoil about which we are reading and the effects of which we are noting, lies the industrial unrest, and the industrial unrest is the direct outcome of conditions which are humanly unsound and are bound to change.

The tendency of the times is unmistakable. The harbor strike is still going on in the Port of New York, called for the second time because the awards of the first strike were not agreeable to the workers, in spite of the fact that the Government was called in by the workers in the first strike and the decision of the war labor board was denounced by the owners as favoring the workers too much. It is to be noted in the demand which was made for a strike to begin July 1, on the slogan, "no beer no work." While this suggestion petered out, it was not squashed until some 500,000 workmen had voted for it.

It is not only that demand follows demand and that the employer is unable to approach his labor costs and his production problem from the labor standpoint with any certainty at all; it is not even that Government consideration demanded that capital and management accept decisions to which they did not agree, but it is the general tendency for labor to defy the Government unless the decisions of the Government are agreeable with their demands and with their estimated requirement.

It will be noted that in the last 4 months the great triple alliance of labor in Great Britain, involving the transportation workers and the coal miners, have threatened a strike of a general character through the whole of that country three times because of dissatisfaction with the Government position and with the length of time dur-

ing which the Government has been attempting to arrive at a settlement of the questions involveu. It should not pass without attention that the Sankey Report of the proposed settlement of the coal miners' dispute, which has not yet been accepted by the workers because it does not sufficiently establish them, definitely limits the profit per ton which capital can secure and also definitely provides for a combination in the management of the industry by representatives of the workers together with representatives of capital or the owners.

It is necessary to recognize the fact that we do not live in the same world from an organization standpoint that we did in 1914 *when the war broke out. It is necessary to emphasize the fact that this conflict has changed the outlook and the ideas of whole peoples to such an extent that it may result in a more severe period of political uncertainty and, perhaps, warfare, unless measures are taken which are founded upon the deep-seated necessities of the human being as an individual and as a part of an organization and not upon the temporary and supposed requirements of a production method.*

It has been the boast of this country that we have been able to throw away methods of operation at any time when new methods presented themselves before our industries. We shall be called upon to justify this boast in a larger measure and under more critical circumstances during the next few years than at any time in the history of our development.

No Discussion of Human Nature

ONE SEARCHES IN VAIN THROUGH THE BIBLIOGRAPHY OF INDUSTRIAL PRODUCTION, THROUGH THE BOOKS UPON EMPLOYMENT AND EMPLOYMENT MANAGEMENT, THROUGH THE WORKS UPON MOTION STUDY, EFFICIENCY AND INDUSTRIAL ENGINEERING, FOR ANY VOLUMES WHICH ARE DEVOTED TO A SERIOUS AND THOROUGH DISCUSSION OF THE HUMAN SIDE OF BUSINESS AFFAIRS.

The preacher, the socialist and the labor leader know a great deal more than the business man about the conditions among the workers, about their aspirations and about some of their necessities. It is true that their ideas as to the solution of the matter may be impractical and destructive, but that does not militate against the value of their discussions and their examination of the conditions, the aspiration and the tendency to be observed in this department of industrial affairs.

On account of this lack of study of the place of the individual in the industrial organization and the place of labor as a mass in its relation to management and capital in industrial work, the statements which have been made as to the increase of efficiency, the necessity for specialization, the value of standardization, the importance of this or that method of operation, cannot be regarded as accurate or scientific. If it is true that the whole production system depends for its value upon the action of the individual laborer and that all the mechanical processes are subsidiary to the human factor in the case, IT IS OBVIOUS THAT THE ALMOST TOTAL NEGLECT OF THE HUMAN FACTOR DESTROYS THE VALUE OF THE CONCLUSIONS WHICH HAVE BEEN REACHED AND MAKES IT NECESSARY TO DISREGARD THEM ALMOST ENTIRELY IN ANY PROPER EXAMINATION OF THE SUBJECT.

1—If this means anything, it means that the production manager, the engineer, the general executive, the capitalist must be prepared to throw away all preconceived notions and prejudices which have accumulated through the hundred years' operation of the factory system unless these can be justified by a more logical and more effective study than they have been given up to the present.

2—It means that they must be prepared to give far more attention to the Socialist, the labor leader, the preacher and the politician than they have been wont to do in the past, because these men have studied the human being more thoroughly and more carefully.

3—It means that the industrial executive and the capitalist must be prepared to examine afresh the real part which is played by capital, by management and by labor in the total necessities of production.

The statement that because the capital has been advanced the capitalist should control will not be permitted to pass unchallenged. In fact, it is being challenged with a greater voice every day, and the tones in which the challenge is spoken becomes less and less uncertain and more defiant. The statement that because management has been empowerd by capital to conduct the affairs of industry it must control altogether the conduct of that industry is being challenged in the same way, and the statement of labor, that it forms the bulk of the productive work and that it should control industry deserves to be challenged as it is being challenged by the management and the capitalist.

The New Objective

IF THIS INDUSTRIAL QUESTION IS TO BE SETTLED WITHOUT SUCH A PERIOD OF POLITICAL AND INDUSTRIAL UNCERTAINTY AND TURMOIL, AS WE WOULD HESITATE TO DISCUSS, IT WILL BE NECESSARY THAT CAPITAL SHOULD BE WILLING TO TAKE A SMALLER SHARE OF THE PROFIT OF INDUSTRY AND A VERY MUCH SMALLER SHARE IN THE CONDUCT OF INDUSTRY; THAT MANAGEMENT SHOULD EXTEND TO LABOR A SHARE IN THE RESPONSIBILITY FOR THE CONDUCT OF INDUSTRY AND PARTICULARLY A LARGE SHARE IN THE RESPONSIBILITY FOR THE CONDITIONS OF ITS OWN WORK, AND THAT CAPITAL, MANAGEMENT AND LABOR SHOULD ALL THREE SHARE IN THE PROFITS OF INDUSTRY AS WELL AS ITS RESPONSIBILITIES.

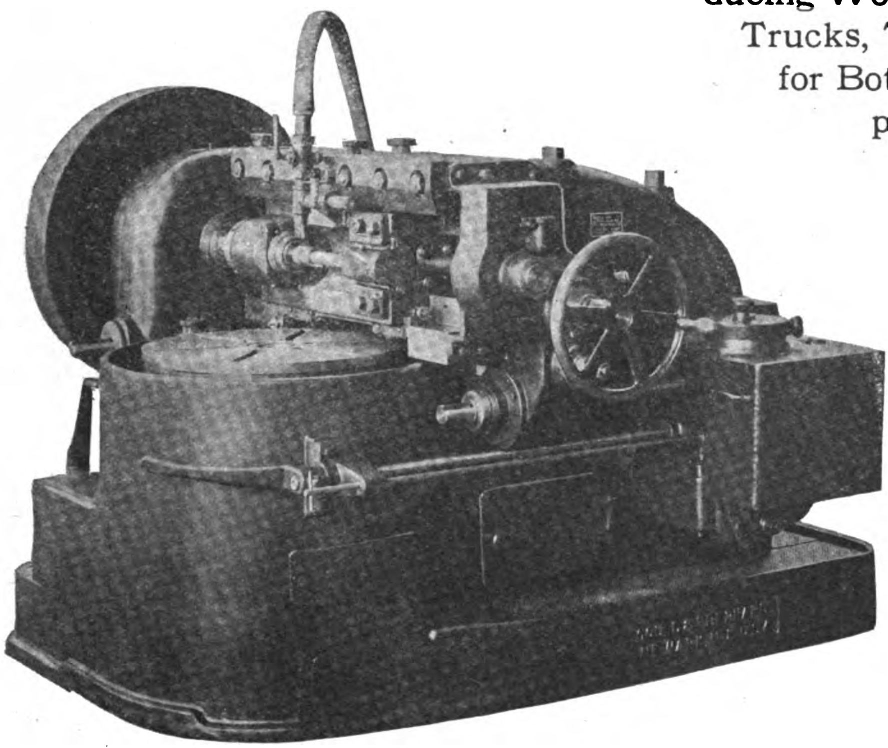
This can be done best by the individual organization arranging matters with its employees. The difficulty of accomplishing this in an orderly way through organized labor and organized groups of manufacturers is being illustrated in Great Britain to-day in the difficulties of arriving at agreement. The ease with which it can be done in the individual organization, provided that it is permeated by the spirit of square dealing, is indicated by the number of organizations of this kind which have been started in the last four years in this country without any turmoil and which are successfully handling the problems as they come up.

This is specifically an indication of the necessity for action, not for mere academic interest or so-called open-mindedness, but the necessity for serious examination and study of the problems and the decision along the best available lines. The final solution cannot be forthcoming at the present time, but the basis for an orderly solution has been provided in a sufficient number of individual cases to make it possible for any manufacturer to discover among these cases something which is applicable to his own plant. These cases should be studied, the fundamental reasons for their operations and the methods of their operation determined and action taken.

In this country we have the opportunity to settle this matter with less trouble on a better basis, with greater promise of progress than in any other country of an industrial character, but to do this it will be necessary for us to act, not merely to think about it.

G & E 18-In. Worm Wheel Generator

New Machine Specially Designed for Producing Worms and Worm Wheels for Trucks, Tractors, Etc—Adapted for Both Production and Experimental Work



G & E worm wheel generator. This illustration brings out strongly the robust construction of the machine

THE rapid increase in the manufacture of worms and worm wheels for use in motor trucks, tractors, elevators and worm gear reduction sets has created a demand for machines designed especially for this class of work. Such a machine is the automatic worm gear generator manufactured by Gould & Eberhard, Newark, N. J. It will automatically generate worm wheels with a tapered hob having a tangential feed or with a straight hob, which is fed into the worm wheel and not across it, and has means for cutting worm wheels with a fly tool. The latter method is particularly useful when carrying on a series of experiments, when it would be costly to make up special hobs for every wheel.

The success of worm and worm-wheel drives depends largely upon the accuracy and smoothness with which the worms and worm wheels are cut. The machine, to cut the worm wheels of the required quality must be unusually substantial; it must comprise the least number of parts, to eliminate torsional strains and to obtain the greatest amount of production from the hobs before grinding becomes necessary.

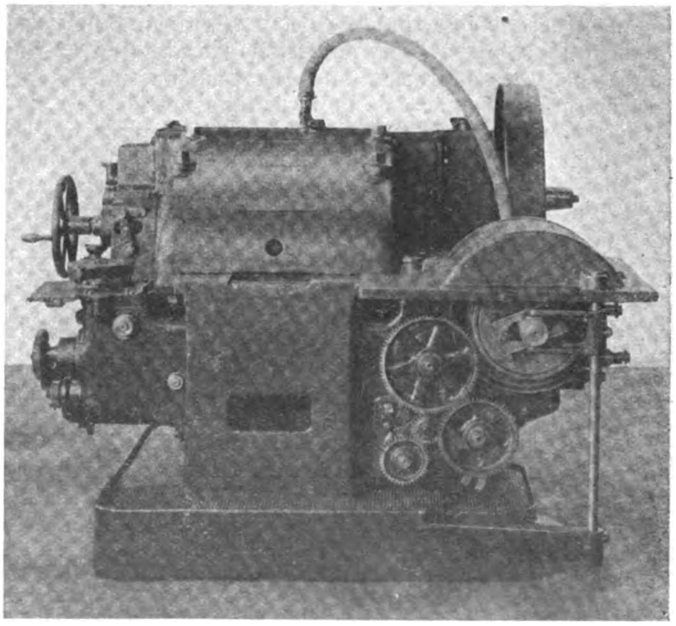
Worm-wheel hobs, by reason of their design, cannot be ground back as far as ordinary hobs, with the result that it is highly important that the machines in which hobs are used be of such substantial proportion that the hobs will cut the greatest number of worm wheels before getting dull.

The cutter spindle drive is through a powerful worm and worm wheel, with a large flywheel mounted directly on the end of the cutter spindle. It is also important that the work table be of substantial design and powerfully driven, so that it will be rigid under heavy strains. To insure this rigidity, the table is mounted in a permanent bearing in the base, while the cutter or hob carriage is mounted on a horizontal adjustable stanchion. This permits the work table to be arranged with a long cylindrical hub bearing, in addition to a conical and flat bearing and an indexing worm wheel of large diameter, which could not be incorporated if the work table was mounted in an adjustable carriage.

It is essential that the work table or face place be of convenient height for loading and unloading, and consideration has been given to this in the arrangement of the machine. All running parts are readily accessible and all necessary operating levers are conveniently located at the front of the machine, giving the operator full and instant control.

The machine is driven with a single pulley, and a high-speed clutch is incorporated so that it may be started or stopped instantly. This is operated by a lever at the front of the machine. There are six changes of cutter speeds, ranging from 58 to 183 r.p.m., making it possible to run various diameter hobs at the proper speed for the material being cut.

It is essential in a machine of this type to have a differential mechanism to enable the operator to take a second cut through a worm wheel, when using a tapered hob or fly tool, without losing the lead. The differential mechanism is also an advantage because it permits of changing the feed without changing the lead gears. When using a straight

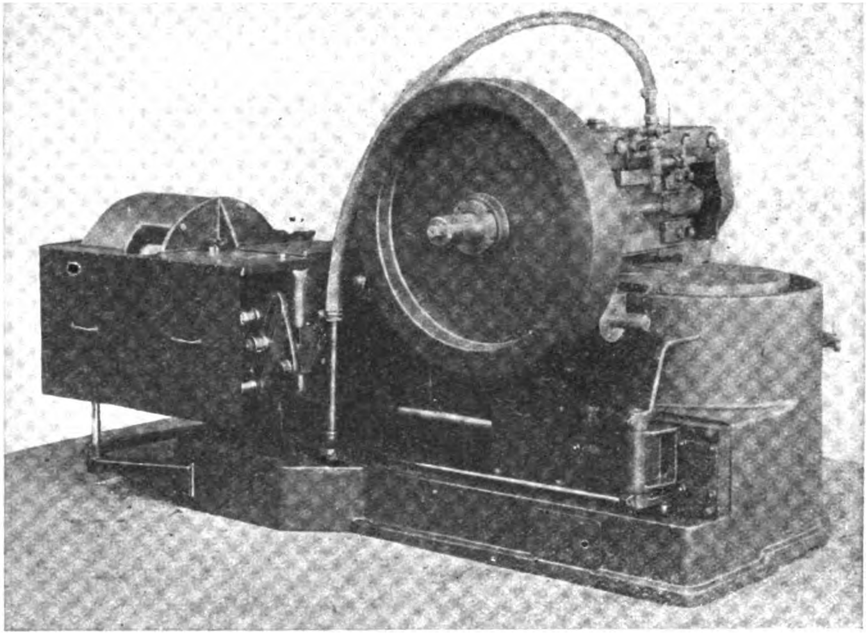


Rear view of the worm wheel generator showing belt pulley, clutch and gearing for changing cutter speeds

hob with automatic infeed, the differential is not required, and convenient means are provided for locking it.

A portable cutter arbor is furnished. The cutter carriage has an automatic tangential feed in one direction, and power return. An automatic stopping device is also provided, and may be set so as to stop the cutter carriage at any predetermined point. A graduated dial on the stopping device allows the operator to set the stopping mechanism to stop the cutter carriage at any predetermnied point.

The stanchion is provided with automatic infeed and power return. When feeding automatically into the revolving worm-wheel blank an automatic stop is provided, which is equipped with a graduated dial so that the operator can set the mechanism to stop at any predetermined point. When the tangential feed is being used, the stanchion is adjusted to the proper depth of tooth and then securely bolted to the base of the machine by four bolts. In adjusting the stanchion by hand, a dial graduated in thousandths of an inch is furnished, in addition to a scale and vernier, to set the hob and worm-wheel blank at the required center distance.



Side view of generator, showing flywheel on cutter arbor, hose connection for coolant, etc.

A centrifugal pump is regularly furnished with each machine to allow the use of a coolant, when cutting steel or bronze. It is attached to one side of the machine and is driven by gears. It may be conveniently disconnected by means of a clutch.

The machine will cut worm wheels up to 18 in. diameter; it will cut worm wheels with any number of teeth from 10 to 100 and with numbers of teeth from 102 to 120 except prime numbers. The cutting is done with hobs of one to five threads. A hob up to 5½ in. diameter can be swung and the length of hob may be anything up to 8 in. The cutter slide has a tangential travel of 10 in. The center distance from the cutter to the work spindle is limited to 3 in. minimum and 13¼ in. maximum. The center of the cutter arbor, which arbor is 1¼ in. in diameter, is located 7 in. above the top of the face plate. The net weight of the machine is 8600 lb.

Improving the Climbing Rate of Airplanes

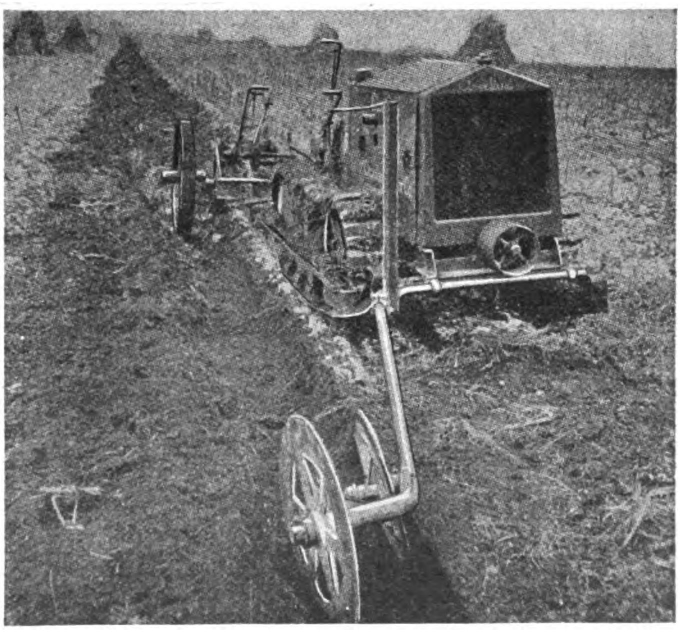
WRITING in the Zeitschrift für Flugtechnik und Motor-Luftschiffahrt, H. von Burberg states that when the wings of an aeroplane are being covered the fabric on the lower surface is sprinkled lightly with sand. Although the friction is thereby increased, the climbing power is considerably improved. This result is associated with the production of innumerable small eddies all in close proximity to each other on the undersurface of the wing, forming a species of air cushion. A fact closely associated with this is the phenomenon that when a machine flies direetly into a head wind it climbs better than when flying in still air with the same relative speed. The author considers that this effect is directly connected with the eddying air encountered by the machine.

Experiments are being conducted to test the effects of roughening different parts of the surface of propellers and streamline bodies, and these have so far given satisfactory results. They have shown that roughening the under-surface of the wing is favorable to the production of a cushion of supporting eddies.

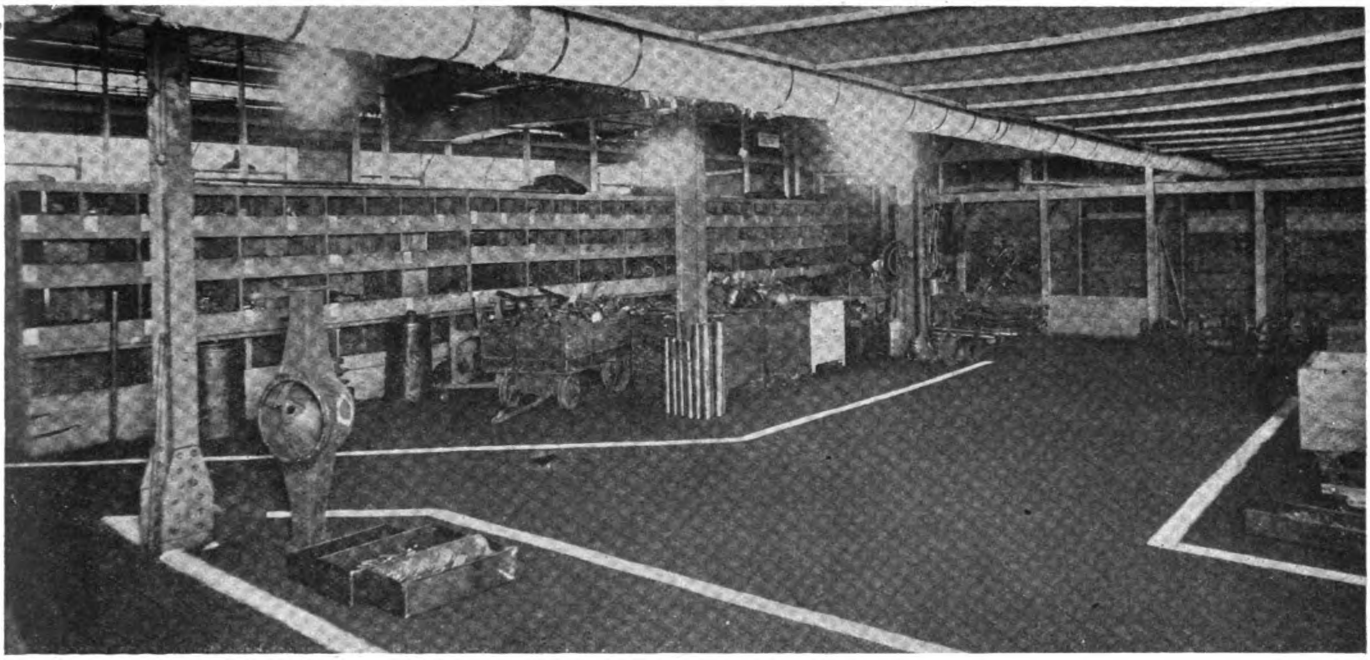
Willis Tractor Guide

A SELF-STEERING attachment for creeper type tractors is being marketed by the Willis-Flack Mfg. Co., Kansas City, Mo. It consists essentially of a forwardly extending tubular arm. The rear end of this arm is bent at right angles and is supported in bearings bolted to the front cross member of the tractor frame. At the forward end the tubular arm carries a pair of disk wheels running in the furrow. An upright of angle iron is secured to the arm at its bend and connects to a lever in front of the operator's seat, thus furnishing a means of lifting the guide when the tractor is to be turned at the end of the field.

The obvious advantage of a device of this kind is, of course, that the driver does not need to pay any attention to the steering, except in turning at the ends of the field, and is free to watch his plows. An indirect advantage is also claimed, namely, that with the guide the tractor can be run closer to the furrow than would be possible with hand-steering, and as a result the side draft can be reduced. While the guide is applicable to creeper type tractors generally, it seems to have been designed specially for the Cleveland, to which it can be fitted without drilling any holes. The runners are adjustable for 12 and 14 in. furrows. When not required the guide can be taken off in 10 min., it is claimed.



Application of the Willis Tractor Guide



Incoming parts and material are delivered either by train, motor truck, or trailer. The trailer comes from the Timken forging shop and is pulled by a gasoline tractor designed for this heavy haul work

Timken Solving Production Problem

Efficiently Operated Electric Trucks for Interdepartmental Transportation Reduced Truckers by 50 Per Cent—Use Elevated Containers

By J. Edward Schipper

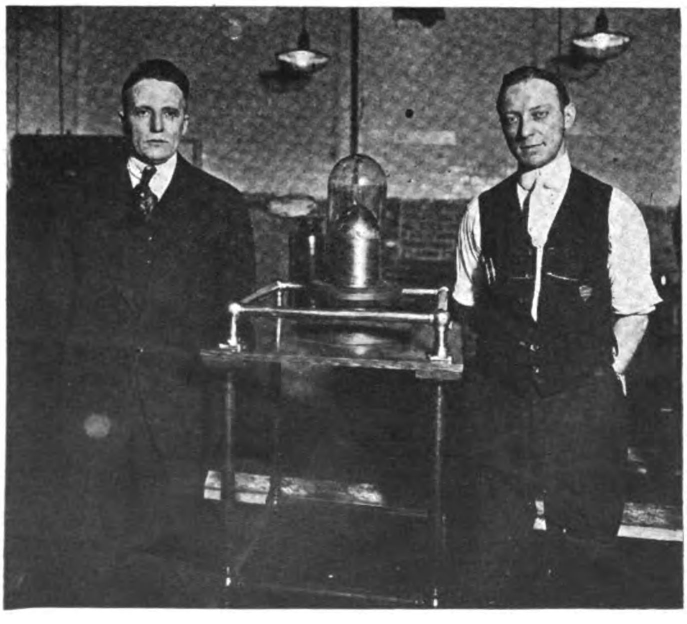
Part II

OWING to the necessity for scattering the departments throughout the gradually erected buildings of the Timken-Detroit Axle Co., it is of great importance that interdepartmental communication be maintained at high efficiency wherever it is necessary that such communication exist.

For example, between the material and the manufacturing departments there must be quick and good transportation of materials to the manufacturing department.

There must be rapid and good transportation of the incoming raw stock to the material stockroom.

The Timken factory has grown gradually, and it has been necessary to add buildings after buildings, until now there are approximately ninety buildings devoted to the business. In the particular series of fifty-seven buildings we are discussing, only motor truck axles are manufactured, with the exception of the Cadillac passenger car axles. Another group of buildings handles the passenger car production; another section produces the forgings. A certain amount of special work is purchased outside, although this is confined to very few products.



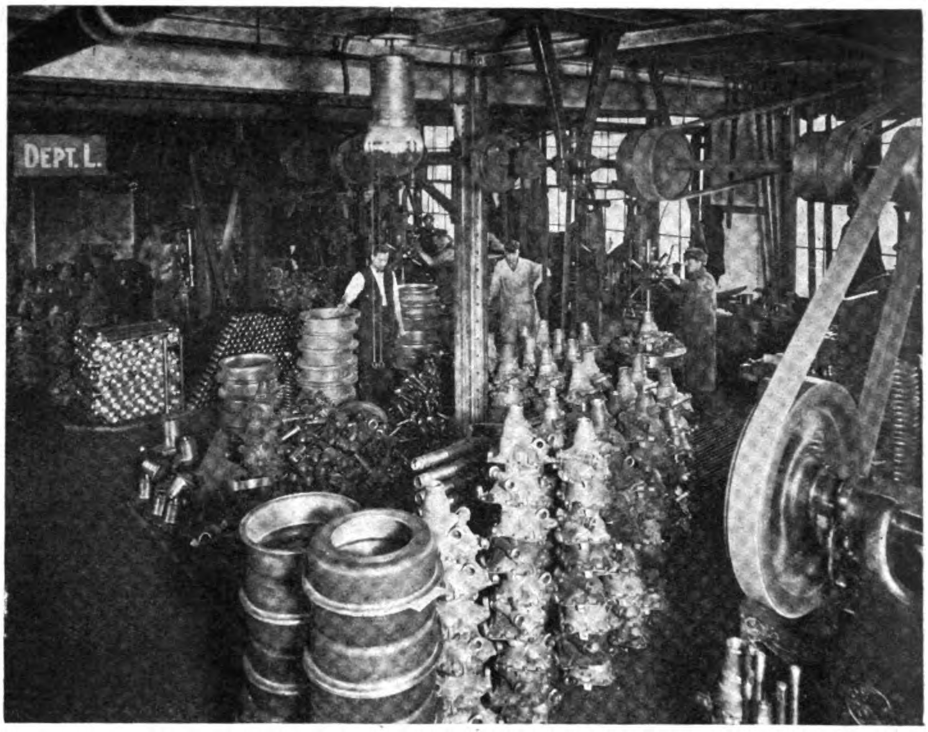
At the end of each month the night and day foremen of the cleanest department have their names inscribed on the shell, and this is kept in that department for a month

Visualizing these conditions, it is easy to see, in manufacturing the Cadillac-Timken axle, which perhaps is made in fifteen buildings, how vital it is that the movement of these parts—from raw stock to manufacture, from manufacture to heat-treatment, from heat-treatment to finishing operations, and from finishing operations to finished stock, and thence to assembly and shipping — be judiciously handled if the work is to go through smoothly. Consequently, interdepartment transportation has been given a great amount of attention. Recently a new system has been introduced which has reduced the number of men han-

dling the work from ninety-eight to fifty-four. This will be cut still further by completing the electric truck equipment now in use.

To accomplish this, standard boxes and racks, mounted on castors, are used. When one of these boxes is filled it can be pushed aside and an empty one introduced. The electric trucks are continuously on the move, picking up the filled boxes and carrying them to points where needed. This may be from the manufacturing department to the heat-treating room, or it may be to convey a load of forgings from the receiving room to the knuckle department. The boxes are quickly picked up by the electric truck, which has a platform lower than the space beneath the box.

The driver soon becomes expert in running the truck beneath the box, turning on the elevating electric motor, which raises the platform and lifts the box off the floor. The trucks are capable of traveling 7 to 14 m.p.h. They are equipped with electric horns, which allow them to proceed with high speed and safety down the aisles.

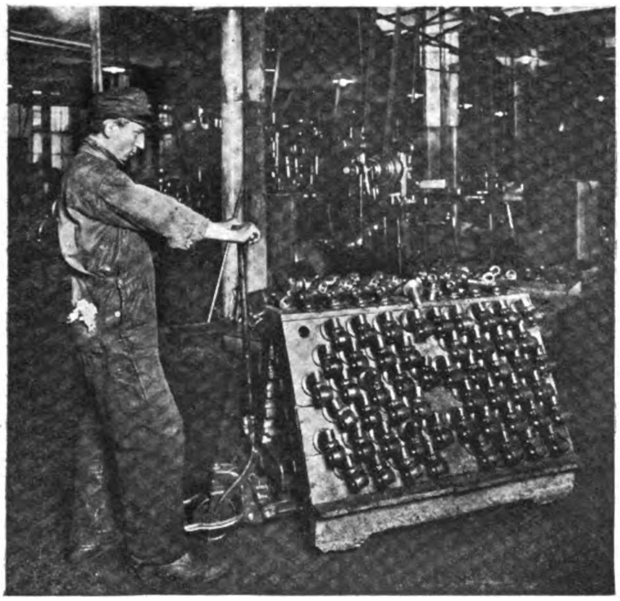


Carrier department, showing carriers for various types of axles all going through the same department

Naturally, with high-speed transportation between the departments it is necessary to keep the aisle space clear, which is done by vividly outlining them with white lines. It is made a special matter of duty to keep the aisle spaces clear, because obstructions in them would mean delay in transportation. It is estimated that since the introduction of the electric industrial truck, with the standard boxes and containers, and the clearing of the aisle spaces, transportation efficiency has gone up 400 per cent. Working on the regular schedule, the electric trucks travel over their routes.

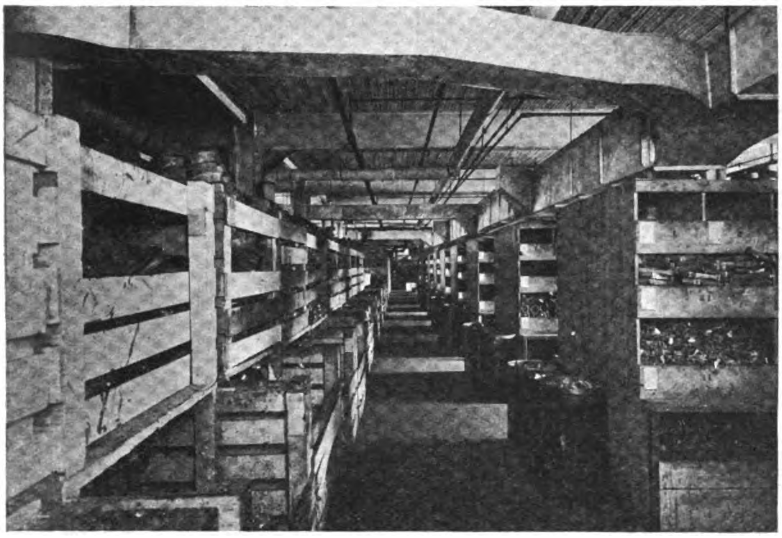
An observation in the raw material department indicated that an electric truck left every 10 min. loaded with a box of materials. Only 25 sec. elapsed from the time the electric truck arrived in the department until it had slipped its platform under the box, raised the box off the floor and started on its trip. Boxes of all the required materials are always waiting in the raw materials department, so that no delay exists at this point. An electric truck never has to stand and wait while a box is being filled. When it arrives in the department it travels up the aisle to the box it wants, slips its platform under it, the elevating motor is turned on, and in a few seconds it is off with its load to the department requiring that material.

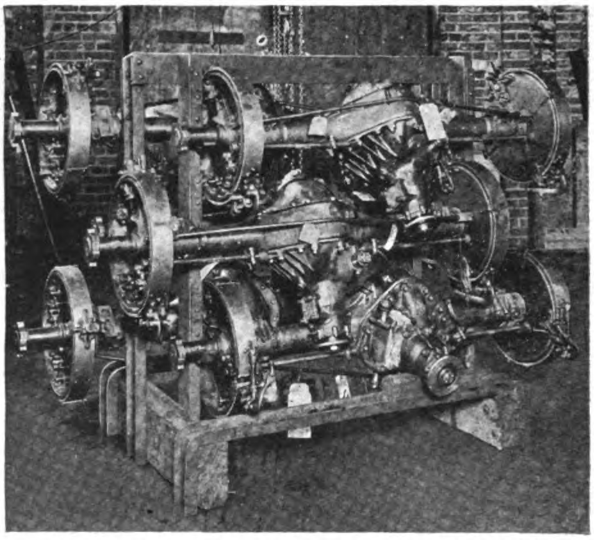
Realizing the importance of a clear aisle space, it has been made a matter of pride with the different departments to present the cleanest possible aspect, with ma-



Electric truck slipping its platform beneath a loaded box of parts

Racks of parts can be moved around the department by means of hand trucks which elevate the racks





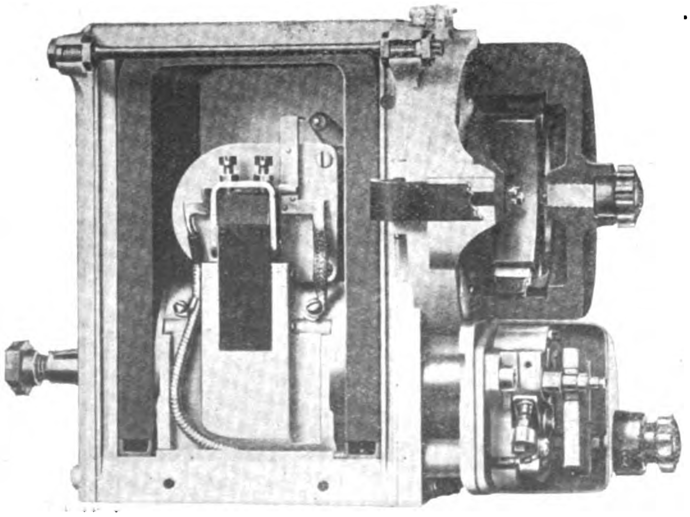
Left—Type of bins which clear aisle spaces for finished stock. Right—Back of finished axles. Note how rack is constructed so that electric truck platform will fit underneath, allowing for quick transportation

terials neatly arranged in racks or in some instances in piles, with nothing protruding into the aisle spaces. During the month an inspection record of departments is kept, and the one which has been cleanest is given a mark of recognition in the form of a shell, with the names of the night and day foremen engraved upon it. This shell is kept in a glass case mounted on a stand, and remains in the department for the month following that in which it was won.

New Dixie Automobile Magneto

A NEW series of magnetos for passenger cars and motor trucks, referred to as aero magnetos, has been placed on the market by the Splitdorf Electrical Co., Newark, N. J. The most apparent change from the former series is that the finish, instead of being black, is khaki. A single square carbon brush is used, heavier interrupter points, and more rugged construction throughout. The magneto is unidirectional. Micarta gears are employed, and the distributer block is made of Americanite. The Mason inductor principle, embodying the use of stationary windings and revolving fields, is adhered to.

The unidirectional principle may be explained as follows: Like practically all other ignition magnetos, the Dixie magneto generates an alternating current, comprising both a positive and a negative wave. It has been found in experiments with such magnetos that one of the waves is always stronger than the other, and in the aero-type magneto the negative wave is the stronger. The aero magneto is so designed that only negative waves are used for producing the sparks. The cam of the interrupter has two lobes, and the revolving field, or rotor, has four wings. When the rotor wings on the distributer end of the magneto leave the poles, the cam separates the platinum points. At this moment a spark is produced. When the rotor wings on the drive end of the magneto leave the poles, the cam holds the platinum points apart, with the result that no spark is produced. This explanation applies directly to a magneto designed for right-hand operation. In a left-hand type magneto the cam opens the platinum point when the rotor wings on the drive end leave the poles. In this case the position of the magneto is reversed, and the spark therefore is of the same polarity as with a right-hand driven type.



Part-sectional view of Dixie aero-type automobile magneto

Substitutes for Platinum

THE chief source of platinum is Russia, and since the revolution in that country the stocks of platinum in allied countries have been much depleted. Platinum owes its uses largely to its high melting temperature and to its resistance to attack by acids. It is extensively used for crucibles and for electric spark terminals. Extensive experiments have been carried on with the object of finding a suitable substitute, and some of the work done in France is covered in a recent article in *La Nature*.

Gold-platinum alloys, which have been available commercially for some years, contain about 12.5 per cent platinum. These alloys have the disadvantage of melting at 1200 deg. C., and softening at about 1500 deg. C., so that they cannot be subjected to great heat from the blowpipe without deforming. They resist acids very well and do not decrease appreciably in weight from one operation to another. They are generally used for work where a temperature of 1000 deg. C. is sufficient.

Gold-palladium alloys are capable of wider application and require less careful handling. They are widely employed in the U. S. A. by the names of "palan" and "rhotanium," usually in the form of crucibles, bowls, electrodes, etc. Their manufacture has now commenced in France. They can be heated without special precautions and resist the action of reagents better than platinum does. They contain at least 20 per cent of palladium and have the same color and appearance as platinum.

IN the article on the Campbell Transmission in our issue of March 13, the name of the manufacturer was inadvertently omitted. This transmission is the product of the Campbell Transmission Co., Buchanan, Mich.

The Lubrication of Motor Cars*

A Discussion of Methods Employed in the Lubrication of Steering Gears, Drag Links, Rear Axles, Springs, Spring Eyes and Road Wheels —Oil and Grease Retaining Devices

By Capt. G. W. A. Brown

PART II

FIG. 21 illustrates the method of oiling the universal joints of a well-known car. To the author's mind, this seems more a method of disposing of the surplus oil from a badly packed gear-box shaft than a serious attempt to lubricate the joint pin. In any case, additional measures for lubricating the universal joint would appear to be necessary.

Live Axle—The strictures which have been made on the antiquated methods at present in use for lubricating gear-boxes apply equally, in the author's opinion, to back axles, and, in the same way, the author is of the opinion that the ideal way of lubricating this important part of a car is that illustrated in Fig. 22. In this system a plunger pump, driven by a cam on the differential casing, supplies oil, as can be seen, to all the revolving surfaces, including the bevel wheels at their point of meshing. It will be noticed that the driving shafts are tapered; this of course is essential from a stress point of view, but use is made of this taper to wind oil along it to the wheel bearings, whence it drips off and returns to the sump at the bottom of the axle casing.

In the "Fergus" car, the back axle (Fig. 23) is lubricated on the splash principle, i.e., the bevel wheel dips in oil contained in the casing, but there is no special provision for oiling the road wheel bearings, nor is there any method of maintaining the level of the oil with certainty, although a certain quantity of oil is constantly draining into the case via the spring housings and the torque tube.

Fig. 24 illustrates a trough system of lubrication similar to that already referred to for the gear-box.

III. Steering Gear: Drag Link Connections

As usually arranged, these connections are the most inadequately lubricated parts of the car. Whether knuckle joints or pin and fork joints are employed, the method of treatment is the same, namely, to fit a grease cup on the joint and to surround the whole thing with a leather cover. The net result is that, after one drive on a wet day, if the trouble is taken to remove this leather covering, it will be found to be filled with water and mud. In any case, the author has noticed that there is a marked disinclination on the part of drivers of cars to fill grease cups, or even to turn them, the consequence of which is that rust soon sets in, accompanied by wear, and a serious accident may possibly occur.

In the "Fergus" car (Fig. 25), the lubrication of the steering gear has been carried out with the most commendable thoroughness. Here, it will be seen, provision is made for entirely filling the tubes with the lubricant, which finds its way into the ball and socket joints through suitable oil-ways, while the joint itself is rendered oil-tight by a metal cap held in contact by a spring.

A design of the author's, which also obviates the difficulties

*Paper presented to the Institution of Automobile Engineers, London.

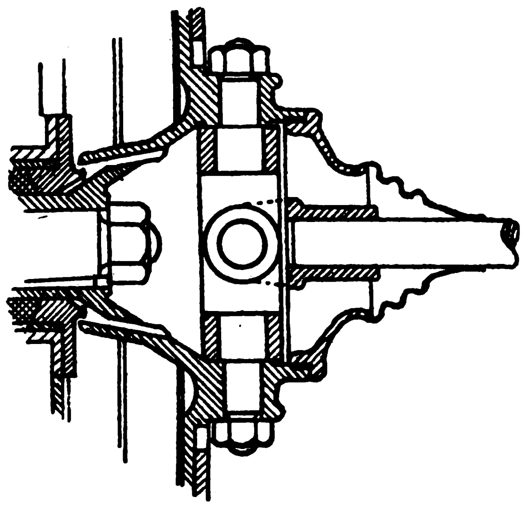


Fig. 21—Haphazard method of lubricating universal joint

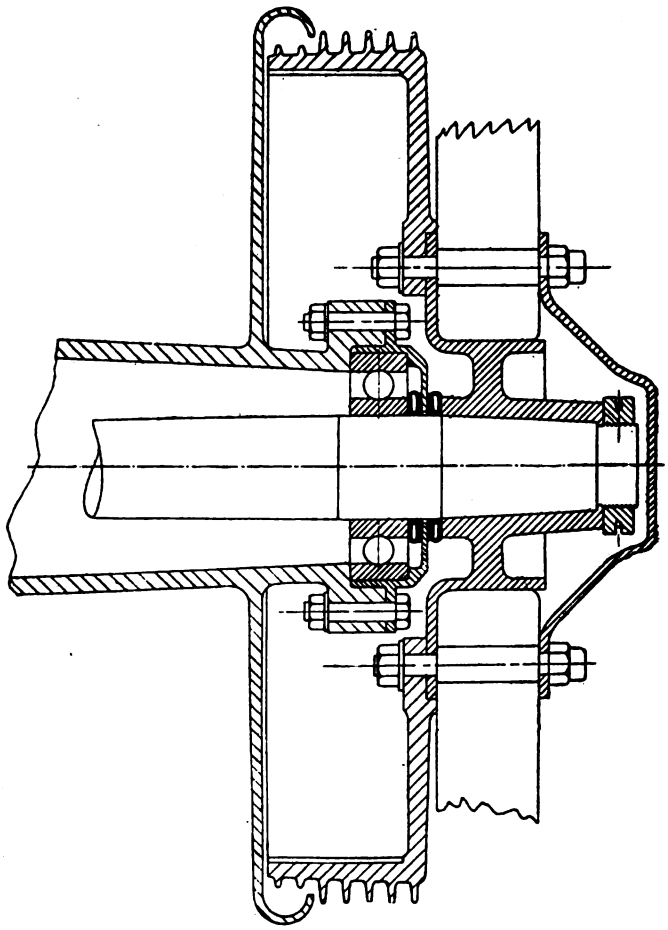


Fig. 22a—Outer end of oil-lubricated axle

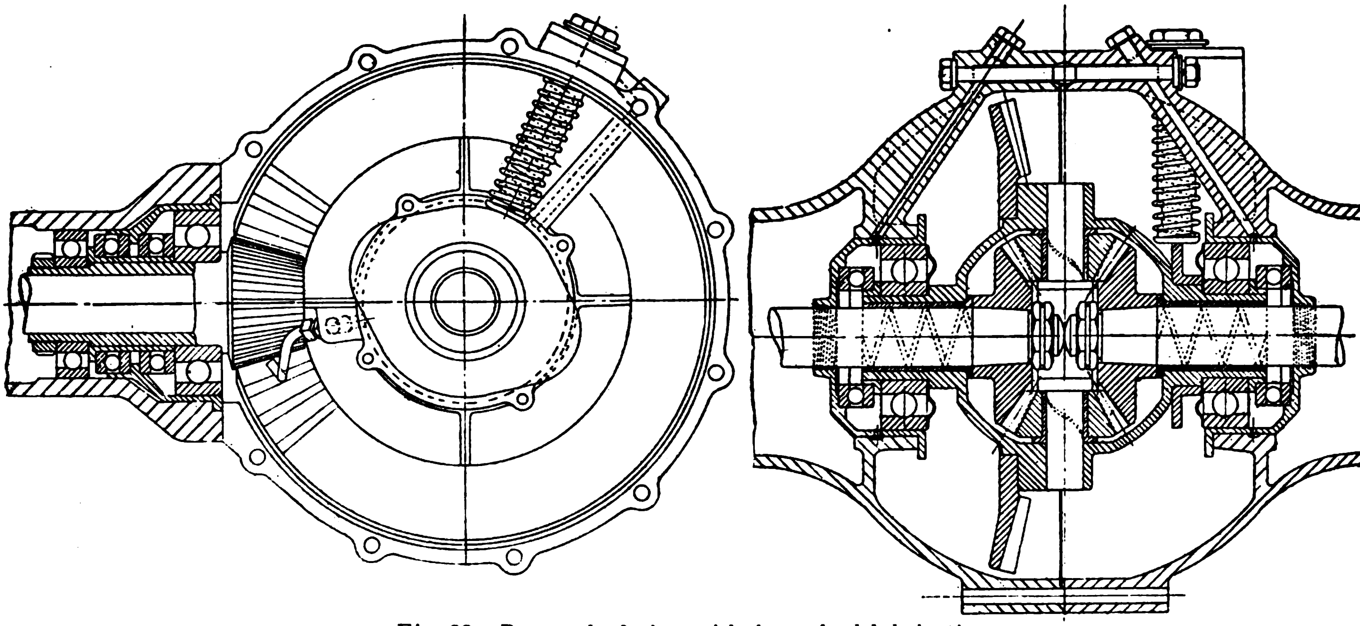


Fig. 22—Rear axle design with force feed lubrication

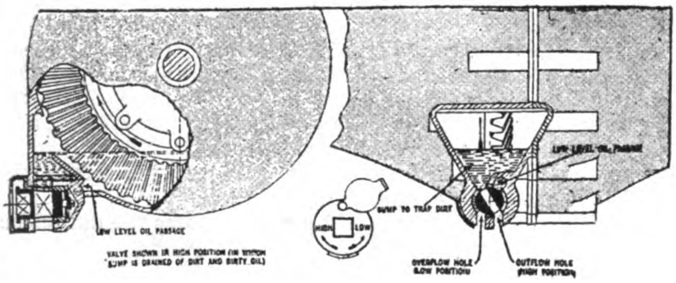


Fig. 23—Splash lubrication of Fergus rear axle

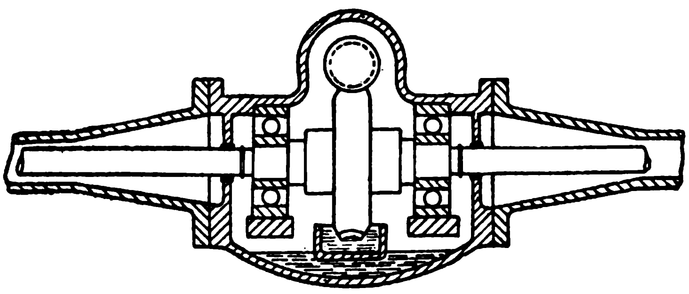


Fig. 24—Trough system of rear axle lubrication

already mentioned, and renders the lubrication of these important parts automatic, has met with a considerable measure of success. In this case the oil is retained in the ball and socket joint by the use of an oil-resisting fabric washer, which is so made that it is compressible to allow for angular changes in the relation to the ball and the rod.

It has also been suggested that the steering-box should be attached to, and be in communication with, the engine crankcase, whereby it would receive copious lubrication by splash. The author considers that there are more reasons against adopting this construction than there are in favor of it; with care the bearings and the worm gear can be efficiently lubricated by providing a removable plug of ample size so arranged that the casing can be well filled.

IV. Suspension

Various methods have been suggested for lubricating the leaves of the road springs. Normally, they come from the makers having had a mixture of graphite and oil put between the leaves before they are bolted up. This lubricant lasts them for a few hundred miles, when, if it is desired to renew it, it is necessary to jack the frame of the car up so as to take the load off the spring leaves, and, by means of a chisel or screwdriver, to pry the leaves apart and introduce fresh lubricant between them with the blade of a palette knife. It can be easily understood that, as this is a long and dirty operation, it is practically never done. One well-known maker, recognizing this to be the case, rusts the blades of his springs before he fits them to his vehicles, the assumption being that they will then give as easy suspension at the end of the car's life as they will at the beginning.

Other methods have also been proposed, namely, the fitting of perforated zinc or other non-ferrous metal strips between the leaves, the perforations being used to hold lubricant, while one concern supplies a graphite impregnated fabric for the same purpose.

The method recommended by the author (Fig. 26) is to cover the whole of the spring with a stocking made of grease-proof fabric, and to attach this, in the case of a cantilever spring, to an oil-tight casing placed round the trunnion of the spring, and, at the forward end, to an oil-tight casing which carries the shackle pin, roller, or whatever the method of attachment at that part may be.

The casings are then filled with oil, and can be left, with the certainty that no further trouble will be experienced from the springs until the oil has been used up—a matter of 10,000 miles or more.

A rather crude method of enclosing the springs is reproduced in Fig. 27 from an illustration in *The Automobile Engineer* of July, 1918.

For cheaper constructions, we have the half-elliptic leaf springs bolted direct to the frame and the axle as in the "Stellite," "N. E. G." "Humberette," and several other pre-war cars of the cheaper class, while in America a variety of springs have been made and tested with the ends so designed that all the flexion is taken by the spring, thereby dispensing with the shackles themselves and the consequent number of joints. A few examples are illustrated by Fig. 28.

In the author's opinion, this is far too important a point for reliance to be placed on the occasional turn of a grease cup, for, on examining one or two well-known makes, it will be found that the load on these pins reaches somewhere between 250 and 500 lb. per sq. in., and, in nine cases out of ten, the grease hole and groove are situated on the loaded side of the bearing!

Oil-less Bearings—It would be improper to leave this subject without some description of a type of bearing which does not require lubrication as it is understood in the ordinary sense. The author refers to those bearings which are generically called "oil-less bearings." They are of several kinds, the most usual being a bronze shell in which a spiral groove has been cut, subsequently to be filled with graphite under pressure, illustrated in Fig. 29.

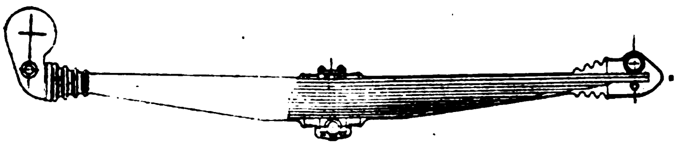


Fig. 26—Grease casing for body spring

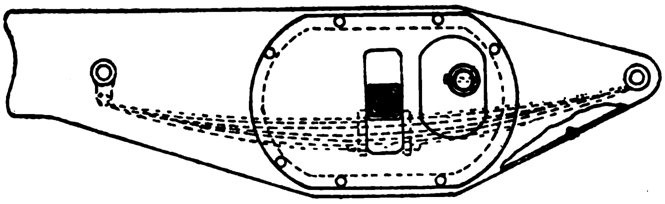


Fig. 27—Crude suggestion for spring enclosure

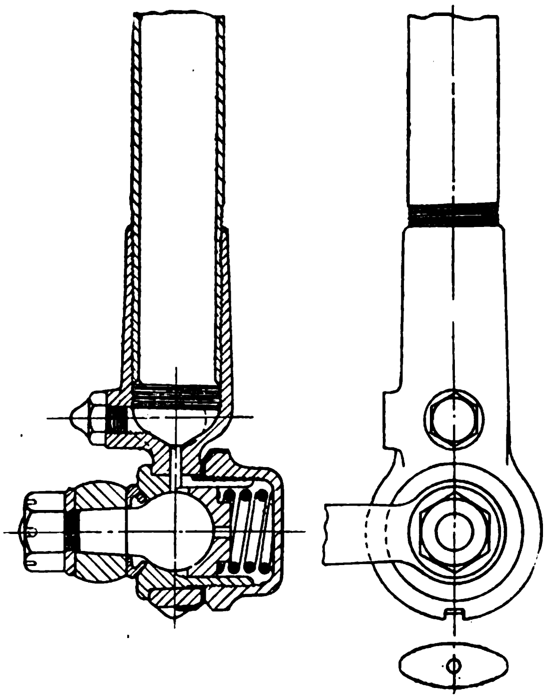


Fig. 25—Drag link connector lubrication

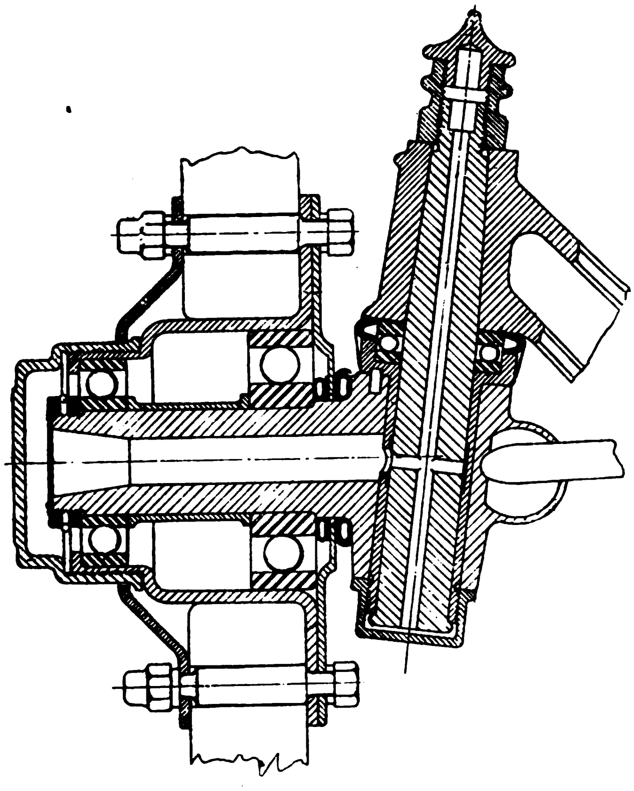


Fig. 30—Steering pivot and front wheel lubrication

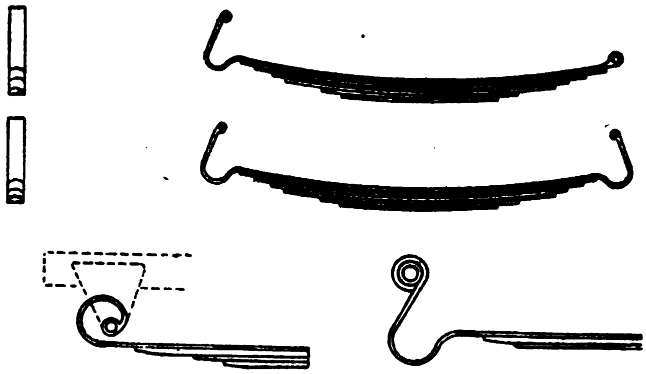


Fig. 28—Types of chassis springs with rigid connections

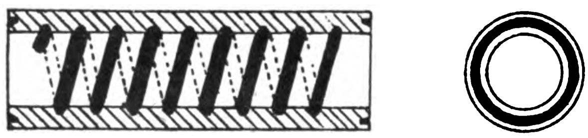
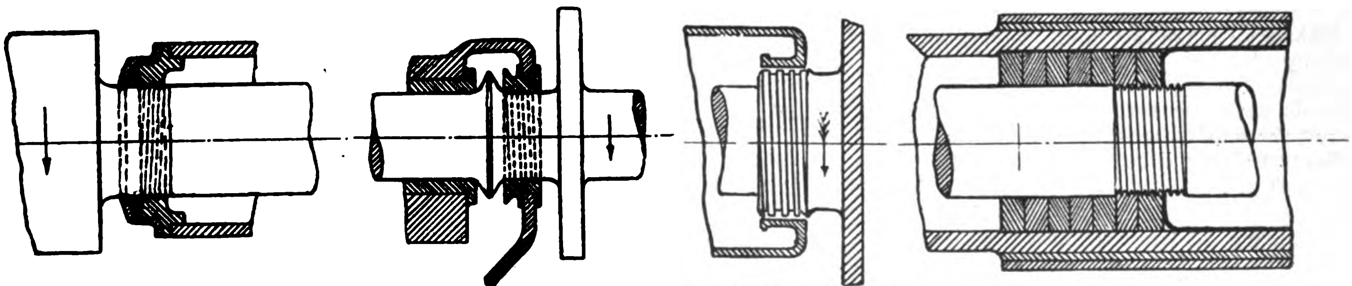
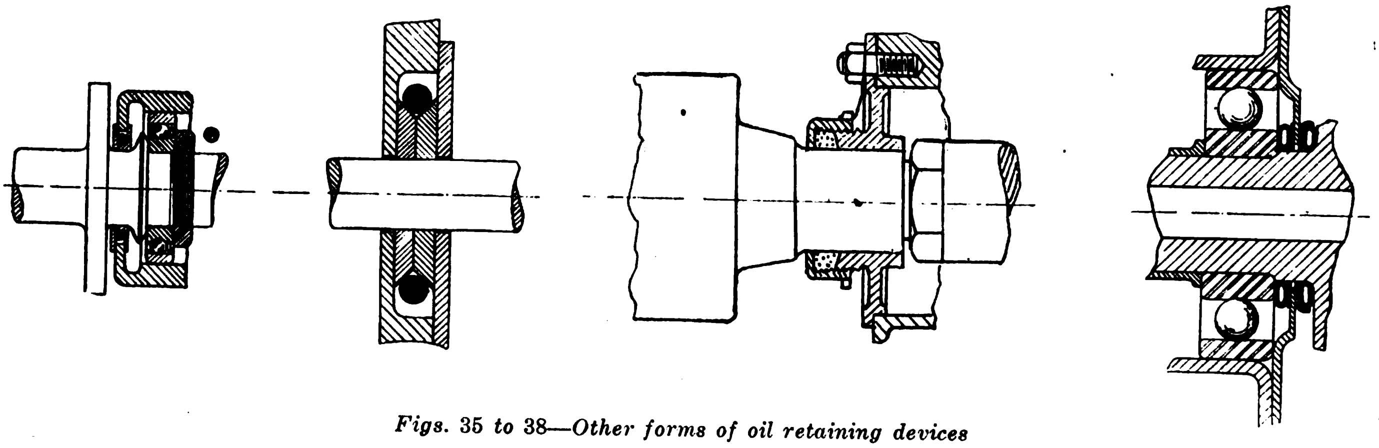


Fig. 29—Oil-less bushing



Figs. 31 to 34—Oil retaining devices



Figs. 35 *to* 38—*Other forms of oil retaining devices*

The author recently had an opportunity of investigating a very ingenious example of this type of bearing which is fitted to the "Marmon" car. The essential feature of this bearing is the provision of an inner and outer steel shell, between which is a lining of wire woven asbestos fabric which has been impregnated with graphite. The inner member of this bearing is dowelled to prevent it turning upon the pin or shaft, while the outer casing is forced into the boss of the bracket or lever. These bearings are used throughout the "Marmon" car for such parts as the spring shackles, brake levers, pedals, and the like.

V. Road Wheel Bearings

The well-known method of filling the hub with grease by fully loading the hub cap and then screwing it home, and so forcing grease into the bearing is open to improvement, as by this means only a small proportion of the grease is ever used. Fig. 30 shows a method favored by the author applied to the front hubs, from which it will be seen that one filling of oil will serve to lubricate the swivel pin and the hub bearings. Similar provision is also made on the "Fergus" and "Marmon" cars; one charge should last for a considerable period if proper measures are taken to prevent leakages. The same remarks apply to the bearings of the rear hubs, except that it is possible to lubricate these from the live axle supply, one method already having been mentioned.

VI. The Necessity for Efficient Retaining Devices

We cannot discuss methods of lubrication without devoting some time to the importance of suitably retaining the oil, and at the same time excluding the dust and water, which in many cases have largely contributed to the rapid destruction of ball and roller bearings. In almost any repair shop are to be seen numbers of racers worn and corroded beyond hope.

The best retainer in places to which water cannot have access and which are above the level of a body of lubricant, such as the ends of the crankshaft, the cam-shaft, or the gear-box main shaft, is undoubtedly the screw-thread, but the form of this is a matter which is open to discussion. Types now in use are shown by Figs. 31 and 34, and they all seem to be equally effective; the spiral groove cut in the stationary member works quite as well as the revolving screw on the shaft.

This is an important point, as it often happens that the revolving shaft or wheel-boss is so highly stressed that the addition of a screw-retaining thread could not be incorporated without seriously weakening the part; or, if the part itself is not threaded, dispensing with the necessary loose threaded collar, which could be fitted if room permitted.

Fig 34 is a type of retainer used on the "Marmon" car for the back axle, and is interesting inasmuch as the screw is an ordinary Whitworth thread with a more rounded top, and is distinct from other types in that it revolves in the felt washers without clearance.

The scope of these types of retainer is, however, limited. They cannot be applied to the hubs of road wheels, for instance, because of—

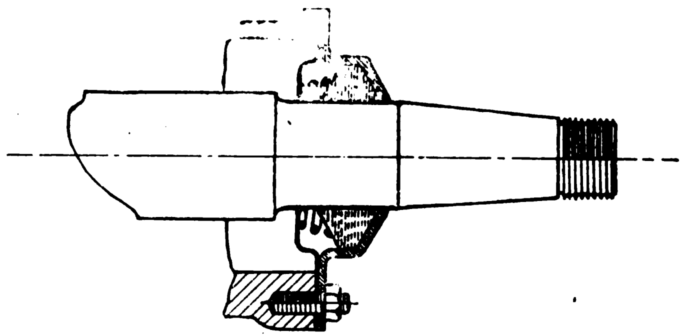


Fig. 39—*Fergus gland packing*

(1) Risk of water entering when the car is reversed or being washed;

(2) Admission of moist air when the car is laid up;

(3) Liability of leakage when the wheels are stationary and the hubs filled with a thin lubricant.

The hubs of the front wheels particularly are in so exposed a position that in dirty weather the steering heads are literally covered with water and mud, while, when washing the car, the centre of the hub receives copious supplies of water under pressure from the hose.

For these two reasons alone, therefore, the very best provision for retaining the lubricant is a necessity.

In the back hub it is equally important, as, although usually protected by the brake drum and cover, the lubricant must not be allowed to leak on to the brake mechanism.

Various devices are illustrated in Figs. 35-37, while Fig. 38 shows a new form favored by the author, which is of simple construction and easy to renew, and which will be capable of serving its proper purpose.

The type shown by Fig. 37, which is really a gland packing capable of adjustment from time to time, is not ideal, as, when tight enough to exclude oil, the friction on the shaft is of no small moment, while the chance of its being properly attended to is somewhat remote, as, in the author's opinion, it may be in such an inaccessible position that it is very seldom noticed, and is in any case a too frequent and complicated operation for most owner-drivers to undertake.

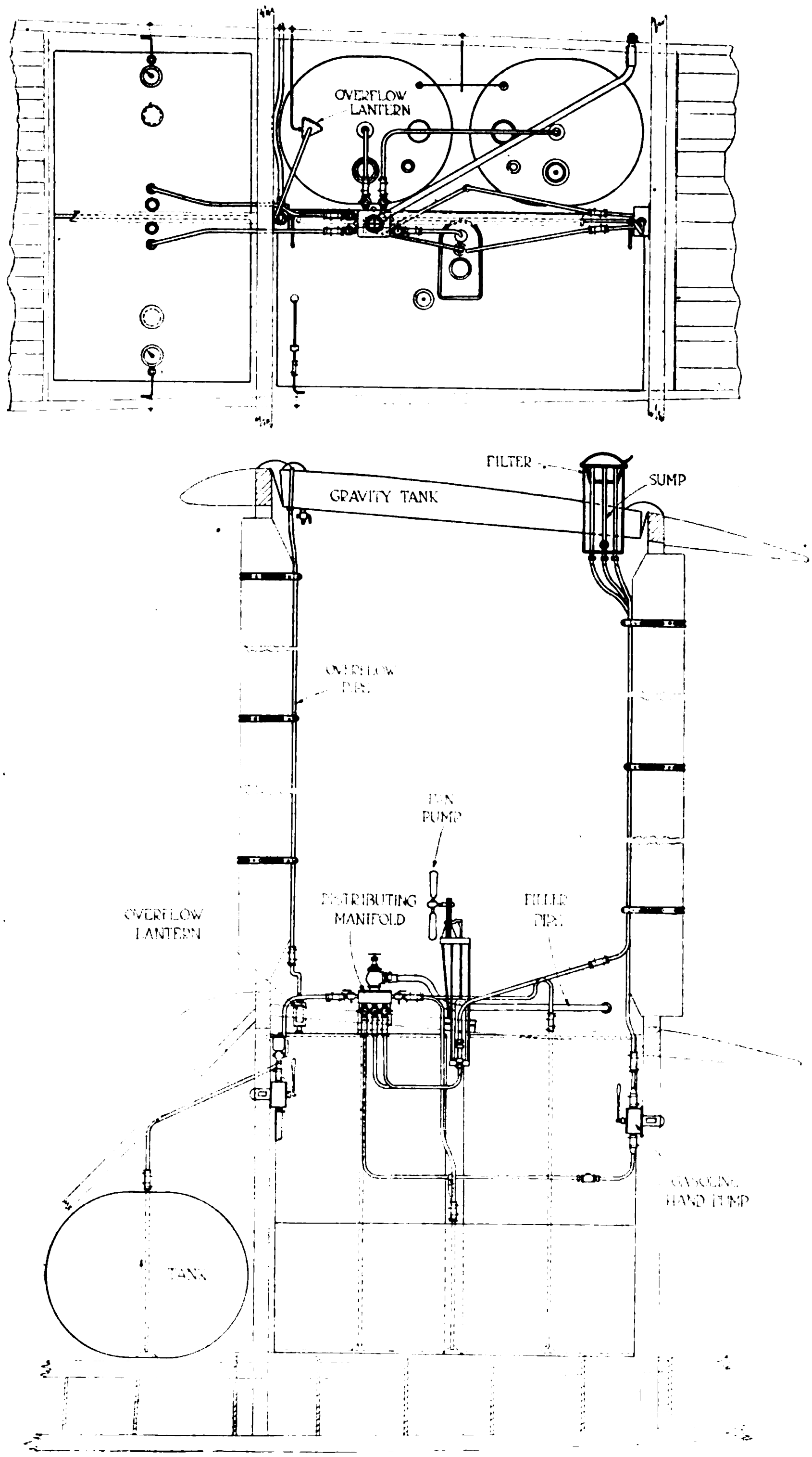
A much better method is employed on the Fergus car, and is illustrated by Fig. 39. This type provides for the wear of the packing ring, and does not grip the shaft too tightly; it has already been employed for the packing of oil and water pump glands on aero engines and is found to be thoroughly effective.

ALLOYS of iron with certain of the rarer metals are used to a great and increasing extent as a means of introducing these metals into steel, with a view either to removing oxygen from molten steel and securing sound castings or to securing special mechanical or other physical qualities in the steel. The manufacture of ferro-alloys is one of the principal electric furnace industries.

F-5-L Navy Flying Boat

Details of the Engine Mountings and Fuel and Oil Tanks—The Gasoline Supply System

Part III



Plan and elevation scale drawings showing the location and method of installation of the fuel tanks in the F-5-L Navy flying boat

By S. T. Williams
Assistant Chief Engineer, Naval Aircraft Factory, Philadelphia

SUMMARIZING the entire F-5-L flying boat, it was defined as a twin-motored tractor biplane, the engine being mounted at each side of the boat hull; the hull carrying the gasoline supply, crew and part of the ordnance. It was stated to have a wing span of 104 ft., a chord of 8 ft. and a boat hull 50 ft. long, the total flying weight being about 7 tons.

Two Liberty engines comprise the power plant. These engines are identical with the engines used by the army, with the exception of the pistons. The pistons are given more clearance, so that the compression pressure is reduced. The result is a slight reduction in maximum horsepower but greater engine life. This is advantageous because in seaplane service long patrols place a premium on dependability; and a seaplane does not habitually frequent high altitudes or require the maximum available horsepower.

In the main, the engine mounting differs only slightly from the mounting of the Liberty engines in the Curtiss H-12 and H-16 seaplanes. Horizontal laminated engine bearers are carried on wooden V-struts over each main wing hinge fitting, and are attached to the upper panel by tubular A-struts.

The radiator is carried on a bracket at the front, and the oil supply in streamlined tanks at each side of the bearers. However, in details, the F-5-L mounting is simplified, and made a better production proposition.

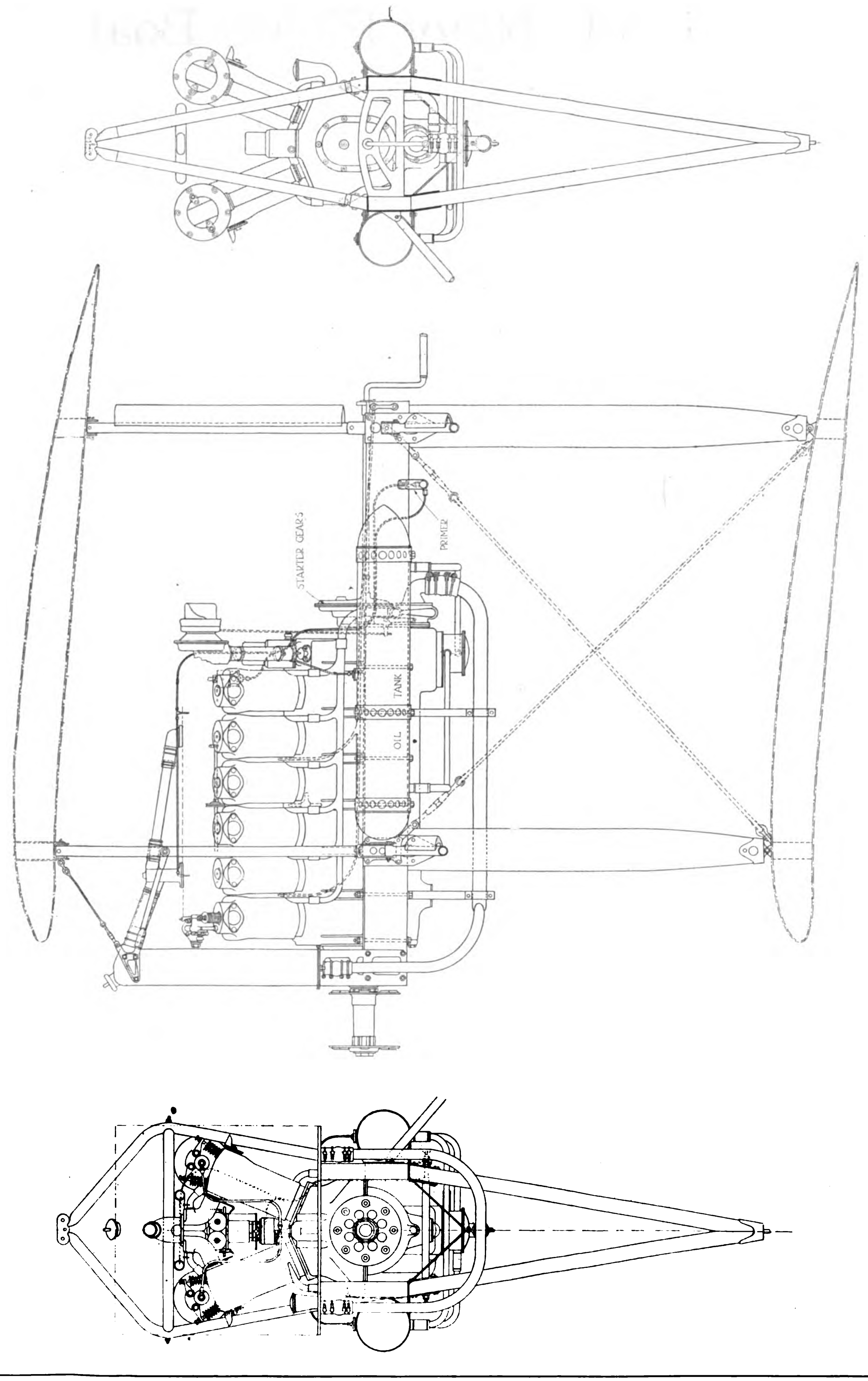
The first step was the elimination of drop forgings. Strap fittings built up and brazed together are used for attachment of bearers to V-braces, and the upper attachment of the A-brace to the engine section is also a strap fitting. This attachment is strong and simple. The ends of the tube are first fitted with a tubular sleeve, and then formed to a U-section.

In addition to the simplicity of construction, this end is extremely rigid. The A-braces are attached to the beam fitting through a universal joint bearing plate. This is also a built-up fitting.

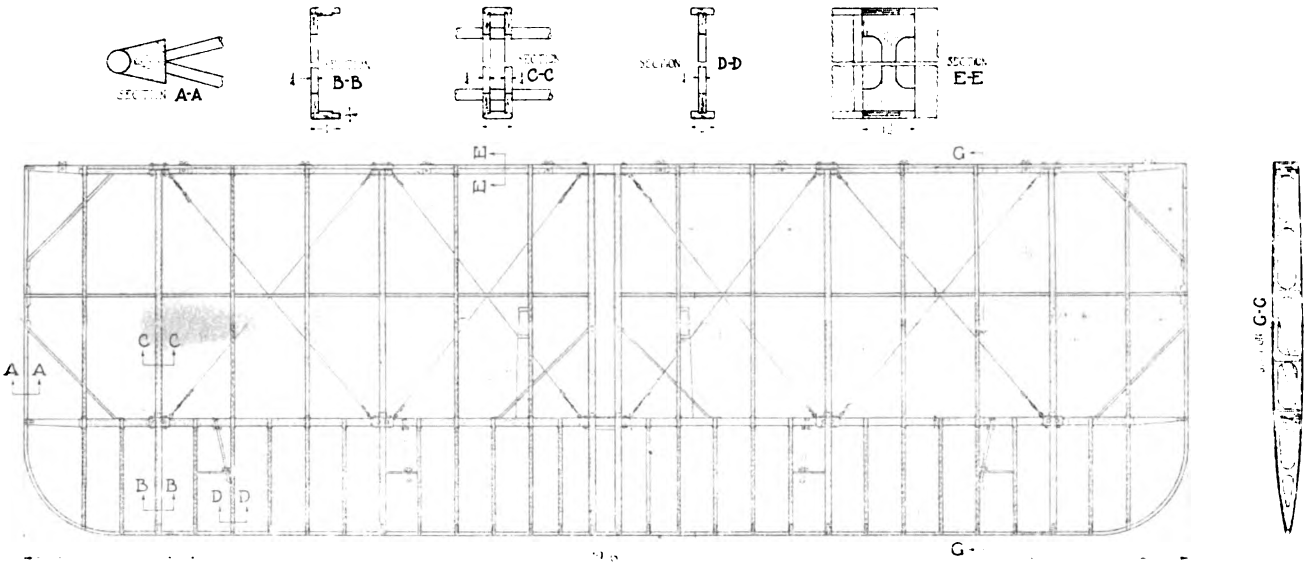
The forward A-brace is bowed to clear the engine cylinders, and the halves are tied together by a cross tube and through bolt. This brace must be removed before the engine can be taken from the plane, and the removable cross tube and through bolt permit this to be done.

Differing from previous construction, the engine bearers are carried forward so that a straight radiator bracket may be used. Previously, the bearers were cut off by the

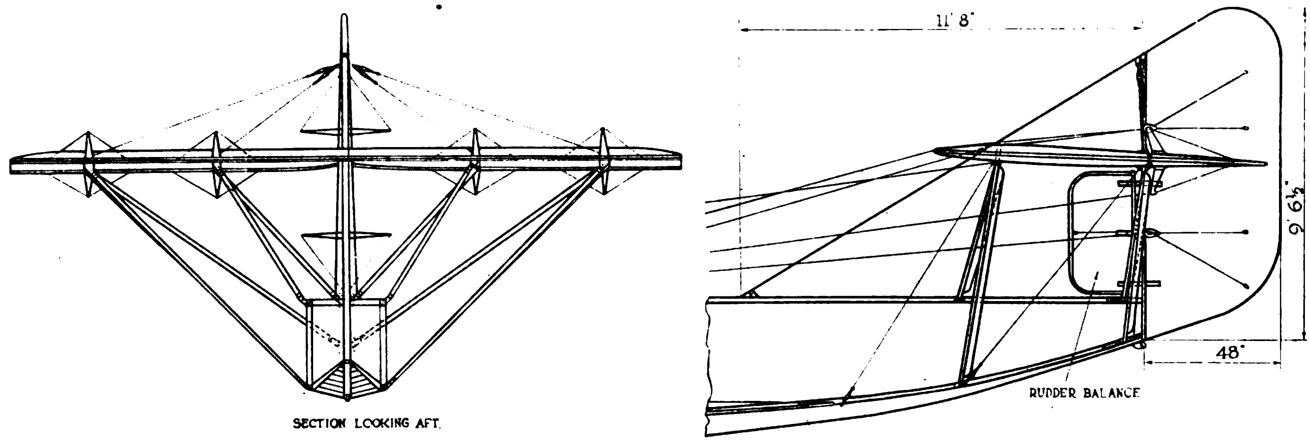
Scale Drawings of Liberty Engine Mounting in Navy F-5-L Flying Boat



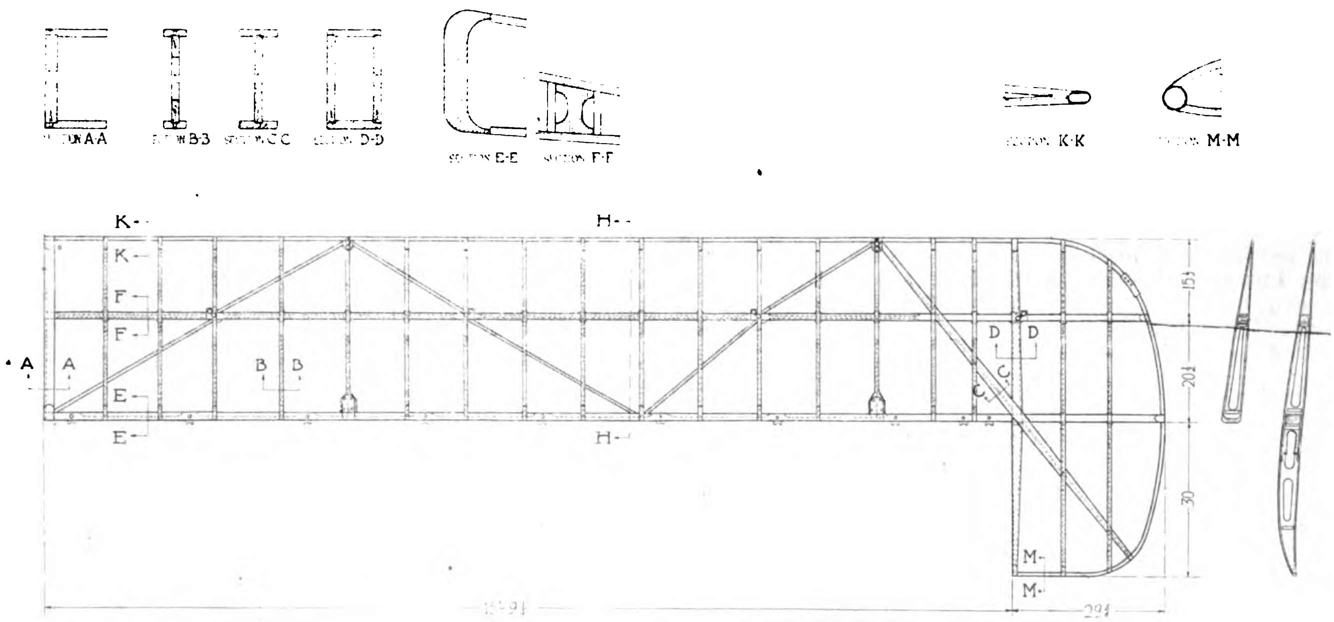
Panel and Control Details of F-5-L Flying Boat



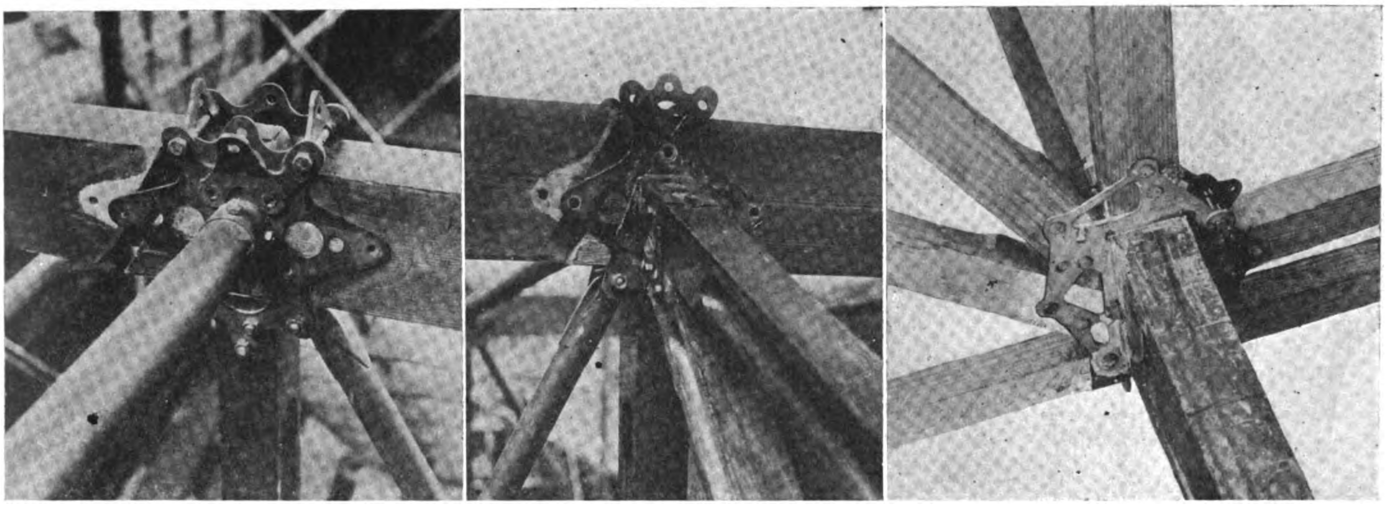
Details of the horizontal stabilizer



Dimensions and arrangement of the rudder and elevating gear



Plan of the left side aileron



EXAMPLES OF STANDARDIZED FITTINGS USED ON THE F-5-L NAVY FLYING BOAT

Front side of side wall beam center fitting — *Center side wall beam support and fitting* — *Center side wall beam fitting, rear side*

front engine flange and arched brackets used. However, the straight bracket is simpler to construct, and is possible on Liberty installations.

In an installation of this nature, it is, of course, impossible to start the engines by hand cranking on the propeller. For this reason a rear hand starter, comprising a reduction gear and clutch engaging the crankshaft, is used. One man can readily turn the engine over, though two are generally used.

As stated, the oil tanks are streamlined, cylindrical, and mounted at each side of the engine bearers. The total capacity per engine is 17 gal., and the two tanks are connected by a manifold, the division simply being constructional.

In later planes the side oil tanks are being superseded by one streamlined tank mounted between the engine bearers and behind the engines. This serves to clean the installation up to a marked extent.

A long-distance thermometer bulb is installed in the oil return line, and the gage is mounted in the mechanics' compartment by the tanks.

The oil pressure gage is installed on the pilots' instrument board. A water thermometer gage likewise is in the mechanics' cockpit. This location of the thermometers is because engine temperatures are of enough importance to demand quite frequent attention.

The gasoline supply is carried in five tanks placed amidships in the hull. There are two large cylindrical vertical tanks, one fore and aft horizontal tank, and two transverse horizontal tanks. The latter two were originally consolidated, but the single tank could not be removed without taking the plane to pieces. All have a total capacity of approximately 498 gal.

As these tanks are below carbureter level, a header or gravity tank is necessary. This is located in the upper wing, between the two engines, and carries about 20 gal.

The gasoline is pumped from the hull by a double-barreled windmill pump, and forced into the gravity tank sump. From this sump leads are taken to the two engines, and the surplus over this amount flows through small holes in the sump sides into the gravity tank.

Construction of Gravity Sump Noteworthy

When the gravity tank becomes full, an overflow pipe carries the excess back through a sight box into one of the tanks. And this overflow serves to show the mechanic that gasoline is being pumped and that the graviy tank is full.

The construction of the gravity sump is noteworthy. It will be noted that the base of the sump is somewhat below the bottom of the tank, and that the two are only connected through small holes at the sump sides. Hence if the gravity tank be shot away, the supply of gasoline pumped may be shut down to the amount used, with the base of the sump alone serving as a header tank.

A semi-rotary hand pump is used to fill the gravity tank when the windmill pumps are inoperative. This pump is an English design, and a similar pump is also used for bilge water.

The leads from all the supply tanks are consolidated into one manifold, and by regulating the valves gasoline may be pumped from any tank into the gravity tank. However, it all returns into the starboard forward vertical tank, and in flight gasoline is pumped alternately from this tank and each of the other tanks in rotation. It is necessary to pump from the tanks in rotation in order to trim ship and a separate manifold would be necessary to return the overflow gasoline to any tank.

Manifold Incorporates Filler Valve

It is to be noted that the manifold incorporates a filler valve piped to a union at the hull sides. This serves for the attachment of a pipe line from a supply boat or tank that the seaplane tanks may be filled by gasoline under pressure. Though this method of filling is not much used it is stated all the tanks may be filled thus in a few minutes whereas the funnel and measure method takes from a half to one hour.

There are few other points of interest in the gasoline system, standard sumps being used to prevent water and dirt from reaching the engine and dial gages being used on the tanks to show the gasoline supply at hand. Throughout the system all pipe line connections are through olive joints, and the features here are ease of connection, flexibility, and the fact that full flow of gasoline is permitted. As an aid to starting, a small hand primer permits raw gasoline to be pumped into the intake manifold.

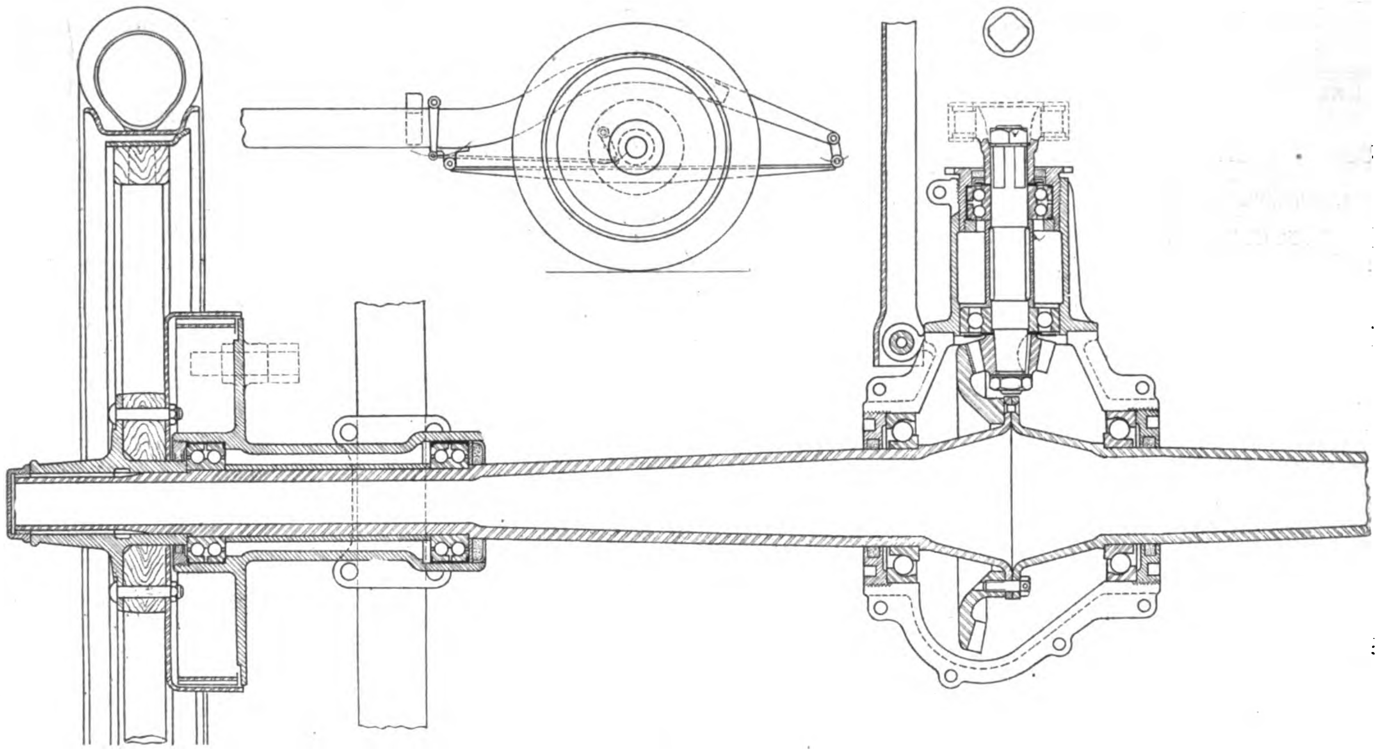
(*To be continued*)

Advocates Adoption of Metric System of Weights

THE adoption of the metric system of weights and measures is advocated by Harry Allcock in the *Bulletin* of the Federation of British Industries. He suggests that the Government should encourage the more widespread use of the international metric system both in the United Kingdom and in the British Empire generally by officially recommending all British manufacturers hereafter engaging in new industries, or introducing new standards into existing industries, to base their operations on the metric system on the distinct understanding that the Government will adopt that system as the sole legal system of weights and measures five years hence, or upon such later date as Parliament may then decide. He also suggests that the requirements of all Government departments should be specified in terms of the metric system wherever possible, and recommends other public and semi-public buyers to follow their lead in the national interest.

Kline Undivided Driving Axle

Is Built Without a Differential and Has Hollow Driving Shafts Which Also Serve as Carrying Members, Giving a Low Unsprung Weight



Section through Kline's solid driving axle

A RATHER interesting design of driving axle has been patented by Harmon J. Kline of Detroit, Mich. A sectional view of this axle is shown in the accompanying illustration. Mr. Kline's object in designing this axle was to produce a design that is relatively light in weight, inexpensive in construction and durable.

It has been proved in automobile racing that it is not necessary to employ a differential gear on a high speed car; under certain conditions of operation the differential is a positive detriment, as when one of the driving wheels stands on slippery ground, when it is impossible to obtain the necessary traction. The braking also becomes defective as the result of the differential action.

A tubular construction was adopted for the axle shaft in order to obtain an axle of maximum strength for a given weight. The great section modulus of the axle will enable it to easily withstand the strain due to the slight slippage of the wheels while turning corners.

The advantages of the low, unsprung weight are well known. A car having this feature will be easier riding, and will be less hard on the tires. Of course, the effect on the tires will be more or less neutralized by the increased wear due to slippage in turning corners.

An axle of this type would be most suitable for a speed car intended mainly for touring. Its low cost of construction would be a factor in its favor.

Steam Tractors in Germany

THE use of steam tractors and tractor wagons for the transport of heavy loads which came into favor in Germany during the war, owing to the shortage of motor trucks and fuel, has proved so satisfactory even in the most congested districts of Berlin that it is expected that that mode of transport will be used to an increasing extent after the war where rapidity of transport is not of great importance. Some relaxation of transport regulations, to which such tractor-trains are subject, will, of course, be necessary, owing to their weight exceeding 9 tons. A law and a decree exist according to which it is necessary for users of heavy road vehicles to obtain the permission of the authorities responsible for the maintenance of roads before such vehicles can be allowed to ply. It is suggested that the speed of steam tractors should be limited to 6 km. per hour, thus getting over the objections of the road authorities, who fear further increased maintenance expenses. The strengths of certain bridges would also have to be increased to bear the extra loads involved, and smoke and soot would have to be eliminated as far as possible. Coke has been used successfully for this type of tractor in Berlin.

Duration of Gas Explosion

C. A. NORMAN, in a paper read at the recent annual meeting of the American Society of Mechanical Engineers held in New York, in support of his opinion that combustion is not complete before expansion begins, said: "Clerk concludes from his experiments on an engine running at only 160 r.p.m. that some combustion is proceeding after the whole normal expansion stroke and whole intervening compression stroke. All experiments with closed vessels show gas explosions to take certainly not less than one-fortieth of a second, and this with only rich mixtures. With normal mixtures it takes a much longer time than that to reach the maximum pressure. Turbulence accelerates combustion very much. Yet such direct experiments seem to show that with normal mixtures even a turbulent combustion would take quite one-fortieth of a second. That, however, is exactly the time occupied by the whole expansion stroke of an engine running at 1200 r.p.m. We have, then, absolutely no reason to assume that the combustion is complete before the expansion begins.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1919 by the Class Journal Co.

Vol. XL Thursday, April 3, 1919 No. 14

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address .... Autoland, New York
Long Distance Telephone .... 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico .... One Year, $3.00
Canada .... One Year, 5.00
Foreign Countries .... One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Industrial Training

A LITTLE over a year ago, when it was attempted to supply the Army's needs in carpenters, plumbers, electricians, machinists, etc., from the young men in the draft, it was found that the number of mechanics available was not half enough, and to make up for the deficiency the plan of giving instruction in the handicrafts at the different colleges and universities of the country was conceived and put into effect. The schedule called for the training of 90,000 men, each of whom was to be given two months' schooling. It is obvious that in this limited time it was impossible to impart to the soldier-students a variegated training, so it was decided to teach each set of men a certain well-defined subject, but to make them as nearly as possible perfect in that branch.

The experience with the young men in the draft discloses a defect in our educational system. We see to it that every child gets a common school education, and up to the age of 14 the educational needs of all are provided for. Then follows that important period in life from 14 to 18 years, when the boy is usually allowed to do as he pleases. Instead of looking ahead and endeavoring to get a sound training in some good vocation, he will select the job that pays the best or that seems to require the least exertion. Employers also often take a narrow view of the situation, endeavoring to obtain the most work out of the boys without giving them a chance to qualify themselves for something better in years to come.

In Continental Europe industrial training schools have been a regularly established institution for a great many years. All young men engaged in learning trades are required to attend industrial evening schools in which such subjects as geometry, mechanical drawing, commercial arithmetic, etc., are taught. England last year introduced a similar system and the United States is now the only great industrial power in which the training of young men in secondary industrial schools is practically unknown.

We have been trying, by the extreme division of labor, to minimize the need for skilled men and have achieved really remarkable results in this way, but in the case of an emergency like the late war the country would be in a much more secure position if it possessed a greater number of well-trained mechanics. Would it not add greatly to our national assets if, instead of allowing our boys beyond the grammar school age to while away their spare hours in idleness, we compelled them to attend classes in which are taught the practical subjects listed above?

Dual Rotation Engines

MOST prime movers comprise one major stationary and one major movable part, and the output of power per unit of weight or bulk depends greatly upon the speed of the moving part. What really counts is the speed of one part relative to the other, but as long as the one part is stationary this is the same as the absolute speed of the other part. Assuming the speed of the moving part to be limited by conditions of strength of materials, it follows that if both parts could move, in opposite directions, the power obtainable from an engine of given dimensions could be greatly increased.

This principle was first applied to electric automobile motors. The armature speed of an ordinary automobile motor is limited by the fact that a single step gear reduction to the rear wheels is usually desired, besides which the wear and tear at very high speeds is excessive. By mounting the field frame so it can rotate, the relative speed of armature and field poles—and hence the output—can be doubled without increasing the strain on the parts and without introducing difficulties in gear reduction. The armature is geared to one road wheel and the field to the other, and the incidental advantage is gained that no differential is required.

The same principle may be (and has been) applied to internal combustion engines. Indeed, after Sequin in France and Farwell in this country had developed the rotary cylinder engine it was a foregone conclu-

sion that before long some one would build an engine in which both the cylinders and the crankshaft rotated. Textbooks on aircraft engines mention a Burlat engine which is of this type, but little has been heard of this engine's practical performance. It is evidently a long step from the mere conception of the idea to its practical embodiment in successful form. But the war has also seen this idea carried to fruition, for during the latter stages of the struggle the Germans put into service a single seater with a Siemens & Halske dual rotation engine which for a 240-hp. engine has the remarkably low weight of 1.78 lb. per horsepower, besides which the fuel consumption is said to be little if any more than that of stationary cylinder aircraft engines.

In connection with the early dual rotation engines, it was planned to use double propellers, say a right-handed traction propeller and a left-handed pusher propeller. This plan, of course, does not work out well in the case of single-seater scout machines, and the Siemens & Halske has only a single propeller, which is secured to the revolving cylinder structure. There is a gear connection between the cylinder structure and the crankshaft, comprising a set of three bevel gears, two of them coaxial, which are keyed to the crankcase hub and the crankshaft respectively, and the third on a stationary shaft or stud, meshing with both of the others. The power of the rotating crankshaft is thus transmitted to the oppositely revolving crankcase through the bevel gearset.

It is quite possible that the successful application of the dual rotation principle will revive the vogue of the rotary aircraft engine. With this construction it is possible to use comparatively low absolute speeds, so that the centrifugal stresses and the gyroscopic effect of the engine on the plane can be kept down. In fact, the gyroscopic effect can be practically eliminated, owing to two sets of parts rotating in opposite directions. Owing to the high virtual speed, that is, the short period of time required to complete the cycle, the thermal efficiency is bettered. With all rotary engines the churning of air is a serious source of power loss and with low speed of rotation this will be lessened. Finally, low speed tends to increase propeller efficiency.

The chief objection to the rotary engine in aircraft work so far has been its uneconomical use of fuel. This probably was due to the peculiar cycle employed and can hardly have any direct connection with the rotary principle. Since air cooling permits of, and in fact compels, the use of higher cylinder temperatures, it should be possible to overcome this handicap.

Tractor Development Threatened by Legislation

DURING the early period of automobile development a great deal of restrictive legislation was passed which considerably hampered the popularization of the new means of locomotion. It now looks as though a similar flood of tractor legislation was about due. There will be this difference, however, that whereas automobile legislation sought to regulate the use of the machines, tractor legislation will be so drafted as to control their sale.

Committee to Pass on Makes

In Nebraska legislation is proposed whereby a committee to be appointed from the Faculty of Agriculture of the State University is to be given power to determine which tractors shall and which shall not be allowed to be sold in the State. This would be an entirely new departure in legislative interference in business. The farmer buys a lot of other machinery besides tractors, such as binders, threshers, hay loaders, etc., and, if our memory serves us, no legislation has ever been adopted to appoint committees to pass on the worth of different makes of these machines. All these different classes of farm machinery had to pass through a development stage, when they were far from perfect. This stage unfortunately cannot be eliminated by legislative action. As the saying goes, a child has to crawl before it can walk, and so with new types of farm machinery: The best possible use has to be made of them while they are being developed.

Probably the argument will be made that the farmer should be protected against unscrupulous manufacturers who offer a product that is not up to the standard of the times and who do not stand behind it with adequate service facilities. The answer is that the best protection that can be given is that resulting from the system of selling through local agents. The farmer does not buy his tractor by mail from a catalogue house but from a nearby dealer, which latter often also sells automobiles and farm implements.

If a dealer in selecting his line picks a poor machine, or if he falls down on his repair service, the news will soon spread over the whole neighborhood and give him a serious set-back, if it does not ruin his business. Therefore, the dealer has very much at stake in making connections, and we believe the farmers' interests are safer in his hands than in the hands of a committee with no personal responsibility but with all the power of the State Government behind it.

To Compel Parts Service

Another thing which it is proposed to regulate by law is the maintenance of a parts supply in the state. While it is possible to compel manufacturers to maintain stocks of parts as long as they are selling tractors in the state, the chief difficulty in the past has been due to unsound manufacturing concerns going into bankruptcy and leaving customers with orphan machines on their hands. Now, it is quite conceivable that firms having the official sanction would fail in business, and the paternalism of the State would then prove of little avail to the farmer.

Latest News of the

10% Duty in France on European Cars and 45% on American

Congress of Automobile Manufacturers, Representing America, France, Belgium, England and Italy, Decides in Favor of Stiff Tariff—Attempt at Secrecy Badly Received

PARIS, March 10—A European import duty of 10 per cent against all European cars and a 45 per cent import duty in all European countries against American automobiles was the decision arrived at in the Congress of Automobile Manufacturers representing America, France, England, Italy and Belgium which met in Paris this week.

The Congress also voted that the Paris show would be held in the Grand Palais during the month of October, the London show in November, Brussels show in December, New York in January, and Chicago in February, as published in AUTOMOTIVE INDUSTRIES, March 27, page 721.

Before the war there existed a Union of Recognized Automobile Manufacturers' Associations. Germany and Austria were members of this Union. America was never invited to take any part in it. Its headquarters were in Paris, and the general secretary was Henri Cézanne, who is also secretary of the French Automobile Manufacturers' Association. It is impossible to hold a meeting of this Union without inviting Germany and Austria, and as there is no intention of entering into negotiations with these enemy countries, the union is being allowed to die a natural death.

45 Per Cent Duty on American Cars

On the other hand, it was necessary that there should be an exchange of views between the automobile manufacturers of Allied countries. The French manufacturers' association, therefore, invited delegates from England, Belgium, Italy and America to a meeting to be held in Paris. The American delegate was C. C. Hanch, representing the National Automobile Chamber of Commerce. It was this meeting which voted 45 per cent import duties throughout Europe against America, while retaining a 10 per cent duty among European countries.

A well-organized attempt was made to prevent any of the decisions of this congress reaching the press. While the proceedings were in progress not an atom of news was allowed to leak out.

When the congress came to a close an official communication was made to the press, but this had obviously been written with a view to hide the truth. Gradually the news leaked out, and finally, 3 days after the closing of the Congress, a French journal, *L'Echo des Sports*, revealed the whole proceedings. This attempt to put a cloak of mystery around the meeting has been very badly received in France.

As the outcome of this meeting a permanent Bureau of Inter-allied Automobile Manufacturers has been created. The American representative on this Bureau is the National Automobile Chamber of Commerce; France is represented by the Chambre Syndicale des Constructeurs d'Automobiles; England, by the Society of Motor Manufacturers & Trades; Belgium, by the Chambre Syndicale de l'Automobile de Belgique, and Italy by the Union Italienne, of which Engineer Marchesi, of the Fiat Co., is president. It is to be noted that this is the first time the American Automobile industry has been officially recognized by European manufacturers.

Mr. Hanch, who attended the meeting on behalf of the National Automobile Chamber of Commerce, refused to make any statement regarding the proceedings. He said that he had been sent over as the official delegate of the Chamber, and while in Europe intended to visit the leading automobile factories of France, Italy and England.

L'Echo des Sports, an independent French paper, has protested in strong language against the decisions of the Congress. It maintains that the importance of America as an automobile exporting nation is decreasing. In 1910, it declares, America exported 11 per cent of its automobile production; this dropped to 10 per cent in 1911, 8 per cent in 1912, 6 per cent in 1913, and 4 per cent for the first 6 months of 1914. All the European countries are automobile exporters. Thus, during the year 1913-1914 France exported 44 per cent of her automobile production, Italy 71 per cent, England 52 per cent, and Belgium 38 per cent. Protectionism, declares this paper, will ruin France.

France Favors 45 Per Cent Duty

PARIS, March 14—America has the reputation of being the home of yellow journalism, but the Hearst papers have been outmatched entirely by the Parisian journal *L'Echo des Sports*. When the Inter-allied Congress of Automobile Manufacturers was held in Paris last week all the business papers were annoyed at being unable to get anything more than a brief official summary of the proceedings. It was known that the question of import duties had been discussed, but no real information on this matter was issued.

Three days after the closing of the Congress *L'Echo des Sports* came out with what it claimed was a complete report of the proceedings. It maintained that the Congress had voted in favor of 10 per cent import duties in all European countries against European cars, and 45 per cent in the same countries against American cars. It now appears that this information was substantially correct, although no actual vote was taken.

The information was printed in such a way that it appeared to have been given out by C. C. Hanch, delegate of the N. A. C. C. now in France. Further, *L'Echo des Sports* hinted that it and Mr. Hanch were the only ones in possession of certain statistics regarding European and American exports. It also declared very proudly that on the day after the meeting Mr. Hanch sent a cable to Southerland E. Taylor, export manager of the Studebaker Corp., expressing his satisfaction at the vote taken by the Congress on this matter.

The facts are that there is no such person connected with the Studebaker Corp., that Mr. Hanch sent no telegram to the United States, and that he gave no information to any member of the press. All the information given by *L'Echo des Sports* with regard to Mr. Hanch originated in the fertile brain of the *Echo des Sports* reporter.

Automotive Industries

Ten French Firms in Union

No Competition in Models—Will Pool Purchases and Manufacture

PARIS, March 14—Ten French automobile manufacturers have formed a union to make their purchases in common, thus getting the advantage of lower rates; to standardize many parts of their cars, to avond direct competition by the production of similar models, and to produce a joint cheap car. The ten firms involved are Delage, Darracq, Clement-Bayard, Unic, Aries, Charron Limited, Delahaye, Brasier, Chenard-Walcker and Lorraine-Dietrich.

While the war was in progress it was suggested that the French manufacturers should co-operate through their national association in order to avoid direct competition, and get the advantage of standardization of parts. After negotiations had been carried out, it was realized that the entire trade was too big for real co-operation. As a consequence, the initiative was taken by Louis Delage to get together a group of manufacturers who would reveal their plans to one another, and who would co-operate toward standardization and low cost of production. The ten firms forming this group are all, roughly, of the same financial and engineering importance. The biggest does not employ more than 6000 workers, and the smallest has a staff of 2000. They do not all aim at producing the same type of car; indeed, one of the objects of the union is to prevent this, but they all do good engineering work.

One of the first results of this union is that no firm will build more than two models, and, as far as possible, each one will endeavor to avoid coming into direct competition with the type of car built by another member of the union. In order to make this possible, the members agree to put their plans before the union, and in case of dispute to submit to arbitration. An engineer who was formerly with Delahaye has been appointed general engineer for the union, and will work on questions of standardization and records for all ten firms.

An immediate benefit is expected to be obtained by pooling purchases of raw materials, for these ten firms are collectively equal in importance to the largest single automobile firm in France. The next almost immediate advantage is that no two of these firms will produce exactly the same type and same priced car. Where it is impossible to avoid competition there will not be more than two in any one class.

Advantages from standardization will be a little longer in coming. It has already been decided, however, that these ten manufacturers will reduce tire sizes to four. The union is now working on the standardization of electric equipment, size and type of battery, size of bolts and nuts, size of brake liners, size of steering wheels, gasoline connections, magneto bases and couplings, body dimensions and fittings, etc. There is no intention of stultifying design. Every manufacturer will be free to follow his own plans, but will at all times endeavor to work with the standards of the union.

It is quite possible that there will be a considerable exchange of finished material between these factories as work progresses. For instance, Delage now makes a piston of 88-mm. bore for a high-class 6-cylinder car. There is no reason why he should not also make the pistons for the Charron 4-cylinder car, which has the same bore. Another firm well equipped for cutting spiral bevel gears could very advantageously cut these gears for two or three other members of the group.

The buyer will be disposed to make his purchases inside this group when he realizes that most of the electrical equipment is the same for the twenty cars built by these ten firms; when he realizes that fifteen out of twenty front springs are interchangeable, that most of the ball bearings are the same size and type, that a length of fan belting will be the same from whatever firm it is bought; in a word, that he has the stocks of ten dealers at his disposal instead of one.

The designs are being worked out in common, with a view to low cost of production, and it is understood that each firm shall build the part for which it is best fitted. There will be a separate assembly plant and selling organization.

Former Ford Assistant Chief Engineer Allied with Chief

Special Telegram

DETROIT, April 3—Charles Mongana, Jr., who resigned as junior assistant chief engineer of the Ford Motor Co. this week, has associated himself with his former chief, C. Harold Wills, who resigned his position as chief engineer of the company two weeks ago. It is said that Mr. Wills left the Ford organization to bring out a new car. He will neither confirm nor deny this report, but states that he will remain in the automotive business. He has opened an office in the Book Building. Mr. Mongana was with the company for seven years, and during the war was in charge of its Liberty engine operations.

A. M. Wible, who has been connected with the Ford engineering department for some time, succeeds C. Mongana.

Natural Gas Recovery Increasing Rapidly

Multiplied 28 Times in 6 Years—Solution of Fuel Problem Indicated

WASHINGTON, March 31—The recovery of gasoline from natural gas is increasing and has attained special importance as a potential solution of the gasoline problem, according to John Dean Northrop, chief of the Petroleum Division of the U. S. Geological Survey, Department of the Interior. In a pamphlet discussing this subject, Northrop states that although the recovery of gasoline from natural gas is an industry scarcely a dozen years old, still in process of growth, it has become a material contributor to the domestic supply of motor fuels. Following are excerpts from Northrop's pamphlet:

"In 1911, the first year for which statistics are available, 176 plants in nine states produced 7,425,839 gal. of raw gasoline from natural gas. In 1917, only 6 years later, 886 plants in twelve states produced 217,884,104 gal., a gain in that brief period of 403 per cent in the number of plants and of 2834 per cent in the annual output of raw gasoline.

"Prior to 1916 the greater portion of the gasoline recovered from natural gas was obtained from casing-head gas, oil-well gas, or 'wet' natural gas by methods involving compression and condensation. Much of the output came, of course, from plants specially designed and installed to recover the gasoline vapors carried by gas of that type, but a fair proportion, particularly in the Appalachian oil field, was recovered incidentally by the use of simple and relatively inexpensive condensing apparatus, connected with vacuum pumps installed to expedite the production of oil, and some was recovered as drips from gas transmission lines.

"Since 1913, however, a steadily increasing proportion of the annual output of natural-gas gasoline has been recovered by the absorption process. With the scope of the industry broadened to include practically every type of natural gas found in the United States, its growth since 1913 has been in the direction of increased capacity for production of gasoline rather than in a direction that would tend to determine what other products could be derived from natural gas by variations in the methods employed to recover gasoline."

Discussing the industry further with relation to the production in the United States, Northrop stated that the year 1917 was one of marked expansion. "The quantity of raw gasoline recovered from

natural gas in that year," states Northrop, "including that produced by compression, by absorption, and by vacuum pumps, as well as that saved as drips from gas mains, was 217,884,104 gal., a gain of 114,391,415 gal., or 111 per cent, over the output in 1916. Of this quantity 168,866,555 gal., or 77.5 per cent, was recovered by compression and by vacuum pumps and the remaining 49,017,549 gal., or 22.5 per cent, by absorption and by salvage from gas mains. The combined gasoline obtained by compression and by vacuum pumps was greater than in 1916 by 83,943,768 gal., or 99 per cent, and the gasoline obtained by absorption and from drips was greater by 30,447,647 gal., or 164 per cent.

300,000,000 Gallons in 1917

"The quantity of commercial gasoline represented by the raw gasoline in 1917, though not susceptible of accurate determination, probably amounted to more than 300,000,000 gal.

"The average price received in 1917 for the raw gasoline at the sources of production was 18.45 cents a gal., and the market value of the entire output was $40,188,956, a gain of 4.6 cents in average unit selling price and of $25,857,808, or 180 per cent, in gross market value, compared with 1916, which reflects the steadily appreciating value of motor fuels in the period under review.

Gasoline Recovering Plants Increase

"The volume of natural gas from which the natural-gas gasoline was recovered in 1917 amounted to about 492,000,000,000 cu. ft., and the average recovery of gasoline per 1000 cu. ft. by all methods was about half a gallon.

"The number of plants, including vacuum-pump plants, recovering gasoline from natural gas increased from 596 at the beginning of 1917 to 886 at the end of that year, a gain of 49 per cent, and the combined daily capacity of all plants increased during the same period from 495,448 gal. to 902,385 gal., or about 82 per cent."

The analysis of the natural-gas gasoline industry by states is indicated in the table below:

All Aerial Activities Under One Head

Director to Have Charge of Training, Supply, Administration and Information.

WASHINGTON, March 31—Army aerial activities will be co-ordinated under one head by the Director of the Air Service. The reorganization is designed to supersede the dual wartime air establishment and to develop peacetime activities. Major-General Charles T. Menoher, Director of Air Service, has assumed full charge of all the aerial activities. He has appointed an executive organization under Col. M. F. Davis, who in turn has divided the duties of the various branches into four groups, as follows: (1) Training and Operations; (2) Supply; (3) Executive and Administrative, and (4) Information, Publication and Statistics.

The Chief of the Supply Group has charge of the supplies, airplane engineering, production, procurement, inspection, maintenance and finance disbursement for the entire Air Service, including both the old branches—Aircraft Production and Military Aeronautics.

The Chief of the Information Group gathers and distributes all information, statistics and publicity. In wartime he would have charge of intelligence work for the whole Air Service.

The Chief of the Training and Operations Group directs all training and operations.

The Chief of the Administrative Group is practically the Adjutant-General of the Air Service, controlling administration and executive work, personnel, office management, the medical section, cables, correspondence, etc.

Brigadier-General William Mitchell assumed charge of Training and Operations. Colonel William E. Gilmore became Chief of Supply. Lieutenant-Colonel William F. Pearson assumed charge of Administration and Major Horace M. Hickam became Chief of Information. It is to be noted that the Supply, Administration and Information Groups exist practically for the creation and maintenance of the Training and Operation Group. The latter has at its head the ranking officer of the branch chiefs—Brigadier-General Mitchell.

Each branch chief is directly responsible to the Director of the Air Service, and in this manner the activities of the entire service are co-ordinated in and centered upon the office of the Director.

Following the overseas divisional system, the Director has designated the Supply Group as first in the organization, Information as second, Training and Operations as third, and Administration as fourth. This does not imply rank. Each chief is immediately responsible to the Director. The Director designates what action is to be taken, lays down service policies and co-ordinates the activities of all four branches.

The primary purpose of this organization is to develop the Air Service, cooperate in the advancement of commercial aeronautics, and promote the principle that the United States deserves a leading place in the air, promised by our original application of the principles of mechanical flight.

Natural-Gas Gasoline Marketed in the United States in 1917

State.	Number of operators.	Plants. Number.	Plants. Daily capacity.	Gasoline produced. Quantity	Gasoline produced. Value.	Price per gallon.	Estimated volume of gas treated.	Average yield of gasoline per thousand cubic feet of gas.
Oklahoma	167	234	492,436	115,123,424	21,541,905	18.71	84,719,941	1.359
West Virginia	128	188	135,663	32,668,647	6,511,813	19.93	167,771,351	0.195
California	45	49	99,761	28,817,604	4,438,022	15.40	45,351,247	0.635
Pennsylvania	287	251	59,164	13 826,250	2,778,098	20.01	49,487,056	0.279
Texas	10	11	32,550	6,920,405	1,149,441	16.61	12,677,216	0.546
Ohio	49	61	25,137	5,439,560	1,051,376	19.33	30,062,141	0.181
Louisiana	15	20	20,118	4,979,754	814,747	16.36	2,233,511	2.229
Illinois	33	55	17,392	4,934,009	866,033	17.55	2,685,895	1.837
Kentucky	5	5	13,400	3,818,209	763,186	19.99	24,915,946	0.153
Kansas	4	6	4,642	1,174,980	241,219	20.53	9,315,339	0.126
New York, Colorado	7	6	2,122	181,262	33,116	18.27	68,154	2.659
	750	886	902,585	217,884,104	40,188,956	18.45	429,287,797	0.508

Saxon Reorganization Plan Goes Through

DETROIT, April 3—At the moment of going to press word has been received that the advisory committee handling Saxon affairs will meet immediately and declare the present stock forfeited and reorganize, according to the plan already outlined in the March 20 issue of AUTOMOTIVE INDUSTRIES. This step has been taken because of the apparent lack of interest of stockholders and the failure of repeated efforts to get them together. As already stated, this will virtually wipe out the $6,000,000 stock of the company, and will call for an issue of $2,000,000 in bonds, $1,500 000 preferred stock and $3,200,000 common. Creditors will receive common stock in return for their obligations. The committee will meet this week either here or at Chicago to take action necessary to authorize the reorganization.

The reorganization of the company will not affect production operations. The plant is turning out between 40 and 60 cars daily and orders are already two months ahead of production.

General Motors Capital Now $370,000,000

DETROIT, March 31—The General Motors Corp., Wilmington, Del., has taken out papers at Lansing showing an increase in capitalization from $102,600,000 to $370,000,000. The Michigan Crank Shaft Co. of Muskegon has increased its capital from $50,000 to $200,000. The Union Tire Co., Detroit, has been organized with a capitalization of $100,000. The Moto-Meter Co. of Long Island City has incorporated its Michigan branch company, with headquarters in Detroit. Capitalization figures are $75,000. The T. W. D. Tractor Co. has been formed in St. Clair and incorporated for $100,000.

Program for Foreign Trade Convention

To Take Up Every Phase of Foreign Trade on April 24, 25 and 26.

NEW YORK, April 3—The complete program is now ready for the Foreign Trade Convention which is to be held in Chicago, April 24, 25 and 26. The convention is to take up every phase of foreign trade, and includes such well-known experts as James A. Farrell, Hugh Frayne, Eugene Meyer, Jr., P. S. Steenstrup and others. Following is the complete program:

THURSDAY, APRIL 24

Morning

Session Topic: America's Need of Foreign Trade.
The Effect of Increased Productive Capacity Upon Our Foreign Trade—Edward Prizer, president, Vacuum Oil Co.
America's Financial Equipment for Foreign Trade—Fred I. Kent, vice-president, Bankers Trust Co.
The Interest of Labor in Foreign Trade—Hugh Frayne, War Industries Board.
The Element of Labor Cost in American Exports—William Pigott, president, Seattle Car & Foundry Co.

Afternoon

The Vital Concern of Agriculture in Foreign Trade—Charles J. Brand, Chief of Bureau of Markets, U. S. Department of Agriculture.
The Mississippi Valley and Foreign Trade—John M. Parker, president, Mississippi Valley Association.
The Bargaining Tariff—Hon William S. Culbertson, U. S. Tariff Commission.
The Stabilizing Effect on American Industry of a Definite Foreign Trade Policy—J. W. Hook, president, Allied Machinery Co. of America.

Evening

Group I. Commercial Education for Foreign Trade.
Export Technique: Job Analysis of an Exporting House, Showing What Employees Should Know—D. E. Delgado, export manager, Eastman Kodak Co.
Cultural Equipment for Foreign Trade—John F. O'Hara, C.S.C., Notre Dame University.
Vocational Education for the Business of Exporting—R. S. MacElwee, assistant chief, Bureau of Foreign and Domestic Commerce.
Report of Foreign Trade Training Survey of U. S. Bureau of Education—Glen Levin Swiggett, specialist in Commercial Education, U. S. Bureau of Education.
Group II. Foreign Trade Merchandising.
America's Foreign Commerce and the Necessity for Co-operation of All Interests to Protect It—W. H. Douglas, president, Arkell & Douglas, Inc.
The American Foreign Trader — John F. Fowler, vice-president, W. R. Grace & Co.
Can American Fabricated Products Hold Foreign Markets?—Wm. E. Peck, president, W. E. Peck & Co.
The Mechanism of Foreign Trade—Wm. H. Knox, president, Wm. H. Konx & Co.
Group III. Financing Foreign Trade.
Financing Our Excess of Exports—Eugene Meyer, Jr., managing director, War Finance Corporation.
Acceptances in Foreign Trade—D. C. Wills, Federal Reserve Bank, Cleveland.
American Branch Banks Abroad—James H. Carter, vice-president, National City Bank.
Foreign Exchange—J. McCurrach, vice-president, Continental and Commercial National Bank.
Group IV. Advertising for Foreign Trade.
Survey and Method—F. A. Arnold, manager, Foreign Department, Frank Seaman, Inc.
Media—Stanley Resor, president, J. Walter Thomson Co.
Foreign Advertising Successes—W. G. Hildebrandt, Gotham Advertising Company.
Discussion—J. W. Helburn, Tanners Council of U. S. A.

FRIDAY, APRIL 25

Morning

Session Topic: The American Merchant Marine.
American Shipbuilding — Homer L. Ferguson, president, Newport News Shipbuilding and Drydock Company.
The World's Merchant Fleets To-day—W. S. Tower, Division of Planning and Statistics, U. S. Shipping Board.
The Future of the American Marine on the Pacific — Frederick J. Koster, president, San Francisco Chamber of Commerce.
The Relation of Law to the Development of Our Merchant Marine—Ernest J. Baldwin of the New York Bar.
The Relation of Inland Waterways to Foreign Trade—James E. Smith, president, Mississippi Valley Waterways Association.

Afternoon

Group V. Foreign Credits and Credit Information.
What Part Must Credit Play in the Expansion of Our Foreign Trade—E. D. Fisher, vice-president, Bank of Detroit.
Some of the Peculiar Difficulties and Problems in Foreign Credit Granting—F. D. Rock, credit manager, Armour & Co.
In What Form and Manner Can Exporters Co-operate for Developing Foreign Credit Information—H. F. Beebe, Winchester Repeating Arms Co.
What Assistance May the Government Give Exporters in Selecting Safe Foreign Credit Risks—E. E. Pratt, vice-president, Overseas Products Corporation.
Group VI. Direct Selling and Representation.
Direct Selling in Europe: Larger Nations, . . .; Smaller Nations, H. S. Demarest, general export manager, Green - Tweed Company.
Direct Selling in South America — P. S. Steenstrup, General Motors Export Company.
Direct Selling in the Orient — Howard E. Cole, Standard Oil Company of New York.
Direct Selling Through the Parcel Post—Maynard D. Howell, export manager, Montgomery Ward & Co.
Group VII. Export Combination—The Webb Law in Operation.
The Webb Law in Operation—John Walsh, chief counsel, Federal Trade Commission.

(*Continued on page* 768)

Big Gain in February's New York Exports

An Increase of More Than 60 Per Cent Over January Totals

NEW YORK, April 2—Although the new year started well with big figures for the month of January, February automotive exports from the port of New York show another substantial gain in number and value of cars and trucks and in value of parts.

Totalling the various items for January gives $4,274,827. The total for February is no less than $6,870,057, an increase of over 60 per cent. January exports of cars numbered 1047, valued at $1,480,-832; 515 trucks, valued at $1,604,418, were shipped, and the value of parts was represented by $1,189,577. The totals for the corresponding items for February are given at the foot of the table on this page.

Belgium appears as a purchaser again, after a long lapse, and business appears to be opening up with Turkey (both European and Asiatic). Both Japan and China show evidence of increasing business, and France has taken considerably more than half the truck total.

AUTOMOBILE, TRUCK AND PARTS EXPORTS FROM NEW YORK FOR FEBRUARY

	Cars		Trucks		Parts
	No.	Value	No.	Value	Value
Argentina	202	$300,323	4	$8,130	$38,287
Australia	195	221,445	16	15,678	55,208
Barbadoes	3	2,499	..	......	159
Belgium	3	12,400	..	......	1,710
Bolivia	..	......	..	......	536
Brazil	121	148,673	5	9,765	87,869
British East Africa	1	982	..	......	271
British East Indies	..	......	..	......	10
British Guiana	2	1,025	..	......	992
British India	43	56,633	6	11,700	60,015
British South Africa	126	146,316	4	18,544	80,166
British West Indies	1	595	3	1,650	2,547
Chile	55	138,065	2	5,672	50,685
China	54	82,539	17	42,400	11,020
Colombia	3	2,301	..	......	3,904
Cuba	88	84,729	8	29,363	67,387
Danish West Indies	..	......	1	3,350	74
Denmark	36	48,289	5	13,035	4,653
Dutch East Indies	3	9,000	..	......	2,932
Dutch Guiana	..	......	..	......	41
Dutch West Indies	4	2,737	..	......	250
Ecuador	2	2,734	..	......	2,242
Egypt	..	......	..	......	5,917
England	2	2,236	9	14,247	705,419
France	82	281,131	510	2,291,595	203,788
French Africa	1	800	..	......	8,547
French East Indies	13	14,286	..	......	......
French West Indies	2	2,151	1	1,800	3,660
Greece	21	38,906	10	25,720	23,949
Guatemala	..	......	..	......	117
Haiti	21	22,344	1	550	930
Honduras	..	......	..	......	785
Hongkong	22	23,710	15	17,352	772
Ireland	..	......	..	......	304
Italy	1	1,500	1	2,731	500
Jamaica	1	1,000	..	......	4,716
Japan	107	153,573	104	144,573	6,952
Mexico	10	11,961	1	900	9,163
Netherlands	..	......	..	......	190
Morocco	..	......	..	......	6,121
Newfoundland	5	5,779	..	......	103
New Zealand	105	105,731	24	38,382	61,158
Nicaragua	2	1,725	..	......	1,937
Norway	26	28,874	31	75,775	7,271
Panama	6	6,150	1	550	5,544
Peru	77	147,961	4	10,540	18,634
Philippine Islands	36	31,266	5	4,611	3,494
Portugal	2	3,500	..	......	2,098
Portuguese Africa	..	......	..	......	134
Salvador	7	9,346	..	......	598
Santo Domingo	..	......	..	......	1,627
Siam	18	14,530	..	......	374
Spain	36	43,665	1	1,145	9,497
Straits Settlements	1	1,000	5	11,250	15,048
Trinidad	9	5,670	6	3,300	7,163
Turkey in Asia	10	6,978	..	......	2,756
Turkey in Europe	..	.....	59	97,305	13,026
Uruguay	25	38,106	1	1,070	17,621
Venezuela	24	27,346	2	1,360	10,920
	1,646	$2,315,790	874	$2,921,399	$1,632,868

Earnings of Overland Set Record

To Concentrate on Small Four Poppet Valve and Medium-Price Knight Car

TOLEDO, April 2—The profits of the Willys-Overland Co. for the year ending Dec. 31, 1918, amounting to $11,510,645, were the largest in the history of the company. The net income after deducting all charges and taxes amounted to $5,536,254, which is equivalent, after paying preferred dividends, to $2.54 a share earned on the common stock as compared with $3.16 earned in 1917. The reduction is due to writing off $3,775,642 pending government settlements, and $1,000,000 from the investment in the Curtiss company.

The report states that all passenger car production had ceased on Nov. 1, 1918, and adds that the manufacturing plans for the coming year will be based upon a complete standardization of models and concentration on but two types. One of these will be the small four-cylinder car and the other will be a new Knight-engined car in the medium-price field. Following is the complete report:

Operating at 80 Per Cent War Basis

The express determination of the Willys-Overland Co. to shape its production program throughout 1918 to the winning of the war inevitably entailed the early acceptance on a large scale of a wide variety of Government contracts, the result being that on Nov. 11, when the armistice was signed, the company had on hand $75,000,000 of Government business. The factories were then operating on an 80 per cent war basis with 100 per cent set for the end of the year.

The cancellation of the bulk of the war work, which had involved the most radical factory adjustments, the creation of special departments, the changing over of equipment, and the preliminary expenditure of over $12,000,000 in preparation for the urgently desired large scale production, necessitated another sweeping readjustment to a normal peace basis. Its rapid and successful accomplishment has been a splendid tribute to the flexibility of the company's plants and organization.

All passenger car production had ceased Nov. 1, 1918. By Jan. 2, or within less than 50 days after "stop-work" instructions on war contracts, we were again turning out automobiles and by Jan. 31 were shipping 315 cars daily. At the present time 425 cars are being turned out daily, in accordance with a schedule calling for a steady increase in output to 1000 cars daily in August.

Notwithstanding the retarded start in automobile production caused by the delay in settling the status of the Government contracts, it is expected that the 1919 output will reach 175,000 cars, or over twice the war-depleted 1918 production, and exceeding by 25 per cent the company's best year. First hand reports of dealers and distributors evidence a steadily increasing demand for cars, each succeeding month of the new year having thus far recorded a striking gain in sales over the previous. In proportion to the supply, the demand for cars was probably never greater than to-day.

The manufacturing plans for the coming year represent a complete standardization of models and concentration upon but two types, viz.—a light four-cylinder car for the low-priced field, and a new Knight-engined car for the medium field. The elimination of the superfluous types will permit of production commensurate with the company's plant capacity and through the lowering of manufacturing costs will result in increased profits. Consolidation of manufacturing in two models for the principal selling fields will further entrench the company in its position in the industry.

In September, 1918, the company, anticipating, regardless of war or peace, an almost unlimited demand for tractors in an age of power farming, acquired the control of the Moline Plow Co., manufacturers of agricultural implements and of the Moline Universal tractor. The purchase enabled the immediate application of our immense plant facilities and large scale production methods to a proven tractor, and afforded the best and quickest way to attain a lead in this manufacturing field.

The Moline Plow Co. output this year will be double and in 1920 doubled again. Its acquisition has resulted in the permanent solidification and broadening of our production base.

Adjustments with the United States and British governments on war contracts are progressing somewhat slowly but satisfactorily.

The increase in the item of investments in and advances to other companies is represented mainly by the Moline Plow Co. common stock and by advances to subsidiaries.

Profits of $11,510,645 Greatest in History

The company's profits last year after allowance for taxes, $11,510,645, were the largest in its history, but it was felt that under present conditions conservatism should dictate their disposition. Accordingly deduction for depreciation, accruing renewals and tool replacements has been made to the extent of $3,775,642. In addition it was deemed wise to write off, pending Government settlements, $1,000,000 from the investment in the Curtiss Aeroplane & Motor Corporation.

The outlook for the automobile and the farm tractor industries was never brighter. With war conditions and restrictions past, I anticipate a year of activity and expansion. Both our production and financial programs, though conservative, have been made with this view in mind.

	1918	1917
Net earn. after taxes..	$11,510,645	$10,193,490
Depreciation, etc.	2,457,842	1,330,798
Tool replacements	1,317,800	1,030,000
Written off	*1,000,000	†559,940
Interest	1,198,748	1,151,208
Balance	$5,536,254	$6,121,543
Preferred dividends	1,315,654	1,138,341
Pfd. stock redemption...	554,208	450,000
Common dividends	1,626,891	4,885,237
Common stock divs.....	......	1,965,991
Surplus	$2,039,501	‡$2,318,026
Premiums	......	......
Previous surplus	24,301,384	27,596,594
Total surplus	$26,340,885	$25,278,568
Written off	......	74,243
Development exp.	......	902,941
Profit and loss surp..	$26,340,885	$24,301,384

*Written off book value of investments.
†Parts of discontinued models written off.
‡Deficit.

Another Rumor Dies

NEW YORK, April 3—To-day a rumor was afloat on Automobile Row that the parties who recently bought the Bosch Magneto Co. from the Alien Property Custodian had sold it, cleaning up $1,000,000. Inquiry at the Bosch factory in Springfield, Mass., brought forth smiles at the amount involved and indignation that the company should be the subject of such rumors. Sales Manager Alfred H. Bartsch stated that the factory is operating at capacity, that a dividend has just caused an increase of a couple of points in the stock and that there is absolutely nothing to the rumor.

Schumann Joins General Motors

NEW YORK, April 2—John J. Schumann, Jr., has accepted the position of assistant financial manager of the General Motors Acceptance Corp., the subsidiary of the General Motors group formed to finance its dealers. He was executive secretary of the distribution committee and assistant director of distribution of the Liberty Loan Committee for the Second Federal Reserve District, and his services with the Government loan organization are being volunteered by the corporation.

White Sales Increase 53 Per Cent in 1918

Profit and Loss Surplus Slightly Reduced, Due to Larger Federal Taxes

CLEVELAND, April 2—Gross sales of the White Motor Co. increased 53 per cent in the year ended Dec. 31, 1918, over sales for 1917, the increase being $13,810,348. After deducting Federal income, war and excess profits tax, the profits for the year were $6,380,585. A further deduction for Federal income, war and excess profits tax, estimated at $3,700,000, and dividends of $1,280,000, leaves a balance for the year 1918 of $1,400,585. This compares with $2,520,308 in 1917. The decrease is caused by the larger Federal taxes.

The annual report of the company points out that the financial condition at the end of the year was excellent. Production was, of course, largely influenced by the requirements of the war. In addition to a largely increased commercial demand, which, however, it was necessary to curtail because of the war, sales included 6451 trucks for the United States and French governments as against only 1358 trucks which were produced for war purposes in 1917.

The company has sold in all to the Allied nations, including the United States, nearly 18,000 trucks at a valuation of over $52,000,000. At the time the armistice was signed there were, in addition to these, 5700 trucks on order with a valuation of approximately $16,000,000, which were canceled.

Following is the consolidated income account of the White company and its subsidiaries for the year ended Dec. 31, 1918:

	1918	1917
Operating profit	*$5,947,494	$4,494,749
Other income	433,091	335,559
Total income	$6,380,585	$4,830,308
Federal taxes	3,700,000	1,030,000
Reserve	......	......
Balance	$2,680,585	$3,800,308
Dividends	1,280,000	1,280,000
Surplus	$1,400,585	$2,520,308
Previous surplus	5,216,301	2,541,041
Adjustments	4,590	154,951
Profit and loss surp..	$6,621,476	$5,216,300

*Operating profit, after deducting manufacturing, selling and other expenses.

Assets

	1918	1917
Prop. account	$4,902,978	$4,235,380
Good will, pat., etc....	5,388,910	5,388,910
Inventories	10,156,558	9,638,129
Accounts receivable ...	5,422,498	3,629,589
Notes receivable	1,011,520	1,499,185
Cash	817,653	698,600
Government securities..	1,886,800	125,448
Emp. unpaid bond sub..	466,652	......
Investments	240,000	240,000
Miscellaneous accts. rec.	42,373	......
Deferred assets	117,870	118,296
Total	$30,453,812	$25,573,537

Liabilities

	1918	1917
Capital stock	$16,000,000	$16,000,000
Notes payable	1,000,000	300,000
Accts. payable, etc.....	2,298,060	2,118,212
Deposits on cars.......	62,058	104,589
Accrued taxes	32,218	64,436
Deprec.. reserve	......	......
Conting. reserve	740,000	740,000
Tax reserve	3,700,000	1,030,000
Surplus	6,621,476	5,216,301
Total	$30,453,812	$25,573,537

U. S. Rubber Profits $16,072,042

Earnings Establish New Record—$30.81 on Common, Against $28.77 in 1917

NEW YORK, April 2—The U. S. Rubber Co. accumulated a net profit of $16,072,042 during the year ended Dec. 31, 1918, thereby establishing a new record in the history of the company. This profit is after the deduction of federal taxes, interest and dividends amounting to approximately $28,251,000 and is equal to $30.81 a share on the $36,000,000 of common stock as compared with $28.77 earned in 1917.

Sales increased from $176,159,694 in 1917 to $215,398,425, or $39,238,731. Net profits increased $1,731,465, and the surplus is $4,144,098 higher than it was in 1917.

In a statement accompanying the annual report, Col. Samuel B. Colt, chairman of the board of directors, says: "In refunding our indebtedness under our first and refunding mortgage, as set forth in the annual report presented March 20th, 1917, all outstanding issues were provided for at that time in cash except $9,000,000 of debentures of the General Rubber Co., which fell due December 1, 1918, and $2,600,000 of bonds of the Canadian Consolidated Rubber Co., Limited, which will fall due in 1946, for refunding which an equivalent amount of first and refunding mortgage bonds was reserved.

"Provision was this year made to take up the debentures of the General Rubber Co. when they fell due, through an issue of $6,000,000 of 7% five-year gold notes of this company, secured by $9,000,000 of our first and refunding mortgage bonds which were issuable for that purpose. The balance to take up those debentures was provided from our current resources.

"The financial condition of the company is strong, as indicated by the consolidated general balance sheet. With the continually expanding business and present high prices of materials, more working capital is required, in addition to which extensions have been planned, especially in the tire division, which will consume a large amount of money.

"Although the past year's earnings considered by themselves would warrant a dividend upon the common stock, your directors felt that it would not be prudent to pay one on account of the uncertainties which existed in business, and the company's cash position.

"Inventories of manufactured goods and materials have been taken on a conservative basis, having in mind the decline in values as a consequence of the closing of the war.

"The plants and properties have been maintained in the highest state of efficiency and adequate charges for depreciation have been made.

"The export sales outside of war orders were maintained during the year, and with the close of the war your directors believe there is a greater opportunity offered in this field than ever before and preparations are being made to materially extend our export business.

"The operating divisions of the company are now under the direct charge of the president. The president presides at the meetings of the operating council and reports their recommendations to the Executive Committee, of which body he is also a member. Greater directness and efficiency are thus obtained.

"The volume of business of our company so far this year has been somewhat in excess of the same period of last year, and though we look for a falling off in certain lines, especially those where war orders were large, now that we are on a peace basis, the present indications are that our volume for 1919 will be satisfactory."

The consolidated income account of the United States Rubber Co. for year ended Dec. 31, 1918, compares as follows:

	1918	1917	1916
Tot. sales..	$215,398,425	$176,159,694	$126,759,129
Costs, etc..	169,594,286	144,916,641	110,962,739
Op. Profits.	$45,804,139	$31,243,053	$15,796,389
Other inc...	....	....	2,442,815
Total inc..	$45,804,139	$31,243,053	$18,239,204
Disc. allow.	5,443,461	4,416,943	2,733,105
Bad debts..	880,046	607,529	314,444
Prof. on sls.	$39,480,632	$26,218,581	$15,191,655
Chg. Fed. tax	19,289,535	7,760,147	1,275,895
Inc. credits.	....	....	....
Interest ...	4,119,055	3,177,857	3,517,565
Net profit.	$16,072,042	$15,340,577	$10,398,195
Pfd. divs...	4,961,992	4,961,370	4,885,844
Com. divs...	....	....	....
Sub. co. divs.	19,510	20,092	119,238
Surplus ...	$11,090,540	$10,358,515	$5,443,113
Prev. sur...	31,891,207	28,479,134	22,962,322
Tot. sur...	$42,981,747	$38,837,649	$28,405,435
Adjustments	1,133,696	6,946,442	78,700
P & L sur.	$41,848,051	$31,891,207	$28,479,135

Consolidated balance sheet of the United States Rubber Co., as of Dec. 31, 1918, compares as follows:

ASSETS

Plants &c..	$134,886,551	$128,105,826	$130,187,629
Inventory ..	70,704,226	72,440,170	48,530,398
Cash	12,330,287	9,463,833	10,123,709
Notes rec...	1,627,473	2,056,906	1,764,000
Accts. rec..	35,566,177	36,313,607	26,052,706
Securities ..	6,494,433	7,987,920	3,481,655
Skg. fd. cash	....	....	509,852
Dfrd. assets	1,282,303	1,257,519	1,716,620
Total ...	$262,891,450	$257,575,781	$222,366,569

LIABILITIES

1st pfd. stk.	$61,722,200	$61,722,200	$60,773,600
2d pfd. stk.	403,600	403,600	403,600
Com. stock.	36,000,000	36,000,000	36,000,000
Sub. co. stk.	284,000	320,655	376,980
Bonds	68,600,000	71,600,000	36,807,000
Accts. pay..	14,852,945	8,548,084	6,526,168
Drafts pay..	942,263	1,877,676	1,891,093
Accrd. tax &c	....	5,249,719	801,527
Notes and loans pay.	9,465,350	19,430,955	26,703,866
Miscel. res.	9,142,779	4,874,021	1,300,329
Deprec. res.	11,680,389	7,707,891	5,000,000
Div. res....	1,240,498	1,240,498	1,223,040
Fixed sur..	6,709,275	6,709,275	15,080,231
Surplus ...	41,848,051	31,891,207	28,479,135
Total ...	$262,891,450	$257,575,781	$222,366,569

Lee Increases Directorate

NEW YORK, March 31—At the annual meeting of the Lee Rubber & Tire Corp. John M. Dettra, secretary of the company, was elected a director to fill the vacancy caused by the resignation of James W. Johnson. The retiring directors were re-elected. It was voted by the shareholders to increase the number of directors from nine to eleven, and J. C. De La Cour, vice-president and treasurer of the W. C. Schull Co., Camden, N. J., and H. C. Jones, president of the H. C. Jones Co., Conshohocken, Pa., will be added to the board as soon as the legal formalities are complied with.

John J. Watson, Jr., president, stated that the reason for increasing the board was that the management hoped to merge the Lee Tire & Rubber Co. of Pennsylvania, the operating company, and the Lee Rubber & Tire Corp. of New York, the holding concern, thereby eliminating duplication of accounts and also bringing about a saving on tax payments. Messrs. De La Cour and Jones are directors of the operating company.

The output of tires last year was 225,000 compared with 244,000 in 1917, and this year plans call for 250,000. According to the general manager, the labor situation has improved. The plant at present employs about 750 men.

Production Nearing Normal

Michigan-Ohio Plants Produced 5741 Cars Daily in March—4822 in February

DETROIT, April 1—Production in the States of Michigan and Ohio is approaching to near normal figures. During the month of March the daily output of 32 factories was 5741 passenger cars. This is a big gain over February, during which month 4822 automobiles were produced daily.

In the month of January, when the majority of the plants were just getting into commercial manufacture on greatly curtailed schedules, 2984 machines were built. The average daily production for the first quarter was 4467 cars.

Manufacturers are now beginning to talk in terms of annual production. A large number of the companies have drafted production schedules for 1919. Others, while outlining production for the year, are not making figures public.

This increase will be very noticeable during April. Packard will be in production. This company has put through its first car. Hudson will double its Hudson and Essex production. Buick hopes to attain the 600 daily production mark. Willys-Overland will be getting into production on its new light car. Oldsmobile and Reo propose big production increases. Studebaker is running up production approximately 40 per cent a month, while Ford will be hitting the 3000 mark. All the smaller concerns, many of them not in full swing as yet, will increase their output materially.

In 1918 car production figures were 1,044,754, as against 1,737,151 the previous year. In 1916 production was 1,493,617 cars. Normally the output increases at the rate of about 40 per cent a year. Had this rate prevailed last year the output would have been 2,750,000 cars, or more than double what it actually was. Because 90 per cent of the companies were on war work and started the year under a great handicap, many production experts declare remarkable results will have been obtained if 1919 figures exceed the 2,000,000 mark.

Some of the Detroit companies are having trouble getting material and parts. This is not true in all cases, but in a number of instances it is curtailing production. The trouble seems to be due to the inability of certain parts makers to get back into peace production.

Firms dealing with these concerns are therefore affected, while others are not. Lack of funds owing to unadjusted Government contracts and the unstability of the steel market are the big factors at the bottom of this trouble. The fixing of steel prices by the Government is now relieving this situation, as this market is gaining confidence again, even if the prices are a little high to suit the majority of the buyers.

For a few days following the fixing of the steel price by the Government the trade was uncertain and continued its

hand-to-mouth buying policies. Now, however, the companies are beginning to purchase steel in larger quantities. The immediate effect of the fixing of the price so far as the automotive industry is concerned was the stimulus it gave building operations. A number of plants have placed orders for structural steel and there is going to be a healthy increase in factory construction this summer.

Daily production figures for the first quarter of the year, together with the proposed annual output of Michigan and Ohio automobile plants, follow:

Car	Jan.	Feb.	March
Buick	100	400	450
Briscoe	30	50	50
Barley	..	4	10
Cadillac	55	60	80
Chalmers	30	65	70
Chandler	..	50	90
Chevrolet	..	300	350
Columbia	8	10	15
Dodge	300	375	400
Dort	40	65	70
Ford	1,300	2,000	2,400
Harroun	4	4	10
Hudson	30	50	50
Hupp	38	55	65
King	..	4	10
Liberty	15	15	25
Maxwell	150	150	220
Monroe	5	5	8
Oakland	160	160	200
Olympian	4	5	10
Oldsmobile	..	110	140
Overland	320	400	442
Packard	..	..	1
Paige	50	50	55
Paterson	10	10	10
Jackson	..	..	..
Reo	100	100	125
Saxon	10	50	65
Scripps-Booth	20	40	45
Studebaker	150	150	175
Essex	30	50	50
Grant	25	35	50
Total daily production	2,984	4,822	5,741

—

McFarland Back at His Desk

DETROIT, March 31—J. W. McFarland, purchasing agent of the American Auto Trimming Co., who has been at the Rock Island arsenal for some time in charge of purchases of leather and saddlery, has returned to Detroit and resumed his duties.

—

Program for Foreign Trade Convention

(*Continued from page* 765)

Forming an Export Association.
Discussion—William T. Nardin, American Canners' Export Association; E. E. Judd, American Webbing Manufacturers' Export Corporation; R. R. Fox, Simonds Mfg. Co.
Group VIII. Ocean Service.
Marine Insurance — Benjamin Rush, president, American Foreign Iuslrance Association.
Improved Port Service and Foreign Trade—R. A. C. Smith, New York.
Freight Forwarding for Export—W. J. Riley, export manager, Judson Freight Forwarding Company.
Inland Traffic Management for Export— Andrew Young, traffic manager, American Sheet & Tin Plate Company.

FRIDAY, APRIL 25

Banquet, Congress Hotel, Gold Room
The Relation of Diplomacy to Foreign Trade —Hon. Breckinridge Long, Third Assistant Secretary of State.
The Meaning of Foreign Trade to the Middle West—Hon. Frank C. Lowden, Governor of Illinois.
American Maritime Policy—James A. Farrell, chairman National Foreign Trade Council.
The Future of Our Foreign Trade—Edward N. Hurley, chairman, U. S. Shipping Board.

SATURDAY, APRIL 26

Packing for Export—Captain H. R. Moody, Q. M. C., U. S. A.

Industry Was Ready for 100% War Work

Fully Equipped on Jan. 1—Gain of 250 Per Cent in Orders in First Half of 1918

WASHINGTON, March 29—That the automotive industry was fully prepared to enter into an almost 100 per cent war program by Jan. 1, 1919, and had increased its war orders more than 250 per cent in the first 6 months of 1918, is shown in figures made public to-day by the Department of Commerce, which took a census last year of the steel and iron on hand, consumed and required by the automotive industry. This census was taken as a war measure.

The industry on Sept. 1, 1918, had on hand 288,819 tons of steel, not including 13,406 tons of scrap steel. The 590 concerns reported also that the consumption of steel from Jan. 1 to June 30, 1918, totaled 637,707 tons, of which 142,094 were used for government contracts. This does not include 41,371 tons of scrap iron and steel, of which 6225 tons were used for government orders. Requirements estimated for July 1 to Dec. 31, 1918, were placed at 627,137 tons, of which 356,422 tons were intended for government orders. In addition 38,764 tons of scrap iron and steel were needed, of which 25,783 were for government purposes.

The preparation for increased war work is consequently noticeable in the increase of steel for war purposes; 142,094 tons, 20 per cent of the total amount, was used in the first 6 months for war orders as being compared with 356,422 tons, 55 per cent of the total amount being estimated for war orders for the last half of the year.

—

Two New Caterpillars

PEORIA, March 31—The Holt Mfg. Co. has brought out two new Caterpillar farm tractors—one a 5-ton 4-plow machine and the other a 1-ton 8-plow machine. In general design they are practically the same as previous Caterpillar models, but have been slightly altered and refined as a consequence of the company's experience in building war automotive apparatus.

Both models show external evidence of military influence in their automobile style hoods. The seat is more comfortable and is located so as to give the driver a view both of the field ahead and of the work of his implements. The belt pulley is placed at the rear. The lubrication system has been improved.

The 4-plow model is equipped with a 4-cylinder modified Class B Liberty truck engine in which the bore and stroke are 4¾ x 6 in. Ignition is by high-tension magneto and lubrication by a pressure system through a drilled crankshaft with a bypass feed to the rocker arms and return to the crankcase; a standard type of centrifugal governor, fully inclosed and sealed, is fitted. Provision is made for mounting an electric lighting generator and starting motor. The Master clutch is a dry, multiple disk type, transmitting the drive through a standard 3-speed and reverse gearset of selective type. Drive is through a pair of bevel gears with two spur-gear reductions from the steering clutch to the track drive sprockets. There is no differential and steering is effected through steering clutches independently operating the tracks. Speeds are 1.3, 2.6, 4.9 m.p.h. ahead and 0.97 m.p.h. reverse.

The 8-plow machine has a 4-cylinder, vertical 6½ x 7-in. engine, all the other units being of similar design and differing only in size. Speeds are 1.35, 2.52, 3.88 m.p.h. ahead and 1.0 m.p.h. reverse. The overall length is 146 in. and the weight 18,600 lb. The overall length of the 5-ton machine is 124 in. and the weight 9400 lb.

—

Five Tractor Demonstrations in New York

ALBANY, N. Y., April 3—The State of New York is contemplating five tractor demonstrations during the coming season, all of which will be staged directly for tractor manufacturers and not for dealers and distributers as entrants. The exact dates of these demonstrations have not been scheduled as yet. The plan is to have 2-day demonstrations so that there will be one or perhaps more devoted to plowing and the second day for fitting. The two days will give a better opportunity of obtaining accurate records of performance than the acre or hour tests of last year.

The demonstrations will be divided over the State, with one for the western section, which probably will be in the vicinity of Batavia; one in the central will be held at Syracuse, and will have to be at the same time as the State Fair. This would not be so important a demonstration from the standpoint of performance but would be more in the nature of an exhibit. One would be in the eastern portion of the State, possibly in the area of Hudson; the fourth would be held in southern New York State in the vicinity of Elmira, and the fifth in the northern portion of the State in the zone of Malone or thereabouts.

The State of New York at present owns 70 tractors, and during the past winter established three repair depots, where these tractors were all overhauled. These were in Syracuse, Ithaca and Albany.

—

Restrictions Lifted on Canadian Imports

OTTAWA, ONT., March 29—Restrictions on the importation of automobiles into Canada have been lifted. It will be remembered that the Canadian Government, during the war, decreed that no cars for pleasure purposes that cost more than $1,250 should be imported into Canada. Later it was permissible to bring in a more expensive car under a special license granted by the government.

The War Trades Board of Canada has now approved a general license permitting the importation of all commodities restricted during the war except foodstuffs.

English Tractor Trials in Fall

To Be Held by Motor Mfrs. and Traders—Royal Agricultural Society Plans for 1920

LONDON, March 17—Recently the Royal Agricultural Society of England, the oldest body of the kind in the world, considered associating with the Society of Motor Manufacturers and Traders in promoting a trial of tractors and plows at a date suitable to British manufacturers on the resumption of their normal output after the cessation of war work. The R. A. S. E., however, demurred to the proposal of the tractor side of the trade—which in this instance largely represents imported or assembled tractors and plows—that the trial should be held this year, so the S. M. M. & T. decided to carry out a trial of its own. The event will be held next September in the neighborhood of Lincoln, one of the chief arable areas.

The R. A. S. E. notifies that it will organize trials of tractors and plows in the autumn of 1920, the date not yet being disclosed. There will be six classes of entries, four confined to internal combustion engines. In each class there will be awards of medals and cash prizes. There will be a class for tractors up to 30 hp. capable of plowing three 10 x 6 in. furrows, and another for more powerful tractors which will be required to plow four 10 x 8-in. furrows. There will also be a class for self-propelled plows of any power.

There is a separate class for direct-hauling steam tractors, and two classes for double-engine cable sets of the steam and internal combustion class respectively.

Resta Will Drive Sunbeam at Indianapolis

PARIS, March 22—Daria Resta, according to a statement from the Sunbeam factory at Wolverhampton, England, has taken up the exclusive agency for Sunbeam cars in America. He will drive the second Sunbeam at Indianapolis vacated by the death of Joseph Christiaens.

The accident which caused the death of Joseph Christiaens is almost inexplicable. Christiaens left the factory on the Indianapolis racer, and when 300 yards away, and on second gear, the car skidded, a tire burst and the machine swung right around. It charged a low wall and turned over, pinning Christiaens beneath it. Death was instantaneous. The steering gear of the car was found to be in perfect condition after the accident.

More Foreign Entries for Indianapolis

PARIS, March 14—Daria Resta will doubtless secure the Sunbeam car which should have been driven by Joseph Christaens at Indianapolis. The first car will remain in the hands of Jean Chassagne. There is a possibility of the Sunbeam company preparing a third car for this race. The name of the driver is not announced.

Arthur Duray is endeavoring to secure one of the Nagant Grand Prix racers which have been hidden away in Belgium for the last 4 years. These cars, which are on the Peugeot lines, were built for the 1914 French Grand Prix. They returned to Belgium after this race, and when war broke out they were so cleverly concealed that the Germans never were able to find them although they searched for them for 4 years.

André Boillot, the youngest and only surviving brother of Georges, will come to Indianapolis this year. Young Boillot counts on getting a 150 cu. in. Peugeot which is in the hands of private owners at the present time. This car is being worked on now, and if finished by April 15 Boillot will bring it to America and start in the Indianapolis race. With only half the cylindrical capacity of his rivals he has not much hope of winning first prize, but he believes that on a distance of 500 miles he can get within the prize money.

No Shows for Italy in 1919

TURIN, March 15—The Italian Automobile Manufacturers' Association has decided to hold no motor shows in Italy during 1919. This decision has been made to give every opportunity to the industry to get back from a war to a peace basis. It is probable, however, that the leading Italian makers will exhibit at the Paris and London shows to be held towards the end of the year.

Japanese Importer Studying Conditions Here and Abroad

NEW YORK, March 29—S. Umemura, of the Japanese automobile importing firm of Yanase & Co., Tokyo, Japan, has recently arrived in this country to make a study of automobile conditions here. Mr. Umemura will sail on April 5 on the *Aquitania* for England, and before returning he will also visit France, and, if possible, Germany. Yanase & Co. represent the General Motors Co. in Japan.

National Highway System for Japan

WASHINGTON, March 31—The Japanese Government plans a system of national highways to connect up all parts of the country. Two Japanese engineers, Mr. Makino and Mr. Zhalakeyma, have been sent to this country to study road administration, and are working with the Highways Industries Association. It is quite likely that Japan will create some form of national highway supervision and control similar to the Federal Highway Commission which is planned in this country under the Townsend bill.

Can Ship to Trinidad

WASHINGTON, March 31—Embargoes against the importation of automobiles, motor trucks and motorcycles into Trinidad and Tobago, West Indies, have been lifted, and these commodities may now be imported freely.

French Tractor Trial Entries

America, France and England Will Be Represented—Automobile Firms Demonstrating

PARIS, March 22—America, France and England will be represented at the official French tractor trials to be held at Saint-Germain, near Paris, from March 30 to April 6. The Ministry of Industrial Reconstruction and the French Agricultural Tractor Syndicate are jointly responsible for these trials, which, it is believed, will become the only official test of their kind to be held in France.

It is evident from the list of entries that European automobile firms are interesting themselves in the agricultural tractor, for, among the new machines to be demonstrated by automobile firms, are Renault, Delahaye, De Dion Bouton, Tourand-Latil, Schneider and Paris General Omnibus Co. The English participant is the Austin tractor, which was shown for the first time in France at the recent Lyons fair. Among the American machines are: Cleveland, Titan, Case, Avery, Moline, Fordson, Rip, American, Pidwell and Butterosi. In all sixty machines will take part.

Dirigible Service from Europe to Buenos Aires

WASHINGTON, March 31—Aerial traffic between Europe and Buenos Aires will be a reality within a few months when the Vickers Co. of London inaugurates a regular route between these two points by dirigible. It is expected that the airship will have a capacity for about 15 passengers, and will make the voyage in 6 days by way of Spain and Brazil.

U. S. Airplanes to Czechoslovaks

WASHINGTON, March 31—The sale of military airplanes and equipment, which was announced last week in AUTOMOTIVE INDUSTRIES, was a sale made by this government to the Czechoslovak military authorities of airplanes and airplane accessories, including $319,000 worth of planes and $600,000 worth of equipment.

The $319,000 worth of airplanes were 25 L. W. F. planes equipped with Sturtevant 5-A engines. The $600,000 worth of airplane equipment was 392,112 Chinese Dogmats (used for lining leather coats worn by aviators) sold to the H. E. Lazarus Co., New York.

Automobile Traffic of Central America

WASHINGTON, March 29—The selling of automobiles in Central America is limited by the absence of good roads, according to a report received by the Department of Commerce. Even in the capitals the streets are rough and the distances short, prohibiting increased use of cars. Consequently road building holds forth a promise for increased use of automobiles.

Manufacturers will be interested in three projects on foot in Guatemala and Nicaragua, which plan highway construction to facilitate automobile traffic between the cities of these two countries. One automobile company has obtained concession to transport freight and passengers, without competition, between Leon and Matagalea, Nicaragua, for the next 20 years.

Freight Rates to Far East Reduced

WASHINGTON, March 29—New and reduced rates on export traffic to China, Japan, Australia and the Philippine Islands, applying from Missouri River territory east through the Pacific Coast ports, have been issued by the United States Railroad Administration. Agricultural implements may now be shipped at $1 per 100 lb. Passenger cars and parts go at the rate of $3.75 and trucks and tractors at $3 per 100 lb.

German Automobile Business Dull

WASHINGTON, April 1—The cessation of army contracts has unfavorably affected the German automobile industry, according to reports received by the Department of Commerce. No cancellations of army truck contracts have taken place yet, so that this work may go on for several months, but the passenger car business and commercial truck business prospects appear gloomy, due to the great numbers of vehicles built during the war suitable to commercial and other use. Neutral countries indicate but a limited demand for German vehicles. There is a scarcity of bearing metal and lubricants.

Agriculture Machine Purchaser from Sweden

WASHINGTON, March 28—A buyer of harvesting and agricultural machinery is expected to arrive in this country from Sweden in April, as the representative of a concern with connections in Scandinavia, Finland, Russia, the Baltic Provinces and Holland. This information came to the Department of Commerce from the Swedish Chamber of Commerce of the United States, which has its office at the Produce Exchange, New York.

Disposition of War Material Abroad

WASHINGTON, March 31—Considerable war material, including tractors and trailers, will be disposed of abroad by the American Expeditionary Forces. A list made public to-day by the War Department shows the stock abroad includes 84 20-ton tractors, of which 7 have been returned to this country; 820 10-ton tractors, of which 112 have been returned, and 605 gun trailers and gun carriages, of which 93 have been returned. The remainder will be disposed of by the A. E. F. Contract cancellations to date include $240,000 worth of tanks, trucks and trailers, leaving $24,585,000 worth of orders still to be completed. Motor vehicles, accessories valued at $550, and oils, greases, etc., valued at $1,107.94, were reported this week by the Director of Sales.

France Retards Ford Dealers

Government Sells 5000 in Devastated Regions—Importers Dissatisfied with Duty

PARIS, March 22—French dealers of Ford cars have a grievance against the government. There are at the present time about 5000 cars ready for assembly at the Ford factory at Bordeaux. As the French government no longer requires these for military purposes, it was requested that the Ford company should be allowed to repurchase them and sell them privately. The French government would not permit this, but insisted on the cars being completed and delivered according to contract.

As soon as ready these cars are sold by the government to the big railroad companies of France, or to persons in the devastated regions who have urgent need of transportation. The dealers claim that this is illegal competition. The government, instead of using these cars for its own purposes, is acting as a dealer, and selling the cars to private concerns, thus robbing the legitimate and established dealers of their profit.

French importers of American cars are preparing a statement to be submitted to C. C. Hanch, representative of the National Automobile Chamber of Commerce, setting forth the hardships of their case. At the present time it is forbidden to import cars to France, although there is an urgent need of transportation. It is claimed that this prohibition is necessary in order to enable the French factories to return to peace conditions. It is pointed out, however, that the prices of cars are exceedingly high, largely owing to prohibited imports, and that many manufacturers are now in a position to make deliveries.

Just before prohibition was adopted the French levied a 70 per cent import duty. This worked very unjustly against American importers, for the 70 per cent was calculated, not on the invoice price of the car, but on the price of the car delivered in the French ports, thus including the original price, ocean freight and insurance. In some cases cars which cost 6,250 francs had to pay an import duty of 10,000 francs.

European manufacturers do not suffer from this to the same extent, for freight charges from either England, Switzerland or Italy are very low compared with ocean freight from America. It is understood that these facts are being laid before Mr. Hanch in order that he may bring them to the attention of the proper authorities.

Efficiency of Benzol Fuel

LONDON, ENGLAND, Feb. 26—The efficiency of benzol as a motor car fuel was well shown recently with an American coupé, which had been averaging 15 miles to the gallon of gasoline and which averaged 21 miles per gallon on benzol under practically identical conditions. The same car in the week's running around town is averaging between 19 and 20 miles per gallon on benzol. At present the price of benzol is artificially large and kept at the same level as gasoline, the only difference between the two being the 12 cents difference of the government license.

85,000,000 Bbl. of Gasoline Produced in 1918

WASHINGTON, March 29—Gasoline production in 1918 exceeded 85,000,000 bbl., an increase of 17,000,000 bbl. over 1917 production and 35,000,000 bbl. more than the production of 1916. The daily increase for 1918 was 47,000 bbl. above the 24-hour average of 1917. In 1916 there were 8,473,102 bbl. of gasoline sent abroad; in 1917 this amount increased to 9,901,877 bbl., while the 1918 exports reached a total of 13,312,508 bbl.

Gasoline Price War in South

NEW YORK, March 31—Certain parts of the South are at present in the throes of a gasoline war, which has brought the price of fuel down to 13 cents in Memphis. The battle was started when the Gulf Refining Co. cut its price 1 cent under Standard and other companies. Memphis has the lowest price, some other southern cities quoting as follows: Chattanooga, 16 cents; Knoxville, 18 cents, and New Orleans, 19 cents. It is anticipated that the war may reach to Baltimore, where the Gulf company is about to open headquarters. At present the cost is 22 cents.

Slow Methods Will Hamper Export Business

NEW YORK, April 1—A tire distributer in Manila complains about slow methods of some United States tire manufacturers, which is not going to accelerate export business. This distributer placed a number of orders with an American manufacturer. The orders included some items which had been increased in price, but the majority of items had not. Instead of filling the order with the exception of those items affected by a price increase the manufacturer held up the entire order. As it requires practically three months from the time of placing an order until the goods are received, the distributer was incensed at what he considered an unreasonable delay in the transaction.

Gear Manufacturers to Meet

CLEVELAND, April 2—The American Gear Manufacturers' Association will hold its annual convention here at the Hotel Statler, April 14, 15 and 16. The organization includes gear makers in the United States and Canada who are striving to develop means for standardizing their products. The coming convention will center its attention on this problem.

The following papers will be presented: "Gear Steels," by Dr. Parker, Carpenter Steel Co.; "Proper Sizes and Materials

for Gears;" "Worms and Worm Wheels," by a representative of the Timken-Detroit Axle Co.

The association officers are: President, F. W. Sinram, Van Dorn & Dutton Co., Cleveland; vice-president, H. E. Eberhardt, Newark Gear Cutting Machine Co., Newark, N. J.; secretary, Frank D. Hamlin, Earle Gear & Machine Co., Philadelphia; treasurer, Frank Horsburgh, Horsburgh & Scott Co., Cleveland.

Mexico Prohibits Oil Drilling

WASHINGTON, March 26—The Mexican Department of Industry has ordered foreign companies and individuals to refrain from drilling wells or any other wise developing the petroleum fields without permission of the Mexican government. The order reopens the many Mexican oil problems in which Great Britain, French and American companies are interested. The United States Department of State has begun a study of the order, and it is expected will soon take up the matter with Mexico.

High Freight Rates on Road Supplies Maintained

WASHINGTON, March 31—That the existing high freight rates for road construction materials will be maintained is evidenced in correspondence between the Highway Industries Association and the U. S. Railroad Administration. Protests were filed against the U. S. R. R. Administration plan, which will allow the reduction of freight rates on road building materials only if such are purchased by Federal, state or municipal agents, by the Highway Industries Association which pointed out that this would give very little relief. In reply the Director General of railroads stated that no reductions are now contemplated on the freight rates of materials for road building to be purchased by any other than the government, the states or municipalities.

Service Truck Putting Up Administration Building

WABASH, IND., March 29—An administration building to contain the offices of the company and to provide facilities for conventions and welfare work is being erected by the Service Motor Truck Co. The building, which will be three stories, 130 x 50 ft., fireproof and constructed of concrete and ivory finished brick, will cost about $100,000. The company expects to occupy it in July.

Airplane Competition for France

Engines Will Be Officially Tested in 1920 — Requirements and Specifications

PARIS, March 15—A big airplane and airplane engine competition will be organized by the French Government next year. It has been decided that there will be three types of engines:

a—125 to 150 h.p.
b—250 to 300 h.p.
c—500 to 600 h.p.

Each engine will have to run 300 consecutive hours at 80 per cent of its maximum power.

The maximum weight for the complete engine with water, gasoline and oil for 5 hours running is 6.6 lb. Propeller speed is limited to 800 r.p.m. It has been decided that in order to allow present engines to compete, they can be used with geared-down propellers, in order to obtain the limited number of 800 r.p.m.

The airplane conditions are:

a—Solidity with a coefficient of 6;
b—Excess power; theoretical ceiling 5000 ft.;
c—Minimum speed at 3280 ft.; 93 m.p.h.
d—Landing ability; practical conditions corresponding to a weight of 38 kgs. per square metre maximum (this is based on the fact that the lower the wind for a given area, the easier it is for the plane to land);
e—Security; Multi-engines. When three or four used, a single engine should be capable of maintaining the machine in the air.

Planes to Be Examined

Airplanes now under construction can be presented for examination as they are finished, but the final classification will not take place until 1920. In addition to this, there will be a big competition on a fixed date during the year 1920. It is stated that important orders will be placed for the successful machines, and all planes having obtained a satisfactory minimum number of points will receive an order sufficiently large to cover the cost of experiments.

U. S. Tractor Will Bring Out Uncle Sam

MENASHA, WIS., March 31—The U. S. Tractor & Machinery Co., organized with a capital stock of $250,000, is equipping the Strange building at 100-110 Tayco Street for a machine shop and assembling plant, pending the construction of the first unit of its permanent plant. The company will produce the Uncle Sam tractor, a 20-30 type designed by G. D. Harris, Chicago, who is the designer of the new company. H. C. Berry, chief engineer of the U. S. Tractor Co., Chicago, which is taken over by the new corporation, will hold the same position in the new organization.

Government Sells Non-Usable Vehicles

WASHINGTON, March 28—Request for bids on motor trucks and passenger cars made by the Zone Supplies and Storage Officers of Baltimore to the public this week has not been withdrawn because they did not state that the vehicles offered for sale were only scrap value and not usable. A proposal will be sent out by the War Department which will distinctly state that these vehicles are beyond repair and only good for scrap.

Export Licenses Valid Until Used

WASHINGTON, March 28—Export licenses which have been issued by the War Trade Board for Norway, Sweden, Denmark and European Holland, which by their terms are limited to a particular date, will be valid until used, notwithstanding that such licenses are stamped with the expiration date on them.

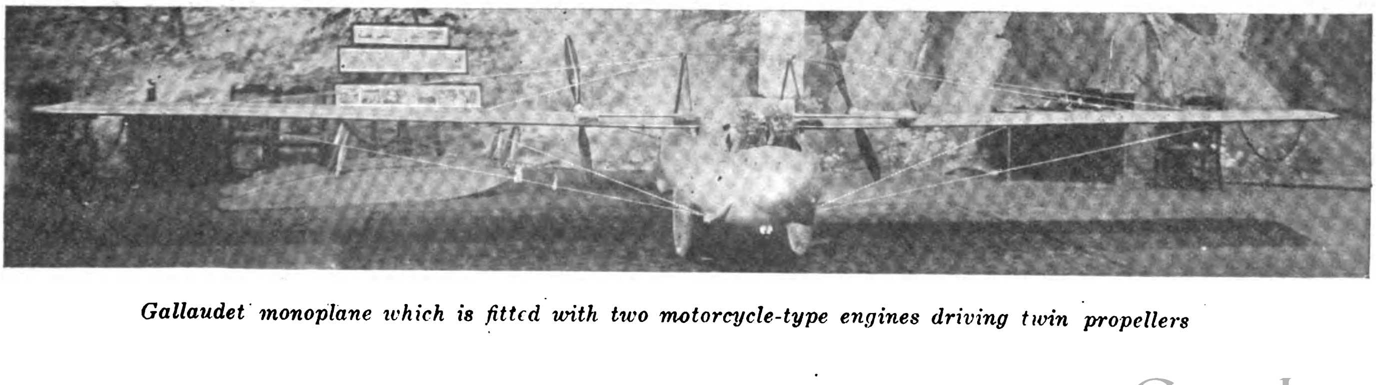
Swiss Aerial Passenger Service

WASHINGTON, March 29—An aerial passenger service between Zurich and St. Moritz, in Switzerland, is planned, a company being formed with capital stock of $96,500. The Swiss legislature announces itself in favor of the scheme. A flight between the two cities can be made in an hour and the fare will be $96.50 per person. These two towns are well known resorts frequented by tourists, and it is expected that they will patronize the air route.

Sell Condemned Army Trucks

WASHINGTON, March 31—Eighty trucks, touring cars and ambulances owned by the Army and which have been condemned as unserviceable will be sold to the highest bidders. These vehicles are at Canton, Md., and can be examined by application to Captain Wayman, 11th floor, Coco-Cola Building, Baltimore. Bids will be f.o.b. Canton, and bidders are expected to make full payment before the cars are delivered or shipped. Proposals should be accompanied by a certified check for 20 per cent of the amount of the maximum bid, and will be received up to April 4.

Included in the vehicles to be sold are: 2 Bourne, 2 Dodge touring, 1 Dodge



Gallaudet monoplane which is fitted with two motorcycle-type engines driving twin propellers

roadster, 1 Dodge patrol, 14 Ford touring cars and trucks, 2 G. M. C. ambulances, 1 Hupmobile touring, 1 International truck, 20 Kelly-Springfield trucks, 2 Liberty trucks, 1 Maxwell touring, 5 Overlands, 1 Peerless, 1 Reo, 1 Republic, 5 U. S. A. trucks, 5 White trucks, 1 Reo engine, 1 class B engine, 8 truck frames, 10 axles and housings, 1 class A transmission, 4 truck bodies, 2 trailers, 6 class B dashes and 2 truck seats.

Airplane Distribution of Parts for Service Trucks

WABASH, IND., March 29—Aerial distribution of repair parts to distributers and service stations for Service trucks has been instituted by the Service Motor Truck Co. It will be handled under contract with the Service Aviation Training & Transportation Co., a separate organization formed by stockholders of the Service Motor Truck Co. J. P. Porter, chief pilot, was formerly of the Royal Flying Corps and was one of the instructors at Love Field Aviation Camp, Texas. Assistant pilots are Harold C. Brooks and V. P. Hollingsworth. Oscar Bricker, formerly of Love Field, is in charge of the hangars and landing field. A 44-acre field has been prepared for landing. Curtiss JN-4 planes will be used.

Cleveland Co. Completes Experimental Cars

CLEVELAND, April 1—The Cleveland Automobile Co., recently organized by F. C. Chandler, J. V. Whitbeck and other Chandler officials, has completed its first experimental car. It is a 6-cylinder job with block-enclosed engine and 118 in. wheelbase. It is built to sell at approximately $1,200. The body is of the straight line type, 5-passenger capacity, with cellular radiator. The company is making its own axles but is using Timkin ball bearings. The ignition system is Gray-Davis battery type. The bore and stroke of the engine is 3 x 4¼.

Ellis-Smith Making Complete Products

ELMIRA, N. Y., March 31—The Ellis-Smith Mfg. Co., Inc., is now making its products from raw materials in its own foundry.

Ford Tractor Plants Springing Up

Production at Detroit and Hamilton Under Way—Eight Small Plants Along Rouge River

DETROIT, March 26—Henry Ford's latest tractor projects, both here and in Hamilton, O., are well under way. The Detroit establishment is now hitting volume production and work is progressing on eight smaller plants along the River Rouge. In Hamilton, O., contracts have been let and work commenced on a $1,000,000 tractor plant to be in operation in about a year.

The Hamilton plant will be operated by water power secured by damming the Miami River at that point. The units to go up first will be the power house, factory, dock and heating plant. Later warehouses and additional manufacturing units will be added. The capacity of the Hamilton plant will be 500 daily. The power plant will be 50 x 60 ft. The manufacturing plant, 100 x 700 ft., directly behind it, will be built of steel, concrete and brick. The dimensions of the loading dock are 30 x 400. The finished tractors will leave the plant under their own power and be driven to the loading dock and into the cars.

At Nankin, Mich., a few miles from Detroit, Ford is completing a small plant, consisting of a dam, power-house and factory. It will be in operation soon. At that time some parts departments from the present Fordson plant at Dearborn will be moved into the small establishment, and certain other parts will be made there.

A similar factory, only larger, is about to be built at Plymouth. Plans for the Plymouth plant are now being drafted. Work on a dam at that point is under way, and building operations will start soon. Each of these little factories will employ from 25 to 75 men.

Army Trucks for Hospital Use

WASHINGTON, March 31—The 1000 motor trucks which were recently turned over by the War Department, as announced in a past issue of AUTOMOTIVE INDUSTRIES, will be used for the transport of soldiers, sailors and marines between government hospitals. These trucks were transferred without charge to the Secretary of the Treasury, who directs the Public Health Service under Public Act No. 326, which authorizes such transfers and directs the Secretary of War to supply as many motor vehicles not required by the War Department as may be required by the Health Service.

Packard Now in Production

DETROIT, April 1—The Packard Motor Car Co. has completed its first passenger car since the war and expects to be in production by the first week of April, although earlier plans did not call for production until May. The last war truck has been completed and the government adjustment of canceled contracts is progressing rapidly.

Martin Co. Buys

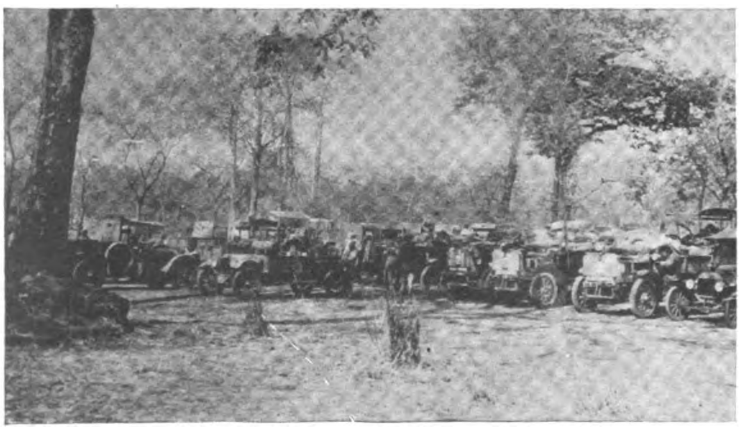
LANCASTER, OHIO, March 31—The Martin Mfg. Co. has purchased a 3-story building formerly occupied by the Wilson Mfg. Co. for $39,000.

Ford Considers D. C. Site

WASHINGTON, March 29 — Henry Ford & Son will give "due consideration" to Washington when they decide to build another factory, according to a letter received here to-day by the Chamber of Commerce from E. G. Liebold, secretary to Henry Ford. The letter was in response to a request by the Washington Chamber of Commerce urging Mr. Ford to locate his next plant here.

New Advance-Rumely Four-Wheeled Tractor

LAPORTE, IND., March 31—The Advance-Rumely Thresher Co. has developed a new small four-wheeled tractor which is quite similar to its older models, and which is designed to pull three 14-in. mold board plows or four disk plows. It is rated 12-20 hp. and follows standard Oil-Pull design and construction throughout. It has a slow-speed, two-cylinder, horizontal, heavy-duty engine, equipped



Left—Motor convoy in camp in Bush country, late German East Africa. Right—A frequent occurrence to motor transport in the swamp districts of German East Africa during the late campaign

with a Secor-Higgins carbureter burning kerosene, and has the usual oil cooling system and fanless radiator. All transmission gears are cut from forged steel blanks, and are thoroughly protected from dust and run in oil. Transmission shafts and axle are mounted in Hyatt roller bearings. The gearset provides forward speeds of 2.1 and 3.26 m.p.h. and reverse.

Maxwell-Chalmers Rumored Moving

DETROIT, March 31—Maxwell-Chalmers Motor Car Co. officials will neither confirm nor deny the story coming from Dayton that the company proposes to move its plant to this city. Dayton newspapers, however, declare such a deal is contemplated, and that the removal will be made within the next five weeks. The plants of the company in Dayton employ about 2500 men. It is also rumored that the Maxwell Motor Corp. plant at New Castle, Ind., also will be moved here. The New Castle plant employs 2500 men.

Pontiac Factory Destroyed by Fire

PONTIAC, MICH., March 28—The Hess Pontiac Spring & Axle Co., a unit of the Standard Parts Co., Cleveland, was destroyed by fire Monday night. The loss is $150,000, of which $90,000 is covered by insurance. The forge plant burned down. A new forging department will be built immediately. Approximately 150 men are out of work. The fire started from the explosion of an oil burner.

Aluminum Co. to Build Warehouse

DETROIT, April 1—The Aluminum Co. of America, which leases a warehouse here, is about to build one of its own. A 5-acre site in the northeastern factory district has been purchased and building will start soon.

Allied Industries Takes Over Star P. & V.

NEW YORK, March 31—The Allied Industries Corp., which is a manufacturers' representative, has taken over the business and agency lines formerly controlled by the Star P. & V. Corp. These include Gary truck, Fruehauf trailers, Esta water auxiliator and Federal tires.

Kelly-Springfield Doubles Stock

NEW YORK, April 2—Stockholders of the Kelly-Springfield Tire Co. have approved the proposal of the directors and authorized the increase of the common stock from $5,029,000 to $10,000,000. The increase is for the purpose of distributing common stock dividends at the rate of 3 per cent quarterly, beginning in May.

Edison Lowers Price of Batteries

ORANGE, N. J., April 2—The Edison Storage Battery Co. has reduced the price of types A, B and C Edison Cells about 16 per cent.

Merger Rumors Set Detroit Talking

Ford, General Motors, Maxwell-Chalmers and Standard Parts All Involved

DETROIT, March 28—This city is seething with merger rumors affecting the Ford Motor Co., General Motors, Standard Parts Co., and Maxwell-Chalmers Motor Car Co. These rumors are directly due to General Motors expansion projects. While 80 per cent must be discounted as street talk, there is sufficient evidence to convince automotive circles that transactions of magnitude are pending. In every instance, however, officials of the companies are busy issuing denials.

Rumor declares that General Motors is trying to gobble up the Ford interests in the Ford Motor Co. From a semi-authentic source it is learned that the Du Pont-Durant interests have made the Fords a cash offer for their holdings in this company. From another equally authentic source comes the declaration that Henry and Edsel Ford have no desire to dispose of their stock, and that the first announcement of their proposed withdrawal from the Ford company was a mistake.

A typical illustration of the type of rumors going around tells of a General Motors project to purchase the Ford stock in the Ford Motor Co. for $187,000,000 and to discontinue the manufacture of Ford cars entirely. In such event the plant would be used for the manufacture of Cadillac cars.

While no statement has been issued, it is certain, however, that General Motors is planning large expansion projects involving leading automotive concerns. It is a known fact that a consolidation of the Maxwell-Chalmers companies is being worked out with General Motors' financial aid. Details of this proposed merger have been published in New York and are generally known among Detroit brokers. For a financial consideration General Motors is to get possession of the common stock of Maxwell-Chalmers, and, while it might not take over the active management, the Maxwell-Chalmers organization would virtually become a General Motors unit.

Merger plans call for the organization of a new company to take over on an exchange of security basis, yet to be worked out, assets of the present Maxwell company. An effort is to be made to cancel the lease of the Chalmers, under which Maxwell is operating the former's plants, and take the Chalmers directly into the new Maxwell corporation. Some new cash capital would be supplied by General Motors. The proposed change in management is to be deferred until the end of the current fiscal year, July 31.

General Motors officials and officers of the Standard Parts Co. deny the report that the Durant interests are negotiating for the control of the Cleveland company. Absorption of Standard Parts, however, would give General Motors practically everything which goes into the manufacture of an automobile and place it in a great strategic position in the manufacturing field. United Motors Corp., which is a General Motors concern, is supplying ball and roller bearings, gears and transmissions, ignition systems, passenger car axles and engines. Control of Standard Parts would add truck axles, springs, rims, bearings, etc.

Changes on Staff of Motor Life

NEW YORK, March 31—C. B. Ames, business manager; C. G. Sinsabaugh, editor; A. B. Hunt, southern advertising manager, and W. W. Sheppard, western advertising manager, of *Motor*, have resigned their connection with that publication to become associated in similar capacities with *Motor Life*.

Sinsabaugh was with *Motor* for four years, previous to which he had been editor of *Motor Age*. Hunt, Ames and Sheppard were identified with *Motor* for approximately 12 years. A. J. Stocker, for many years with *Automobile Blue Books*, becomes middle western advertising manager of *Motor Life*. All five of these men will be engaged to some extent in work on the *Automobile Blue Books*, as well. Monte W. Sohn, former editor of *Motor Life*, leaves that post to assume the post of Director of Research and Publicity for *Motor Life*, *Automobile Blue Books* and *Automobile Trade Directory*.

Pilot McClelland in America

NEW YORK CITY, April 2—Pilot H. McClelland of the R. A. F., who gained the distinction of having piloted the Handley-Paige bombing plane from England to Salonica in July, 1917, arrived in America last week for a 2-months' visit. Pilot McClelland was a member of the independent bombing forces of Great Britain whose special work was to bomb industrial centers of the Rhine Valley.

Fair Association Buys Tractors

CHATTANOOGA, TENN., March 28—To help the tractor manufacturer get his product better known in the South and to get Southern farmers to see the opportunities and greater yields from power farming are the two reasons which have caused the Chattanooga Interstate Fair Association to buy two Case tractors for demonstration purposes. These tractors, a 10-18 and 10-23, will be delivered this week and immediately put to work on farms in the vicinity of Chattanooga. Hamilton County, in which this city is situated, has at present about twelve or thirteen tractors scattered through it. The plan of the association is to make the tractors self-supporting, so that when they are finally worn out there will be money to buy new ones.

The outline of the working schedule of these tractors is as follows: Two men have been hired as operators, and receive besides their daily wages a certain sum for every acre plowed, disked or harrowed. The machines will operate in different parts of the county. Each man

will carry his own fuel and supplies, as many of the farms in this section of the country do not carry these.

The men will pick their customers, who are to pay not more than $2.50 for haying the land turned, 75 cents for having it disked and a proportional sum for drag-harrowing. A minimum of 5 acres is to be worked, but many of the farmers working small tracts of land can club and thus get the minimum figure. It is very likely that tractors will be sold here in much the same way; that is, several farmers whose lands adjoin may purchase a tractor jointly, because singly their farms are too small to warrant buying a tractor.

The farmer whose land is being worked will board the tractor man. Two sizes of machines were chosen, so farmers can study the performances of both and pick ones suitable for their needs.

Stanley Develops Railway Car

BOSTON, April 2—The Gray & Davis Co. is now building units for the newly formed Unit Railway Car Co., Newton, Mass., which is building the Stanley railway car for use on lines of any road. This car was designed by the Stanleys, and when the motor car plant was taken over by the new company they retained the patents for the vehicle. The car is operated by a steam engine and uses kerosene or fuel oil in the burner. The engine is geared direct to the driving axle by a spur gear, and both units run in an oil bath in an oil-tight case.

Will Support Federal Highway Bill

WASHINGTON, March 31—That Senator Charles E. Townsend, who will probably be chairman of the Committee on Post Offices and Post Roads in the Senate, will support the highway commission bill was evidenced by a letter sent to the Rotary Club of Kalamazoo by Senator Townsend, in which he stated: "You may be certain that if I shall become chairman of the Committee on Post Offices and Post Roads in the Senate, I shall devote most conscientious attention to this great subject (the Federal highway commission bill), which is properly within that committee's jurisdiction."

Bour-Davis Car Made by Louisiana Car Co.

SHREVEPORT, LA., April 2—The Louisiana Motor Car Co. has taken over the production of the Bour-Davis car and is now putting through a run of 33 jobs, and will bring out also a 2-2½-ton truck. One hundred of these trucks are now going through. The company has been in existence for a year and in actual production for about 4 months, and has produced to date 24 cars and 2 trucks. W. F. French is general manager of the company, which is capitalized at $1,000,000 and headed by T. H. McGregor. Other officers are E. C. Rhodes, vice-president; factory manager and engineer, William Ross, and chief designer, A. L. Vargha.

Government Buys 14 Aviation Fields

Will Retain These and Six Balloon Stations—Will Release 11 Other Fields

WASHINGTON, March 31—The Government has purchased fourteen aviation fields and will retain six balloon and aviation fields that are already Government owned. Eleven aviation fields used during the war have been released. Following the announcement of this fact in a recent issue of AUTOMOTIVE INDUSTRIES, it can now be stated that the following fields are the ones to be purchased and released. Those being purchased are:

March field, Riverside, Cal.
Mather field, Sacramento, Cal.
Carlstrom field, Arcadia, Fla.
Dorr field, Arcadia, Fla.
Ellington field, Houston, Tex.
Kelly field No. 2, San Antonio, Tex.
Park field, Millington, Tenn.
Souther field, Americus, Ga.
Selfridge field, Mount Clements, Mich.
Chanute field, Rantoul, Ill.
Scott field, Belleville, Ill.
Balloon School, Arcadia, Cal.
Brooks field, San Antonio, Tex.
Engine and repair depot, Montgomery, Ala.

Under the same order the following fields will be released June 30, 1919:

Wilbur Wright field, Dayton, Ohio.
Taylor field, Montgomery, Ala.
Payne field, West Point, Miss.
Eberts field, Lonoke, Ark.
Gerstner field, Lake Charles, La.
Call field, Wichita Falls, Tex.
Taliaferro field, Hicks, Tex.
Carruthers field, Benbrook, Tex.
Barron field, Everman, Tex.
Love field, Dallas, Tex.
Rich field, Waco, Tex.

Further orders will define the policy regarding Chapman Field, Miami, Fla., and Hazelhurst and Mitchell fields at Mineola, Long Island.

It is understood that the following fields owned by the Government will be retained:

Army Balloon School, Fort Omaha, Neb.
Army Balloon School, Lee Hall, Va.
Kelly field No. 1, San Antonio, Tex.
Post field, Fort Sill, Okla.
Rockwell field, San Diego, Cal.
Langley field, Hampton, Va.

According to the Assistant Secretary of War, the Army Air Service will abandon Camp John Wise, San Antonio, Tex., and McCook Field, Dayton, Ohio.

The status of Bolling Field, Anacostia, D. C., has not been definitely decided.

Tarrytown Addition for Chevrolet

NEW YORK, April 2—The General Motors Corp., Chevrolet Division, has awarded the contract for the erection of a 3-story reinforced concrete enameling and assembling plant on its Tarrytown, N. Y., property. The building will be 220 x 80.

England Fears Foreign Competition

(*Continued from page* 738)

tion to question the legality of the Board of Trade's action in continuing to exclude goods now that the war is practically over, without the direct sanction of the legislature. It is, however, expected that a statement of policy on this matter will be made within the next fortnight. Up to the present it seems as if the State Department concerned is merely acting as an agent of manufacturers whose plea that their action is to protect labor from being unemployed, deceives no one who is acquainted with the past views of many of these persons, and who now fails to see any corresponding effort of theirs to resume their normal time productions. There seems to be some special favor being shown to the Ford interests in the matter, for it is admitted that quite a large number of parts have been permitted to be imported for that car—and the defense offered is the plea that two-thirds of the materials required had been made up here. Naturally many people in the trade are asking why it is not possible for them to get imported spares for cars of other makes and why all this special attention to Ford interests.

I now hear that the Morris Co. have fixed up a contract for engines with the Hotchkiss Co. at Coventry, but as this company is unknown here as builders of small car engines, some doubt exists as to the outcome of this deal. Writing of specialist engines and engine builders reminds me that a big fillip is being given to this side of the British industry, notably by the Tylor Co. of London and the Dorman Co. at Stafford, both these companies being out for mass production.

The Tylor company has a new large works still unfurnished where the engine for the Angus Sanderson car is being built. The Dorman Co. hitherto have been mostly associated with engines for trucks, but are now going to cater for the car and light car trades. They have one size of engine about being started on for a mass output of 12,000 sets to be retailed at $225 without magneto and carburetor. The pre-war corresponding figure for this engine would have been about $150.

This company also is about launching a scheme for getting private car owners interested in Dorman engines. It is proposed to list this special engine to garage men and repairers at a discount, and with special inducements to interest them in re-engining customers' cars. Blue prints and all particulars and brackets and lugs for attaching the engine will be offered ready for standard makes of cars, the necessary fittings being listed at practically cost price.

Olympia Show Nov. 7-15

LONDON, ENGLAND, March 20—The Society of Motor Manufacturers and Traders have definitely fixed the dates for the Olympia Motor Car Exhibition. These are Nov. 7-15 inclusive.

Briggs Leaves Wheeler-Schebler

NEW YORK CITY, April 2—George T. Briggs, for years sales manager of the Wheeler-Schebler Carbureter Co., Indianapolis, has resigned and associated himself with the Sinclair Refining Co., Chicago.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:	
Muriatic, lb.	.02 -.03
Phosphoric (85%)	.35 -.39
Sulphuric (60%), lb.	.008
Aluminum:	
Ingot, lb.	.31
Sheets (18 gage or more), lb.	.42
Antimony, lb.	.06½-.06¾
Burlap:	
8 oz., yd.	.06¼
10½ oz., yd.	.08½
Copper:	
Elec., lb.	.15¼
Lake, lb.	.15½
Fabric, Tire (17¼ oz.):	
Sea Is., combed, sq. yd.	1.50
Egypt. combed, sq. yd.	1.25
Egypt. carded, sq. yd.	1.15
Peelers, combed, sq. yd.	1.10
Peelers, carded, sq. yd.	1.00
Fibre (⅛ in. sheet base), lb.	.50
Graphite:	
Ceylon, lb.	.90 -.22
Madagascar, lb.	.10 -.15
Mexico, lb.	.03¾
Lard:	
Prime City, gal.	2.40
Ex. No. 1, gal.	1.10 -1.15
Linseed, gal.	1.45 -1.48
Petroleum (crude):	
Kansas, bbl.	2.25
Pennsylva'a, bbl.	4.00
Menhaden (dark), gal.	.95
Lead, lb.	.05 -.05¼
Leather:	
Hides, lb.	.24 -.39½
Nickel, lb.	.40
Oil:	
Gasoline:	
Auto, gal.	.24½
68 to 70 gal.	.30½
Rubber:	
Plantation:	
First latex pale crepe, lb.	.50½
Brown crepe, thin, clear, lb.	.45
Smoked, ribbed Sheets, lb.	.49½
Para:	
Up River, fine, lb.	.56
Up River, coarse, lb.	.34
Island, fine, lb.	.47½
Shellac (orange), lb.	.60 -.64
Spelter, lb.	.06¼-.06½
Steel:	
Angle beams and channels, lb.	.03
Automobile sheet (see sp. table).	
Cold rolled, lb.	.0625
Hot rolled, lb.	.039
Tin	.71 -.72
Tungsten, lb.	1.50 -2.10
Waste (cotton), lb.	.12¾-.17

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.
- Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automobile Makers Buy British National Factory

THE first of fourteen large manufacturing plants erected by the British Government during the war has been disposed of by the Disposal Board, Land and Buildings Section. This is the National Aircraft Engine factory at Edmonton, which has been purchased by Straker-Squire, Ltd., for £140,000. It is stated that the original cost of construction was £133,000.

The factory is a new one, constructed within the last two years and comprises a splendid range of buildings of brick and glass, standing on a site of 14 acres. The works adjoin the Edmonton passenger station, and are well equipped with railway sidings.

The purchasers propose to transfer the whole of their manufacturing activities to Edmonton. Their program is to concentrate upon two standard models, a six-cylinder type of fast pleasure car and a four-cylinder commercial chassis suitable for transport work and motor omnibuses. The cars will be British-built throughout, and will be fitted with British magnetos. Almost all the engineering work and the whole of the body work will be completed on the premises. The entire factory will be organized on the lines of quantity production from standard jigs, and it is anticipated that 5000 work-people will be continuously employed. It is planned to produce 2000 complete vehicles the first year.

Automotive Securities on the Chicago Exchange at Close March 29

	Bid	Asked	Net Ch'ge
Auto Body Company	8	9¼	..
Briscoe Motor Car com	13	..	..
Briscoe Motor Car pfd	50	65	..
*Chandler Motor Car	124⅞	126⅞	—⅛
Chevrolet Motor Car	189	191	..
Cole Motor Car Co	93	105	..
Continental Motors com	7⅝	8⅛	—⅛
Continental Motors pfd	98	101	+1
Edmunds & Jones com	15	20	..
Edmunds & Jones pfd	75	90	..
Electric Storage Bat	69	71	+5
Federal Motor Truck	34	36	..
Fisher Body Co. com	55	58	+7
Fisher Body Co. pfd	95	98	..
Ford Motor of Canada	285	295	+15
General Motors com	170¾	171¾	+8¼
General Motors pfd	89½	91½	+½
Hupp Motor Car com	8⅜	8⅞	+⅛
*Hupp Motor Car pfd	95	100	..
Kelsey Wheel Co. com	37	39	—2
Kelsey Wheel Co. pfd	94	96	—½
Manhattan Electric S. com	..	48	..
Maxwell Motor com	38⅞	39⅞	+3¼
Maxwell Motor 1st pfd	67½	68½	+4½
Maxwell Motor 2d pfd	31½	32½	+3⅛
*McCord Mfg. com	33	36	+1
*McCord Mfg. pfd	91	93¼	+1
Mitchell Motor Co	27	31	..
Motor Products Corp	..	35	..
Nash Motors Co. com	230	..	—10
Nash Motors Co. pfd	95	100	..
National Motor Co	15	20	..
Packard Motor Car com	115	119	+1
Packard Motor Car pfd	99	101	—1
Paige-Detroit Motor com	28	29	—½
Paige-Detroit Motor pfd	8¾	9¾	..
Peerless Motor Truck	22	24	..
Pierce-Arrow M. Car com	45¼	46¼	+1
Pierce-Arrow M. Car pfd	102	104	—2½
Premier Motor Corp. com	5	...	..
Premier Motor Corp. pfd	..	75	..
Prudden Wheel Co	18	19	..
Reo Motor Car Co	23½	24¼	—¼
Republic M. Truck com	36	37	..
Premier Motor Corp. pfd	..	75	..
Saxon Motor Car com	6½	8½	..
Scripps-Booth Corp	21	25	..
*Stewart Warner S. Corp	89¼	91¼	—1½
Stromberg Carburetor Co	38	40	+1
Studebaker Corp. com	63¾	64¾	+1⅜
Studebaker Corp. pfd	94	97	.
*Stutz Motor Car Co	50½	51½	—½
United Motors Corp	43½	45½	..
*White Motor Co	52¾	53¾	+¼
*Willys-Overland com	29⅝	30⅝	+⅞
Willys-Overland pfd	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co	71½	72½	—2¾
*Firestone T. & R. com	147	149	—2
Firestone T. & R. pfd	99½	101½	..
Fisk Rubber Co. com	103	105	..
Fisk Rubber 1st pfd	100	105	..
Fisk Rubber 2d pfd	101	105	..
Fisk Rub. 1st pfd conv	99	101	..
Goodrich, B. F., com	66½	67½	—2¼
Goodrich, B. F., pfd	106½	107½	+½
Goodyear T. & R. com	270	273	—2
*Goodyear T. & R. 1st pfd	106	107	+½
Goodyear T. & R. 2d pfd	106¼	107½	—¾
Kelly-Springfield com	119½	120½	..
Kelly-Springfield pfd	95	97	..
Lee Tire & Rubber Co	24	25	—1
Marathon Tire & Rubber	55	75	..
Miller Rubber Co. com	175	178	..
Miller Rubber Co. pfd	101½	103	..
Rubber Products Co	133	135	..
Portage Rubber Co. com	163	165	..
Swinehart T. & R. Co	80	85	..
U. S. Rubber Co. com	83¼	84¼	+¾
*U. S. Rubber Co. pfd	110⅝	111⅝	—⅞

*Ex dividend.

Hanch Visiting Foreign Factories

PARIS, March 14—C. C. Hanch, official delegate of the National Automobile Chamber of Commerce, left Paris to-day for Lyons and Turin. He attended the International Meeting of Allied Automobile Manufacturers called together by the French makers, and at which the formation of a permanent bureau was decided on. Mr. Hanch will spend 2 days at the Lyons fair and from there will proceed to Turin and Milan, to visit such factories as Fiat, Isotto-Fraschini, Lancia, Spa, Bianchi and Itala. On returning from Italy, he will spend a few days in the Paris district before leaving for England, where he expects to remain about a month, and will then sail for America.

—

Released Officers with Standard Parts

CLEVELAND, March 28—Several officers who left their positions with the Standard Parts Co. to go into government service have returned to civilian life and their pre-war work. Other officers identified with the engineering division of the Motor Transport Co. have also been added to the staff.

Capt. E. R. Finkenstaedt, formerly active in the production of the Liberty truck for the government at Washington, has resumed his duties as assistant to President Christian Girl. Major Lewis P. Kalb, until recently in charge of designing, testing and specification work in the engineering division of the Motor Transport Corps, has joined the engineering staff of the company as assistant director of engineering, and Capt. A. L. Watts, in charge of the specification and record section of the engineering division of the Motor Transport Corps, has also joined the engineering staff. Both Lieut. Rex Gosling, who before entering service was purchasing agent of the Standard Welding division, and Lieut. Ray Jones, who gave up his position as production manager of the Perfection Spring division to enlist in the navy, have returned to their respective plants.

—

V. K. McBride, formerly assistant sales manager of the Federal Motor Truck Co., has been appointed to a similar position with the Premier Motor Corp., Indianapolis.

—

Fred D. Rice, who has recently been released from service in the navy, is now representing the Hess Steel Corp., Baltimore, in western New York and western Pennsylvania.

—

Frank Dawson, who has been identified with the truck industry for the past 14 years, has resigned as designing engineer and production manager of the Master Truck Co., Chicago, to become general manager in charge of production for the Gary Motor Truck Co., Gary, Ind.

—

Herman A. Holz, metallurgical engineer and manufacturer of metallurgical and magnetic testing apparatus, has moved his office from 1 Madison Avenue to 17 Madison Avenue, New York City, where he is occupying the third floor.

Men of the Industry

Changes in Personnel and Position

British Trade Expert Will Try to Recapture Colonial Trade

LONDON, ENGLAND, March 17—The Association of British Motor & Allied Manufacturers, Ltd., has appointed Major R. E. Goddard as its overseas commissioner. He will make a tour of investigation of the markets of Australasia, India and the East and will include Ceylon, the Dutch East Indies, Australia, New Zealand, Japan, China, Malaya, Burma and India, in the order named. The whole tour will occupy about a year. It is possible that operations will be extended to other territories if this first year's tour is as satisfactory as anticipated. In this matter the association is acting in conjunction with the Overseas Trade Department of the British government. The government is assisting in every way, partly as regards finance and partly as regards official introductions and shipping arrangements.

Though Major Goddard has good credentials for his task, it is not clear how he is to compass so wide and distant a field of trade territory in a year. This is especially true because he is faced with the task of trying to dislodge American hold of the Australian and New Zealand markets, which were lost through lack of competent control and progressive ideals.

—

Ben Drewes, general superintendent of the foundry department of the Avery Co.'s motor works at Milwaukee, resigned April 1 to accept the position of foundry superintendent of the Kissel Motor Car Co., Hartford, Wis. He is succeeded by G. H. Joner, who has been assistant superintendent. Mr. Drewes went to the Avery motor works from the Kissel company about a year ago.

—

F. H. Berger, Detroit, former chief engineer of the Oakland Motor Car Co. and of the Abbott Co., is reported to be designing a new car. He has opened an office in the Hodges building.

—

C. R. Bulley has been appointed sales metallurgist to the Hess Steel Corp., Baltimore. During the war he was in charge of the design, building and operation of the heat-treating department of the Symington-Anderson Co., Ordnance, Rochester, manufacturers of 75 mm. field shells for the government. Prior to this he had several years' experience in the metallurgical department of the Halcomb, Midvale and Carpenter steel companies.

—

Edward S. Babcox has been appointed sales manager of the Rubber Products Co., Barberton, O.

Ford Mechanical Engineer Rumored Out

DETROIT, March 31—It is rumored here to-day that Charles Mongana, Jr., chief mechanical engineer of the Ford Motor Co., has resigned and is out. This cannot be confirmed at the Ford plant. It is also repeatedly heard on all sides that F. L. Klinginsmith, vice-president of the company, will retire immediately upon his return from his vacation.

—

Jack Neely, formerly with the sales department of the Roamer distributing agency at Kansas City, has been made assistant sales manager of the Barley Motor Car Co., Kalamazoo, makers of Roamer cars.

—

Edward T. Walling, associated with the Spranger Wire Wheel Co. for five years as assistant general manager, has resigned.

—

C. L. Thurston, export manager, has been placed in charge of the export offices of the Briscoe Motor Corp., Jackson, Mich., which have been opened at 1834 Broadway, New York City.

—

H. B. Niblette has been appointed supervisor of the tire sales division of the Thermoid Rubber Co., Trenton.

—

Allan S. Place, formerly with the Chevrolet Motor Co., Flint, has become superintendent of the Duplex Truck Co., Lansing.

—

W. D. Langdon, purchaser of metals for the Willys-Overland Co., Toledo, has been made assistant general purchasing agent of the company.

—

H. A. Reed, vice-president of Reed, Tilley & Co., Inc., exporters of automotive apparatus, has just returned from a business trip through Cuba.

—

Robert Evans, formerly service manager of the Page-Detroit Motor Car Co., is the new service director of the Landman-Griffith Co., Toledo.

—

John Gilson, Sr., Port Washington, Wis., founder of the Gilson Mfg. Co., manufacturer of gasoline engines, garden tractors, etc., died March 24 at the age of 69 years.

—

John Millen, of 366 Wood Avenue, Westmount, president of John Millen & Son, Ltd., 323 St. James Street, Montreal, Canada, died on Tuesday, March 25, in his 76th year.

—

Warner Gear Secretary-Treasurer Dies

CHICAGO, March 31—John Edgar Johnson, age 45, secretary-treasurer of the Warner Gear Co., Muncie, Ind., died suddenly Sunday morning after one week's illness. Johnson was born in Ashtabula, O., but was a resident of Muncie since the age of seven. He was also associated with the Morrison-Johnson Insurance Co. and a director of the Muncie Savings & Loan Co.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Additional Buildings for Stephens

FREEPORT, ILL., March 31—Approximately $125,000 is being expended by the Stephens Motor Car Co. on additional buildings, new machinery and equipment. Both of the main units are now in operation. Until March 1 only the Chicago Street plant, employing 227 men, was active, the old Freeport carriage plant, known as Plant No. 2, having been idle since the opening of the war, when lack of materials forced a temporary suspension. The latter unit will employ 300 men. The schedule calls for an output this year of 5000 cars. The No. 1 plant has been specializing in bodies for commercial trucks, and its business for 1918 aggregated $1,000,000.

Continental Motors Handled by Beckley Ralston

CHICAGO, March 29—Retail sales of single engines and spare parts for Continental motors for replacement in cars and trucks will be handled in this territory by the Beckley Ralston Co., accessory dealers and jobbers. The company expects to establish several repair depots in the city.

Duplex Truck Co.'s Production Increased 25 Per cent

LANSING, March 29—The Duplex Truck Co. has increased its production 25 per cent in the last three months, having completed its return from war to peace work without difficulty. The company now has 70 active distributing agencies throughout the country.

Olympian Increases 100 Per Cent in Production

PONTIAC, MICH., March 31—The Olympian Motor Car Co. has increased production 100 per cent in the last 30 days. The company is now running 10 and 12 cars daily. The last of the depth-bombs, which it was making for the navy, was completed Saturday.

American Bosch Co. Holds Sales Convention

NEW YORK, March 31—The American Bosch Magneto Co. closed its first sales convention last Thursday. The morning of the first day was taken up with an automobile trip around Springfield. Inspection of the works was held in the afternoon and business sessions in the evening. Wednesday and Thursday were given over to a discussion of trade matters and a review of new products. On Wednesday evening 100 executives and department heads sat down to a banquet at the Nayassett Club.

Giant Trucks in New Hands

CLEVELAND, March 31—The motor truck division of the Chicago Pneumatic Tool Co., making Giant trucks, was purchased Saturday by C. A. Finnegan, of Buffalo, N. Y., owner of the Buffalo *Commercial*, and A. Webber, who is interested with Mr. Finnegan in various enterprises. The business will be carried on with all branches and employees as before. H. B. Young will be associated with the new company in an executive capacity and will be in Chicago.

Bohnet & Co. to Enter Body Field

LANSING, MICH., March 28—John Bohnet & Co. have increased their capitalization from $10,000 to $75,000 and will enter the commercial body field. The company will be in production within 60 days. The present factory building, which has 60,000 sq. ft. of floor space, will be altered to accommodate the new department. W. G. Suprenant, Philadelphia, has been placed in charge of the body work.

Walker-Weiss Now Flint Axle

FLINT, MICH., March 31—The Flint Motor Axle Co. is the new name taken by the Walker-Weiss Axle Co. The capital stock and the policy of the company will remain unchanged, and with the exception of W. T. Walker, the same men are in control of its affairs. Mr. Walker disposed of his interest last April, and the remaining members of the concern took over his stock. The company has been making axles for the Chevrolet Motor Co. of New York, the Dort Motor Car Co. of this city, as well as for other outside concerns.

New Ford a Couple of Years Off

DETROIT, March 26—In a letter signed by Edsel B. Ford, sent to all dealers throughout the country, the Ford Motor Co. says that rumors about the new Ford are greatly exaggerated.

"In the first place," the letter states, "a large majority of the rumors afloat are distorted. A new car may be manufactured, but when we are not in a position to say, except that we know a new car could not possibly be designed, tested out, manufactured and marketed in quantity under two or three years."

Superb to Manufacture Trailers

MONTICELLO, IND., March 31—In addition to manufacturing parts and accessories the Superb Mfg. Co. will bring out a line of light and heavy trailers within the next 60 days. In order to have sufficient production facilities it is adding 20,000 sq. ft. of floor space to its present plant.

Traffic Truck in New Quarters

ST. LOUIS, March 31—The Traffic Motor Truck Corp. is moving from its original factory at 3810 Laclede Avenue to 8000 North Broadway, where it will have more than 100,000 ft. of factory space.

No Plans for Future of Inter-State

DETROIT, March 26—The General Motors Corp. has not stated to what use it will put the plant of the Inter-State Automobile Co., Muncie, Ind., purchased last week. The sale included the plant and 40 acres of ground adjoining, on which additions will be built. The Inter-State stopped the building of passenger cars after America entered the war, and concentrated its energies on production of trucks for the army. This contract has just been completed.

Wallace Barnes Opens Branches

BRISTOL, CONN., April 1—The Wallace Barnes Co. has opened branch sales offices in New York City at 50 East Forty-second Street with Lisle K. Lasher in charge, and another in Detroit, 618 Book Building, with Brown Joyce in charge.

New Cars Not to Be Driven from Factory

DETROIT, March 27—Detroit automobile manufacturers are discouraging their distributers who come to the city with the intention of driving away their cars. The manufacturers declare an automobile leaving the factory new is not a new car when it reaches its destination of 500 to 1000 miles away.

Lancaster Steel Products Bought by General Motors

LANCASTER, PA., March 29—The Lancaster Steel Products Co. has been sold to the General Motors Co. and will be operated as a subsidiary, it is announced. H. B. Cochran of this city will remain at the head of the local concern.

Clinton Planning New Truck

DETROIT, March 28—The Clinton Motor Truck Co. is bringing out a new 1-ton truck. The new model was already on the market before the war, but owing to war work and scarcity of material manufacture was suspended. The Clinton Truck Co. will locate its main plant in Cleveland.

Parsons Mfg. Co. to Move

DETROIT, March 28—The Parsons Mfg. Co., now on Stanley Avenue, will shortly be located at Bellevue Street, where enlarged facilities will be available. The company will occupy 30,000 sq. ft. of floor space in its new quarters, and expects to be in full operation by April 15. The Parsons company makes concealed hinges for passenger car bodies, also coach locks for sedans, limousines and other closed cars.

Daylight Saving Conserves Coal

WASHINGTON, March 29—The United States Fuel Administration stated to-day that 1,250,000 tons of coal were saved during the 7 months last year when the daylight saving law was in effect.

Peerless Shows Smaller Profit This Year

CLEVELAND, March 29—Net profits of the Peerless Truck & Motor Corp. and subsidiary companies for 1918 were $773,895, after all charges, interest, depreciation and $71,596 reserved for Federal taxes were taken off. Although depreciation, costs, interest and taxes were less in 1918 than 1917, net profits were $175,608 less and net sales $7,039,373 less for 1918 nad 1917.

The consolidated income account of the Peerless Motors Corporation and subsidiary companies for the year ended Dec. 31, 1918, compares as follows:

	1918	1917
Net sales	$11,890,079	$18,924,452
Cost of sales, plant	10,831,089	17,329,985
Depreciation of plant	214,808	291,849
Net inc. from sales	$844 182	$1,302,618
Other income	230,808	405,013
Total income	$1,074,990	$1,707,631
Deduct int. on notes	229,113	300,000
Interest on bonds	......	......
Premium on bonds	......	......
Organization expenses	......	......
Depreciation in investments	386	34,963
Fed. and income taxes	71,596	306,799
Balance	$773,895	$1,065,870
Net loss on munitions	......	......
Reserve for contingencies	......	116,367
Net profits for year	$773,895	$949,503

The consolidated balance sheet of the Peerless Motors Corporation, as of Dec. 31, 1918, compares as follows:

Assets

	1918	1917
Plant, land, etc	$2,957,027	$3,886,314
Patents, etc	2,862,035	3,710,520
Cash	1,790,890	2,869,569
Liberty bonds	1,600,731	......
Marketable securities	163,144	192,980
Inventories	2,465,448	5,318,743
Government claims	945,353	......
General vehicle investments	50,429	63,413
Sundry debtors	67,775	111,299
Accounts and notes receivable	1,627 683	2,098,205
Cash and purchase	22,890	29,190
Prepaid expenses	38,742	43,676
Total	$14,592,147	$18,323,909

Liabilities

	1918	1917
Capital	$4,898,110	$4,898,110
Peerless Motor preferred stock	21,800	27,800
Funded debt	3,453,800	5,280 000
Accounts payable	917,122	1,264,414
Special deposits	......	......
Drafts discount	64,407	1,044,892
Sundry creditors	398,511	716,859
Contingent reserves	249,425	719,916
Surplus	4,588,972	4,371 918
Total	$14,592,147	$18,323,909

Despite the fact that net sales of the Peerless Truck & Motor Corp. show a decrease the corporation is in good financial condition. As of Dec. 31, 1918, current assets were $8,711,452 and current liabilities $1,380,039, making net working capital $7,331,413. Deducting from this the $3,453,800 bonds now outstanding there remains $3,877,613.

The signing of the armistice found Peerless with orders on hand covering substantially all of its truck material in process. These orders are about completed.

Crow-Elkhart Back on Its Feet

ELKHART, IND., March 31—The financial difficulties of the Crow-Elkhart Motor Co., brought on by war conditions, have been taken care of, and the company will soon resume normal production. Settlement of litigation following a petition for a receiver will enable the company to increase its output. H. T. Shafer & Co., Chicago, will have an interest in the concern from the fact that it will underwrite a bond issue of $600,000.

Both the Indiana company and Arizona corporation, forming the Crow-Elkhart Motor Co., will be dissolved, and the business will be conducted by the Crow-Elkhart Motor Corp., with an authorized capitalization of $10,000,000. H. T. Ligtig, as a representative of H. T. Shafer & Co., will be auditor and treasurer. It is announced that the former stockholders will receive an equal amount of stock in the new corporation, while the creditors who had accepted a settlement on a 25 per cent basis will receive also an amount equal to 75 per cent in the stock of the new corporation. The company now has orders for all the cars that can be produced within the next six months.

$801,607 Net Earnings of Hale & Kilburn

PHILADELPHIA, March 29—During the past year Hale & Kilburn Corp. has increased its net sales $240,970 over 1917, and its net earnings $216,212. Its balance sheet as of Dec. 31 last shows cash amounting to $164,216; a surplus of $498,404, and its total assets and liabilities, $7,517,637. Net sales to the amount of $4,476,552 and net earnings amounting to $801,607 are reported in the financial statement of the company, which follows:

	1918.	1917.
Total net sales	$4,476,552	$4,235,582
Net earnings	784,024	542,328
Miscellaneous revenue	17,583	43,067
Total net earnings	$801,607	$585,395
Interest charges, taxes, etc.	403,764	323,238
Surplus	$397,843	$262,157

Dividends Declared

General Motors Corp., Pontiac; regular quarterly dividend, 3 per cent on common, 1½ per cent on preferred and debenture stocks; all payable May 1 to stockholders of record April 15.

Standard Parts Co., Cleveland, 1¾ per cent, quarterly, preferred, payable April 1 to stockholders of record March 20.

Maibohm Surplus Amounts to $32,811

RACINE, March 29—A regular annual dividend of 6 per cent was declared at the annual meeting of the directors of the Maibohm Motors Co. The financial statement of the company for 1918 shows a surplus of $47,370, of which $14,559 was deducted to pay for the loss due to the fire on Dec. 3, leaving a net surplus of $32,811. Operations were continued in spite of the damage done to the plant. The company was not engaged on any war contracts, but, although working only on its regular products, production was somewhat curtailed because of government restrictions.

The following officers were elected for the new year: President, H. C. Maibohm; vice-president, T. W. Cushing; secretary and treasurer, I. O. Bormann; works manager, W. C. Maibohm, and director, Albert Mohr.

The balance sheet for the year ended Dec. 31, 1918, shows:

Assets

Cash and cash items		$157,272
Inventories		50,960
Deferred to operation		205,123
Machinery and equipment		94,477
Trademarks and good will		50,000
		$557,832

Liabilities

Current liabilities		$30,509
Reserves		3,578
Dealers' deposits		4,624
Outstanding stock		486,310
Surplus	$47,370	
Less fire loss	14,558	
		32,811
		$557,832

American Veneer Co. Soon Ready for Production

HAYWARD, WIS., March 31—A concern manufacturing veneers, veneer panels and other select hardwood products is being established here by the American Veneer Co., incorporated last year with a capital stock of $150,000. Work will start at once on a factory, 180 x 250 ft., to be ready about June 15, and to employ from 100 to 150 men.

Marwin Truck Co. Buys Leased Plant

KENOSHA, WIS., March 31—The Marwin Motor Truck Co. has acquired the former plant of the Skidd Mfg. Co., which it has been occupying since last fall under lease, and plans to erect several additions. The purchase price was $22,500, and more than an equal amount will be invested in new buildings and equipment during the year. The present output of the company is two machines a day.

Arrow-Grip Enlarges

GLENS FALLS, N. Y., March 31—The Arrow-Grip Mfg. Co. has increased its capital stock from $100,000 to $500,000, and will commence the erection of a new factory building soon. It has also opened an export office at 16 West Sixty-first Street, New York City, and continues to operate its warehouse in Chicago.

War Department Will Sell Surplus Trucks and Cars

WASHINGTON, April 1—A possible surplus of Army trucks and passenger cars is now considered likely, and in event that there are more vehicles than can be used by the Army these will be disposed of by the Director of Sales according to a plan which is designed to protect both the War Department and the automobile industry.

After the inventories, which are now being taken by the War Department, are completed, if it is found that there is a surplus of motor vehicles, the different branches of the Government will first be consulted to learn whether the surplus can be used to fill their requirements.

Various manufacturers of automobiles and trucks will be next approached to ascertain whether they will take over the vehicles of their own make to market them with their own machines to secure a fair market price for the Government and at the same time prevent disturbances of market conditions.

The net surplus remaining after the various branches of the Government and the manufacturers have been consulted will be disposed of to the public either through auction or by sealed bids. Full publicity will be given this sale throughout the country in order that the Government may realize the best results. In the meantime the public should understand that no motor trucks or passenger cars are being sold. It is anticipated that between the various Government departments and the manufacturers, whatever surplus is available will be taken up by them.

Standard Grading of Singapore Rubber

WASHINGTON, March 26—The Rubber Association of the Singapore Chamber of Commerce will establish a standard for Singapore rubber. A Standard Qualities Committee examines all samples of rubber offered for sale by members of the association and grades them.

Two standard qualities are recognized: Latex crêpe, which must be well prepared dry rubber of even color and free from all stains, spots and traces of oxidation; and F. A. Q. ribbed smoked sheet, which must be clean, tough rubber, free from mold, dampness or under or oversmoked sheets. The rules provide that all rubber sold as standard quality must be certified as such by the committee. The awards of the committee remain in force for one month from date of examination of sample. It is believed that this step will prove an important one and will result in "Singapore Standard" becoming of high rank in the markets of the world.

Pratt & Whitney to Make Hoke Gages

HARTFORD, CONN., April 2—The Pratt & Whitney Co. has secured the manufacturing rights for Hoke Precision Gages, which are now being made at the Bureau of Standards in Washington, as inspection and reference sets for Army and Navy use. The first sets ready for the market will consist of five blocks of 1-in., .5-in., .3-in., .2-in., .1-in., giving any tenth up to 2 in. The addition of ⅛-in., ¼-in. and ⅜-in. sizes will provide any eighth or tenth up to 2¼ in. in a set of eight blocks; and the addition of 1/16-in. and .05-in. blocks, making ten in all, will give any sixteenth or any .05-in. interval.

South May Have Tractor Plant

BIRMINGHAM, March 28—This city is being discussed as a likely location for the manufacture of the Mobile tractor, produced by the Mobile Tractor Co., which has its headquarters in Mobile. Officials of the company are desirous of putting up their own plant and plan to manufacture other automotive products along with the tractor. The northern and western demands are supplied through the Fort Wayne, Ind., plant, where the machine goes under the name Automotive tractor.

Freight Cars Released for Automobiles

NEW YORK, April 2—Regional railroad directors in the West and South have issued imperative orders that freight cars for the transportation of automobiles and which have been used for general purposes during the war must now be returned as speedily as possible into automobile manufacturing territory. In consequence 539 empty automobile cars passed east through Kansas City within a period of 48 hours last week. An official will be stationed in Detroit to have full control of the distribution of automobile cars in the Michigan-Toledo zone.

Elcock Returns to Atlanta Office of Cement Assn.

ATLANTA, April 2—Walter B. Elcock has returned as district engineer in charge of the Atlanta office of the Portland Cement Association, which position he left in March, 1917, to serve as Major of Infantry and Adjutant of the 157th Depot Brigade at Camp Gordon.

Government to Give Credit Ratings on Foreign Firms

NEW YORK, April 2—The Government is arranging to give American manufacturers credit ratings on foreign firms. Certain records and information obtained by the Bureau of War Trade Intelligence will be used as the nucleus to build up the service, which eventually will become a distinct bureau of the Government. For the present, the Washington office of the American Manufacturers' Export Association is prepared to answer inquiries regarding the financial responsibility of foreign firms.

Porter New Chief Engineer for Curtiss

NEW YORK, April 1—F. R. Porter has been appointed chief motor engineer of the Curtiss Engineering Corp., Garden City, L. I., where the experimental work of the Curtiss company is carried on. He has also been appointed chief engineer of the Curtiss Aeroplane & Motor Corp., Buffalo. His headquarters will be at Garden City. For the past year Mr. Porter was chief engineer at McCook Field for the Government, and in that capacity had to handle all new inventions in connection with engines and accessories.

Toby American Commerce Chamber Secretary

NEW YORK, April 2—George P. Toby has been appointed executive secretary of the American Chamber of Commerce in London. He will sail from New York about May 12.

To Build Texas Helium Plant

WASHINGTON, April 1—A helium plant is being constructed by the Government at North Fort Worth, Tex., to provide helium gas for airships. The plant will cost $900,000. Helium is a gas recently found to be particularly adapted to the filling of balloons. It is said to have 92 per cent of the lifting power of hydrogen and is not inflammable. The products of certain natural gas wells in Clay County, Tex., have been found best suited for the extraction of helium, and pipe lines will be arranged to Fort Worth.

Duplex Governor Chicago Office Moves

CHICAGO, April 2—The office of the Duplex Engine Governor Co. has been moved from 220 S. State Street to 28 East Jackson Boulevard.

Soss in Charge of Detroit Branch

BROOKLYN, N. Y., April 2—Samuel Soss has been placed in charge of the Detroit branch of the Soss Mfg. Co.

Decrease in February Oil Exports

WASHINGTON, April 2—The following is the complete tabulation showing the detailed decrease in oil exports, described briefly in the last issue of AUTOMOTIVE INDUSTRIES, for February and eight months previous:

	February, 1919		February, 1918		Eight Months Ended February, 1919		Eight Months Ended February, 1918	
	Gal.	Value	Gal.	Value	Gal.	Value	Gal.	Value
Mineral oils	165,689,425	$25,448.791	221.579.890	$24.031 982	1,755.072.757	$236,411,462	1,774,312,127	$183 933.493
Crude mineral oil	7,707,112	415,911	19.734.996	1,005.760	124.806.406	7.848,846	119,053.749	5,568,194
Illuminating oil	64,679,339	7,347.172	29.878.381	3,262 420	371.234.786	40.124,851	362,375.485	31,176,908
Lubricating oil	29.627.360	9.476.195	17,707,037	4,826.359	180.309.847	58,216.030	178 125,460	40.994.987
Gasoline, naphtha, etc.	26,964,764	6,373.852	35,396,038	8,426.107	360.433 084	89,474,987	272,424,081	65,089,146
Residuum, fuel oil, etc.	36,710,850	1,835,661	118,863,438	6,511,336	718,288,634	40,746,748	842,333,352	41,104,258

Calendar

ENGINEERING SHOWS

March 29-April 5 — Passenger Cars. April 8-12—Trucks, Brooklyn. Brooklyn Motor Vehicle Dealers' Assn. I C. Kirkman, Manager.

March 31-April 5—Cumberland, Md., Automobile Dealers Assn., Armory.

March 31-Apr. 5—New Orleans, La. Henry B. Marks, Manager.

April 1-5—Denver, Col.—Denver Automobile Trades Assn. Stadium.

April 3 — Macon, Ga. Motor Truck Demonstration, Macon Automobile Chamber of Commerce.

April 5-12 — Bridgeton, N. J. Fourth Annual, Automobile Dealers' Assn.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

April 8-12—Deadwood, S. D. Seventh Annual Cars and Tractors, Deadwood Business Club.

April 16-19 — Waynesburg, Pa. Automobile Dealers' Assn. of Greene Co., Armory. Frank L. Hoover, Mgr.

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and Accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-15 — London — Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December—Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

TRACTOR SHOWS

April 15—Walla Walla, Wash. Sectional Tractor Demonstrations.

May 5—Sacramento, Cal. Sectional Tractor Demonstrations, Demonstration Field.

June — Denver, Col. Sectional Tractor Demonstrations.

July—Wichita, Kan., Automotive Committee of National Implement Assn.

Aug.—Aberdeen, S. D. Sectional Tractor Demonstrations.

RACES

†May 17—Uniontown, Pa., probably 112½ miles.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 22-23—Elgin, Ill. Speedway.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Oct. 1—Cincinnati, O. Speedway race.

†Sanctioned.
*Tentative dates.

CONVENTIONS

April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

May 1-June 1 — Atlantic City, N. J.—Pan-American Aeronautic Convention and Exhibition — Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

Foreign Trade Opportunities

WASHINGTON, March 31—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has received requests for automobiles or parts agencies from individuals and companies in foreign countries. These are listed below. For further information address the Bureau of Foreign and Domestic Commerce and specify the Foreign Trade opportunity number.

Algeria—Agricultural machinery, petroleum for lighting and motors; automobiles. Correspondence should be in French. No. 28844.

Australia—Motor car and motorcycle accessories, motor car body and top materials and trimmings. Quotations should be given f.o.b. New York. The goods ordered will be handled and paid for by a firm in New York City. No. 28852.

Italy—Automobiles of 12 to 15 and 15 to 20 hp. Correspondence may be in Italian or French. Payment will be made on receipt of goods through bank. No. 28854.

Italy—An agency for automobiles and motorcycles. Correspondence may be in English. No. 28834.

Italy—An agency for agricultural apparatus. Correspondence may be in English. No. 28789.

A British Indian company, with buying headquarters in New York City, wishes to purchase direct from manufacturers automobiles and accessories. Payment will be made against documents in New York. No. 28794.

France—An agency for southern France of automobiles and trucks. No. 28795.

Switzerland—Agencies for cheap and medium priced automobiles. Correspondence should be in French or Italian. No. 28816.

Italy—An agency for motorcycles. Correspondence should be in French or Italian. No. 28823.

Mead-Davis for Distribution, Sales and Advertising

CHICAGO, March 29—The Mead-Davis Co. has been formed with temporary offices at 814 Hearst Building. Its activities will include factory products distribution, sales and advertising. F. L. Mead will be in charge of the sales department and B. E. Davis, head of the advertising department. Mr. Mead resigned his position as general sales manager of the Dearborn Truck Co., where he has been for three years, on Feb. 1. He has also been connected with the General Motors Truck Co., Buick Automobile Co. and Oakland Motors Co. Mr. Davis has been advertising manager for the Dearborn Truck Co. for the past two years. The new company plans to act as director of advertising and sales for manufacturers.

Parts Coming From Louisville

LOUISVILLE, March 31—Announcement was made here to-day by the Louisville Industrial Foundation that the Louisville Pattern Works, specializing in patterns for automobile parts, will begin operations within 30 days. The concern has been incorporated for $15,000, the incorporators being John F. Reeder, A. J. Roth and P. W. Roth of Muncie, Ind., where they have been engaged in pattern and foundry work for motor cars. Only skilled labor will be employed. Machinery and equipment have been ordered and will be installed as soon as the plant's location is selected. The concern is considering several sites. It will make patterns for engines, cylinders, crank cases, transmission cases and other automobile parts.

General Motors to Build 1000 Homes

FLINT, MICH., March 28—Work is about to start on construction of 1000 homes for Buick and Chevrolet employees, which will be completed by Dec. 1. The General Motors takes this action to relieve the house shortage here, which is becoming acute. The new homes will be built on the outskirts of this city, in Flint township. The company proposes to construct sewers, water mains, pavements, sidewalks and to provide recreation centers. The homes will be sold on an easy payment plan.

Overland Mechanics O.K. Wage Scale

TOLEDO, O., March 31—Machinist employees of the Overland plant met Saturday and approved the Willys-Overland new wage scale agreement. The agreement will affect the Overland plants at Toledo, Elyria, O., and Elmira, N. Y. A sliding scale will be asked, with a minimum wage increase from 55 cents to 70 cents an hour for machinists, and other scales have been written for helpers and similar workers.

Onondaga Steel Adds to Directorate

SYRACUSE, N. Y., March 29—Morton D. Whitford, treasurer of the Semet-Solvay Co. and a director of the Syracuse Trust Co., and Charles H. Canfield, general auditor of the company, have been added to the directorate of the Onondaga Steel Co., Inc. The company is planning to move its offices and remaining furnace and melting equipment to its newly acquired site at Eastwood this spring. Plans have been made for the immediate construction of a temporary office building, and an addition to the main building, 40 x 40 ft., to house the blacksmith shop and the small hammer shop.

Tractor Service Book

We have received from the Gurney Ball Bearing Co., Jamestown, N. Y., a copy of a recently issued Tractor Service Book. It contains instructions for the care and operation of tractors, particularly in relation to bearings, lubrication, engine starting and magneto and other electrical equipment. There are also an article on the draft of tillage implements, an article on field operation and adjustment of light farm tractors, the tractor standards adopted by the S. A. E., miscellaneous data and a number of blank sheets on which data concerning plowing operations can be entered.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, APRIL 10, 1919—CHICAGO NO. 15

International Air Navigation Regulations

Paris Commission Adopts Preliminary Code — Will Be Basis for Final International Rules — Recognizes Rights of Individual Countries

By Allen Sinsheimer

WASHINGTON, April 7—The first comprehensive attempt to formulate an international code controlling aërial navigation has been completed by an inter-ministerial commission at Paris, appointed for this purpose. The first copy of these regulations has just been received in this country and is printed herewith.

Following a brief explanation of the past history of the attempts to formulate navigation regulations, the code comprises fourteen articles, with a number of annexes and programs.

Primarily, the code is intended to regulate navigation throughout the world, although for the time being and until the peace treaty is signed only the Allies and the United States are recognized.

Neutral countries will be allowed to join after peace terms are completed, and at that time the attitude toward Germany and other enemy countries will be decided. The right of each individual nation to formulate individual aërial regulations is recognized in so far as these regulations do not conflict with the international code.

The work of the commission was quite complete, and the general scheme includes provisions covering practically all of the more important problems of civil aviation. In order to secure permission to fly over the territory of any other country, an aviator must be registered in one of the nations recognized by the code, must possess a flying license, and the pilot of the machine must be a citizen of one of the recognized countries.

The airship must be provided with a route-book, corresponding to a ship's log, in which the nature of the airship, register number, name, nationality and residence of the owner and pilot, crew, passengers, complete details of the trips, memorandum of transported merchandise and route incidents must be recorded.

Any of the recognized countries may forbid private individuals to fly over certain zones of its territory. The carrying of cameras, war appliances or any dangerous explosives is forbidden except when specially authorized.

Military planes are not allowed to fly over foreign territory.

All the recognized countries are to agree to provide assistance to any airship when it is needed, and especially to build landing fields. Tariff, hygiene and landing-field regulations are to be determined by the individual countries.

Technical conferences are to be held at which representatives of at least two-thirds of the recognized countries will be present and at which additional provisions and modifications of these provi-

sions will be suggested for the final draft of the international code, which will be valid in every contracting country and which cannot be renounced until 3 years after notice is given.

The airships of each country will be lettered to denote their nationality and type of ship, and these letters must be displayed prominently.

Licenses will be granted after sufficient trials before competent aeronautics associations or in the presence of public authorities. In this particular provision there is opportunity for misuse of the regulations, inasmuch as it can become possible for an aeronautic association, by this authority, completely to control aeronautics in its particular country.

Furthermore, the navigation license must include complete and intimate data relative to each airship, and any rules which will allow a private aeronautics association to possess such information in its files also allows for further abuse.

Certificates of competency are to be provided each pilot and engineer of an airship by the country to which he belongs.

Detailed regulations regarding the use and placing of lights, driving, signals and use of ballast are given.

Motor-driven airships must give right of way to all other ships, including free balloons and dirigibles, according to the regulations, which apparently means that airplanes must allow right of way to balloons and dirigibles. A distance of 200 meters must be maintained between airships whenever possible; when they are closer than this, special regulations are provided for their operation.

Pilots' tests include flights for 1 hour at an altitude of at least 2000 meters, descent in a volplane with the engine shut off, flying around posts, landing with the engine completely stopped when the airplane touches the ground or water, endurance tests and written or verbal technical examinations. Pilots must have theoretical knowledge regarding air resistance, the functions of the various mechanisms, fitting up of planes, aërial navigation rules, complete engine construction, and must be versed in climatic conditions and map-reading.

Following is the report, including the code of the Inter-Ministerial Commission of Civil Aeronautics at Paris:

Regulations for Air Navigation

Inter-Ministerial Commission of Civil Aeronautics

THE end of the war is opening new vistas to civil aeronautics. A large number of machines and pilots given back to pacific activity are ready to develop air locomotion in all its forms, in Belgium, France, Great Britain, Italy and the United States. Aeroplanes or even dirigibles will certainly be precious help for touring, trade, public services, etc.

Great Britain, fearing to lose her privileges as an island, did not seem at first to welcome the invention, but she has become now much interested in the development of air navigation. France, which was the seat of the first international conference, which in 1910 attempted to solve the difficult judicial problem, must on her behalf and that of other nations resume the work which she so successfully started 8 years ago. Such a task has been assigned to her by decision of the Inter-Allied Parliament held in London last November. In 1910 Great Britain's hesitation had caused the conference to be postponed with no other result than an unsigned project of international convention; but to-day Great Britain's opposition has ceased. The 1910 text, too carefully detailed, can be given a shorter form. Moreover, at that time lack of experience prevented certain regulations from being settled; but to-day the necessary modifications can be made.

In 1910 four powers which are now the enemies of France were present at the conference, along with Denmark, Netherlands, Sweden, Switzerland. There is no question of treating the first four like the five others and the neutrals like Belgium, Great Britain, Italy, Portugal, Roumania and Serbia; the reciprocal freedom of navigation can only be granted with full confidence to the States which alone, from war to victory, have drawn their bonds closer. The European allied nations represented at the 1910 conference, and the United States of America alone, will be invited to exchange their views from which, on the morrow of victory, the first great conventional law of the air will spring. Later on neutrals can join. Then peace negotiations will decide in what degree it may be extended to the various enemies.

It is, therefore, in this spirit that the Inter-Ministerial Commission of Civil Aeronautics, which had not waited for the armistice to anticipate and examine the question, drew up the following project of convention, to be taken as a basis for an exchange of views, in Paris, between the European Allies and American associates.

Project of International Convention Regarding Air Navigation (1)

Article I

Airships owned by citizens of one of the contracting States alone, answering the following conditions, are authorized to fly over the territories of the contracting States:

It is necessary:

1—To be duly registered in one of the contracting States, according to Regulation, Annex A.

2—To possess a flying license, according to Regulation, Annex B.

3—To be driven by nationals of one of the contracting States and be provided with technical certificates and licenses, according to prescriptions of Regulations, Annex C.

The original, or an authentic copy, of each of these documents must always be kept on board and presented at any requisition.

Article II

The airship must have a routebook along with a list of the transported persons, goods and objects, drawn up according to the prescriptions of Regulations, Annex D.

Article III

Each State is allowed to forbid private individuals, no matter what their nationality, and under the penalties referred to in its regulations, to fly over certain zones of its territory; previous notice is given to the other contracting parties.

Article IV

It is forbidden to carry, without special authorization, camera, war appliances or ammunitions, as well as any other dangerous explosives.

(1) The project was unanimously adopted in the meeting of Nov. 13, 1918.

Article V

Except if especially authorized, the military airships of a contracting State are not allowed to fly over the territory of the other contracting States.

Article VI

In case of war, the stipulations of the present convention do not affect the liberty of action of the contracting States, either as belligerents or as neutrals toward belligerents.

Article VII

The navigation must be effected according to the Regulaions, Annex E.

Article VIII

The contracting States undertake to assure all measures with a view of giving airships the necessary help when landing, especially in case of breakdown.

Article IX

The present Convention does not affect the special regulations of the contracting States as long as they stand outside its clauses.

Special agreements settle the conditions relative to customs, stations, hygiene, etc.

Article X

The present Convention applies to all colonies, possessions or protectorates.

Article XI

Third parties will be authorized to adhere to the present Convention on condition the contracting States unanimously grant their consent.

Article XII

The present Convention will be put into force at the same time as the exchange of ratifications, which will take place within 6 months at the latest.

These ratifications will be deposited at the archives of the French Foreign Office.

Article XIII

Technical conferences which will be held at the request of at least the two-thirds of the contracting States will proceed to the examination of the modifications to be made in the regulations added to the present Convention.

Article XIV

The present Convention cannot be denounced before the expiration of a 3-years' delay, dating from its signature.

The denunciation only concerns the State which notifies it and 1 year after.

Annex A

Conditions of Registering

The name, surname, nationality and residence of the owner and constructor will be entered in a register.

The registering, inscribed in Roman types, will include:

I—The capital letters (one or several) characteristic of the owner's nationality, indicated as follows: BELGIUM, *B;* UNITED STATES, *US;* FRANCE, *F;* GREAT BRITAIN, *GB;* ITALY, *I;* PORTUGAL, *P;* RUMANIA, *R;* SERBIA, *SB*.

II—The small letters, characteristic of the nature of the airship: a, for aeroplanes; b, for free balloons; d, for dirigibles.

III—The figures and letters of the record number of the airship in the register.

Everything according to the following model: *"USa101G"*

The letters and figures representing the registering indication of the airship must be at least 45 centimeters high. Their width must be two-thirds of their height and their thickness the sixth of their height. They must be printed in black on a white background and placed:

For *a dirigible or balloon:* On the top part of the balloon, under the car, and on both vertical sides of the car.

For *an aeroplane:* Above the upper wing, under the lower wing and on both sides of the helm or on each of the outer parts of the helms.

The States must send to one another the list of their registering through the medium of the French Government.

Annex B

Navigation License

The navigation license will only be granted after sufficient trials effected in the presence of a public authority or competent aeronautics association belonging to one of the contracting States.

This navigation license will include the following indications: Name or firm and residence of the constructor; place and year of manufacture; number or any other identity indication given to the machine by the constructor; characteristics of the airship.

The latter must be the following:

For free balloons:

1—Dimensions of the envelope (diameter, circumference, volume).
2—Diameter of the orifice of the appendage.
3—Nature of the envelope.
4—Disposition of the driving and inflating orifices.
5—Weight of the envelope, net and car.

For dirigibles:

1—Regarding the envelope: Its model and chief dimensions.
2—Regarding the car: Number, dimensions, places.
3—Regarding motors: Number, model, diameter of cylinders, length of pistons, normal power and consumption.
4—Regarding tanks: Number, specification, volume.
5—Regarding propellers: Nature, number, places, diameters.
6—Regarding helms of directions: Disposition, nature, number and places.
7—Regarding empennage: Disposition, number, places.
8—Necessary crew for the driving of the balloon.

For aeroplanes:

1—Model of the machine.
2—Sustenation surfaces, number, dimensions.
3—Motors.
4—Tanks.
5—Propellers.
6—Helms.
7—Empennage.
8—Landing disposition.
9—Fitting.
(3–9) Same as for dirigibles.
10—Necessary weight (fuel, accessories and crew being deducted); that is, available weight for passengers and goods.
11—Speed, horizontal at 1000 meters altitude.
12—Time of ascent (empty and with full load) at 1000, 2000, 3000 meters, etc.
13—Ceiling (empty, full load).
14—Necessary crew to drive the airship.

Any modification made in the machine must be declared to the competent administration. The visits made by public authorities, with a view to examining the navigation conditions of airships, must be mentioned in the certificate, along with repairs and modifications.

Annex C

Certificate of Competency

Each of the members, pilot, engineer, or any other specialist of the driving crew of an airship must be provided with a special certificate of competency according to the enclosed model, delivered after theoretical and practical examinations by the competent authorities of the State he belongs to.

This certificate bears the names, surnames, nationality, birth date and place, photograph and signature of the owner, who must be at least 18 years old.

The present program of the examinations is as follows:
(See *Regulation of the Aviator Pilot's Certificate.*)

Annex D

Routebook

The routebook, according to the enclosed model, must contain the following indications:

Nature of the airship, registering number, name, surname, nationality and residence of the owner.

Moreover, for each journey: Name, nationality and residence of the pilot, crew and passengers; the place, date, time of departure and route incidents (landing, accidents, etc.)

The list or memorandum of the transported goods must be added to the book if necessary.

Annex E

AIR TRAFFIC REGULATIONS

Regulation Regarding Lights

Article I—The regulations regarding lights must be observed, no matter the weather, from sunrise to sunset. In the meantime, an airship must not show any light liable to be mistaken for a regular light.

The use of flashlight is forbidden except for landing.

Article II—Motor airships must carry the following lights, the radius of visibility of which is determined in relation to the vertical plan P of longitudinal symmetry of the airship, when the latter is in a horizontally rectilinear position of flight:

a—In the forepart, a white light placed in the plan P, visible in a dihedral with vertical faces, each forming a 110-deg. angle with P, according to the following:

b—In the back part, a white light placed in the plan P, visible in a dihedral with vertical faces, each forming a 70-deg. angle with P, according to the sketch.

c—On the right, a green light visible in a dihedral with vertical faces, respectively, forming 0-deg. and 110-deg. angles with P, according to the sketch.

d—On the left, a red light, visible in a dihedral symmetrical with the preceding one.

e—The faces of these four dihedrals must be provided with vertical screens so that the light cannot be seen in the obscure field of the dihedral.

f—The white light in front must be visible at a distance of at least 4 kilometers, the white light behind and the green and red lights at a distance of at least 2 kilometers, in a dark night, with no mist.

g—The lights must not be screened in any part of the illuminated field. To this effect, each light must be duplicated so that the couple of lights yield the regular dihedral of visibility above and under the airship.

However, regarding dirigibles, the lights need not be visible in the upper sheet of the cone of revolution, the generatrixes of which are inclined by 60 on the vertical.

Article III—Free balloons must have a ready white light, of at least 2 kilometers range; this light must be pulled up at the approach of another airship.

Route and Drive Regulations

Article IV—Motor airships must always keep away from free balloons and dirigibles when the latter carry signals similar to those of free balloons.

Article V—A motor airship must always keep away from any other airship at a distance of at least 200 meters, and drive according to regulations referred to in Articles VI and VII, as soon as it is aware that the distance is getter shorter.

When airships are less than 200 meters in depth away from one another, they must drive as if they were at the same altitude, according to the following regulations:

Article VI—a—In the case of two airships going in the same direction, the one which is behind, when the quickest, must drive so as to keep away from the other. It must not get beyond the other by diving but by flying over, on condition that it can keep away at a distance of at least 200 kilometers.

If it wants to get beyond without flying over, it must pass by on the left.

b—When two airships are going crossing directions, the one which sees the other on its right must drive so as to keep away, avoiding to cross in front of the other. As to the latter, if it thinks necessary to move, it must do so, so as to increase the space between both airships.

c—When two airships are going in opposite directions, they must both keep to the left.

Article VII—The airship which is going a free way and wants to turn around on the left must not do so unless it is sure that it is not followed by another airship at a distance less than 200 meters. In case it cannot get sure of it, it must turn on the left within at least a 500-meter radius.

Article VIII—When a dirigible voluntarily stops, it must pull down, five meters under the car, a black ball, of a diameter at least one meter. In that case it remains submitted to the same regulations as moving airships.

If it cannot control its movements, it must show another black ball, two meters lower than the first one, and is then like a free balloon.

In both cases, at night, it lights its white lights only, and is similar to free balloons.

Article IX—Airships must use, under the circumstances mentioned further on, phonic signals emitting three kinds of calls, according to schemes A, B, C.

Scheme A—Short sounds of 3 sec. at intervals of 3 sec. These calls must be heard in all kinds of weather: fog, mist, snow or heavy rains.

Scheme B—Alternatively short sounds of 3 sec. and long sounds of 9 sec. at intervals of 3 sec. These calls must be emitted by airships on the point of landing.

Scheme C—Long sounds of 9 sec. at intervals of 3 sec. These calls must be emitted, if possible, by airships in distress.

Distress Signals

Article X—Besides phonic signals, according to Scheme C, dirigibles and free balloons must observe the following prescriptions, as much as possible, in case of distress above land as above sea:

a—In the day time, dirigibles must place a triangular red flag under the car, and show the two black balls referred to in Article VIII.

In the night time, they must show and wave a white light, and put out their side lights.

b—A free balloon must hoist a triangular red flag under the car in the day time and show a white light at night.

Use of Ballast

Article XI—It is forbidden to use other ballast than fine sand or water.

Regulation of the Aviator Pilot's Certificate (Public Transport)

Practical Tests

Tests of Height and Volplane—Fly without landing for one hour at least and keep up at an altitude of at least 2000 meters above the starting point.

The descent must end in a volplane, motor shut off. This volplane must begin 500 meters at least above the landing ground. The landing must be effected at a distance of 200 meters from a point fixed beforehand by the commissaries controlling the test, without restarting the motor.

Handling Test—Fly without landing around two posts (or buoys) situated at a 500-meter distance from one another, effecting an interrupted series of figures of eight, each loop of which must alternately include one of the two posts (or buoys). This flight must be effected at an altitude of 200 meters above the ground, without touching the soil or water, on a distance of at least 5 kilometers long, the distance counted for each figure of eight being that between the two posts (or buoys).

Landing must be effected according to the following indications:

1—Shut off the motor altogether at the latest when the aeroplane touches the ground or water.

2—Definitely stop the aeroplane at a 50-meter distance from a point designated by the candidate before the test.

Test of Endurance:

1—A triangular journey of 200 kilometers, the distance being counted according to the length of each side of the triangle, which must not be less than 20 kilometers. This journey must be effected on the same aeroplane within 24 hours, including two compulsory landings fixed by the commissaries. Landing must be effected on the grounds of departure at least one hour after sunset and one hour before sunrise.

2—A journey without stopping, of at least 50 kilometers, in a straight direction, effected with the same machine, and on the same day, between sunrise and sunset.

This test includes a distance of at least 100 kilometers at an altitude over 1500 meters.

After having completed the satisfactory practical tests,

the candidate must undergo, after convocation, two examinations, one on aeroplanes and driving, the other on motors, according to the program given herewith.

Observations

The delivery of the certificate is optional. The candidate will be on board in each practical test.

Practical tests must be effected within six months from the first to the last test.

They can take place in any order and be started again once each.

The departures, stoppages and landings will be verified by two competent controlling commissaries, who will send to the authorities the reports drawn up in the form required. These reports must indicate the various incidents, especially regarding landing.

The candidate must furnish, at the beginning of each test, unquestionable identity papers, which must be presented to the commissaries.

Registering barometers must be sealed by the commissaries, who will tell the candidate that he must carry out the test so that the line 0 of the diagram, before and after landing, be clear enough and especially sufficiently prolonged after the arrival, and that the diagram be absolutely legible. The commissaries will refuse graduated barometers above 1000 meters.

The diagram of each test must be taken off by one of the commissaries, who will make sure that the graduation of the sheet corresponds to the altitude indicated by the plate fixed on the barometer case. The diagram, signed by both commissaries, will be added to their report.

The pilots provided with the military certificate of aviator pilot will also be granted the pilot's certificate for public transports.

As to private people, the pilot's certificates delivered by the Aero Club, along with the military certificate, will amount to a driving license.

Program of the Knowledge Required by the Candidate for Aviator Pilot's Certificate

I—Aeroplanes

Summary theoretical knowledge regarding the resistance of air applied to aeroplanes, helms and propellers.

Function of the various organs and the handling thereof.

Fitting up of aeroplanes, propellers, landing gear, helms and handling thereof.

Air traffic regulations.

II—Motors

Generalities on sparking engines and rotation at four speeds.

Study of the various functions of the motor; distribution, carburetion, lighting, escape.

Characteristics of aviation motors.

Ideals on regulating, function of the steering-wheel, equilibrage.

Generalities on the constitution, construction, regulating and putting engine in a proper condition.

Causes of the bad working of motors.

Ideas on spirits and oils.

Detailed description of the aviation motor used.

Regulating, driving, greasing, upkeep, taking to pieces and putting together of the chief organs with the means on board.

Finding out the causes of breakdowns.

III

Practical knowledge of the special conditions of air journeys; care to be taken in cold weather, at high altitudes, rain, fog.

Reading of the map, direction, etc.

"The Consulting Engineer"

By R. A. C.

THE writer notes with pleasure the excellent editorial entitled "The Consulting Engineer," appearing in the March 6 issue of AUTOMOTIVE INDUSTRIES and wishes to express his appreciation and at the same time compliment the editor for the efficient and able manner in which the subject was handled and presented.

The writer could cite many instances of where great financial losses were caused through the unwillingness of not only the plant engineer but the business management as well, to call in a consulting engineer.

It seems to be the opinion of most manufacturers that consulting engineers are over-technical, fussy and impractical, and are only useful after something has gone wrong, thus interfering with the production, operation or sale of the commodity manufactured. The writer has attended the last rites of a number of concerns that put off calling in a consulting engineer until it became evident that what was needed was a referee in bankruptcy instead.

The most economical time to call in a consulting engineer is in the beginning, before the new design is made. If called in at that time, a good broad visioned, well informed consulting engineer becomes a dividend paying investment in that he not only instructs the plant engineer and the business management as to the best method of procedure but, most important, he advises them as to what not to do.

To be successful in the consulting engineering profession, it is necessary for an engineer to be very broad visioned and intensely practical, and he must have commercial ability so as to be able to quickly determine the commercial value of new ideas or suggestions offered and at the same time be able to point out the practical limitations of theory in design.

The more capable and efficient the plant engineer is, the more willing he is to have a consulting engineer called in, as he soon discovers that the value of his services to his employer are materially increased by the assistance given him by the consulting engineer and finally regards him as a real friend to whom he can go for assistance when difficult problems present themselves, without feeling that his own value has been lowered in the estimation of his employer.

Aircraft Yearbook

A YEARBOOK for the year 1919 has just been issued by the Manufacturers' Aircraft Association, Inc., New York City. It is virtually a record of what the members of this association accomplished during the past year. The book has been compiled by a committee of the Association, Fay L. Faurote acting as editor. According to the preface, the Annual is intended also to constitute, in some measure, a history of aviation, both industrial and scientific, and a repository of aeronautical information.

After an introductory chapter on the future of aviation, there follows a short article on the history of the Manufacturers' Association. Then follow articles on the different companies forming the membership of the association, giving their histories, their personnel and a description of the product they are turning out. It is stated that the facts for this record were obtained through the co-operation of the individual companies.

The remainder of the book contains a list of Government organizations having to do with aircraft development, a list of the world's aces, a history of the early period of aviation, and a chronology of important events in connection with heavier-than-air flying machines; also articles on "Aerial Mail To-day and To-morrow," "The Weather Bureau and Aviation," "Balloons," "Important Events in Balloon History," "Mapping of Aerial Routes," "Landing Fields" and "How Can Men Fly?", a list of air service stations, designation of aeroplanes, a list of books on aeronautics, and a list of aeronautical magazines.

Worm Gear Efficiency

Description of a Test Rigging for Determining the Efficiency of Worm and Wheel Rear Axle Drives—Some of the Results Obtained in the Tests

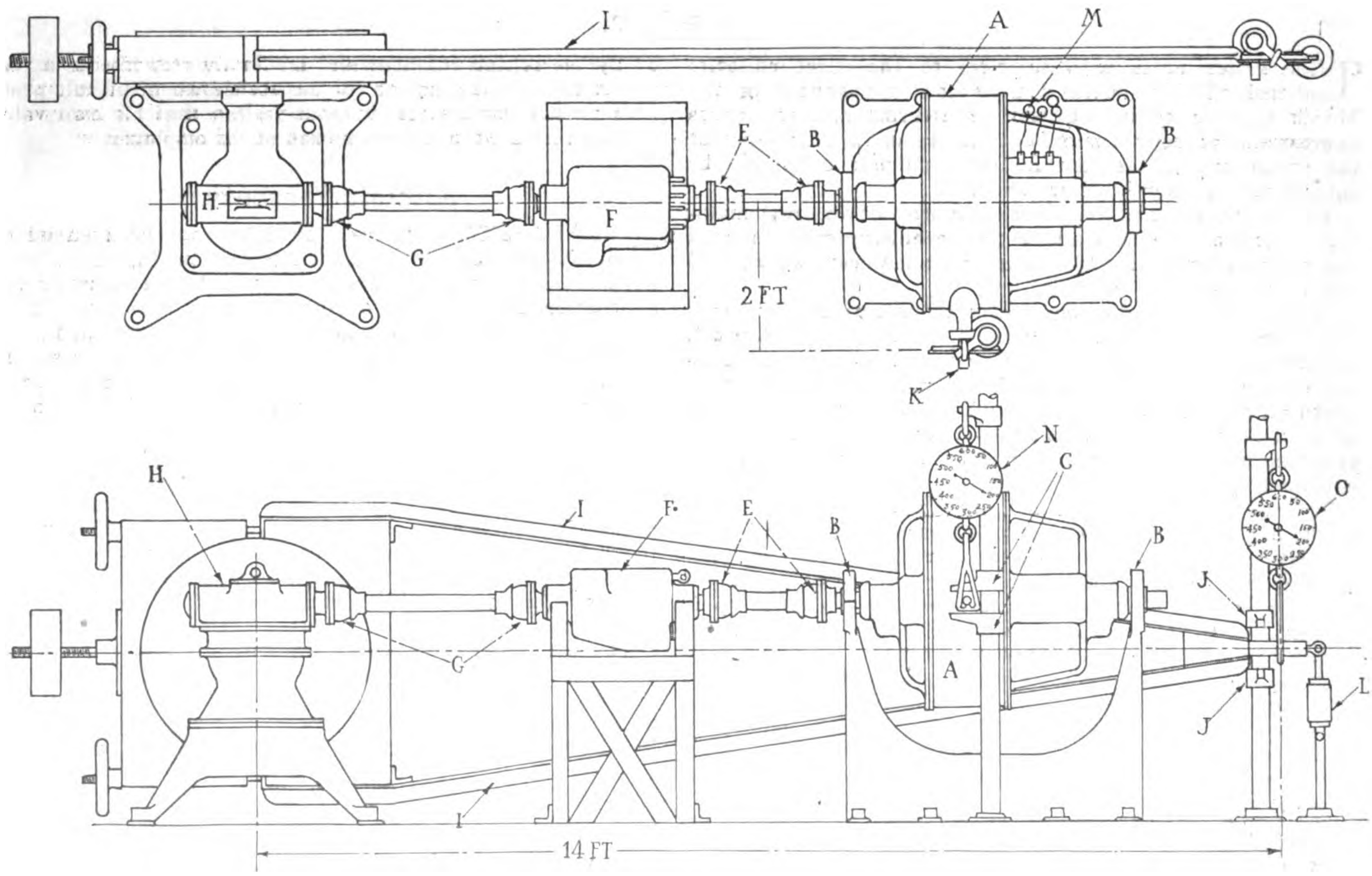
By C. H. Calkins

MUCH confusion exists regarding the actual mechanical efficiency of worm gears. The zealous gear salesman and the academic treatise tell us that their efficiency is 99 per cent, or better, and the shop man, who is not familiar with modern worm gears, denies that their efficiency is better than 60 per cent.

It should, in the beginning, be realized that more advance in the theory and practice of worm gear manufacture has been made in the past 8 or 10 years than perhaps in the previous 50 years. Until recently worm gears with leads of from 3 to 6 in., such as are now common on automobile rear axles, were rarely seen. Grinding the teeth of a worm was unheard of, and little was known of correct tooth shapes and angles or their relation to efficiency and reversibility. Still less was known of the relation of various steels and bronzes to efficiency and durability. Even at the present time few brass foundries are able to produce a gear bronze which is properly cast and chilled to enable it to meet the high requirements of the modern worm wheel. Every foundry thinks it is easy to do this, but the writer has found by bitter experience that only those foundries which have specialized on this work and which have had long experience are able to produce desirable results.

It was with a view to clearing up some of this uncertainty regarding worm gear efficiency and to demonstrate to themselves what a modern high-grade worm gear could do that the Baush Machine Tool Company, of Springfield, Mass., worm gear specialists, and a truck manufacturer jointly undertook to obtain some accurate, authentic efficiency data. The truck company was not only interested in obtaining worm gear data, but wanted to know the total power loss from engine to rear wheel; consequently tests were made covering the truck gear box or transmission losses, together with the rear axle worm gears. Worm gears alone were also tested.

The Baush Machine Tool Company had previously built a small efficiency machine suitable for testing gears up to 5 or 6 hp., so this experience was brought to bear on the design of a larger machine, which was finally completed in the summer of 1917, as shown below. The tests described below were made at the Baush Company's plant by representatives of the truck company and the Baush company, and were made solely with the



Plan and elevation of the Baush company's worm wheel testing stand

idea of obtaining information, and the results have never been used in an advertising way.

Referring to the drawing, A represents a 230-volt, 32-hp. motor with a speed variation of from 300 to 1200 r.p.m. The fields are mounted on ball bearings indicated at B. This leaves the fields free to oscillate a short distance limited by the stops C. The armature shaft is extended by means of two universal joints E to truck transmission F. This transmission and the universal joint are regular standard equipment as used on the truck company's 3-ton truck. The transmission has 4 speeds and is ball bearing throughout, the construction being of the very highest grade. The armature shaft is continued by means of two more universal joints G to a standard worm gear housing H. The worm wheel shaft, which in a truck would correspond to the rear axle drive shaft, is extended on one side only, and carries the drum of a prony brake. This shaft is mounted on ball bearings. The prony brake is of cast iron, 8 in. wide by 36 in. in diameter, and is hollow to admit the introduction of water for cooling purposes. It carries two heavy wooden brake shoes, which are adjustable by means of hand wheels. These brake shoes are extended into a 14-ft. lever I, the oscillation of which is controlled by stops J. Both the prony brake arm and the 2-ft. armature arm X are very accurately counterbalanced by means of adjustable weights, and the longer arm is held from vibration by a dash pot L, the piston of which is included in the balancing adjustment. The motor leads are extended by means of rigid terminals into mercury cups M, so that any error which might be due to the weight of the leads is obviated. The spring balances shown at N and O are the standard product of John Chattilon & Sons, and register up to 600 lb. The whole machine is rigidly mounted so as to reduce vibration to a minimum. The temperature of the oil bath, in which the worm gears ran, was taken by means of a calibrated thermometer which dips directly in the oil.

The results below are the average of a great number of tests, the idea in this paper being to set before the reader only net results. Before each test the brake and motor field balance were verified before witnesses, as in fact were all readings.

Several makes of worm gears were tested, but in this paper we will consider only those made by the Baush company. Also three bronze mixtures were tried, and it was found that mixtures had considerable influence on durability, and, consequently, efficiency. Whitmore's No. 45 oil was used in the transmission throughout all the tests and 600 W. Steam oil was used in the worm gear housing.

The ratio tested was 3:27, which gives a reduction of 9 to 1. The centers were 7.721 in. The normal angle of the worm tooth was 55 deg., the lead angle, 26 deg. 27 min. 8 sec. The circular pitch of the wheel was 1.468 in. The worm pitch diameter was 2.819 in. The worm was made of a low-carbon carbonizing steel, the analysis being approximately as follows:

Carbon	0.16 to 0.23
Manganese	1.00 to 1.2
Sulphur	0.045 to 0.06
Phosphorus	0.045 to 0.06

The worm teeth were carbonized, hardened, ground and polished.

The worm wheel was made of a bronze of the following mixture:

Copper	89 per cent
Tin	11 per cent

The casting was poured in a graphite mold so that the periphery to a distance of perhaps ½ in. was chilled. The Brinell test was 107 points.

Both worm and wheel were the regular product of the Baush company, selected at random from regular production.

Referring again to the drawing, it will be noted that the distance from the center of the armature to the end of the motor field arm is 2 ft., while the distance from the center of the prony brake to the end of the arm is 14 ft. In some of the tests the brake arm was 9 ft. in length, but in order to get the desired torque and still be within the capacity of the motor, it was necessary to lengthen it. The final results are not affected thereby.

The formulæ used were as follows:

$$\text{Efficiency} = \frac{\text{Brake pull} \times \text{length of brake arm } l \text{ (9 or 14 ft.)}}{\text{Motor pull} \times 2\text{ ft.} \times \text{total reduction}}$$

$$\text{Horsepower input} = \frac{\text{Torque on motor fields} \times 2\text{ ft. radius} \times \text{R.P.M. of motor}}{5252}$$

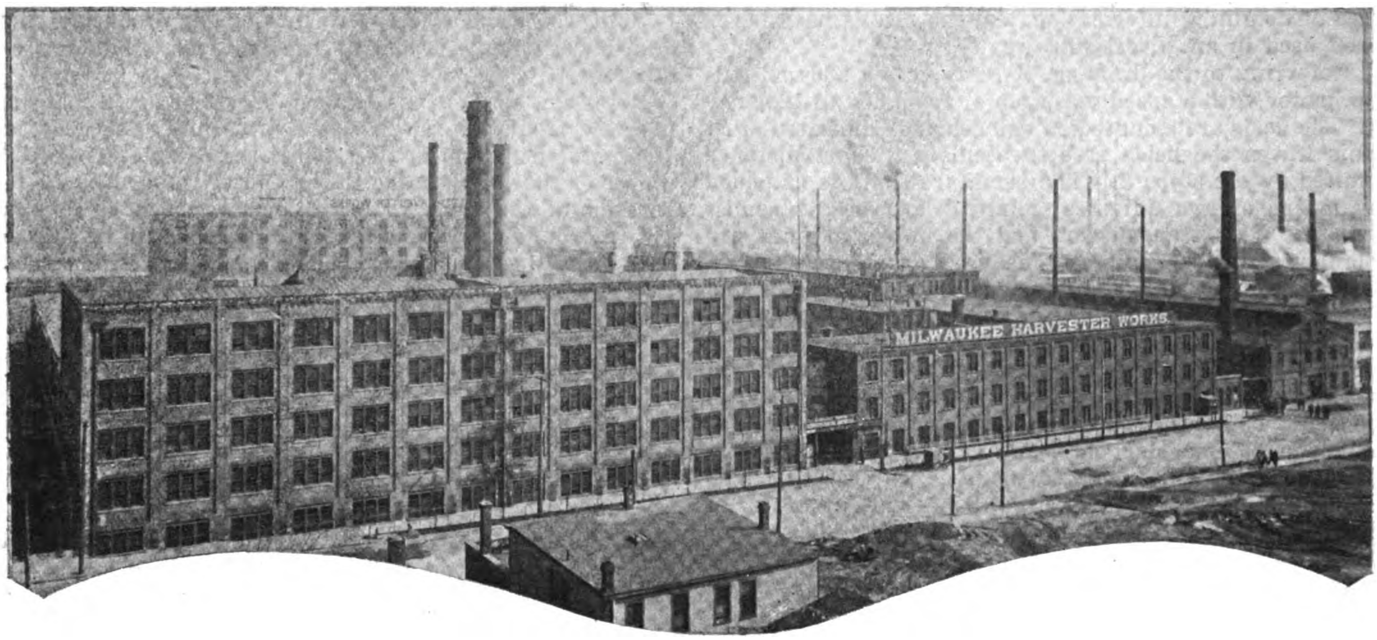
It will be noted that in using this machine the indicated efficiency is lower on account of losses in transmission, ball bearings, universal joints, worm bearings and oil splash. However, it is believed that these losses are very small.

SUMMARY OF TESTS

Test	R.P.M. of Motor	Motor Torque at 2 Ft. Radius in Lb.	Brake Torque in Lb.	Oil Bath Temp.	H.P. Input	Efficiency, per Cent	Remarks
1	800	104	187 lbs. at 9 ft. radius	186	31.68	89.9	Direct drive through transmission.
2	800	103.5	265.3 at 9 ft. radius	189	31.53	86.34	In third speed through transmission. Total reduction, 13.36.
3	800	103.4	296.2 at 14 ft. radius	185	31.5	86.8	In second speed of transmission. Total reduction, 23.1.
4	800	103.9	528.7 at 14 ft. radius	184	31.65	86.2	In transmission low speed. Total reduction, 41.3.
5	800	52	95 at 9 ft. radius	185	15.84	91.3	Direct drive. Transmission removed entirely.

It is realized that these efficiency values are not excessively high. They are, however, actual and are duplicated under actual working commercial conditions with all the gear products of the Baush company and trucks of the truck company. It is realized, too, that the subject might be treated in a more academic way and the tests might be made more scientifically and much more exhaustively. Indeed, the tests were actually made at speeds varying from the lowest to the highest truck speeds, but the results showed so little variation that they are not considered here. These speeds corresponded to an engine variation of from 280 to 950 r.p.m. It is undoubtedly true that if worm speeds—or, to speak more accurately, rubbing velocities—were greatly increased or decreased above these speeds, there would be a falling off in efficiency. Also, when the load per square inch on the teeth exceeds a certain value there is a power loss. The converse of this is also true. The efficiency of a worm gear depends in a very large measure on the fact that a film of oil always exists between the teeth, separating them and rendering metal contact impossible. The fact of this separation has been proven electrically.

It may be asked why, if the teeth touch only oil and not metal, they ever wear out. They do not wear very much. An automobile worm gear properly installed and cared for need never be replaced. By care is meant that there must always be plenty of oil and it must be changed occasionally, as dirt or chip particles set up at once a destructive wear and the oil may become a very fair abrasive. Also, the supporting bearings on the worm and wheel should be of such size that correct alignment is always maintained.



Turning Out 100 Tractors Per Day

Production System Employed at the Milwaukee Plant of the International Harvester Co.—Details of Machining and Assembling Methods

By P. M. Heldt

THE International Harvester Co., one of the oldest firms in the farm tractor field, is at present manufacturing four different tractor models, of which one, the Titan 10-20, is made completely in the Milwaukee works. Only four parts used on this tractor are purchased from outside concerns, namely, the mechanical oiler, the magneto, the chains and the spark plugs, every other part being made on the spot. The plant covers a site of 37 acres and employs in the neighborhood of 5000 men. Not all of the ground is covered by buildings, but every bit of it is used for one purpose or another, as the yards and spaces between buildings are stocked with raw material, parts in process of manufacture or completed machines. At the present time the plant runs on a schedule of 100 tractors a day, but this is constantly exceeded and the actual daily production is generally from 106 to 108 machines. Not all of the plant is devoted to tractor work, however, as farm engines and cream separators are also being made, but tractor production absorbs from 75 to 80 per cent of the entire capacity. The International Harvester Co. has been manufacturing tractors for 10 years, and the Titan 10-20 model has been turned out without important changes for about three years, so the concern has had time to fully develop its production methods.

One of the most important departments in a plant of this kind is the iron foundry with its subsidiary departments, represented by the core room, pattern storage vault and chipping room. The foundry of the Milwaukee plant of the International Harvester Co. is 148 ft. wide by 779 ft. long. Its location with respect to the other departments of the plant is shown by the accompanying general plan. In this department of the works, including the core room and shipping department, about 1100 men are employed. An idea of the capacity of the foundry may be gained from the fact that on March 5 last 360 tons of iron were poured, and during the month of January 7777 tons.

The company takes particular pride in its new core room, which has been in full use only about eight months. The basement under this room serves for sand storage. It is about 25 ft. high, and the sand is brought into it by means of 3 belt conveyors under the ceiling. The sand is shoved off the belt by means of deflectors or boards extending at an angle across it. Back of the sand storage room there is a passage with a number of openings in the wall, through which sand of the different grades can be withdrawn even when the room is practically full. The openings are closed by slightly inclined planks, which slip into grooves in the door frame. These prevent the sand from sliding out through the openings, and can be readily removed one at a time.

In making the core mixture, all of the materials used are dumped into a hopper, whence they are elevated by means of a bucket elevator, from which the mixture drops into another hopper, which feeds it into a revolving screen. This screen is of ½-in. mesh, and all the material that does not pass through this screen is separated out. This material is not thrown away, however, but is ground, and is then fed into the hopper again. Directly below the screen there is a mixer with agitator arms. While the dry materials entering the mixture, including the sand and rosin, are conveyed to the mixer by the elevator, oil is fed into it directly. The mixer delivers the core mixture to an elevator below it, which carries it into the core room upstairs. There are two of these power mixers.

Ordinarily core sand is used only once, but on account of war conditions and the restrictions on means of transport, the International Harvester Company breaks up all its old cores, grinds the material up in a machine with manganese steel rollers, mires it with fresh oil, sand and rosin and uses it over.

The furnaces for heating the core ovens are located in the basement, and the heat is carried up to the ovens through a large flue. A pyrometer of the indicating type, so arranged that it can be connected with any of the thermo-couples in the 32 furnaces, is located on the wall and can be made to instantly show the temperature of any of the ovens. The core-

racks are made of angle steel and tubing. They are so designed that an electric industrial truck can be driven under them and then raise the rack by means of a power lift about 8 in. off the floor. When the core maker has completed a core, he places it on a rack behind him, and as soon as the rack is full along comes an electric truck and takes it away. About one-third of the workers in the core room are women, who do all of the lighter work. The core makers work on benches, and above these benches there is a runway along which the sand is moved by means of wheelbarrows. Over the bench of each core maker there are two hoppers, for two grades of sand. Only metal core boxes are used, and at the present time core making machinery is being installed. An underground passage connects the core room with the foundry.

Unloading Pig Iron

All pig iron is unloaded from the cars into large outside bins, and scrap steel and iron are also loaded into bins in the yard. This material is handled by means of an electric traveling crane with electromagnet. The crane runs the whole length of the yard and has a capacity of 10 tons. The capacity of the magnet is 3000 lb. of pig iron or 1600 lb. of scrap iron. This crane deposits the pig iron and scrap iron on the charging platform for the cupolas outside of the building. On this charging platform the pig iron and scrap iron are loaded into dumping cars, which are dumped into the cupolas by means of air hoists. For unloading sand and coke from railroad cars, so called clam buckets are used in connection with the crane. Every bit of pig and scrap iron that goes into the cupolas is weighed. A track runs the whole length of the charging platform, with two scales on wheels upon it. The track is sunk below the level of the platform, to such a depth that the scale platform is level with the loading platform. The dumping cars are loaded outside the building, are pushed on to scales, and then are moved on toward the cupolas.

There are 6 cupolas in all, in 3 sets of two, but not more than four are ever in use at one time. This gives opportunity for making the necessary repairs, such as relining with fire brick. The usual charge consists of one half pig iron and one half scrap iron, but in one of the cupolas a special mixture with a higher percentage of pig iron is melted. Every time a change is made in the charge of the cupola, a test bar is taken and given to the chemist to analyze.

The foundry, as may be imagined from the dimensions given in the foregoing, is an immense structure, and has a craneway running its entire length, upon which there are three electrically operated cranes. In addition to this, there are eight wall cranes. All of the small work is done on a balcony, which is half the total width of the foundry.

In addition to the overhead traveling crane and the wall cranes, there is installed in the foundry a narrow gage railway on which heavy material can be moved with the least effort. Each group of men in the foundry is provided with an air hoist for lifting molds, patterns, and castings, and for use in pouring. The bigger molds are poured directly from the car ladles from the cranes, while hand ladles are used in pouring the smaller ones. In the medium heavy work each man is provided with an air hoist, so it is not necessary for him to wait for the crane to come around. All heavy molding is done by means of molding machines, in connection with which pneumatic tamping is used.

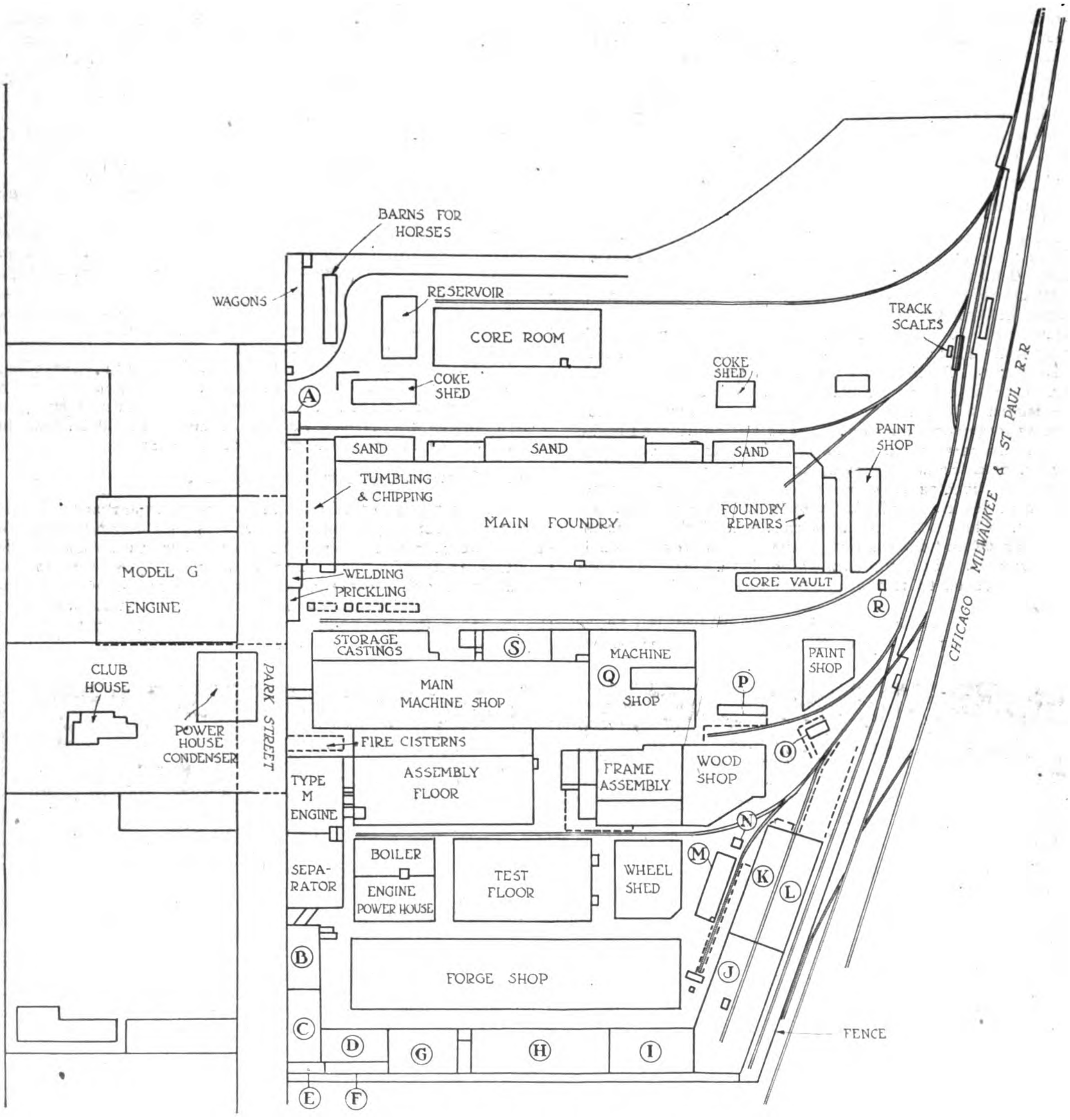
Up to the present all the chipping, tumbling and grinding has been done at one end of the foundry, in a mill room partly separated from it, but another mill room is now being installed at the opposite end, so the castings will not have to be transported the whole length of the foundry.

Repair Shop for Foundry Equipment

At the north end of the foundry there is a general repair shop for foundry equipment. All castings leaving the foundry are weighed on a scale at the point where they leave the tumbling room. They are also counted. Adjacent to the foundry repair shop there is a storage room for obsolete patterns. The Milwaukee plant of the International Harvester Co. began in 1906 to make farm engines. Many of the designs which have been produced in the plant since that time

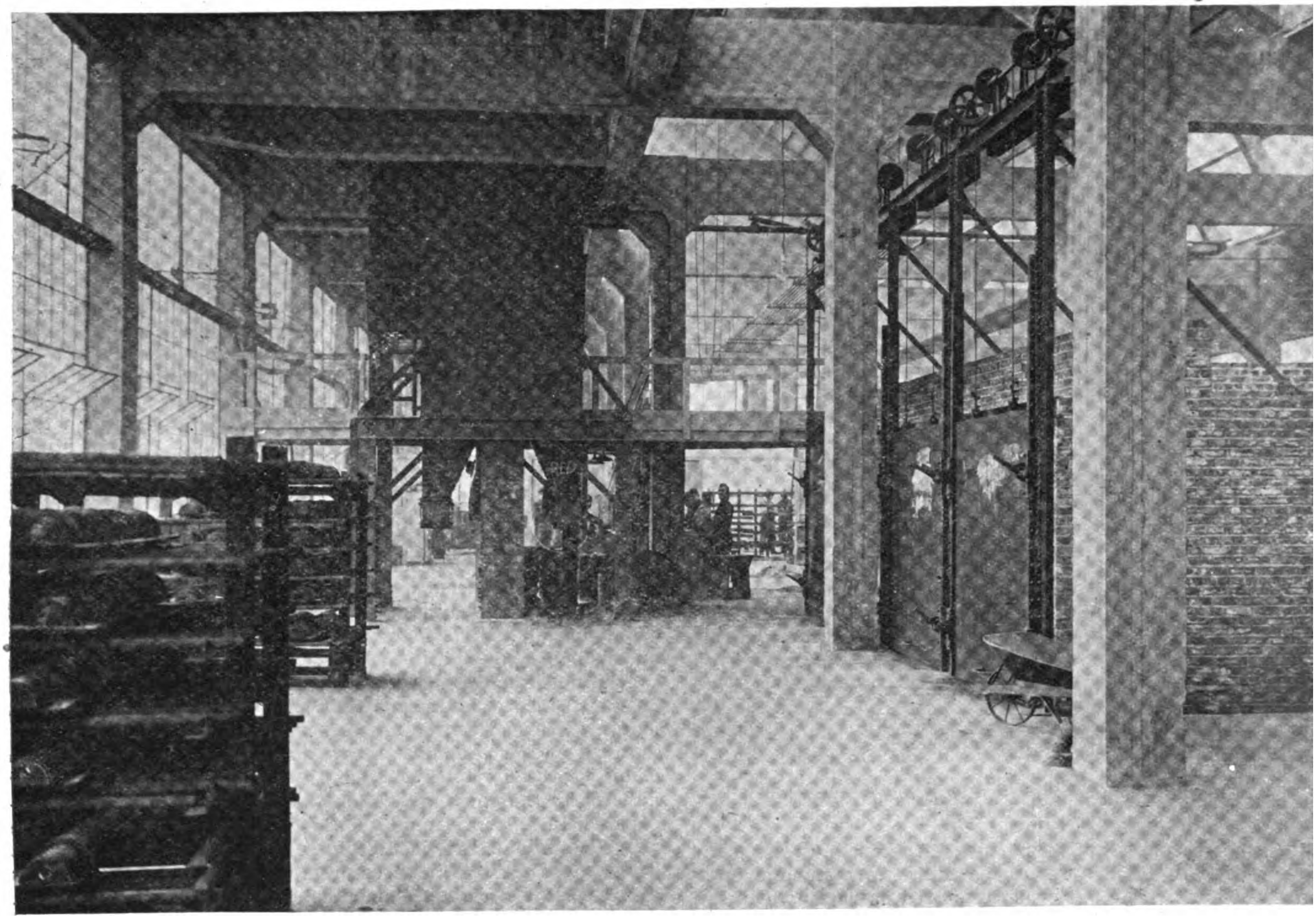
View in main machine shop of the International Harvester Co., where most of the heavy tools are located

Plan of International Harvester Milwaukee Works

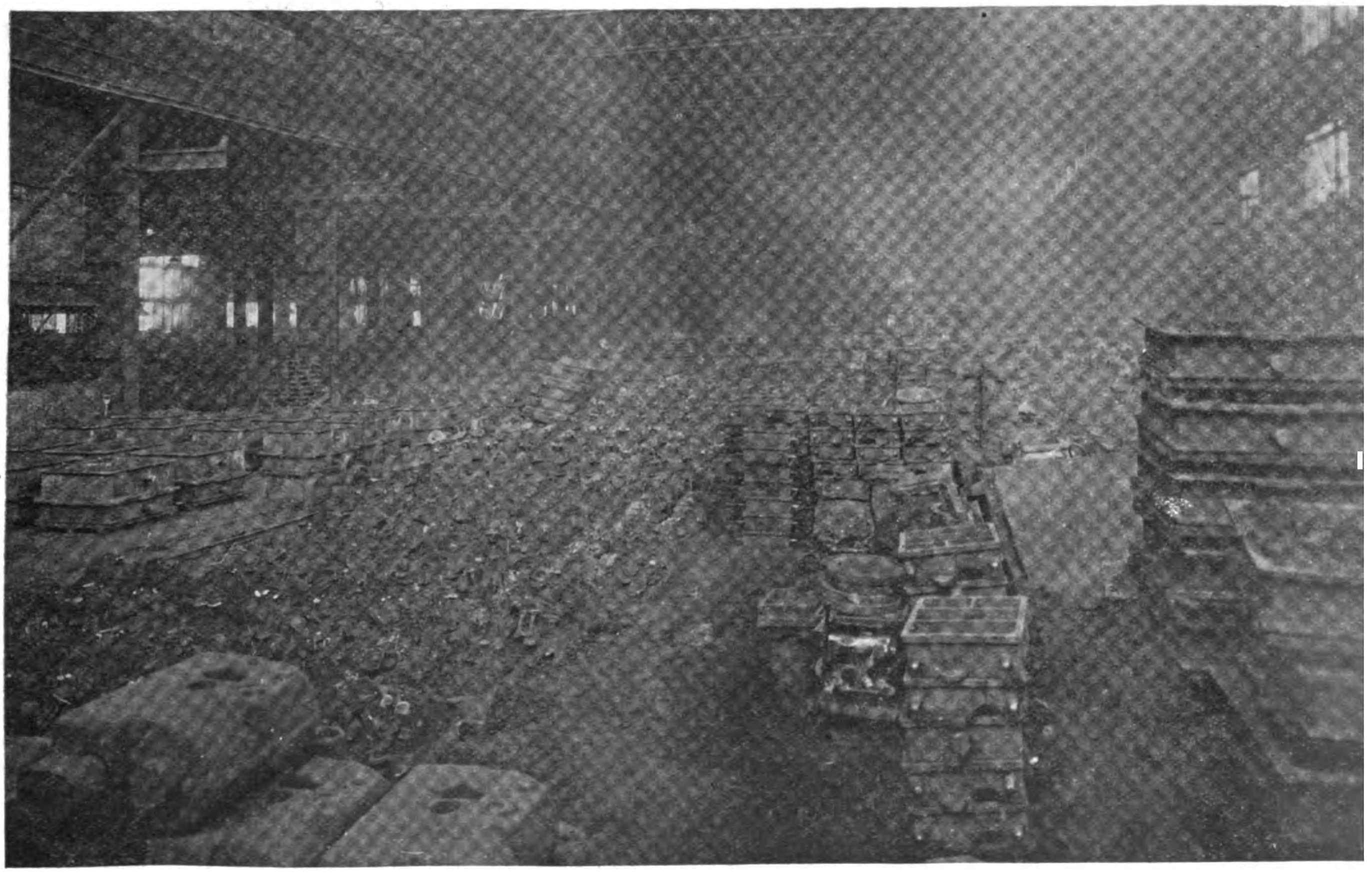


Key to Reference Letters

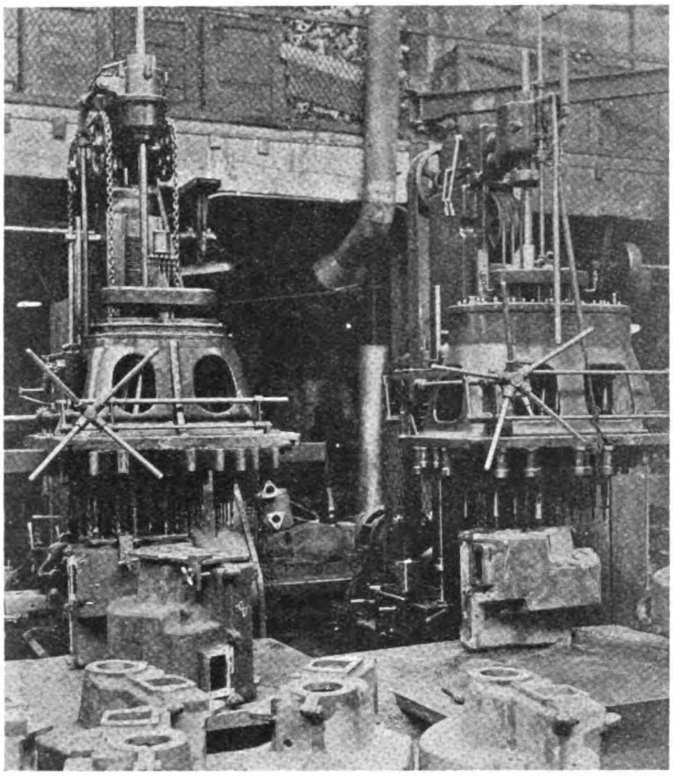
A, Elevator for refuse sand from tumbling room; B and C, Receiving Department and lunch room on main floor, Receiving Department and office on second floor, cream seperator erecting department on third floor; D and G, Tin Shop on first floor, office on second floor, cream separator painting and packing on third floor; G, Fourth floor wood patterns; H and I, First and second floors tin shop, third floor painting and packing, fourth floor metal patterns, painting and packing; J, K and L, Storage, shipping, repair and foreign packing (6 stories high); M, oil and paint storage and mixing; N, oil storage and pumps; O, shed for waste material; P, Receiving room for malleable castings; Q, Receiving department for bar steel, bolts, etc., in basement; R, Storage for excelsior packing; S, Wash rooms on first floor, brass foundry on second floor, carbonizing department on third floor



Core room, showing core racks at left, sand elevator in center and core oven on right



View in the foundry; even though it is Saturday afternoon, there is considerable "atmosphere"



Multiple spindle drills working on gear case

have become obsolete, but all patterns are kept, and the plant is in position to furnish repair parts for any machine ever turned out by it. The patterns are stored on racks which are lettered, and each shelf carries a number. A record is kept of all patterns and where they are stored, by means of which it is an easy matter to locate a pattern whenever it is required.

At the north end of the foundry there is a store room for current patterns. In the foundry only metal patterns are used, but all master wood patterns, from which the metal patterns were made, are preserved. The main foundry has a sawtooth roof, and is well lighted. For night illumination there are clusters of nitrogen lamps in the balcony, and single 800-watt nitrogen lamps in the main foundry.

The tumbling and chipping room is located at the south end of the main foundry. It is equipped with disk grinders which take off all the burs from the castings as they come from the molds. Every casting leaving the foundry is inspected, and all of the heavier castings are tumbled on the main floor.

Forge Shop

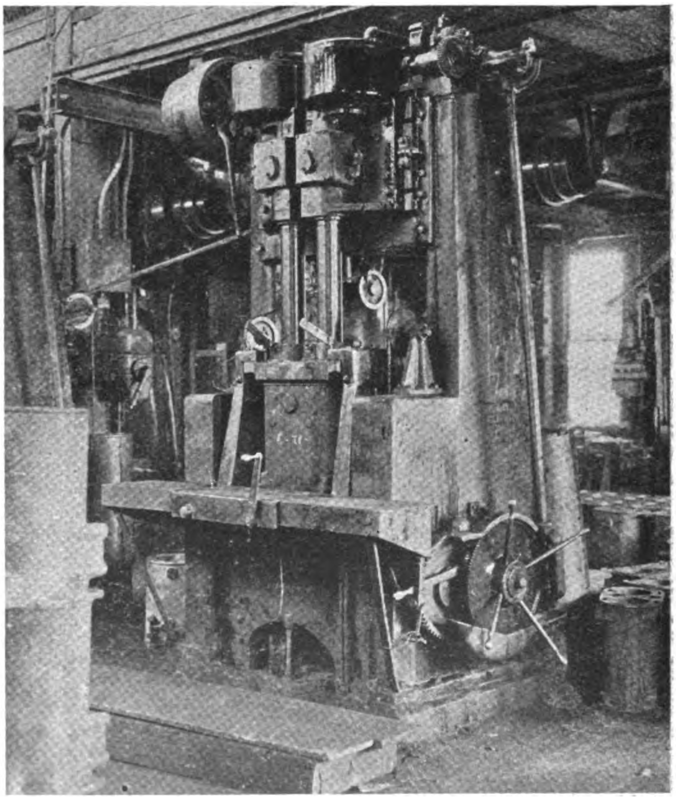
A department of almost equal importance as the foundry is the forge shop, which measures 101½ ft. in width by 474 ft. in length. All of the large ring gears employed in the Titan tractor are made from forged blanks which are forged in an upsetting machine or bulldozer. All material under 5 in. in diameter is sheared off cold. At one end of the forge shop the wheels are made. The rim material, cut to the right length and punched with the requisite number of holes, is delivered to the plant from outside. The first operation on the blanks is to roll them into circular form. Next the ends are riveted together and then the rims are assembled with the hubs and spokes, which is done in a jig. In joining the ends of the rims together, a couple of bolts are first put in and then the rivets are put in place, and headed by means of air riveters. In the forge shop a great many operations are being carried on, such as the forging of the front axles, gear blanks, crankshafts, connecting-rods, etc., but the equipment of drop hammers, steam hammers, bulldozers, etc., is the same as found in any large forge shop. Adjacent to the forge shop is the heat treating department in which both forgings and castings receive heat treatment. The piston castings, for instance, are annealed in order to relieve cooling strains. All forgings, such as the crankshaft, connecting-rods, etc., are submitted to a heat-treatment to refine their molecular structure, and thus to improve their physical properties.

Machine Shop

The machine shop comprises one single-story structure, 100 ft. wide by 392 ft. long, and at the end of same a six-story building in which most of the lighter work is done. On the upper floor of this six-story structure all of the automatic screw machines are installed. It is interesting to note that the company makes all of its taper pins and similar parts. It was noted that a color scheme of marking is used to distinguish steels of different carbon contents. The automatics are set in the usual way at an angle, so that the bar stock projecting from the head stock of one machine passes by the adjacent one. One of the most interesting machines in this department is an automatic for threading the ends of studs. These studs are used in considerable number for holding the engine cylinders, cylinder heads, etc. The studs, threaded on one end, are fed automatically through a hopper. A chuck clamps the threaded end and then a self-opening die cuts the thread on the other end. Then the die opens and a new stud entering the chuck pushes out the finished one. The first two operations on the studs, that of threading one end, and that of cutting off the stock to the right length, are performed in an ordinary automatic. An idea of the capacity of the special machine for threading the last end of the stud may be gained from the statement that six ½ in. studs with ¾ in. length of thread can be finished per minute.

In all of the automatic screw machines, a constant stream of oil is played on the work, and a great deal of oil naturally adheres to the shavings. About 90 per cent of this oil is recovered in a centrifugal oil separator. The shavings are shovelled into a basket in this separator, which is spun at great speed for two to three minutes, and when the shavings are removed from the machine, they feel absolutely dry. About 8 bbl. of oil is thus recovered each day. Sawdust is used on the factory floor below the automatics to soak up any oil that may leak from the machines.

(To be continued)

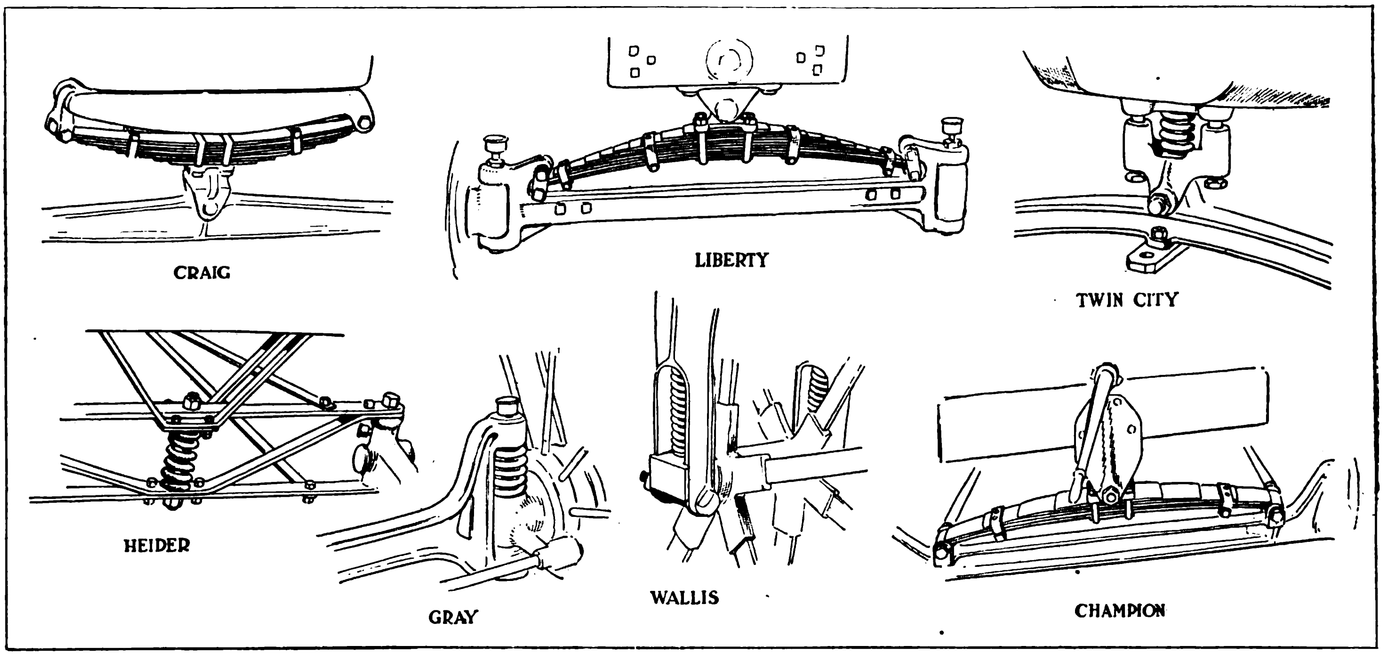


Boring cylinders in vertical boring mill at International Harvester plant

Spring Suspension of Tractors

Both Plate Springs and Coil Springs Used—Spring Suspension of Front End Fairly Common, of Rear End Rare—Sketches of Different Designs

By P. M. Heldt



The above sketches were made by an AUTOMOTIVE INDUSTRIES *artist at the recent Kansas City tractor show and include nearly all the front suspensions seen*

THERE are just two causes of wear and deterioration in tractors, the same as in other types of vehicles—friction and shock. Much has been done to minimize friction. Ball and roller bearings are being used more and more in tractor design, and lubrication means are also receiving close attention. But little has as yet been done to protect the mechanism against shock. It is true that when a tractor travels over soft ground it is really cushioned by the soil and does not require spring suspension to protect it. Whatever vibration may be caused by lack of balance of the engine would not be alleviated by springs but, on the contrary, would be rather aggravated thereby, because with spring suspension the mass on which these vibrating forces act would be cut down and the amplitude of vibration would be increased in proportion. The remedy for this sort of vibration has to be sought in careful balancing of the engine.

Tractors, however, often are required to travel over hard ground and sometimes even over stony roads. This causes a very severe vibration of every part, if no spring suspension is provided. The vibration is a good deal stronger than in a horse-drawn truck, for instance, as the truck usually has wheels of somewhat larger diameter and the wooden wheel absorbs most of the high-frequency, low-amplitude vibration.

Vibration is detrimental in that it tends to loosen joints and to crystallize the material of the parts chiefly affected by it. The force of the shocks produced when a moving vehicle strikes an ordinary road obstacle is greatly reduced by spring suspension. When a moving body strikes a heavy rigid body the force of the impact depends on the inertia of the moving body and on its speed. In the case of a spring suspended vehicle the obstacle is struck directly only by the non-suspended part, and it is chiefly the mass of this part which determines the force of the blow. The spring suspended part will not be deflected from its course as much or as abruptly as the non-suspended part and, while it contributes to the shock, it does so in a much lesser degree than if it were rigidly mounted on the axles.

Spring suspension of the front end of the conventional tractor with rear drive does not involve any structural difficulties. Moreover, spring suspension of the front end is more necessary than spring suspension of the rear end, because all or nearly all of the more delicate mechanism, such as oiler, magneto, governor, etc., is located nearer to the front than to the rear axle.

On creeper type tractors the forward end is practically always spring suspended. Owing to the low pressure per square foot of ground contact with the creeper type, the latter undoubtedly has more need for spring suspension. The suspension sometimes takes the form of a cross spring by which the engine supporting frame is carried on the truck. In other cases coiled springs are used.

There are three different methods of suspending the front of a wheel type tractor. In a few instances, half-elliptic side springs are used, as in passenger cars and trucks. However, it is generally considered that this construction does not offer sufficient flexibility for farm tractors. The centrally pivoted axle is so common in farm tractors that it may almost be considered standard. If the springs could be made as flexible as automobile springs, the side springs might do, but such is not the case. There being springs only at the forward end, this already reduces the magnitude of the ground warp to which the tractor will readily accommodate itself by about one-half.

The older type of spring suspension used on wheeled trac-

tors is that employing coiled springs. As far as the qualities of suspension are concerned, there is certainly very little difference between the coiled spring and the flat leaf spring. With the former there is no equivalent to the interleaf friction of the latter but at the low speeds at which tractors operate the rebound is not a factor of importance, so this does not matter. The objectionable feature of the coiled spring is that it has to be paralleled with a sliding pin or sliding pins through which the drive can be transmitted from one to the other of the parts separated by the spring.

To prevent undue wear of these pins and their guides they must be well lubricated, and inasmuch as these parts are directly exposed to the dust raised by the front wheels this is practically impossible. The closer the sliding joint is to the wheel the worse the conditions. If the sliding pin and guide could be surrounded by a leather boot filled with grease, it might be possible to get tolerably good wear out of such constructions, but leather boots are not in favor with tractor designers, and with some types of spring suspension they would be practically impossible.

Of course, wherever there is a spring suspension there must be sliding motion. But while in the case of guides parallel to coiled springs the motion is equal to the spring play, with leaf springs pivoted or shackled to the frame or axle, the motion on the surface of the shackle bolt will be only about one-twenty-fifth of the spring play. It is obvious that the smaller the range of motion the less will be the amount of wear on the pins or bolts. Moreover, a shackle pin or spring bolt is naturally much better protected against dust and dirt than a pin sliding in a guide with a range of motion of ½ in. or more. Therefore, it would seem preferable to use plate springs owing to the better wearing qualities of the connection.

As regards the range of spring action, this can be made comparatively small, owing to the low speed. The stiffer the spring the higher its natural rate of vibration and the better it is adapted to absorb shocks following one another at short intervals. Of course, it is not to be understood that the stiffest spring is the best, as this would logically lead to the conclusion that no spring at all would be best of all. The point is that as compared with motor trucks, and especially passenger cars, the vibrations of the running gear, which the springs must prevent from being transmitted to the frame, are essentially of short period. A compression of 1 in. under the dead load upon it and clearance for a slightly greater additional deflection under shock would meet the requirements. The obstacles causing these vibrations, in the case of a motor truck or passenger car, are absorbed by the rubber tires.

At the Kansas City tractor show there were nearly a dozen makes of tractors with spring suspension in front. A large variety of designs were represented, including half-elliptic side springs, half-elliptic cross springs, inverted half-elliptic cross springs, coiled springs on the steering knuckle and coiled springs at the center of the axle. Sketches of some of these suspensions are shown herewith.

Rear spring suspension in tractors is very rare. The chief reason for this is that the transmission of power from a spring-suspended frame to the rear wheels or rear axle involves difficulties. In the few cases where the rear end is spring-suspended it is supported on the axle through the intermediary of coiled springs, the axle moving up and down in a guide slot in the frame itself or in a bracket secured to it. It is figured that the slight range of spring play, although it does change the center distance between bull gear and pinion, does not change it enough to appreciably affect the mesh of the teeth. The driving thrust is transmitted to the frame directly and the torque reaction comes on the bearings of the bull pinion shafts.

Water Injection in Oil Engines

VARIOUS effects of the injection of water into the cylinders of internal-combustion engines are discussed by A. F. Van Amstel in the columns of *Engineering*. He says the misleading statement has been published that the use of water injection for obtaining increased power has been proved to be attended with injurious results to the engine because the sulphur present in the oil combines with the water and forms sulphuric acid, which rapidly eats away cylinder walls, pistons and piston rings.

The fact is, however, that the worst fuel does not contain more than a maximum of 2 per cent of sulphur and at the same time contains at least 6 per cent of hydrogen. This hydrogen combines with oxygen of the air and forms water, a part of which latter combines with the sulphur and more oxygen, forming sulphuric acid, according to the equation:

$$2S + 3O_2 + 2H_2O = 2H_2SO_4.$$

So 4 parts of hydrogen form sulphuric acid by combining with 64 parts of sulphur and 128 parts of oxygen, the atomic weights of the said elements being (rounded off) 1.32 and 16 respectively. Whereas the fuel does not contain more sulphur than one-third of the weight of hydrogen contained in it, it is clear that it is impossible that injection of water can cause the formation of more sulphuric acid than is formed if no water at all is injected. In using oil containing sulphur it is advisable to avoid the use of copper or copper alloys, not only in the engine proper but also in the fuel pump and all parts coming in contact with the fuel or the burnt gases.

The injection of water into internal-combustion engines is very useful, if it is arranged in a judicious way, because it greatly improves the combustion process by its catalytic action and in proportion as combustion pressure is produced earlier during the working stroke, the mean pressure, of course, is higher, so more power is obtained from the same quantity of fuel. The water vapor prevents the combustion from proceeding slowly and tardily, and obviates the possibility of formation of soot and other products of incomplete combustion. This catalytic acceleration of combustion processes by water vapor is very remarkable.

Dixon observed that a completely dry mixture of carbon monoxide and oxygen cannot be ignited, neither by a red-hot spiral nor by induction sparks. After adding water vapor, however, the mixture becomes explodable. A carbon monoxide flame goes out in dry air. Dry nitro-cellulose detonates with a velocity of 3750 m. per sec., whereas wet nitro-cellulose burns with a speed of 6000 m. per sec.

The Motorcycle Outlook in Great Britain

THAT there will soon be a great shortage in motorcycles in Great Britain is the opinion of Duncan Watson, managing director of the Harley-Davidson Motor Co., Ltd., of London, at present in this country. Says Mr. Watson:

"Of course, there is an absolute embargo on the importation of American motorcycles, automobiles and motor trucks into the British Isles at the present time. It seems to be the consensus of opinion, however, that within a few weeks this embargo will be partially lifted so that the British importers can bring in a limited number of American motor products. I believe that gradually the embargo will be further lifted by a process of rationing. It is not to discourage American competition that the present embargo is in effect. I want to emphasize this point because the impression seems to have gained ground that the embargo exists solely for the protection of the British manufacturers.

"As a matter of fact, most of us feel that the embargo is being used to hold up the rates of exchange more than for any other purpose. That is to say, that if the embargo was lifted completely there would be a tremendous in-rush of American-made products, which would create an overwhelming trade balance which would be detrimental to the rate of exchange, as you can readily see.

"The British post-war demand for motorcycles will not be satisfied until one million and a half motorcycles are put into the British Empire, one million of which will probably be absorbed in the British Isles alone."

Italy's War Vehicles Traveled to France by Own Motor Power

Cars and Trucks Took Road Over Alps Through Mont Cenis Pass—Airplanes Made Flight at Height of About 12,000 Feet

By W. F. Bradley

PARIS, March 19—The finest example that could be obtained of the value of roads to military operations is furnished by the passes over the Alps between France and Italy. There are three railroad lines connecting France with Italy, and the most important French line goes over the Alps by the Mont Cenis pass.

Very early in the war Italy became an important factor in furnishing motor vehicles to the allied armies, and the only practicable railroad route by which these could be delivered was via the Mont Cenis pass. It was not long before the insufficiency of this route was manifest and arrangements were made to make deliveries of automobile material by road whenever possible. There is a very fine road over the Mont Cenis pass. Italian automobiles for the French army, being practically all built at Turin, were delivered by road over Mont Cenis pass. Fiat was the first to start this service. From Turin to the French frontier station, on the eastern slope of the Alps, the distance is not more than 80 miles, but practically twenty of these constitute steady climbing, and the altitude attained is 7500 ft. Nearly every day a convoy of trucks or touring cars, which had previously been accepted by the French military commission, left Turin in charge of civilian drivers, climbed over the Alpine pass and were delivered at one of the French forts at Modane, about 6 miles inside French territory. From this point the civilian drivers returned to Italy by train and the following day came out with another and similar convoy.

All the roads over the Alps are snowed over from December to March or April. The authorities soon realized that they could not afford to lose these roads throughout the winter; consequently arrangements were made for gangs of soldiers to work on Mont Cenis pass in order to keep this road open for about two months of the closed period. At the beginning of the winter of 1918 all arrangements had been made for French territorial troops and 3,000 German or Austrian prisoners to keep this road free of snow throughout the whole of the year, so that had the war continued there would, for the first time in the history of the world, have been a stream of traffic across Mont Cenis throughout the winter.

After the disaster to the Italian army at Caporetto in November, 1917, the stream of traffic across the Alps changed in direction, for it became necessary for the British and the French to send temporary reinforcement into Italy. The two railroad lines were worked to the limit of their capacity; trains ran through from France to Italy at intervals of about 20 minutes, unloaded, and returned immediately, the authorities refusing to allow them to wait for a return load, so great was the need of sending men and supplies into Italy.

Italy supplied not a few airplanes to the French and American armies in France. At first these were shipped by rail, but it was soon realized that this method was slow and unsatisfactory. After a few experimental flights had been made over the Alps it was decided to send all planes from Italy to France on their own power. Most of these planes were built at Turin and Milan. Starting from this point they had to rise to a height of about 12,000 ft. in order to clear the top of the Alps safely. The necessary height was obtained while the planes were over the valleys, and the crossing was never attempted unless the safe height had been reached. As a precaution, the Italian authorities constructed a big landing ground on the top of Mont Cenis, 7000 ft. above sea level. A huge white cross was marked out in the ground and served as a guide to the pilots. In case of any accident which made it impossible for the pilot to continue his flight over the Alps into France he could always plane down to this Alpine landing ground.

Left—Fiat trucks for the French Army on the top of Mont Cenis pass, 7500 ft. above sea level. Right—Fiat trucks at Modane frontier station on the French side of the Alps. During the war all these vehicles were delivered over the Alps by road

Liberty Line of Wisconsin Engines

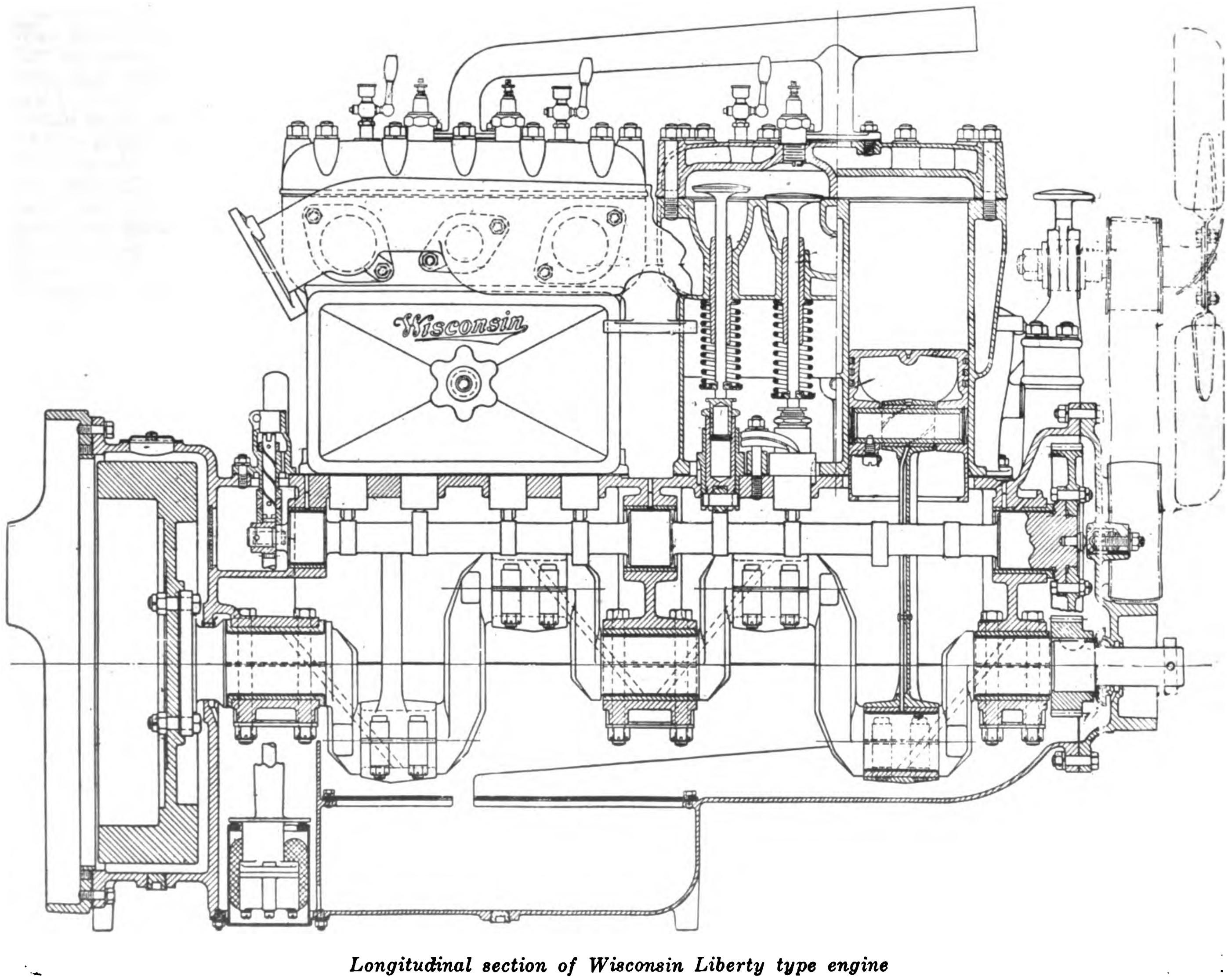
Principal Features Include Unit Power Plant Design, Aluminum Crankcases, Pressure Lubrication and "All-Steel" Three Point Support

A NEW line of four-cylinder engines, to be marketed under the trade name "Liberty," has been developed by the Wisconsin Motor Mfg. Co., Milwaukee. The line includes seven different types, viz., Type RAU, 4¾ x 6 in.; RBU, 5 x 6 in.; TAU, 4 x 6 in.; UAU, 4¼ x 6 in.; VAU, 4½ x 6 in.; EAU, 3¾ x 5 in.; BAU, 4 x 5 in. Of these different models the first two have their cylinders cast in pairs, with detachable cylinder heads, while the last five have their cylinders cast in blocks with solid heads.

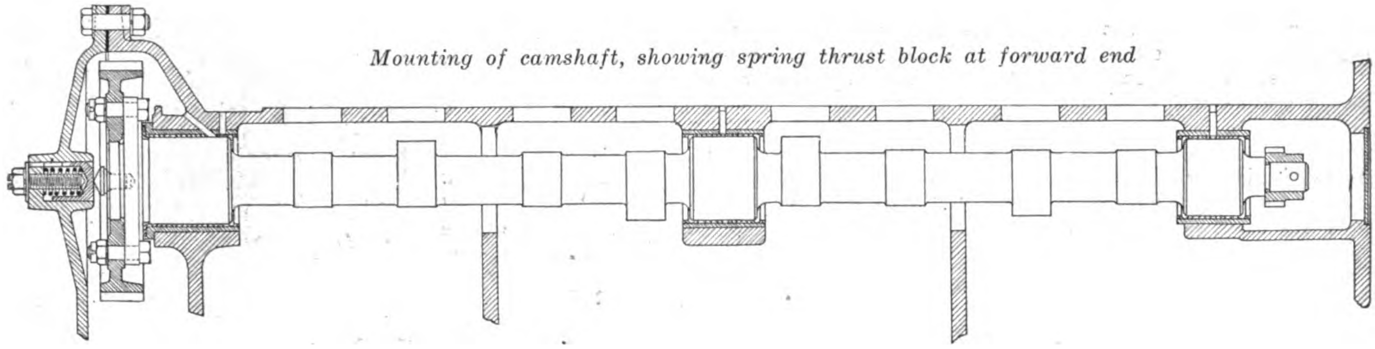
Taking up the two larger models first, they have L-head cylinders, which are bolted to the aluminum crankcase. These engines are specially designed to handle the lower grades of fuel which are now offered on the market. The crankshafts are made of chrome nickel steel, 2¼ in. in diameter on the crankpin, and 2¼, 2 5/16 and 2⅜ in. diameter on the front, center and rear main bearings respectively.

The crankcase is made of aluminum, with massive webs supporting the bearings. At the forward end there is a large, combined breather and oil filler, and an indicating oil gage is located on the same side of the case at the rear. As indicated by the "U" in the type designation of the engine, these two models are of the unit power plant type, and the flywheel is enclosed in a bell housing which is cast integral with the crankcase. The three point system of suspension is used, and special emphasis is laid on the fact that the engine has an "all steel" suspension. At the front it is supported on a trunnion bearing formed on the timing gear housing cover, while at the rear there is a cast steel or malleable supporting beam which is bolted to the bell housing. It is pointed out that dependence upon aluminum for support is undesirable, not only on account of the wear in the holes for anchor bolts, but also on account of breakage of the aluminum arms due to vibration. In case one of the steel arms should be broken in an accident, it can be very cheaply replaced.

The camshaft is formed with very large diameter bearings, and can be withdrawn from the forward end of the engine. To a flange forged integral with the camshaft at the forward end is secured the camshaft driving gear. A spring pressed



Longitudinal section of Wisconsin Liberty type engine


Mounting of camshaft, showing spring thrust block at forward end

plunger of hardened steel presses against a button head screw in the forward end of the camshaft, and presses it against the thrust flange of the forward bearing.

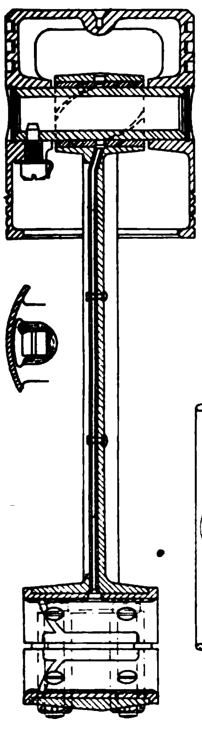
Valve tappets are of the roller type, of extra large diameter. The tappets, rollers and roller pins are hardened, to insure long life to these vital parts. The guides are of cast iron and are held in position by crabs and studs. This entire mechanism is inclosed by an oil type cover plate, which keeps out the dust. Openings are provided into the crankcase so that the oil vapors from the latter rise to lubricate the tappets and valve stems. The timing gears are cut with helical teeth, of wide face. The pinions of the timing gear are made of drop forgings, heat treated, while the large gear on the camshaft is made of cast iron. All main and connecting-rod bearings, as well as the camshaft, pump, drive shaft and other gear bearings, are of babbitt-lined bronze. Main and connecting-rod bearings are fitted with one-piece laminated shims.

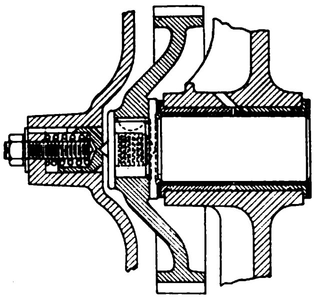
The oiling system is of the pressure type, an oil header being cast in the crankcase, which leads to the main bearings. The crankshafts are drilled, so that the oil is also forced to the connecting-rod bearings, and through tubes on the rods to the piston pins. The oil pump is bolted to the upper half of the crankcase and extends down into the oil reservoir. A large screen surrounds the oil pump and can be removed for cleaning without disturbing the pump or the oil pan. A relief valve is provided on the pump, so that a constant pressure is maintained.

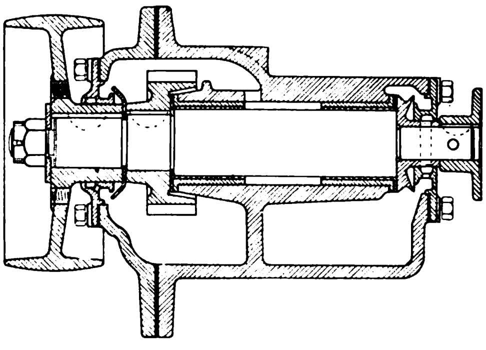
Combined inlet and exhaust manifolds are used, and are made of cast iron. They are so designed that the heat of the exhaust will vaporize the low grade of fuel which must now be used. To insure economical use of fuel, the inlet passage is kept down in diameter.

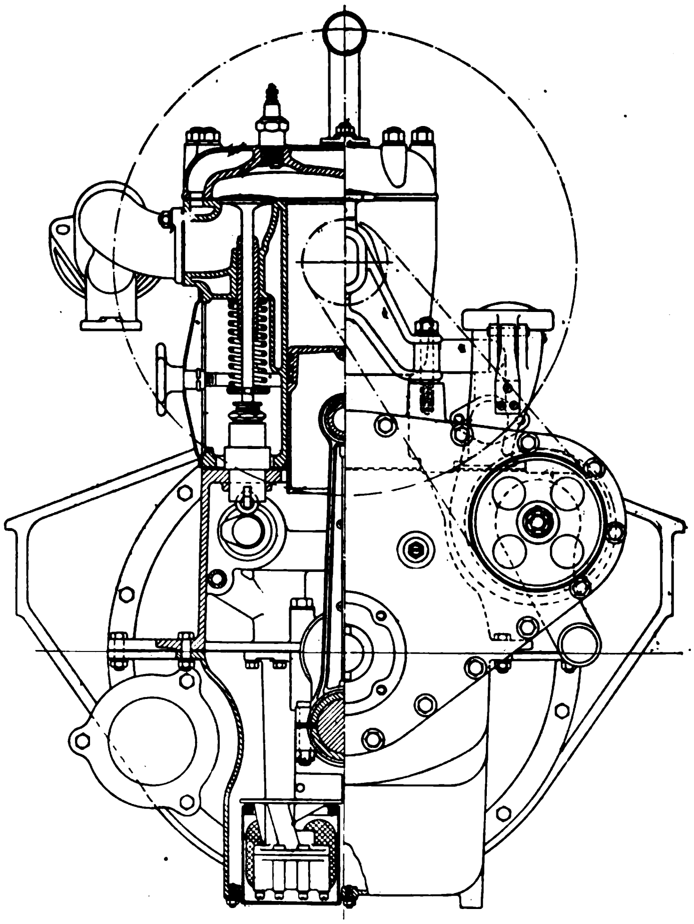
A substantial fan drive is provided, a 2-in. belt being used, which transmits plenty of power for the larger fans necessary for truck and tractor service. Provision is made for mounting electric generators and starting motors, the crankcase being designed with S. A. E. standard flanges. The locations of these accessories, as well as those of the carbureter and magneto, are so chosen as to leave all mechanism very accessible. An inspection of the drawings herewith will illustrate this, and will also bring out the fact that mounting of the steering gear on either the right or left side of the engine was provided for in the location of the various accessories. A drive is also provided for the various commercial governors, and manifolds can be furnished to accommodate same.

The second set of sizes, which are 4 x 6 in., 4¼ x 6 in., and 4¼ x 6 in. cylinders, follow very closely the RAU and RBU models just described except that they have block-cast cylinders and that the valve tappets are of the mushroom instead of the roller follower type. All of the dimensions are,



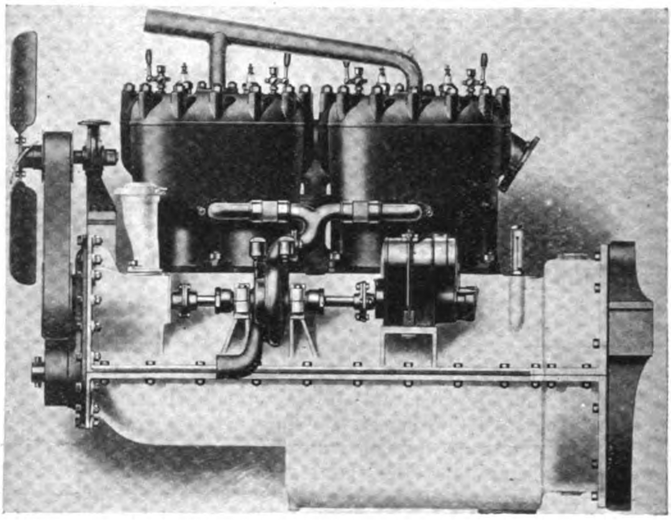

Spring thrust block on idler gear


Left—Piston and connecting-rod. Right—Accessories driveshaft mounting


Cross section through cylinder

of course, reduced in proportion, the crankshaft, for instance, being 2 in. in diameter. It, however, is also made of chrome nickel steel, and the same material as in the larger models is used throughout.

In a general way the two smaller models, of 3¾ x 5 in. and 4 x 5 in. cylinder dimensions, also follow the above specifications. The principal exceptions are that the cylinders are cast in blocks, with integral heads, and that mushroom tappets are used. No relief valve is fitted to the oil pump on these smaller models, as the pump is smaller and does not require a pressure relief.



Wisconsin engine

AS an evidence of the necessity which exists for immediate action, the latest published returns show, say the British Industrial "Safety First" Association, that, in 1914, 969 persons were killed and 147,045 were injured by accidents in workshops and factories alone, a large proportion of which would undoubtedly have been prevented had those who became casualties been educated in matters pertaining to their own safety. Millions of dollars paid in compensation, and huge sums of money lost to workers as wages, might have been saved and utilized to better advantage.

Oil-Shale Deposits in the United States

MUCH attention is now being paid to the oil-shale deposits in the United States, and the possibility of exploiting them to take the place of the liquid oil supply in due course, as it is estimated that the latter source of supply will be exhausted in about twenty years' time. Oil-shale deposits are found in several parts of the United States, but those in Colorado and Utah are the most extensive and have so far received the greatest attention. The following facts regarding the nature of oil-shale are taken from an article in *The Engineering and Mining Journal.*

Oil-shale has no oily appearance indicating that it contains free oil, but upon being subjected to heat its organic materials are broken up, and among other things, oil and gas are yielded. The yield varies from 6 to 90 gallons of crude oil per ton of shale. The crude oil distilled may give 7 per cent to 12 per cent gasoline, 28 per cent to 49 per cent kerosene and 39 per cent to 62 per cent residuum. Shale analysis indicates ½ per cent to 3 per cent moisture, 20 per cent to 52 per cent volatile matter and 45 per cent to 80 per cent ash. The asphalt varies from ½ per cent to 4 per cent and paraffin from 2 per cent to 9 per cent.

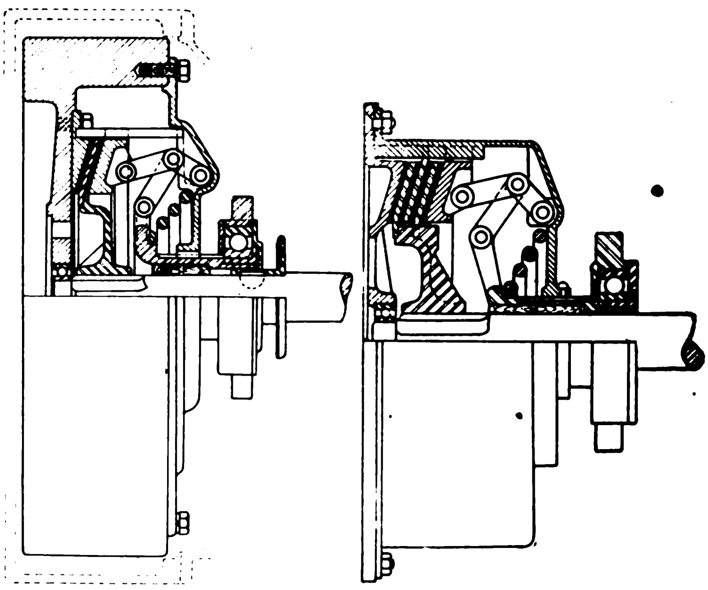
The by-products of oil-shale are extremely valuable and include gasoline, kerosene, lubricants, enamels, varnishes, paints, rubber substitutes, manufacturing products for glass, pottery and ornamental tiles, dyestuffs, ammonium sulphate, flotation oils and producer gas. The Colorado shale area covers more than 2500 square miles and the Utah area over 3000 square miles. The strata vary from a few inches to 80 feet thick. The yield is from 31½ to 80½ gallons per ton.

In Scotland over 3,000,000 tons of shale are profitably treated annually, but it is only the ammonium sulphate produced as a by-product which makes the business pay. On the other hand, the prospects of the American oil-shale industry should be good, as in Colorado and Utah the shale beds are relatively thick, suitably located high up for gravity transportation, and give a yield of 40 to 50 gallons per ton.

M. & E. Multiple Dry Disc Clutch

MERCHANT & EVANS CO. of Philadelphia, who for many years have been manufacturing the Hele Shaw multiple disc clutch, have recently brought out a new type of dry disc clutch. This is made in two forms, with a single driven disc and with multiple driven discs respectively. The clutch spring does not compress the discs directly, but acts on them through the intermediary of a toggle mechanism. It is claimed for the clutch that it contains very few working parts, is very simple and tool proof, and that it can be very easily disassembled. No adjusting means are provided, and owing to the peculiar construction of the disc compressing levers, a low-pressure spring can be used, thus making the clutch soft-acting. This clutch is recommended for both passenger car and truck use and, although first-class materials and workmanship are embodied in its manufacture, the makers state that it can be sold at a price within the reach of all motor vehicle manufacturers.

The same toggle mechanism that is used with the multiple disc clutch is also used with the single disc clutch. This latter type is made in two designs, one self-contained, the other of what is described as the flywheel type. This single plate clutch is intended for use in connection with engines up to 30 hp. The self-contained type of clutch is adapted for use where the engine and transmission are mounted separately, while the single-plate type is best adapted to unit power plant construction. The shifting collar of all these clutches is fitted with an annular ball bearing.



Left—M. & E. single plate flywheel type clutch. Right—M. & E. multiple plate clutch, showing toggle mechanism and ball bearing shifting collar

The Velie Biltwell Tractor

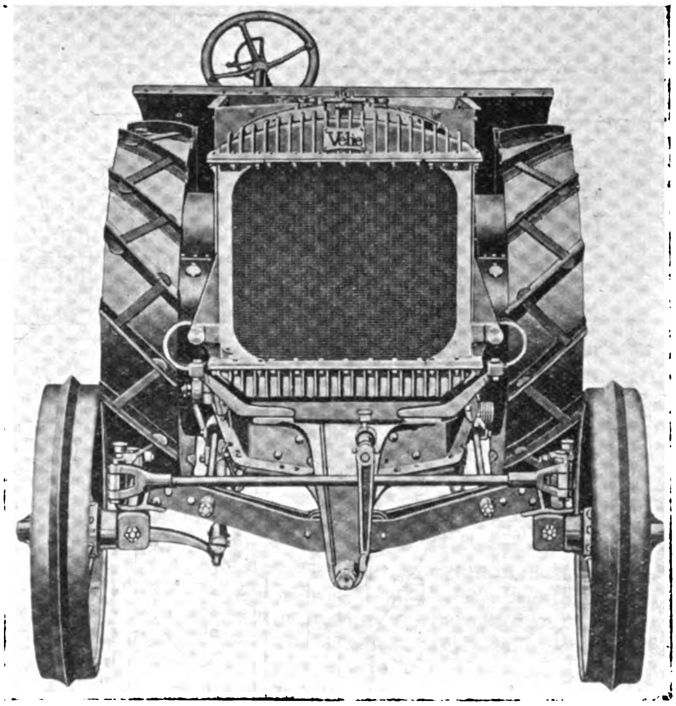
A 3-Plow Machine with Kerosene Burning Engine, 3-Speed Sliding Gear Transmission and Inclosed Bull Gear Drive—Flexible Running Gear with Spring Suspension of Frame in Front

By P. M. Heldt

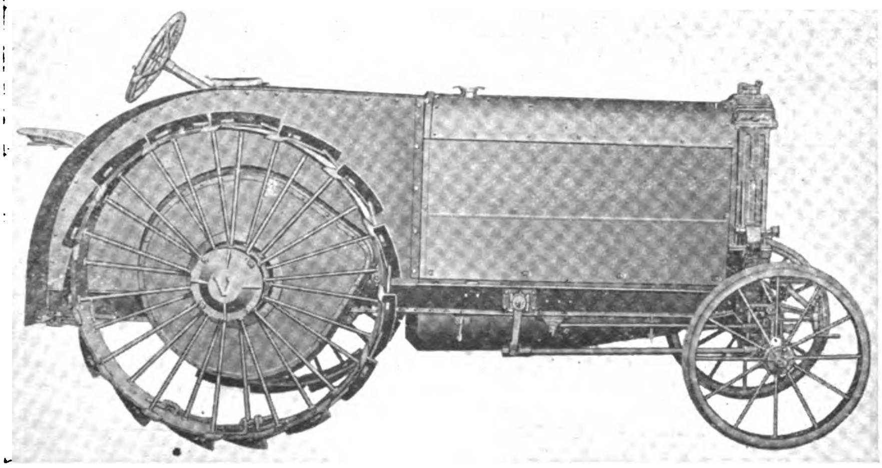
FOR several years past the Velie Motors Corporation of Moline, Ill., has been doing development work on farm tractors, and had it not been for the war, the concern probably would have marketed its first product in this line nearly a year ago. However, in view of the difficulties in the labor and materials fields, and the restrictions placed on the tractor industry by the Government, the Velie corporation decided to suspend manufacturing operations until the end of the war, meanwhile continuing its field tests with a considerable number of machines.

The tractor was exhibited at Kansas City, and is now to be put in production. It must be classed as in line with the most modern trends in tractor design, smooth lines and complete inclosure of all working parts being its outstanding features.

The engine is a four-cylinder type of 4⅛ in. bore by 5½ in. stroke, and the tractor has a 24 hp. rating. The four cylinders and the top half of the crankcase are made in a single casting, while the cylinder head is separate. The engine is specially designed for tractor work, and is of materially heavier construction than the Velie truck engine. It has a crankshaft of 2½ in. diameter, which is supported in three main bearings. The connecting-rod bearings measure 2¼ by 3 in. and the lengths of the main bearings (front to rear) are as follows: 3 7/16 in., 4½ in., 5 11/16 in. The cylinders are of the L-head type, and the valves are completely inclosed. In order to provide for access to the connecting-rod bearings, two large hand holes are provided in the upper half of the crankcase on the side opposite the valves. The valves have a clear diameter of 1 11/16 in. and a lift of ⅜ in. They are operated by means of cams with mushroom type cam followers. Bushed valve guides are used. The camshaft is supported in three bearings, which are quite liberal in size, as may be judged from the following dimensions: Front, 2½ by 2½ in.; center, 2⅜ by 2 3/16 in.; rear, 2 3/16 by 2½ in. Non-Gran bronze bushings are used for the camshaft bearings, while the crankshaft and connecting-rod bearings are of the bronze back, babbitt-lined type. The bronze used for these bearings is of the "Ring true" brand, and a special tin babbitt is used. Non-Gran bronze is also the material for the piston pin bushings. The pistons are of conventional design, with three ¼-in. rings at the upper end, and three oil grooves at the lower end or skirt. The piston pins are hollow, hardened and ground, and are held in position by pin screws. H-section drop forged connecting-rods are used, and the caps are held in place by nickel steel heat-treated bolts. As may be seen from the sectional views of the engine herewith, all of the main bearings are completely supported from the upper half of the crankcase. The camshaft is driven from the crankshaft through a pair of helical gears, and there is an additional gear for the drive shaft. A 23-in. flywheel, weighing 163 lb., is bolted to an integral flange on the crankshaft. Including the carbureter and magneto, the engine weighs 885 lb.



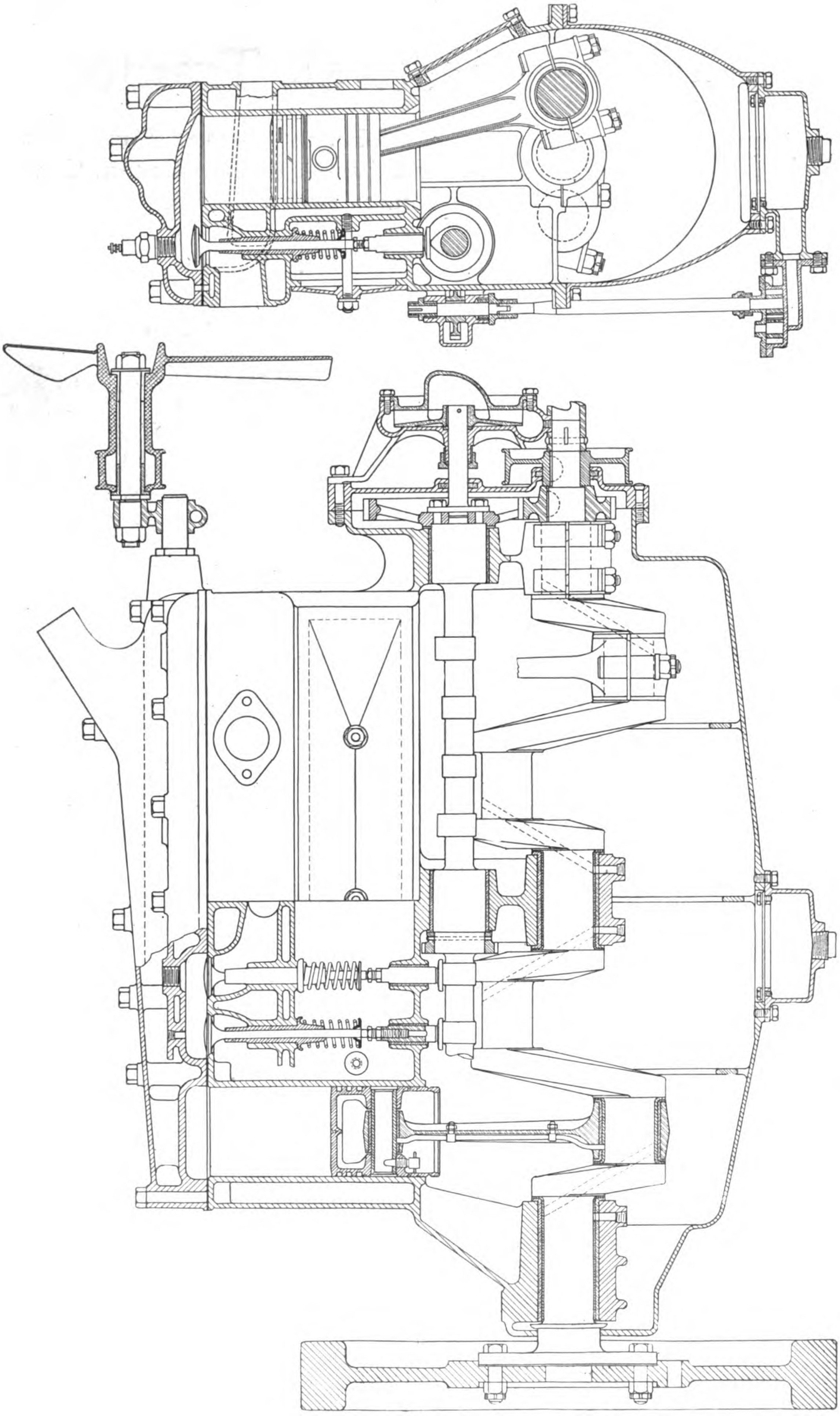
Front view, showing axle mounting, spring suspension of radiator, etc.



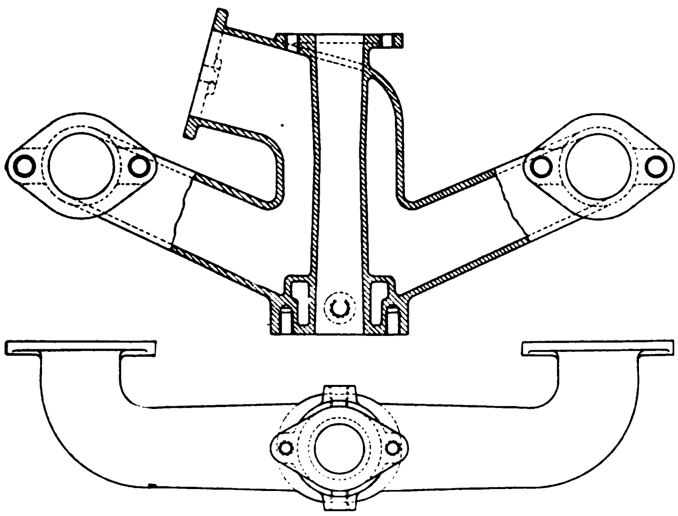
Side view of Velie tractor

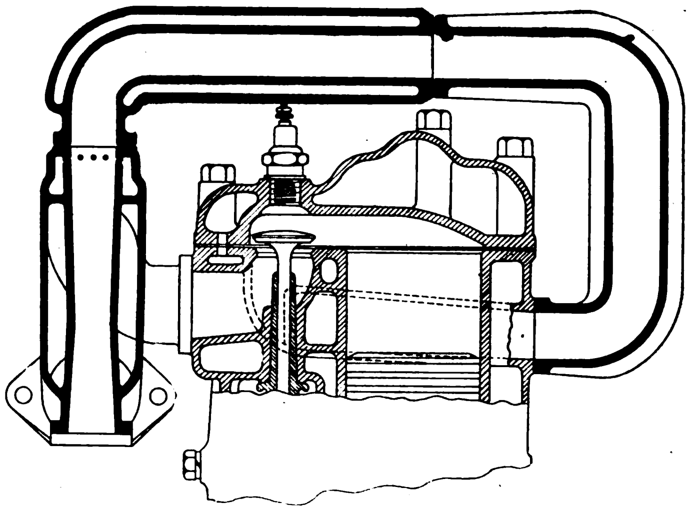
Kerosene is the fuel regularly used, and a supply of 22 gal. can be carried in the main fuel tank. There are also tanks for 2½ gal. of water and for 2½ gal. of gasoline. Water is drawn into the cylinders automatically whenever the engine runs under appreciable load. All tanks are of cylindrical form, and made of 16 gage terne plate, with welded seams. The gas-

Four-Cylinder Engine of the Velie Tractor



This engine has $4\frac{1}{8}$ x $5\frac{1}{2}$ cylinders, burns kerosene, is pressure-lubricated and is of heavy construction throughout


Combined exhaust manifold and inlet pipe


Inlet passage, partly water jacketed and partly air cooled

oline and water tanks are located under the hood, while the kerosene tank is located in back of the dash, crosswise.

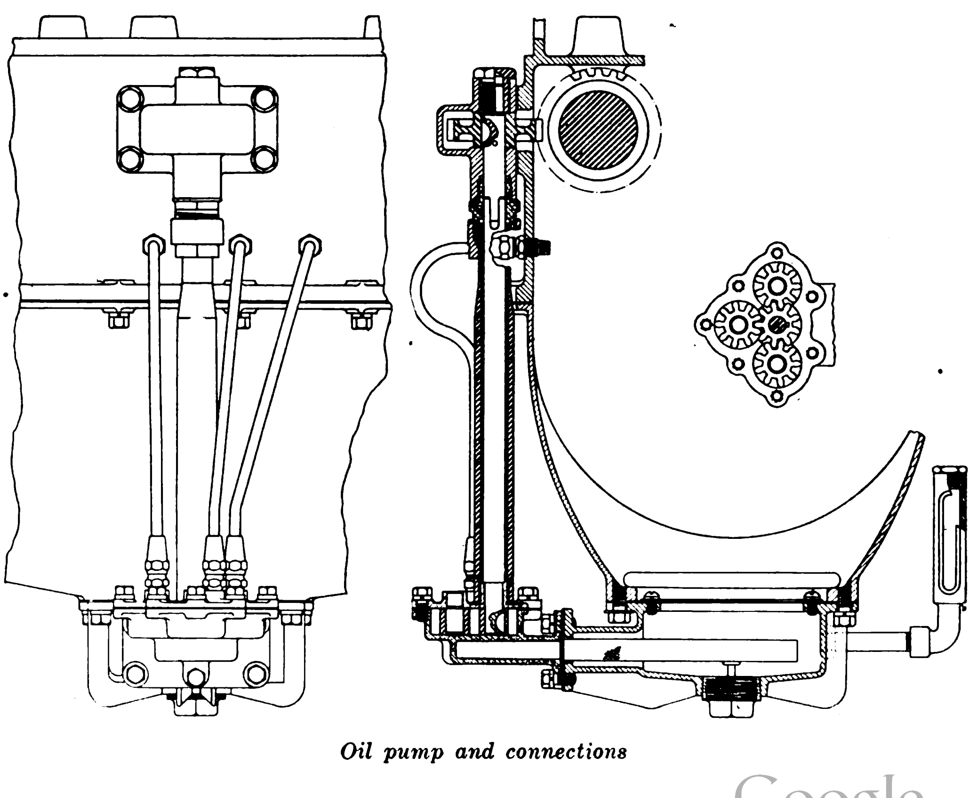
Two Kingston carbureters are fitted, one for starting on gasoline and one for operating on kerosene after the engine has warmed up. There is a three-way valve at the junction of the carbureters with the inlet pipe, so that either one of the carbureters can be shut off completely, or part of the mixture can be drawn from each. The water tank is located directly above the engine, and water passes through a T fitting, clearly seen in the photograph of the engine to the right of the inlet pipe, which fitting also contains a throttling or suction control valve. By means of this suction control valve, the feed of water can be regulated. The water feed is ordinarily so adjusted that from 2½ to 3 gal. of water are used to 20 gal. of fuel. Directly above the three-way valve in the inlet pipe is located the throttle valve for controlling the amount of charge entering the cylinders, and above this valve is an insert in the inlet pipe containing the throttle valve which is controlled by the mechanical governor. Then follows an offset section which brings the inlet pipe somewhat closer to the engine. The upper vertical portion of the inlet pipe is in the form of a venturi tube, and is completely surrounded by the exhaust pipe, except for a short length at the top, which is surrounded by a steam chamber. It is into this steam chamber that the water from the water control valve is fed. From the steam chamber there are a number of jets or outlets into the inlet pipe. An equalizing tube extends from that portion of the inlet pipe surrounded by the steam chamber to the offset portion of the inlet pipe referred to in the foregoing.

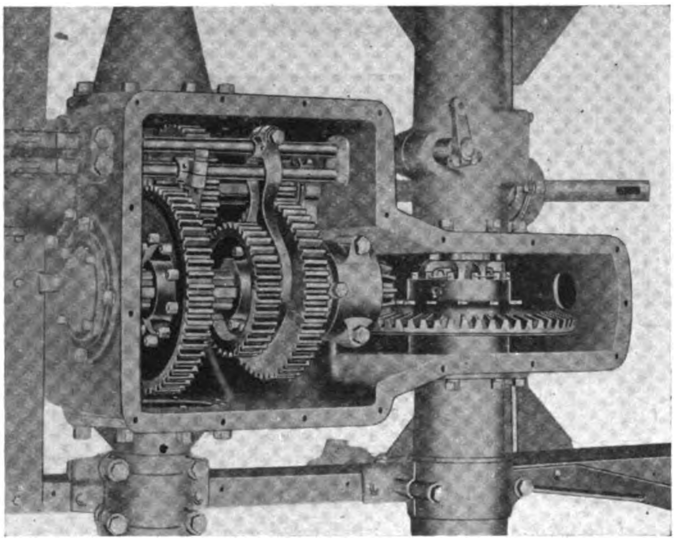
The combination inlet and exhaust manifold extends to a height even with the tops of the engine cylinders, and thence a water jacketed inlet pipe extends across the top of the engine to the opposite side. The inlet pipe then drops to the middle of the cylinder block, where it bolts over the end of the inlet passage which extends through the cylinder block between the second and third cylinders. While that portion of the inlet pipe located on top of the engine is water jacketed, that section extending down to the connection to the cylinder block is provided with cooling ribs. A Bennett air cleaner is fitted to the air inlet to the kerosene carbureter. There is a supplementary air valve at the connection of the inlet pipe to the cylinder block.

Ignition is by a Kingston high tension magneto, with impulse starter, which is mounted on a bracket cast integral with the bottom half of the crankcase, on the carbureter side.

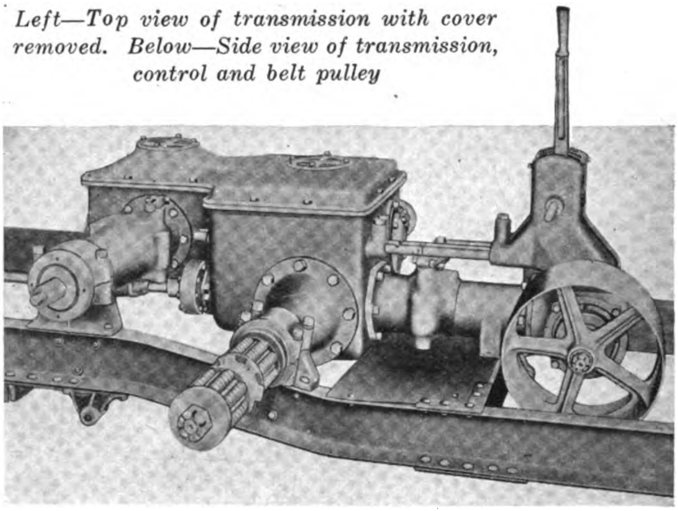
Design of Cooling System

Special attention appears to have been given to the design of the cooling system. It will be noticed from the sectional views of the engine that the jackets extend all the way down the cylinders, and the cooling water is also carried all around the spark plug bosses and the valve seats. A tubular type of radiator, with Bremer core, is used. It has a cast shell and radiating fins are cast on both the top and bottom tanks. In order to protect the radiator against severe shocks, which are inevitable with a machine of this type, it is supported on two scroll springs. Back of the radiator is mounted a four bladed fan, containing a Hyatt roller bearing, and driven by a 2-in. belt. Means are provided for adjusting the tension of this belt. The total water capacity of the cooling system is 7½ gal. The water is circulated by means of a centrifugal pump having a patented flexible mounting. The pump is really mounted on the driving shaft, and has a one


Oil pump and connections



Left—Top view of transmission with cover removed. Below—Side view of transmission, control and belt pulley



point support on the gear case cover, so that it can automatically adjust itself to the position of the driving shaft. Water enters the cylinder jackets at the bottom and leaves at the top. The water jackets are cast with baffle plates which insure circulation to every part.

Force Feed Lubrication

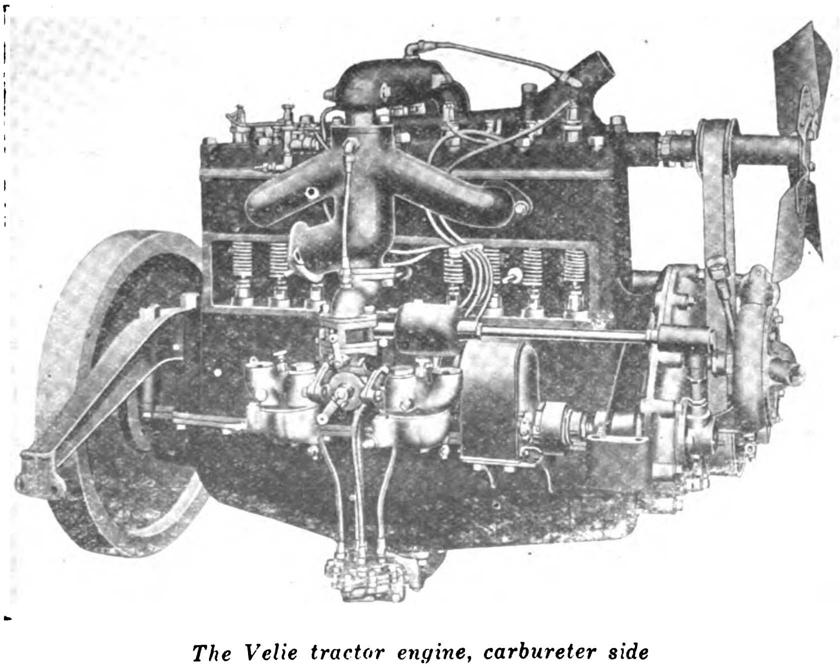
Lubrication is by the force feed system. An oil pump of the gear type is used, and is located at the lowest point of the engine, but outside the crankcase, where it is readily accessible. This pump is driven by a helical gear from the camshaft, through a vertical shaft with tongue and groove joint, just below the gears. The pump is located at the side of the oil sump and delivers oil through outside pipes under 40 lb. pressure to each of the main engine bearings. It is forced through drill holes in the crankshaft to the crank pin bearings, and through tubes leading up the connecting rods to the piston pin bearings. Thus, the lubrication of all the power carrying parts is effected by force feed and the pressure of feed at normal engine speeds is about 40 lb. to the square inch. There is a branch from each main bearing leading to the corresponding camshaft bearing, so that camshaft lubrication is also by force feed. It is recommended that when the tractor is in constant use, the oil should be renewed every forty hours.

A Borg & Beck 12 in. plate clutch is used, and is mounted on the flywheel, being enclosed in a separate revolving drum. The transmission is of the company's own design, and affords three forward speeds in addition to a reverse. It is similar in layout to a motor truck transmission. The two shafts are mounted one above the other, the lower being the primary shaft. All gears are made from forgings of 3½ per cent nickel steel, and are cut with 6-8 pitch teeth, the face widths being 1½ and 1⅝ in. Timken roller bearings are used throughout the transmission. On the ring gear end of the jackshaft a Timken bearing is used, and on the other end a Hyatt. There are two hand holes in the top of the transmission case. All moving parts of the transmission are run in oil. An extension of the primary shaft backwards, provided with a jaw clutch, carries at the rear end a bevel gear meshing with another bevel gear on the belt pulley shaft. This set of bevel gears gives a reduction of speed in the ratio of 22/17.

Belt Pulley at Rear

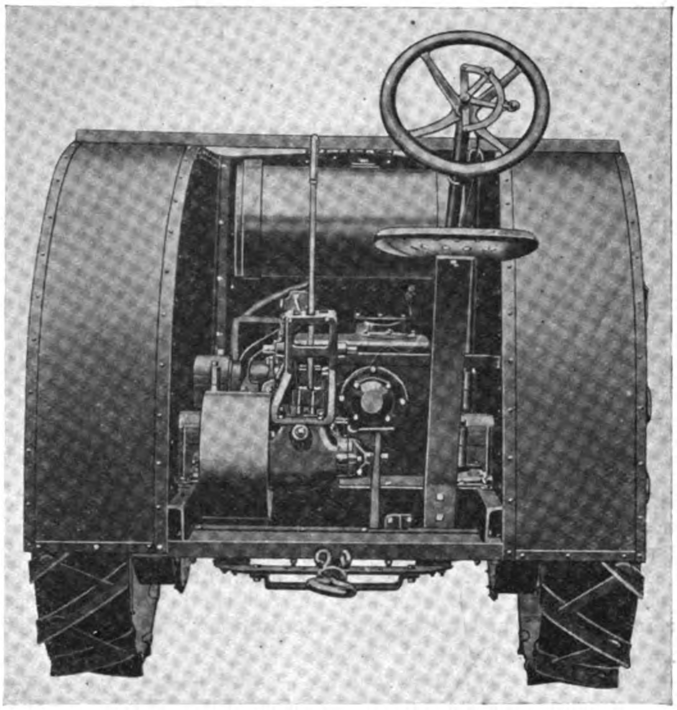
The belt pulley, which is located at the rear on the left-hand side, is 13 in. in diameter with 7 in. face. With the gearing specified, a belt speed of 3067 ft. per min. is obtained, at normal engine speed. The radial load on the pulley shaft is taken on a Hyatt bearing and the thrust load on a Timken. There is a safety bolt at each end of the belt pulley shaft. Control of the change gears is effected selectively by means of a lever working on an H-quadrant. The jackshaft of differential gear housing is built in one with transmission housing. The final drive is by bull gears of the spur type, which run in a bath of oil. The joint in the housing is only 3 in. from the axle, and 1½ gal. of oil is poured into each housing. This supply is said to be sufficient for a year.

The frame of the Velie tractor is built up of 5-in. steel channels weighing 9 lb. per ft. These frame members are bent so that they come below the rear axle. Everything on the frame is riveted and 7-in. gussets are used so as to insure the greatest possible rigidity. The rear axle is made of 2½-in. round stock, heat-treated and ground. Hyatt roller bearings are fitted in the rear wheels, there being two bearings at each end of the axle, each bearing 4 in. long. There is no single solid axle extending from wheel to wheel, but instead two short axles are used, each pressed into a cast axle horn which is bolted to the transmission. These horns are clamped between the axle brackets and their caps. The frame comes to a point at the front, and has a pivot support below the front axle, the center of the support being only 10½ in. from the ground.



The Velie tractor engine, carbureter side

The front axle is made of strip steel, and is riveted to cast steel axle ends. Drop forged steering knuckles are used, and are fitted with Timken roller bearings on the axle stub. The knuckles are of the Lemoine type, and steering is effected by means of a hand wheel and a worm and nut steering mechanism. The steering lock is such that the tractor can be turned around in an 18 ft. diameter circle, figured to the center of the machine. Two and one half turns of the steering hand wheel are required to bring the front wheels from hard over one way to hard over the other way. A reduction of 12:1 is obtained by means of the screw and nut mechanism. The steering hand wheel is provided with a wood rim and the steering mechanism is really a standard truck steering gear. Center control is used, and the spark and throttle levers are mounted on the steering wheel.



Rear view of tractor

Built-Up Wheels

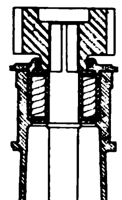
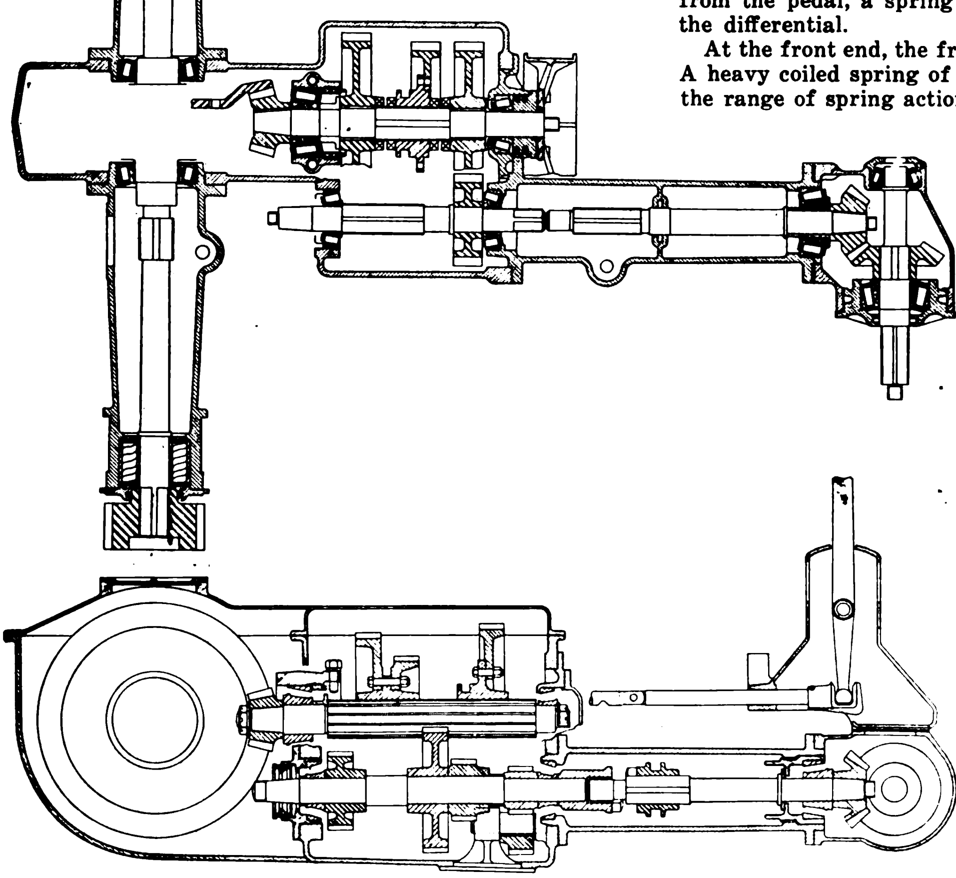
Both sets of wheels are of the built up type. The front wheels are 32 in. in diameter by 5½ in. width of tire, the tires being of the flanged type, and the spokes of round section. The rear wheels, which are 52 in. in diameter by 10 in. width of face, also have round spokes and flanged tires, the flanges being 1¼ in. wide. At the rear of the tractor there is a frame extension which carries a wood platform on which the driver can rest his feet.

The drawbar attaches to a cross member of the frame. A bracket is riveted to the center of this crossbar, and from it run brace rods to the side members of the frame at points where the bull pinion bearings are located.

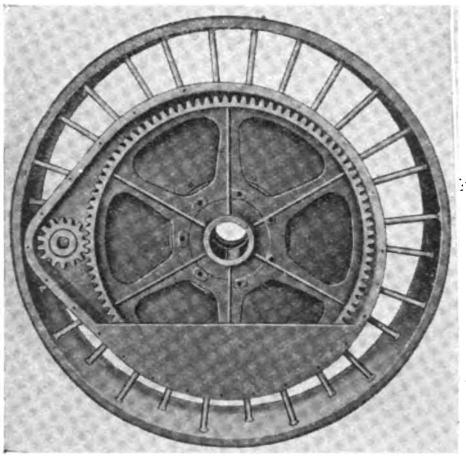
There is a spring cushion in the drawbar, and the latter has 18 in. lateral adjustment on a crossbar riveted to rear extensions of the frame. The hitch is 16½ to 17 in. from the ground, which is a convenient height for hitching such implements as binders, disc harrows, etc.

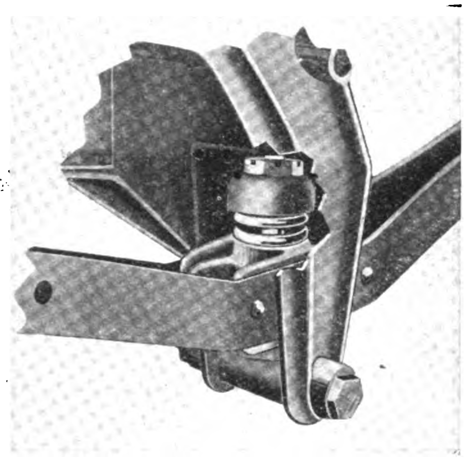
The Velie tractor has a wheelbase of 91 in. Its extreme width is 66 in. and the extreme length 138 in. An implement type of seat is used, and is supported by a spring secured to a cross member of the frame. Mud guards of No. 18 sheet metal, with an angle iron frame, are fitted over the rear wheels. These extend only to the center of the wheel forward, but down to the level of the platform at the rear. A feature of the Velie tractor is a differential lock, which can be engaged by means of a pedal convenient to the driver when in the seat. This lock is in the form of a jaw clutch, which locks one of the differential shafts to the differential housing, thus making the differential gear inoperative. When the operator withdraws his foot from the pedal, a spring withdraws the clutch, thus freeing the differential.

At the front end, the frame is spring supported on the axle. A heavy coiled spring of only a few turns is used and, while the range of spring action is small, it suffices to relieve those short period shocks which are so harmful to tractor mechanism. The front axle is braced to the tractor frame by two radius rods, which extend substantially parallel with the frame side members. The rear end of these brace rods is pivoted to brackets riveted to the frame, while the forward end extends through holes in the front axle, and is surrounded by coiled springs on both sides of the axle which act to relieve severe shocks on the brace rods. A mud pan of No. 16 gage sheet metal is located under the engine, and is designed chiefly to protect the engine from trash. The engine is set 2 in. to one side of the frame center. There is a permanent sheet metal hood over the engine, but the sides of the engine space are covered with heavy duck. Snap fasteners are used to fasten the duck at the bottom to the tractor frame, and a 5/16 in. steel rod is secured to the duck about half way up so as to prevent it from blowing against the engine. These duck curtains roll up and fasten by straps to

Two sectional views of the transmission





Left—Rear wheel, with bull gear and pinion and case for same, showing provision for keeping oil in

Right—Spring support of forward end of frame and pivot mounting of front axle

the hood. The water and gasoline tanks are located under the hood, with their filler openings projected above it, thus making filling of these tanks an easy matter.

All of the control devices are conveniently located at the rear. The gear shift lever also controls the belt clutch, there being an extra slot in the gear quadrant into which the lever is moved when it is desired to do belt work. This makes it absolutely certain that all of the gears are out of mesh when the tractor is used for doing belt work. All control levers are of neat and handy form

The price of the Velie tractor, completely equipped, including a set of Loxon lugs, is $1865.

Hints on Storing Timber to Prevent Decay

MANY serious losses from decay in wooden structures are possibly due to the fact that the timbers used were infected with wood-destroying fungi while in storage. These losses can be greatly reduced by keeping lumber storage yards in a sanitary condition. Some hints as to how to do this, issued by the Forest Products Laboratory of the U. S. Forest Service, Madison, Wis., are given below:

Strong efforts should be made to store the product on well-drained ground, removed from the possible dangers of floods, high tides and standing water.

All rotting débris scattered about yards should be collected and burned, no matter whether it be decayed foundation and tramway timbers or stored lumber which has become infected. In the case of yards already filled in to considerable depths with sawdust and other woody débris the situation can be improved by a heavy surfacing with soil, slag, or similar material. Weeds should be cut away from the piles to allow good ventilation.

More attention should be given to the foundations of lumber piles in order to insure freedom from decay and better ventilation beneath the stacks. Solid foundations should never be used. In humid regions the stock should not be piled less than 18 to 24 in. from the ground. Wood blocking used in direct contact with wet ground should be protected by the application of creosote or other antiseptic oils, or else replaced by concrete, brick or other durable materials. Treated skid timbers would also be highly advantageous.

Foundations should be built so that the piles will slope approximately 1 inch to every foot of length.

In most regions lumber should not be close piled in the open, but should be "stuck" with crossers at least 1 in. thick. Lateral spacing is also very desirable. Roofing or cover boards on piles should not be neglected, and should extend over for several inches in front and back.

Instead of throwing the "stickers" about on the ground to become infected with decay, they should be handled carefully and when not in use piled on sound foundations and kept as dry as possible. If pine, saturated with resin, or the heartwood of such durable species as white oak or red gum, be employed, the danger of possible infection will be greatly decreased.

In storage sheds the necessity for piling higher from the ground is very apparent in many cases. The same remedies apply here as for pile foundations in the open. The sheds should be tightly roofed and the siding should not be run down below the bottom of the foundation sills. Free air circulation should be allowed from all sides beneath the inclosure. Only thoroughly dry stock should be stored in close piles under cover.

Should fungous outbreaks occur in storage sheds not constructed to meet sanitary needs, the infected foundation timbers should all be torn out and replaced with wood soaked in an antiseptic solution or by concrete or brick. In all cases the new foundations should be so constructed as to keep the lumber well off the ground, and the soil and timber immediately adjoining the infected area should be sprayed or painted with an antiseptic solution of a water-soluble salt, like sodium fluorid, mercuric chlorid, zinc chlorid or copper sulphate.

A more detailed discussion of methods of handling lumber to prevent decay is to be found in Department of Agriculture Bulletin No. 510, "Timber Storage Conditions in the Eastern and Southern States with Special Reference to Decay Problems," obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price 20 cents.

Theory of Action of Lead Cell

CH. FERY read a paper on the theory of the lead cell some time ago before the Société Française de Physique. It is argued that the usual assumption that the material of the negative plate passes through the form $PbSO_4$ during the discharge is a fallacy. This view is supported by a consideration of the change of weight of the negative plate during discharge, and also by the darkening of rolor of the plate, which would not be expected with the formation of white lead sulphate. It is more likely that Pb_2SO_4 is formed. This theory is supported by certain chemical reactions and changes of weight that were noted in experimental plates.

Carburetion Temperature of Oil Mixtures—Correction

N the article on the "Carburetion Temperature of Oil Mixtures" in the issue of AUTOMOTIVE INDUSTRIES for Feb. 27, there occurred a couple of typographical errors which should be corrected. In the second formula on page 491, the numerator ought to read $.01 \times 6.5 \times 760$ instead of $+ 760$ as printed. In the third formula on the same page the denominator should read 14×50, not $14 + 50$. In the last column on page 491, $746 = 460 = 286$ deg. Fahr. should be $746 — 460$.

Lack of Care in Promotion Retards Conference-Plan Development

Matters of Interest to the Worker Must Be Told in His Language—Legal Verbiage Unnecessary and Adds to Difficulties—Campaign of Education Required

By Harry Tipper

THE adoption of conference systems, the representative shop committees, and of joint government of working conditions by management and labor together is attracting a great deal of pubiic attention and is being announced by more individual plants every day. In some cases the systems have not appealed to the worker as thoroughly as they should and in some cases the manufacturers have been disappointed by the results where they have only been working for a few months.

It is evident from investigations which we have made of the matter that three cardinal points have been lost sight of in the preparation of some of these plans. Perhaps this is due to the lack of appreciation on the part of the manufacturers as to the worker's point of view. There is a very deep-seated suspicion on the part of the worker in respect of the motive which is behind all voluntary suggestions by the manufacturer. This suspicion arises out of past history, which has, in too many cases, provided a justification for it, and out of the lack of understanding and the consequent partial viewpoint which the worker has. The important thing is not the reason for the suspicion, however, but the fact of its existence and its strength.

Worker Must Be Educated to Appreciate Plan

In the promotion of all plans looking toward the establishment of the shop committee, or conference system, which will provide the worker with some share in the management of his own affairs, it is necessary to take this suspicion into account and clear it away before the plan can become operative in any real measure. All the arrangements which are made in advance of the submission of the plan to the workers should have in mind this necessity for the education of the worker to the reasons behind the plan and the opportunities presented by the plan.

In some of the details which have come to hand, concerning the action of individual manufacturers who have adopted this system, the carrying out of the plan and the provisions for its promotion among the workers indicate that the legal department of the company has controlled its preliminary operation too largely and the commercial, sales and advertising departments have not been consulted sufficiently in regard to the method of bringing it about. The attitude of the manufacturer who said: "It is true that we have made no attempt to promote this among the workers, feeling that a plan which offered such benefits and opportunities to the worker would, of course, be received with enthusiasm," does not offer any substantial hope that the conference system will work itself out in such a plan without considerable difficulty, before the workers' and employers' representatives come to any common ground of understanding. It is particularly unfortunate that a measure of this kind, which is intended to bring about a more democratic arrangement in the government of the worker's condition and give him a voice in the affairs, should be promoted in such a way that it does not bring with it a realization that its inception is due to a keener understanding of the demands of industrial progress and a more intimate knowledge of the worker's necessities and aspirations.

The terms of the conference plan, in a number of these cases, are characteristic of the methods of legal departments and the language of a lawyer. It is undoubtedly wise that the legal department of a large company should have a good deal to do with the articles constituting the conference plan, but the lawyer is not a close student of human affairs in business as a rule. His method of approach to a question does not lead to that simplicity and clarity which is absolutely necessary in a case of this kind if the value of the method is not to be befogged by the verbiage that surrounds its constitution.

In the manufacturing business the men who have charge of the sales and advertising work are better equipped to arrange an idea so that it will convey the right impression to the people who are to receive it. Their business every day necessitates the use of this knowledge and the cultivation of a considerable amount of it.

Where a conference plan is to be adopted, or where any organization changes are to be made in the expectation that they will offer a basis for the solution of the labor difficulties, the adoption of such a plan is of sufficient importance to justify the employment of the best brains in the concern for each particular part of the work, and no part of the preparatory work can be slighted without increasing the difficulties of operating the plan and materially lengthening the time required to make it successful.

Plan Must Be Adapted to Particular Case

In the case of one plan with which we have been in touch, the general counsel and the executives of the company spent not less than nine months investigating the merits of this or that plan and making their decisions upon the modifications necessary for that particular manufacturer. These provisions were drawn up, then the plan was presented to the workers by means of a notice and a dry booklet merely containing the proposed provisions. The whole presentation of the plan to the workers occupied three weeks and hinged upon the character of the notice and the booklet. Yet it is evident from the character of the booklet and the notice that no man who was accustomed to the work of impressing a body of men with the importance and value of a new idea had anything to do with the handling of these two matters. In fact, the adopting of this system by the workers in this particular organization, in the face of the methods which were employed to promote it, simply indicates the value

of a plan which can succeed in spite of such a presentation.

The mixture of races which obtains in many plants has not been taken into consideration sufficiently in most of the cases where this plan has been presented to the worker. It is sufficiently difficult for the average worker to understand, without an educational process, the benefits which he is to secure from a plan of this kind where he is conversant with the English language, the political habits and the ideals of the American people. It is sufficiently difficult to remove the suspicion which attaches to his mind where this background is provided.

In most plants, however, the problem is complicated by the fact that the labor is largely foreign, frequently including as many as twenty different races, few of whom have any knowledge of democratic institutions, most of whom have been brought up in the tradition of feudal systems, whose knowledge of English is frequently very limited and who have no background of traditional understanding of the American habits of mind and general political arrangement. Yet it is expected that these mixed races will, in the course of two or three weeks, with a single notice, a few brief explanations and a complicated document of provisions, understand what they are to vote about and the benefits which they are about to receive by virtue of such voting. Under these circumstances it is not amazing that in some cases the voters have not approved of the plan. The only amazing thing is that the workers have in most cases approved of the plans and that the rejections have been so few and far between.

Whether the plan has been adopted or not, under these conditions the lack of care and attention in the promotion of the plan, particularly to the mixed races that are to be found in most of the large manufacturing establishments, will, without any question, militate against the progress of the plan, increasing the difficulty of getting it into thorough working order, and lengthen the time which is necessary before it will be of definite value.

The third item which has not been sufficiently considered in the presentation of this plan is the necessity for simplicity in the provisions of the plan and the danger of including in the constitution too many operating definitions and limitations.

Temporary Character of All Operating Plans

It is necessary to emphasize again, as we have emphasized before, the temporary character of all operating plans in the building of human organization. The operating necessities are constantly changing and the value of any committee, or any established body, within an industrial organization grows as the body gets to work and makes it valuable for decision upon or discussion of matters which were not originally thought of. This is true of all legislative organizations and all committees which deal with policy and the methods of putting that policy into operation. Under these circumstances the provisions of the plan as it is presented for adoption should be as simple and elastic as possible. The committee, or conference, should be started at work upon the least important and most immediate of operating necessities, but neither its authority nor its work should be so limited by the original provisions that it cannot be extended in its operations to cover matters for which it proves to be the most effective body as it grows and develops.

There is a second danger involved in complicated provisions, and that is the danger of a constant discussion as to the interpretation of those operating provisions which lead away from the main issues and prevent the organization from proceeding in an orderly way toward the development of the proper harmony in the main requirements.

We have received in the course of the last few months booklets containing the plans established by approximately twenty-five organizations, and in 70 per cent of these cases, where these booklets have been passed out for comment in our own organization, they have elicited requests for further information in order to elucidate several of the provisions and statements of procedure. In four or five of these booklets the things for which the employee can be discharged without redress, the things to which the company reserves its rights and similar matters make up the first few pages of the booklet, while the plan which is intended to confer the various benefits upon the employees is left for the last pages of the booklet and presented without any real explanation.

The method of promoting and presenting the conference plans to the employees of the industrial organization is just as important as the character of the plan itself, and it will advantage the manufacturer greatly to see that those executives in his establishment who are most capable of understanding methods of promotion be called in upon the promoting and presentation, so that the plan is thoroughly understood before its adoption and the proper amount of enthusiasm created in respect to it. The value of the plan will be enhanced very greatly by such measures and the difficulties correspondingly reduced.

The Strength of Commercial Liquid Glues

MOST of the commercial liquid glues are manufactured from the skins, heads and swimming bladders of fish. Others are made by special treatment of the glue extracted from the hides, skins and bones of cattle; some for special uses are prepared from starch, from various natural gums or from casein.

At the Forest Products Laboratory tests were made by B. A. P. inspectors on a number of these liquid glues, who found that they differ very widely in strength. Some of them are so weak as to be entirely unsuitable for woodworking purposes, while others compare favorably in strength with the "hot" glues. The glues tested varied from one which exerted a binding force of less than 50 lb. per sq. in. to one with an adhesive strength 60 times as great, or more than 3000 lb. per sq. in.

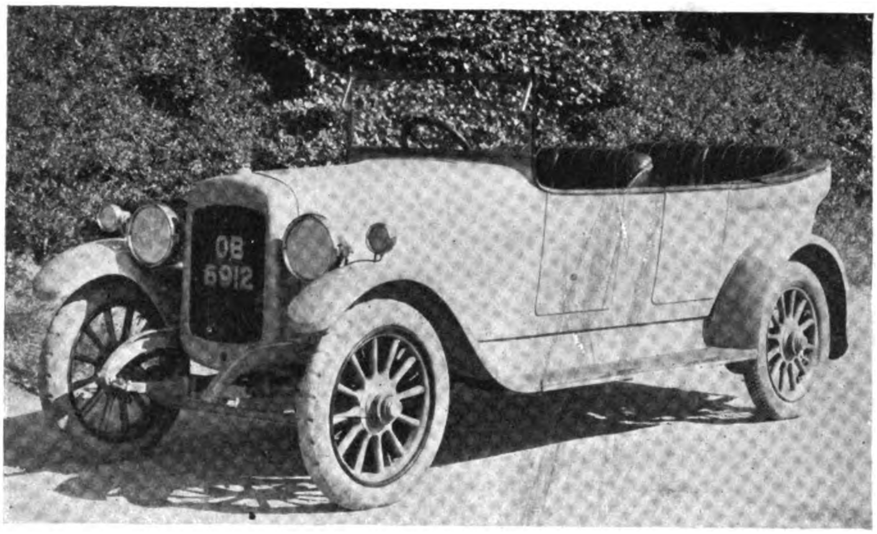
Liquid glues may be tested by gluing together pairs of specially selected hard maple blocks, placing them in a testing machine and measuring the force required to shear them apart. About 300 specimens, representing 26 different glues, have been tested in this way at the laboratory. According to the data thus obtained, a high-grade liquid glue should have an average shearing strength of not less than 1700 or 1800 lb. per sq. in.

In addition to uniform high adhesive strength, it is evident that certain other characteristics are desirable in a liquid glue. When spread upon wood surfaces, it should "set" and dry rapidly. In its container, it should remain fluid and workable at all ordinary temperatures. It should be elastic and shock-resistant. It should not be unusually susceptible to the action of high temperatures, high humidity, molds and bacteria.

The study gave evidence that the strength of liquid glue, like that of "hot" glue, depends largely upon its "body" or thickness, or, strictly speaking, upon its viscosity. Of 11 liquid glues examined, the thickest or most viscous glues showed the greatest adhesive strength.

NO less than ten national aircraft factories were erected or purchased by the British Ministry of Munitions. All of these were completely finished, and engaged in production for some months prior to the armistice. The approximate cost of these establishments was $11,300,000.

A New British Quantity-Production Car



The Austin, Rated at 20 Hp., but Developing 45 Hp. on the Brake — Body Designed with Receptacle for Top—To Be Offered in Open Touring, Coupe and Landaulet Models

Austin open touring car

EUROPEAN manufacturers of automobiles have taken a leaf out of the book of their American confrères and are adopting a number of practices that, while popular here in the past, have been practically unknown abroad. One of these is the production of a single model in the greatest possible numbers consistent with manufacturing facilities and the visible market. Another is the production of complete cars instead of bare chassis. Both these practices are intended to reduce the cost of the machine to the consumer, and the ultimate object is to create a wider market.

One of the first British post-war models to be announced, and which is to be manufactured along these lines, is the Austin "twenty." This had been completed before the signing of the armistice and was shown to members of the delegation of American business paper repre entat ves which visited England and France in November and December of last year. In this connection it may be well to recall that the Austin plant grew enormously during the war and during its later stages employed around 25,000 persons. Consequently, if the resources of this enormous plant are to be devoted to turning out one passenger car model the annual output should be very high. It is somewhat surprising that the price contemplated is in the ne'ghborhood of $2,000 for the standard touring model, which is considerably beyond that asked for American cars with much larger engines.

There are four L-head cylinders cast in block, with detachable head, and the crankshaft is supported in five bear'ngs. The camshaft is driven by a silent chain of ample dimensions. The crankcase has large inspection doors.

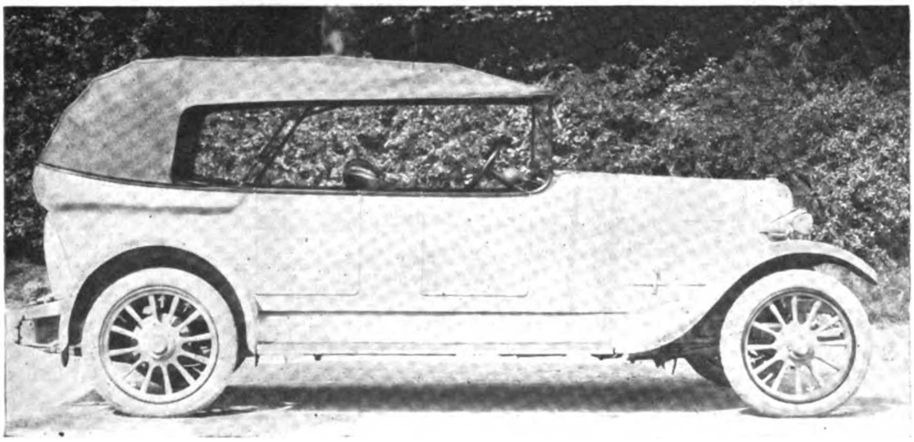
An automatic carbureter is fitted. The inlet p'pe is combined with the exhaust manifold, so that ample heating may be obtained. An extra air valve is fitted and is controlled by a lever on the steering wheel. Ignition is by coil and battery with a high-tension distributer. Lubrication is by means of a gear pump which forces oil through the hollow crankshaft to all bearings. A strainer is placed in the bottom of the crankcase and by this means all oil is strained before being circulated. A strainer is also fitted to the filler. Cooling is effected by the thermo-syphon system. A honeycomb radiator of ample size is provided and assisted by a high-speed fan.

Some idea of the general characteristics of the car can be gleaned from the following specifications:

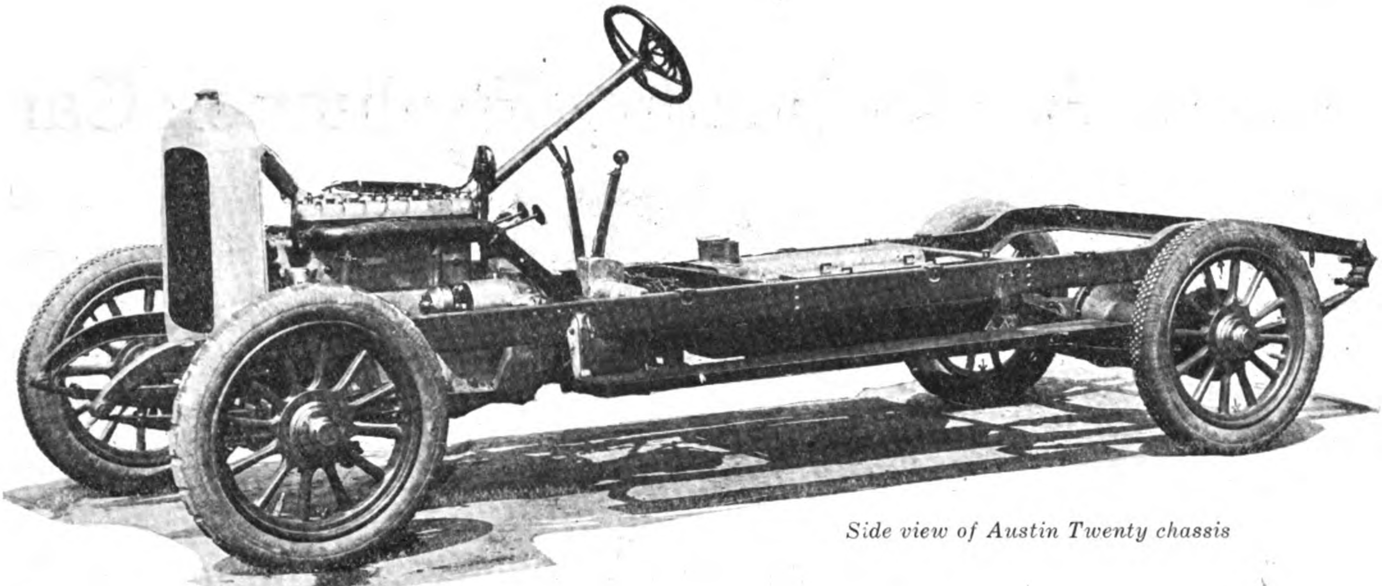
Wheelbase	10 ft., 9 in.
Tread	4 ft., 8 in.
Width overall	5 ft., 2½ in.
Length overall	14 ft., 11 in.
Body space	8 ft., 7½ in.
Distance from rear of dashboard to center of rear axle	7 ft., 11 in.
Tires, standard model	32 x 4¾ in.
Colonial model	36 x 4 in.
Ground clearance, standard model	9 in.
Colonial model	11 in.
Approximate weight of chassis	2000 lb.
Bore and stroke	3¾ x 5 in.
R. A. C. rating	22.4 hp.
B.-hp. of engine at 2000 r.p.m.	45.

Fuel is fed by gravity through an Autovac secondary tank. The main fuel supply is carried in a 15-gal. tank supported on substantial brackets attached to the cross-members in the center of the frame. A fuel lever indicator is supplied, and an outlet pipe fitted at the bottom. Ample filling arrangements and a large strainer are provided in an accessible position under the front seat. A combined electric self-starter and lighting equipment is provided, and there is also a detachable starting handle for use in case of emergency.

A single-plate pattern clutch with asbestos friction facing is fitted. The gearbox gives four speeds forward and



Austin touring car with top up



Side view of Austin Twenty chassis

one reverse, the shafts being carried on ball bearings. The speedometer is gear-driven from the change speedbox. The change speed is operated by a lever through a gate, which, with the brake lever, is fixed in a central position. The engine and gearbox form one unit with three-point suspension on the frame.

The rear axle is of the three-quarter floating type, the axle housing carrying the rear wheels on ball bearings, thus relieving the shafts of the chassis weight. The main driving gears are of the helical bevel type.

The I-section front axle, knuckle and knuckle arms are forged of high-grade steel, carefully tempered so as to resist fatigue. The front wheels run on roller bearings with ball thrust. The steering is of the worm-and-sector type, with a stationary outer column supported from the cowl, and is fitted with a 17-in. wheel, with the throttle, ignition, and extra air levers on a stationary quadrant.

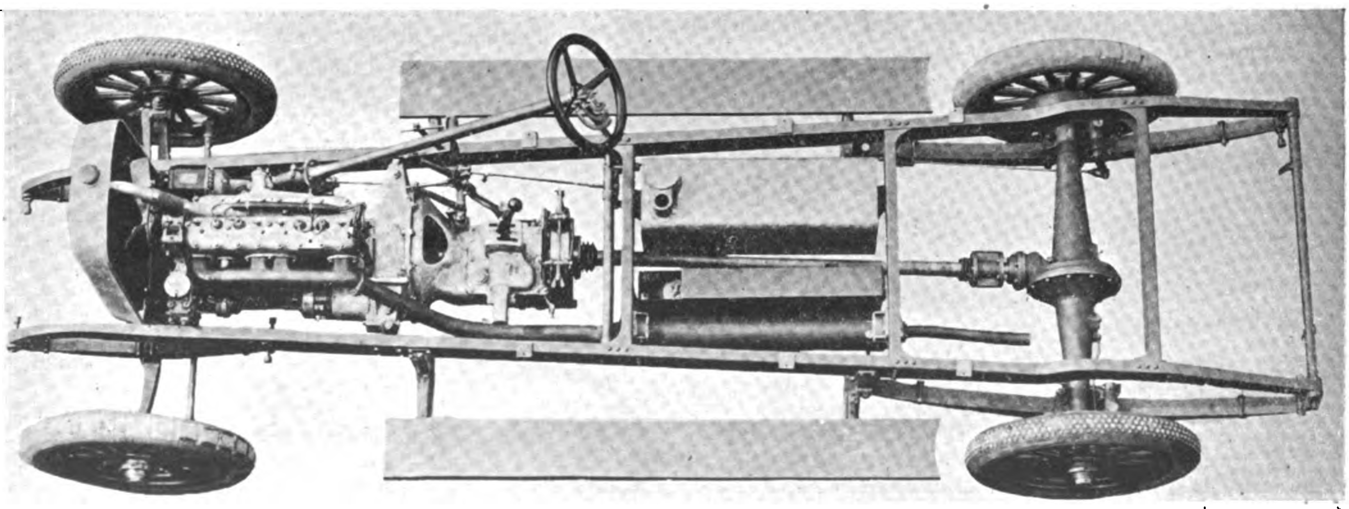
The chassis springs are semi-elliptic, the rear being of the underslung type 60 in. long, while the front are 36 in. long. Special provision is made to prevent rust between the leaves.

Metal-to-metal internal expanding brakes act on drums on the rear wheels and contracting shoes faced with asbestos fabric close upon a drum mounted on the third motion shaft at the rear of the gearbox. The car is fitted with Austin detachable artillery wheels as standard. One spare wheel with studded tire is also provided. Three separate types of body are to be mounted on the chassis—the standard model open touring car with top, a four-seated coupé, and a landaulet.

The standard touring model is an elegant piece of work. The top, when not down, is tucked away into a neat, well-drained receptacle. The front seat is arranged to slide backward or forward and is adjustable to any angle. There is an all-metal framed windshield with both top and bottom halves deflecting. The electric lighting outfit includes two powerful headlamps and side and tail lamps. A specially arranged tire carrier with metal cover is fitted at the rear and can accommodate two spare wheels. All doors are fitted with interior locks and concealed hinges. The general finish is in nickel and the body work is painted in one of three standard colors, gray, dark green or blue, with upholstery to match.

The coupé is a roomy four-seated car with streamline body accommodating two passengers at the rear and two at the front, the rear seats being fitted with arm rests at each side. The top is of black leather and is capable of being raised with automatic raising and lowering gear, while the door windows are in two parts arranged to slide horizontally, the frames thus falling inside the doors when not in use. A window is also provided at the back of the top. The lighting arrangements and general equipment resemble those of the touring car.

Features of the landaulet model include a semi-domed roof with fixed sloping canopy, automatic folding head with cant rail and concealed head joints. All doors are fitted with concealed hinges, large lever locks, and silent dovetails. Easily raised frameless and noiseless windows are fitted to doors and quarters. A specially arranged tire carrier with metal cover is fitted at the rear, and can accommodate two spare wheels. The tool equipment includes a complete set for average running, carried at the rear of the car, in a new type toolbox, and some special tools for use in the garage.



Plan of chassis. Note location of fuel tank (vacuum feed) and storage battery

F-5-L Navy Flying Boat

Details of Flying Controls and Method of Hook-Up—Weight and Percentage of Weight of Every Component

By S. T. Williams
Assistant Chief Engineer, Naval Aircraft Factory, Philadelphia

PART IV

IN the previous three articles describing this boat, the various outstanding features of the hull, wing panels, engine mounting and gasoline systems were outlined. The boat is a twin-engined tractor biplane equipped with Liberty engines. It has a wing span of 103 ft., with wings 8 ft. wide, and a boat hull 45 ft. long and 10 ft. wide. The total flying weight is 7 tons and the cruising radius is 10½ hours as a fighter and 8½ hours as a bomber.

The outstanding features of the flying controls are the laminated-yoke dual elevator and aileron control mounting, and the adjustable rudder bar installation.

The yoke itself is built up of ⅛-in. laminations of ash, glued and riveted together, making a strong and light construction. Each end is extended to form the elevator throw, and the aileron control wheels are mounted on brackets at the top.

These wheels are connected by an endless chain, from the middle of the lower part of which are taken the aileron control wires. The cross tube is integral with the yoke, and the whole swings on bearings at the hull sides.

In addition to lightness of construction, rigidity, and simplicity of wiring, this control affords a maximum amount of room for passing from the front to the rear cockpit, and does not interfere with the legs of the pilots as does a post type control.

Originally, adjustment of the distance between the pilot and the rudder bars was effected by shift-

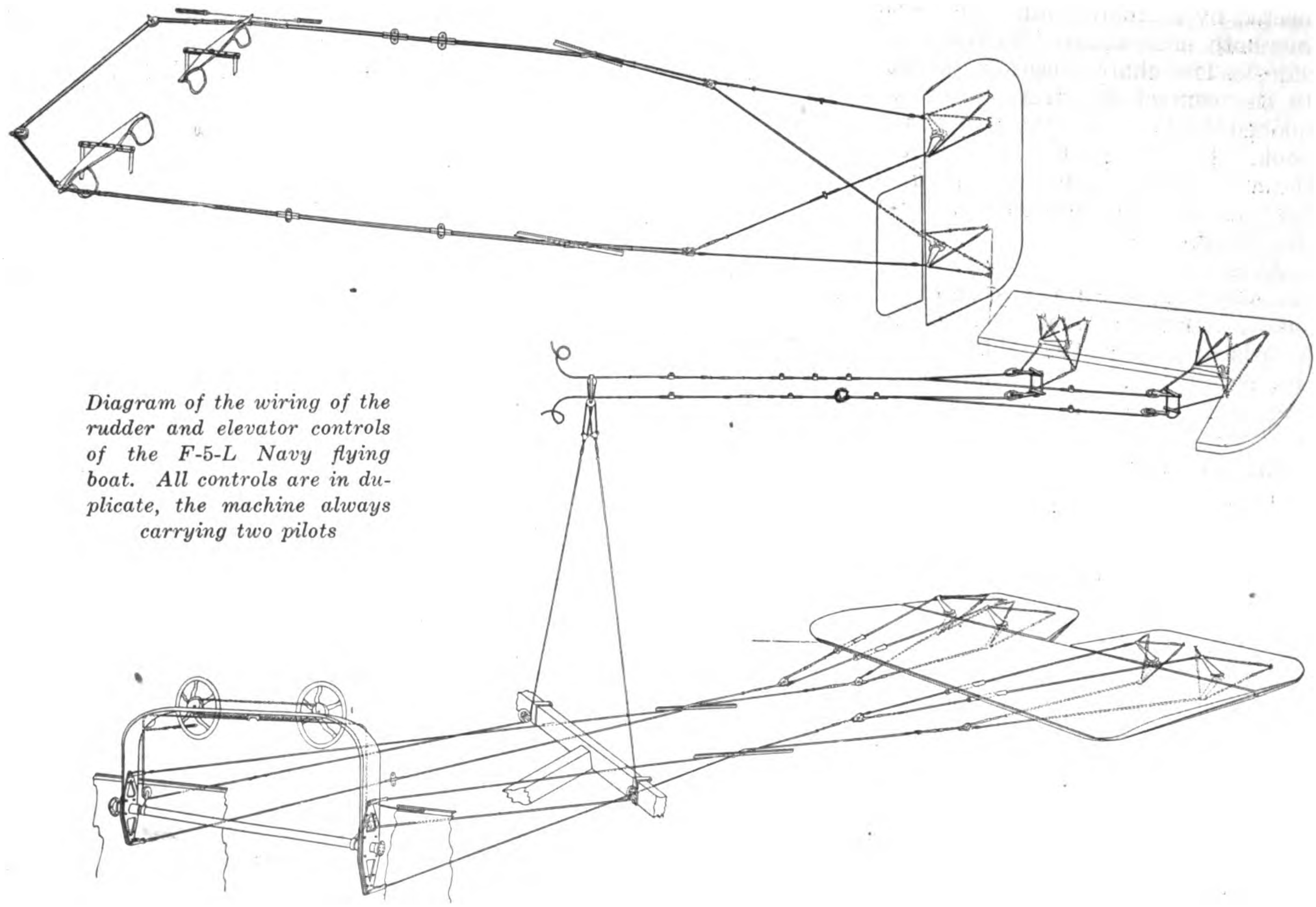


Diagram of the wiring of the rudder and elevator controls of the F-5-L Navy flying boat. All controls are in duplicate, the machine always carrying two pilots

ing the seat. But this also brought the control wheel closer, and the installation was complicated. Adjustment on this plane is effected by shifting the rudder bar bodily fore and aft the required amount.

The rudder bar is carried between two straps that are supported on a tubular framework in front of the pilots. These straps have a series of holes, and the rudder bar may be set to swing on a pin passed through any one of these. A similar adjustment permits the outer end of the bar to be set properly in connection with the rudder cable. As these pins are set in place by a small brass cotter, any desired setting can be made quickly.

Under severe flying conditions, or in the case of tail or nose heaviness, it is sometimes necessary for the pilot to exert a continuous pressure on the controls. On the elevator or rudder controls, this continuous pressure may be applied at will, in any desired amount through rubber cords called "bungies."

The complete bungy is simply two pieces of rubber cable, connected by a small chain, and having both ends secured to the hull sides. The chain passes adjacent to the control it governs, and is hooked to it at will with a snap hook. The pressure is applied to the control by extending the rubber cable before the attachment of the chain.

All control cables are carried on brass ball-bearing sheaves, and the sheave housings are fitted with guards to prevent the cables from coming off. With the exception of the point where the aileron cables pass through the upper wing, all control cables are open to inspection.

Weight Chart of Experimental

Corrected for Recent

Item	Part of	Per cent	Weight
Gross weight		100%	13659.53
Machine empty	Gross weight	61.7%	8435.19
Wing structure	Machine empty	31.20%	2612.73
Planes	Wing structure	6.95%	1815.42
Wires	Wing structure	10.0	261.08
Struts	Wing structure	10.70	279.55
Floats	Wing structure	3.90	102.34
Wing fittings	Wing structure	5.90	154.34
			2612.73
Hull (Complete with controls and equipment)	Machine empty	27.00%	2285.38
Seats	Hull	1.82%	42.20
Shell	Hull	75.20	1709.75
Hand controls	Hull	2.80	59.03
Foot controls	Hull	1.10	24.62
Control wires	Hull	2.00	49.09
Flooring	Hull	2.60	65.71
Bulkheads	Hull	4.20	100.98
Sandow (Rudder, Elevator)	Hull	0.08	1.98
Wing root	Hull	10.20	232.02
			2285.38
Power plants	Machine empty	36.30	3068.37
Engines	Power plants	55.50	1700.00
Struts	Power plants	0.78	24.44
Mounting	Power plants	7.62	234.00
Oil tanks and pipes	Power plants	2.60	81.00
Engine controls	Power plants	0.70	21.46
Propellers and hubs	Power plants	5.90	181.30
Auxiliary gear	Power plants	3.70	115.01
Gravity tank 44.00, Gas tank 225.75, Piping 35.19	Power plants	9.90	304.94
Radiators 158.00, Supports 5.66, Piping 16.56	Power plants	5.90	180.22
Water	Power plants	7.40	226.00
			3068.37
Accessories	Machine empty	5.50	468.71
Navigationinstrum	Accessories	58.22	272.77
Parts added	Accessories	39.00	182.94
Canvas covers	Accessories	2.78	13.00
			468.71
			8435.19
Fuel and oil	Gross weight	22.9	3138.96
Fuel	Fuel and oil	93.50	2934.00
Oil	Fuel and oil	6.50	204.96
			3138.96
Crew, 4 men	Gross weight	5.0	680.00
Military load	Gross weight	10.4	1405.38
Guns	Military load	5.26	73.88
Ammunition	Military load	11.40	160.00
Pistols	Military load	1.80	26.00
Bombs	Military load	65.60	920.00
Bomb gear	Military load	7.12	100.00
Bomb release control	Military load	1.75	24.66
Gun mounts	Military load	5.35	75.18
Bomb sight	Military load	1.72	25.66
High altitude fixtures	Bomb sight	3.90	1.00
Pilot directing	Bomb sight	96.10	24.66
			25.66
			1405.38
			13659.53

Steaming Green Lumber

SATURATED steam as a means of alleviating the tendencies of green lumber to honey-comb in the kiln has for some time been successfully applied in the commercial drying of heavy vehicle stock. Under intelligent control, such treatment has meant the difference between success and failure in many kiln runs. It has frequently afforded the means of overcoming discrepancies in operation or misjudgments as to the ability of stock to withstand rigid drying conditions.

So far, however, the steaming treatment has been confined to straight stock. The contention has always been that bent stock, such as rims, should not be steamed after removal from the form, experience indicating that stock so treated would tend to straighten out to its original shape. The kiln drying of heavy bent rims has been carried on, therefore, without resorting to steaming to remove casehardening and other defects of drying.

Model F-5-L Flying Boat

Changes in Equipment

Top planes	24.40%	441.99							
Extensions	12.95	235.24					Vertical	35.6%	54.25
Center panel	7.09	127.29	Stabilizers		47.70%	152.64	Horizontal	64.4	98.39
Lower planes	29.70	537.91							
Ailerons	7.33	132.79							152.64
Non-skids	1.10	20.00							
Tail unit	17.53	320.20					Port	50.0	29.84
			Elevators		18.70	59.68	Starboard	50.0	29.84
		1815.42	Rudder		12.80	41.33			
			Tail stays		20.80	66.55			59.68
						320.20			
			Longerons	137.90					
			Keel	47.29					
			Keelson	50.89	31.00	241.36			
			Sternpost	5.28					
			Bracing nose	2.24					
			Bracing w. r.	60.21	7.90	62.45			
			Stringers	71.48					
			Floors	97.03	32.90	257.55			
Skeleton	45.80	782.46	Fin timbers	89.04			Hull wires	29.3	26.05
			Metal parts		11.40	89.02	Fittings	70.7	62.97
Paint	2.10	36.00							89.02
Hood	7.10	121.12							
							Metal	41.7	55.02
Fabric	0.64	10.68	Stanchions		16.80	132.08	Wood	58.3	77.06
						782.46			132.08
			Sides		13.10	83.82			
			Fin decking		12.90	82.32	Planking	78.0	369.28
Skin	37.40	640.22	Bottom		74.00	474.08	Steps	22.0	104.80
						640.22			474.08
			False keel		2.17	2.59			
			Tank supports		41.60	49.58			
			Doors and supports		14.60	17.48			
Sundries	6.96	119.27	Aft cross members (tail fin)		6.53	7.79			
			Ammunition boxes		19.60	23.35			
		1709.75	Miscellaneous		15.50	18.48			
						119.27			
Center bracing (wood)	12.20	28.36							
Spars	26.80	61.91							
Compression tubes	6.00	14.18							
Ribs, end and covering	35.20	81.84							
Fittings	19.80	45.73							
		232.02							
Tachometers (2)	9.50	10.92							
Gravity fan pumps	12.60	14.52							
Hand gas pump	4.70	5.41							
Thermometers (2)	2.20	2.52							
Oil gauges (2)	5.60	6.46							
Hand starters (2)	33.80	38.86							
Storage batteries (2)	18.20	20.90							
Ampere switches (2)	4.00	4.68							
Gas gauges (4)	5.90	6.75							
Miscellaneous	3.50	3.99							
		115.01							
Wireless	91.90	251.74							
Compass (2)	2.65	6.14							
Air speed line	4.15	11.32							
Inclinometer	0.48	1.32							
Clock	0.48	1.32							
Altimeter	0.34	0.93							
		272.77							
Communicating set and battery	5.47	10.00							
Pyrene ext. and brackets (7)	25.16	46.27							
Hand bilge pump, complete	8.21	14.97							
Liberty tool kit	16.96	31.00							
Life preservers (5)	5.47	10.00							
Goggles	0.82	1.50							
Windshield	2.02	3.70							
Safety belt-gunner	1.92	3.50							
Medical outfit food and water	27.40	50.00							
Binoculars	1.10	2.00							
Chartboard and pigeon outfit	5.47	10.00							
		182.94							
Propeller covers	53.90	7.00							
Gun cockpit cover F.W.D. / Gun cockpit cover, main / F.W.D. cockpit cover	46.10	6.00							
		13.00							

Recent experiments conducted under the direction of the Forest Products Laboratory have shown that judicious steaming of heavy bent vehicle stock results in a considerably improved product, and that the operation can be accomplished without serious effect upon the curvature. Careful judgment is necessary, however, as it is a very easy matter to ruin the entire charge by too severe treatment. Contrary to the common impression, this steaming has been done at high temperatures (150 to 180 deg. Fahr.) and for short periods (½ to 3 hours), the temperature and time varying according to the requirements

Copper Alloys

A PAPER on the above subject by Dr. W. Rosenhain was read at the annual general meeting of the Institute of Metals in London on March 25. It describes the method of preparation of a number of copper alloys and gives the results of tensile and hardness tests carried out on them. The alloys were intended to meet very stringent requirements involving extensive cold-working, so that high tensile strength with great ductility was aimed at.

The alloys dealt with fall into two main classes. The first class consists of alloys of copper with aluminum, with manganese, and with both aluminum and manganese. Difficulties were experienced in casting these alloys into slabs, and special methods of casting were adopted. A process sometimes known as "pressure casting," which has been developed and patented by F. Tomlinson, was eventually adapted for use with these alloys and proved very successful. In this method the liquid metal is forced, by means of externally applied air pressure, through a feeder tube dipping into the molten metal nearly to the bottom of the crucible and communicating with the bottom of the mold. Alloys cast by this method were subsequently rolled into strips. The results of tensile tests show that a very high degree of ductility can be obtained, together with considerable tensile strength, by the use of aluminum, or aluminum plus manganese. For example, the alloy containing 7 per cent aluminum without manganese has a tensile strength of just under 80,000 lb. per sq. in., with an elongation of 17.5 per cent in the "as rolled" condition, while after annealing it still has a tensile strength of 55,000 lb. per sq. in. and the remarkable elongation of 71 per cent.

The second class consists of alloys containing no aluminum: these are mainly combinations of manganese and zinc, or nickel and zinc, with copper. They were cast successfully with the aid of borax as a flux and and were subsequently rolled into thin strips of excellent quality. Of this series the strongest alloy is that containing 3 per cent manganese and 10 per cent zinc, which, in the cold rolled condition, has a tensile strength of 94,000 lb. per sq. in., with an elongation of 3 per cent, and in the annealed condition a tensile strength of 46,000 lb. per sq. in., with 35 per cent elongation.

Suggested Touring Sedan

Single or Double Compartment, with Baggage Space and Rear Trunk—Straight-Effect Body Lines

By George J. Mercer

THE inside-drive sedan type is the most popular custom order body, and any builder will confirm the statement that more than half of all the orders for special bodies are of this class of design. For a while the body with the removable pillars, in which the side-window openings are all made into one, had a large following, but that has lessened each year for two seasons, and to-day the orders for this design are negligible.

Close-coupled, compact bodies are the rule now. The car owner is buying for himself rather than for his friends' convenience, and the snug, sensibly proportioned body does have a degree of style and smartness to it that the large buslike looking bodies never can have.

The design illustrated is for four passengers, including the driver, and has a division with a large glass that drops entirely down, so that it can be either a two or a one-compartment interior. For an emergency, an extra seat, close to the partition, and so that the one extra passenger can sit across the car, is quite within reason, as the proportions will permit of this.

This design is specially suitable for touring and vacation trips, as provision is made to carry luggage and wraps. The rail on the roof is only one bar high. It is intended to be used for carrying spare wraps, coats, robes, etc., inclosed in a rubber or tarpaulin bag, and is never intended that anything other than such articles should be put on top. There is room inside the body, forward of the feet, for such satchels and bags as will be needed, in addition to the trunk at the rear, which trunk is back of the tire, and in a measure is inaccessible; but it is the best place for it. As it will not be needed except when long stops are made, it can be lifted off and taken to the room of the hotel. Used in this way, it will have a real value, and will hold those additional necessities needed en route.

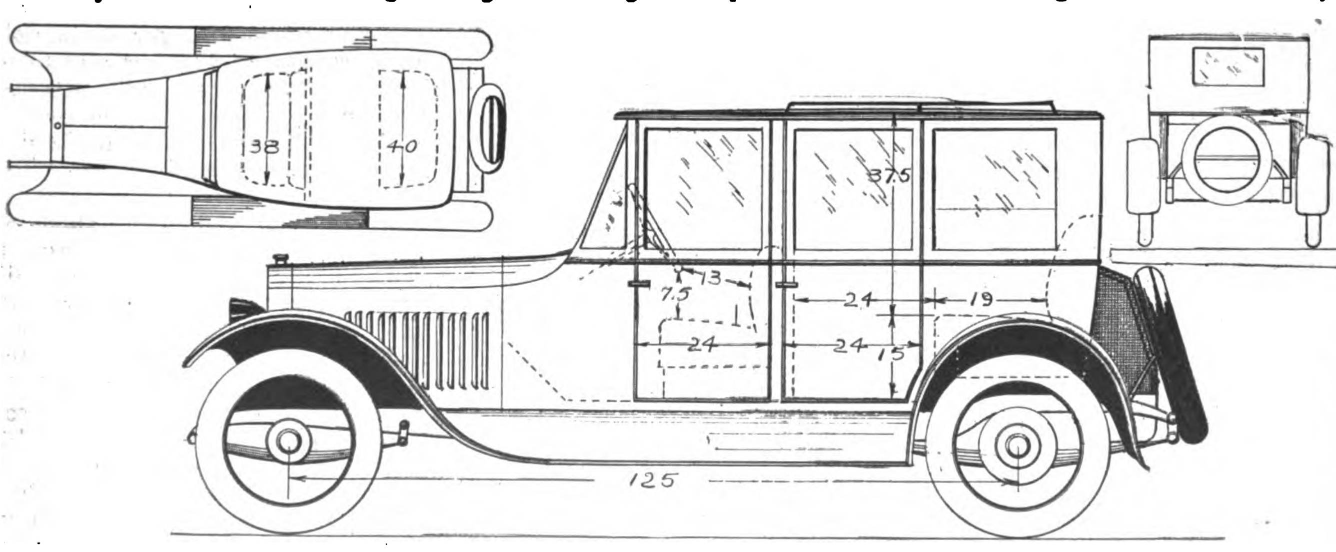
The object aimed at in this design is to get the straight effect throughout, and not only the horizontal but the perpendicular lines of the sides and back. These upright lines can never be actually straight. If so, the body would look too much like a box if there were not some curve or turnunder to relieve the flat look. The body must be narrower at the bottom than at the top to reduce weight and conform to the chassis width.

Another fact not so generally known, except to the trade, is that the surface of a body, when painted and varnished, always looks a trifle flatter than it actually is, and the varnished surface looks better when convex than when flat; hence the flat-sided and flat-backed body really has more turnunder sweep than is supposed.

The intention of the designer is to have the body straight, yet flat-looking, and that is one of the reasons that has helped to bring in the small bodies. A close-coupled narrow body can incorporate the requisite appearance qualities because of its size.

The design illustrated by side, back and top views is intended for a chassis of 125 in. wheel base, with 32 by 4½ tires. The angle of the front windshield post is 22 deg. from perpendicular, and this is made to blend well with the line of the engine hood, both on the top and at the line of the post.

The construction of this body is plain, the only moldings being around the doors, the middle horizontal, and the drip at the top. Both the horizontal moldings extend entirely around the back, thus permitting the joining of the upper and lower panels without welding. The roof is of laminated wood, and covered with cloth in the customary coachmaker's method. Metal roofs are being used quite extensively, but to use metal the roof should be more convex than this design, the reason being that metal requires to be strained in order to lay tight. When flat it will whip, although on this body the slats to protect the roof from damage where used as carrying



Touring Sedan body with four doors. Front windows operated by regulators. Rear side quarters have concealed lift straps

space would be a sufficient binder to keep any metal from giving trouble through moving. These slats are wood, put on with screws after the top surface has been well protected with paint. They simply keep the articles that may be carried on the top from defacing the protecting paint. The rail, three-eighths round, and supported by standards at the corners and in the middle of each space, is only high enough to secure the straps holding the baggage.

The trunk on the rear is of the customary design, but must be made to fit the job, and is intended to be lifted off when taking articles from it. The extra tire is released from its holder when the trunk is removed.

The outside line of the body is illustrated to good effect on the plan view. This effect is pleasing, and the aim is accomplished in having a smooth extended line from the radiator to the end of the body. The radius of the rear corner is less than usual. It is a tendency to have the rear corner of shorter radius than formerly; in fact, there are more square-cornered rears than since the early days of the automobile. Personally, I think that a square rear corner is not suitable for a body as large as this design. The radius may be only 1 in., and it will look well, but a square corner is suitable only for a small two-passenger job. It has a balance on a small body that is not needed on a larger body.

The illustration shows four doors, with windows operated by regulators, except the rear side quarters, which have concealed lift straps and the glass drops to the line indicated. The other windows all drop flush. The triangular one at the front and the back window are stationary.

The front windshield is two-piece, the upper one swinging outward and the lower part being stationary. There is a tendency at present to have the lower part of the glass swing inward to serve as a ventilator, but it stands to reason that this will surely let in the rain, and it can be arranged by having a ventilator on top of the cowl, which can be made watertight. The ventilator on the side of the cowl has been discontinued on account of the hot gases from the engine-hood louvres coming in.

The metal used on this body must be aluminum sheet for custom work, and the entire surface is so covered except the roof.

The essential dimensions for comparative tests with another body already built, to see if they are right for the person interested, are given on the several views. These dimensions are for the average person, and are intended for comfort and luxurious thick trimmings.

A sport type would be 2 or more inches lower, as the fancy of the owner dictated, and could be 2 in. narrower for the same class of customer. Sensible proportions, however, are best adapted to bring out harmonious lines, as this design illustrates.

The doors are hinged to open forward, and exposed coach hinges are used to save thickness in the pillars. Bar handles and locks on each right-side door should be specified. The windows are proof against opening from the outside, where regulators are used. The quarter windows must have a fastener to prevent opening from the outside.

The most popular color scheme has been Rolls-Royce blue and hair-line yellow striping, with silver-finish door handles and lamps. A radiator of silver finish would add beauty and harmony to the car.

Interior trimmings have been quite modest in design and color, and a gray with small black markings will go well with this color scheme.

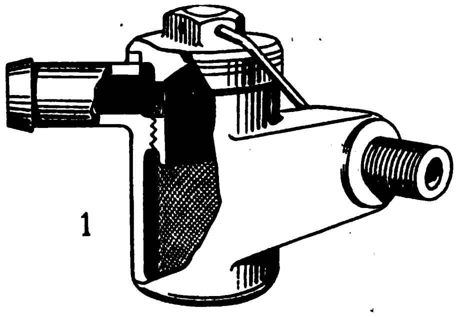
Liberty Carbureter Gasoline Strainer

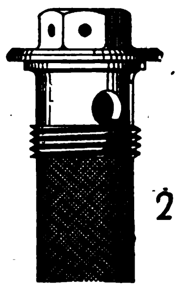
ON all the Liberty engines shipped after Nov. 10, 1918, a new form of carbureter gasoline strainer was used. There had been some difficulty experienced through dirt working into the carbureter jets, and disturbing the measured flow necessary for the best results. This occurred because there was no strainer in the gasoline system between the tank and the carbureter, and the gasoline being in contact with the rubber hose, rotted this after a time, causing particles of rubber to be carried along into the carbureter.

To avoid this difficulty a gasoline strainer was designed to filter the gasoline entering the float chamber and to make an easy mechanical break-down for removing the carbureter. This strainer incorporates a bucket screen. The gasoline entering from the top, filters through the screen, while the dirt is caught in the bottom of the bucket, which can easily be removed and emptied at intervals.

As a further protection against rubber particles, a brass hose liner or "olive" was inserted in the rubber hose. This strengthens the hose and acts as a spacer between the supply pipe and the strainer intake. The tapered ends of the olive fit into the beveled ends of the pipe and strainer, preventing the gasoline coming into direct contact with the rubber. The entire layout and method of assembly is shown in the sketch herewith.

To install the strainer assembly, it is only necessary to remove the gasoline connection from the carbureter bowl and screw the strainer in its place. The gas line attaches to the gasoline connection at the top of the strainer by means of the rubber hose containing the brass hose liner. Suitable clamps are supplied with the service set.


1


2


3

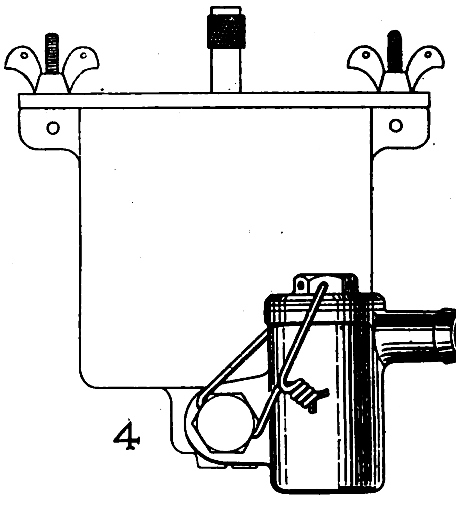

4

Fig. 1—Section through strainer. Fig. 2—Bucket screen. Fig. 3—Olive rubber hose liner. Fig. 4—Strainer in position on float bowl of Zenith carbureter

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, April 10, 1919 No. 15

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address — Autoland, New York
Long Distance Telephone — 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico — One Year, $3.00
Canada — One Year, 5.00
Foreign Countries — One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

High Duty to Bar American Automobiles

DURING the past two years we have heard a great deal about the war after the war, which phrase was generally used to convey the meaning that after the cessation of military operations hostilities would be continued by means of trade boycotts, discriminatory tariffs and other suitable means, the inference being that the line-up of Powers would be the same as in the military struggle. But recent news reports from Paris suggest that in the automobile field at least the phrase may soon come to have an entirely different significance.

As duly recorded in last week's issue of AUTOMOTIVE INDUSTRIES, representatives of the automobile manufacturing industries of all the Allied countries held a convention in Paris recently at which post-war policies were discussed. Following the practice of another famous convention now sitting in Paris, the sessions were held in star chamber, and a properly expurgated official report was issued. It has leaked out, however, that the convention decided on a tariff duty on automobiles of 10 per cent between the different European countries and a duty of 45 per cent in Europe against American automobiles.

At first sight this appears alarming. Fortunately it is not the automobile industries of European countries which make the tariff laws of those countries. The only thing the Paris congress can do is to urge upon its members to recommend to their respective governments that certain steps be taken with respect to the taxation of automobile imports. Inasmuch as the automobile manufacturers are not disinterested and unbiased persons it is rather doubtful whether much heed will be paid to this advice by the legislatures.

It may be that the idea in holding the convention at Paris at this time was to exert some influence on the Peace Congress, as the latter is to consider post-war economic questions among others, but it is greatly to be doubted whether the Peace Congress will stop to consider such detail matters as automobile duties. If it deals with the subject of duties at all it will probably formulate some general rules which are applicable to all lines of merchandise alike.

It appears that the Paris Congress of Automobile Manufacturers is to continue the work of the former Association Internationale des Chambres Syndicales d'Automobile Reconnues. This was a rather loose organization with headquarters in Paris, the secretaryship being identical with that of the French Automobile Manufacturers' Association. The chief function of the association in the past was to assist in the dating of automobile shows so as to obviate interferences. At one time also a decision against participation in races was made. No really active organization ever existed, but on a few occasions representatives of the foreign automobile industries were called to Paris to discuss certain topics of mutual interest. As American manufacturers previous to the war rarely exhibited at European shows and took no part in European automobile races our N. A. C. C. nor its predecessor was ever a member of the International Association.

The action taken by the Paris congress reflects the fear of American competition. At the present time automobile imports are totally prohibited in both England and France, but it is realized that these prohibitions were war measures, and that although they are continued in force pending the reconversion of the home industries from a war to a peace basis they cannot be continued indefinitely. The doors must be opened again before long and the terms of admission to be offered to American machines is a point of great importance. Whatever the effect of the resolution may be on future tariff legislation, it should not be lost upon the great importing markets of South America, Africa and Australia. Manufacturers of the different Allied nations have practically gone on record that they consider themselves to be on a sufficiently even footing to enable all of them to agree to a reciprocity measure, but that the United States must not be admitted to the pact.

Quality in Inclosed Cars

SOME years ago closed bodies were fitted only to high-grade chassis, and the possession of a closed car was regarded as a sign of affluence. More recently, however, the manufacturers of low-priced cars have responded to the demand for closed vehicles suitable for all-year use and have brought out designs which are very attractive in appearance. There is considerable demand for these vehicles, which commend themselves especially to elderly people and to families in which there are persons not in the best of health. That these vehicles make a strong appeal was noticeable at last winter's show, where they were usually surrounded by interested visitors.

Unfortunately, the interior finish and fittings of the coupés and sedans offered are not always what might be anticipated from the attractive lines and the rather high price. These are defects which should be promptly remedied, if it is desired to build up a permanent trade in these models. It should be remembered that the owners of closed cars see much more of the interior than of the exterior of their vehicles, and any unsightliness or cheapness in the interior finish will soon offend them and cause them to become dissatisfied. Take, for instance, the matter of floor mats. These often have a cheap appearance when new and soon wear threadbare. Metalwork sometimes shows rough corners and badly finished surfaces, and the interior paint work is of a character that would not pass inspection in a first-class shop. It may well be that a purchaser who has been captivated by the attractive lines of the vehicle soon becomes disgusted with the shabby interior and develops a grudge against the manufacturer.

During the war many things were excusable, as most of the best mechanics were on Government work and good materials were hard to get, but now that the war is over and the restrictions are removed there should be a general improvement in the quality of construction, and especially in the interior finish and fittings of moderate-priced inclosed cars.

The Cyclonette

A FORM of light motor vehicle that has met with considerable success in Continental Europe but has never been introduced here is the cyclonette, which is in a way a cross between a motorcycle and a light car. It differs from a motorcycle in that one does not ride astride it, but it resembles a motorcycle in having a tubular frame, a light air-cooled engine, suspension wire wheels, etc. The machine would seem to fill a demand similar to our motorcycle with side car, over which it would appear to have certain advantages.

In the cyclonette the engine is mounted on the front fork, with which it turns in steering, and it drives directly to the single front wheel. Evidently the conditions are unusually favorable to effective air cooling. There are seats for two between the two rear wheels, which are located rather low, giving the vehicle a high degree of stability. There is no side draft as in a side car, and the driver is certainly seated more comfortably.

The weak point of the cyclonette appears to be that the proportion of the total weight that is supported by the driving wheel is rather small especially in climbing steep grades, so that it might be difficult to get traction if the road surface was at all slippery. For use in fairly level districts and possibly for taxicab service in cities a vehicle of the cyclonette type may have a future.

Air Code Should Be Criticised

THE formulation of a preliminary international air code at Paris should be given the attention of all who are interested in the future of aviation. The primary code is purposely intended for criticism and revision. It is given to the world so that it can be carefully considered and constructively criticised in order that an intelligent, comprehensive and complete international code can be finally arranged.

Consequently, it is to the professional pilot, individual airplane owner, aeronautical engineer, airplane engine builder, plane maker, manufacturer of dirigibles and producer of balloons that the interministerial commission addresses itself. And it is to the interest of each of these to examine the report carefully and offer suggestions. There is no question but what the experience of operators and engineers can be used to revise these rules advantageously.

There are, without doubt, errors in the preliminary draft. For example, there is the authority granted by the present code to aeronautic associations to examine pilots and issue licenses which can very easily lead to a monopoly and complete control of aviation in any country in which such associations exist.

AUTOMOTIVE INDUSTRIES will be pleased to receive any suggestions for the revision of the new regulations as published in this week's issue, and will forward them to the Inter-Ministerial Commission of Civil Aeronautics.

¤ Latest News of the

Government Insisting on Quick Settlement

Contractor Must File Claims by June 30 or Submit Them to Slow Court of Claims

DETROIT, April 8—Manufacturers must present their war claims before June 30. Settlement of the $1,500,000,000 war claims in the Detroit district continues to progress slowly, so slowly in fact that the local claim adjustment boards have issued a warning designed to stir manufacturers tardy in filing their claims into renewed activity.

On and after June 30 local boards will receive no more claims. Contractors with informal contracts must file before that date or their claims automatically became invalid. Contractors with formal claims will be denied the assistance of the claims board after that date and must seek redress in the Court of Claims at Washington.

Inasmuch as the Court of Claims is a slow-working organization, only last week approving a claim for $1,800 filed in 1876, and still having many civil war claims pending, the disadvantage of being obliged to go before this court for settlement is too plainly apparent for the tardy contractor to fail to perceive and the government claim officials here hope the warning will cause him to double his accounting force if necessary to get his documents ready for immediate filing with the respective boards.

Ordnance and quartermaster claim boards thought the bulk of their adjustment work would be settled by April 1. April 1 is here and passed, however, and figures at ordnance headquarters show that on April 1 only 13 per cent of the total 270 claims have been passed and approved by Washington. Approximately 25 per cent have been passed by the local board from 58 per cent of the total which have been filed.

Although the ordnance, quartermaster and aircraft claims boards have several hundred experts at work aiding the manufacturers in preparing reports, inventories and other data required by the government before settlement is made, the work continues to be slow, owing to inability of the contractors themselves to produce the necessary information. Poor accounting and cost system work in the plants is the cause, and in numerous instances the government experts have been obliged to take the books of firms and audit them completely from the day the first purchase was made for contract work until the last job was completed.

The Aircraft Claims Board is making better progress than either the quartermaster or ordnance divisions. This is due to less rigid requirements and the fact that the companies with which this department is dealing are larger and better organized than the others. This board has passed and received settlement on approximately 55 per cent of its total claims, to date having paid out in the neighborhood of $90,000,000. Seven hundred claims remain to be filed and passed upon, however, among them being those of the Packard, Lincoln, Ford, Fisher Body, Cadillac, Buick, Willys-Overland and C. R. Wilson Body Co.

The majority of the sub-contractors' claims have been adjusted by this board, and it is now devoting its entire effort in getting the main contracts in line for adjustment.

—

Unsettled Steel Price Halts Buying

Makers Waiting for Agreement Between Railroads and Steel Committee and Doing Little

DETROIT, April 7—Until the railroad administration and the steel committee agree on the price the railroads must pay for steel, the automotive industry will continue its present hand-to-mouth buying policies. While the recent price decision fixing a minimum steel price caused increased buying activity, the larger automotive plants continue to buy just what steel they need when they need it. But when the railroads, the nation's greatest steel consumers, get into the market, there will be a demand for steel sufficient to force the automobile, truck, tractor and parts makers to purchase in greater quantity.

When steel prices were set three weeks ago, scores of companies placed orders they had been holding back since Dec. 31, assured that the price would probably take a drop when the cost was fixed April 1, and holding that business conditions during the first few months of the year, would be far below normal, owing to cancellation of government contracts and the general reconstruction depression following the termination of the war. The companies arranged their production schedules for the first few months in accordance with this belief but planned for increased production from April on. When the steel price was fixed the companies were obliged to release these orders which they were withholding, and they did this knowing that from a business standpoint it would be impossible to keep them pigeon-holed much longer. The release of these orders stimulated the market to some extent. These releases were bidding fair to create a general buying movement, and this movement was gaining considerable momentum until the railroad administration upset the equilibrium of the market by holding out for a still lower price.

(*Continued on page* 820)

—

Metropolitan Section of S. A. E. Discusses Heavy Oil Engine

NEW YORK, April 10—Heavy oil engines, including both the hot surface and the Diesel type, were the subject of discussion at last night's joint meeting of the New York Branch of the American Body of Mechanical Engineers and the Metropolitan Section of the Society of Automotive Engineers, which was held at the Automobile Club of America. Dr. Chas. E. Lucke of Columbia University presided. Among the papers presented was one by Mr. Dean of the Bureau of Mines on the fuel situation, which handled the subject in a statistical manner, and one by J. H. Hunt of the Dayton Electrical Laboratories Co., dealing with some experiments on fuels carried out by the Delco organization. The other papers related to the hot surface type engine and to the Diesel marine and Diesel stationary engines respectively. Little time was left for discussion.

One point brought out at the meeting was that the more abundant the fuel the more difficult it is to build an engine suitable for burning it. In the paper by Mr. Dean it was pointed out that the constituents of crude petroleum suitable for fuel purposes are separated by distillation into five parts, namely, gasoline, kerosene, gas oil (or fuel oil distillate) and light and heavy residual fuel oils. The production of these various fuels for 1918 had just been determined, although the figures available were only the preliminary ones. These were as follows: Gasoline, 3.6 billion gallons; kerosene, 1.8 billion gallons; fuel oil 7.3 billion gallons. No official figures were yet to hand as to the proportions of the different grades of fuel oil, but it was estimated that the total was made up of 1.5 billion gallons of gas oil; 2.0 billion gallons of light and 3.8 billion gallons of heavy residual oil.

Automotive Industries

Post Office Wants 10 Planes

Asks Bids on Multi-engined Machines of Commercial Type—The Specifications

WASHINGTON, April 8—New specifications for ten multi-engine airplanes of strictly commercial type and particularly adapted for carrying mail were issued to-day by the Post Office Department, which is asking manufacturers for bids. The specifications are general, allowing the manufacturers wide latitude of design and construction, and are the result of many views gathered from pilots, airplane makers, aeronautical engineers and manufacturers. Consideration will be given to planes of two, three or more engines connected on one shaft or set in the wings or central fuselage, or both, and with the minimum capacity of 1500 lb. of mail. Preference, however, will be given to planes capable of carrying 2000 to 3000 lb.

The Post Office is especially desirous of securing a plane with a very low landing speed either with speed structurally inherent in the machine or accomplished mechanically, with a cruising speed of 90 to 100 m.p.h. and a cruising radius of about 6 hr. with normal load. A service ceiling of 15,000 ft. is desired. If the planes are built around Liberty or Hispano-Suiza engines the department will furnish the engines.

It is expected that a plane with a carrying capacity of 1500 lb. of mail and 6-hr. cruising radius will not exceed 100 ft. in the wing span. If placed in the wing, engines must be safely accessible to mechanics for minor repairs in the air, and each engine must be equipped with independent and, as far as possible, dual gas, oil and ignition systems.

Bids will be opened on June 2, and it is expected that planes will be ready for delivery within 6 months after letting the contracts.

Bidders are to agree to furnish the planes in lots of six as often as requested at the price specified originally up to June 30, 1920, and must also submit price lists of spare parts and satisfactory bonds with the bid. The time of delivery will count as an important factor in making the contract awards. Following are the general requirements and complete specifications as provided by the Post Office Department:

GENERAL REQUIREMENTS

1. *Fundamental Requirements.* Should be a radical departure from military designing, making the following qualities of primary importance:
   a. Inherent stability in power and glides.
   b. Machine to be balanced for cruising speed, altitude 6000 ft.
   c. Controllability and wide vision.
2. *Performance* (Normal Load).
   a. Efficient cruising speed of 90-100 m.p.h. at 6000 ft.
   b. Cruising radius of 5 to 6 hours.
   c. Buoyancy speed of 50 m.p.h. *or less.*
   d. Low landing speed either inherent or mechanical.
   e. Ceiling of about 15,000 ft.
   f. Capable of horizontal flight or climb on one-half normal maximum power.
3. *General Requirements.*
   a. Two or more motors.
   b. Mail load of 1500-3000 lb. at 17½ lb. per cu. ft.
   c. Crew of one pilot and one mechanic on two-motored planes, and two pilots and one mechanic on three-motored planes.
   d. A method of retracting or hinging wings for storage with wing spans over 80 ft. Optional.
   e. Overall height of 18 ft.
   f. To be capable of easy assembly and disassembly.

DETAILED CONSTRUCTION

1. *Power Plants.*
   a. To be independent power plants.
   b. Accessible for major repairs or removal.
   c. Accessibility for minor repairs during flight.
   d. An approved motor starter system.
   e. Complete radiator shutters adjustable from pilot's seat.
   f. A compression release to be provided for each motor.
2. *Fuselage.*
   a. Preferably a removable mail cage which may be drawn up into fuselage recess.
   b. Steerable tail skid to be optional with builder.
   c. Two tail skids to be provided in tandem; that is, one behind the other, with universal joints, if practicable.
   d. In flight, fuselage to withstand a loading of 30 lb. per sq. ft. on horizontal tail surfaces and 20 lb. per sq. ft. on vertical tail surfaces.
   e. Fuselage to have landing factor of safety of 12-15.
   f. Accessibility of all tanks, leads, controls, etc., during flight.
   g. Variable loads at center of gravity.
3. *Wings.*
   a. Approved construction.
   b. Factor of safety of 6.
   c. Extra strength wing skids hinged with shock absorber of rubber.
4. *Landing Gear.*
   a. To have a factor of safety of 15 in all members.
   b. Center of gravity to be as far back of landing gear as possible.
   c. Elimination of any tendency to nose over.
   d. Landing gear to give adequate support to motors.
5. *Controls and Control Surfaces.*
   a. "Dep."
   b. All controls to be readily accessible for maintenance and repair.
   c. All control surfaces to be balanced where necessary for easy handling.
   d. Emergency control to be provided with removable stick.
   e. Variable horizontal stabilizer to be provided and balanced at neutral point with standard load.
   f. Internal controls designed to be free from danger of ice.
6. *Gas and Oil.*
   a. An independent gas and oil supply for each motor, with intercommunication leads.
   b. An absolutely reliable gas feed system such as provided by mechanical vane pumps and central hand pump as auxiliary.
   c. Accessibility to all valves and leads, both oil and gas, for repairs while in flight.
   d. Strongly anchored tanks.
   e. All leads to be protected against vibration.
7. *Safety and Comfort of Crew.*
   a. Pilot and pilot mechanic to be placed behind main loads, or preferably to

(*Continued on page* 820)

Protest Prohibition of Imports

Importers of American Cars in France Want Bars Let Down—Would Reduce Tariff

NEW YORK, April 9—French importers of American cars have lodged a complaint with the American Peace Commission regarding the present prohibition of importation into France, and have outlined their position in a letter addressed to C. C. Hanch, who is at present in Europe as the representative of the N. A. C. C.

The complaint comes from the *Groupement des Importateurs d'Automobiles Americaines*, and urges the speedy abandonment of the prohibition law on the plea that competition is needed by those who sell French cars, those who make them and those who buy them. The letter suggests a reduction in customs duties, but would have a comparatively high duty for a time to protect French industry, with a reduction as the industry builds itself up. The letter follows:

In the interest of the importers into France of American automobiles, we desire to bring to your notice the situation which is brought about by the embargo existing in France at the present time, and to expose to you our ideas as to the means of alleviating this situation in the interest of:
1. The American automobile manufacturers.
2. Importers of American cars and their French dealers, and
3. The French public in general.

Before the war the customs duty on American automobiles was frs. 750 per 100 kgs. Now, on June 24, 1916, the tariff was increased to 70 per cent *ad valorem* on the value of the goods, augmented by all charges for the transportation, war and maritime insurance; this in order to protect French industry, as all the factories were occupied on war work. At this rate a car costing, say, frs. 8500 in America would pay about frs. 10,000 duty. On April 1, 1917, the French government passed a law prohibiting, purely and simply, all importations of cars of foreign manufacture.

As long as hostilities continued we submitted to this state of affairs, considering them inevitable and necessary to the successful prosecution of the war. Our most ardent desire was the final triumph of the Allied cause.

During this period we and our numerous agents scattered over the whole of France were obliged to live and to keep our business open in spite of the absolute impossibility of trade. We waited patiently and did our best to induce the manufacturers to do the same, thinking that when once the war was successfully terminated we should be allowed to immediately recommence business and develop the sale of American cars in France.

Now the Minister of Industrial Reconstruction in France declares, in his discourse of Feb. 14, 1919, that everything must be done in order to protect the French automobile industry and to stop the inundation of the markets with American automobiles before the French manufacturers are ready to deliver.

The fallacy of this is evident and made manifest by the fact that the French manufacturers are already advertising that their new models are ready for sale to the public.

The reason for the prohibition can therefore not be attributed to the cause mentioned above, but rather to the fact that

(*Continued on page* 820)

War Contracts Settlement Plan Outlined by War Department

Claims Board Offices All Over Country for Speedy Adjustment—Provision for Raw Material, Work in Process, Interest and Profit

WASHINGTON, April 7—In order to further explain the War Department's method for adjusting and paying contracts, Benedict Crowell, Assistant Secretary of War, has again outlined the system adopted by the War Department. His explanation was made in response to a request by the Treasury Department.

The War Department is ready to terminate any claim if the contractor has agreed to terminate production to the extent requested by the War Department, and will waive all claims to prospective profits on uncompleted portions of the contract. Raw materials, component parts and work in process will be considered in adjustments to an amount not exceeding the uncompleted portion of the contract. Interest will be allowed at 6 per cent on borrowed money, and profit will be allowed up to 10 per cent on work in process. Cost of terminating unperformed sub-contracts will be allowed. The contractors are requested to present statements of claims promptly to their proper claim boards. Following is the complete statement:

ADJUSTMENT AND PAYMENT OF WAR DEPARTMENT CONTRACTS

The following questions have been asked by the Treasury Department:

First: What compensation may contractors safely expect to receive on the termination of war contracts, and

Second: How may that compensation be secured?

Shortly after the signing of the armistice thousands of contractors were asked to reduce or suspend production under war contracts and to negotiate the terms of their final settlement.

Many of these contracts were formal written agreements, but others had not been drawn or signed in the exact manner prescribed by law. While payments were made for finished articles or supplies delivered under both formal and informal agreements, it was impossible, in the absence of remedial legislation, to recognize any obligation to contractors on account of anything done in connection with any part of an informal agreement which had not been fully performed. The remedial legislation was introduced in Congress on Dec. 7, 1918, and became a law on March 2, 1919.

As a result of this legislation, the War Department is now able to adjust and settle all of its war obligations, both formal and informal, and is prepared to do so with the greatest possible speed. The Department desires to make these settlements by voluntary agreement wherever possible, and to avoid litigation.

The Department is ready to adjust every agreement on the basis set out in paragraph 7 hereof. If the contractor agrees to that basis he can secure payments with little or no delay because the Department is prepared to make partial payments in the manner set out in paragraphs 8 and 9 hereof, in those cases where a final adjustment of every item would involve considerable delay.

The Department is prepared to carry on negotiations with great speed, and has stationed in the leading cities of the United States, negotiating officers, agencies or boards, so that each contractor can adjust his own contract near his own place of business. A list of these boards is attached hereto. No final adjustment of War Department obligations can be secured, however, unless the contractors will co-operate with the Department.

The process and basis of effecting a settlement is as follows:

1. Every contractor should present a statement or claim which should set out the amount of his expenditures and obligations, the amount and character of materials, supplies and property which he has, the amount which he believes the United States should pay if it takes title to all this material and property in its present condition, and the amount which the contractor believes the United States should pay if the contractor retains this material and property.

2. If any sub-contracts or other items or elements are involved with reference to which the contractor cannot, at the present time, state any final and definite figure, he should at least give such information in connection therewith as is presently available.

3. Where the original contract is a formal one, executed in the manner prescribed by law, this statement or claim should be presented in such place and form as the Supply Bureau which made the contract shall designate. Information as to form and place of filing can be secured from any contracting officer, board or agency within that Bureau.

4. If the original agreement is an informal one and an adjustment thereof is to be made under the Act of Congress of March 2, 1919, the contractor should file with the Claims Board of the Bureau with which the agreement was made, a formal claim, setting out the nature, terms and conditions of the agreement and the amount of money claimed. Proper addresses of these Claims Boards are as follows:

Ordnance Claims Board, War Department, Washington.

Claims Board, Air Service, War Department, Washington.

Claims Board, Chemical Warfare Service, War Department, Washington.

Claims Board, Construction Division, War Department, Washington.

Claims Board, Director of Purchase, War Department, Washington.

Claims Board, Signal Corps, War Department, Washington.

Claims Board, Office Chief of Engineers, War Department, Washington.

(Claims based on agreements with the Quartermaster Corps should be addressed to the Claims Board, Director of Purchase, as above.)

5. Forms for stating claims on informal agreements can be secured from any contracting officer, supply officer, Claims Board or negotiating body of any Bureau at any part of the United States, and these officers, Boards or bodies will give the contractors information and instruction concerning the manner of filling out these claims.

6. After the contractor's claim is presented, the facts therein stated are investigated and verified and negotiations are carried on to fix the terms of final settlement. When these negotiations are completed, the final settlement is made by a supplemental agreement based upon the original contract, if that contract is a formal one executed in the manner prescribed by law, or by an award under the Act of Congress of March 2, 1919, if the original agreement is within the terms of that Act.

In case any contractor is in doubt as to whether or not his agreement does or does not come under the terms of the Act, he can get immediate information by inquiring from the appropriate Procurement Bureau in Washington, or from any of its agencies throughout the United States.

7. If the contractor has agreed to terminate production to the extent requested by the War Department, and will waive all claims to prospective profits which he might have made had the uncompleted portion of his contract been performed, he will be paid:

(a) For raw materials, component parts and work in process on hand in an amount not to exceed the requirements of the uncompleted portion of the contract, the cost thereof plus inward handling charges, plus overhead directly applicable. If this full payment is made, title and possession of the materials, parts and work in process shall be transferred to the United States. If by agreement the contractor retains title to any of this material, parts or work in process, the agreed value thereof shall be deducted from the amount otherwise payable.

(b) A remuneration or reward ordinarily fixed at

(1) Interest at the rate of 6 per cent per annum on money invested in raw materials and component parts, or if the money was borrowed, then interest actually paid, and

(2) 10 per cent profit on work in process.

(c) An amount equal to all money which the contractor is compelled to expend to terminate and discharge unperformed sub-contracts or commitments properly made for the purpose of performing the uncompleted portion of the contract.

(d) Such amounts as are necessarily spent in connection with the care and custody of property involved from the date that the contractor has suspended production down to the time of settlement.

(e) On account of facilities, machinery and equipment acquired for the purpose of performing the contract, and the cost of which would have been recouped had the contract been performed,—an amount which shall be computed as follows: From the cost deduct the present value, and of the balance take the same proportion that the uncompleted part of the contract bears to the whole.

(f) Any other special item of expenditure which, in the opinion of the Secretary of War or any duly authorized officer, is proper.

For the purpose of determining the exact amount payable under paragraphs (a) and (b) above, raw materials and component parts have been defined, for the purpose of contract termination, as follows:

"All of those materials, parts, articles and supplies, direct and indirect, which are in substantially the same condition, nature or state of fabrication that they were in when they were acquired by the contractor, and in the production, fabrication or assembling of which the contractor has neither employed nor performed labor other than labor connected with custody and handling."

(8) It frequently happens that the determination of all of the amounts which may be payable in accordance with the terms of the foregoing paragraphs, and the determination of the most economic disposition which can be made of all property involved in final settlement, requires a considerable time, but that there are many items with respect to which a final adjustment can readily be made. It further happens that it is often of economic value to make an immediate adjustment and payment of some of the items involved without waiting for an adjustment and payment of all. Under such circumstances, if the contract is a formal one, a supplemental agreement will be entered into which will fix the basis of final adjustment as outlined in paragraph 7, and will provide for the payment of each item involved just as rapidly as the amount payable is determined. In this way, various raw materials, supplies and work in process can be put to an immediate use, and the contractor's plant kept in production, and labor retained in employment and the contractor's obligations on different sub-contracts and commitments finally disposed of just as rapidly as tentative agreements are reached with the sub-contractors and commitment men.

9. When the agreement is an informal one and is paid by award under the Act of Congress of March 2, 1919, if it is found that a situation exists similar to that described in paragraph 8, partial awards are made, and items are adjusted and discharged just as rapidly as the amounts to be paid are determined.

10. The attention of all contractors should be directed to the fact that where their agreements are informal, their claims must be filed prior to June 30, 1919; otherwise they are, by the Act of Congress of March 2, 1919, forever barred from any relief.

11. There is no occasion for any contractor to have any doubt about his ability to secure an adjustment on the basis above outlined. Although several months have passed since the contractors were requested temporarily to suspend production, there are thousands of contractors who have as yet presented no statement or claim showing what they want. If there are any reasons why any contractor cannot state his full claim and the disposition which he desires to have made with reference to every item thereof, there is no reason why he should not present as much of his claim as possible in order that the necessary investigations and negotiations can be proceeding. The organization which is handling this matter is essentially civilian in character, and composed of men who have come into the Department merely for the purposes of the war and who remain in this work only at a very great personal sacrifice and at the urgent request of the department. Contractors who desire to avail themselves of the existing organization in the department for the settlement of their claims must present them prior to May 15, 1919, as after that date the method of handling these claims will necessarily be changed through the impossibility of continuing the present personnel.

12. For the purpose of supervising and securing uniformity in regard to settlement of formal contracts, and for the purpose of making awards under the Act of Congress of March 2, 1919, the War Department Claims Board has been created, and this board, or its

members, are in constant duty in Washington. From time to time this board issues detailed instructions and directions governing the methods of making settlements. These are available to any contractor at any time. Actual negotiations under these instructions and rules are, however, carried on with the contractor by the various agencies scattered throughout the country.

BENEDICT CROWELL.
The Assistant Secretary of War, Director of Munitions.

LIST OF BOARDS SUPERVISING AND PASSING UPON THE ADJUSTMENT OF CONTRACTS IN THE WAR DEPARTMENT.

War Department Claims Board, Washington. Munitions Building.

Board of Contract Adjustment, Munitions Building, Washington.

Ordnance Claims Board, War Department, Washington.

Claims Board, Air Service, War Department, Washington.

Claims Board, Chemical Warfare Service, War Department, Washington.

Claims Board, Construction Division. War Department, Washington.

Claims Board, Signal Corps, War Department, Washington.

Claims Board, Office Chief of Engineers, War Department, Washington.

Claims Board, Director of Purchase, War Department, Washington.

Board of Review for Medical & Hospital Supplies Division, War Department, Washington.

Board of Review for Machinery & Engineering Materials Division, War Department, Washington.

Board of Review for Motors & Vehicles Division, War Department, Washington.

DISTRICT AND ZONE BOARDS

Ordnance District Claims Boards

Baltimore; Bridgeport, 945 Main Street; Boston, 19 Portland Street; Chicago, 155 E. Superior Street; Cincinnati, 229 E. Sixth Street; Cleveland, Plymouth Bldg., Cleveland; Detroit, 35 Washington Blvd., Detroit; New York, 1107 Broadway; Philadelphia, 1710 Market Street; Pittsburgh, Chamber of Commerce Bldg., Pittsburgh; Rochester, 82 St. Paul Street; St. Louis, Equitable Bldg.

Chemical Warfare Service

Board of Review, Gas Defense, New York City.

Board of Review, Gas Defense, Edgewood Arsenal.

Board of Review, Gas Development, Cleveland.

Zone Boards of Contract Review. Office of the Director of Purchase and Storage

Zone No. 1, Boston, 108 Massachusetts Avenue.

Zone No. 2, New York City, 461 Eighth Avenue.

Zone No. 3, Philadelphia, Twenty-first and Oregon Avenue.

Zone No. 4, Baltimore, Coca-Cola Building.

Zone No. 5, Atlanta, Transportation Building.

Zone No. 6, Jeffersonville, Ind., Meigs Avenue.

Zone No. 7, Chicago, 1819 W. 39th Street.

Zone No. 8, St. Louis, Mo., Second and Arsenal streets.

Zone No. 9, New Orleans, Audubon building.

Zone No. 10, San Antonio, General Supply Depot.

Zone No. 11, Omaha, Army Building.

Zone No. 12, El Paso.

Zone No. 13, San Francisco, Fort Mason.

Zone No. 14, Washington, 17th and F streets, N. W.

The District Offices of Air Service Finance

Lt. L. S. Landers, Dist. Finance Manager, Boston, Little building, Boylston and Tremont streets.

Capt. A. B. Berger, Dist. Finance Manager, New York, 360 Madison avenue, Abercrombie & Fitch building, ninth floor.

J. E. Cole, Dist. Finance Manager, Buffalo, P. O. Box 56.

Capt. Fred White, Dist. Finance Manager, Detroit, 1550 Woodward avenue.

C. S. Hamilton, Dist. Finance Manager, Chicago, Room 1216 Consumers building.

Lt. N. L. MacLeod, Dist. Finance Manager, Pittsburgh, Seventh and Liberty avenues, eleventh floor Kennan building.

Capt. D. G. Ong, Dist. Finance Manager, Dayton, 810 Mutual Home building.

C. C. Campbell, Dist. Finance Manager, Portland, Ore., Yeon building.

56,000,000 Acres Added for Tractor Possibilities

WASHINGTON, April 5—The possibilities of a steadily increasing farm tractor business are indicated in the announcement made to-day by the Department of Agriculture that more than 56,000,000 acres have been added to the country's aggregate crop acreage in the last 10 years. The figures given out show that the aggregate last year totaled 367,738,000 acres, or 605,840 square miles. This covers more than one-fifth of the land area of the United States. The number of farms is estimated at 6,717,000.

Texas has the largest aggregate crop acreage, with 25,328,000 acres, or a little more than one-sixth of her total land area. Kansas is second, with 22,588,000 acres, or almost half of her entire land area. Illinois is third, with 21,727,000 acres, or about three-sevenths of her land area. Iowa, in fourth place, is very close to Illinois, with 21,613,000 acres, which is about three-sevenths of her land area.

The aggregate crop acreages, which included those of corn, wheat, barley, oats, rye, buckwheat, potatoes, sweet potatoes, tobacco, flax, rice, hay, cotton, peanuts, kafirs, beans, broom corn, hops and cranberries, and the number of farms by States follow:

56,000,000 FARM ACRES INCREASE

State	1918	Farms
Maine	1,633,000	60,000
New Hampshire	592,000	27,000
Vermont	1,307,000	33,000
Massachusetts	674,000	37,000
Rhode Island	88,000	5,000
Connecticut	601,000	227,000
New York	8,509,000	215,000
New Jersey	1,183 000	33,000
Pennsylvania	8,377,000	218,000
Delaware	526,000	11,000
Maryland	2,254,000	50,000
Virginia	5,577,000	195,000
West Virginia	2,351,000	100,000
North Carolina	7,232 000	275,000
South Carolina	6,992,000	190,000
Georgia	12,624,000	330,000
Florida	1,563,000	56,000
Ohio	11,462,000	270,000
Indiana	12,764,000	215,000
Illinois	21 727,000	245,000
Michigan	8,808,000	209,000
Wisconsin	9,326,000	182,000
Minnesota	16,008,000	157,000
Iowa	21,613,000	215,000
Missouri	15,232,000	275,000
North Dakota	18,298 000	95,000
South Dakota	15,845,000	95,000
Nebraska	18,646,000	135,000
Kansas	22,588,000	180,000
Kentucky	6,922,000	270,000
Tennessee	7,252,000	260,000
Alabama	10 569,000	280,000
Mississippi	8,089,000	295,000
Louisiana	4,981,000	123,000
Texas	25,328,000	450,000
Oklahoma	13,744,000	220,000
Arkansas	7,399,000	230,000
Montana	4,845 000	36,000
Wyoming	1,569,000	15,000
Colorado	4,060,000	60,000
New Mexico	1,485,000	45,000
Arizona	477,000	13,000
Utah	1,095,000	24,000
Nevada	448,000	3,000
Idaho	2,136,000	38,000
Washington	3,649,000	70,000
Oregon	2,768,000	52 000
California	5,927,000	98,000
United States	367,738,000	6,717,000

Farm lands in the United States are steadily increasing in value. The Department of Agriculture reports the average grade of plow lands was worth about $74.31 per acre on March 1 this year, compared with $68.38 a year ago, $62.17 two years ago and $58.39 three years ago.

Values show the greatest percentage increase during the last year occurred in the South Atlantic States, in the Carolinas and Georgia, and extended to Alabama, Kentucky and Arkansas. Small or no increases were made in the New England States, the Pacific Coast States and Louisiana, Texas, Kansas and Montana. Material increases were reported from Nebraska and South Dakota.

Iowa's plowing lands stand first in value, her average being $169 per acre, followed by Illinois with $144, California with $121, and Indiana with $100. Alabama reports the lowest average of plow lands at $24 per acre, and Mississippi next at $25.50.

Canada Takes Most American Tractor Engine Exports

WASHINGTON, April 5—Canada was the largest user of American farm tractor engines in the month of January. A total of 2711 engines, valued at $2,799,852, were exported from the United States into Canada. France was the next largest user, taking 584 engines, and Italy was third with 242. Following are the statistics:

Countries	Number	Value
France	584	$826,207
Greece	105	63,700
Italy	242	448,635
Norway	1	2,208
Portugal	22	7,032
England	29	39,408
Canada	2,711	2,799,852
Guatemala	1	1,525
Mexico	27	31,868
Jamaica	1	1,890
Cuba	30	20,393
French West Indies	2	3,750
Argentina	2	3,800
Brazil	2	2,383
Chile	15	24,750
British Guiana	11	12,904
Peru	6	18,138
Venezuela	3	2,400
China	2	2,378
Australia	3	1,861
New Zealand	36	27,126
Philippine Islands	33	45,756
British South Africa	28	22,016
French Africa	1	325
Total	3,897	$4,410 305

Interstate Highways Approve Federal System

KANSAS CITY, April 7—Twenty-eight interstate highway associations have so far qualified for membership in the Associated Highways of America. They represent about 50,000 miles of marked highways, reaching to nearly every part of the United States, to the borders of Canada and Mexico and to the coasts. By the time Congress convenes the organization will be further strengthened, and it will back a bill for a Federal Highway Commission, probably one of the bills already introduced. The Associated Highways of America will present the combined system of marked highways of its membership as the plan for Congress to adopt, for the Federal system to be built and maintained by the Government.

Northern Foundry Doubles Force

MARINETTE, WIS., April 7—The Northern Foundry Co. will double its operating force at once.

Pulcher Heads N. A. C. C. Truck Show Committee

NEW YORK, April 9—Martin L. Pulcher, vice-president of the Federal Motor Truck Co., has been appointed chairman of a motor truck show committee of the National Automobile Chamber of Commerce to arrange for proposed exhibits of trucks in New York and Chicago next winter during the same weeks as the national passenger car shows. Associated with him on the committee are A. J. Wipple, general sales manager of the Diamond-T Motor Car Co., Chicago; David S. Ludlum, president of the Autocar Co., Ardmore. Several additional members of the Motor Truck Committee have been appointed as follows: David C. Fenner, Mack Bros. Motor Car Co., and R. H. Salmons, Selden Motor Vehicle Co. F. W. Fenn, who has handled the Rural Motor Express Department of the N. A. C. C., has been made secretary of the Motor Truck Committee.

D. C. Fenner has been appointed chairman of the committee to co-operate with the S. A. E. in furthering truck standardization work, and associated with him are Francis Davis (Pierce-Arrow), F. A. Whitten (General Motors), E. M. Sternberg (Sterling), F. F. Beall (Packard). Another committee has been appointed to revise the standard service and repair parts policies of the N. A. C. C. as they relate to trucks. Members of the committee are: Chairman, E. T. Herbig (Service), F. H. Drew (Packard), W. M. Ladd (Pierce-Arrow), A. B. Cumner (Autocar), F. H. Harris (Republic).

—

Unsettled Steel Price

(*Continued from page* 816)

There is a general attitude of doubt displayed by the purchasing agents. The trade is demanding lower prices, the manufacturers of cars and trucks are demanding lower prices. The parts makers are demanding lower material prices, and this is the situation right at present. In normal times the steel mills should be running 100 per cent capacity at this time of the year. The companies should have the major portion of their 1919 steel purchased or contracted for. The companies, however, have but little steel on hand and are buying in small lots. The mills, purchasing men declare, are only operating at from 50 to 70 per cent capacity.

While some are holding back for an expected drop, others declare this reduction is impossible. But whether the market goes up or down, the automotive industry is going to wait until a more stable condition prevails. It is believed that pronounced buying will send the price up, because of high fuel cost, high labor prices and high overhead which are the big elements which will cause a further upward movement at the mills. High labor and raw material cost prevent such a reduction, they declare.

While the automobile passenger car business has been flourishing from the moment the big plants got back to peace production, the truck industry has been decidedly backward. Makers of axles and other parts declare they are prepared to do twice the truck business they are doing at present.

The truck makers, however, tell of good buying business and fair production schedules, but the parts makers hold that the truck business is not what it could be. Competition in the truck field is decidedly keen and new truck companies are springing up with regularity both in Detroit and other parts of the state. This competition is shaping itself into a matter of efficiency and price. The best truck at the best price is going to get the business, and knowing this the truck makers are endeavoring to shave prices as low as possible conducive to reasonable profit.

This policy has caused curtailed production, inasmuch as the makers hoped steel price reduction would aid them in decreasing manufacturing costs and permit the establishment of lower retail truck prices. There is no question but what steel price fixing has given this department of the automotive industry greater confidence than the others.

—

Protest Prohibition of Imports

(*Continued from page* 817)

the manufacturers fear and exaggerate the danger of American competition. We know ourselves that competition never had any baneful or injurious effects for the consumer or the producer. We possess proof of this in America, where competition is extremely acute, especially in the automobile industry, and it is an incontestable fact that most automobile manufacturers in the United States are in a prosperous and flourishing condition. It is only necessary to glance at the retail price of automobiles in America to appreciate the advantage which the general public derives from this competition.

As long as the importation of American automobiles is prohibited in France the French manufacturers will have every opportunity to sell at excessively high prices and therefore make large profits, to the detriment of the French public.

We do not ask to immediately return to the pre-war customs tariffs, as we understand perfectly that it is necessary to protect the French automobile industry; but we do not admit that it should be protected in such a manner as to be prejudicial to the interests of the French public and the good will and friendship which exists between the two sister republics. We only desire to be allowed to compete in a fair and loyal manner with the French constructors.

We would ask you, therefore, to assist us in every way possible to obtain, without further delay, the cancellation of the prohibition order at present existing, and that we be advised immediately as to the date of its ultimate suppression.

In order to facilitate the abolition of this order we would be disposed to accept the imposition of customs duties which would commence at a certain rate and gradually decrease each quarter until a normal rate is attained. These duties will be calculated upon the purchase price in the United States, in the same manner as French goods exported to America, which are only taxed upon the invoice value in France.

The customs tariffs between the United States and France should be established on a reciprocal basis. The tariff in force at the present time, which is imposed on the actual cost of the goods delivered at a French port, places the English, Swiss and Italian manufacturers in a far more advantageous position than the American, as the first named have very little freight to disburse, whereas the cost of transportation from the United States is, and probably will be for some considerable time, extremely enormous.

With a scale of customs duties based upon the proposition indicated in this letter, French industry would be protected in an efficacious manner without undue hinderance to our numerous dealers throughout France and would at least permit them to earn their livelihood and contribute to the support of the workmen they employ.

In like manner this would conduce to maintain the good will and friendship which should endure between France and the United States after the substantial assistance rendered by America toward the successful prosecution of the war.

It is certainly in the interests of the French public that the importation of American automobiles into France should be permitted without undue let or hindrance, otherwise the French manufacturers will continue to maintain the present exorbitant prices.

It might be argued that the French constructors do not in any way acquire large profits, but we feel assured that if importation from America is authorized they would immediately reduce their prices to a considerable extent and they would so adapt their methods of fabrication to those practised in America that they would prosper in spite of foreign rivalry. As mentioned previously, competition is salutary and, in our opinion, necessary.

The fact must not be lost sight of that the American factories have been more or less exclusively employed during the past year or so upon work in connection with the war, and in view of this they are practically in the same situation as the French factories. In this way they do not constitute a very formidable menace to French industry, as they will be obliged to limit the exportation of their products in order to cope with the demands of the American public. Another fact which might be noted is that the cost of raw material has increased considerably in the United States, so that it will be a practical impossibility to revert to pre-war prices.

New Officials of S. A. E. Metropolitan Section

NEW YORK, April 10—At the monthly meeting of the Metropolitan Section of the Society of Automotive Engineers held last night at the Automobile Club of America, officers for the ensuing year were announced as follows: Chairman, A. C. Bergmann; treasurer, Lars G. Nielson; secretary, Austin M. Wolf. H. M. Crane, F. G. Diffin and Alfred Reeves form the board of governors.

—

Postoffice Wants 10 Planes

(*Continued from page* 817)

be placed over loads in streamline at at top of fuselage.

b. That provisions be made for protection against bad weather.

c. A passage way to be provided, so that vital parts are accessible to mechanic in flight.

d. That suitable slideways and eyes be provided for belt and snap hook to be worn by mechanic in making repairs in exposed places.

e. Suggested that streamlining on exposed power plants be hinged at front and of sufficient width and length to provide shelter for mechanic while working on motor. To be held out by suitable, adjustable strut.

f. That room be available in control cockpit for map boards, instruments and radio controls.

g. That a good fire extinguisher system be provided, such as Pyrene or equal, tubed by suitable leads to gasoline tanks and all motor compartments, to be operated from control cockpit.

h. That pilot's seat be adjustable in relation to controls.

Bidders are requested to submit with proposals full information and particulars, as indicated below, of the ships that they propose to furnish.

a. *General Arrangement Drawings*, showing plan, side and front elevations, drawn to a scale of one-twelfth or one twenty-fourth full size.

b. *Main Dimensions*. Areas of maian surfaces, areas of control surfaces, stagger, dihedral, incidence, span, chord, gap, gap-chord ratio, setting of stabilizer to wing chord.

c. *Weight Schedule and Balance Diagram*, giving weight of power plant and accessories, fuel and oil, mail load, passenger and pilot and instrument loads, structural weight subdivided into groups. Balance diagram for ship with normal load, showing position of center of gravity.

d. *Performance Estimates*. Speed, climb, speed at altitude, endurance at full power ground level, endurance at 6000 ft. at cruising speed.

e. *Power Plant*. Fuel and oil consumption and brake-horsepower curve for engine other than Liberty motor. Diagrams and descriptions of gasoline system, cooling system, oil-circulation systems.

f. *Stress Diagrams* for Wing Truss, Fuselage with air and ground loads, Landing Gear.

g. *General Assemblies of and Structural Information* on wing structure, fuselage and landing gear, with details of special construction, important fittings, statements as to whether streamline wire or cable will be employed, etc.

Materials and Shop Processes. All materials and shop processes employed should be in accordance with either Army or Navy specifications and standards.

Inspection. Airplanes in process of construction shall be open to the inspection of the Post Office Department.

Tests Prior to Acceptance. One machine to be sand-tested at the option of the Post Office Department, in accordance with the Army Specifications. One machine to be tested for performance, landing speed and controllability—tests to be carried out by the Post Office Department.

Unless otherwise provided, remaining airplanes under the contract will be accepted, based upon inspection complete at the works and on inspection of complete drawings. This is for the purpose of checking parts, alignment, completeness and satisfaction of details. At this time the power plant shall be operated in every detail to the satisfaction of the Post Office Department.

General Motors Plans to Spend $37,398,000

For Additions, Plants and Equipment in Flint, Detroit, Pontiac, Toledo, Etc.

DETROIT, April 3—General Motors Corp. expansion plans for 1919 were outlined to-day by William C. Durant, its president and general manager. Combined, they entail an expenditure of $37,398,000 to be invested in new plants, additions, office and sales buildings and new equipment in Detroit, Flint, Pontiac, Lansing, Saginaw, Toledo, St. Louis, Mo., Janesville, Wis., Bristol, Conn., and Muncie, Ind.

Detroit will get the lion's share of the appropriation, $12,650,000 to be spent here. General Motors expansion here includes a complete new plant for the Cadillac Motor Car Co. division, to be located on Clark and Scotten avenues; a sales and service building for the same company to be at the corner of York and Cass avenues; a $5,000,000 15-story general office building for the General Motors Corp. and all of its subsidiary units, to be located on Cass Avenue, with a four-story research laboratory in the rear; a differential gear and transmission plant; a general bearing and power plant; extensions to the Central Forge Co., and the Northway Motor & Manufacturing Co. plant, all to be located on Holbrook Avenue.

The proposed office building will cover an area of 336 x 482 ft. Four wings will extend from front to rear, and these will be connected by a central wing, this plan offering direct outside light to every office in the building. The ground floor will contain salesrooms for all of the subsidiary companies of the corporation, as well as service stations for the United Motors Corp.

In the center of the building and on the ground floor there will be an auditorium seating approximately 1000, with stage, dressing rooms, etc. It will be used for conventions and other purposes. The main entrance will be in the center. Other entrances will lead from both sides to the main lobby and elevators. There will be 16 passenger elevators in the building. The laboratory in the rear will be 60 x 480. It will be 4 stories high, with approximately 50,000 sq. ft. of office space on each floor. The entire building, including laboratory, will have a floor area of about 875,000 sq. ft., exclusive of corridors, toilets, elevators. It will be strictly fireproof.

Buick and Chevrolet Extension

General Motors will spend $6,715,000 at Flint, where large plant extensions to the Buick and Chevrolet companies are proposed. The remainder of the appropriation will be used to build 1000 homes for employees, with water mains, sewer systems, paved streets, etc. They will be sold to the workers on easy payment plan.

Lansing projects total $2,540,000. A new axle plant will be built and large extensions made to the Olds Motor Works division. At Saginaw, $2,427,000 will be spent in extensions to the central foundry, motor and steering gear departments for the Saginaw Products division and a central heating plant. Toledo will get $543,000 to be invested in extending the transmission department of the Chevrolet Motor Co. branch factory there. A new plant will be built for the St. Louis Woodworking Co. at St. Louis, Mo., as well as large assembling plants for the Buick and Chevrolet division in that city. These improvements will cost $4,135,000.

Janesville, Wis., projects total $4,500,000 and include plant extensions for the Janesville Machine Co., the Sampson Tractor Co. and hundreds of houses for employees. At Bristol, Conn., $1,028,000 will be spent in extending the present plant of the New Departure Manufacturing Co. At Muncie, Ind., $800,000 will be spent in plant extensions and houses for employees.

Mr. Durant also said that Walter P. Chrysler, now president and general manager of the Buick Motor Car Co., Flint, has been made vice-president in charge of all General Motors operations and assistant to Mr. Durant. This new arrangement does not involve any material changes in the policy of the independent management of the General Motors division. The central operating organization headed by Mr. Chrysler will direct the carrying out of the policies of the corporation.

Mr. Chrysler will be succeeded by Harry H. Bassett, as general manager of the Buick. He has been associated with Mr. Chrysler as assistant general manager for several years.

—

Minerva to Supply Truck and Tractor Engines

CLEVELAND, April 6—The Minerva Engine Co., which has been incorporated here under Ohio state laws for $250,000, will engage in the manufacture of truck and tractor engines. The officers and directors are: President, C. S. Goby; vice-president, R. K. Johnson; secretary, L. R. Long. The directors include E. P. Dowling, John R. Dowling, H. F. Eilbert and J. J. Cummings. Offices have been established in the Vickers building.

Experiments and tests are completed and preparations are under way for immediate production. The company expects to give employment to several hundred men. For the present it will make only its Model A engine, which is a 50 hp. machine. It will be manufactured for other lines as well as tractors and trucks.

R. K. Johnson, director of engineering, was formerly connected in a similar capacity with the Garford Engineering Co., and the Gramm Motor Truck Co. He also spent two years in England studying engine design. The engine has a special water-jacket construction, high pressure oiling system and an air cleaning device for purifying the air of dust before it enters the carbureter. A plant will be erected early this spring.

Housing an Important Problem

Cessation of Building in Detroit Creates Serious Shortage of Workers' Homes

DETROIT, April 6—The Detroit Housing Association, of which Frank W. Blair is president, is completing organization of a separate $1,000,000 corporation to build homes for workingmen in Detroit at minimum cost. It is hoped to enlist the aid of every merchant and manufacturer of the city with the view of solving the city's serious housing problem.

Hundreds of Detroiters have walked the streets for months looking for houses and apartments. The present shortage is the result of the cessation of building during the war, in which time 61,999 families have reported to have come to Detroit, while but 28,196 houses were erected. Allan A. Templeton, president of the Chamber of Commerce, declares the plan of building houses on a wholesale scale is the only method which can be pursued in solving the problem.

Detroit companies are vitally interested in finding suitable living conditions for their workingmen. The Ford Motor Co. has solved the housing problem as far as Highland Park is concerned by the inauguration of a realty department and a building and loan association, where Ford employees are encouraged to borrow and build on the easy payment plan. The Ford Co. urges its workmen to build and settle down, and this factor has been successful in cutting turnover.

At Dearborn, Henry Ford is duplicating his Highland Park housing program. His recently incorporated Dearborn Realty & Construction Co. has scores of small homes in the course of construction. This company is contemplating house construction on a gigantic scale. It is expected that the General Motors Corp. will shortly announce a housing project for Detroit similar to that about to be undertaken by the corporation at Flint and Janesville, Wis. The Solvay Process Co., for years past, has been engaged in providing housing for its employees. The Edison Co., American Blower Co., Gemmer Manufacturing Co., Timken-Detroit Co. have also engaged more or less in providing homes.

At Ojibway, Ont., just across the river from Dearborn, the Canadian Steel Corp. is building a second and greater Gary.

—

Contract Cancellations Increasing

WASHINGTON, April 9—Cancellations of aircraft war contracts have increased until 84 per cent of those outstanding Nov. 9, 1918, have been terminated, with 15 per cent delivered since that time and 1 per cent remaining in force. Contracts of the motors and vehicles section have been terminated up to 63 per cent of those outstanding Nov. 9, with 24 per cent delivered since that time and 13 per cent remaining for completion.

Lieutenant Andre Boillot, who will fly at the Indianapolis Speedway, May 31. The machine is a French fighting Spad which was used by Boillot at the front

Bleriot-Spad for Indianapolis

PARIS, March 20—André Boillot will fly the latest type of French army fighting plane during the Indianapolis race meeting on May 31. Young Boillot is the only surviving brother of the well-known Georges Boillot, who was killed in a single-handed fight against seven German planes. Immediately after the death of his brother, André Boillot, who was then serving in the infantry, asked to be transferred to the air service. Within a few months he was at the front and won the Croix de Guerre. For the last twelve months Boillot has been chief test and experimental pilot at the Bleriot factory, and has carried out all the initial trials with the latest French scout machines.

The machine with which Boillot will give exhibitions at Indianapolis is a Bleriot-Spad which was used on the front by the French pilot Fonck. This type of machine has never previously been seen in America.

In addition to coming as an air pilot, it is quite possible that André Boillot will start in the Indianapolis race on a 150 cu. in. Peugeot. If he does this his flying exhibitions will be given either before or after the speed contest. The little Peugeot is a machine which was built in 1914 for a race to be held in France in August of that year. The war prevented that race, and the machines were stored away awaiting better days. Officially Peugeot is unable to take part in the Indianapolis race, but Boillot has secured the loan of one of these small racers and is having it equipped.

Official Indianapolis Entries to Date

NEW YORK, April 7—Ralph De Palma, in his special Packard, equipped with an engine having a piston displacement of 299.2 cu. in., has entered his name for the Indianapolis events on May 31. Louis Chevrolet will also race in a special model which is presumably a Frontenac, although the name has not been disclosed, and has a piston displacement of 299.5 cu. in. Another Frontenac special with a displacement of 299 cu. in. will be driven by Ralph Mulford. Three Duesenberg specials have been entered, one a Roamer-Duesenberg to be driven by Kurt Hitke, the other two by Tom Milton and Ed O'Donel. Earl Cooper will have a Stutz. Besides these, as already reported, W. W. Brown will race in his 24-valve Hudson, R. C. Durant in a Chevrolet, and the two Sunbeams will be piloted by J. Chassagne and Dario Resta, who will take Joseph Christiaens' place.

French Races for 1920

PARIS, March 22—In all probability there will be a Grand Prix road race in France next year. The Automobile Club of France will celebrate its twenty-fifth anniversary in 1920, and intends to mark this happy event by several big demonstrations, of which a road race will be one. No official announcement has been made, but the feeling of manufacturers in general is in favor of road racing next year. In addition to the national race a big speed contest in the neighborhood of Marseilles will be held independently in 1920.

Birmingham Fair in 1920

WASHINGTON, April 5—The British Industries Fair for 1920 will be held at Birmingham, England, beginning the last Monday in February and continuing 14 days. Exhibits will include motorcycles, cars, trucks, accessories and aeronautic accessories and engines, etc. Further information can be secured from the Chamber of Commerce of Birmingham.

Willys Picks Men for Profit Split

TOLEDO, April 3—The committee of ten which is to work out the details of the Willys-Overland Co. 50-50 profit sharing plan, which President John N. Willys recently announced for the Toledo factory, has been appointed. Five members of the committee represent the factory and five the executive departments.

L. M. Ellis is chairman of the committee and A. H. Sarvis secretary. Other members are: H. G. Fitch, sales and service department; Harry Bothart, first assembly department; L. A. Miller, administration building; J. R. Woodruff, polishing and plating department; W. J. Highley, compensation department; Wilfred H. Emery, toolroom; Harry A. Webb, paint shop. The method by which the employees will share in the profits of the company on a 50 per cent basis with the stockholders and the date for the first payments are expected to be announced soon.

289 Refineries in United States

WASHINGTON, April 7—A total of 289 refineries are producing 1,295,115 bbl. of crude oil per day in the United States, according to announcement made to-day by the Bureau of Mines. Following is the list of the petroleum refineries in the United States, with the daily capacity:

State	No. of Refineries	Capacity Bbl.
Arkansas	1	300
California	37	280,870
Colorado	2	1,500
Illinois	11	46 000
Indiana	2	36,500
Kansas	31	71,350
Kentucky	2	2,600
Louisiana	12	67,925
Maryland	4	15,500
Minnesota	1	300
Missouri	5	16,375
New Jersey	4	100,000
New York	4	34,500
Ohio	10	24,360
Oklahoma	79	233,300
Pennsylvania	48	90,935
Texas	26	212,050
Utah	1	800
West Virginia	5	7,700
Wyoming	5	52 250
Total	289	1,295,115

F. W. D. Tractors to Have Canadian Branch

CLINTONVILLE, WIS., April 7—The establishment of a F. W. D. motor truck assembling plant and branch works at Kitchener, Can., was determined upon at a special meeting of stockholders of the Four Wheel Drive Auto Co. at the main offices here. The plan involves the organization of a new and distinct corporation, having a capital stock of about $200,000, practically all of which will be owned by the stockholders of the present company. With this in view, the corporate articles of the F. W. D. company were ordered amended so that it may legally acquire and own stock in other corporations. While details of the Canadian plant project have not been definitely fixed, it is the intention to erect a large machine shop at Kitchener for the assembling of F. W. D. trucks from parts made here and shipped into Canada in bulk.

Willys Starts Profit-Sharing

TOLEDO, April 6—The Willys-Overland Co. has approved two sections of the

50-50 profit-sharing plan under which it proposes to operate. The two sections have been completed by the factory committee of ten to work out the details.

Profits which are to be shared with the employees will be distributed five times annually—in April for January, February and March; in July for April, May and June; in October for July, August and September; in December for October and November.

The other section of the plan outlined defines permanent labor. An employee, to become a profit sharer, must have been six months in continuous service. Absence from work because of illness, injury or on consent of employer, does not affect his continuity of service. Absence, however, without report or satisfactory excuse automatically removes the employee from the continuous service record. Overland men still absent in military service will be considered as in continuous service if they make prompt application for re-employment after their discharge from military service.

Goodyear Council of Industrial Relations

AKRON, April 8—The Goodyear Tire & Rubber Co. has established a Council of Industrial Relations. This will give representation to all employees over 18 years of age, who are American citizens and who have had six months' continuous service or one year's total service with the factory. The council will meet with the factory manager, and is intended to be a broad and comprehensive democratic form of management. About 20,000 employees will be affected.

The council will be composed of an executive council consisting of five men named by the factory manager, the manager and assistant manager of the labor department, two foremen to be selected by all the factory foremen, and six non-salaried employees. All questions of industrial relations will be passed upon by this body. Its first duty will be to formulate a plan to establish a legislative body along the lines of the national congress, which will give representation to all employees eligible to vote.

Carlisle Cord Tire Putting Up Plant

STAMFORD, CONN., April 7—The Carlisle Cord Tire Co. will establish its principal factory here, and has purchased about 10 acres of land, with a frontage of 1000 ft. on Fairfield Avenue and a depth of 400 ft. It is expected to be in operation by Aug. 1.

The main building is to be 250 x 150 ft., cement, steel and glass, of sawtooth construction. The company has had a plant at Andover, Mass., for two years, and intends to continue it in operation, although the main factory and executive offices will be moved here.

Brazil to Spend $500,000 for Aviation

WASHINGTON, April 5—The sum of $500,000 has been appropriated by Brazil for organization of an aviation service, purchase of airplanes, establishment of aviation schools and the buying of various accessories.

Pierce-Arrow Sales Increase 27%

Production Curtailed by War Orders—Aircraft Program Cut Short

BUFFALO, April 8—Gross sales of the Pierce-Arrow Motor Car Co. increased about 27 per cent during the year ended Dec. 31, 1918, or from $32,565,908 in 1917 to $41,354,439 in 1918; and in this period the company produced 8,635 vehicles, of which 1168 were passenger cars and 7467 were trucks. In 1917 the company produced 7703 vehicles, of which 2532 were cars and 5171 were trucks.

The statement for the year ended Dec. 31 last compares with 1917 as follows:

	1918.	1917.
Net profits after depreciation, etc.	$4,273,171	$4,791,274
Estimated war and excess profits and income taxes	1 200,000	1,161,803
Balance	$3,073,171	$3,629,471
Other income	15,601	11,858
Total income	$3,088,772	$3,641,329
Interest	323,032	42,582
Net profit	$2,765,740	$3,598,747
Preferred dividends	800,000	800,000
Balance	$1,965,740	$2,798,747
Common dividends	1,562,500	625,000
Surplus	$403,240	$2,173,747
Previous surplus	2,415,962	242,215
Total surplus	$2,819,202	$2,415,962

The balance sheet as of Dec. 31 last shows:

Assets—	1918.	1917.
Property account	$4,874,350	$5,431,438
Investment in affiliated selling company	40,000	40,000
Inventories	14,582,749	14,837,786
Notes and accounts receivable	4,012,994	3,665,632
Miscellaneous investments and deposits	87,647	86,463
Cash at bank and on hand	2,338,694	1,192,696
Liberty bonds	275,000	634,991
Deferred charges	67,181	195,904
Total assets	$26,278,617	$26,084,912
Liabilities—		
Preferred stock	$10,000,000	$10,000,000
Common stock	1,250,000	1,250,000
Capital surplus	4,081,411	4,081,411
Bank loans	3,837,500	5,141,583
Accounts payable	2,662,202	1,914,402
Customers' deposits	115,800	119,800
Estimated war and excess profits and income taxes	1,200,000	1,161,802
Common dividend payable Feb. 1, 1919	312,500	......
Surplus	2,819,203	2,415,962
Total liabilities	$26,278,617	$26,084,912

The report to the stockholders says:

"The energies of your company during 1918 were absorbed mainly in war activities under growing demands from the War Industries Board. Passenger car production was curtailed early in the year and was practically deprived of raw material from about August 1 on. Trucks for war purposes were given precedence over trucks for commercial purposes in an increasing ratio as the year advanced. During the latter part of the year it was impossible to secure material for either commercial trucks or passenger cars.

"Coincident with its increased demands for trucks for war purposes, the government besought us to enter the aircraft field. In August the Aircraft Production Board entered into a contract with your company for the manufacture of a large number of Hispano-Suiza airplane engines, deliveries of finished product to begin in 1919. This aircraft program, contemplating the use of two-thirds of our existing machine facilities, seriously interfered with the use of such facilities for the production of war trucks, and additional producing agencies had, therefore, to be created, details in regard to which are given under a later caption.

"With the signing of the armistice on Nov. 11, this entire program of production for government purposes was cut short. Further preparation for aircraft production came to an abrupt end with the cancellation of the aircraft contract—but, inasmuch as this contract contemplated reimbursement of your company for all outlays and there can be no doubt of the government's intentions in this matter, the auditors have set up no reserves against this investment, which appears among accounts receivable. Likewise were canceled the bulk of the truck orders for the United States government and part of the truck orders for the French government. This situation is reflected in the unfilled orders on hand Jan. 1, 1919, which were 2,341, as against 5,098 on hand Jan. 1, 1918.

On the other hand, the armistice put an end to the embargo on passenger car material and resulted in a prompt and gratifying revival of passenger car business. Following the armistice, factory night work and overtime was eliminated and steps were otherwise taken to bring operation down to a normal basis. We are now operating on a permanent 48-hour week basis.

Shipping to Central America Permitted

WASHINGTON, April 7—Manufacturers of passenger cars, motor trucks, tractors and accessories can ship freely, without individual export licenses, to Mexico, Cuba, Haiti, San Domingo or to any country in Central America or South America, excluding the colonies of Great Britain and France, according to announcement made to-day by the War Trade Board. Fuel oil and gas oil are still restricted in shipment.

Fuel Oil Contracts Let to Standard

WASHINGTON, April 5—The Shipping Board awarded contracts for 7,500,000 bbl. of fuel oil to the Standard Oil Co. yesterday. This oil is for the operation of vessels under its jurisdiction. The contracts were all for Atlantic and Gulf ports delivery.

Claudel Carbureter to Have American Production

NEW YORK, April 8—The Aeronautical Equipment Co. has contracted with the Claudel Co. of France for the American rights to manufacture the Claudel carbureter. The contract calls for a minimum of 20,000 carbureters for the first year, progressing through a minimum of 100,000 carbureters in the sixth year. The company expects to exceed these figures very considerably.

Foreign Drivers to Arrive Soon

PARIS, FRANCE—(Special Cable)—April 8—Coatalen, engineer of the British Sunbeam Co., and Chassagne, who are to drive Sunbeam cars in the 500-mile Sweepstakes Race on the Indianapolis Speedway, May 31, will sail from Liverpool on April 15. A number of other French drivers will sail from Havre on May 3.

Re-sells Obsolete and Unserviceable Planes to Curtiss

WASHINGTON, April 4—The War Department has resold a number of obsolete and worn out airplanes and engines to the Curtiss Aeroplane & Motor Corp. The contract was made following a request for bids from various airplane and engine makers, and Curtiss made the highest bid.

Practically every bit of this property, according to the War Department, is obsolete and worn out. The OX-5 engine is one of the 5-cylinder types of engine developing 90 hp., and was used in elementary training planes. They will have to be entirely rebuilt before they will be of any value. The JN-4 planes, which were also used in early training, can in some instances be overhauled and rebuilt, while the remainder, about 50 per cent, will be salvaged. These JN-4 planes are not the same as the JN-4-H planes now used by the Air Service, which are a much later model. The 1100 Standard planes have been condemned by the Air Service and are said to possess only scrap value.

The War Department will continue the policy of requesting bids from manufacturers of airplanes whenever necessary in order to dispose of certain surplus materials without disrupting the market.

—

Business Improving Steadily

DETROIT, April 7—All business here, especially in automotive lines, is showing a marked improvement. The transition to a peace basis is going forward with few serious jolts. Released available labor is being rapidly absorbed and building operations have taken a great boom. Work was started on 335 new buildings and 165 new additions during February. The majority of the building operations represent manufacturing plants and business places. The estimated cost of these new structures total $1,279,065.

Business is approximately 34.13 per cent normal as compared with 30 per cent in February. Business above normal during March was 17.64 per cent against 19.99 per cent in February. About 48.23 per cent is below normal, which is a decrease of 2 per cent when compared with February figures. Improvement totals 62.50 per cent, which is a big increase over the February record of 49.18 per cent. Only 8.75 per cent is on the decline, while 28.75 per cent is stationary.

—

Air Service Appropriations Cut 50 Per Cent

WASHINGTON, April 7—Appropriations for the Air Service have been reduced 51 per cent for 1918-19 from $944,304,758 to $459,304,758. The total appropriations for the service during the war, after making the reductions, total $1,097,304,758, of which 65 per cent, or $712,000,000, were expended to March 15.

It is estimated that $340,000,000 will be saved in the liquidation of suspended contracts. The following is a summary of the values of cancellations and suspensions of contracts to March 22, 1919:

	Value	Per Cent of Total
Engines and spare parts..	$266,961,771	54
Airplanes and spare parts	165,288,590	33
Chemicals and chemical plants	18,648,239	4
Instruments and accessories	10,761,081	2
Balloons and supplies....	10,071,035	2
Fabrics, lumber and metals	7,977,445	2
Miscellaneous	13,634,218	3
Total................	$493,342,379	

Speculation is Rife in Detroit

Wills and Leland Cars Talked Of —Maxwell-Chalmers and Saxon Affairs

DETROIT, April 4—Automobile business circles are awaiting with keen anticipation the outcome of a number of important matters this week, interest centering in General Motors, Saxon Corp. and Maxwell-Chalmers affairs. The trade is also discussing some pretty authentic rumors of a new car to be brought out soon by C. Harold Wills, formerly with the Ford Motor Co., and one of the designers of the Ford car. The labor situation and the veiled plans of the Lincoln Motor Car Co. are also causing much speculation.

The announcement of W. C. Durant relative to the $37,396,000 General Motors expansion plan, calling for the investment of $12,650,000 in new buildings, plants, additions, etc., in Detroit alone, created somewhat of a sensation, and has served to divert the attention of the automobile business from the tangled affairs of the Saxon Motor Corp. to some extent.

Detroit knows but little about the proposed Maxwell-Chalmers merger, which is said to be steered by the General Motors Corp., and which, if it materializes, will practically give General Motors control of the two companies. It is said General Motors will refinance the combination, taking over all of the common stock of the companies. William C. Durant and other General Motors heads have nothing to say regarding the plan at this time, and no information is being given out at Maxwell-Chalmers headquarters.

It is said, however, that Walter Flanders, president of the Maxwell Co., which is operating the Chalmers properties under a 5 year contract, is soon to resign from the company. It is added that he is disposing of all his Detroit properties and proposes to locate in Chicago. Mr. Flanders himself will not discuss the matter.

Those close to C. Harold Wills declare he is working on a new passenger car and is soon going to give the trade a sensation. Two cars are under construction, it is said. One of them is an experimental passenger car and another is a racer designed to make its debut in the coming Indianapolis races. This car is just about complete and will be entered under the name of a well-known racing enthusiast who will also enter two other powerful machines.

The Lincoln Motor Car Co., owned by Wilfred and Henry Leeland, is getting ready to enter the passenger car field. This company is building up its sales and advertising force, but details of the proposed car are being kept in the dark. It will be a 6-cylinder machine to sell at a popular price and will make its appearance in mid-summer, it is said.

There is quite a labor organization movement in Detroit. While labor was always strongly organized here, this spring is witnessing the birth of more union organizations than usual. The movement is spreading more rapidly in the factories themselves, where the different trades of individual plants are forming their own organizations. The machinists at Dodge Brothers, for instance, have their own organization now, and this same trade is also organizing in other plants.

The greatest movement, however, is the formation of the Automobile Workers' Union, designed to take all men and women engaged in any department of the automobile manufacturing business. This organization is growing rapidly and is conducting extensive membership campaigns.

There is also a movement on foot for a 6-hour working day. This movement is springing from an unknown source. The American Federation of Labor, which maintains headquarters in Detroit, knows little of the 6-hour question, and it is apparent that it is not being pushed by that organization. It is said that the 6-hour plan is being tested in several local factories, but an exhaustive inquiry fails to locate these factories. It is denied that 6-hour shifts are in operation at the Ford Motor Co., although rumors to that effect persist in gaining circulation.

—

France Has 220,000 Vehicles

PARIS, March 22—At the beginning of 1917 France possessed 98,534 privately owned automobiles exclusive of trucks, taxicabs, motorbuses and motorcycles. In 1914 the number of privately owned automobiles was 115,906. The decrease of 7372 is explained by requisitions made by the army, particularly during the first six months of the war. While the official figures show the number of automobiles in France to be 98,534, this is far from being the total. These returns are based on taxation. Cars which do not pay direct taxes are not included. Thus there is no official record covering the number of trucks, taxicabs, motorcycles, etc.

As the army possesses 95,000 automobiles, and as there are about 15,000 privately owned trucks in service and probably 5000 motorcycles, the total number of motor vehicles in France is about 220,000. The Department of France, which heads the list, is the Seine district, including Paris, where there are in service 15,818 privately owned automobiles. The lowest number is found in the High Alps Department, where there are only 74 automobiles.

—

Shipments to A. E. F. Decreased

WASHINGTON, April 7—A noticeable decrease in the shipments of engines and spare parts is displayed in figures made public to-day by the War Department, by which it is shown that 6 per cent of the tonnage of motors and spare parts were shipped in the first 20 days of March, 1919, as compared with 100 per cent of the tonnage shipped in October, 1918. Shipments of fuel, oils and

greases have likewise decreased. Following are the figures showing the tonnage shipments by months, as compared with the October shipments, estimating October at 100 per cent:

	Fuel, Oils and Greases	Engines and Spare Parts
November	171	99
December	159	49
January	132	9
February	148	12
March	113	6

Army to Have 1050 Tanks

WASHINGTON, April 7—Preliminary plans for the future United States Army provide for maintenance of a minimum of 1050 tanks, 330 to be of a heavy and 720 of a light type. Arrangements provide for 45 fighting tanks to a battalion, with 24 in reserve, and 45 to a light battalion, with 27 in reserve. The tanks which have already been manufactured and used, the 2-ton and the 35-ton, will be continued as the light and heavy types, the 35-ton being equipped with Liberty engines carrying a 37-millimeter cannon on each.

Lieutenant Vrooman Vindicated

WASHINGTON, April 5—Lieut. S. B. Vrooman, charged in the Hughes aircraft investigation report with violation of the statute prohibiting persons acting for the Government from tansacting business with a corporation in which they are interested, was vindicated of the charge yesterday by Attorney-General Palmer.

Testimony taken since the publication of the report, said the attorney-general's announcement, showed that all lumber for airplane propellers purchased by the Government from the S. B. Vrooman Co., Philadelphia, in which Lieutenant Vrooman was financially interested, was inspected by agents of the National Hardwood Lumber Association and not by the officer or others appointed by him. This information, the attorney-general held, constituted a complete vindication of the officer.

Liberty Airplane Engines Contracts Completed

WASHINGTON, April 7—All contracts for Liberty 12 engines were completed when the Packard Motor Car Co. made final deliveries on its contracts on March 21. A total of 20,478 engines were delivered to the Government by all the different companies from which they had been ordered, as follows:

Firm	Number Produced	Percent of Total
Packard Motor Car Co.	6,500	32
Lincoln Motor Co.	6,500	32
Ford Motor Co.	3,950	19
General Motors Co.	2,528	12
Nordyke-Marmon Co.	1,000	5
Totals	20,478	100

Restrictions on Ferromanganese Import Lifted

WASHINGTON, April 7—All restrictions on ferromanganese and spiegeleisen have been removed by the War Trade Board. Licenses will be issued freely.

Aircraft Production Board Dissolved

President Wilson Abolishes Bureau Formerly Headed by Howard Coffin

WASHINGTON, April 7—The Aircraft Production Board, of which Howard E. Coffin was chairman during the early part of the war, and about which centered the storm of "protests" from Congress, has been formally dissolved by President Wilson. A director of aircraft production will be appointed to work under Major General C. T. Menoher, in charge of production. Following is the complete executive order, signed Woodrow Wilson:

EXECUTIVE ORDER

By virtue of the authority in me vested as Commander in Chief of the Army, and by virtue of further authority upon me specifically conferred by "An Act authorizing the President to co-ordinate or consolidate executive bureaus, agencies and offices, and for other purposes, in the interest of economy and the more efficient concentration of the Government," approved May 20, 1918, I do hereby make and publish the following order:

I

The Aircraft Board, created by Act of Congress, approved October 1, 1917, having accomplished the important purposes for which it was created, is hereby dissolved.

The last paragraph of Section 3, Article 1, of the Executive Order of May 20, 1918, is hereby revoked and the following paragraph substituted therefor:

"A director of Aircraft Production, selected and designated by the Secretary of War, shall hereafter have direct charge, under the direction of the Director of Air Service, of the Bureau of Aircraft Production and he shall perform such duties in connection with the activities, personnel and properties of said Bureau as may, from time to time, be assigned him by the said Director of Air Service, or as may be prescribed by law."

II

All unexpended funds of appropriations heretofore made for the Signal Corps of the Army and already specifically allotted for use in connection with the functions of the Aviation Section of the Signal Corps and specifically placed under the jurisdiction of the Director of Military Aeronautics, as well as all such funds already specifically allotted for use in connection with the functions bestowed upon the Bureau of Aircraft Production and specifically placed under the jurisdiction of the Director of Aircraft Production are hereby transferred to and placed under the jurisdiction of the Director of Air Service for the purpose of meeting the obligations and expenditures authorized by law or Executive Order in the field of activity of the Aviation Section of the Signal Corps and the obligations and expenditures authorized by the Bureau of Aircraft Production.

Crow-Elkhart Personnel

ELKHART, IND., April 7—The personnel of the reorganized Crow-Elkhart Motor Co. is as follows: President, M. E. Crow; first vice-president, E. C. Crow; vice-president and general manager, M. E. Hoshaw; secretary, D. C. Thomas; treasurer, Henry Lichtig; vice-president and purchasing agent, H. B. Schmid. The officers, with S. H. Penfield, vice-president of the Salisbury Wheel & Axle Co., Peru Auto Parts Co. and Norwalk Auto Parts Co., and also identified with a number of other parts manufacturing concerns, comprises the board of directors. The St. Joseph Valley Bank of Elkhart has been appointed trustee for the note holders. The company expects to gradually build up the production to 15 cars a day within the next 60 days. Orders are booked at the present time for the first 60 days production.

Fordson Dealers' Convention

CHICAGO, April 8—The Rue Motor Co., Fordson representative in this territory, has formed a plan whereby dealers are to carry in stock a sufficiently large stock of parts to insure immediate replacements and, if necessary, will replace the entire tractor while the damaged one is being repaired. This was announced at the Fordson dealers' convention this week. More than 200 dealers attended the convention, which was addressed by A. E. Hildebrandt, president of the Tractor Distributers' Association of the United States, who spoke on power farming requirements. John Fletcher, vice-president of the Fort Dearborn National Bank, addressed the meeting on "Farming from the Bankers' Viewpoint."

Braddon Motors Company Gets Factory

CHICAGO, April 7—The Braddon Motors Co., a new concern involving Chicago capital, has been organized to build a small 4-cylinder car, and has secured a factory building at Downer's Grove, Ill. The moving spirit in the organization is George J. Fogle, vice-president and general sales manager, formerly with the Locomobile company and more recently with the Maibohm company at Milwaukee. Other officers are: President, F. J. Clark; secretary-treasurer, John Voiral. The company is capitalized at $50,000. Production at the rate of four cars per day will begin within the month. The car will be assembled from standard units, but painting and trimming will be done at the factory. The factory building is a two-story brick structure 50 x 100 ft.

Chair Factory Becomes Auto Body Plant

PORTLAND, MICH., April 5—The Ramsey-Alton Mfg. Co., which was a chair factory before the war, a wagon parts plant during the war, is now going to engage in the manufacture of bodies for motor trucks. The company has received its settlement on government contracts. Nearly $250,000 was spent in changing the plant from chair manufacture to war work. The company has not yet decided whether it will continue chair manufacture as an additional department or devote its entire time to the automotive business.

American Pressed Radiator Corp. Elects

DETROIT, April 5—The American Pressed Radiator Corp. has elected the following officers for the coming year: President, C. H. O. Meyer; vice-president, R. S. Drummond; secretary, John S. Irwin; treasurer, H. F. Hiney. Mr. Drummond was formerly vice-president and general manager of the Detroit Steel Products Co., and Mr. Hiney was associated with him at that plant.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Hayes Wheels for Trucks and Tractors

JACKSON, MICH., April 9—The Hayes Wheel Co., which has made wood wheels for passenger cars ever since the industry was established, is now launching into the business of supplying wheels for trucks and tractors, and has established a new branch in the plant of the Jackson Munitions Corp., which it has leased and will probably purchase. A large number of men are already employed in the munitions plant, and as fast as Government-owned machinery used for munitions work is removed by the Government machinery for making steel wheels and metal parts is being installed.

New Wilson Body Building Soon Ready

DETROIT, April 9—The new press and die department of the C. R. Wilson Body Co. will be completed within 60 days. This will add 200,000 sq. ft. to the company's plants. These additional facilities will enable the company to produce more than 1000 bodies per day.

Panzardi & Co. New Porto Rican Dealers

PONCE, P. R., April 9—Santiago A. Panzardi & Co. have been organized to buy and sell motor vehicles and accessories and will have the agencies for the following cars: White, Packard, Premier, Hudson Super-Six, Buick, Chevrolet and Essex, Indian motorcycles and Tilene greases. The firm is made up of Santiago A. Panzardi, Juan E. Villeta, Jaime Oppenheimer and Jorge Oppenheimer. Messrs. Villeta and J. Oppenheimer will have direct charge of the business, and besides the store here at Calle Isabel, corner of León, it will open agencies at Juana Diaz, Coamo, Barros, Santa Isabel, Adjuntos, Ponuelas, Guanica, Yauco and Guayanilla.

J. E. F. Spark Plug Putting Up Factory

MILWAUKEE, April 9—The J. E. F. Spark Plug Co. has completed plans for the erection and equipment of a plant at 37th Street and Hillside Lane. Work will begin at once on a one-story factory, 50 x 156 ft., of reinforced concrete and brick, designed to receive additions and extensions as necessary. The investment in building and equipment will be about $25,000.

Metal Products Sales Co. Organizes

DETROIT, April 9—The Metal Products Sales Co., formed by A. F. Stengle and F. B. Breakey, will act as direct factory representatives for the Globe Machine & Stamping Co., Cleveland; Standard Foundry Co., Buffalo; Springfield Malleable Iron Co., Springfield, O.; Enterprise Mfg. Co., Akron, O.; Maynard Electric Steel Casting Co., Milwaukee, and the Barnett Drop Forge Co., East Hampton, Mass.

Advance-Rumely $1,338,586 Ahead This Year

LA PORTE, IND., April 7—Showing net profits and income for the year of $1,188,928, as compared with $550,557 for 1917, the annual report of the Advance-Rumely Thresher for the year ended Dec. 31, 1918, reports a prosperous condition of the company. The gross profits from operations are $3,073,877, compared with $2,101,832 in 1917. Various items added to the above make a total profit and income for 1918 of $3,393,703. Net profits amount to $1,338,586, against $715,758 in 1917.

The report shows that during the year there was spent in La Porte for machinery, equipment and warehouses $237,332, and for similar purposes in Battle Creek $298,011. The plants here are running at practically capacity, while at Battle Creek the number of employees has been increased from 407 to 1415. The company subscribed for $2,000,000 in Liberty Bonds and purchased $366,320 for its employees, sold to them on instalment plan. It also bought $750,000 worth of U. S. certificates of indebtedness and $100,000 worth of Canadian Victory Bonds. During the year 376 of its employees entered military service. The debenture debt of the company was materially reduced. Reserves set aside amount to $876,065.

American Bosch Adds to Staff

SPRINGFIELD, MASS., April 7—Additions and changes have taken place in the staff of the American Bosch Magneto Corp. W. G. Brown has been transferred from the New York office to become branch manager of the Chicago branch. T. C. Miller, formerly assistant manager at Detroit, assumes the position of branch manager at New York. Harold A. Wilson, formerly of the Diamond State Fibre Co., has joined the organization as assistant branch manager at Chicago. A. C. Hyser, who was in charge of the service department of the Willard Storage Battery Co., goes to Detroit to succeed T. C. Miller, and Oliver S. Stanley, who has been the assistant manager of the St. George Paper Co., Norwalk, Conn., has become assistant manager at New York.

Glidden Co. Buys Pennsylvania Plant

CLEVELAND, April 5—The Glidden Co., manufacturer of paints, varnishes, acids and chemicals, has taken over the A. Wilhelm Co., Reading, Pa., and will continue the business as heretofore. Besides its factories in Cleveland, San Francisco and Toronto, it now has manufacturing facilities in the east.

Olds Up 40 Per Cent in Production

LANSING, April 9—Truck production at the Olds Motor Works is reaching quantity figures. Although this company went into truck manufacture only 2 months ago, that division of operation is now in full swing, 30 machines of the ¾-ton type being completed daily. Passenger car production is now at the 140 daily mark. This is an increase of 40 per cent over February figures.

Work on Olds Plant Expansion

LANSING, MICH, April 9—Work on one of the largest of the buildings to be included in the Olds Motor Works expansion program has begun on the Reliance Engine Co. property. This structure will be 700 x 240, and will be used to house the axle department of the plant. It is estimated that the expansion plans of the Olds company, which will be carried out this spring and summer, mean an expenditure of between $1,000,000 and $1,500,000. A new administration building is among the structures in prospect.

Ford Street Car Coming Next

DETROIT, April 4—Henry Ford and the engineers of his tractor organization are working on plans for a street car driven by an internal combustion engine, which will be demonstrated in Detroit this summer, according to Charles E. Sorensen, general manager of the Henry Ford & Son tractor plant.

Lieut.-Col. E. J. Hall, one of the designers of the Liberty engine, will come to Detroit to assist in the demonstration of the new car. He has already successfully worked out engine-driven street cars, but will co-operate with Mr. Ford in perfecting the latter's new idea.

Samson Plans 30 Tractors Daily

DETROIT, April 4—It is stated at the General Motors Corp. headquarters here that the Samson Tractor Co., Janesville, Wis., will begin operations in three weeks, and that by July 1 approximately 1850 Model M tractors will have been completed and shipped. It is expected that by that time the company will be producing 30 machines daily.

Hudson Doubles Car Production

DETROIT, April 5—The Hudson Motor Car Co. launched into its second quarter production Monday by doubling its output of both Hudson and Essex cars. From 2500 machines of each make last month this company jumps to 3750 production basis, and hopes to turn out 7500 jobs of both makes in April.

New Spring Factory for Standard Parts

CLEVELAND, April 7—A new spring factory is under construction for the Standard Parts Co. at Flint. It will replace the company's present Flint plant, long since outgrown. The new factory will have an immediate capacity four times greater than that of the old plant.

Men of the Industry

Changes in Personnel and Position

Barnes Gives Up Management of Parrett Tractor

CHICAGO, April 8—Claire L. Barnes has resigned as vice-president and general manager of the Parrett Tractor Co. He was instrumental in the reorganization of the company a year ago, and at that time took over the management of the company's affairs. Feeling that his work has now been completed, he has resigned to devote his time to the development of other interests. Mr. Barnes is a well known figure in the industry, having been for years associated with John N. Willys in the management of the Willys-Overland properties. Management of Parrett production will be under an executive committee of three under the chairmanship of President Dent Parrett, who recently retired from the service as a captain in the Ordnance Department.

—

LeRoy A. Hillman will be in charge of the branch of the Detroit Pressed Steel Co., which has been opened here for Disteel wheels. Mr. Hillman has been in civilian service with the Bureau of Aircraft Production, and before that operated The Bearings Shop, interest in which he still retains.

—

P. S. Russell, formerly general sales manager for the Hale & Kilburn Corp., Philadelphia, has recently been released from the army and has been appointed manager of the new Packard Motor Car Co.'s branch at St. Louis.

—

Harry M. Gardiner, General Motors Corp., has been appointed successor to H. J. Sproat, works manager of the Olds Motor Works, Lansing.

—

A. J. Wise, formerly with the F. B. Stearns Co., Cleveland, and later with the New York branch of the Paige-Detroit Motor Car Co., has been made manager of that organization.

—

Brockholst Mathewson has been placed in charge of the Detroit office of the Savage Arms Corp., which has recently been opened at 1408 Kresge Building.

—

Clifford A. Williams, director of sales of the Kissel Motor Car Co., Hartford, Wis., has resigned, to take effect April 15. He is to become vice-president of the Western Motor Co., new distributers of Kissel products in California and Arizona. This organization is headed by Cuyler Lee, former Packard distributer.

—

George Hills, manager of factory sales of the American Rolling Mill Co., has resigned to accept the general management of the Ohio General Tractor Co., Cleveland.

—

Wm. R. Blackburn, formerly factory manager of the Cadillac Motor Car Co., Detroit, has assumed the position of manager of the Gray Motor Co., Detroit. He was connected with the Cadillac company for twelve years.

Amel R. Carlson, who has completed his government service on the purchasing staff of the Wright-Martin Aircraft Corp., New Brunswick, N. J., has returned as assistant general manager to the Commonwealth Motors Co., Chicago.

—

Harold C. Bement has been placed in charge of the electric furnaces at the new plant of the Onondaga Steel Co., Inc., Eastwood, N. Y. He was formerly melter foreman at the government arsenal at Watertown, Mass.

—

M. W. Bartlett, for the past five years secretary of the Splitdorf Electrical Co., has joined the Wire Wheel Corp. of America as Eastern District representative, with headquarters in New York at 835 Eleventh Avenue. Service direction and export matters are also under his supervision.

—

J. D. Mooney, recently discharged from his military duties as captain with the 309th Ammunition Train, has gone with the General Motors Corp., New York. He was manager of the Hyatt Roller Bearing Co.'s Industrial Division prior to joining the army in 1917.

—

Clark W. Upp has been appointed special foreign representative of the Federal Motor Truck Co. to cover the West Indies, South and Central America and Mexico.

—

F. M. House, who has been with the Republic Motor Truck Co. for many years, has been appointed manager of the Pacific coast sales division of that company.

—

W. G. Langdon, who has been with the Willys-Overland Co. for some time, has been made assistant general purchasing agent of that company. He was formerly connected with the Michigan Stove Works and later with the Hayes Manufacturing Co.

—

W. L. Mahon, who has been with the General Motors Truck Co., Pontiac, for some time, has been made manager of a new department of the sales division of that company. He will have charge of research and statistics and will prepare data on motor truck operation for G. M. C. owners.

—

Paul Welhener, who comes to the motor truck field from the farm implement business, has joined the factory sales department of the General Motors Truck Co, Pontiac.

Yoder Becomes Secretary of Federal Trade Commission

WASHINGTON, April 5—J. P. Yoder, formerly special examiner of the Federal Trade Commission, has been made secretary of the commission to succeed Leonidas L. Bracken, who resigned recently. Mr. Yoder left the commission in February, 1918, to serve as a captain in the Army Sanitary Corps, and has recently returned from service in France.

—

S. Bloom has been appointed director of the Essenkay Products Co., Chicago. For the past year he has been in military service, and previous to that was in the advertising business both in America and Australia.

—

H. W. Meyer of the Ajax Auto & Aero Sheet Metal Co. has turned over his plant and machinery to the Ajax Auto & Aero Sheet Metal Co., Inc.

—

Milton W. Franklin, consulting electrical engineer, has been engaged by the Remy Electric Co., Anderson, Ind. Mr. Franklin has written articles for technical publications. He was formerly connected with the General Electric Co. and was president and general manager of the C. & C. Electric Mfg. Co., Garwood, N. J.

—

W. F. McLaughlin has been appointed factory superintendent of the Hyatt bearings division of the General Motors Corp. at Harrison, N. J.

—

C. P. Cary, who has been manager of the New England branch of the Garford Motor Truck Co. for several years, coming here from San Francisco, has resigned and is now in charge of the truck department of Alvan T. Fuller's agency for Packards.

—

George B. Chapman, who came to Boston from the Federal Truck Co., Detroit, to manage the agency placed by that company for New England, has resigned to succeed C. P. Cary as manager of the New England branch of the Garford Motor Truck Co. The position of manager of the Federal agency will be filled by C. E. Whitten, Jr., Lynn, whose father controls the Federal business in Boston and vicinity.

—

L. S. Chamberlain, formerly manager of the San Diego branch of the Savage Tire Corp., has been promoted to the position of assistant sales manager, with headquarters at the factory. H. E. Cressler, until recently with the Goodrich Tire & Rubber Co., succeeds him as branch manager.

—

Frank M. Comrie and **Wm. J. Cleary** have resigned from the Thielicke Advertising Co. to go into business for themselves as Comrie & Cleary, Inc., with offices at 1512 American Building, Chicago. Mr. Comrie is president of the new company, Mr. Cleary treasurer and general manager, and with E. J. Phillips and J. M. Rosser, constitute the board of directors.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb. .... .02 -.03
Phosphoric (85%, lb. .... .35 -.39
Sulphuric (60%), lb. .008

Aluminum:
Ingot, lb. .... .29 -.31
Sheets (18 gage or more), lb. .... .42
Antimony, lb. ...... .06½-.06⅞

Burlap:
8 oz., yd.......... .06¼
10½ oz., yd........ .08½

Copper:
Elec., lb. .... .15½
Lake, lb. .... .15¾

Fabric, Tire (17¼ oz.):
Sea Is., combed, sq. yd. 1.40
Egypt, combed, sq. yd. 1.25
Egypt, carded, sq. yd. 1.20
Peelers, combed, sq. yd. 1.10
Peelers, carded, sq. yd. .85

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
Ceylon, lb. .... .09 -.22
Madagascar, lb..... .10 -.15
Mexico, lb. .... .03¾

Lead, lb. .... .05 -.05¼

Leather:
Hides, lb. .... .24 -.39½

Nickel, lb. .... .40

Oil:
Gasoline:
Auto, gal. .... .24½
68 to 70 gal....... .30½
Lard:
Prime City, gal..2.45 -2.50
Ex. No. 1, gal...1.15 -1.20
Linseed, gal. ....1.45 -1.48
Petroleum (crude):
Kansas, bbl. 2.25
Pennsylva'a, bbl..4.00
Menhaden (dark), gal. .... .95

Rubber:
Plantation:
First latex pale crepe, lb. ...... .48½-.49
Brown crepe, thin, clear, lb. .... .44
Smoked, ribbed sheets, lb. ..... .47½

Para:
Up River, fine, lb... .56
Up River, coarse, lb. .... .34
Island, fine, lb...... .47½

Shellac (orange), lb.. .60 -.64

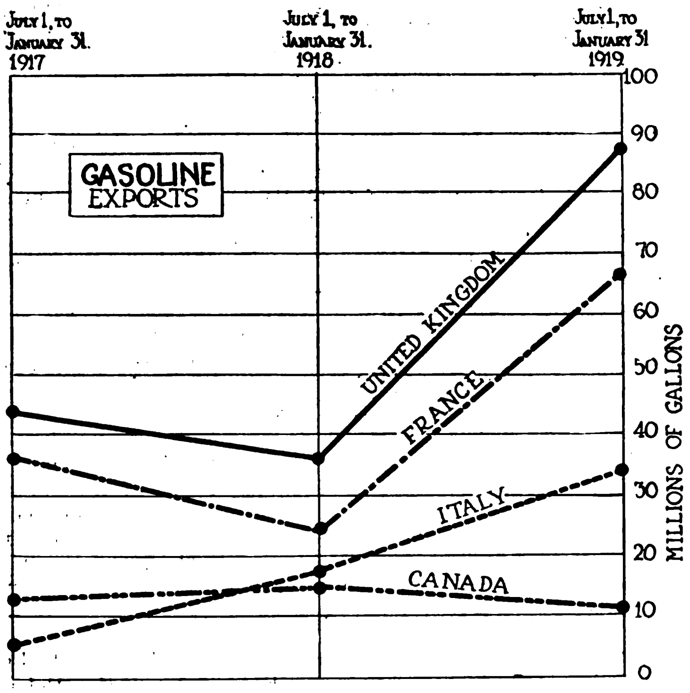
Spelter, lb. .... .06¼-.06½

Steel:
Angle beams and channels, lb. ..... .03
Automobile sheet (see sp. table).
Cold rolled, lb..... .0625
Hot rolled, lb....... .039

Tin .... .71 -.72

Tungsten, lb. ....1.50 -2.10

Waste (cotton), lb.. .12¾-.17



Showing the enormous demand made by the Allies for gasoline for war purposes during 1918

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock................	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock................	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping.........	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping................	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.
Blank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.
Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automative Securities on the Chicago Exchange at Close of April 5

	Bid	Asked	Net Ch'ge
Auto Body Company......	9	10	+1
Briscoe Motor Car com....	13	..	..
Briscoe Motor Car pfd....	50	65	..
•Chandler Motor Car.....	126	128	+1⅛
Chevrolet Motor Car......	189	191	..
Cole Motor Car Co........	93	105	..
Continental Motors com..	7¾	8¼	+⅛
Continental Motors pfd...	98	101	..
Edmunds & Jones com...	15	20	..
Edmunds & Jones pfd....	75	90	..
Electric Storage Bat.....	69	71	..
Federal Motor Truck.....	34	36	..
Fisher Body Co. com.....	56	58	+1
Fisher Body Co. pfd......	92	94	—3
Ford Motor of Canada...	285	295	..
General Motors com......	170¼	171½	—¼
General Motors pfd.......	89¾	91¾	+¼
Hupp Motor Car com.....	7¾	8¼	—⅝
Hupp Motor Car pfd......	96	100	+1
Kelsey Wheel Co. com...	35	37	—2
Kelsey Wheel Co. pfd....	93	95	—1
Manhattan Electric S. com.	..	48	..
Maxwell Motor com.......	36¾	37¾	—2⅛
Maxwell Motor 1st pfd....	65	66	—2½
Maxwell Motor 2nd pfd...	30½	31½	—1
McCord Mfg. com.........	32	35	—1
McCord Mfg. pfd.........	91	93¼	..
Mitchell Motors Co.......	27	31	..

	Bid	Asked	Net Ch'ge
Motor Products Corp......	..	35	..
Nash Motors Co. com.....	230	250	..
Nash Motors Co. pfd.....	95	100	..
National Motor Co........	15	20	..
Packard Motor Car com...	120	123	+5
Packard Motor Car pfd...	99	101	..
Paige-Detroit Motor com.	28½	29½	+½
Paige-Detroit Motor pfd..	8¾	9¾	..
Peerless Motor Truck....	21	23	—1
Pierce-Arrow M. Car. com.	45¾	46¾	+½
Pierce-Arrow M. Car pfd.	102	104	..
Premier Motor Corp. com.	5	..	..
Premier Motor Corp. pfd.	..	75	..
Prudden Wheel Company.	18	19	..
Reo Motor Car Co........	23½	24¼	..
Republic M. Truck com..	39½	41	+3½
Republic M. Truck pfd...	91	95	..
Saxon Motor Car com.....	6½	8½	..
Scripps-Booth Corp.	21	25	..
Stewart Warner S. Corp..	89½	91½	+¼
Stromberg Carburetor Co.	38	40	..
Studebaker Corp. com....	64⅜	65⅜	+⅝
Studebaker Corp. pfd.....	94	97	..
•Stutz Motor Car Co......	50⅝	51⅝	+⅛
United Motors Corp......	45	47	+1¼
White Motor Co..........	54¼	55¼	+1½
Willys-Overland com.	28⅝	29⅝	—¾
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co..........	74½	75½	+3
Firestone T. & R. com....	147	150	..
Firestone T. & R. pfd....	101	102	+1½
Fisk Rubber Co. com.....	108	111	+5
Fisk Rubber 1st pfd......	100	105	..
Fisk Rubber 2nd pfd......	107	110	+6
Fisk Rubber 1st pfd. conv.	99	101	..
Goodrich, B. F., com.....	65¼	66¼	—1⅛
Goodrich, B. F., pfd......	106½	107½	..
Goodyear T. & R. com....	270	275	..
Goodyear T. & R. 1st pfd.	105½	107	—½
Goodyear T. & R. 2nd pfd.	106½	108½	+¼
Kelly Springfield com....	118½	119½	—1
Kelly Springfield 1 pfd....	95	97	..
Lee Tire & Rubber Co....	25	26	+1
Marathon Tire & Rubber..	52	70	—3
Miller Rubber Co. com....	175	178	..
Miller Rubber Co. pfd....	102	103	+½
Rubber Products Co......	129	133	—4
Portage Rubber Co. com..	158	162	—5
Swinehart T. & R. Co....	80	84	..
U. S. Rubber Co. com....	83½	84½	+⅛
•U. S. Rubber Co. pfd....	111¼	112¼	+½

•Ex dividend.

Collision Abandonment Insurance Now Available

KANSAS CITY, April 9—A new kind of insurance, which provides payment by the insurance company of the unpaid notes held by dealers when a car or truck is damaged by collision and abandoned by its purchaser, is being written by the Employers Indemnity Corp.

This insurance is paid for by the purchaser when he buys the car, the charge being included among the other various items involved in arranging for the time sale. The dealer usually requires that the purchaser take out fire and theft insurance and some other coverages.

The new insurance protects the interests of the dealer (or of the banker or other person who may hold the notes). The policy costs $5 to $15, depending on the list price of the car. The purchaser has no interest in the indemnity. The policy explicitly guarantees to the dealer or holder of the notes that in case the car is damaged and abandoned the insurance company will take up the unpaid notes. The company is given possession of the car and takes its chances on salvage.

—

Natl. Welding Assn. Organized

NEW YORK, April 9—The American Welding Society was formed at a meeting March 28 at the Engineering Societies Building. C. A. Adams, Cambridge, Mass., was elected president. Other officers elected were: Vice-president (1 year), J. M. Morehead, New York; vice-president (2 years), G. L. Brunner, Utica, N. Y.; treasurer, W. E. Symons; secretary, H. C. Forbes; directors (1 year), W. M. Beard, New York; M. H. Roberts, New York; M. M. Smith, New York; L. D. Lovekin, Philadelphia; Alexander Churchward, New York; W. H. Patterson, Pittsburgh; Walter J. Jones, Philadelphia; C. A. McCune, New York. Directors (2 years): R. R. Browning, New York; A. S. Kinsey, Jersey City; Victor Mauck, Conshohocken, Pa.; E. L. Hirt, South Bethlehem; J. F. Lincoln, Cleveland; H. M. Hobart, Schenectady, N. Y.; D. C. Alexander, New York; H. R. Swartley, Jr., Jersey City. Directors (3 years): L. H. Davis, New York; E. L. Mills, New York; D. B. Rushmore, Schenectady; James Burke, Erie; D. H. Wilson, Jr., New York; Herman Lemp, Erie; C. J. Nyquist, Chicago; Alexander Jenkins, Baltimore. The society is a merger of the welding committee of the Emergency Fleet Corp. and the National Welding Council.

—

Decline in Malay Rubber Exports

WASHINGTON, April 9—Rubber exports from the Federated Malay States and Straits Settlements declined in 1918 to 140,631 tons as compared with shipments of 152,923 in 1917. This was due to the lack of cargo space and to the American restrictions on imports. Many of the rubber companies in Malaya voluntarily restricted their tapping operations, but notwithstanding there was a considerable amount of rubber stored at Singapore at the close of 1918. Following are the export figures for the past three years:

	Federated Malay States			Straits Settlements		
	1916 Tons	1917 Tons	1918 Tons	1916 Tons	1917 Tons	1918 Tons
Jan. ...	4,471	5,995	7,588	4,443	3,562	4,302
Feb. ...	5,207	7,250	6,820	3,359	6,495	2,334
Mar. ...	4,429	7,088	7,709	4,481	8,299	8.858
April ..	3,914	5,955	7,428	4,219	6,103	6,584
May ...	3,956	7,179	5,881	3,274	6,282	13,587
June ..	5,114	6,009	5,161	3,836	8,775	6,515
July ..	5,053	5,798	5,706	5,106	7,351	1,978
Aug. ..	5,782	6,487	5,291	3,246	8,786	1,249
Sept. ..	6,376	7,087	6,588	2,987	5,679	6,209
Oct. ...	5,968	7,079	5,901	5,233	4,702	3,260
Nov. ..	6,776	6,180	7,097	5,247	5,555	2,661
Dec. ...	5,718	7,724	7,085	3,219	6,503	4,889
Total	62,764	79,831	78,255	48,650	73,092	62,376

The Straits Settlements' totals include transshipments amounting to 7416 tons in 1917 and 4447 tons in 1918.

—

Goodrich-Lenhart Moves to New Factory

HAMBURG, PA., April 7—The general office of the Goodrich-Lenhart Mfg. Co. has been moved here, where the company has recently completed a new factory building. A sales office will be maintained in the Widener Building, Philadelphia, where it has been located for the past three years.

Chamber Recommends Repeal of Anti-Trust Law

WASHINGTON, April 4—Reconsideration by Congress of all anti-trust legislation is recommended by American industry as the result of a referendum vote of the business interests of the country represented in trade and commercial organizations, instituted by the Chamber of Commerce of the United States. Complete returns from the referendum, made public to-day, show that the constituent membership of the chamber voted in favor of all four proposals advanced by a special committee which has studied the subject.

The proposals and the vote follow:

Congress should be asked immediately to consider the present situation of all statutes constituting our anti-trust legislation—for, 1543; against, 51.

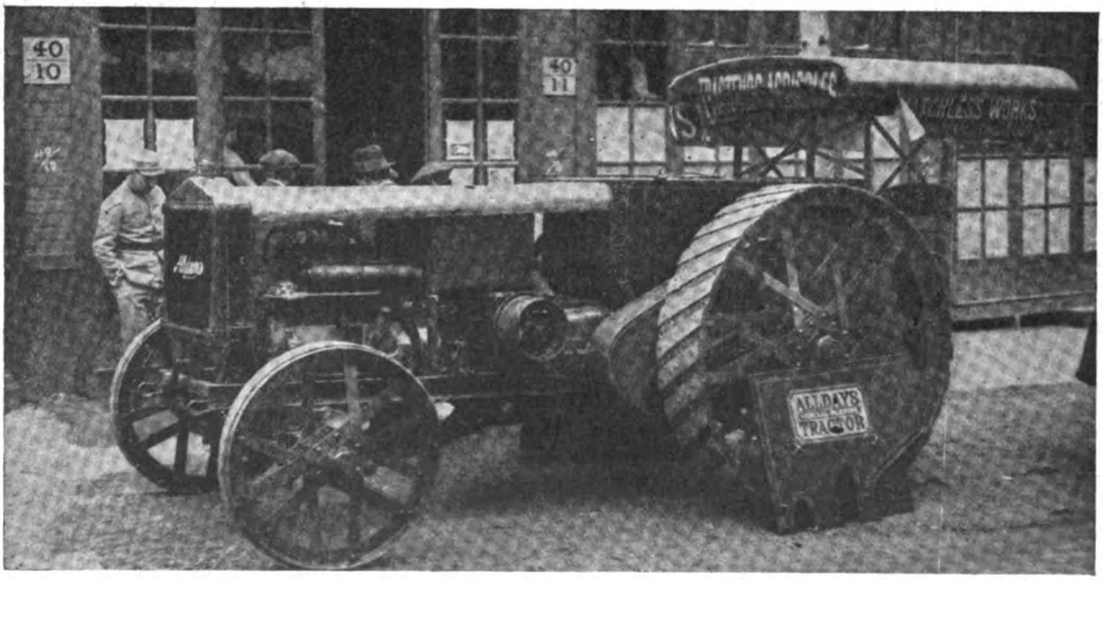
In reconsideration of existing anti-trust legislation there should be formulation of standards of general business conduct to be administered by a supervisory body—for, 1159; against, 389.

An enlarged Federal Trade Commission should be made the supervisory body—for, 1102; against, 437.

In view of the importance of the functions of the Trade Commission as they would exist the membership of the Federal Trade Commission should be increased to nine—for, 1104; against, 422.

The committee's report and the results of the vote are significant in view of the fact that the subject of anti-trust legislation will be taken up at the seventh annual meeting of the chamber to be held at St. Louis April 28 to May 1.

In requesting a vote on this legislation, the chamber pointed out that there were several hundred proceedings against great industrial concerns based on the Sherman act, and that frequent interpretations of the law had made it almost impossible for a manufacturer to know when he was violating it. It further pointed out the discouragement to business enterprise created by the act. Suggestion for the continuation and enlargement of the Federal Trade Commission was made because the commission has obtained a mass of information about American industry and commerce.



An English type of farm tractor exhibited at the Lyons Fair in France. It is the Alldays & Onions machine

Calendar

ENGINEERING SHOWS

April 5-12 — Bridgeton, N. J. Fourth Annual, Automobile Dealers' Assn.

April 5-12—Montreal, Can.—National Motor Show of Eastern Canada, Victoria Rink. T. C. Kirby, Manager.

April 8-12—Deadwood, S. D. Seventh Annual. Cars and Tractors, Deadwood Business Club.

April 16-19 — Waynesburg, Pa. Automobile Dealers' Assn. of Greene Co., Armory. Frank L. Hoover, Mgr.

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and Accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-15 — London — Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December—Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

April 15—Walla Walla, Wash. Sectional Tractor Demonstrations.

May 5—Sacramento, Cal. Sectional Tractor Demonstrations, Demonstration Field.

June — Denver, Col. Sectional Tractor Demonstrations.

July—Wichita, Kan., Automotive Committee of National Implement Assn.

Aug.—Aberdeen, S. D. Sectional Tractor Demonstrations.

RACES

April 24—San Bernardino, Cal. Rim of the World Hill Climb.

†May 17—Uniontown, Pa., probably 112½ miles.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*June 14—Sheepshead Bay, L. I. Speedway race.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15—Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

†Sanctioned.
*Tentative dates.

CONVENTIONS

April 10-12—Philadelphia. National Assn. of Motor Truck Sales Mgrs., Bellevue-Stratford.

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

May 1-June 1 — Atlantic City, N. J.—Pan-American Aeronautic Convention and Exhibition — Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

Sept. 22-24—Philadelphia, Annual Convention, National Association of Purchasing Agents, Bellevue-Stratford.

Foreign Trade Opportunities

WASHINGTON, April 7—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has inquiries for the agencies of automobiles and accessories. Full information regarding each of the following can be secured by addressing the Bureau of Foreign and Domestic Commerce and referring to the Foreign Trade Opportunity number:

Italy — Agricultural machinery. Correspondence should be in Italian. No. 28899.

France—Heavy trucks. No. 28880.

Swedish buyer of harvesting and agricultural machinery is about to arrive in this country and desires to be placed in communication with American manufacturers and exporters. No. 28884.

France—Motor cars and accessories. Correspondence should be in French. No. 28907.

Norway—Electric touring cars (without tops), with chauffeur's seat in front, Edison batteries preferred; and rubber tires. No. 28910.

Algeria—Motor vehicles, to maintain a depot for same, and to secure an exclusive general agency for the sale in North Africa of automobiles, tractors, and other motor driven vehicles which might find ready sale in that country. It desires to establish a depot for these vehicles with all accessories, and requests catalogues and prices. No. 28912.

Scotland—Motor vehicles, principally 1-ton chassis, suitable for vans. No. 28923.

Switzerland—Industrial machinery. Correspondence should be in French. No. 28927.

Italy—Automobiles and accessories, including pneumatic tires, greases and oils for lubricating. Payment guaranteed through bank deposit. Correspondence should be in Italian. No. 28928.

Machinists Endorse Short Hours to Reduce Labor Surplus

COLUMBUS, April 9—Delegates to the convention of the Ohio Federation of Machinists have before them for consideration resolutions indorsing a 44-hour week and if necessary a 32-hour week to give employment to the 25,000 machinists said to be out of work because of the cancellation of government contracts.

To Popularize Magneto Ignition

NEW YORK, April 9—Five of the principal manufacturers of magnetos have banded together for the purpose of instituting a propaganda campaign to popularize the more extensive use of magnetos on various forms of automotive equipment. The association has established headquarters at 110 West Fortieth Street, New York. It includes Splitdorf Electrical Co., Newark; Bosch Magneto Co., Springfield, Mass.; Simms Magneto Co., East Orange; Eisemann Magneto Co., Brooklyn, N. Y.; Ericsson Mfg. Co., Buffalo.

Garage Association Formed

BOSTON, April 5—The Garage Association of Metropolitan Boston has been formed with a membership comprising active and associate members of more than 500. It plans to extend its activities throughout Massachusetts first and later all over New England.

Union Switch to Make Shafts

SWISSVALE, PA., April 5—The Union Switch & Signal Co. has purchased machinery for finishing crankshafts and camshafts, and will be ready for delivery about June 1. It manufactures its own forgings.

Singleton Advertising Co. New Name

CLEVELAND, April 5—The Singleton-Hunting Co., advertising agency, has changed its name to the Singleton Advertising Co. The management, personnel and financial status remain the same as before.

Dutch Rubber Activities Restricted

WASHINGTON, April 7—Rubber trade in the Dutch rubber market has not increased during the past year, according to the annual report of the Amsterdam Association for the Rubber Trade. No rubber whatever can be distributed to factories except under strict conditions imposed by the Netherlands Oversea Trust, which permitted distribution of only 464 tons during the past year. The report states that, contrary to expectations, the rubber trade will not be able to operate without restrictions despite cessation of hostilities. The shortage of cargo space will restrict the activities of the trade for a long period.

Greenfield's Second Show in Armory

GREENFIELD, MASS., April 7—Cars, trucks and tractors took part in the second motor show held here at the State Armory. As there were no miscellaneous accessory booths there was adequate room for the display of the vehicles. Dealers and distributers staged their own displays, which included the principal makes of motor vehicles of all kinds.

Elgin to Build Canadian Plant

WINNIPEG, MAN., April 7—The Elgin Motor Co. will build an assembling plant here to cost about $100,000.

Factories Urged to Adopt Open-Air Sports

DETROIT, April 5—The Recreation Commission will hold a conference for Detroit manufacturers Thursday, April 10, to organize plant welfare workers in promotion of inter-plant athletics and recreation. The big plants will be asked to form baseball clubs, tennis clubs and clubs for other athletic games.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 16

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, APRIL 17, 1919

Fifteen cents a copy
Three dollars a year

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL — NEW YORK—THURSDAY, APRIL 17, 1919—CHICAGO — NO. 16

Necessary Internal Co-operation

Between Employer and Employee

Must Be Mutually Evolved

Capital and Labor Are Equal Necessities in Modern Industry, Says Steinmetz, and Must Be Equally Represented in Management and Distribution of Profits

NEW YORK, April 11—Dr. Charles P. Steinmetz of the General Electric Co. expressed his views on the present chaos in the labor situation and the strife between capital and labor before the editors of New York business papers to-day by declaring that the necessary internal co-operation between the organizations and the workers will never come about until both parties mutually evolve the scheme. It will not do for the scheme to be evolved by the organization and thrust upon the workers, because then it will be viewed with more or less suspicion by the workers, and will be considered paternalistic to a greater or less extent.

Many organizations have advanced schemes for closer co-operation with their workers, but these have not been favorably accepted by the workers solely because they originated with the organization and the worker had nothing to do with the formulation of them. In all such cases the worker does not accept such suggestions favorably even if they might work for his good.

Internal co-operation that will be effective must come from the workers as well as the organization, and if a corporation has in mind evolving an improved scheme it is necessary for the workers to be given equal representation in the formulating and evolution of the plan. Such a plan, evolved under such conditions, will undoubtedly succeed if its fundamentals are correct, whereas such a plan evolved solely by the organization and thrust upon the workers would, in nine cases out of ten, not succeed.

Dr. Steinmetz believes that the organization must make greater sacrifices, make much greater expenditures of money and go immeasurably farther than it has gone up to this time in co-operation of labor in order to solve the present labor chaos. He advanced many reasons for this: Generally speaking, the organization heads are much better educated than the workers and so should be expected to take a broader view of the case. Many of the organization are college graduates, whereas too many of the workers have had to leave school at 14 and have had no opportunity of completing their education. It is really natural to expect that those who have had to neglect their education cannot take as broad a view of the situation as those who have had the opportunity of going through college. Because of this, the organization must take a broader view than it is inclined to take, and must view with greater clearness the radicalism, or, perhaps, unbusinesslike view, expressed by many of the workers.

The results leading up to the present division between capital and labor or between organizations and workers are historical, according to Dr. Steinmetz. It started when industry began growing and the factory owner could not keep in touch with his individual workers as he did at one time. This led to the appointment of superintendents, foremen, etc., whose acts ostracized workers to quite an extent. The employer got out of touch with his workers; he drifted away from them, his mind was engrossed in the development of business and the progress of the worker was neglected.

Inauguration of Labor Unions

This led to the creation of labor unions which were started for offensive purposes and literally became a hostile camp to the organization. It has taken a generation or more to bring about this condition of hostilities and it is not going to be corrected in a day, a week, a month or a year. And bringing about the desired internal co-operation is going to be a long slow process, in which the organization or employer must take the lead.

Dr. Steinmetz outlined the various systems that have been used by organizations to obtain closer co-operation, but dismissed most of them as being unsatisfactory, and advocated a plan in which capital and labor would have equal representation in each other—would be one group instead of two groups, namely, labor and capital. In his plan, labor would be equivalent to capital. The worker would have labor stock and the organization would have capital stock. Both organization and labor would share in the profits, getting dividends, one on capital stock and the other on labor stock. Both would share in the management; both capital and labor would be entitled to a fair rate of interest, capital on the money invested and labor on the wages for work done. All profits beyond this belong to capital and labor, and should be divided as dividends, part on the capital stock and part on the labor stock.

Dr. Steinmetz's address complete follows:

There is an old saying, "In unity lies strength and a house divided against itself must fall." If that is true of anything, it is true in Mother Industry, and particularly true to-day where modern civilization in the world's war has practically become bankrupt, and we now, as receivers, have to reorganize the world again. Our industries must have co-operation to be successful, efficient; to be able to take care of the world's work as it has to be done to redeem our civilization from what has occurred in the last few years. But is it possible?

Interests of Capital and Labor

The socialistic radical labor agitator tells us there can be no peace between capital and labor. They are inherently antagonistic and must fight to a finish because the interests of one are against the interests of the other. In industrial depression the employer as well as employed suffer. The old-time corporation president preaches to us that capital and labor interests are identical; that if the individual interests are trusted to his keeping that they will be taken care of. At the same time every child sees and knows that a dollar more paid out in wages means a dollar less profit and that the interests of capital and labor are different—entirely opposite in some respects. We cannot get any further in solving the problem if we take an extreme view one way or the other. Capital and labor interests are not identical but are the same in some respects and opposite in other respects. In general, in any industry, those interests which have to do with industry on the outside, customers, etc., are usually identical.

How to Institute Co-operation

Within the industry the interests of employer and employee are often opposite to each other. There are relations in which capital and labor interests are identical and some in which they are not identical, but there are many other relations in our modern civilization where there are common interests and unidentical interests. Take buyer and seller, manufacturer and customer, landowner and renter. Many interests in common, and still we do not have warfare. They are not going to fight merely because there are some features where the interests are opposite. In all those relations where the relations exist as between employer and employee, there is no settlement of the condition by fight and warfare; but on the contrary there are often, usually very often, friendly relations between the manufacturer and customer. It is not the historical relation, as we unfortunately find, in this one feature. Why is it necessary that employer and employees and capital and labor cannot get along in the same manner by co-operation? The reason is historical. Originally the employer and employee bore an equal standing as regarding industrial power in the days of small manufacture. The organization of employers as represented by the formation of industrial corporations meant an increased power on the side of the employer and a disadvantage to the employed, until labor organizations were formed; but conditions had already become hostile.

How to bring the co-operation about; how to return to such conditions as should have remained operative, is the main problem, because we must bring about co-operation within our industry if we wish to meet the demands of the new world.

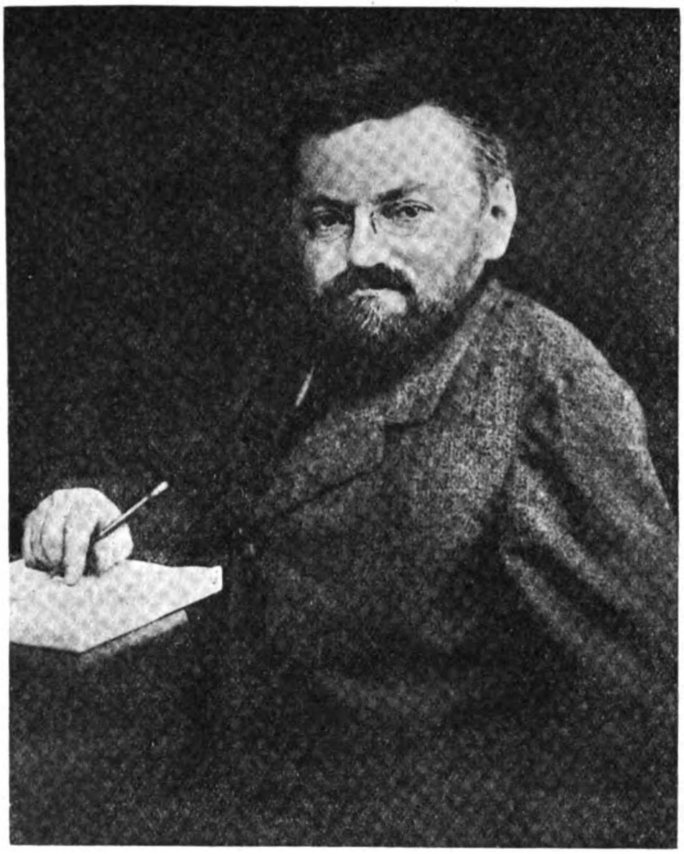
It has taken two generations of development to bring about the present unfortunate situation where differences are settled by fighting. We cannot expect to secure this co-operation by merely wishing or talking about it. It is a long, slow, difficult work which will mean many setbacks, and we have to remain at it and fight for it.

Employer Expected to Have Broader View

Adjustment must come first from the employers, but not from any moral reason. The present situation is not the fault of labor more than capital. It is merely historical development of a situation beyond the control of man. The employer must have a broader view than the employees. We must not forget that there are still many imperfections in our civilization. Most serious is that a large majority of men cannot enjoy complete education, as would be desirable for making the most of themselves, and heads of industry as a rule have the benefit of the broader education and must take the broader view of things. We cannot expect the same broad view of the one who left school at fourteen years of age as the one who has enjoyed a more extensive education. That the initiative must come from capital is realized. All through groups of occupations and industries we have talk on co-operation. We must realize it does not mean to spend a few dollars here and there, but the work is probably the most important development in the industrial field which faces us to-day, and men must devote their time and attention to it and must give high-grade service the same as those in charge of other administrations. We cannot expect to see any positive results until we are really willing to approach it more seriously in time, interest, quality of men and amounts of money devoted to bringing about industrial co-operation.

Co-operation implies two parties working together, not one settling the matter and telling the other you must do that and that and then we will co-operate. Unfortunately, most of the serious efforts made in this direction have been of that character—that the employer has worked out plans and then asked the employees to co-operate on those plans. Very often those plans are good and the whole scheme would have been satisfactory if it could have been worked out jointly, but it came as paternalism and was therefore tainted from the beginning. That is not co-operation.

It is easy to say we must have co-operation; also to find fault. It is not easy to make suggestions how it should be done and how the present strained relations between capital and labor should be overcome. Probably there is no single way to bring about true co-operation. It depends largely on local conditions and social conditions. In short, there is not a broad and single way. Before we try to find out let us discover the relation of Mother Industry. One attitude, the attitude of the old-time employer, which means industry is private property of the one who supplies the capital. That is the old-time relation where industry is private property of the owner, which recognizes only capital and not labor. This relation was destroyed forever at the moment when President Roosevelt interfered in the anthracite coal trouble and brought both sides to terms. The other extreme is the socialistic conception that all wealth is created by labor and that all wealth therefore belongs to labor and that capital is a parasite on labor due to having acquired a monopoly of the means of production. At present industrial production requires capital and labor. Both are necessary. Labor unrest is a demand for a share of the profits of industry and a share in the management of industry. This is the final foundation of all our social unrest. Since they are both necessary it is right that they both demand a right in the share of the profits and management of industry. There are several ways—mostly unsuccessful. One way, welfare work, which is important and useful but offensive and insulting, by being forced on labor in a paternalistic manner. It is appreciated where not done as a welfare work but merely as a matter of corporate self interest. We must realize quality of one's work depends on conditions under which work is done. That makes the difference in the self-respect and quality of the man. This will not bring about co-operation. We must not use the name welfare work. It should be called an Industrial Relation Department or Committee, instead of Welfare Department. The most difficult thing in co-operation is to put yourself in the other's place and see things as he sees them.



DR. CHARLES PROTEUS STEINMETZ was born in Silesia and educated in Berlin and Zurich. He came to America more than 30 years ago and is at present chief consulting engineer for the General Electric Co., Schenectady. When Steinmetz reached America he had just $10 in his pocket. He is physically handicapped as very few men are, and yet has risen by sheer force of will and intellect to a commanding position as a worker and a thinker. He has written many books on various subjects and is considered by many to be the greatest electrical engineering genius in the world.

Another attempt which has been made is the attempt of getting closer relation by the bonus system, giving bonuses during times of industrial prosperity and getting the employee interested in the industry. To some extent that is all right. Somewhat of paternalism. It may be all right in Germany, where people have been trained to look up to their masters as superiors, but leaves a bad taste among Americans. They are prone to ask, "Why not give us an increase of wages instead of a bonus?" The bonus system has the disadvantage of sharing only in profit, not in management.

Another attempt is the committee system, claimed to have been successful in England. There are several forms. There are the committees elected by employees which take up with employers all relations of mutual importance and interest, arbitrating wages, hours, etc. Another form is joint committee, half of which is elected by employees and half by the corporation. This appears to have very much in its favor. There are, however, some difficulties. The most serious difficulty is that labor has its own organization, and such action is apt to be taken by labor unions as not recognizing them. Labor unions claim that they represent the employees. Facts show in many cases that they are right, because while union men may often have a minority among employees, when serious questions arise, experience very often shows that the majority of non-union workers take the lead of the union rather than the non-union committees. Shop committees are liable to be considered as eliminating the labor unions by putting up a rival union. While leaders of industry recognize the necessity of co-operation, unions of labor organizations have not yet realized the advisability of co-operation in industry. But there is another side. Do we want the committee system? Let us assume it is successful. A board of directors on one side and a labor committee or committees on the other. Is this not another warfare by organizing two different parties? The last is wage dividend. Mother Industry requires capital and labor. Therefore both are entitled to share in the profits. Capital is entitled to a fair rate of interest on the money invested and labor is entitled to a fair rate of wages for the work done. All profits beyond that belong to capital and labor. These should be divided as dividends, being dividends on capital stock, the other being divided on labor stock as found by yearly wages. This system is in operation in a number of corporations, in electric utilities companies and others. It lacks provision for share in the management. But we could carry it further and recognize labor as equivalent to capital and give the labor stockholder the same right as the capital stockholder in the management. This would be revolutionary, but both would share in the profits, getting dividends, one on capital and the other by labor stock. Both share in the management (labor union officials could hold the proxies). This does not set up rival administration, but brings about joint control by evolution and not by revolution. The question is: How far should employees be recognized as stockholders? Should every one, even if he joined yesterday, vote to-day? There are many things that show that only those who have been with the organization for a number of years should be recognized as wage stockholders, taking part in dividends and management. We could set the limit at ten years. There would not be many and would not make any radical change in industry, and every year or so we could change the minimum, going down to six or five years. This would eliminate any opposition except from the extreme socialists who refuse to recognize capital at all.

Finally, leave only laboring men as stockholders. This revolution could be brought about by evolution if desired. This could be carried to full socialization of society by evolution, as the final outcome of our industrial development.

Gear Makers Hold Successful Meeting

Company Representation in American Gear Manufacturers' Association Doubled Within a Year—Progress Made in Standardization Work—Technical Papers Read and Discussed

By P. M. Heldt

WORK on its standardization program and the reading of technical papers filled most of the 3 days' session of the American Gear Manufacturers' Convention held at the Hotel Statler in Cleveland on April 14, 15 and 16. The Association is a rapidly growing one, as is shown by the fact that while at the time of the meeting at White Sulphur Springs, W. Va., last year there were only 32 member companies, the number had increased to 59 at the time this meeting was called, and several more were added in the course of the meeting. As President Sinram expressed it in his inaugural address, most of the manufacturers of cut gears are now represented in the Association.

The present meeting brought the Association to the close of its second year. In his inaugural address President Sinram said that the third year of the Association's activities opened with our country and business confronted with many large problems, and that few would question the statement that the future would demand radical changes in many directions. In the evolution already under way, co-operation would light the way to many of the problems arising. The character and extent of this co-operation would measure the influence of the American Gear Manufacturers' Association and would have a distinct bearing on the stability of the industry.

President Sinram's Address

Mr. Sinram quoted Otto Kahn, the eminent New York banker, who, in a recent address before the Cleveland Chamber of Commerce, stated that the United States was facing the greatest era of prosperity in its history, and, farther, that this country would stand fast no matter what happened in Europe. Nearly a year ago, at the White Sulphur Springs meeting, in speaking of the Gear Makers' Association, he had made the statement that "The foundation had been completed and was substantial." Notwithstanding the unprecedented demands upon industry during the interval, the American Gear Manufacturers' Association had made progress.

Membership in the A. G. M. A. had become a valuable asset to the gear manufacturer. The second year of the Association closed with over 60 interests privileged to use its monogram, these being represented by more than 120 leaders of the art. Few were the representative manufacturers of cut gear who were not affiliated with the A. G. M. A. This membership evidenced a desire and willingness to co-operate, and an appreciation of the value of the exchange of ideas on subjects of common interest.

Referring to the subject of standardization, Mr. Sinram said the evolution of gear standards was an obligation the gear makers owed not only to themselves, but to the collective gear purchasers and the enginering world. While gear standardization in the aggregate was a task of considerable magnitude, a start with the simpler phases would form the foundation on which they might build successfully. Definite and specific standards would be recommended for the consideration of the Association in the near future.

Demands of the war and other conditions had restricted progress during a part of the year just closing. However, a most successful meeting solely in the interests of standardization was held in Buffalo in February. Another meeting was held at Buffalo on March 27 by the Commercial Standardization Committee, and as a result definite and specific recommendations would be submitted for consideration to the Association.

Some consideration had been given to the formation of a division or bureau to adjust controversies as to product between manufacturer and purchaser—a plan to insure equitable settlement without litigation. Times and conditions considered, the A. G. M. A. was to be congratulated on its progress and the present state of the organization. A successful industrial organization had been developed under most abnormal conditions and was now available for service. To be of greatest benefit to the membership now demanded activity in practically every phase of Association endeavor, and the success of the A. G. M. A. was the responsibility of every representative.

Standards Committee Meeting

After the official welcome to Cleveland by a representative of Mayor Davis and the reading of President Sinram's inaugural address, the meeting was turned over to Chairman F. B. Waterman of the Standards Committee. The entire afternoon of the first day was devoted to reports of various subcommittees of the Standards Committee and discussions thereon. Reports were made by the following sub-committees: Spur Gear, Bevel and Spiral Bevel Gearing, Worm, Worm and Spiral Gears, Herringbone Gears, Sprockets, Composite Gearing, Gears and Pinions for Electric Railways and Mine Locomotives, Hardening and Heat Treating, Inspection.

None of the work of the sub-committees was in such shape that final action could be taken on it, and the recommendations definitely adopted as standards at this meeting of the Association. Hence it is not considered advisable to go into the details of the reports and discussions.

The greatest progress had been made by the Commercial Standardization Committee, which had worked out a blank contract form which it is expected the Association will definitely adopt immediately.

This will form the basis of any contract entered into for the manufacture of cut gears by members of the Association, and covers all the points that come up in doing such work.

Technical Session

What may be described as a technical session of the meeting took place Tuesday forenoon, when three papers on subjects of interest to gear makers were read. The first paper on "Gear Steels," was by Dr. J. Heber Parker of the Carpenter Steel Company. We expect to reprint this paper in full in an early issue of AUTOMOTIVE INDUSTRIES. Mr. Parker said that cut gears might be conveniently divided into three classes, namely, gears for automotive, electric car and commercial or jobbing use, respectively. They might also be divided into two classes according to the grade of steel used and the kind of heat treatment given it, into case hardened and tempered gears.

The question had often been asked as to which of these two classes was the better, but the only answer that could be given was that each was best adapted to a particular class of work. Tempered steel gears were best for clash gears, while case-hardened gears were best for constant mesh gears. With tempered gears, misalignment of shafts was sometimes a cause of pitting. This could be overcome by a change in the drawing temperature and sometimes by an increase in the length of gear face.

Dr. Parker said that there were in use six grades of steel

for automotive gears, and he gave a table showing the chemical compositions and the physical properties of these steels. It is of interest to note in this connection that the elastic lin.it of the core material of case-hardened gears made from these steels varies from 50,000 to 150,000 lb. per sq. in.

Discussion of Dr. Parker's Paper

This paper was followed by a lively discussion. E. J. Frost asked the speaker whether he had made any experiments to determine what percentage of phosphorus and sulphur was necessary to produce any harmful effect on the properties of steel. Dr. Parker said that the impression that phosphorus and sulphur were very detrimental constituents had been handed down from the dark ages. During the war the Standardization Committees of the Society of Automotive Engineers and the American Society for Testing Materials had let down the bars on phosphorus and sulphur to a large extent, simply because it was impossible to obtain steel in the large quantities required under the rigid specifications as to these two elements which had previously been insisted upon.

Dr. Unger of the Carnegie Steel Co. had made some tests with high sulphur steels in which the excess sulphur was added to the steel in the mold, and his results showed that an excessive sulphur content had no deleterious effect, but this method of adding the sulphur had been objected to by some of his colleagues.

Dr. Parker said that the greatest value of a low sulphur in steel was really the fact that it was a criterion of the conditions under which the steel had been produced, because sulphur could be eliminated only by means of a reducing slag, and the fact that there was a low sulphur content therefore showed that the steel had been made in a reducing atmosphere. In order to show the real effect of sulphur on the physical properties of steel, it would be necessary to run a big open-hearth heat, and that of course would be an expensive undertaking.

A question was also asked as to whether there was not a tendency toward non-uniformity in the quality of 3½ per cent nickel steel. Dr. Parker said that this steel had a tendency to laminate, and as a result showed low values in transverse tests. The addition of a moderate amount of chromium overcame this tendency.

Dr. Parker also made repeated references in his paper to the subject of shock tests and drop tests. This matter was also referred to in the discussion and it was then brought out that it was almost impossible to make a comparison of the results of such tests obtained by different observers, owing to the use of different machines and to different conditions in making the tests. The suggestion was made in this connection that the American Gear Manufacturers' Association might take it upon itself to standardize a shock test and a shock testing machine for gear material.

Value of Vanadium Steel

A question was also asked the speaker in regard to the value of vanadium steel. His answer was that his company did not believe in the use of steels containing minute quantities of vanadium, of the order of 0.08 per cent. Vanadium steels had been exploited by the sellers of ferro-vanadium. The point had been made that the vanadium steels had better machining qualities than chrome nickel, and other high-grade steels, but here they ran up against the difficulty that there was no recognized test for machinability. Steels containing an appreciable vanadium content were of very high quality, but with vanadium climbing rapidly back to its old price of $10 per lb. the outlook for the popularization of these steels was rather discouraging.

Dr. Parker was also asked regarding the respective merits of the scleroscope and the Brinell machine for testing hardness. He said that one advantage of the scleroscope over the Brinell was that it could be used on any finished surface without destroying that surface. A scleroscope no doubt could be used very well for inspection purposes. That is, after it had once been decided that a material should show a certain scleroscope hardness, the instrument was well adapted for quickly determining whether or not the parts were up to this degree of hardness. But where it was decided to make comparative tests the Brinell instrument was preferable at least up to about 400 points.

Reference was also made in the paper to air-hardening chrome nickel steels, and in answer to a question the speaker said that these were introduced by Derihon of Belgium, and only a small amount found its way to this country previous to the war. This steel contained 0.30 per cent of carbon, 1.5 per cent of chromium and 4 per cent of nickel, and its most valuable characteristic was that it hardened in the air without practically any distortion.

The usual plan was to place the parts on an iron plate which was inserted into the furnace and heated up to a moderately high temperature, after which the plate was withdrawn and the parts allowed to cool in the air. A scleroscope hardness of 70 is about the limit obtainable with this steel. Unfortunately this steel is very hard to machine, and another difficulty is that it must be annealed within very narrow temperature limits. Where it is essential to have a hard surface without distortion this steel has its uses. During the war it was employed for the connecting rods of aircraft engines.

In order to obviate difficulty from distortion, some people in manufacturing case-hardened gears first rough them out, carbonize and quench them. Then the gears are annealed, finish-cut and rehardened.

Worms and Worm Wheels

The next paper on the program was one on "Worms and Worm Wheels," by G. W. Carlson of the Timken-Detroit Axle Co. and was of an elementatry character. Mr. Carlson brought out the fact that in the early years worm gearing was used chiefly to effect a very large reduction in speed; this necessitated very short leads and resulted in a low efficiency of transmission. People had formed an idea that whereas in spur and bevel gears the motion was very largely of a rolling character and there was only a slight amount of sliding motion, in worm gearing the motion was almost entirely sliding.

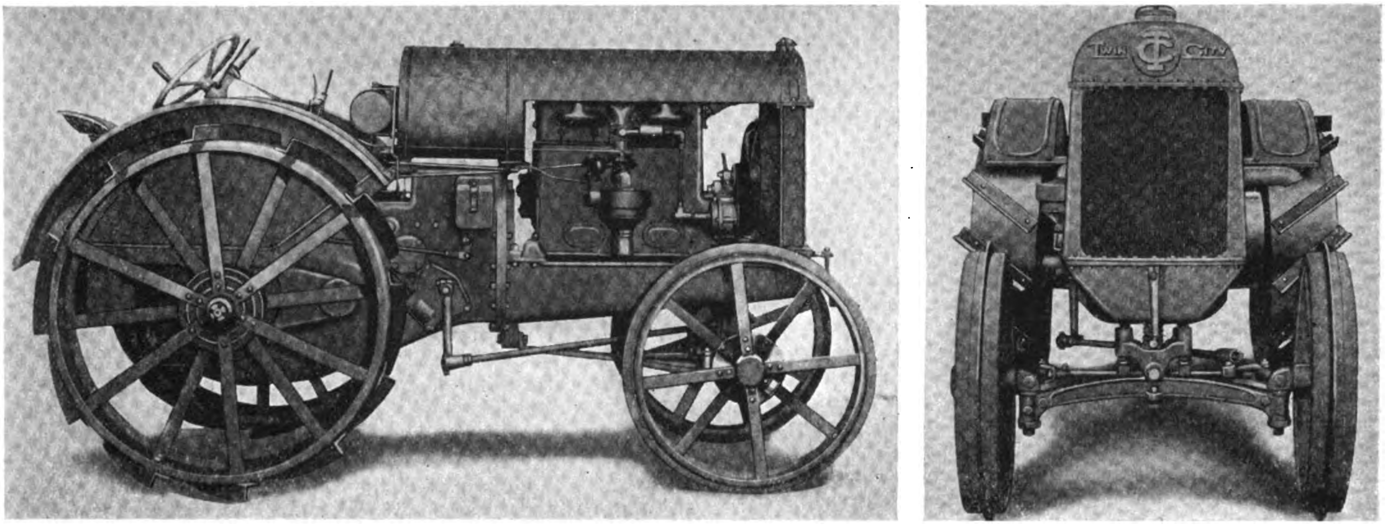
However, recent advances in the design of worm gearing had resulted in an increase of rolling and a decrease in sliding motion. Asked as to how this had been brought about, Mr. Carlson said by the adoption of a constant lead angle of 45 deg. and a pressure angle of 45 deg. taken on a line tangent to the tooth base circle of the wheel.

Mr. Carlson was asked whether the chief object in view in the selection of this large pressure angle was not to secure more space to get a grinding wheel in between the teeth, to which query he replied that the design of the gear had been perfected in England by the David Brown Co., and that he was not in position to give the reasons for the choice of pressure angle.

J. B. Foote gave some points regarding the use of worm gearing in tractor drives. He said there was a great difference in the conditions of operation of the final drive gears in motor trucks and motor tractors respectively. In plowing with a tractor the machine pulls under nearly full load sometimes for a distance of three-quarters of a mile or so without letup, and under these conditions the oil film is forced out from between the teeth, with the result that the draft is as much as 25 per cent greater when approaching the end of the field as when first beginning the furrow. Naturally, there is also a great deal of wear on the gear. Therefore, in designing a tractor worm gear the aim should be to make it large enough to prevent the forcing out of the oil film, but if this is done there will not be sufficient ground clearance. He was, therefore, of the opinion that the worm gear was not as well adapted to tractor transmission as to truck transmission.

E. J. Frost read a paper on "Proper Sizes and Materials for Gears for Tractor Construction." We expect to reprint this paper in full in an early issue of AUTOMOTIVE INDUSTRIES. The main point of Mr. Frost's argument was that by the use of high-grade alloy steels in tractor construction the necessary sizes of gears and shafts could be much reduced and thus the proper enclosure of the working parts greatly facilitated.

The entertainment features of the convention, in charge of J. C. McQuiston of Pittsburgh, were also a great success. They included a banquet at the Statler and an automobile tour through the city of Cleveland.



Side and front views of the new Twin City tractor

Twin City 12-20 Kerosene Tractor

A Three Plow Tractor with Double Intake and Exhaust Valves, Enclosed Drive, Pressure Lubrication, Thermostatic Temperature Control, Backbone Frame Construction and Front Spring Suspension

By P. M. Heldt

NONE of the new tractors put out during the past year has elicited more favorable comment than the Twin City 12-20 which was introduced to the trade at the New York and Kansas City shows. It is the product of the Minneapolis Steel & Machinery Co., and is built from designs of two well-known members of the S. A. E.: H. C. Buffington, who is responsible for the engine, and A. W. Scarratt, the company's tractor engineer. Some of the advanced features embodied in the design are removable cylinder liners, counterbalanced crankshaft, double inlet and exhaust valves in the cylinder head, thermostatic engine temperature control, completely enclosed drive, backbone frame construction and spring suspension in front. The machine is to be turned out on a quantity basis at a moderate price, and there is little doubt that it will be a strong factor in the tractor market.

The cylinder bore is 4¼ in. and the stroke 6 in. The rating of 20 hp. on the belt is very conservative, as a maximum of 35 hp. is developed on kerosene and 40 hp. on gasoline at the governed speed of 1000 r.p.m. With gasoline, a brake mean effective pressure of 93 lb. per square inch is thus obtained, and with kerosene about 82 lb. These figures are considerably above the pressures obtained from conventional tractor engines, and reflect the favorable influence of the double valves and the rational form of combustion chamber.

The cylinders, together with the upper half of the crankcase, are cast in a single block, into which are inserted the cylinder liners. These liners form the entire cylinder wall, and have a bearing or guide at both ends. At the lower end a groove is turned in the guide, which is filled with packing material, while at the upper end the liner is formed with a flange, which is fitted to a ground seat. The lower end of the liner is tapered both inside and outside, so that it can be readily inserted into the cylinder block and the pistons and their rings can be easily introduced into the cylinders from the lower end. The cylinder head is cast separately, and this permits of seating the valves directly on the metal of the head and thoroughly water-cooling both the valve seats and the valve stems.

The bottom half of the crankcase is made of sheet metal, and two dash plates containing the splash troughs are inserted into the base. The crankshaft is 2⅜ in. in diameter, and is carried in three main bearings, all supported from the upper half of the case. Balance weights are forged integral with the four short arms of the crankshaft. The connecting-rod bearings measure 2⅝ x 2⅞ in., and the dimensions of the main bearings are as follows (front to rear): 2¼ x 3 1/16 in., 2 11/16 x 2⅝ in., and 2¾ x 4 in. The camshafts also are supported in three bearings each, and are so arranged that they can be withdrawn from the forward end of the engine. The shafts are 1¼ in. in diameter, and the three bearings are of the following dimensions (front to rear): 1⅞ x 2¼ in., 1⅞ x 2¼ in., and 1¼ x 2¼ in. These camshafts run in bronze bushed bearings, and have the driving gear bolted to an integral flange at the forward end.

The valves are arranged in the head at the corners of a square, the two on one side of the engine being the inlet valves, and the other two the exhausts. They have a clear diameter of 1½ in.

It will be seen from the cross-sectional drawing of the engine that the piston, when in the topmost position, projects slightly above the cylinder liners, and the entire compression space is within the cylinder head casting. This obviates the necessity for counterboring the liner from the top end. Pistons are made of cast iron, and are of conventional design, with three ¼-in. compression rings at the top end and an oil scraper ring at the bottom end. They are 5 in. long, and it will be observed that the bearing surface is about equally divided

between the upper and lower ends. The piston pin is secured in one of the piston bosses by means of a pin screw, which is secured in position by a lock nut and a cotter pin, the latter inside the piston pin. There is nothing special to note in regard to the construction of the connecting-rod, except that the cap is held on by four bolts and that it is provided with a substantial oil splasher.

The valves are operated through the intermediary of rockers and tappet rods. These tappet rods are formed with ball ends at top and bottom, the bottom end resting in a suitable socket in the bottom of a thimble-shaped push rod, which bears directly on the cam, thus forming a mushroom type cam follower. Similarly, the top end fits in a socket formed in a headed pin set into the end of the rocker lever. The valve guides have inserted bushings, and the rocker arms are provided with set screws for the purpose of adjusting the clearance. Each pair of like valves in a cylinder is operated through a single tappet rod, but each valve is separately adjustable. The valve rockers are mounted on a hollow shaft, which can be oiled through oilers on top of the pressed-steel valve housing, so that it is not necessary to remove this housing when it is desired to oil the valve mechanism. The shaft is carried in bearing brackets bolted to the cylinder heads. Oil tubes are screwed into the tops of these bearing brackets and project through the valve cover. The valve cover is formed with an outward flange where it joins to the cylinder head, and is held in position by means of nuts on the oil tubes. There is communication between the valve chamber on top of the cylinder and the crank chamber, and the crankcase breather is located on top of the valve cover. This places the breather in a high position, where there is likely to be less dust in the air. It also tends to carry some of the oil mist from the crankcase up into the valve chamber, and thus keep all parts lubricated. Contrary to common practice, the breather does not also serve as an oil filler, a special filler being secured to the forward one of two hand hole cover plates on the right side of the crankcase.

The cylinder block is cast with two compartments on each side, through which the tappet rods pass. These are open at top and bottom, but there is no opening in the outside wall, hence the usual valve cover plates are missing. Owing to the absence of these covers, and the fact that the cylinder block is straight from top to bottom, without the usual break at the bottom of the water jacket, and merges gradually into the crankcase, the engine is of unusually clean-cut appearance.

The engine is equipped with a Holley 1¼-in. kerosene carbureter. The latter draws air through a dry-type air cleaner, and fuel is fed to it by gravity from a tank having a capacity of 23 gal. of kerosene. There is also a gasoline tank of 3 gal. capacity, gasoline being used for starting. The location of the two fuel tanks is clearly shown in the side view of the complete tractor, the main tank, which is of cylindrical section, being placed on a saddle over the forward part of the transmission, and the small tank being secured to the rear side of the large one. The main fuel tank forms the rear support of the engine hood. The Bennett air cleaner is located directly beneath the carbureter, on the right-hand side of the engine. A Pierce centrifugal governor is used, and is located close to the carbureter, acting on a separate throttle in an insert in the inlet pipe.

Ignition is by a Bosch high-tension magneto, with impulse starter. The magneto is located on the left side of the engine, toward the rear, and is driven through the pump shaft, which in turn is driven through a flexible joint from a gear meshing with the exhaust camshaft gear. The governor, which is set to control the speed of the engine at 1000 r.p.m., is completely enclosed and sealed. Provision is made for fitting a speed indicator which will show the operator whether the engine is working properly, and when it is overloaded. This is not a part of the regular equipment, but is furnished at an extra charge. S. A. E. ⅞-in. spark plugs are used, and are screwed into the cylinder head casting from the side.

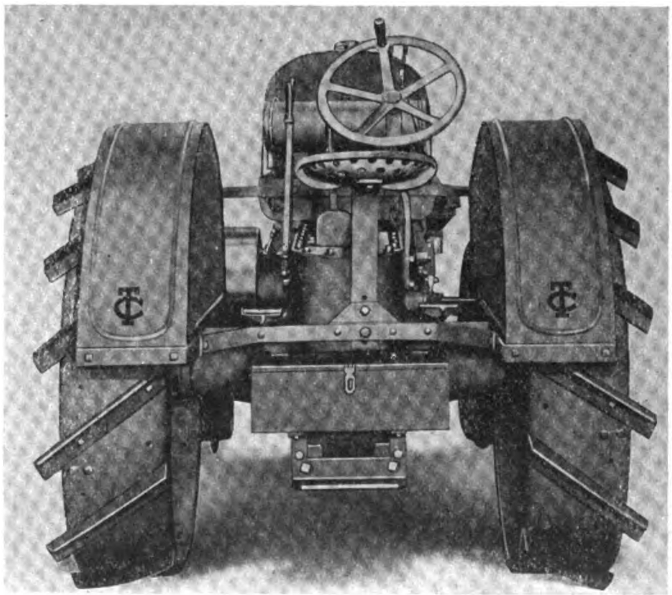
A Spirex radiator, with cast-iron top and bottom tanks and side spacers, is fitted. Water is circulated through it by means of a centrifugal pump, the outlet flange of which bolts directly against the engine casting. A 4-blade 20-in. fan is mounted on the engine, back of the radiator, and is driven through a 2-in. flat belt, the tension of the belt being maintained automatically by a coil spring pulling on the long arm of the bell crank bracket supporting the fan. The outlet from the cylinder jacket is at the forward end, and it is within this outlet fitting that the Sylphon thermostat is located. The entire cooling system has a capacity of 7 gal.

Lubrication of the crankshaft is by force feed. The gear-type oil pump is secured to the outside of the gear housing, being driven from the forward end of the pump and magneto drive shaft, and draws oil from the bottom of the crankcase through an outside pipe. It delivers oil into a main distributer pipe in the side wall of the crankcase, from which there are branches to each of the three main bearings. There is an automatic relief on the oil pump, which prevents the oil pressure exceeding a certain value. Oil holes are drilled in the crankshaft from the main to the connecting-rod bearings, and lubrication of the cylinder and piston-pin bearings is effected by both spray and splash. The large oil pockets forward on the camshaft bearings deserve notice.

The engine is mounted as a separate unit upon a front frame casting which bolts up to a bell housing on the forward end of the transmission case, thus insuring perfect alignment of the engine and transmission units. The bottom tank of the radiator forms part of the frame casting.

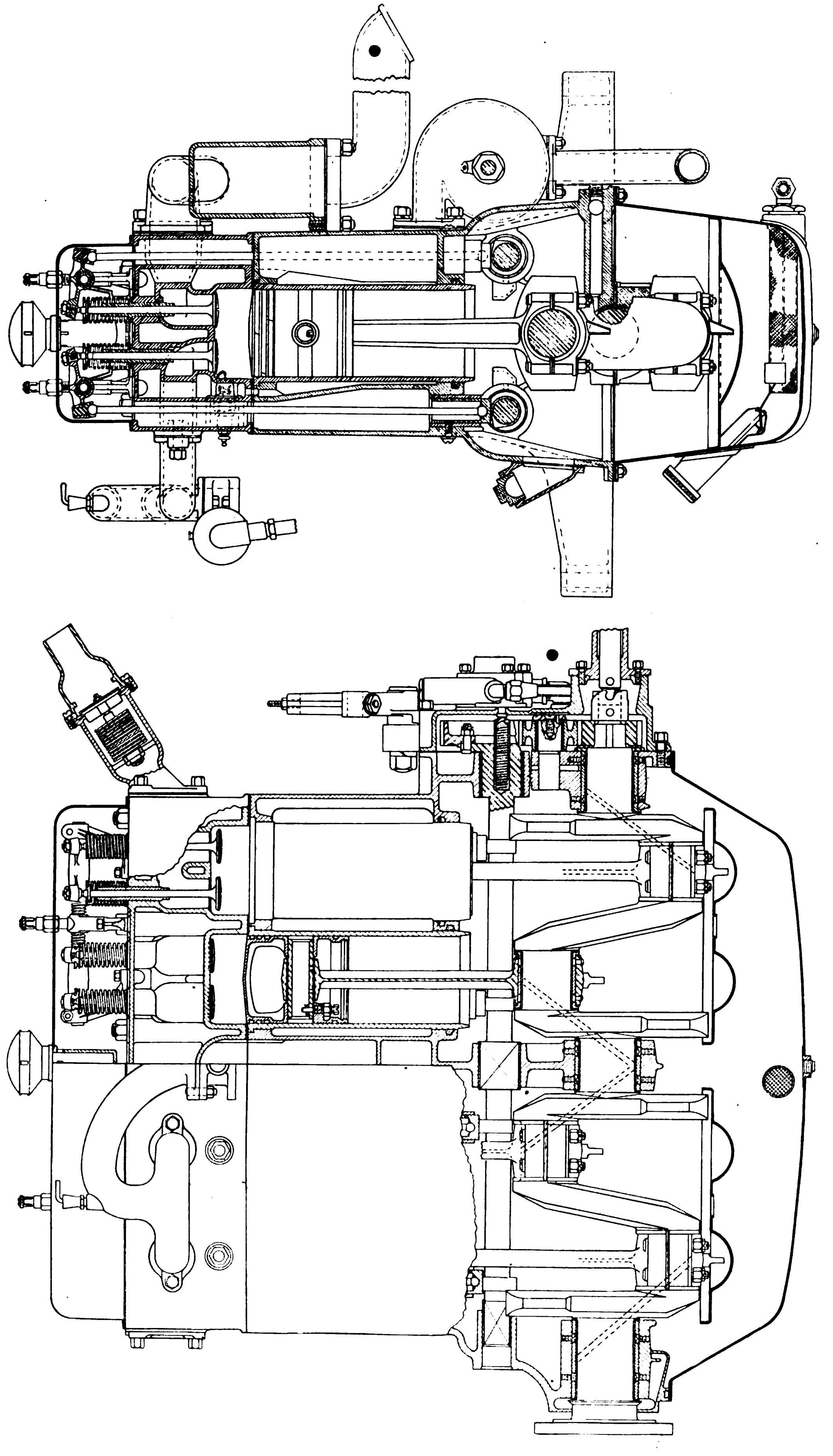
The engine power is delivered to the transmission through a Borg & Beck clutch operated by a foot lever. Access to the clutch for inspection or adjustment is provided for by a large hand hole in the bell housing.

The fuel tanks are mounted on a cast-iron saddle, which in turn forms a large cover plate over the clutch and gear-shifting mechanism.



Operator's seat and controls of the Twin City tractor

Twin City Four-Cylinder Sixteen-Valve Tractor Engine



Side and end sectional drawings of the Twin City tractor engine, which is the first tractor engine to be equipped with double intake and exhaust valves. Valves are in the cylinder head at the corners of a square, those on one side being the intakes and those at the other the exhausts

The power is delivered from the clutch shaft to the first countershaft through a pair of bevel gears. Two sliding change-speed pinions are mounted on this splined countershaft, which in turn engage either the high or low-speed intermediate gears mounted on the intermediate shaft, with the main drive pinion between them.

The main pinion engages the differential ring gear secured to the differential spider, in which four pinions are mounted. These in turn engage with the two differential bevel gears into which the splined inner ends of the rear axles are fitted. The two forward speeds are 2.2 and 2.9 m.p.h., and the reverse is 1.75 m.p.h. Gear reductions are 51:1 for the high and 68:1 for the low gear.

The differential is assembled as a complete unit, and is mounted independently on large Hyatt roller bearings located at the inner ends of the axle housings.

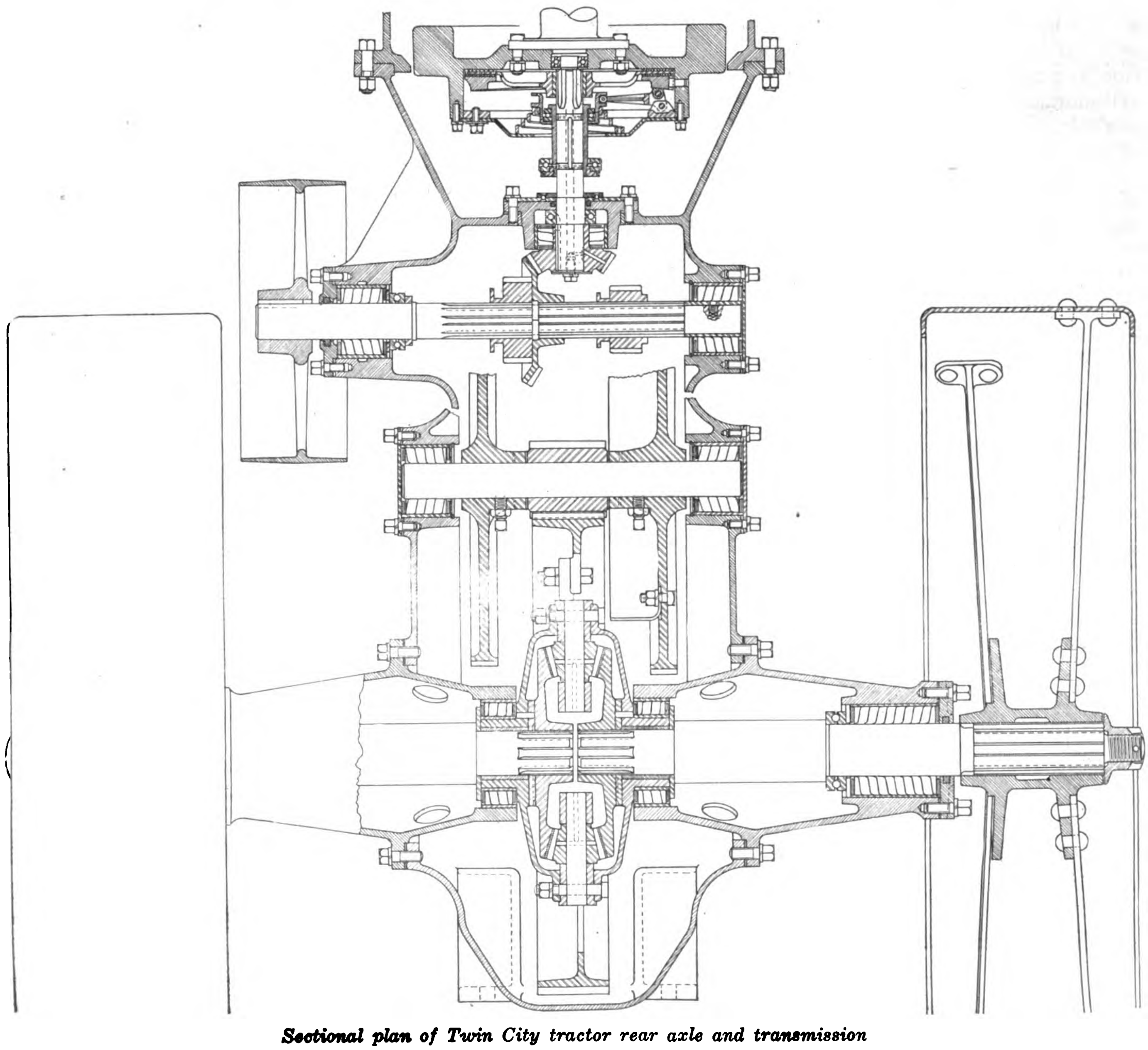
The transmission case and front frame castings are of semi-steel. All transmission gears, except the two large intermediate gears and the differential ring gear, are steel drop forgings, accurately machined and case-hardened to insure maximum service. The two large intermediate gears and the differential ring gear are rolled steel forgings of 0.45 carbon steel, accurately machined and heat treated. All gears are of generous proportions and are of the 20-deg. stub-tooth type.

The transmission shafts are made of 0.40 carbon steel, heat treated, and ground to exact limits, and possess great strength. They are mounted on Hyatt roller bearings throughout, and wherever thrust loads are encountered, due to bevel gears, ball thrust bearings are employed. The clutch shaft is piloted on a single annular ball bearing mounted in the flywheel. The total gear reduction for either forward speed is accomplished in three steps. The entire transmission runs continually in a bath of oil. Transmission lubrication, therefore, requires absolutely no attention on the part of the operator.

The drive wheels are 50 in. diameter and 12 in. face, with flanged rolled-steel rims and forged-steel "Tee" head spokes. The hubs are splined, and are a push fit on the rear axles. Each is secured in place by a large castle nut which clamps the wheel against a shoulder on the axle.

The drawbar, which is a steel drop forging, spring mounted, provides a liberal lateral adjustment and is attached to the rear part of the transmission case. A

(*Continued on page* 877)



Sectional plan of Twin City tractor rear axle and transmission

Believes in Four-Cylinder Engines

Declares Smooth Operation Is Possible with Four-Cylinder Design as Well as with Greater Number of Cylinders

By Lawrence H. Pomeroy *

MY first impression of American design is the lack of attention which has been paid to the possibilities of the four-cylinder engine in its application to the first-grade automobile. One feels that, as a result of the earlier development of the four-cylinder engine in America, which tended toward large engines running at comparatively low speed, the line of recent development has been toward the multi-cylinder engine, in conjunction with a very low top-speed gear ratio. So that from the point of view of the motor, the impulses per revolution are increased in proportion to the number of cylinders, and from the point of view of the car as a whole, the revolutions of the engine are increased in accordance with the gear ratio.

The general effect is, therefore, that the tendency of design has swung heavily in the direction of obtaining even engine torque at low car speeds. It seems questionable as to whether the effect mentioned is worth the considerations involved in producing it.

Smoothness of Four-Cylinder Engine

The capacity of the senses to appreciate variations in engine torque, or, to speak more correctly, variations in engine torque reaction, is limited. For example, in using alternating current for electric lamps the eye cannot detect any variation in the intensity of the light if the periodicity of the alternating current is more than 40 cycles per second. The eye is probably the most sensitive of the human organs, and it would be a matter of considerable interest to determine the corresponding periodicity which could be detected, arising from torque variation in an automobile. In fact, the experience gained in Europe during the past 4 years is that, with the four-cylinder engine, the smoothness of running, even at quite low car speeds, is such that it is very difficult, indeed, to distinguish between a four-cylinder engine and one with six or more cylinders.

The simplicity of the four-cylinder engine from other points of view is apparent. Its chief defect—that is, the fact that severe secondary unbalanced forces are set up which produce annoying periods and vibrations—has been completely overcome by recent inventions which are worthy of a more complete description than can be given from a series of somewhat casual impressions as are here set down.

There seems to be a feeling that in order to obtain hill-climbing capacity on top gear and good acceleration, a multi-cylinder engine is essential. The determinant of the above qualities in any car depends upon the ratio of total horsepower to total weight at any given car speed. There is not the slightest difficulty in making this ratio whatever may be desired, irrespective of the number of cylinders.

For example, a well-known American car develops some 40 hp. at 1000 r.p.m., at which engine speed the car speed is about 22 m.p.h. The weight of this car is about 4400 lb. At 22 m.p.h., therefore, we have approximately 1 hp. for every 110 lb. In a four-cylinder engine which was developed in Europe before the war the horsepower developed at a car speed of 22 m.p.h. was 27 hp. for the car weight of 2500 lb.—that is, 1 hp. for every 92 lb. of weight. The capacity for acceleration and hill climbing on top speed is therefore some 12 per cent better than in the American multi-cylinder car, and there is practically no perceptible variation in torque at low speeds.

As a matter of interest, the acceleration which could be obtained on low speeds was such that if the car was suddenly accelerated upon reverse, the passenger climbing into the front seat would find himself falling out over the fenders. Even with the same ratio of horsepower to car weight, the acceleration obtainable with a four-cylinder engine is better than with the multi-cylinder, due entirely to simpler induction pipe design.

American Car Not Economical of Fuel

From the point of view of fuel economy, the American car does not strike one as approximating any degree of efficiency. A consumption of 32 to 36 ton-miles to the gallon can easily be obtained with a modern four-cylinder engine, whereas with a multi-cylinder car the consumptions seem to be more on the order of 11 miles to the gallon, or 22 ton-miles for a car of 2 tons weight.

From the point of view of oil economy, the consumption of 1 gal. for 1000 to 1200 miles is quite usual on the modern European engine.

The multi-cylinder, in general, contributes very

**Editor's Note.—L. H. Pomeroy recently arrived in the U. S. A., where he hopes to remain and establish manufacturing connections. In England he was chief engineer and executive manager of the Vauxhall company, maker of the Vauxhall car, which established such a favorable reputation for itself in the last few years. The new 30-98 four-cylinder Vauxhall is reported to be one of the best performing cars in England.*

largely to the difficulty of carburetion. It is possible, in my view, to obtain very much better warming up with the four-cylinder engine, due to the fact that the induction passages are of greater area, than with the multi-cylinder engine. Further, the smallness of the individual cylinder on the multi-cylinder engine and the large area it offers to the cooling water adversely affect the point in question. The general proposition as to the number of cylinders necessary for an automobile is determined principally by the total load to be carried and the nature of the body work. For very heavy and luxurious cars there is certainly a case for the multi-cylinder engine, but the arguments therefore do not carry anything like so much weight, in my opinion, when the object of the car is to transport four or five people with adequate comfort in an open body. This leads to the probability that in future the chassis for an open touring body will be developed upon quite different lines from that for closed body work.

With respect to chassis design in general, the manufacturer of complex parts seems to have obtained such a high level in America that designers feel themselves independent of any present need for reduction in cost of manufacture by design alone.

Concluding this very brief impression, I feel called upon to express my great admiration of the methods of manufacture and the very high class of workmanship which so far I have seen. This problem has been tackled in a very whole-hearted and thorough way, and there is no doubt that the American high-grade car is deserving of the very greatest respect from European engineers.

Hilliard Clutch for Trucks and Tractors

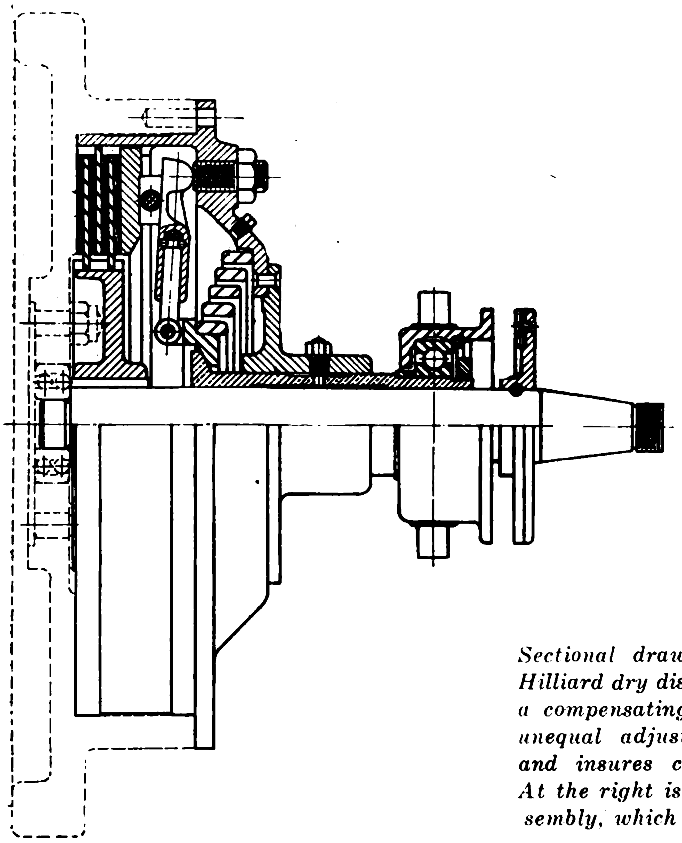
A NEW design of heavy duty clutch for use on trucks and tractors has recently been placed on the market by the Hilliard Clutch & Machinery Co., Elmira, N. Y. This firm has been manufacturing friction clutches for trucks, tractors and stationary power transmission purposes for the past 12 years. Its truck clutches in the past have been of the larger size only, having a rating of 75 hp. and over at 1000 r.p.m. To meet the demand for heavy duty type clutches for use in connection with engines of smaller ratings, the firm has now developed its types X and XU clutches.

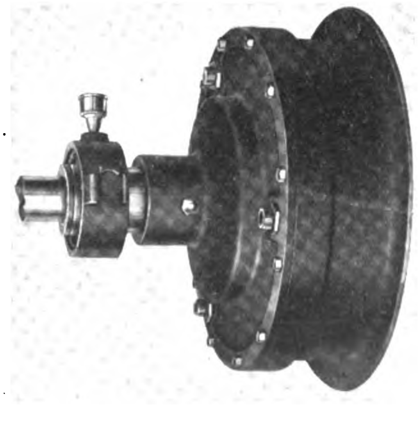
These clutches are of the dry disk type, and comprise two driven disks and one central driving disk, not counting the presser plate and the flywheel web, which also serve as friction surfaces. The friction disks are compressed by means of three levers, which are connected to a compensator ring, surrounding a sleeve on the clutch shaft. These levers bear against rollers, supported by lugs on the presser ring, and their outer end takes purchase against a set screw in the housing. These set screws serve the purpose of adjustment.

The special feature of the clutch is the compensating ring to which the lever arms are attached. This has a tapered surface which coacts with a spherical surface on a flange on the sleeve on which the shifting collar is mounted. Owing to the use of this compensating ring, if the different set screws should be unequally adjusted, or if there should be unequal wear on the disks, this will not affect the perfect operation of the clutch, as the compensator ring will so adjust itself that the pressure will be uniform over the whole surface of the disks. The clutch shaft is provided with a pilot extension, which by means of ball bearings, can be mounted inside of the flywheel. The shifter collar is provided with radially extending pins, adapted to engage with a forked lever. The rear end of the shifter collar is flanged outward, and is adapted to make contact with a disk on the clutch shaft, provided with a friction facing, which serves as a clutch brake. While the compensator ring tends to automatically equalize the pressure on the friction disks, it is nevertheless recommended to always keep the adjusting screws equally adjusted.

The matter of lubrication of the clutch has been fully attended to. A grease cup is provided for the trunnion bearings, and there is a small oil cup on the shifter sleeve. In order to insure proper lubrication of the pilot ball bearings, a small amount of oil is injected through a plugged filler opening in the housing of the clutch.

These clutches can also be operated with an oil bath, in which case from one pint to one quart of medium machine oil is poured into the housing.





Sectional drawing of the new Hilliard dry disk clutch in which a compensating ring allows for unequal adjustment and wear and insures correct operation. At the right is the complete assembly, which is fully enclosed

The Engine of the Side Car Motorcycle

An Analysis of Features of Cycle Engine Construction in a Paper Presented to the Institution of Automobile Engineers by E. Caudwell

FOLLOWING up its decision to give some attention to motorcycle engineering matters in the future, the Institution of Automobile Engineers recently has had two papers on motorcycle topics presented to it. The first of these, by D. S. Heather, contained a general critique of current motorcycle design, based on personal experience as a rider. The second, just to hand, deals with motorcycle engines from the standpoint of the designer and engineer.

The first part of Mr. Caudwell's paper is of a somewhat general character and may be briefly summarized. He points out that there are on the market to-day five varieties of engine:

(1) The single-cylinder.

(2) The Vee twin-cylinder with an angle of 55 degrees or less between the axes of the cylinders.

(3) The Vee twin-cylinder with an angle of 90 degrees between the axes of the cylinders.

(4) The horizontally opposed twin-cylinder, and

(5) Four cylinders in line.

The discussion is limited to air-cooled engines of over 31 cu. in. piston displacement. The author states that air cooling would be very difficult under right conditions but that very little attention seems to have been given to its improvement. To bear out this statement it is pointed out that a careful examination of a 1906 Minerva 3½-hp. engine cylinder and any 1919 cylinder shows no essential differences in design except that the valves and passages are somewhat larger. Better cooling, the author says, is undoubtedly badly needed, as it will give longer life of valves, less carbonization, and, in permitting the use of a higher compression ratio, will improve thermal efficiencies—and therefore fuel consumption.

As an indication of the large scope for improvement, Fig. 1 shows the tractive effort of a 4-hp. motorcycle engine. It will be noted that while it amounts to 90 lb. at 18 miles per hour, it falls away steadily until at the very moderate speed of 36 miles per hour it has dropped to 64 lb., showing that as the engine revolutions increase the mean effective pressure steadily decreases. This indicates not only inefficient cooling, but restrictions in the valve ports and passages. As a fully laden side-car outfit may weigh 700 lb., the commencing values are quite creditable, but the engine should hold its torque over a considerable range before the curve turns downward.

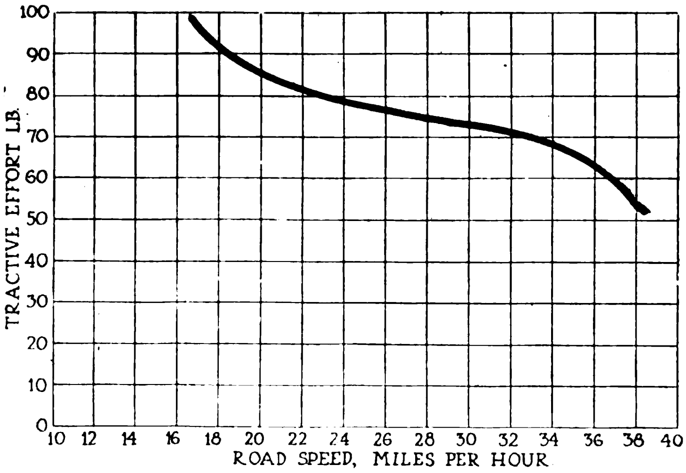


Fig. 1—Tractive effort of motorcycle engine

Next the subject of engine balance is taken up and inertia force and crank effort diagrams are given for each type. The results arrived at, with the aid of a theoretical indicator diagram, may be given most conveniently in the form of a table. All crank efforts are figured for 1700 r.p.m., and the assumed pressure diagram is such as to give 90 lb. per sq. in. mean effective pressure, and therefore about 80 lb. brake mean effective pressure.

Engine Type	Bore and Stroke, mm.	Crank Effort in Lb. In. Max. Pos.	Max. Neg.	Mean, for Entire Cycle	Ratio of Crank Effort Range to Mean
Single Cylinder Vertical	85x99	1950	300	242	9.3
55 Deg. Vee Twin	85x88	1920	410	432	5.16
90 Deg. Vee Twin	85x88	1970	360	432	5.4
Flat Twin	74.5x68	990	300	257	5.02
Four Cylinder Vertical	52x88	500	0	345	1.45

The values given for the variation in crank effort for these five types of engines are of course a measure of the flywheel capacity required, the single-cylinder needing the heaviest flywheels; the 90 degree Vee and the 55 degree Vee and the flat twin engines have lighter flywheels in the order given, and the 4-cylinder engine the smallest of any.

These figures have an interesting bearing on the transmission question, as the more jerkily the power is applied, the more wear and tear it causes, so that everything has to be made correspondingly heavier and stouter to withstand it, and although makers of single and twin-cylinder engines nearly all provide shock absorbers, these can hardly be regarded as a mechanical expedient. It is difficult to make a satisfactory one, although there are several types available. Some prefer a form of clutch which can be so adjusted that it only slips when the power impulse reaches its maximum value, but experience shows that this type is very difficult to regulate, as it usually either slips all the time or is locked solid.

Better results are obtained with a type which drives through a spring, but here again the springs have to be adjusted very carefully, and when they weaken through use they will simply shut up solid and give a rigid drive. In any case they are a source of waste of power, as if energy is used in slipping a clutch or shutting a spring, it is not available at the back wheel for propelling the vehicle. Such devices, therefore, can only be regarded as attempts to render an uneven drive tolerable.

Crankshaft and Flywheels

It is difficult to understand why makers of single-cylinder and Vee twin-cylinder engines, with few exceptions, have always placed the flywheels inside the crankcase; the disadvantages of this method of construction are numerous and obvious, while advantages seem to be non-existent. As the engine width has to be kept narrow, two flywheels can only be employed at the expense of bearing space. A car engine with an 85 mm. bore cylinder has a crankpin about 2 in. diameter by 2½ in. long, so that it is extraordinary that there should be many thousands of motocycle engines running with crank-

pins only ¾ in. diameter by 1¼ in. long, and still more extraordinary that, although the oil is only fed in a most erratic manner with a hand pump, they may yet last 5000 miles without requiring renewal—that is, about six months' work for a fairly hard rider. Although some improvement has been effected by the use of roller bearings, these can hardly be regarded as a satisfactory solution of the problem in view of their small size and the heavy loads and shocks to which they are subjected.

The placing of the flywheels inside the crankcase means, too, that the diameter cannot exceed about 8 in., so that they have to be unduly heavy. The average weight is from 25 to 35 lb. the pair, which is about one-third the total weight of the engine. It is also an expensive method of construction, as the crankpin and the two sides of the crankshaft are all separate pieces, which have to be fitted into the flywheels with tapers and keys, and pulled up with nuts which require to be securely locked.

In order to renew the connecting-rod big end bush, the flywheels have to be separated, and every practical rider who does his own repairs knows the difficulty of getting them to run true again, if they ever do at all.

Bearing Sizes Inadequate

Bearing sizes, too, seem quite inadequate, although these are usually of the ball or roller type. We find that one well known maker of ball bearings lists a ⅞ in. by 2 in. by ⅝ in. bearing specially for motorcycle crankshafts, and this size has been used on innumerable engines. Although it is a wonderful testimonial for the makers that these bearings may have a life of over 10,000 miles, it is short as compared with that to be obtained from the size of ball bearing that car manufacturers would employ for the same duty. If, on the other hand, a solid crankshaft is used in conjunction with an outside flywheel, the bearing surfaces can be brought up to more adequate dimensions, and the flywheel weight reduced by increasing its diameter. In this respect the flat twin engines at present on the market present a very much more satisfactory design.

However, the first four types of engines we are dealing with are all cramped for bearing space, as their width must be kept down to that which will go comfortably between a rider's feet, while the four-cylinder engine, with its axis coincident with the longitudinal axis of the machine, is practically unrestricted.

Fig. 2 shows a section of the crank, piston, and connecting-rod of a 90 mm. by 130 mm. touring car engine, and of an 85 mm. by 88 mm. motorcycle engine. Both are drawn to the same scale; as the differences are so obvious, comment is unnecessary.

Piston and Connecting-Rod

The question of the design of the connecting-rod is rather tied up with that of the crankshaft, as, with internal flywheels, the usual type having a plain gunmetal bush or roller bearing big end is obviously the best, but if a solid crank is employed, it permits of adequate bearing surfaces and a car type of rod with a split big end and white metal bearings, although even in this case ball or roller bearings may be used, as they can be arranged to thread on over the crank webs.

The restrictions connected with the use of internal flywheels limit the distance between them to about ⅝ in., so that the connecting-rod is not wide enough to resist transverse strains. This results in the rod springing, so that it is usual to find that the piston pin is not parallel with the crankpin after a very little use.

All piston pins at present in use are hopelessly inadequate in size; in many engines they are only ½ in. in diameter, and, while a few are larger, there are none to be found exceeding ⅝ in. As a piston pin ⅞ in. in diameter can be easily fitted into an 85 mm. piston, it is difficult to account for this preference for the small sizes used, especially as their life is extremely short. In spite of the many different ways in which piston pins are held in the piston, there is still a great deal of trouble caused through their working loose, although this is probably due to the fact that the small dimensions of the pin in the first place do not allow sufficient bearing in the piston bosses. Of all the different ways of

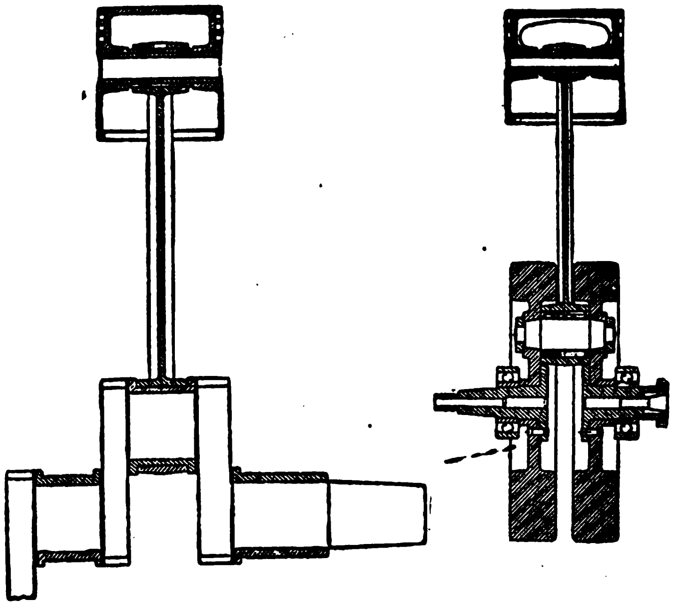


Fig. 2—Section of crank, piston and connecting rod, 90 by 130 mm. touring car engine and 85 by 88 mm. motorcycle engine

fixing piston pins, it would be hard to find a better than that employed for many years by a leading manufacturer, which is to make both ends of the pin of an exceedingly fine taper—one in 1600—and to drive it into a carefully reamed hole in the piston. When properly made, this gives an absolutely perfect fixing which never permits the pin to work loose. Although it appears an expensive method in the first place, it can easily be done on a commercial basis, to judge by the quantities which have been turned out.

Little can be said with regard to pistons, as we do not yet seem to have attained to any definite ideas as to what does actually form correct design. It is to be hoped that before long the aluminum piston will be thoroughly tried out to prove whether it is suitable for everyday use in an air-cooled engine, as if so, it presents distinct advantages in the way of lightness, better cooling and freedom from carbonization.

The subject of carburetion does not appear to have received the attention it deserves, as in spite of the long continued demand which has been put forward through the technical press for a truly automatic carbureter, the author does not know of a single British manufacturer who fits one as a standard. A certain number have been made, and one or two makes have attained a considerable measure of popularity, but the rider who wishes for one has to fit it at an extra expense after purchasing a machine; yet there is no doubt that if the motorcycle is to be placed on a level with the car, an automatic carbureter is a necessity. The present two lever type is an exceedingly primitive device, although in skilled hands it can be made to yield surprisingly good results. What we require, however, is an instrument which will give the best results independent of the skill of the driver, once it has been correctly set.

As the success of an automatic carbureter very largely depends on even suction, it is an exceedingly difficult thing to design a satisfactory one for a single-cylinder engine where the suction is only exerted for half a revolution out of every two, and then stops and starts again with a violent jerk. The conditions are nearly as bad with the irregular suction intervals of the Vee twin-cylinder engines, and it is only with the flat twin and the four-cylinder engines that conditions are obtained which render an automatic carbureter a success. These two types of engine can be fitted with any of the car type carbureters which are on the market, such, for instance, as the Claudel, or the Zenith, to name two well known examples, in which there are no moving parts except the throttle.

The flat twin engine appears to be subject to a good deal of trouble on account of the length of the induction pipe, as the two inlet valves are at opposite ends of the engine, but the

difficulties here should be easily overcome by exhaust jacketing the pipe and providing a hot air supply to the carbureter from a muff on the exhaust pipe. It is certain, too, that the heating of the air supply requires careful attention on a four-cylinder engine, as it has to be remembered that in the present state of development the motorcycle engine is running absolutely exposed to the elements, unlike a car engine which is closed up inside a bonnet, and always surrounded by fairly warm air.

The American manufacturers have progressed much farther than we have in this matter of carburetion, as their machines are universally fitted with an automatic carbureter, although they do not appear to be of the best type, insomuch that they are provided with too many adjustments which are under the rider's control.

Lubrication

As with carburetion, the lubrication of most English engines seems in an embryonic state, and in this respect, too, the Americans have a decided advantage, as mechanical oiling is universal on their machines. Very few English makers of a single-cylinder or Vee twin-cylinder engine appear to have got beyond a hand-pump or sight feed drip. The former over-oils the engine at irregular intervals, depending on the whim of the driver, while the latter is decidedly erratic, and requires frequent readjustment to suit the varying viscosity of the oil under different atmospheric temperatures.

It is satisfactory to note that the makers of the flat twin and four-cylinder engines have brought their lubrication systems into line with modern practice, which is a pump driven by the engine drawing oil from the bottom of the crankcase and delivering it into troughs into which the connecting-rods dip, the surplus oil running down through a filter to be used again.

For the sizes of engine we are dealing with, there is no need to consider forced lubrication with its extra complications in the way of pressure filters, relief valves, etc., which require periodic attention. When the trough system is employed there is no need to use any filter except a gauze tray below the troughs and covering the whole of the base. Its area is then so large that cleaning is never required between overhauls of the engine.

We can say that a correct method of oiling has been evolved, and it only remains for all makers to adopt it.

A brief acquaintance with motorcycle engines is sufficient to convince anyone that most valve gears are very noisy after quite a short period of running. Complaints are also general of undue noise from the exhaust, but we are never likely to have really effective silencers until the mechanical noises from the engine have been reduced, as, for a choice of evils, the bark of the exhaust is preferable to the scream of the timing wheels, though frequently in some engines at high speeds the mechanical noises drown the exhaust. The causes of noisy valve gear are chiefly the inadequate bearing surfaces through lack of space, and incorrect cam forms, particularly those of the internal variety.

With the conventional construction of crankcase with internal flywheels, the cams, wheels, bearings, and rockers have all to be packed into a space about 1¼ in. wide. This compartment is separated from the crankcase by a wall, and usually only gets lubricated in a haphazard manner by the oil mist which passes through the crankshaft ball bearing. Examination of a considerable number of timing wheels shows the bearing on either side of the wheel to have an average diameter and length of 10 mm., and it runs in a hardened steel bush pressed into the crankcase, rarely pinned in any way to prevent it rotating. The timing case cover carries the bushes on one side, and is seldom dowelled, and is only held on to the crankcase by means of screws with clearance holes.

The chances are that the bearings are never put up correctly in relation to one another, and as it is very difficult to get an adequate supply of oil into them, they all very soon wear slack, while the bushes get loose in the aluminum. Also with the loose fitting timing cover, the centers of the respective holes are out of parallel with each other, so that the whole mechanism is generally running out of truth on badly worn bearings, to the consequent accompaniment of the noise previously referred to. Although this type of timing gear does not lend itself to the best design, a considerable improvement could undoubtedly be made by mounting the wheels on ball or plain bearings of more adequate diameter, and dowelling or piloting the cover on the crankcase, or, as on one make of engine, carrying the bearings in a frame which is independent of the cover. Some better means, too, should be taken to insure lubrication of the timing gear, which can easily be done now that mechanical oil pumps have become a necessity for the engine of the future.

(To be continued)

Steaming of Vehicle Stock During Kiln Drying

SATURATED steam as a means of alleviating the tendencies of green lumber to honey-comb in the kiln has for some time been successfully applied in the commercial drying of heavy vehicle stock. Under intelligent control, such treatment has meant the difference between success and failure in many kiln runs.

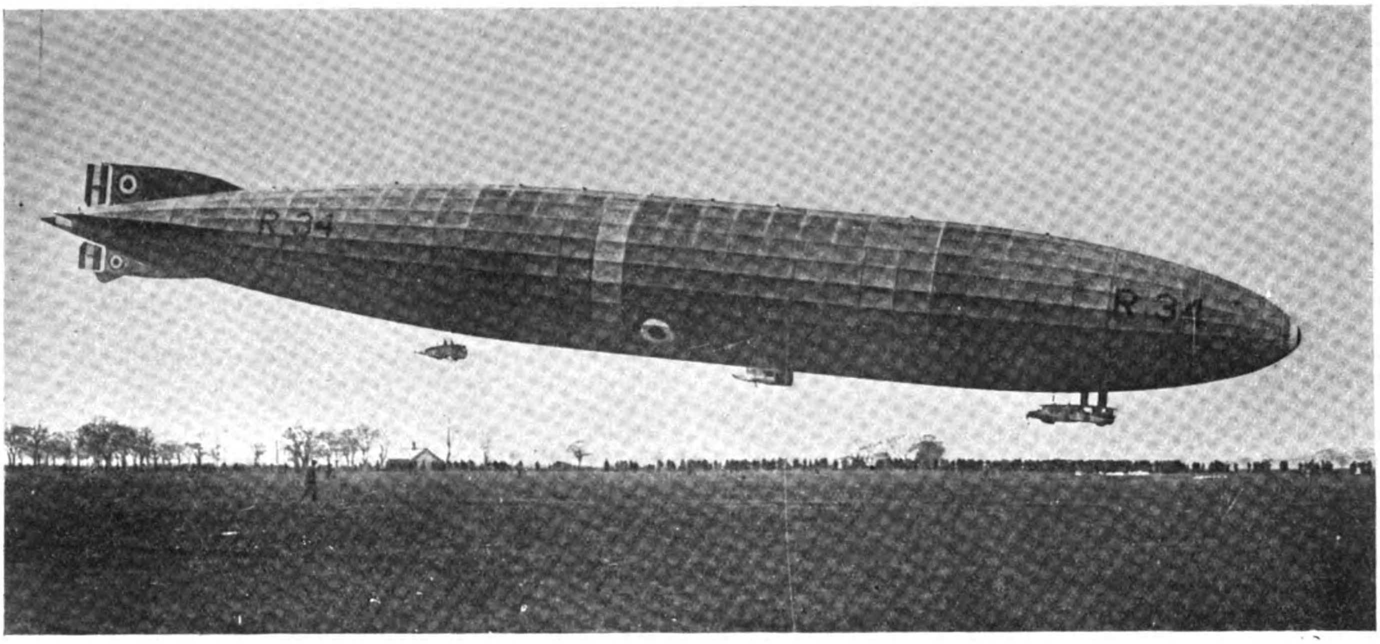
So far, however, the steaming treatment has been confined to straight stock. The contention has always been that bent stock, such as rims, should not be steamed after removal from the form, experience indicating that stock so treated would tend to straighten out to its original shape.

Recent experiments conducted under the direction of the Forest Products Laboratory have shown that judicious steaming of heavy bent vehicle stock results in a considerably improved product, and that the operation can be accomplished without serious effect upon the curvature. Careful judgment is necessary, however, as it is a very easy matter to ruin the entire charge by too severe treatment. Contrary to the common impression, this steaming has been done at high temperatures (150 to 180 deg. F.) and for short periods (½ to 3 hours), the temperature and time varying according to the requirements of the case.

The method was given a rather severe test, being tried first on 56-in. oak rims and later on 60-in. artillery wheel stock. When applied to the kiln drying of heavy oak rims on a commercial basis it worked out very successfully. Checks in the stock before steaming, which showed "pinching in" tending toward honey-combing, closed normally without further damage after steaming. From kiln charges totaling about 2400 pieces, the losses attributable to kiln drying were only 2 per cent.

Co-operative Manufacturing Suggested

IN discussing a paper on Jigs, Tools and Special Machines before the Institution of Mechanical Engineers in London recently, Herbert Carpenter said he would suggest that the Government should call the motor car manufacturers together and get them to form a committee to consider standization. There were 200 or 300 cars on the British market, with not so much as a piston ring standardized. Such a committee might develop designs embodying the best features of every car, and a dozen types might be standardized, embracing light cars, taxicabs, trucks and delivery wagons, together with two or three other essential types. They could evolve five or six types of engine and one or two magnetos, while they could standardize carbureters, valves and piston rings. The making of small fittings could be specialized by the smaller firms, engines by larger firms, and motor cars by firms still larger. Wit hsuch a system, connecting rods should be produced at a cost of 20 cents per rod, and generally the price of cars be reduced to pre-war limits. It might be urged that the scheme would arrest improvement and invention, but he thought that a manufacturers' committee would be well able to judge of the desirability or otherwise of a proposed improvement.



The R-34, 670 ft. long, descending after her trial trip at Clydeside. Over 400 men and women assisted in launching this ship, which remained in the air 4½ hours

The Inauguration of Safe Aerial Transportation

Helium Gas for Balloon Inflation and the Likely Results of Discovery of Means for Producing It Cheaply in Quantity

By Harold F. Blanchard

THE complete safety of aerial travel is assured by the recent discovery of helium gas, or rather a method of producing it. With its use a dirigible airship may float as securely in the air as a ship at sea, and, in fact, more securely, as will presently be explained. Airships have always been considered safe, except for the bugbear of fire due to the use of hydrogen, that most inflammable of gases, to inflate the bag. But now helium, the only other gas that is sufficiently light, has been made available, and helium is just as fireproof as hydrogen is the contrary.

Already plans are being laid for the construction of mammoth passenger-carrying dirigibles resembling the Zeppelins, and these ships, luxuriously fitted, will presently ply by straight line routes between the big cities. They will be easily capable of making non-stop voyages half way around the globe, and even a complete circuit of the globe without a landing is not an impossibility. This is not a hackneyed prophecy uttered in a burst of enthusiasm, but the conservative conclusion that must be reached after due consideration of the facts, particularly the announcement of a process for producing helium recently made by the Navy Department.

The size and lifting capacity of the big dirigibles with rigid gas bags, and therefore called Zeppelins, are staggering, but are really only an earnest of what is to come. A modern Zeppelin has a gas bag approximately 650 feet long and 75 feet in diameter, and contains 2,000,000 cubic feet of gas; it has a total lifting power of 130,000 pounds, or 65 tons, 1400 horsepower and a speed of 75 miles per hour. Such a ship has a load capacity of 38 tons, or 58 per cent of the total lifting capacity, and has a non-stop cruising radius of several days, the distance depending on the speed and how much of the load-carrying capacity is used for fuel.

Such are the characteristics of the German Zeppelin. The British, with an eye to air supremacy, as necessary from their standpoint as their preponderance of sea power, have also developed this type. The *Daily Mail*, London, recently published the first particulars of one of the latest types of British rigid airships, the building of which has been done secretly. These vessels are known as the "33" class and are equal in size to the most successful type of Zeppelin, and preliminary tests have shown that they will equal, if not exceed, the Zeppelin performances.

The first of this type has been built for the admiralty and was originally designed for ocean-going war service. The craft has a length of 670 feet, a diameter of 79 feet and a capacity of 2,000,000 cubic feet. She will carry fuel for a continuous flight of eight days and a speed of at least 70 miles per hour is promised. Such a ship could easily travel half way around the globe, and yet, large as it is, it is small compared to what Great Britain is planning. There is under consideration by the admiralty a ship practically five times as large as this.

Complete details are lacking, but it is to be 1000 feet long, have a gas bag capacity of 10,000,000 cubic feet, and a lifting capacity of about five times, or roughly 200 tons. It will be driven at a maximum speed of 80 miles per hour by engines of 8000 horsepower. There is no limit to the cruising radius of such a machine.

It is difficult to visualize 38 tons, let alone 200, because the average man's experience with tonnage is limited to coal. Perhaps the most striking illustration is to compare the lifting power of these ships with that monster flying boat belonging to our Navy, which recently carried fifty-one men. This machine, perhaps the largest of its kind in the world, has a lifting capacity of only 6½ tons.

These big liners, equipped with all the luxuries known to land and sea travel, will carry passengers and freight to the corners of the earth and will also be used for safe aerial transportation between distant cities in our own land. Even a present-day Zeppelin would carry as many passengers as the justly famous Twentieth Century Limited, which runs between Chicago and New York, making the trip in 20 hours, which figure the big airship would more than cut in two.

On a basis of an 80-mile-an-hour speed, the time it would take to run from New York to various distant points is given below:

	Days
Melbourne	5½
Hongkong	5¼
Calcutta	4¾
Tokyo	3¾
Cape Town	3¼
Buenos Aires	2½
Petrograd	2½
London	1¾
Paris	1¾
Sitka	1½
Los Angeles	1¼

Up to the announcement of the discovery of helium conservatively minded people rightly questioned the safety of aerial transportation. The aeroplane is rather dangerous and likely to remain so, and the airship filled with inflammable hydrogen was likewise out of the question. The sudden destruction of several Zeppelins in flames and the memory of our own ill-fated Vaniman, who lost his life when the machine with which he was attempting to cross the ocean took fire in sight of the Atlantic coast, give sufficient proof, if any were needed, of the hazard of hydrogen.

Helium Is Non-Inflammable

But the production of helium gas in quantity has completely eliminated the fire risk. Helium is a non-inflammable gas somewhat resembling nitrogen, except that it is much lighter. Its existence has been known for a good many years, but until recently so difficult was its extraction that not more than a half dozen cubic feet were ever segregated in one container.

Compared with hydrogen it has a lifting efficiency of 93 per cent. Next to hydrogen it is the lightest gas known. Although its weight is twice that of hydrogen its buoyancy is 93 per cent because of the relatively high weight of air, which is approximately 14.4 times that of hydrogen. Eight per cent greater volume of helium is required to give a lifting power equal to hydrogen, but this difference is not sufficient to cause any difficulty.

The production of helium in quantity is a result of the war. When the United States entered the conflict, Great Britain turned to us for co-operation in solving many problems which would aid in terminating hostilities. Among many others the problem of producing helium in sufficient quantity to enable its use in dirigibles in place of hydrogen was presented.

Uncle Sam, as typified by the Bureau of Mines, scratched his head and looked around, first to see where in this vast country helium was hidden in sufficient quantity to warrant consideration. His card index of the country's resources told him that helium occurred in various places, in the air, in certain minerals and mineral waters, but in exceedingly small quantities. But the natural gas coming from Oklahoma, Kansas, Texas and Ontario contained 1 per cent of the coveted helium, and this source held out great promise.

Pure helium was obtained from natural gas by a very simple process. Natural gas is a mixture of several gases and helium has the lowest boiling point of any of the constituents, so that by cooling the gases down to a temperature of 317 deg. below zero Fahrenheit, all were liquefied except helium. A method for producing helium on a grand scale along these lines was developed by the Linde Air Products Co., and the Navy Department forthwith gave them a contract for erecting buildings and equipment to the value of $900,000 at Forth Worth, Tex., with the understanding that they should be ready for production in April, 1919. The plans also include a 10-in. pipe line from Petrolia, Tex., costing $1,000,000. Although the plant is not yet in operation, it is estimated with accuracy that the cost of helium will be as low as $100 per 1000 cubic feet, and with increasing use it will undoubtedly go much lower.

There is no brighter page in the romance of chemistry than that devoted to this gas, and inasmuch as the history of its discovery and development is very closely linked with its present production in quantity it is worth while to stop a moment and briefly review it.

Helium Found in Sun Spectrum

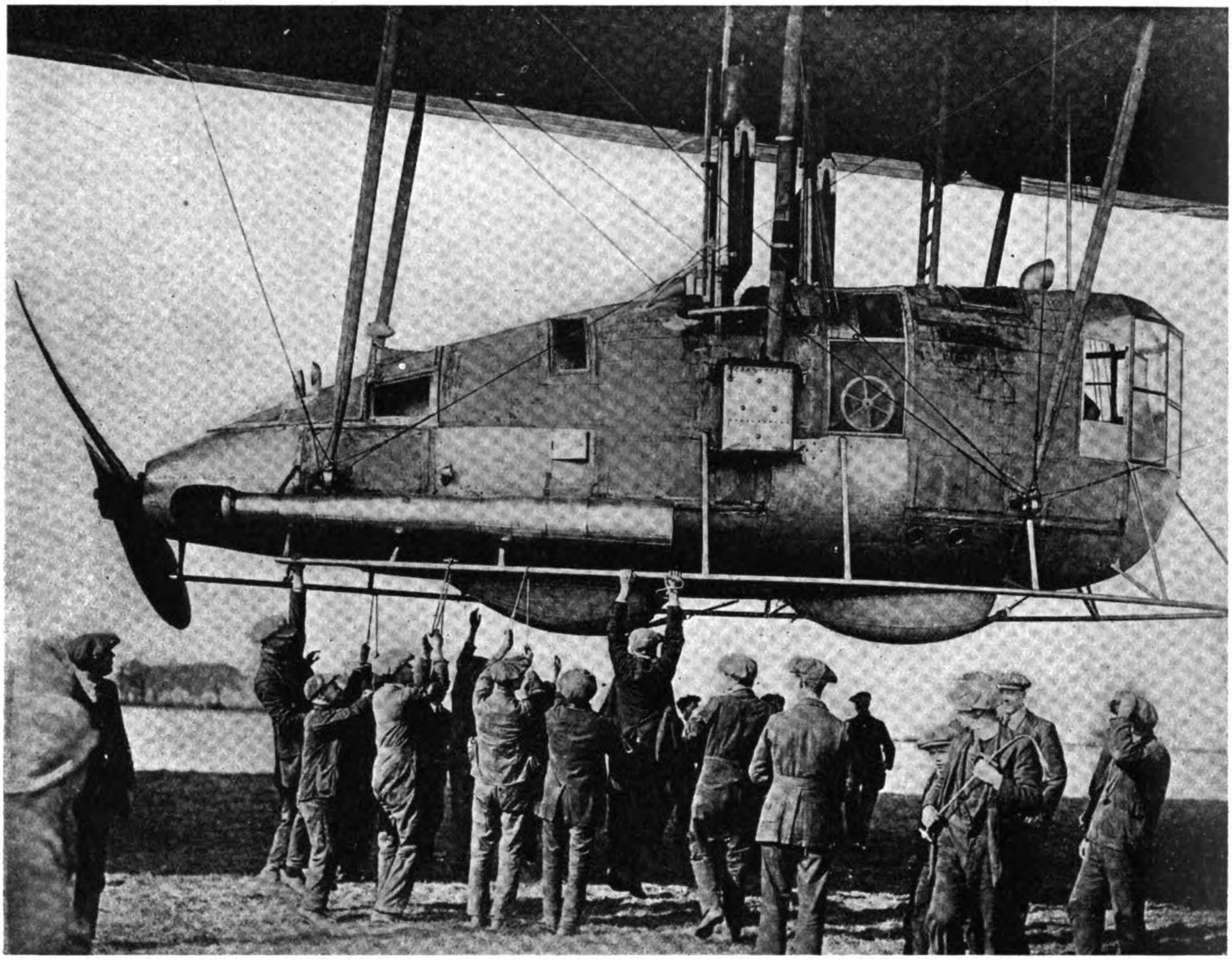
It takes its name from the Greek word helios, meaning sun, because its presence was first noted in the incandescent atmosphere surrounding the sun. Every incandescent substance emits a certain definite color, yellow for carbon, lavender for potassium, green for copper, and so on, and a mixture of the elements in the sun's atmosphere combines to give white sunlight. Therefore, if a beam of sunlight is split up into its constituent colors by passing it through a prism and they are thrown on a screen, the colors show what incandescent substances are producing them. This is spectrum analysis. During an eclipse of the sun visible in India in 1868 a noted French astronomer discovered some brilliant yellow lines in the spectrum not produced by any element known at that time.

Investigation by him and others proved that it was indeed a new substance, and, appropriately, was christened helium.

Years later traces of it were discovered on the earth. Careful analysis of the air we breathe showed that one part in 245,300 was helium, spectrum analysis proving that it was identical with the element earlier found in the sun. It was also found in certain minerals and mineral waters, but only in very small quantities, held there by occlusion; that is, it was not chemically combined, but held by mechanical means, the same as water in a sponge. So difficult was it to extract, and so rare, that it cost several thousand dollars to produce even a few cubic feet of it.

Perhaps its most interesting use up to the present time is to produce the coldest temperature known to man, namely, 455.8 below zero Fahrenheit. This low temperature was produced by evaporating liquid helium.

Its connection with radium, that magical substance, is worth mentioning, in that it suggests the reason for find-



The R-34, England's greatest airship, was launched from Clydeside. The rear gondola is shown here, giving view of observation glass window and car construction

ing it in natural gas. Silver cannot be changed into gold, so the modern alchemists have told us, basing their argument on the immutability of the elements. True, this has never been done, but it may surprise a lot of men who have not opened a chemistry book since they left college to learn that helium, a chemical element, is produced from radium, another chemical element. Radium is unstable, and decomposes into niton and helium. Niton itself breaks up, and metallic lead (supposedly) is the eventual result. So helium and lead are automatically transmuted from radium. Therefore, it is suggested that the helium in natural gas is a product of the decomposition of the radium held in the bowels of the earth.

Just how fireproof helium is is most strikingly illustrated by a test made by the government. A small balloon was filled with the gas and a blow torch applied to the silk fabric until a hole was burned through. Then the torch was removed, and a most remarkable thing happened. The helium poured out of the hole and quickly suffocated the flames, which were slowly eating the silk and enlarging the hole. Based on this observation, the man who is perhaps the most experienced dirigible pilot of the Navy has suggested that the helium gas in the dirigible bag be used for fire protection throughout the car which hangs from the bag. It could be piped, the same as water, to various points in the car, so that in case a fire broke out a jet of helium would quickly extinguish it.

Let us return to the consideration of the airship itself. Weight is not such an extreme consideration as in the airplane, and, therefore, we can expect to see ships with luxurious saloons, dining rooms, cabins, and the like, green carpeted, and finished in mahogany. There will be a promenade walk the full length of the ship for exercise and observation. Quarters will not be cramped, as they must be in large airplanes now talked of.

The estimated speed of 80 miles per hour is conservative. The big airships of the Zeppelin type, with their enormous bags, drive through the air at 75 miles per hour. Even the relatively small non-rigid type developed by our Navy, with a bag approximately 250 ft. long and 40 ft. in diameter, runs just under a mile a minute with a horsepower development of only 300.

Curiously, the speed rises with the size, so that it is not exaggerating the case to expect that the big air liners will run 80 miles per hour.

To the man who knows how much power it takes to overcome the wind resistance and friction of so small a thing as an automobile, the relatively low power required to project the airship through space is most astonishing —almost uncanny. It requires about 100 horsepower to drive a large touring car along at a rate of 70 miles per hour, and yet the relatively enormous bulk of the Navy dirigible just mentioned requires only three times the power to proceed at nearly the same speed.

The cruising radius of an airship with a 200 to 300-ton

carrying capacity, as already suggested, would be almost unlimited. In this respect it has two advantages over the airplane: Its percentage of weight-carrying ability increases with its size; and the power required, and therefore the fuel needed, is very small compared to an airplane; yet the airship, with its superior carrying ability, has really more room for fuel than the plane. To be specific: The big seaplane mentioned can carry 6½ tons, and requires 1000 horsepower, or 154 horsepower per ton. The big airship, on the other hand, carries 38 tons with a horsepower of 1400, which is used for propulsion only, or a ton for only 36 horsepower. From this simple computation it is plain that it takes about four times as much fuel to transport a ton by airplane as by airship. Or allowing the same space for fuel in two machines of equal carrying capacity, the airship would run four times as far. The speeds of these two machines are roughly the same.

It would be quite possible to build a large airship which would run at its full speed of 80 miles per hour for a whole month, and during that period to circle the earth nearly two and one-half times. Not that any one will ever want to perform such a feat, but it does show the possibilities of the airship. It will be of greatest use in connecting cities separated by vast expanses of water, or land undeveloped by railroads. Its availability to reach the corners of the world quickly is particularly appealing. At the same time it will compete favorably with trains and airplanes, even within the confines of the United States. The trip from New York to Los Angeles might be made in 1¼ days, and shorter distances in relatively less time. Even such a distant point as Melbourne is only 5½ days out from New York; and Buenos Aires, Cape Town, and Hongkong are respectively 2½, 3¼ and 5¼ days.

It seems hardly necessary to point out that the speed of the dirigible is three to six times that of a steamship, twice that of an express train, and equals the speed of a large airplane. Of course, it does not approach the enormous velocities of the small, fast machines, but it is very doubtful whether these extreme speeds of 160 miles or better will ever be attained in commercial passenger-carrying work. Perhaps 120 miles per hour is a fair maximum for fast passenger airplanes. However, it is not so certain but that a dirigible could be made to compete at this speed. With increasing airplane speed, first and operating costs mount rapidly, and at the same time carrying capacity is reduced and frequency with which stops must be made to take on fuel are increased.

It is not the aim of this article to attempt to prove the superiority of the dirigible over the airplane, but to show what the usefulness of the airship is going to be, and to drive home this point it is necessary to compare it with other vehicles of transportation, and airplanes particularly, since competition will be closest between these two.

The Landing Problem

In passing, it is only fair to remark that many thinking people do not look upon the airplane as a future universal means of travel, and there are a large number of aviators, and even some airplane manufacturers, who also hold this view. Lest this statement be misunderstood, let it be added that this does not mean that there will not be many, many airplanes used both for business and sport, but that their number will not be as great as many people like to suppose. After eliminating all other danger factors—fire, derangement of controls, and the like, in order to put the best face on the case—there is still the problem of a *safe* forced landing to be considered, something that may be called for in cross-country flying with even the best imaginable machine. A fence or a ditch, not to mention telegraph poles, trees, and houses, might cause disaster. Landing on the sea is safe except in rough weather.

It is hardly too much to say that a helium-filled dirigible offers at least as safe a mode of travel as a ship. It floats in the air in a manner comparable to a ship on the sea. Its big, rigid bag is divided into bulkheads, so that even a rent in the bag would not affect the buoyancy seriously. It floats at least as securely in the air as a ship upon the water. So, unlike the airplane, the danger of a forced landing is practically eliminated.

There remains the problem of foundering on trees, hills, or buildings. This is a remote possibility, as rare as the foundering of a ship at sea. With present perfection of dirigible control, and knowledge of navigation there is no cause for serious apprehension on this score.

Fog does not present the same danger for the dirigible as it does for the airplane. The former may reduce speed, or stop, but the latter must keep on, at least at its minimum flying speed, which is not less than forty miles per hour, and usually nearer sixty. Nor can fogs always be avoided. Perhaps the greatest danger for the dirigible in a fog will be airplanes, but fog horns should reduce this liability to a minimum.

Wings Cause of Trouble

On the other hand, consider the flying boat. It is hard to conceive of one so large that it will, when forced to land, ride a rough sea with safety. The difficulty lies not in making a seaworthy hull on which to mount the wings and tail. Even the hulls of the present-day flying boats, with lengths of 40 to 60 ft., and beams of 6 or 8, are quite seaworthy *per se*. It is the wings, stretching far out to each side, which cause the trouble, the angry waves battering them until they break up, and with them the whole boat gradually swamps. It is difficult to imagine a flying boat so large that it would be seaworthy in rough weather.

However, assuming that it would resist a rough sea successfully until the necessity for a landing was passed, engine repairs, dense fog, or what not—the man who believes that flying boats will never be forced to land is too optimistic—there is the problem of getting off the rough water into the air again. Skimming the surface of the water at 50 or 60 miles per hour is no joke when it is rough, and even if the boat escapes serious injury there is the certainty of missing teeth or even cracked skulls among the passengers as a result of the rough getaway.

Rising from even a moderately rough sea is a serious matter, as the few naval aviators who have accomplished it will testify.

According to present-day experience, a flying boat which lands in stormy water is doomed. Fortunately, there has usually been a ship near enough to rescue the passengers, but the boat has invariably been lost, unless there was a means for lifting it on board. Towing a flying boat at a greater speed than 4 miles per hour is out of the question; it will not stand up at a higher speed, and yet this is too slow to allow navigation of the rescuing vessel.

Curiously, experiments have just been successfully completed in which a dirigible acts as the rescuing vessel, picking the disabled plane up bodily and carrying it to shore. This expedient was hit upon as a means of rescuing disabled flying boats that would otherwise be lost.

It is argued that the multi-engined plane of the future should never be forced to land, inasmuch as it is not likely that more than one engine will refuse to run at

one time. But this view is debatable, although there is not space to discuss its technicalities here.

No comparison of fire hazards in airplanes and airships is attempted, because the indications are that these will presently be practically eliminated in both.

Docking of a big airship presents some difficulties, but with the special facilities which must certainly be developed it should offer no more risk than bringing a large ocean liner to its berth.

From the standpoint of comfort, the roomier airship should prove preferable to the airplane. As to steadiness, the advantage, if any, is in favor of the plane, the air liner having a tendency to roll and pitch. Engine noise should be less in the dirigible; in fact, there is no reason why it should be greater than in the modern automobile, for high power and low weight can be subordinated to quietness, and the engines may be well muffled. The difficulty in quieting an airplane engine lies not in the extra weight and wind resistance of the mufflers, but in the fact that their presence reduces the possible power output, not directly by causing back pressure, as in the automobile, but by producing valve trouble. So it is a safe conclusion that the dirigible will be much quieter than the airplane.

The dirigible will offer a better view of the land underneath, since it can be operated with safety at a low level—1000 ft. is about right for the best view—while the airplane will soar at 5000 ft. so as to increase its gliding radius and allow a large choice of landing places in case of an urgent landing.

There seems to be no limit to the size of a dirigible but there is a limit to the size of the airplane, if the word of F. W. Lanchester, a noted English authority, may be accepted. Various considerations fix the maximum wing span at 160 ft., and there are also limits to the depth of the wings and to their number.

The weight-carrying capacity of the airship increases with the size, while the weight-carrying capacity of the airplane remains constant at about 33 per cent. It is estimated that large dirigibles will be able to carry a useful load of 70 to 75 per cent of their total lifting capacity, and even the large machines of to-day carry 60 per cent pay load.

Helium-Filled Dirigibles Logical for Commercial Use

The cost of an airship is, of course, many times that of a large airplane, but in comparison with a large airplane there is little difference, the cost per ton useful load being about the same.

So, viewing the matter from every angle, it is reasonable to expect to see large fleets of helium-filled dirigibles carrying passengers, valuable freight and mail to the far corners of the earth, speeding up intercourse at such an enormous rate that commerce and the march of civilization, interlinked, will grow far beyond the dreams of even the most ardent champions of aerial transportation.

The military use of the helium dirigible is particularly attractive. Its size and ample weight-carrying capacity permit it to carry an enormous number of bombs for use against submarines, particularly, but also for night bombing. It will also undoubtedly be of service in bombing enemy war vessels when used in connection with fighting planes, and perhaps also war vessels working in conjunction with it.

It will undoubtedly be equipped with small caliber guns for offensive use on both land and sea.

It will be invulnerable to enemy airplanes except against bomb attack. The weakness of the dirigible heretofore has lain mainly in the inflammability of the gas used in the bag, a few well-placed incendiary bullets quickly setting the machine in flames and destroying it, but with a non-inflammable gas, machine-gun fire will have practically no effect. The enormous bag might be fairly riddled with holes without causing a serious loss of gas. By armoring the vital parts, such as the engines, machine-gun fire would have little effect on the operating mechanism.

All of this is assuming that an airplane would dare venture near this new aerial monster. But with numerous machine guns and small-caliber guns for defense, it is doubtful whether any airplane would accept the risk. This circumstance is perhaps best illustrated by the experience of the British with the enormous flying boats which they used for submarine patrol work in the North Sea. These boats carried several men, had a wing spread of about 100 ft., and were equipped with two large Rolls-Royce engines. When first put into service some were lost in unequal combat with several fast enemy planes, the big boat being too slow to run away and being insufficiently armed to put up a fight. Presently, however, these big boats were armed with twenty machine guns, in pairs, and soon after one of them was sighted by a squadron of ten enemy planes. As is customary, it descended close to the water, so that it could not be sought from its blind spot under the large hull, and waited for the attack. The fight was soon over, for its twenty machine guns quickly accounted for all ten planes. Due to the total destruction of the enemy force, no inkling of what happened to the squadron reached enemy headquarters, with the result that shortly thereafter another squadron of ten appeared over the sea and gave battle to another one of these big boats which had formerly been such easy prey. One lone machine escaped from the fray and straggled back to Germany with the news. After that, enemy squadrons were very careful about attacking large flying boats until they had determined the power of the armament.

The point is obvious. If a large airplane is so nearly invulnerable against machine-gun fire of enemy planes, how much more so would the big dirigible be, with opportunity to install almost any number of guns with which to bring them down or ward them off? Even if an attacking machine did weather the storm of lead hurled against its practically defenseless and exceedingly vulnerable structure, and came close enough to insure accurate shooting, it is doubtful whether it could do any damage worth considering.

It may be objected that the monster airplane would at least be the equal of the air battleship, but the enormously greater carrying capacity of the latter would always permit a preponderously superior armament. Nor would the big airplane possess a tactical advantage because of greater speed, because the airship can at least equal it in this regard.

The big aerial warship is therefore an exceedingly formidable weapon, and has nothing to fear seriously as long as it keeps out of range of anti-aircraft guns on land and sea. It is quite certain that the navies of the future will have large numbers of these craft for offense, defense and observation.

Michigan Carries $50,000,000 Good Roads Bonds

MICHIGAN voted overwhelmingly in favor of the $50,000,000 good roads bond issue, the project carrying in nearly every precinct by a 4 to 1 vote. The campaign for the good roads movement was directed by the Michigan State Highway Association, backed by every automobile club and chamber of commerce in the State.

The project authorizes the State to borrow for the improvement of highways and to issue bonds not to exceed $50,000,000. It provides that counties bear from 10 to 60 per cent of the cost.

Review of English Labor Conditions

Trade Union-Manufacturer Agreements — Shop Steward System — District Allied Trades Council

REASONS FOR PRESENT LABOR UNREST INDICATED

By Harry Tipper

IN view of the reports which have just been made public, of the commission which was appointed to deal with the dispute between the coal miners, the owners and the Government and the general industrial commission, it is important that the background for the situation in Great Britain should be understood.

It is obvious that the results of these congresses of capital, labor and Government together, in Great Britain, will have considerable bearing upon the situation as it develops in this country, although the conditions are so different in that country that the methods adopted there would not be of immediate value in our considerations here.

The wide discussion which these measures are causing and the enthusiasm which they are creating in a good many quarters, where the difference in background is not understood, make it all the more important that the same consideration should be given to the conditions out of which these triangular agreements, or decisions, have arisen.

The custom of making agreements between the manufacturers individually, or in groups, and the trade unions interested in those manufacturing operations, is an old one in Great Britain. For at least twenty years there have been agreements between the engineering trades and the trade unions concerned in these special operations, which involve the question of shop committees and which involve the system out of which has grown the shop steward arrangement.

Union Agreements Made 35 Years Ago

The union has been accepted as a necessary means of arriving at arrangements in Great Britain during a period of from twenty to thirty-five years in the different lines of industry. For that reason, the question of the merit of collective bargaining in this way and of agreement upon matters of hours and wages, etc., through the trade union, in Great Britain, does not enter into the discussion. This historical background of usual practice in dealing with the local trade union and the national body in arriving at agreements upon matters affecting the workers has led logically to the situation which is indicated by the triangular conferences between labor, capital and Government as they exist to-day in Great Britain.

It is now some thirty years since the Labor Party, as such, entered into politics in Great Britain actively as a party. Originally this party began with the desire of the trade unions, or the workers, to be represented in the Parliamentary discussions, and the first representatives in Parliament were paid by the trade unions because there was, at that time, no payment of Parliamentary members by the Government. The writer recalls very well the meetings which occurred when the workers of the Lancashire district decided to secure representation in Parliament.

In the course of time the Labor Party as a political body, because of the similarity between its aims and the necessities of a good many of the smaller professional and other types of independent workers, extended itself and secured support from the small shopkeeper, the office worker, the professional class and the other brain workers to a very considerable extent. As a consequence, the influence of the Labor Party has grown out way beyond the original conception of the trade unions in desiring Parliamentary representation and has brought into the platforms of the Labor Party, as a political organization, a great many questions with which the trade union, as such, was not particularly concerned. In the meantime the growth in public power, through the organization of the Labor Party as a political entity, has strengthened the hands of the trade union in extending the organization of other workers into the ranks of the trade unions and in federating the different unions for purposes of organization upon public matters. Furthermore, the practice which began twenty or thirty years ago, of deciding such industrial questions as wages, hours and labor production and methods of operation, through the trade union, itself increased the power of the trade unions and the advisability of all workers aligning themselves with the unions. These considerations meant that at the beginning of the war the industrial workers in Great Britain were organized to the extent of a majority of the workers in the most important industries and in many industries almost exclusively so organized.

When the war broke out it was necessary for the Government, in its preparations to meet the enormous tasks imposed upon the country by the necessities of the war, to use this organized machinery of the workers to provide the means of selecting the essential workers, of diluting labor and of obtaining a more or less smooth and efficient continuance of operations. This was recognized by the Ministry of

Munitions, but the usual inefficiency of the Governmental bodies affected the results so that there was continual cause for dissatisfaction on the part of both workers and manufacturers, and these unsatisfactory methods of procedure were largely responsible for the number of strikes which occurred during the war period in that country.

For instance, the question of naming the essential individual workers and issuing cards to them was at first left in the hands of the local trade unions with the obvious result that great abuses crept in, producing dissatisfaction among the workers, trouble with production, and without properly accomplishing the purpose. This method was changed before very long and the method was adopted which was continued through the rest of the period.

In order to secure the adherence of the trade union organizations to the immediate purposes of the Government in prosecuting the war, it was necessary for the Government to promise these organizations that the privileges which they voluntarily abandoned should be restored to them when the war was over. It is due largely to the difficulty of restoring these privileges at once that the unrest occurred which has resulted in the conferences that have just closed.

A very discerning British manufacturer, with whom we have had the pleasure of talking just a little while ago, made the statement that the labor organizations, as such, were just revelling in their first knowledge of controlling power, and when they had been obliged to shoulder the responsibility which goes with such power, for a sufficient period of time, the situation would develop into satisfactory compromises.

Not only is the power of labor thoroughly organized and recognized in the discussion of labor questions so that treatment between labor organization and manufacturer has become the usual practice, but well defined systems of conference have grown around this power, which vary in practice from the systems that have been adopted in the United States and which lead to an entirely different necessity in present negotiations and those of the immediate future.

The shop steward system in England is one which has been in use for about twenty years and which has grown into a complete system in about the last ten years. The shop steward is the liaison between the workers in a department and the foreman. If the rules as expressed in the agreement between the trade union and the manufacturer are not lived up to, he can carry his grievance to the management. Collectively the shop stewards in a plant form a workers' committee, inasmuch as they are appointed by the workers in each department and are paid by the workers for the time which they must spend upon their shop steward duties. Together with the representatives of the managers they form a conference committee, and this practice has obtained in the engineering and some of the other industries for a number of years. While these shop stewards, together with the management, form a conference plan or joint shop committee, this whole system is bound by and affiliated with the trade union and the manufacturer's group, so that it must operate within the agreement between the union as a body and the manufacturer and be subsidiary to such an agreement.

It is not in itself, therefore, a complete system of co-operative responsibility in connection with the individual factory or manufacturing unit, but simply provides working machinery in the individual manufacturing unit whereby the decisions and agreements arrived at between the trade union and the manufacturer can be kept in orderly operation. The growth of the shop steward system, leading to this conference plan affiliated with the unions, has led to the formation of what is termed the District Allied Trades Council, which consists of representatives of each union in the district in alliance, for the purpose of keeping the district in uniform practice in respect of matters relating to wages, hours and working conditions. This District Allied Trades Council is the bone of contention between the manufacturer and the union organization and has been the seat of revolt against the federated trade union on many occasions during the war and afterwards. In other words, the District Allied Trades Council has secured by its organization sufficient power in its local district to take the power away from the central organization and threaten to disturb the traditional method of agreement between the nationally organized union and the manufacturer's group. Furthermore, this District Allied Trades Council follows the local demand for action much more quickly and much more definitely than the centralized body and is apt to favor the radical demand, which gives more hope of satisfying their immediate constituency in their desire for action rather than deep consideration.

Intensive Force of English Organized Labor

When it is understood that this general condition in the industrial fields in Great Britain is coupled with the desires of a class of great solidarity, homogeneous in its growth, permeated with pretty much the same ideals and the same political outlook, the intensive force of organized labor and its great influence upon the future development of Great Britain politically and economically can be understood.

Great Britain is the oldest machinery manufacturing country in Western civilization. Its generations of workers have worked upon the same line of work from one to the next generation. They have lived in the same towns, they have been imbued with the same ideals, intensified by their definition and application and the homogeneous character of the people. It is for this reason that co-operative societies, organized by workers, have had such a large success in that country, and it is for this reason that profit sharing has made so little headway. These differences need to be thoroughly understood in this country if the developments which are taking place on the other side are to be understood properly in respect of their applicability to our problems and the modifications which must arise in our methods due to the difference in the conditions.

Turning Out 100 Tractors Per Day

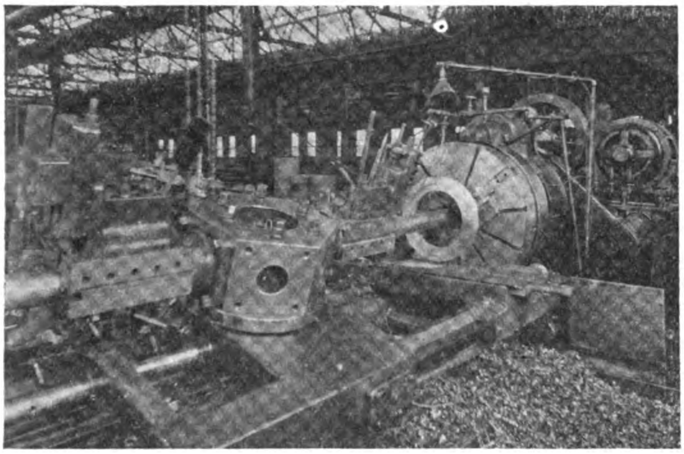
PART II

Production System Employed at the Milwaukee Plant of the International Harvester Co.—Details of Machining and Assembling Methods

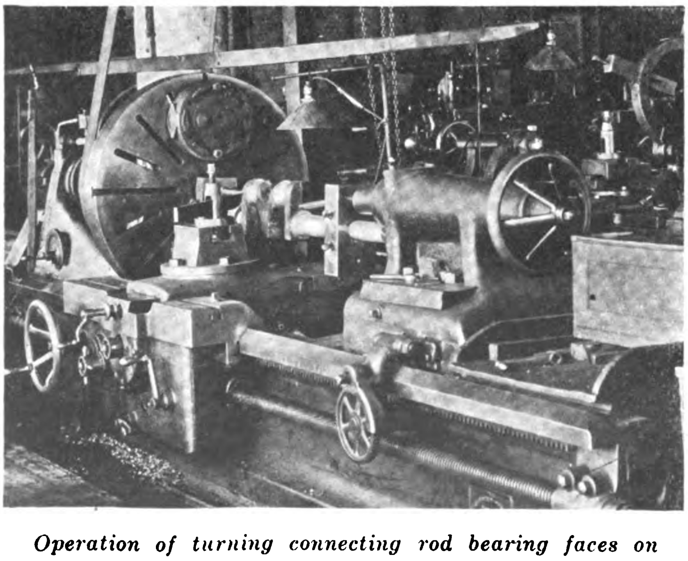
By P. M. Heldt

MOST of the fifth floor of the International Harvester Co. is devoted to the manufacture of piston rings. These are made from the usual cast-iron pots, and are of the eccentric type. Boring out the pot, turning off the outside eccentrically and cutting off the rings are performed in one setting. The lathe carriage carries the boring tool; the turning tool has a sliding mount and is moved back and forth by means of an eccentric pin, and the rings are cut off by means of a multiple cutting tool on the back of the lathe which is fed in toward the axis of the spindle as the carriage with the boring and turning tools progresses toward the lathe head. The cutting-off tools, of course, are so set that the outermost ring is detached first, then the next, and so on, so that the boring and turning operations on any ring are always completed before it is cut off.

All keyways are cut by broaching, and the broaching process is very extensively used in the plant. For instance, all sliding gears are bored out, and then have a square hole broached. All of the small gear blanks are finished in double spindle turret lathes. The small bevel gears are cut on three spindle cutters and the large bevel gears on two spindle cutters. The reverse gears are cut on three spindle machines, six gears being put together on an arbor and cut at the same time. Every gear is tested for trueness on a special testing machine. The broaching and gear cutting work here described are also done on the fifth floor.



One of the large turret lathes



Operation of turning connecting rod bearing faces on the crankshaft

On the fourth floor there is a miscellaneous collection of machine tools, including drills, lathes, etc. Here the steering knuckles are machined up. These are drop forgings, and are subjected to a heat treatment which increases their scleroscope hardness from 28 to 45. In order to provide a proper surface for the rollers of the roller bearings to roll on after the heat treatment, the knuckle is straightened in a straightening press, and is then tested by means of a dial gage.

Practically the whole of the third floor is devoted to tool making, making of dies for sheet steel work, and to tool service.

A platform has been erected in the yard, level with the second floor of the machine shop, so that castings from the foundry which are intended for the second floor of the machine shop can be deposited on this platform by means of the outside crane, and then transferred directly to the second floor of the shop, thus obviating unnecessary congestion of the main floor. Metal shavings from the machine shop are loaded on to cars in the yard in the same way.

Finishing the Crankshafts

On this floor the crankshafts are finished up. Owing to the motor being a two-cylinder machine, the crankshaft is comparatively simple, but a number of interesting machining operations have been evolved. Thus two crankshafts are milled at the same time for counterweights. The crankshafts are drilled for oil delivery to the crank pin bearings. Both ends of the crankshaft forgings are sawed off in power hack saws at the same time, and then center-drilled at the same time. In order to conserve human energy as much as possible, a monorail is installed under the ceiling of this floor, and all crankshafts are handled by blocks and tackle in transferring them from one machine to another. The camshafts are also turned up and ground in this department. The crankshafts are rough turned, finish-turned and ground, and very fine limits must be worked to, as the tolerances on the crank pin are + 0.0005 in. and — 0.001 in. A lapping tool of the nut cracker type is sometimes used, if it happens that a pin or main bearing is very close to the proper size. The camshafts are rough-machined on the round portion and the cams are rough ground, after which the shaft is heat treated. Then the whole is finish-ground.

On the ground floor there are miscellaneous machine tools, including key-way cutters, lathes, drill presses, etc. Both ends of the connecting-rods are bored out at the same time, and after boring they are reamed at the same time. The rods are next put into the milling machine and have the caps cut off and the lugs milled. At this setting, one slitting and two surfacing operations are performed at each end. Flywheels are turned up in a vertical lathe, and are balanced on a static balancing machine. By means of a horizontal mul-

General view of the main assembly room of the International Harvester Co. Here assembly of the clutch, flywheel, pistons, connecting rods, oil leads, muffler, etc., is carried on in the aisles under the balconies. The tractors are then moved around the ends into the main aisle, where the assembly operations are completed

tiple spindle drill, holes are drilled in the flywheel arms for the bolts by means of which the friction clutch pulley is secured to the flywheel. In drilling these holes, the flywheel is centered on the tail stock and a template is used in locating the holes. The friction clutch pulleys are turned up in a heavy turret lathe.

All heavy work is done in the main machine shop, which has one center aisle and two side aisles. Three overhead cranes run on a craneway extending the whole length of the building. Each heavy machine tool has its own air hoist on an arm swinging from a post. In this department there are many heavy continuous millers, as well as large boring machines and drills. Both sides of the crankcase are face-ground on a diamond face miller. The cylinder blocks are milled off at both ends and at the top, in an Ingersoll continuous milling machine in one setting. There are four Foote-Burt two spindle boring machines for boring and reaming crankcases in one setting. A radial drill press is used for spot-facing the surface around the bolt holes of the crankcase on the inside. Four Baush multiple spindle drill presses are installed for drilling and tapping all of the holes in the crankcase, using a jig for locating the holes. Next there are two large continuous millers, one for milling the crankcase, the other for milling the lower half of the transmission case. The former operates with four cutters, of which two are arranged vertically and two horizontally. Many of these machines are fitted with turntables, so that the machine can be loaded at the same time that it is working.

An interesting method is employed for moving the flywheels over the floor. A steel tube is put through five of these flywheels and then a bent bar, forming a handle, is hooked into the ends of the steel tube, whereupon it is possible to roll the flywheels over the floor, the same as a wheelbarrow.

A horizontal milling machine is used for facing the bearing slots in the crankcase. and six of the cases are clamped on the carriage of the machine at the same time. Another continuous miller, with six cutters, operates on two rows of crankcases (8 in all) facing off the top surface and the surface to which the cylinders bolt. A number of other continuous millers are used to finish the frame support faces on the upper half of the transmission case, the cases on each machine being strapped on the carriage in two rows, and the machine being provided with four cutters.

Boring and Milling Operations

After the transmission case halves have been fitted together, the ends of the bearing hubs are milled off, three cases being placed in the machine at one time. There is also in this department a battery of eight boring mills for boring and facing operations on the flywheel, and facing the lower half of the crankcase. A double-ended boring mill serves to bore in one operation the bearing hubs at each end of the transmission case and the reverse gear eccentric shaft holes. The holes in the crankcase are drilled in a multiple spindle drill, and another similar machine serves for tapping these holes.

The holes for bolting the driving sprocket wheels in place are drilled in a multiple spindle drill. Then the wheel blanks go on to an automatic gear cutter that finishes the sprocket

teeth in one operation. Both sprocket wheels on each tractor are interchangeable, there being no rights and lefts. There are four of the automatic gear cutters working on driving wheels.

Pistons are made in one of the galleries. The first operation is to face the open end in a turret lathe, and all subsequent work is located from this machined surface. Next, the piston goes into the drill press for boring the piston pin hole. It is then put into a Potter & Johnston lathe for roughing the outside surface, the top surface and the ring grooves, and then into another one for finish cutting. Next, oil holes are drilled through the piston wall, and the hole for the piston pin set screw is drilled and tapped at the same time. Holes are also drilled for pins for the piston rings. These pins are located one-half in the groove and one-half in the solid metal, and after they have been screwed tight, they are cut off with a hacksaw. After the final grinding of the piston, these pins are slightly relieved by means of a file, so that they will not project above the surface of the piston when the latter is hot, owing to the greater expansion of steel as compared with cast iron. After the pistons have been rough-ground, they are set aside for a while, which gives them a chance to age or relieve themselves of internal strains, after which they are finish-ground on the same machine. The final grinding of the pistons has to be held within limits of + 0.001 and — 0.001 in. Next, the cross hole is finish-bored and reamed in a lathe. A special clamping jig is used for holding the piston to the face plate of the lathe, and there is a taper centering pin on the turret for squaring the piston in the jig.

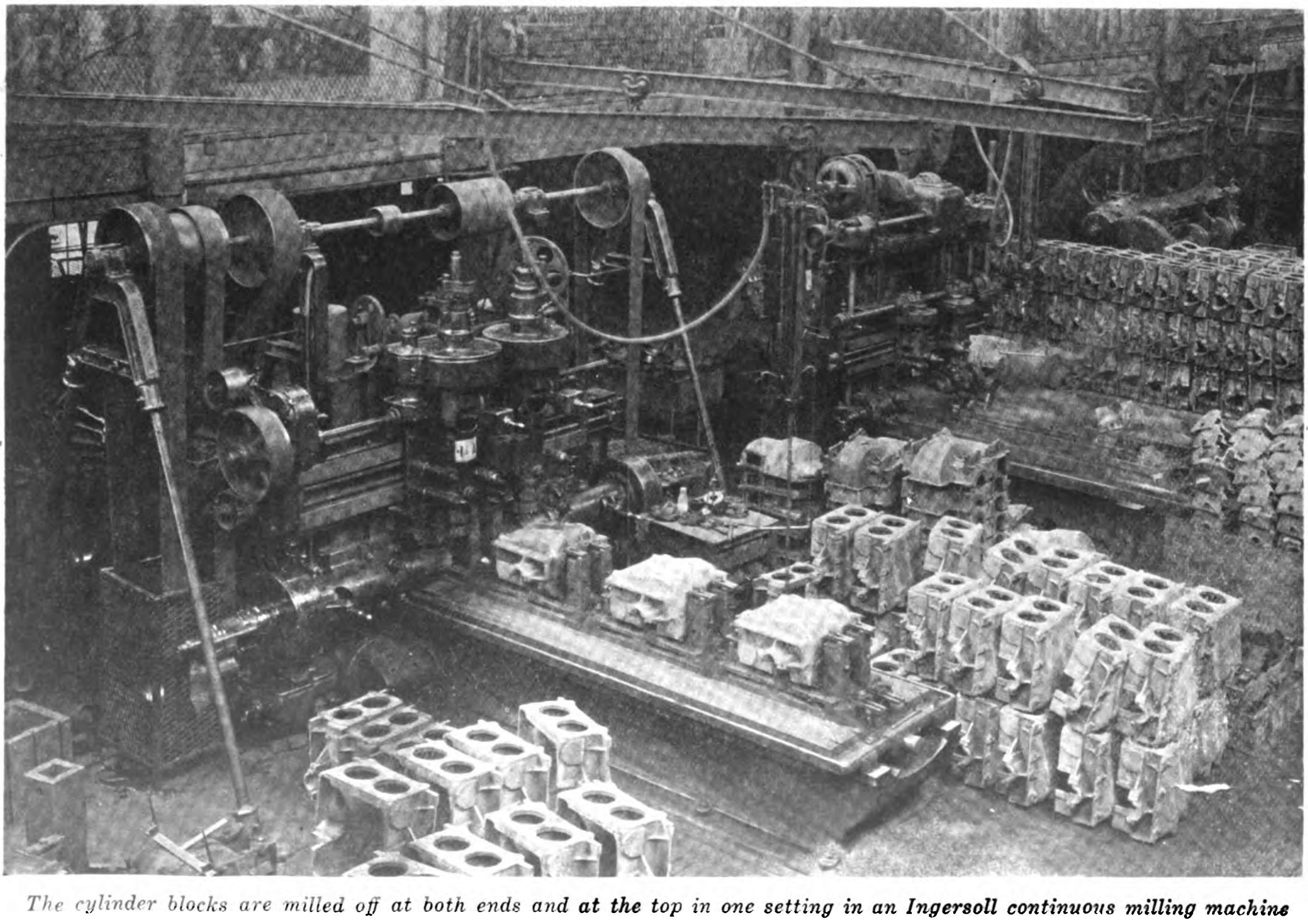
The cylinder blocks are bored and reamed, and the upper edge of the cylinder bore is beveled out so that the piston and rings will enter readily. This operation, performed in a double spindle vertical boring mill, is shown in one of the illustrations. All cylinder and cylinder head castings are given a water pressure test. The water enters the casting through a hose at the bottom; then air under a pressure of 120 lb. to the square inch is applied through a hose at the top. This method has the advantage that one test suffices to show any leakage through either the inside or the outside wall. The cylinder head flange holes are drilled in a multiple spindle drill with 11 spindles. This drill is also provided with a turntable, so that it can be loaded and worked at the same time. The drills are self-feeding, and the operator can devote all his attention to the loading of the fixture. A similar plan is used in drilling the crankcase, this being performed in two operations, four holes being drilled in the first, and five holes in the second operation in the same drill. The holes in the sides of the crankcase are drilled and tapped in single spindle drills.

In one of the galleries of the machine shop, the transmission bearings are babbitted and broached. This broaching operation includes a compacting operation, an arbor with a very small taper being forced through the babbitted bearings. Oil grooves are provided for in the arbor, and do not have to be cut specially. This compacting arbor compacts and smooths the surface of the bearing and imparts to it greater wearing qualities. The arbor is split lengthwise, at a slight angle, so that there is no difficuly in withdrawing it from the bearing after the operation is completed.

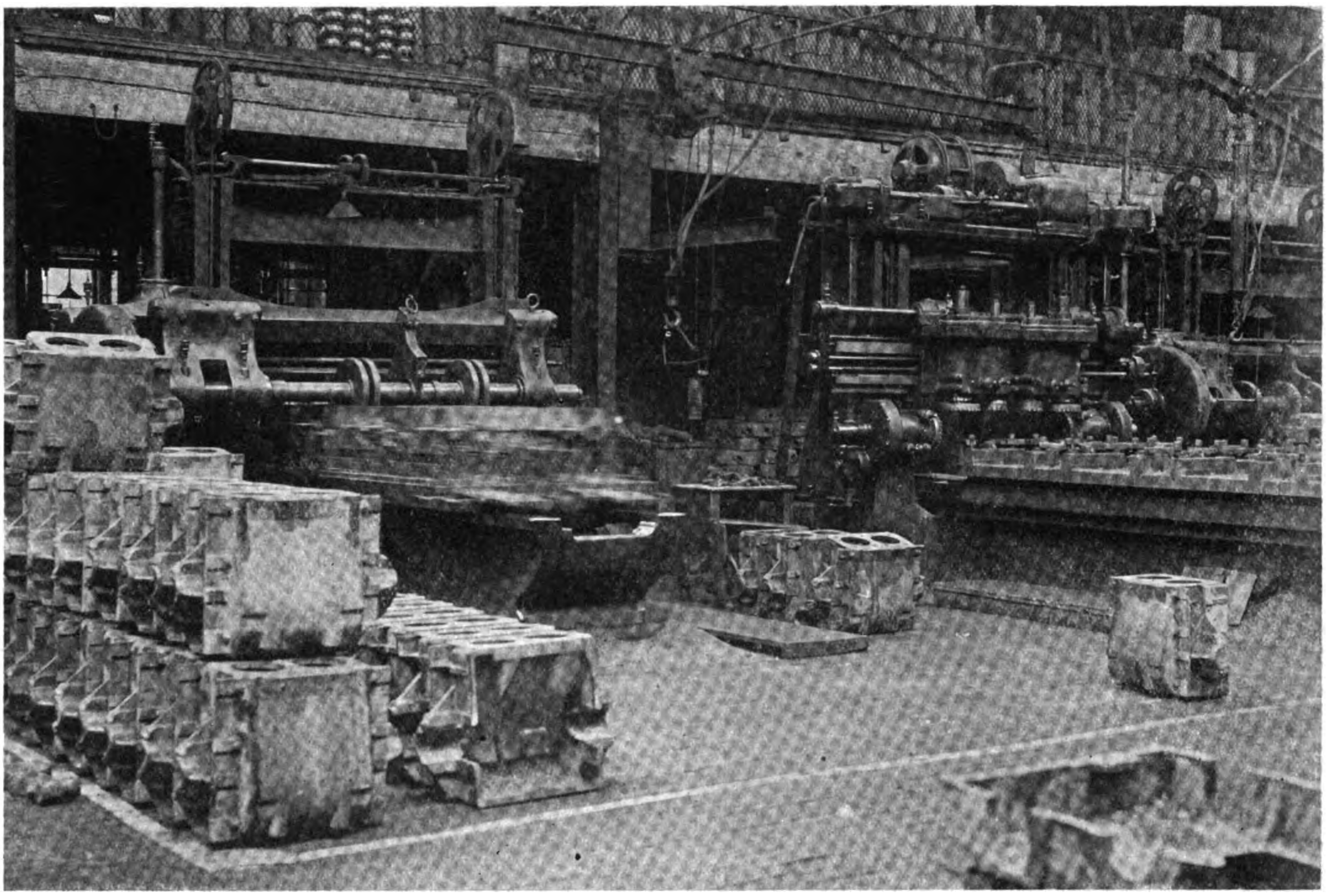
The Brass Foundry

The plant also has a brass foundry, although not a great many brass castings are used in tractors. All brass shavings are recovered in a separator, which works on the magnetic principle. The shavings are fed on to an inclined shaker, over which is passed a revolving multiple electromagnet. As the magnets pass over the shaker, at a short distance, they pick up all magnetic shavings (iron and steel) and carry them along, and as soon as they are beyond the shaker, they are demagnetized and then drop the magnetic shavings into a collector.

In the carbonizing room there are 23 furnaces for carbonizing such parts as the small sprocket, camshaft, valve push rods, cam rollers and valve rods. The connecting-rod bolts, which are made of special material, are heated in a barrel furnace for heat treatment. A recording pyrometer is in-



The cylinder blocks are milled off at both ends and at the top in one setting in an Ingersoll continuous milling machine



Both sides of the crankcase are face-ground on a diamond face milling machine

stalled in the foreman's office, and records the temperature of everyone of the furnaces, being automatically switched into circuit with the thermo-couples of the different furnaces, at intervals of one minute. This pyrometer, as stated, is of the recording type, and the records from it are sent to the assistant superintendent every day. The record is burned into the record sheet by means of electric sparks, passing from the point of the indicator arm to the drum on which the record sheet is mounted. All furnaces in the works are heated by crude oil. It should also be pointed out that all of the heavy machine tools are driven by independent electric motors.

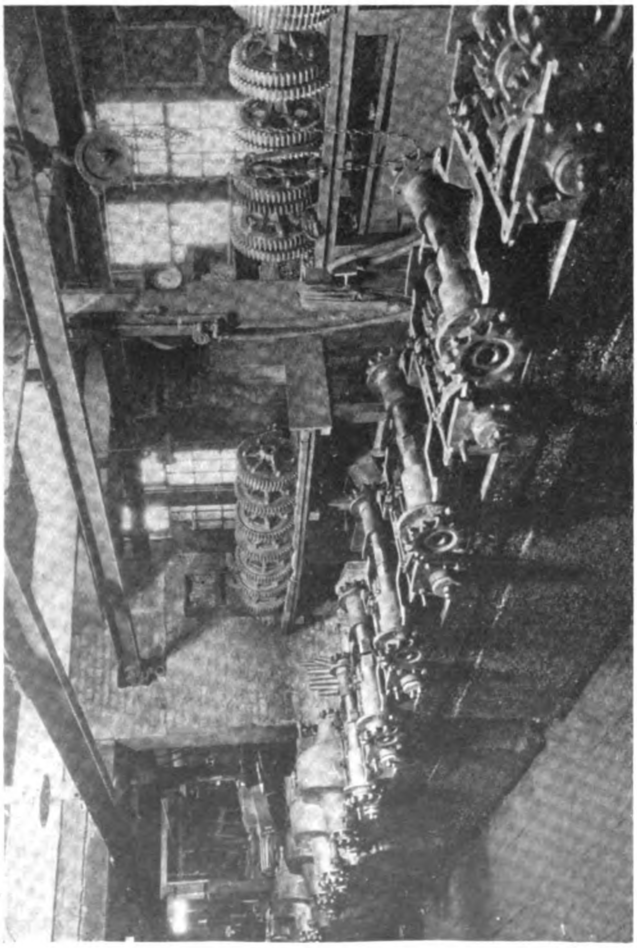
In the assembling department the so-called progressive system is used. First the frame, which is made of steel channels that are bent to form while at a red heat, are assembled with the rear axle housing and the front bolster in a jig, and riveted together. The use of this jig insures that the frame will be square. Next, the frames are placed on three caster wheels, which facilitate their movement over the floor. Each unit is brought assembled to the main line of assembly. A good example of the assembly of components is furnished by the transmission, which is assembled on the progressive plan. The transmission cases are slid along a pair of rails, at a convenient height above the floor for the workman to work upon. The low and high speed ring gears and the differential gear have been assembled previously, and come to the transmission assembly line in the form of a complete unit. An overhead monorail over the differential assembling bench delivers these units to the transmission assembly line and also serves to move the complete transmission to the main line of assembly.

The first part of the assembling work is done in what is referred to as the truck shed. When the tractor frame leaves this shed, the transmission, rear axle, gear shift mechanism and part of the steering gear (the worm and sector) are in place. In the next building, which is the main assembling room, the crankcase is put on and then the crankcase bearings are put in place. These bearings are given a double reaming, which is done by means of air tools. On a side line, oil rings and the counterweights are put on the crankshaft and the crankshafts are balanced. Then on the main line the crankshafts are put into the engine. The next assembling operation is to put on the clutch, clutch wheel and flywheel. Each end of the crankshaft is center-drilled and screw threaded, and these screw threads serve as an anchorage in forcing the flywheel and clutch onto the crankshaft. All of the heavier operations and many of the lighter ones in the assembly are performed by means of air tools. This greatly expedites the work, and obviates fatigue of the workman. Next, the keys are fitted, and the gear shields for the countershaft put on. The next operation consists in putting the cylinders onto the crankcase, the studs having been put into the cylinder block on a side line. All studs are put in place by means of air tools. A jig is used for centering the cylinders with the crank pins, the cylinder flange holes being made slightly larger to permit of this adjustment.

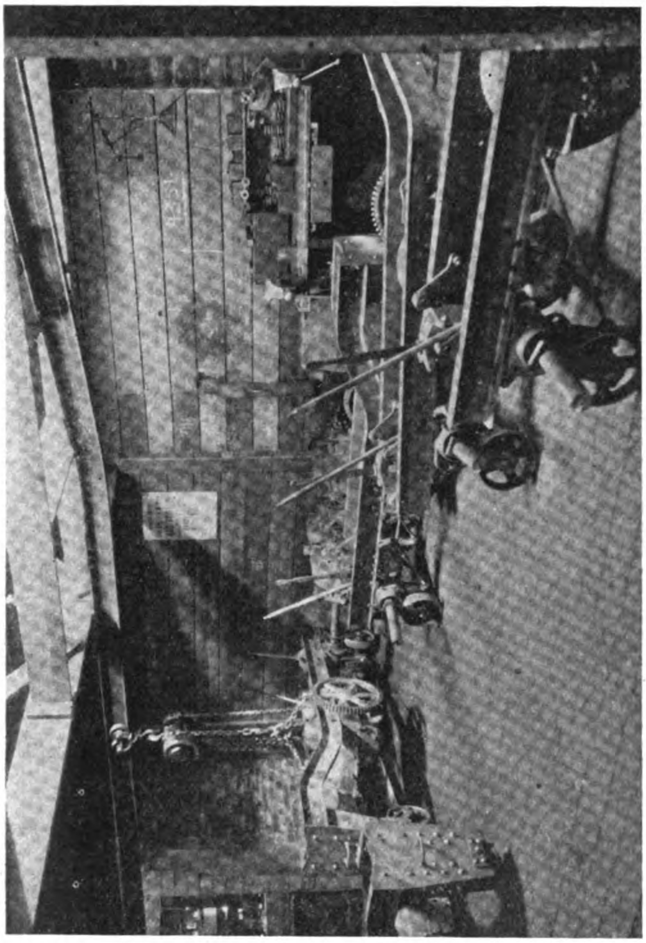
Assembling Piston Rings and Connecting-Rods

On a side bench the piston rings are put on the pistons and the connecting-rods are put in. These complete assemblies of pistons and rods are brought up to the main line at the proper place, where they go on to the chassis. Next, the oiler and oil leads are put on. The cylinder heads, with the valves, tappet arms and studs, are assembled at a side bench, and at the same point on the main line are put on to the engine. Next, the muffler is put on. At this point, the engine is subjected to a low pressure water test (30-40 lb. per square inch) to test the water tightness of the gasket.

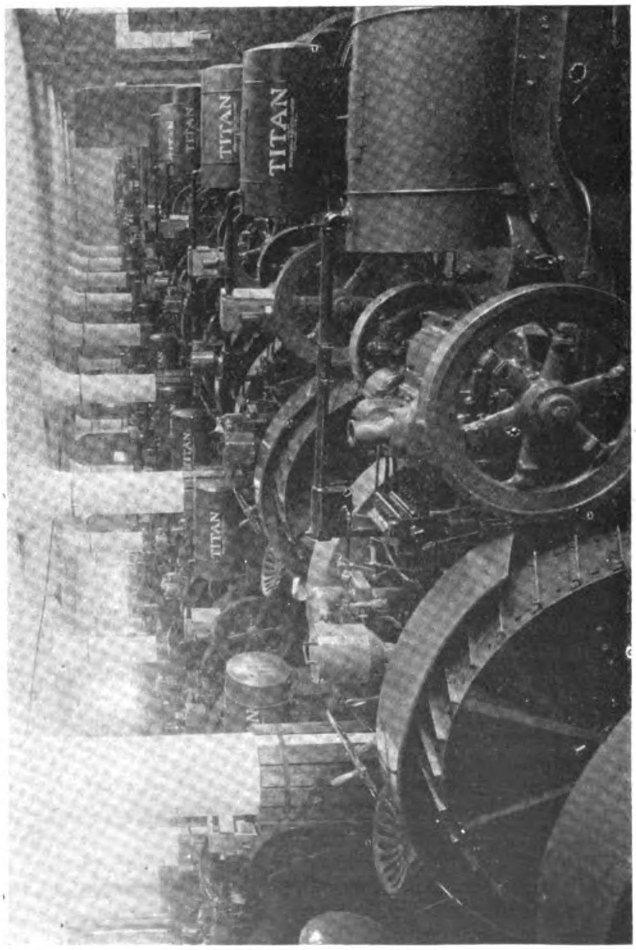
All operations described so far are performed on a side aisle under the balcony. The chassis now having reached the end of this aisle, is turned around and enters the main aisle, and here is moved along by an overhead crane. Through the main aisle the chassis move in three parallel lines. Here the crankcase covers, with the governor, camshaft, push rods and guides, which have been assembled on another bench, are



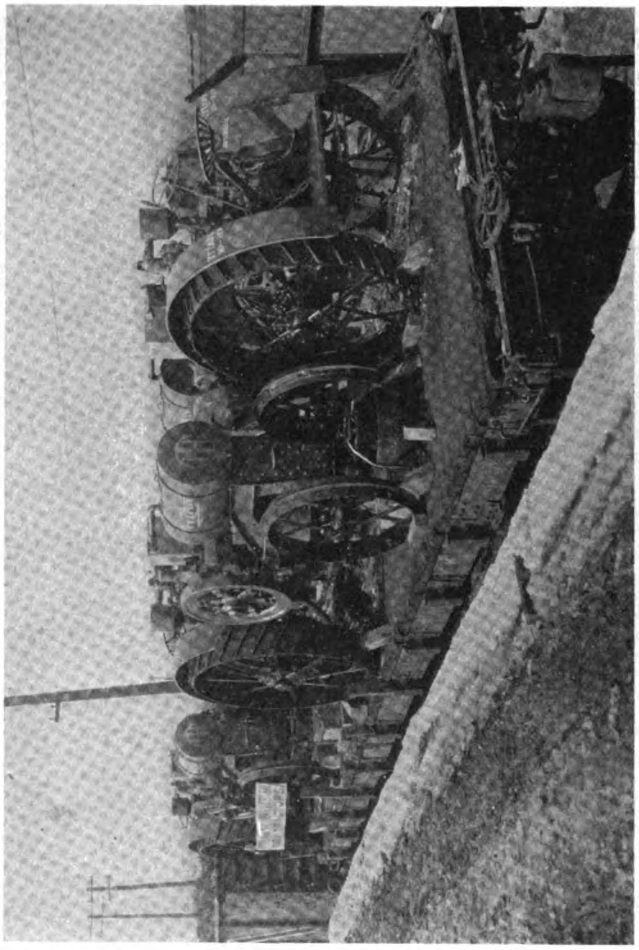
Transmissions are progressively assembled on rails, the finished product passing to the main assembly room



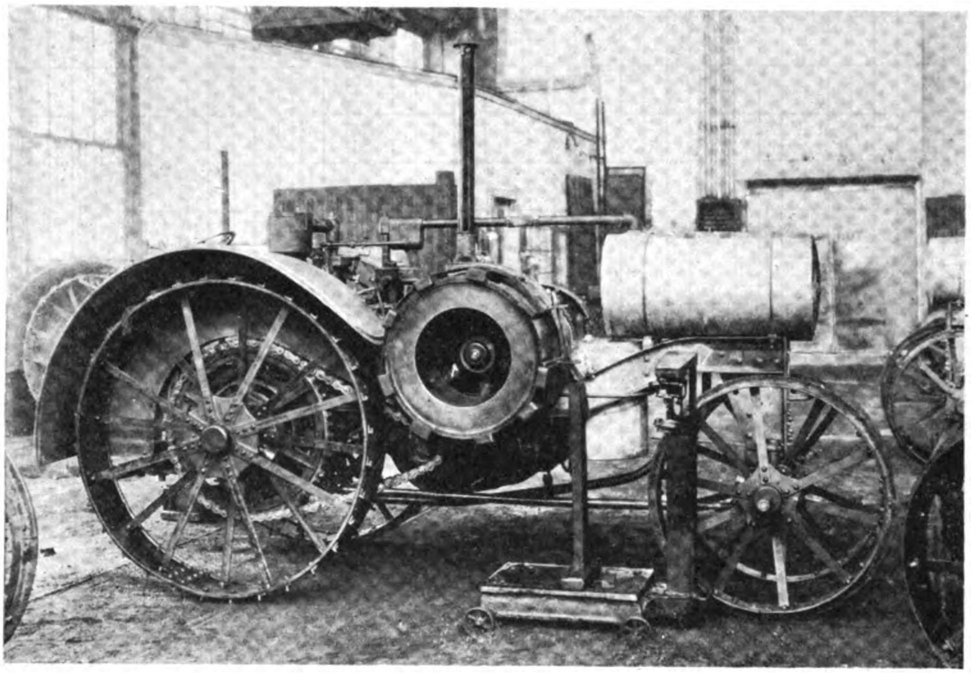
Frames with transmission and rear axle housing are assembled in a wheeled jig



General view, showing stock of finished tractors



Method of blocking flat car shipments of tractors



After final inspection the engine is submitted to a Prony brake test and operated at 500 r p.m. under various loads for 30 min.

put on to the engine. The crankcase covers are assembled in one of the galleries, and are brought down on trucks on an elevator. At this point also the valves are timed and the magneto is set. While this is being done, other minor parts are added, such as the seat and spring, steering wheel, mixer, fuel tank and piping, governor rod and bracket, air cleaner, air pipe and water piping. All these parts are stacked up at the side of the main line of assembly opposite the particular point where they go on to the chassis.

When all these parts have been fitted, the mounting gang takes hold. They put on the front wheels, the front axle, the driving chains and steering rod, all at the same point. Then another gang puts on the water tank and connections. At the same time that the wheel shields are put on, the engine is being filled with kerosene, oil and grease. The water is delivered to the tank through a hose, which depends from a water box mounted overhead. This box is fitted with a flushing valve and all the operator has to do is to insert the end of the hose into the filling hole of the tank, pull a line connected to the valve, and the proper amount of water to fill the system will be released. The grease reservoirs are filled by means of hand grease guns, and fuel is pumped into the fuel tank by means of a measuring fuel pump.

This completes the assembly operations, and a man from the test floor now takes charge of the tractor. He primes the engine with motor spirit, and starts it with a hand crank, which operation usually succeeds at one of the first trials. Then the tractor is driven across the yard to the test floor under its own power. As more than a hundred tractors are turned out every working day, this performance is repeated every six minutes.

On the testing floor the engine is first given a 1½ to 2 hr. idling test, to limber up its moving parts. At the end of this test the connecting-rod bearing caps are removed and the bearings are inspected to make sure that they are in perfect condition. Also, the valve timing is checked over and the magneto timing and wiring is inspected. The mixer is looked over to see that its valve is set properly.

Next the engine is submitted to a Prony brake test, the ordinary water-cooled Prony brake being used. The engine is started up and its speed adjusted to 500 r.p.m., after which it is given a 30 min. variable load test. Having satisfactorily withstood this test, it is run for an hour under 20 per cent overload. After this period, the engine is given a final inspection by the test floor foreman. He removes the crankcase cover, and feels the bearings to detect any possible overheating. The tractor having satisfactorily passed this final test, it is delivered to the paint shop.

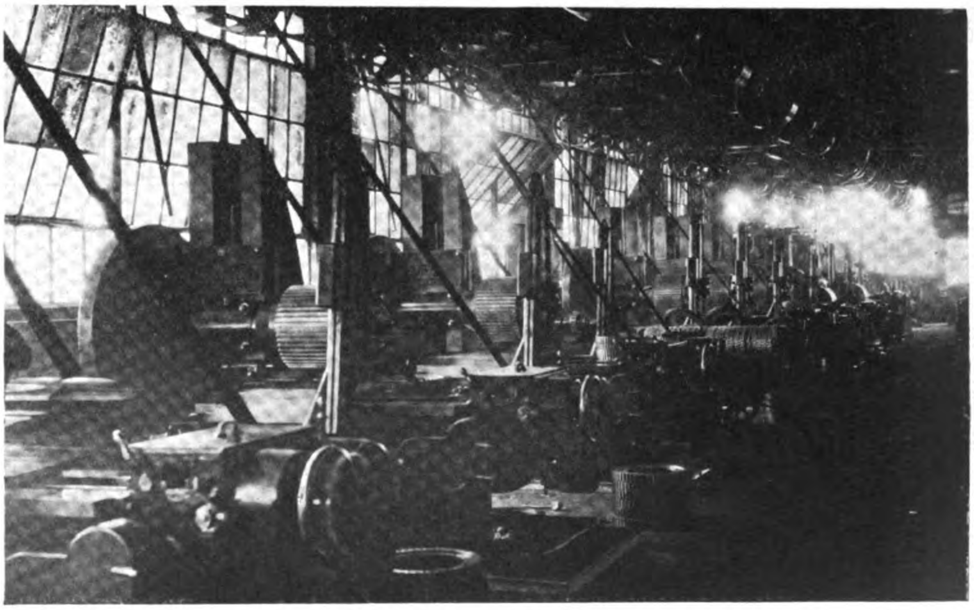
There are about 50 tractors under test at the same time on the test floor, and each tractor remains in this department for about 8 hr.

Painting is done entirely by hand, and each tractor is given two coats. As soon as the paint is dry, the tractors are loaded on platform cars or put into storage. They are driven onto the cars under their own power.

Box Handles of Webbing Save Space

IN export shipment, boxes loaded with 200 to 300 pounds are most easily manipulated when provided with handles. Usually such box handles are made of rope, inserted through holes in the ends of the box and secured with wall knots, or inserted in grooves on the under sides of the cleats on the ends of the box and held in place by nails or screws driven through the cleats.

A box handle made of webbing instead of rope has been suggested by the Forest Products Laboratory as a means of conserving space. For this purpose webbing about ⅛ in. thick and 1⅛ in. wide, which has a breaking strength of 800 lb., should prove suitable.



Battery of Cincinnati gear-cutting machines

SHOP "A" PRODUCTION SHEET

DAILY PROGRESS—MONTH OF MARCH-1919

PART NO.	NAME OF PART		NO. REQ'D PER MONTH	NO. REQ'D DAILY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
5004	TRANS-CLUTCH HAND HOLE COVER	6281			702		702	702	702	702	702	702	61	702	702	702																			
5006	DIFF. HAND HOLE COVER	6112	1000	43	21 0		64 0	107 900	150 1734	193 1734	236 1734	257 1734	0 7	300 1734	343 1734	386 1734	424	472	493		536	579	622	655	708	729		772	815	858	901	944	965		1000
5008	PILOT BUSHING	11164	1000	43	31 0		64 0	107 0	150 0	193 0	236 0	257 0		300 0	343 0	386 0	424	472	493		536	579	622	655	708	729		772	815	858	901	944	965		1000
5016	TRANS BEARING PLATE						176	276	276	276	276	276																							
5032	CLUTCH SHAFT	1348	2911	123	62 8		185 26	308 35	431 36	554 36	677 207	739 285	1	862 295	985 461	1108 516	1231	1354	1416		1539	1662	1780	1905	2013	2093		2446	2339	2462	2585	2708	2770		2900
5033	CLUTCH SHIFTER BRACKET	4273										8		8	8	8																			
5035	CLUTCH SHIFTER	6871			2		3	3	3	3	3	3		3	3	3																			
5036	CLUTCH LEVER INNER	9620			0		1115	1915	1915	1915	1915	1915	1 4	1915	1915	1926																			
5037	CLUTCH LEVER OUTER	5410			0		765	1860	3040	3040	5218	5218	4	5218	5278	5298																			
5044	CLUTCH SHIFTER LINK SHANK	3522	500	21	13 8		33 0	54 0	75 0	96 0	117 0	129 0		150 0	171 0	193 0	213	234	246		267	288	309	330	351	363		384	405	426	447	468	481		500
5046	CLUTCH ANCHOR PIN				95		95	1464	1464	1464	1404	1404		1404	1404	1404																			
5051	GEAR SHIFTER SHAFT	4413	4100	174	87 0		261 25	435 821	609 821	783 821	957 821	1144 821		1218 822	1392 822	1566 822	1740	1914	2001		2175	2349	2523	2697	2871	2958		3132	3306	3480	3654	3828	3915		4100
5052	GEAR AND CLUTCH SHIFTER BUSHING	6893	2100	89	45 1077		134 907	223 923	312 925	401 925	490 925	535 925	14	624 971	713 971	802 972	891	980	1025		1114	1203	1293	1381	1470	1515		1604	1693	1782	1871	1960	2005		2100
5053	GEAR AND DIFF. LOCK SHIFTER	98	7900	336			504 295	840 810	1176 811	1512 811	1848 811	2016 1293	1 1	2352 1295	2688 1295	3024 1295	3360	3696	3864		4200	4536	4872	5208	5544			6048	6384	6720	7056	7392	7560		7900
5054	GEAR AND DIFF. LOCK LOCKING PLUNGER						134 1077	223 1077	312 1077	401 2601	490 2601	535 2601	11	624 3341	713 3341	802 3341	891	980	1025		1114	1203	1293	1381	1470	1515		1604	1693	1782	1871	1960	2005		2100
5090	GEAR SHIFTER LEVER	3821						2	2	2	2	2	12 235	2	2	26																			
5092	GEAR SHIFTER SHOE	5815	2100	89									8 210																						
5093	9/16 X 9/16 X 7/8 KEY																																		
5096	DIFF. THRUST ADJUSTER	7832			2	500W	113	579	885	1154	1154	1154	118	1154	1154	1154																			
5101	DIFF. SHAFT R.H.	5404	500	21	12 230		33 239	54 521	15 615	91 747	117 747	2	130 909	171 1080	192 1081	213 532	234	246	267		267	288	309	330	351	363		374	405	426	447	468	480		500
5102	DIFF. SHAFT L.H.	3494	1400	59	70 0		89 0	148 0	202 0	266 0	325 0	355 0	2	414 0	473 0	552 0	511	650	[illegible]		734	798	857	966	975	1005		1064	1123	1182	1241	1300	1330		1400
5103	BULL PINION SPACER	15267											98																						
5104	DIFF. LOCK SHIFTER LEVER	3972						1	1	1	1474	1474	6 4	1474	1856	1860																			
5127	DIFF. LOCK CONTROL ARM	4840			10		10	10	10	10	10	10	121	10	10	10																			
5128	DIFF. LOCK SHIFTER PIN	18863											91																						
5131	DIFF. LOCK SHIFTER SHAFT	3706	800	34	17 0		51 0	85 0	119 0	153 0	187 0	204 0	102	231 6	272 6	306 6	340	374	391		425	459	493	527	561	578		612	646	680	714	748			800
5141	AXLE HOUSING END R.H.																																		
5144	AXLE HOUSING END L.H.																																		
5145	BRAKE HUB	2911	500	21	13 4	1484W 1570W	33 4	54 1277	75 1979	96 2444	117 2444	154 2444	1	150 2661	171 2661	192 2461	313	234	346		267	288	309	330	351	363		384	405	426	447	468	480		500
5146	BRAKE SHOE ANCHOR	3818	4400	187	44 279		311 279	468 647	155 870	642 1018	1	1123 1028		1310 1028	1497 1140	1684 1294	1871	2059	2152		2339	2526	2713	2900	3087	3181		3368	3555	3742	3927	4116	4210		4400
5147	BRAKE CAM R.H.	19046					4830	4830	4830	4830	4830	4830	15 101	4830	4830	5025																			
5148	BRAKE CAM L.H.	2352	800	34	17 0		57 0	85 377	119 377	153 377	187 377	204 377	53 61	238 373	272 377	306 377	340	374	391		425	459	493	527	561	578		612	646	680	714	748	765		800
5149	BRAKE CAM LEVER	1847	1800	77	38 0		115 721	192 1063	269 1063	346 1063	423 1063	431 1063	307 63	538 1063	615 1063	692 1063	769	846	884		961	1038	1115	1192	1269	1307		1384	1461	1538	1615	1692	1730		1800
5150	BRAKE SHAFT	13664			2		2	2	2	2	2	2	13	2	2	30																			
5165	BRAKE BALL ARM	10007											7																						
5195	ADJUSTING ARM PAWL	4632									485	485	129	485	485	485																			
5188	ADJUSTING ARM GIB	2586	1600	68	34 0		102 0	170 0	238 0	306 0	374 0	408 0	30 76	476 0	544 0	612 2	680	748	782		850	[illegible]	986	1054	1122	1156		1224	1292	1360	1428	1496	1530		1600
5206	GAS TANK BRACKET FRONT	2163	1000	43	21 0		64 0	107 0	150 0	193 0	236 0	257 0	3	300 0	343 638	386 1425	409	472	493		536	579	622	655	708	729		772	815	858	901	944	965		1000
5215	GAS TANK BRACKET REAR	5068			0		163	163	543	543	543	543	9	543	543	796																			
5227	GAS TANK STRAP BOLT	4212			633		1147	1163	1163	1163	1408	1490		1871	1871	1871																			
5249	BEVEL PINION SHAFT COLLAR	1772	2300	98	49 0		147 0	245 0	343 0	441 0	5	588 719		686 719	784	882	980	1078	1127		1225	1323	1421	1519	1617	1666		1764	1862	1960	2058	2156	2205		2300
5251	REVERSE SHAFT	12825			1544		1544	1544	1544	1544	1544	1544	83 22	1544	1544	2163																			
5252	STEERING YOKE PIN	11889					1411	1411	1411	1411	1411	1411	90	1411	1411	1411																			
5254	CLUTCH SHIFTER LEVER	3613											111																						
5255	CONTROL CROSS MEMBER	6	800	34	17 0		51 0	85 0	119 0	153 0	187 0	204 0	600	238 0	272 0	306 0	340	374	391		425	459	493	527	561	578		612	646	680	714	748	765		800
5256	STEERING SUPPORT LOCK	6096											182																						
5257	BRAKE LEVER	5469											1 4																						
5258	HAND LEVER BUSHING	11076											0 5																						
5259	CONTROL LEVER BRACKET	2467	7500	64	32 243		96 243	160 243	224 887	288 1236	352 1602	384		448 1678	512 1678	576 1678	640	704	736		800	848	864	928	992	1056		1152	1216	1280	1344	1408	1440		1500
5262	CLUTCH/HAND SHIFT LEVER	52098											298																						
5263	GEAR SHIFTER LEVER GUIDE	7127			2		2	2	2				1 6	358 2																					
5264	GEAR SHIFTER LEVER GUIDE SEPARATOR	2862	1200	51	26 0		77 0	128 0	179 0	230 565	281 1137	302 1149		358 2264	409 3322	460 1422	511	562	588		689	690	741	792	843	869		920	971	1022	1073	1124	1150		1200
5268	ROD END PIN	5746	3000	128	64 0		192 0	320 0	448 0	576 0	704 0	768 0		896 1426	1024 1476	1152 1426	1280	1408	1477		1600	1728	1856	1984	2112	2176		2304	2432	2560	2688	2816	2880		3000
5270	LEVER CONTROL ROD END REAR	16921											226																						
5271	GEAR SHIFT HAND LEVER	18412			9800		9800	14800	14800	14800	14800	14800	511	14800	14800	14800																			
[illegible]	CONTROL LINK ROD [illegible]	[illegible]																																	

A New Shop Accounting System

As Installed by the Tractor Branch of the Moline Plow Co.—Gives at All Times a Correct Record of the Situation in the Plant with Respect to Raw Materials and Finished Parts

IN order that a production schedule may run ahead smoothly, it is necessary that all parts required for the complete product, whether manufactured directly in the plant or obtained from outside sources, be always kept on hand in sufficient quantity to allow of assembling work going on unhindered. To insure this regular supply of parts, most large plants have a stock accounting or stock chasing department, the duty of which is to keep an accurate record of the stocks of all parts on hand and to issue a warning when the supply of any one part runs low. A special system for accomplishing this object has been worked out and applied by the tractor branch of the Moline Plow Co. and has proved most satisfactory.

Each department is provided with a schedule which covers the various items on which that department does any work, showing what quantity it is necessary to produce each day. These schedules are made up a whole month in advance. As the parts are produced, the production figures are posted on the schedule. When production of a part is up to or runs ahead of the schedule, the figures are posted in black, otherwise they are posted in red ink. Figures regarding parts that are not made in the factory, but obtained from outside sources are posted from the receiving slips made out when the parts come in.

The master sheets are kept in the Production Department, but duplicates of the sheets are sent to the respective factory departments. There are six departments for which duplicate sheets are made out, namely:

1. Purchasing department.
2. Foundry.
3. Forge shop.
4. Grinding and snagging.
5. Machine shop A.
6. Machine shop B.

A master sheet is made out for each department. Each of these sheets contains columns for the parts, numbers and names of all parts which the particular department handles.

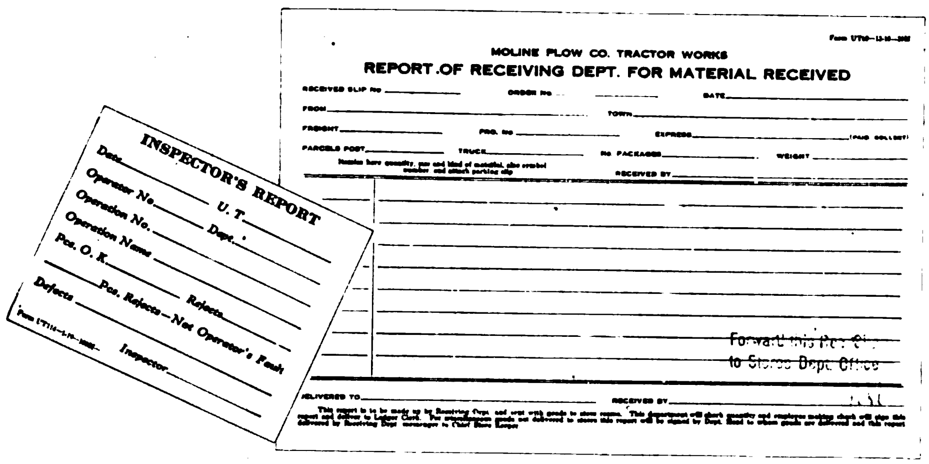
Then follows a column in which are entered the numbers of parts required per month, and then another column in which the numbers required per day are entered. At the beginning of the month there are entered upon the sheets the numbers of all parts on hand, the total numbers required for the month, and the requirements per day, the latter figures being extended across the sheet. Production data are entered upon the sheet in cumulative figures, in black or red, according to whether production runs ahead or behind schedule.

The product of each department goes through the hands of inspectors, and all inspectors make a daily report to the Production Department. One of these inspector's blanks is shown herewith. Red and blue buttons are used to indicate a dangerous shortage in the amount of stock on hand, which is figured in terms of number of days' supply. When the stock of any particular part runs low, a red button is placed on the sheet to indicate the day on which the supply, if not replenished, would run out. Blue buttons are used when the supply of parts runs low, but will last into the following month, in which case it is necessary to post the button in one of the first columns of the sheet. The blue button really indicates that the date to which the supply on hand lasts is in the following month. When new stock is received, the buttons are moved. One man does all the posting, and spends only about one-half of his time at it.

Weekly Check Up of Scrapped Material

At the end of every week, pieces that have been scrapped and parts that have been sent out for repairs are checked off. At the end of every month the man having charge of the accounting system takes the stock on hand at the beginning of the month, adds the number of parts produced during the month, subtracts the number of parts used in manufacturing operations, the number of parts scrapped, and the number of parts sent out for repair purposes, and the remainder is the stock on hand at the beginning of the next month.

The schedule here described acts as a shop order, and also as a stock record. The Moline Plow Co., in its tractor department, issues no special shop orders for any parts manufactured in its own plant, the schedule of the Production Department serving this purpose.


INSPECTOR'S REPORT
Date
Operator No. U. T.
Operation No. Dept.
Operation Name
Pcs. O. K. Rejects
Pcs. Rejects—Not Operator's Fault
Defects
Inspector

MOLINE PLOW CO. TRACTOR WORKS
REPORT OF RECEIVING DEPT. FOR MATERIAL RECEIVED
Received Slip No. Order No. Date
From Town
Freight Pro. No. Express (Paid Collect)
Parcels Post Truck No. Packages Weight
Received by
Delivered to Received by

Sources of Production Sheet Data

The form herewith serves for collecting the data which are entered on the production sheets. All product completed by any department of the works passes through the hands of inspectors and the inspectors' reports are sent to the production department. Similarly when material purchased by the company arrives at the factory it is checked up by the receiving department and the report made out is sent to the production department.

Airplane view of Motor Reconstruction Park

M. T. C. Salvage Park in France

PART I.

An American War Factory in the Heart of France—3500 Employees—Built in 65 Days—Was 120 Miles Behind Front—Engine Department Overhauls 100 Engines Per Week—1000 Jobs Weekly Output—Manufactures New Parts

By W. F. Bradley*

PARIS, Feb. 11—Early in May, 1918, a staff of Motor Transport Corps, U. S. A., officers and mechanics was put in possession of 337 acres of agricultural land in the center of France and told to erect on it a main salvage and reconstruction park capable of taking care of all the wreckage then accumulated from the front, and to provide for the huge quantity bound to come with the summer fighting.

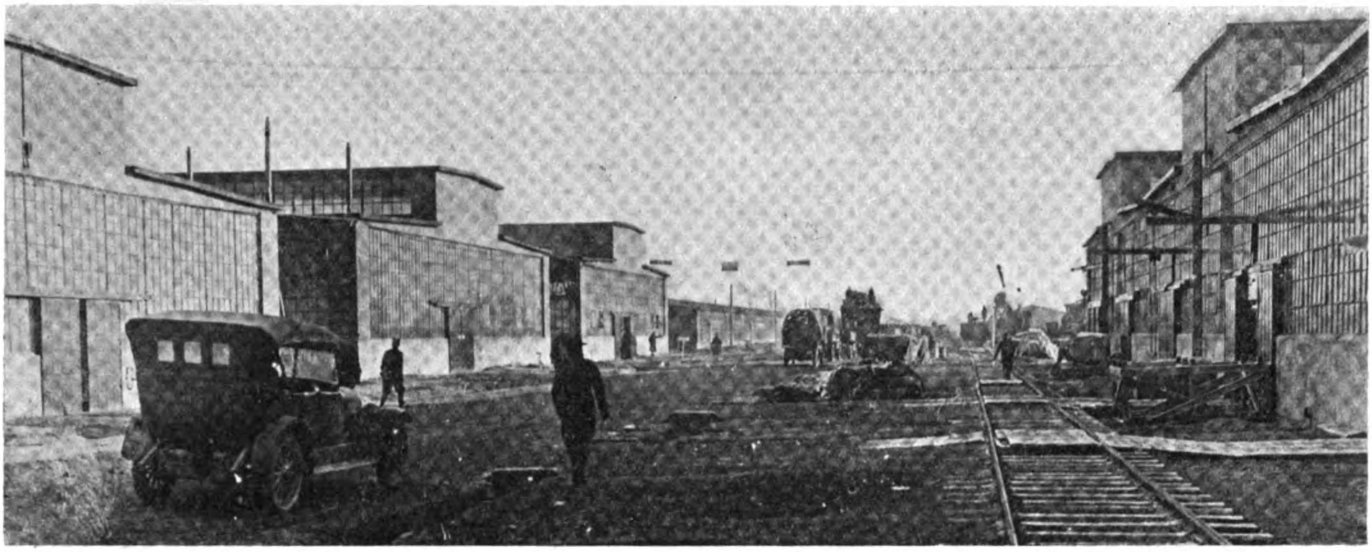
The first task of the M. T. C. men was to drive the cows off the land, then to erect buildings, and, as each one was completed, to appoint a staff and start production. The ground was purely pastoral. A railroad ran through it, and the nearest village comprised a score of houses. The 3500 men put on this job brought all the material, with the exception of some lime and stone. They prepared their own plans. They cleared and drained the land. They erected the buildings and installed machinery, and on July 15, or only 67 days after taking possession of the bare land, moved into the shops. Fifteen days later they were in production.

5300 Busy Workers

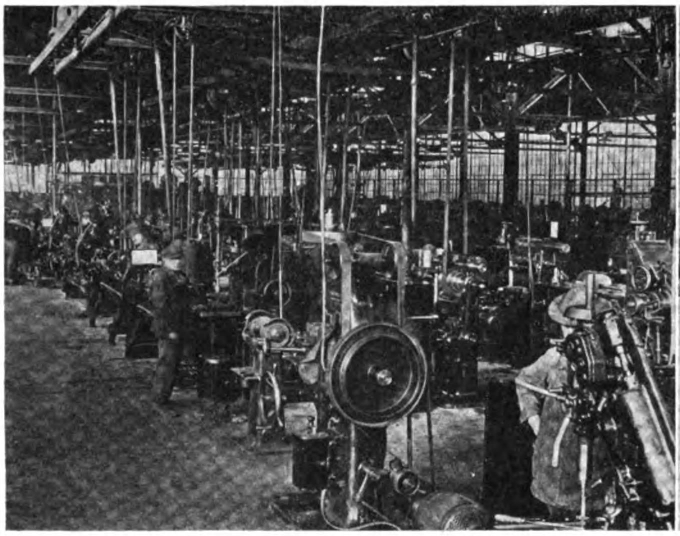
When I visited this reconstruction park in November, 1918, there were 3500 skilled mechanics at work in the shops and a gang of 1800 German prisoners and civilians doing such general work as making roads, laying foundations for buildings, unloading freight cars, etc. The whole organization had grown so fast that outsiders had not had time to marvel at it. Paris had not heard of its existence. Other branches of the army knew in a vague sort of a way that a reconstruction park was being erected and assumed that it was still in the erection stage.

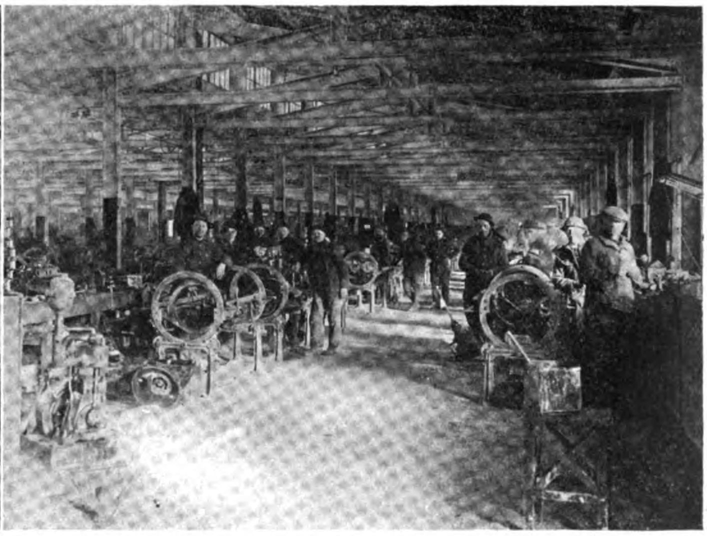
There has been a lot of quick work done by the American Army in France, but it is doubtful if there is anything to equal this job of erecting an automobile reconstruction park to employ 3500 men, and having those men working at their own trades within 4 months of breaking ground. And these M. T. C. mechanics did not

*EDITOR'S NOTE—*W. F Bradley has studied motor transport during the war in France, Belgium and Italy and has been associated with this department of war since 1914. He assisted in the purchase of many automobiles and trucks for the A. E. F. in the summer of 1917 and personally superintended the overland delivery of many Fiat vehicles for our army. He made a minute investigation of the Salvage Park described in this article.*

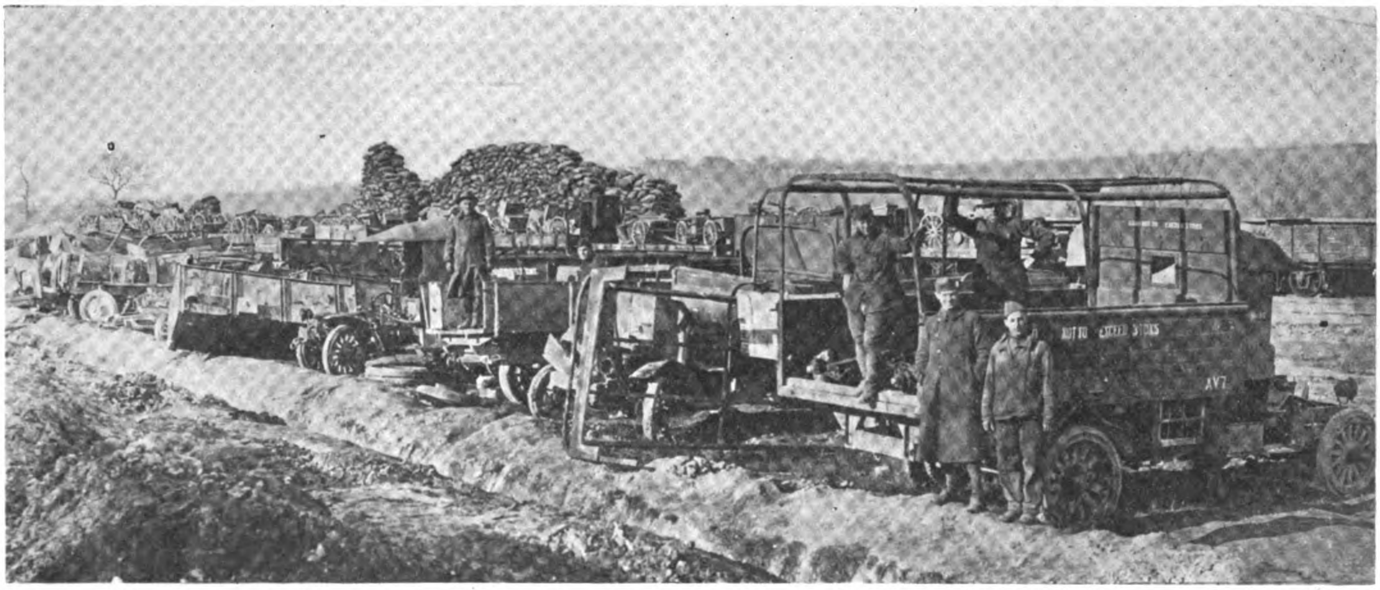


Main street at Motor Reconstruction Park. On right are offices and stockroom; on left are machine shops





Left—Tool room at Motor Reconstruction Park. Right—Engine repair shop with 86 engine stands; 100 engines completely overhauled every week



A line of trucks to be salvaged by Motor Reconstruction Park

apply to the Engineers Corps for assistance, nor did they requisition for labor battalions. Being practically all skilled workers from the automobile factories in the United States, they estimated that they were capable of erecting buildings, laying foundations, and installing machinery as efficiently as any bricklayers or masons. And they did it. It was not until after they had enough buildings up to enable all of them to be employed at the jobs for which they were specially skilled that they were given prisoner and civilian help for the rougher work.

The scope of this reconstruction park is to receive all the wreckage from the front, and to repair or salvage it, according to its condition; also it has to act as main supply depot for the Motor Transport Corps of the A. E. F. It has to cover all vehicles, with the exception of foreign makes, which go to a special park; and in addition to motor equipment it has to take care of all such Quartermaster horse-drawn vehicles as field kitchens, wagons, etc.

The Wreckage of War

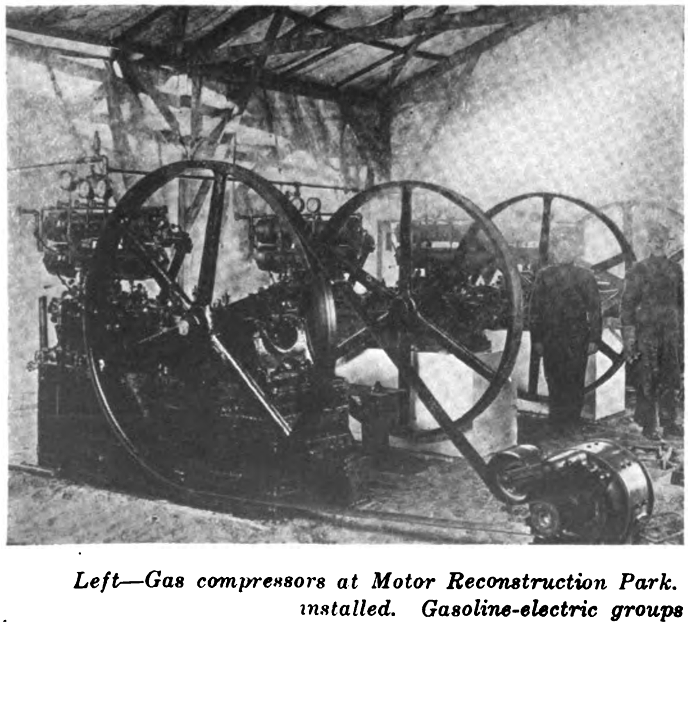
Up at the front, 120 miles away, they collected everything on wheels which they were unable to repair, loaded them on freight cars, and dumped them by the train load in the grounds of the reconstruction park. When the front was quiet there was a steady stream of vehicles which had broken down in service, or which had been damaged in accident. But after every big battle there came a mad torrent of almost indescribable wreckage.

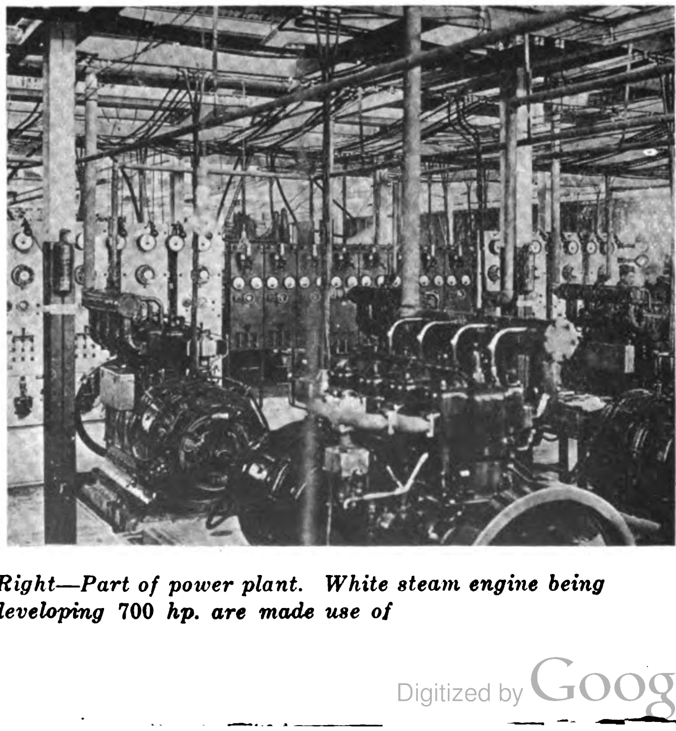
Looking it over, the question which naturally arose was, "How is it possible for automobiles to get into such a condition?" If a gang of ruffians had been put in possession of several hundred automobiles and told to wreck them so that they would look as unlike automobiles as possible, it does not seem conceivable that they would have succeeded in getting anywhere near the wrecking perfection attained by war.

They were all war wrecks covered with a thick coating of yellow, French mud. With some the story could be traced, as for instance the Cadillac limousine which had been in the direct line of a bursting shrapnel shell, and which had been sent back with blood, bits of flesh, remnants of uniform and equipment intermingled with its torn upholstery and horsehair stuffing. A few weeks later that car went out practically new, and the men who are riding in it at this moment undoubtedly are unaware of the grim tragedy attached to it.

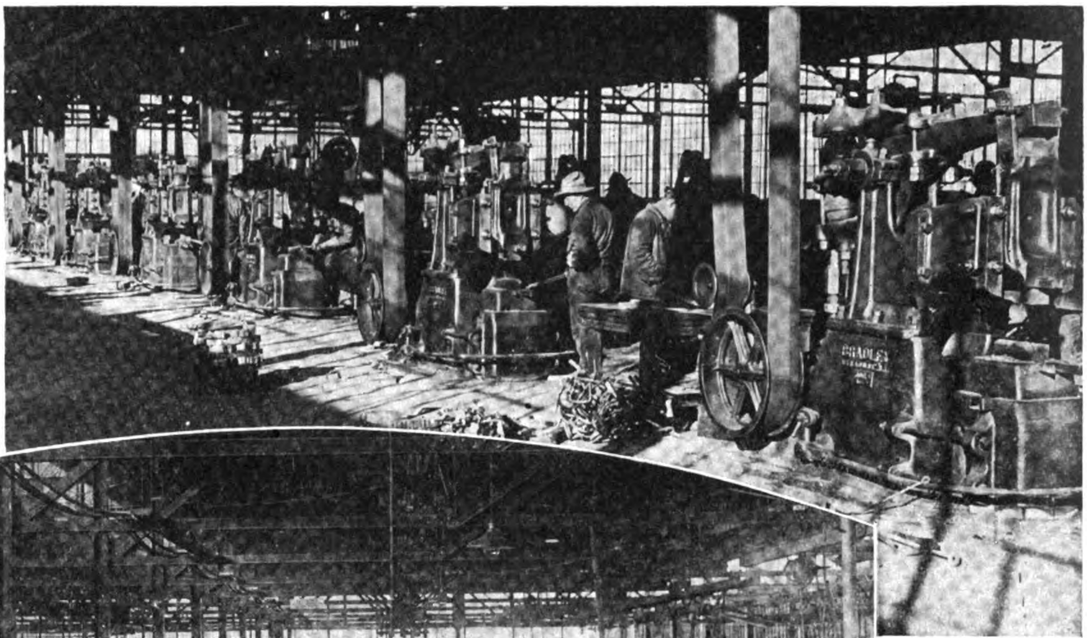
As there was no time to prepare the ground, a Holt tractor had to be used to haul damaged trucks inside the park

German prisoners stacking salvage motorcycle parts

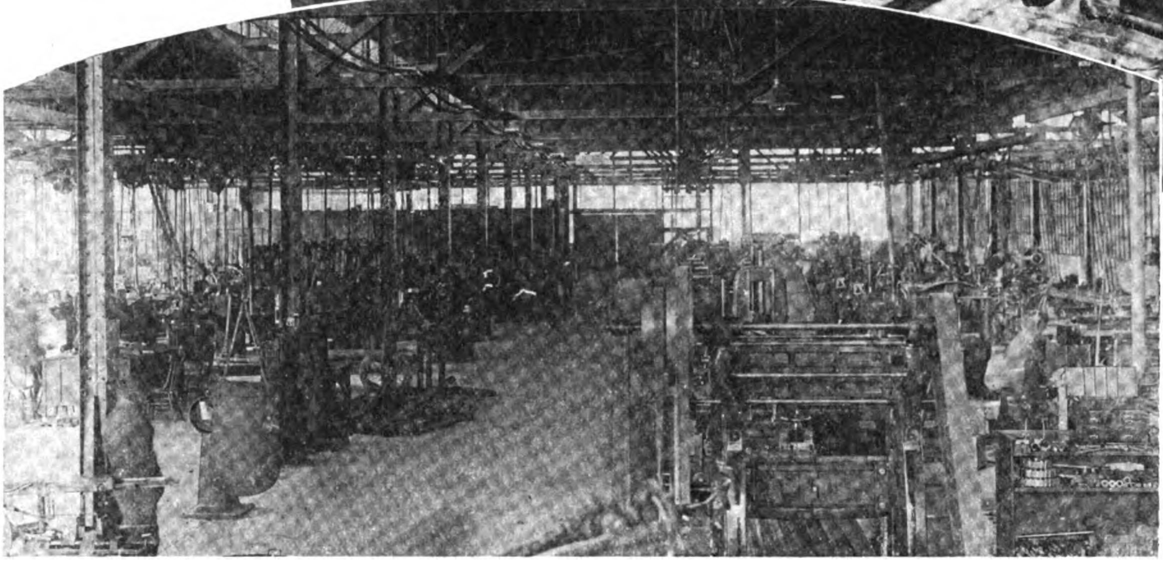




Left—Gas compressors at Motor Reconstruction Park. Right—Part of power plant. White steam engine being installed. Gasoline-electric groups developing 700 hp. are made use of



One line of the 14 Bradley hammers in Motor Reconstruction Park



One of the four machine shops

How a six-cylinder Mercedes aviation engine, complete with radiator, instruments and some of the fuselage, found its way into a wrecked American truck and was then dumped off into the mud of the reconstruction park, nobody ever will know. But the mechanics accepted it without asking any questions, stripped it, relined the bearings, repaired the pierced intake manifold, which had been the original cause of its capture, and soon had it in running condition.

It takes the better part of a day to completely travel over the whole of the motor reconstruction park, of which Colonel H. A. Hegeman is the commanding officer and of which Major J. A. Hickey is the master mechanic. The main office, right in the center of the camp, is an Austin type building 100 by 140 ft., with modern office furniture, a telephone on every desk, and the commanding officer accessibly placed at the head of the building, with the whole of the service under his direct supervision. This American method of placing the chief in the same buildings as his assistants, accessible to every visitor, is an unfailing surprise to the French, who have been taught that a leader's importance is measured by the number of doors separating him from his subordinates.

Of the 337 acres of ground given over to the reconstruction park, 207 had been covered between May 8 and Nov. 1, and the floor space of the shops comprised 485,300 sq. ft. Most of the buildings are of the Austin type, of steel construction, with a small amount of brick. Generally they are 100 by 260 ft. In addition to a number of others of different type, four of these Austin buildings had been erected and were in full operation early in November. The first one was a metal working shop, given over to the repairing of tanks, radiators, gasoline drums, etc. The following, and similar sized building, was a machine shop, fully equipped with modern machinery for all kinds of work. The third building in line was a machine shop with a thoroughly up-to-date tool room. The fourth was the forge, having among other equipment ten Bradley drop hammers and a modern spring making department, controlled by a specialist from Detroit, who produced from 40 to 60 sets of springs per day.

The main engine shop is of different structure, being a long building 639 by 96 ft., with seven bays, each 240 by 50 ft. This shop has 72 engine stands and 14 special Ford stands. It completely overhauls 90 to 108 engines per week. The wood-working department comprises two main buildings, each 100 by 260 ft., fitted with power-driven saws, planers, mortising machines, etc., and used specially for rebuilding horse-drawn vehicles. Adjoining are separate buildings for automobile upholstery, leather work, tops, hood covers. There are completely equipped shops for battery work, for electrical appliances, and for magnetos.

Most of the acetylene, oxygen and hydrogen required by the M. T. C. is produced at the reconstruction park and sent out from there. The plant, at the time of my visit, was filling 60 big acetylene bottles and 69 motorcycle acetylene bottles per day. In the hydrogen and oxygen department 80 of the former and 40 of the latter bottles were being filled, each bottle having a capacity of 200 ft. The compressors were under cover, but the gas lines were led out of doors, so that the actual filling was carried out in the open air. The filling of the motorcycle acetylene bottles was done under water.

(*To be continued*)

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, April 17, 1919 No. 16

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES

United States and Mexico	One Year, $3.00
Canada	One Year, 5.00
Foreign Countries	One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Buying Uncertainty

RARELY has there been such a wary attitude on the part of purchasing agents in going ahead with their inventories for the coming year as there is at present. At this season of the year the material for summer production is generally well in hand, but this year the purchasing agents are not buying more than a month or two ahead, except in very particular instances where the market conditions appear particularly favorable. One of the main reasons for this is the inability of the purchasing agent to accurately gage whether or not there will be a further drop in steel prices. The slowness of the Government in making adjustments on contracts is another factor, and there is no doubt that the continued control of the railroads by the Government is also having an effect, as this has influenced to some extent the release of purchase orders for steel by the railroads.

The practice of "hand to mouth" buying is disturbing and expensive. The cost of handling small orders is almost as great as that of handling larger ones, with the resulting tendency to keep costs up. It is about time that stabilized conditions were reestablished in the industries, and if purchasing agents generally will gather a little more confidence in the situation and act on their beliefs that prices cannot come down materially for some months, it will at once relieve the situation.

Uncertain conditions are not confined to the automotive industry, but obtain in all industries, and the inter-locking relationships of different industries make the uncertainty in the purchasing field of a contagious nature. Once the field goes ahead on its knowledge that material prices are not apt to change radically during the next few weeks, it will have a marked stabilizing effect on business in general.

Since there are no signs at the present time that wages will be reduced, it is quite certain that all other matters are going to remain in about the same state, and reductions in the price of materials, of labor and of factory space are not to be looked for during the balance of this year. The important point is to have manufacturers realize this condition and that they should go ahead and buy for manufacture on a longer time schedule than is being done at present.

Tractor Demands

THE open winter permitting plowing with horses and thus getting away from the peak of early spring plowing, to a measure accounts for the slowing up of tractor demand on the farm, but this is not the complete explanation of the situation. The farmer is better able to purchase tractors today than at any time in his history, but he still holds back and may continue to hold back for 2 or 3 months more until he harvests the present crop.

Possibilities of lower prices are holding back many sales. The small reduction in steel prices is looked upon as but a starter, and the farmer considers himself peculiarly fortunate in being able to get by this spring without investing in a tractor and at the same time not have to reduce his crop acreage.

Too few people in the country realize that prices cannot drop to the pre-war level, but unfortunately the farmer is not one of these few. He looks too often for the price pendulum to swing back to the 1914 level, which it will never do. A little educational work by the tractor makers would accomplish a great deal in analyzing the price situation to the farmer. It would be a much more constructive and positive method of merchandizing than cutting prices.

The present offers a quite confused situation—open spring, high costs of materials, and increased production facilities with many concerns. The trouble will remain for a few months, perhaps until the present crop is harvested, after which it is difficult to see how there cannot but be a big tractor demand. The farmer may perhaps not in a generation be favored with such a set of conditions. It behoves the manufacturers not to do anything that will rock the boat.

Co-operative Plans Between Organization and Labor

CO-OPERATION is very largely psychological, whether it is between the employer and the employee or between persons occupying approximately the same business plane. You have two parties in co-operation, and if the co-operation is to be real then it must result from the united effort of both parties.

It cannot come if the plan is worked out by one of the parties and thrust on the other. That is not co-operation, but rather coercion. The plan must be one of mutual evolution.

In the labor problem many of the so-called co-operative plans have failed because they were evolved entirely by the employer. He worked out the entire plan. The workers were not consulted in it. The employer not only conceived the plan, but put it up to the workers as his plan. They had no voice in it. They were merely asked to accept it.

It did not get a favorable reception from the workers because it was thrust upon them more or less as a charity measure so far as any additional wages were concerned. As such it flavored too strongly of paternalism. It was not co-operation in the sense of two parties working to do a job better and for the improvement of the two parties on an equal basis.

It is not surprising that some workers view with suspicion such co-operative plans which have been cut and dried by the management and then thrust before the workers for speedy ratification by them. Too frequently the workers view the plan with suspicion.

Let the employer put himself in the place of the worker: Let the workers thrust into his hands a carefully worked-out plan of factory management and division of profits and then ask for the ratification of it by the management in a single day.

What management is there that would not want to refer such a document to a corps of lawyers and have it gone through from end to end to find the nigger in the fence?

After receiving such a document the employer might see that real, enduring co-operation must arise from the co-work of two parties in which each is a factor in evolving the plan. The plan must come from both sides. It must be the product of mutual conception and deliberation.

It is this psychological aspect of the worker that Charles P. Steinmetz lays special emphasis on in his address printed on another page in this issue. It is to the failure to recognize this factor that he attributes the failure of so many so-called industrial relationship movements.

The worker has been suspicious of what has come from the management because, as Dr. Steinmetz says, the trouble between capital and labor today is a historical one. It began more than a generation ago and being of such long standing cannot be corrected in a day, a week or a month.

Unfortunately, labor and capital in too many cases occupy hostile camps. Instead of working together for increased production and reduced prices with the greater profits that ensue, labor stands off in its camp and capital stands opposite in its camp.

With the higher average of educational training the employer should take a broader view of the situation than labor. If education is to be of value, this is one way in which it should exhibit itself. Breadth of view is a natural product of education.

To start the solution process and to untangle the present knot, labor must see capital take the initiative.

Capital has been the stronger and as such can the more afford to approach the subject on a real basis of co-operation. Capital must give the worker a free opportunity to discuss the plans. The worker cannot be expected at the start to have as complete a grasp of the situation as the management and will make errors. These will have to be handled carefully.

The organization will discover it has an educational work on hand that it is obligated to carry on. It will require greater investments for this work than many organizations have been accustomed to make, but the goal is deserving of the price, and we cannot afford to fall short in the attainment.

Latest News of the

Overland Refuses to Increase Wages

Employees Threaten Walkout But Have Not Done So Yet—General Labor Unrest

DETROIT, April 17—The Willys-Overland Co. has refused the demands of its employees for increases in wages amounting to from 15 to 40 per cent, but though an immediate walkout has been threatened, this has not occurred. Vice-President C. A. Earl does not believe that the men will walk out, his belief being based on the fact that on Monday the Willys-Overland Co. will make the first distribution of profits under the profit-sharing plan which it recently adopted. This will give about $200,000 to employees who have been in the service of the company for more than 6 months.

The workers definitely demanded an increase of 15 cents per hour, the demand representing a total of 12,000 workers. They also demand that piecework be abolished and the working day be shortened to 8 hours, with 4 hours Saturday, and double time for overtime work.

Willys-Overland has not reduced the war wage scale. The demand for an increase would put wages from 15 to 40 per cent ahead of this scale and, if granted, would cost the company approximately $4,000,000 annually.

General Demand for 8-Hour Day

The discontent in labor circles is not confined to the Overland plants. In and around Detroit labor is in a state of unrest, with a general demand for an 8-hour day. The workers do not want their labors reduced to 8 hours a day, but want a 9- or 10-hour day with double time for the one or two hours overtime. At the Wadsworth Mfg. Co., which is a large top maker, the day force of 300 men has walked out, demanding a general increase in wages.

There is no longer any unemployment in Detroit, the pendulum having swung the other way. It is now difficult to get skilled labor, though unskilled labor is plentiful. Skilled men are averaging 65 cents per hour and unskilled men 45 cents.

Apparently there is a stable element among the older men, who have saved money and built homes, and this is having a good influence. The general impression is that the employers will win out.

Another matter which is causing some trouble is the competition among cities for labor. Cities around Detroit resent employers in Cincinnati, Cleveland and Detroit advertising in papers in those cities for help.

Sinram Heads Gear Makers for Third Term

CLEVELAND, April 16—F. W. Sinram, of the Van Dorn & Dutton Co. of this city, who has been president of the American Gear Manufacturers' Association since its formation at Lakewood, N. J., two years ago, was unanimously re-elected for a third term at the annual meeting of the association held here yesterday.

Fordson Plant Closed for Inventory

DETROIT, April 17—The Henry Ford & Son factory plant at Dearborn has closed down for the first time in 18 months and will remain closed for 2 weeks for a general inventory. The plant has been running three 8-hour shifts daily. On Saturday there was a clean-up and 914 tractors were turned out. The normal daily production has been running about 240 to 250 tractors. To date 53,075 tractors have been completed.

Want Government Tractor Tests

CHICAGO, April 11—Tractor manufacturers who are members of the Tractor and Thresher Department of the National Implement & Vehicle Association, at a special meeting to-day formally expressed to the Department of Agriculture at Washington a desire that it establish a bureau to conduct tractor tests to determine draw-bar and belt-power ratings of machines and to furnish a certifictae of the findings made by the bureau on each tractor tested. It is believed that certificates of power ratings, issued by a government bureau, would be of such standing nationally and internationally as to fully satisfy all interested persons.

Under this plan a variety of tests proposed by the several state legislatures would be done away with, and a much more satisfactory uniform national rating would be applied. This would eliminate the tremendous expense of the manufacturers in having their tractors tested by each of the states and would eliminate the variety of conditions to be met under the state control in all sections of the country. With the rapidly increasing volume of export trade, the tractor manufacturers feel that a federal certificate of horsepower ratings would be more recognized by all foreign countries.

A committee of the Tractor & Thresher Department was appointed to bring this matter before the proper officials at Washington in the hopes that this very desirable legislation may be procured.

Repair Agencies for Trucks Sold to A. E. F.

WASHINGTON, April 15—Thirteen American truck and car manufacturers have arranged to maintain agencies in Europe to supply parts and make repairs for all vehicles sold by the A. E. F.

S. A. E. Summer Meet June 23-27

Will Combine Business and Recreation Convention at a Great Lakes Hotel

NEW YORK, April 17—The summer meeting of the Society of Automotive Engineers will be held at Ottawa Beach, an exclusive summer resort on the east shore of Lake Michigan, 6 miles from Holland. The society has secured the exclusive use of the Ottawa Beach Hotel and cottages for June 23-24-25-26 and 27. Accommodation will approximate 1000 members and guests. The Standards meeting will be held Monday, June 23. In the evening the annual business meeting will take place and on Tuesday, Wednesday, Thursday and Friday professional sessions will occupy the program. Two half days will be given over to recreation and sports.

The rule which barred ladies from attending the sessions the last 2 years during the war has been waived and members will have an opportunity of taking their families and combining a vacation with the summer meeting.

The Meetings Committee, in deciding upon the nature of the meeting, took a mail vote of over 100 members to discover the kind of meeting they desired, and the vote was overwhelmingly in favor of a convention of professional sessions and recreation. The members are anxious to have an opportunity of fraternizing with one another and discussing many matters that cannot be discussed in a regular meeting. In view of this, approximately 30 per cent of the time will be given over to recreation and sports.

The program has not been definitely outlined as yet, but the general plan is to devote 50 per cent of the time to discussion and handle only a few important subjects. Thus the "Future Design of the Passenger Car" will be the subject for an entire session.

In a similar way the questions relating to production as concerned with cars, trucks, tractors, motorcycles, etc., will be the subject of an entire session. It is hoped to handle motor trucks, farm tractors and aviation in a similar way. There will be papers on motor boating, electric lighting systems, etc.

The Meetings Committee that has the meetings of this year in charge has been appointed by President Manly and consists of: Chairman, David Beecroft, W. A. Brush, C. F. Scott, B. G. Koether and Dent Parrett.

Automotive Industries

General Motors Sales $326,044,755

Financial Report Shows Large Increase in Profits, Assets and Capital

NEW YORK, April 12—Net profits of the General Motors Corp. for the year ended Dec. 31, 1918, increased $26,127,-754 over the balance for the previous year, and during that time net sales of all companies were 246,834 cars, valued at $326,044,755. During the year the company's assets increased $165,699,611. This increase in assets is made up to a considerable extent of increased holdings in real estate, amounting to approximately $46,000,000; $27,000,000 increased investment in Liberty bonds, about $44,-000,000 increased value of inventory, $7,000,000 due from the government on war contracts, an increased valuation of $24,000,000 on good-will, patents, etc., and about $16,000,000 increase in notes and accounts receivable.

After deducting reserves for federal taxes and other contingencies amounting to $28,000,000, the surplus for the year increased $24,900,545 and is now $36,-408,937. On Jan. 1, 1918, the working capital of the corporation was $64,554,-765, but by Dec. 31 this had increased to $149,902,028, the increase being $85,347,-263. The net manufacturing profits amounted to $35,504,576, after deducting $4,616,344 to cover depreciation of buildings, machinery and equipment. These profits are exclusive of profits which accrued to the several companies in 1918 prior to their acquisition by the corporation.

The combined profits of the corporation and subsidiary companies before deducting Federal taxes for the twelve months ended Dec. 31, 1918, and including the proportion of profits which accrued to the several companies in 1918 prior to their acquisition by General Motors, amounted to $45,541,726.

Included in the consolidated balance sheet are the assets and liabilities of the following divisions and subsidiary companies, in addition to various sales companies with nominal capitalization:

GENERAL MOTORS GROUP

Buick Motor Co. Division..............Flint
Cadillac Motor Car Co. Division......Detroit
Central Forge Co. Division...........Detroit
General Motors Truck Co. Division..Pontiac
Jackson-Church-Wilcox Co. Division.Saginaw
Northway Motor & Mfg. Co. Division..Detroit
Oakland Motor Car Co. Division.....Pontiac
Olds Motor Works Division.........Lansing
Samson Tractor Co. Division......Janesville
Scripps-Booth Corp. ....Detroit
Champion Ignition Co..................Flint
The McLaughlin Motor Car Co., Ltd..Oshawa
The McLaughlin Carriage Co., Ltd...Oshawa
General Motors Export Co.........New York
General Motors (Europe), Ltd........London
Janesville Machine Co.............Janesville

CHEVROLET GROUP

Chevrolet Motor Co. of Michigan ......Flint
Chevrolet Motor Co. of New York, Inc. Tarrytown
Chevrolet Motor Co. of Texas ...Fort Worth
Chevrolet Motor Co. of St. Louis..St. Louis
Chevrolet Motor Co. of Canada, Ltd..Oshawa
Chevrolet Motor Co. of Bay City...Bay City
St. Louis Mfg. Corp................St. Louis
*Toledo-Chevrolet Co. ....Toledo

UNITED MOTORS GROUP

Dayton Engineering Laboratories Co..Dayton
Hyatt Roller Bearings Division......Newark
Jaxon Steel Products Division.......Jackson
Remy Electric Division.............Anderson
Harrison Radiator Corp.............Lockport
New Departure Mfg. Co..............Bristol
Lancaster Steel Products Co......Lancaster

Following are excerpts from the report of the General Motors Corp.:

The net sales of General Motors Corp. and subsidiary companies for the twelve months ended Dec. 31, 1918 (not including the sales of the companies purchased during the year prior to their acquisition), amounted to $269,796,829.78. The net sales of all companies for the twelve months ended Dec. 31, 1918, amounted to $326,044,755.95. The number of cars, trucks and tractors sold during the year was 246,834.

The payrolls for the year 1918 aggregated $52,500,000. The number of employees in the service of the corporation and its subsidiary companies on Dec. 31, 1918, was 49,118.

Concerning the work done by the corporation on war products, a word at this time may not be out of place. Of the twenty-three operating units, eighteen were engaged on government contracts. The gross value of the products actually completed was approximately $35,000,000. At the time the armistice was signed the orders and contracts in hand exceeded $50,000,000.

The United States had been at war hardly a month when the Truck Division received a large order for its Model 16 chassis to be used for ambulance mounts. During the Mexican trouble this chassis, in actual service, had proven to be especially well adapted to ambulance work and was adopted by the Medical Corps for all motorized units. In the summer of 1918, after having spent months on the design of a new chassis for universal military service, the Army finally acknowledged the sterling worth of the G.M.C. Model 16 chassis by making it the standard ¾-ton chassis for all arms. General Motors furnished over 5000 of these vehicles.

The Quartermaster's Corps, supplying the majority of the vehicles used by all branches of the service, early adopted the Cadillac as the standard officers' car. A total of 2350 Cadillac cars practically standard in all respects were supplied.

The Cadillac eight-cylinder engine, with a few slight changes, was adopted by the Ordnance Department as the power plant for the 2½-ton artillery tractor. A total of 1157 engines were supplied for this purpose.

In the production of Liberty motors for aircraft work, the Buick and Cadillac divisions made an exceptional record. Regardless of the delayed start, due to the fact that the General Motors Corp. had been

(*Continued on page* 871)

—

To Sell 1000 Liberty Engines

WASHINGTON, April 17—One thousand Liberty engines have been placed on sale by the War Department. They are 12-cylinder, V-type, 5 x 7, 400 hp., at 1700 r.p.m., and are equipped with a Delco generator, battery-type ignition, and two complete distributing units working independently with specially designed Zenith duplex carbureter. These engines are all new and are a surplus above the requirements of the Air Service. Bids should be made to the Sales and Salvage Section, Army Air Service, Washington.

SKF and Hess-Bright Brought Together

With Atlas Ball, They Form SKF Industries—Establish Research Laboratory

NEW YORK, April 17—The SKF Administrative Co., which was formed in May, 1917, to consolidate the interests of the SKF Ball Bearing Co. and the Hess-Bright Mfg. Co., has been merged, with the Atlas Steel Ball Co. into a new company to be known as SKF Industries, Inc. The Atlas company has for some time been controlled by the SKF company.

The immediate purpose of the merger, which brings together the sales and executive departments of the three companies, is to facilitate the carrying on of important research work. For this purpose ground is being broken adjacent to the Hess-Bright plant in Philadelphia.

The merger will not affect the financial status of any of the companies and is largely to simplify merchandising problems. Heretofore, Hess-Bright and SKF bearings have been sold separately and in competition. Hereafter, they will be sold by the same sales organization, with the assistance of the research and engineering laboratory, and not in competition. Both names will be perpetuated, Hess-Bright for the company's deep-groove type of bearing, and SKF for its double-row self-aligning type. The establishment of the laboratory permits the company to give scientific advice on anti-friction matters, entirely divorced from the sale of any specific type of bearings.

B. G. Prytz, who has been president of all three companies, is president of the new company. Associated with him are: Vice-president, W. L. Batt, formerly vice-president of the Hess-Bright company; Comptroller J. P. Walsh; Sales Manager S. B. Taylor, formerly vice-president of the SKF company.

The company will consolidate its sales and executive offices at 165 Broadway, New York. The SKF, Hess-Bright and Atlas plants, the former in Hartford, and the latter two in Philadelphia, will be maintained without change.

—

Holt-Best Patent Litigation Settled

SAN LEANDRO, CAL., April 11.—Litigation between the Holt Mfg. Co. and the C. L. Best Gas Traction Co. over certain patents has been adjusted. The Holt company has acquired the Lombard patents, Nos. 674,737 and 854,364, from the Best company and has licensed that company to manufacture under the Holt patents. The number of the patent in the suit instituted by Holt is 874,008.

Militor-Knox Merged as Militor Corp.

Will Continue Militor Motorcycles and Knox Engines and Add Passenger Car

NEW YORK, April 12—The Knox Motors Co., Springfield, Mass., and the Militor Corp. have been merged and will do business as the Militor Motors Co., with a capital of $2,500,000. The company plans to increase the production of Militor motorcycles and will also add a light passenger car. It is planned to continue production of Knox engines.

The original Militor Corp. was organized for the production of war vehicles for the Government, and received contracts for a considerable number of four-wheel-drive trucks, though these contracts were canceled before the company could get into actual production on them. The Militor motorcycle is a four-cylinder, shaft-driven vehicle which differs from other motorcycles in that it is of automobile construction to a very great extent.

N. R. Sinclair, president of the Militor Corp., will be president of the new company. Associated with him are George W. Dunham, vice-president of the Militor Corp. and formerly president of the S. A. E.; second vice-president, R. L. Notman, secretary of the Militor Corp. and formerly vice-president of the McKinnon Dash Co.; treasurer, E. O. Sutton, formerly treasurer of the Knox Motors Co. Production activities will be centered in the Springfield plant, which has more than 230,000 sq. ft. of floor space and a complete equipment of machinery. General executive and sales offices are at 111 Broadway, New York.

Fokker Airplanes to Be Made in Holland

WASHINGTON, April 12—A factory is being erected in Holland for the manufacture of Fokker airplanes, according to information received here by the War Department. Two American army officers, Col. Earl McFarland and Major Robert Marsh, Jr., have been assigned to visit the factory and study the Fokker plane, afterward reporting to the American military attaché at The Hague.

U. S. Chamber of Commerce Convention at St. Louis

WASHINGTON, April 12—The meeting of the Chamber of Commerce of the United States at St. Louis, April 28-May 1, will include in its program discussion on the disposition and operation of the country's railroads and merchant marine, revision of anti-trust legislation, foreign relations and foreign trade, agriculture, industrial production, domestic distribution, waterways and highways, industrial relations and finance. The Advisory Council of American Industries, which comprises 400 war service committees, has been asked to attend the meeting.

Speakers already designated include Carter Glass, Secretary of the Treasury; William C. Redfield, Secretary of Commerce; Edward N. Hurley, chairman of the Shipping Board; Walker D. Hines, Director of Railroad Transportation; Senator Albert B. Cummins; George Ed Smith, President of the Manufacturers' Export Association, and Maurice Casenave, former French Minister to Brazil, now Director-General of French Services in this country, who will speak as the special representative of France.

French Accessory Competition

PARIS, March 26—On June 9 the Touring Club of France will hold a competition for the equipment of automobiles for extensive touring and camping. This competition is a part of the program drawn up by the club in celebration of its twenty-fifth anniversary.

It is felt that very few automobiles are so designed that accessories, such as tires, rims, tools, batteries, etc., can be carried conveniently. The object of the competition is not only to find the best ways of lodging these essential accessories, but also to reveal the best methods of carrying baggage and touring equipment. Light two-wheel trailers suitable for placing behind a passenger-carrying automobile will be admitted at this competition.

Major Halford in America in Interest of English Patents

NEW YORK, April 12—Major F. B. Halford, representing Engine Patents, Ltd., of England, which developed the Ricardo cross-head piston type engine used in the British tanks, and also the slipper design of piston, arrived in New York recently in the interest of American patents on these products, and also the possible development of them in America.

Major Halford was one of the three to develop the B.H.P. aviation engine which was used so much in British bombing planes, and of which perhaps over 6000 have been built. The B.H.P. was a 6-cylinder design and in 1916 was fitted in the first DH-4 bombing plane. With cylinders 145 x 190 it furnished approximately 1 hp. for every 2¼ lb. in weight. The object of the development of the B.H.P., which took its name from the three men who worked on its development, namely, Sir William Beardmore, Major Halford and T. C. Pullinger of Arrol-Johnson, was to give maximum reliability without excess weight. It was a direct-drive engine, and with its use the speed of the bombing planes was increased from 92 to 116 m.p.h.

Closing of Cleveland Plants Throws 1200 Out of Work

CLEVELAND, April 11—The entire works of the Theodore Kundtz Co., comprising five plants, were closed to-day, throwing more than 1200 men and women out of work. Officials say that the step was taken because of agitation among the workers for a wage advance of 10 cents an hour and a 6-hr. day.

$152,000,000 Voted for French Roads

$112,000,000 for Devastated Area —65,000 Miles to Be Entirely Rebuilt

PARIS, March 25—The sum of $152,000,000 has been voted by the French Government for the repair and upkeep of roads. Of this amount $112,000,000 will be devoted to the repair of roads in the devastated regions of France. Approximately $40,000,000 are to be spent on the repair of roads which have indirectly suffered owing to the war. These include roads which, owing to military activities, have had to carry an amount of traffic for which they were never designed.

Careful examination of the roads situation in France shows that 65,000 miles of main roads in the war area must be entirely rebuilt. In addition to this several hundred bridges, which at present are of a temporary nature, must be reconstructed. It is estimated that to put these war-stricken roads into proper condition 10,400,000 tons of material will be required. The estimated cost of this work is $64,000,000. This is in addition to the $48,000,000 which have already been spent by the military authorities during the war for the maintenance of roads in the war area.

For the past 4 years all the roads in the war zone of France have been under the direct control of the army authorities. At the end of April this control will be taken away from the army and vested in the Ministry of Public Works, which will occupy itself not only with the main or national highways, but also with the local or departmental roads. In the past the State only maintained national roads, leaving the upkeep of the secondary roads to the department or local authorities. In view of the enormous task facing it, this divided control has been abolished. All the gravel pits and stone quarries at present worked by the military authorities will be taken over by the Ministry of Public Works. Also all road work which is now handled by the American and British armies will be transferred to the French civilian authorities. Many of the contracts for this scheme have already been placed, and it is believed that active work on the repair of roads will begin by the end of April.

Repair Outside War Zone

The second part of the program, which deals with the repair and improvement of roads outside the war zone, is almost as big as the first. In asking for and obtaining a credit of $40,000,000 the French authorities realize that a tremendous effort must be made to make the roads equal to their condition of 10 years ago. A technical committee has been appointed to determine the kind of material necessary for each type of road. It is probable also that there will be a reclassification of roads.

Since the development of the automo-

bile many roads which were classified as fourth or fifth grade have become of primary importance. These roads should have spent on them an amount of money commensurate with the traffic they have to carry. Under this scheme it is estimated that it will be necessary to furnish immediately 5,000,000 sq. yd. of broken stone and to repair more than 1,000,000 sq. yd. of granite-paved road.

Pershing Highway Planned

WASHINGTON, April 11—The Department of Labor plans to construct a highway, to be known as the Pershing Highway, across the continent from New York to San Francisco, touching various places connected with the life of the commander of the American Expeditionary Forces. A temporary association has been formed for this purpose, and it is believed all the States will co-operate. A preliminary meeting was held in Lincoln, Neb.

The approval of Congress will be necessary, and appropriations made by Congress. Nearly 800 road projects have been approved in various States, and $21,000,000 as now available for State roads, according to the Federal Road Aid Act, by which the Government allows the individual States as large an amount as the States themselves appropriate for road construction.

Nebraska has taken the lead in the Pershing idea and also has 13 road projects of 388 miles approved at a cost of $809,401.43, of which $320,206.66 will be from the Federal funds. New York State has received Federal approval for 13 projects of 61 miles and California has had approved 6 projects covering 96 miles at a cost of $1,290,613.84.

Road-Building Freights Cut

WASHINGTON, April 12—Reduced rates on road building material for Federal, State, county or municipal work were ordered yesterday by the Railroad Administration. All railroads were authorized to cut, without filing tariffs, 10 cents a ton from regular rates exceeding 40 cents a ton on all shipments of broken, crushed or ground stone, sand and gravel, slag, shells, chatts and cherts, where the benefit of the reduction would accrue to the Federal, State or local governments.

Director-General Hines took this action after conference with the Departments of Agriculture, Commerce and Labor.

Gasoline Stocks Are Well Maintained

January Figures Disclose Satisfactory Position—Production Has Increased During Month

PRODUCTION

	January, 1919	December, 1918
Crude oil (bbl.)	26,967,332	26,958,157
Gasoline (gal.)	303,710,556	291,744,465

	Stocks on Hand Jan. 31, 1919	Stocks on Hand Dec. 31, 1918
Crude oil (bbl.)	15,380,185	15,749,771
Oils purchased to be re-run (bbl.)	1,088,264	1,300,018
Gasoline (gal.)	383,212,692	297,326,983
Kerosene (gal.)	332,393,181	380,117,829
Gas and fuel (gal.)	646,411,414	359,001,357
Lubricating (gal.)	158,370,431	138,853,574
Wax (lb.)	189,064,329	199,657,542
Coke (ton)	28,732	22,605
Asphaltum (ton)	93,027	76,858
Miscellaneous (gal.)	483,942,833	477,783,740

WASHINGTON, April 14—In comparison with the past few months, the figures relating to petroleum products for the month of January, 1919, are very satisfactory.

It is true that production of crude oil has remained practically stationary as compared with the total for December, 1918, and gasoline production has increased by less than 12,000,000 gal. Nevertheless we are now getting the benefit of decreased consumption and, accordingly, the position in regards to stocks held on Jan. 31 last is distinctly good.

It is reasonable to suppose that gasoline consumption should be at its lowest point around January, and no doubt it is mainly for this reason that our stock has increased by about 85,000,000 gal. Stock of fuel oil has increased by no less than 287,410,057 gal., a circumstance which augurs well for the maintenance of our new oil-burning merchant marine. Our stock of lubricating oil is also satisfactory, but stocks of crude and kerosene show slight decreases.

Almost all through the year 1918 consumption of crude petroleum and, inferentially, its derivatives has been in excess of production. In June the lines of production and consumption crossed for about a week, but later on the position altered and it was not until almost the end of December before production was again in excess of consumption. In January, 1919, both consumption and production dropped, but as the former decreased more rapidly our position improved.

Gasoline Shortage Affects South African Trade

WASHINGTON, April 12—Shortage of gasoline in British South Africa has affected the use of motor cars and trucks, according to a report from the American consul. Sales of gasoline were suspended by the Government in order to insure adequate supplies for military use. The position is not so serious now, and gasoline is again being sold for commercial requirements.

Parliament has legislated that no excise duty should be levied on Union spirits or on ether manufactured from spirits, if they are used for internal-combustion engine fuel, in order to stimulate and encourage the establishment of a motor fuel industry. As a result a factory has been erected near Durban costing $400,000 and with a full capacity for 3000 gal. daily. This fuel is being placed on the market at a price just below that of gasoline. No statement can be made yet as to its success as a substitute fuel. Warnings have been issued against its used in carbureters with cork floats, as it apparently contains some denaturing chemical which quickly destroys the shellac coating.

Carload Shipments Increase 5000 in March

NEW YORK, April 15—Shipments of automobiles increased nearly 5000 carloads in March, 1918, over the same month last year. In March, 1918, the shipments totaled 16,728, as compared with 21,500 in March, 1919, according to figures presented before the monthly meeting of the directors of the National Automobile Chamber of Commerce.

In the last month the condition of the factories in so far as their ability to get automobile freight cars is concerned has been materially bettered. This has been brought about through the efforts of the N. A. C. C. in having a representative of the railroads permanently located in Detroit with authority to check up and route freight cars.

DALLAS, April 15—The Spencer-Carroll Co. has moved from Waco, Tex., and will now operate its wholesale business in automotive equipment from that center.

Output of Refineries of the United States by Months

1918	Crude (bbl.)	Other Oils (bbl.)	Gasoline (gallons)	Kerosene (gallons)	Gas and Fuel (gallons)	Lubricating (gallons)	Wax (pounds)	Coke (tons)	Asphaltum (tons)	Miscellaneous (gallons)	Losses (bbl.)
January	23,842,587	2,300,334	242,632,044	119,358,184	547,866,248	56,623,425	39,238,858	41,216	54,854	70,995,829	1,078,181
February	23,386,676	2,298,333	234,324,618	121,218,320	510,165,397	58,300,914	35,087,337	42,371	42,033	75,134,088	983,992
March	26,239,662	3,696,872	269,627,968	151,228,007	587,985,804	69,308,351	43,597,019	44,248	56,901	94,865,148	1,097,489
April	26,201,544	3,956,244	293,396,162	153,703,682	578,255,341	71,022,204	40,173,524	45,674	51,242	89,242,012	1,182,020
May	28,510,698	4,112,023	319,391,202	160,590,760	631,586,209	79,589,735	42,544,633	48,864	60,449	88,627,491	1,269,281
June	28,140,479	3,483,270	315,023,445	151,840,252	628,842,033	74,420,996	41,317,794	46,605	50,321	81,110,922	1,282,177
July	29,170,718	5,951,537	332,022,095	156,828,826	658,439,682	79,303,107	41,691,551	48,914	58,433	159,374,139	1,338,304
August	28,534,275	6,376,353	330,335,046	149,678,850	671,113,871	72,892,879	41,829,516	51,759	59,715	163,345,034	1,337,327
September	28,390,431	5,485,747	314,595,959	164,963,798	653,085,050	70,593,079	42,704,894	48,052	49,157	138,201,963	1,236,834
October	29,237,767	5,571,847	314,251,318	164,928,640	661,780,441	72,244,633	43,470,132	48,820	51,878	166,109,867	1,161,545
November	27,411,636	3,857,754	312,968,640	169,278,105	604,403,494	72,178,602	49,642,007	51,393	35,387	75,430,160	1,236,818
December	26,958,157	3,474,890	291,744,465	161,742,713	587,873,987	64,987,842	43,847,092	41,747	37,596	84,273,730	1,352,657
Total	326,024,630	50,565,204	3,570,312,963	1,825,360,137	7,321,397,557	841,465,767	505,144,357	559,663	607,968	1,286,710,383	14,556,625
1919											
January	26,967,332	[illegible],919,492	303,710,556	158,501,260	589,630,056	68,304,613	44,987,603	59,003	54,074	92,324,236	1,183,767

Purchasing Pitfalls Pointed Out

Detroit Purchasing Agents Hear of Wide-Open Traps for the Unwary Buyer

DETROIT, April 14.—How to avoid legal pitfalls in buying was pointed out by Edward G. Wasey, a prominent attorney, at the April meeting and dinner of the Detroit Branch of The National Association of Purchasing Agents, held on April 9. Mr. Wasey pointed out a number of the wide-open traps which catch the unwary buyer unless he is posted on the laws which regard his occupation. His speech followed the banquet and was heard by about 100 prominent purchasing agents of Detroit. A digest of his remarks follows:

"In buying goods where the purchasing price is over $50, there must be a written contract in order to make the sale valid. If, however, special manufacturing operations have to be gone into to produce the goods, or if a part of the order has been delivered, a contract has been consummated. As a rule, however, goods purchased to the extent of over $50 must be purchased through a written contract.

"It is necessary that the man with whom the contract is made have the power to make the contract. This is something which must be watched carefully, as in the employee's contract with his company he may be limited in his powers, and the purchasing agent should not close the purchase, nor should the salesman, on the other hand, conclude a contract, unless he is reasonably sure that the person with whom the contract is being closed is empowered to make the purchase."

Another matter similar to this which must be watched is that a concern is doing business along the lines for which it is incorporated. That is, a corporation cannot be held responsible for debts incurred in doing business in a field for which it is not incorporated. For example, if a concern is incorporated to manufacture a certain article, and for some reason takes a part of its capital and invests it in a farm and starts paying on this farm and suddenly ceases payment to the land company, that land company would have no redress against the corporation, since that is a business beyond the powers of the corporation to conduct.

This defense, known technically to lawyers as *ultra vires* (meaning beyond the powers), is quite common and must be guarded against by the seller in making his contract. That is, he should know that the concern with which he is contracting is undertaking to do something that is directly in its line of business. Of course, the individual officers of the company are liable for the bill incurred in the case of an *ultra-vires* defense.

Another very important requirement is the use of printed forms of contract wherever possible. With such it is highly improbable that anything will be omitted from the contract. Mr. Wasey points out a very typical example of this. A lease was drawn up stating that the tenant was to return the property to the landlord in as good condition as he received it, taking into consideration normal wear and tear, and not including damage by the elements such as fire or flood. By an error the last phrase was left out.

The property was damaged by fire and the building burned to the ground, whereupon the tenant wrote the landlord asking him when he was going to rebuild the property. The tenant was very much surprised to receive a reply from the landlord stating that it was up to him to rebuild the property. A study of the lease showed that this important phrase had been left out and the tenant was forced to rebuild.

Another thing that both the purchasing agent and the seller must watch is that there is an agreement between the parties buying and selling. Sometimes, where a case is brought into dispute, one of the disputing parties will bring a mass of correspondence to the attorney's office, and somewhere in that correspondence is supposed to be evidence that the parties have agreed upon the purchase and sale, or on the specifications or other matters necessary in consummating the deal. Very often a careful search through the entire correspondence fails to reveal any such agreement. It is very necessary therefore, that the purchasing agent so arrange his correspondence on the matter of the sale or purchase as to bring out the fact that there is a definite agreement.

Another failure in the conducting of business along purchasing lines is that of the concern which fails to describe plainly the goods that are to be bought or sold. It is also highly advisable to put in the contract the exact purpose for which the goods are suitable. This then binds the seller to deliver materials or products which are satisfcatory for the purpose intended. Some of the purchasing agents go further than this, and are able to "get away with it" in most instances. They incorporate a phrase stating that the goods must be to the satisfaction of the buyer.

Mr. Wasey dwelt at some length on the bad results of buying too cheaply. If the price is made too low and the seller is not able to make a reasonable profit, the quality of the goods is lessened, or in some way the lack of profit is made up. A concern which forces another concern to operate at a loss to fill an order is not going to get the same sort of treatment as one that allows a reasonable profit, and eventually this curtailment of price will some back in some detrimental way to the purchaser.

The practice of canceling parts of orders increases the risk of the seller and naturally, since he is taking a higher risk, he will ask higher prices. In the case of cancellation, the buyer is also liable for anticipated profits and in some cases for a certain portion of the cost of material if it has been bought specially. The only way of getting around this situation correctly is to make an option form of contract. Wherever the buyer forces the seller to take a risk he must be willing to pay for it.

It is always advisable, if possible, to pay bills quickly. There are certain concerns which have a habit of sending out vouchers on the day the invoice is received or, at most, the day following. This practice is highly beneficial to the seller, as it is a factor in allowing him to turn over his capital more quickly.

Improvements in New DeDion

NEW YORK, April 17—The post-war program of DeDion Bouton has been slightly uncovered, and details of one of the new models which will be on sale in America by the end of June have reached this city. It about follows the previous DeDion design, using a "V" type 8-cylinder engine which is improved in many respects. Cylinder dimensions are 70x120 mm., wheelbase 134⅝ in. and tires 34x4½ in. with standard tread.

Several unusual features are the mounting of the four-speed gearset as a unit with the engine, and the adoption of a conventional rear axle, consisting of a stamped housing with floating drive shafts, in place of the former double type, consisting of a fixed axle with a separate driving system and the differential mounted on the frame and transmitting by two universal shafts to the wheels.

The car is fitted with a single-unit motor-generator for starting and lighting, driven by a silent chain. The springs are very flat semi-elliptical types. Thermo-syphon cooling is retained.

Kalamazoo Spring President Dies

DETROIT, April 17—Charles H. Eaton, president of the Kalamazoo Spring & Axle Co., died yesterday after a brief illness.

Government Vehicles Not For Sale

Federal Requirements Likely to Account For All War Trucks and Cars — Remainder to Makers

WASHINGTON, April 15—Reports, current during this past week, that many thousands of trucks and passenger cars would be thrown on the market in the next few days are untrue. The rumors are the result of action taken by the War Department to learn what possible surplus of trucks and passenger cars can be expected as a result of the reorganization of the army.

Following the inquiry by Acting Secretary of War Benedict Crowell, the Motor Transport Corps notified him that after detailing trucks and passenger cars to the various divisions of the army in accordance with the reorganization plans there will probably be about 30,000 motor trucks and 5000 passenger cars surplus, most of the passenger cars being Fords, while the trucks are divided up among all the different makes which were ordered during the war, some of them new and the balance used.

This surplus, however, is not an indication of a sale to the public. As soon as these amounts are definitely ascertained the War Department will ask the various government bureaus for requisitions for trucks and cars to meet their needs.

The plan is to first provide all government departments with their requirements and then if there is a surplus to allow the manufacturers to rebuy their cars and trucks at reasonable prices. Third, if after these two methods are used a surplus still remains, it will be disposed of by auction sale to the public. It is not expected, however, that there will be any vehicle left for public purchase, and it is very doubtful if there will be any for resale to the manufacturers.

The Post Office Department, the Department of Agriculture, the Department of Commerce, the U. S. Health Service and, in fact, all of the government agencies, are expected to make demands for a large number of the vehicles, probably for more than the War Department can spare. The Post Office originally requisitioned 16,000 motor trucks; 3000 of these have been delivered.

Of the remaining 13,000 the Post Office Department is now able to take only 4000 whenever the War Department can provide them due to the fact that the Post Office appropriation bill failed to pass in Congress in the recent filibuster. The remaining 9000 trucks will be asked for by the Post Office Department if the bill passes in the next session of Congress.

The Department of Agriculture has already signified a need for 1000 passenger cars, 4500 trucks and several hundred trailers, and anticipates that it will use considerable more than this as soon as it definitely formulates its road building program. The plan is to use these cars and trucks for road construction.

The U. S. Health Service has already taken 1000 ambulances, and will take all that the army can spare, which may possibly mean that ambulance bodies will be fitted to some of the truck chasses to meet the needs of the U. S. Health Service.

Likewise, the Departments of the Interior, Commerce, Labor, etc., are expected to ask for considerable numbers of vehicles, all of which can be turned over to the different government agencies under the Act of Congress which authorizes the Secretary of War to meet any such requisitions. Consequently it appears at this time that there will be very few vehicles, if any, remaining to be offered for resale to the manufacturers.

General Motors Sales $326,044,755

(*Continued from page* 867)

selected to build a special type rotary engine which was afterward abandoned, Liberty motors were being delivered within five months from the time the contract was taken. The high standard of excellence of the product of these divisions has everywhere been recognized. At the time the armistice was signed there were orders for over 10,000 Liberty aircraft engines on the books and 2528 Liberty engines were actually completed and delivered.

The Jackson-Church-Wilcox Division, operating an entire plant on trench mortar shells, reached a production of 20,000 per day. This division holds the record as the largest producer of these shells in America. Substantially every claim against the government has been satisfactorily adjusted.

The development of the tractor business is continuing most satisfactorily, and production of Samson tractors in quantities is expected to be reached shortly.

During the year the corporation acquired the following interests:

All the assets of Chevrolet Motor Co., a Delaware corporation (except 450,000 shares of General Motors Corp. common stock), as of May 2, 1918, paying therefor $28,268,400 par value of common stock.

All of the common capital stock ($1,000,000 par value) of the Janesville Machine Co., Janesville, Wis., on July 1, 1918, paying therefor $1,000,000 in cash.

A controlling interest on July 1, 1918, in the no par value common stock of the Scripps-Booth Corp., paying therefor through an exchange of securities on the basis of one share of General Motors common stock for six shares of no-par value Scripps-Booth stock.

All of the capital stock of Chevrolet Motor Co. of Canada, Ltd., the McLaughlin Carriage Co., Ltd., and the balance of the capital stock of the McLaughlin Motor Car Co., Ltd., not already owned by the corporation, as of Nov. 1, 1918, paying therefor $4,900,000 par value common stock and $550,000 in cash.

All the assets of United Motors Corp., subject to liabilities, as of Dec. 31, 1918, paying therefor $29,869,200 par value debenture stock, $9,956,400 par value common stock, and 106,000 shares of United Motors stock owned by General Motors Corp., plus an amount in cash equal to the dividends on the debenture and common stock subsequent to Oct. 1, 1918.

All the preferred and common stock of Lancaster Steel Products Co. and $1,566,000 par value of General Motors debenture stock as of Dec. 31, 1918, paying therefor $1,617,500 par value common stock and $500,000 par value debenture stock.

All of the ($387,100 par value) Harrison Radiator Corp. preferred stock as of Dec. 31, 1918, paying therefor $387,100 par value debenture stock and $38,710 in cash.

There was authorized an issue of $24,000,000 par value of common capital stock, which was sold without expense to the corporation, for $28,800,000 subject to the right of the common stockholders to subcribe therefor.

The corporation has adopted a bonus plan under which stock of the corporation is distributed each year as a reward to its employees, including employees of subsidiary companies, who have contributed to its success in a special degree, by their inventions, ability, industry, loyalty or exceptional service. It is hoped thereby not only to compensate services rendered, but also to encourage further efforts by making its employees partners in the corporation's prosperity. Under the bonus plan, the amount which may be distributed each year is determined by taking 10 per cent of the net earnings of the corporation after deducting therefrom an amount equal to 6 per cent on the capital invested. The bonus plan is in no sense a "profit sharing plan" in the meaning of that term as generally used. There was awarded for the year 1918, under this plan, a total of 24,334 shares of the common capital stock of the corporation, at a cost to the corporation of approximately $2,798,410.

The outlook for the coming year is most promising. Since the signing of the armistice and the subsequent liquidation of the war contracts, which your corporation was engaged in, the plants and facilities have been reconverted in an incredibly short time to their regular lines of activity, and as a result the manufacturing operations are considerably advanced, as is evidenced by the showing for the first quarter of 1919; the number of cars, trucks, and tractors sold to March 31, 1919, inclusive, being 82,456; the net profits before deducting Federal taxes are estimated at upward of $20,000,000.

Condensed Comparative Consolidated Balance Sheet of General Motors Corp. and Subsidiary Companies as of Dec. 31, 1918 and 1917

ASSETS

	Dec. 31, 1918	Dec. 31, 1917
Permanent Investment:		
Real estate, plants and equipment..	$86,818,414.51	$40,086,374.34
Less: reserve for depreciation.....	10,061,983.38	1,428,539.28
	$76,756,431.13	$38,657,835.06
Investments in allied and accessories companies	$2,839,531.23	$2,030,273.48
Current and Working Assets:		
Cash in banks and on hand.........	$30,636,621.48	$18,865,645.27
Liberty Bonds	28,852,018.00	1,255,000.00
Marketable securities	172,304.86	....
Sight drafts against B/L attached..	3,316,384.90	7,590,279.25
Due from United States Government on war contracts	7,305,626.76	449,855.83
Notes ($1,285,908.01 in 1918) and accounts receivable	21,995,359.50	5,555,403.34
Inventories at cost or less...........	91,137,512.59	46,559,394.15
Total Current and Working Assets	$183,415,828.09	$80,275,577.84
Deferred expenses	$762,651.85	$854,434.61
Good-will, patents, copyrights, etc....	$35,714,893.43	$11,971,603.48
Total	$299,489,335.73	$133,789,724.47

LIABILITIES

	Dec. 31, 1918	Dec. 31, 1917
Capital Stock:		
Debenture stock (authorized $150,000,000) issued	$30,756,300.00	....
Less: in treasury of General Motors Corporation	1,581,000.00	....
In hands of public...............	$29,175,300.00	....
Preferred stock (authorized $20,000,000) issued	$19,684,300.00	$19,676,800.00
Less: in treasury of General Motors Corporation	13,300.00	
In hands of public...............	$19,671,000.00	$19,676,800.00
Common stock (authorized $200,000,000) issued	$151,301,100.00	$82,558,800.00
Less: in treasury of General Motors Corporation	3,921,200.00	5,685,500.00
In hands of public...............	$147,379,900.00	$76,873,300.00
Total in hands of public......	$196,226,200.00	$96,550,100.00
Purchase Money Bonds..............	$225,000.00	
Outstanding Capital Stock (par value) and surplus of subsidiary companies, being the portion not owned by General Motors Corporation:		
Capital Stock	$2,960,400.83	$540,500.00
Surplus	427,754.20	859,083.18
Total	$3,388,155.03	$1,399,583.18
Current Liabilities:		
Accounts payable	$18,453,316.99	$10,665,717.52
Notes payable	10,802,154.11	....
Taxes, pay rolls, and sundries accrued not due......................	3,769,865.29	4,858,326.57
Total Current Liabilities........	$33,025,336.39	$15,524,044.09
Reserves:		
For two months' proportion of dividend on preferred and debenture stock, payable Feb. 1.............	$488,463.00	$196,768.00
For Federal taxes and extraordinary expenditures	25,863,823.23	6,939,018.55
For sundry contingencies............	3,863,420.65	1,671,818.08
Total	$30,215,706.88	$8,807,604.63
Surplus	$36,408,937.43	$11,508,392.57
Total	$299,489,335.73	$133,789,724.47

Income Account for Twelve Months Ended Dec. 31, 1918

Net profits after deducting all expenses of manufacture (including maintenance) selling and administration, as well as ordinary taxes, insurance and depreciation		$35,504,576.41
Less: Provision for Federal taxes and extraordinary expenditures		20,113,548.19
		$15,391,028.22
General Motors Corporation proportion thereof......		$14,825,530.19
Preferred dividends for 12 months at rate of 6%	$1,180,901.00	
Debenture dividends for 5 months at rate of 6%.........................	739,566.00	1,920,467.00
Undivided profits for 12 months ended Dec. 31, 1918.		$12,905,063.19

Profit and Loss Account

Profit and loss surplus at the beginning of the year..		$11,508,392.57
Add undivided profits per Income Account above....		12,905,063.19
Additions through acquisition of properties:		
Chevrolet Motor Company (of Delaware)	$8,065,083.10	
United Motors Corporation	9,714,607.59	
Other companies	653,100.98	
Profit from sale of new common stock..	4,800,000.00	23,232,791.67
		$47,646,247.43
Less: Cash dividends paid on common stock:		
February 1, 1918—3%..................	$2,292,150.00	
May 1, 1918—3%..................	2,292,567.00	
August 1, 1918—3%..................	3,205,704.00	
November 1, 1918—3%.................	3,446,889.00	11,237,310.00
Profit and loss surplus December 31, 1918.........		$36,408,937.43

NOTE—The various tangible and intangible assets acquired by the corporation during the year were valued and written on the corporation's books at the same aggregate amount as they had been carried on the books of the corporations so purchased. As these amounts are in excess of the par value of the securities of the General Motors Corporation issued in payment for such assets, the difference results in an addition to the surplus account of the corporation, as shown above.

The properties of the Chevrolet Motor Company of Canada, Ltd., The McLaughlin Carriage Company, Ltd., and The McLaughlin Motor Car Company, Ltd., which were acquired during the year, were appraised and the book values adjusted to agree therewith.

Will United States Hold Trade in the Argentine?

WASHINGTON, April 11—Asking the question, "Will the United States hold its present trade in Argentina?" Commercial Attaché R. S. Barrett at Buenos Aires states that while this country will lose business which will be diverted to Europe, on the other hand imports to Argentina of automobiles, motor trucks, parts and accessories should increase. He points to the fact that the war decreased imports on these commodities and that the great demand now will probably be filled by the United States.

His report states that American manufacturers are beginning to study, know and meet the requirements of the Argentine buyer, and with the establishment of two branches of important national banks of the United States in Argentina, together with the general adoption of trade acceptances, has made the financing of shipments to Argentina easier, and allows the American manufacturer to grant the credit necessary to compete with other countries.

He also states that American concerns are establishing branch houses in Argentina which sell automobiles and parts directly, and that this is encouraging trade. Furthermore, large Argentine concerns heretofore were controlled by large European capital, but are now buying in the United States, locating buyers in this country, and will probably continue their trade.

The United States, says the report, should be placed on a parity with European nations in the matter of shipping and freight rates, must train young men for foreign service, must adopt some plan to protect the Argentine buyer from unscrupulous and unreliable merchants, and should invest American capital more freely in South American securities of proven worth.

—

French Tractor Trials

PARIS, March 25—Agricultural tractor trials will be held in Lorraine about the end of May, and also in Alsace, near Strasbourg, at the end of September.

The Lorraine competition is scheduled for the neighborhood of Metz, where the earth is of a heavy nature. The Strasbourg trials will take place in light Alsatian soil.

These competitions are open to allied and neutral nations.

—

Kansas City Tractor Club Annual Dinner

KANSAS CITY, April 14—The Kansas City Tractor Club, with a membership of 29, gave $112,000 for the tractor show here this year, it was stated in the report of Guy H. Hall, secretary of the club, read at the annual dinner at the Hotel Muehlebach. The club is composed of managers of factory branches and distributers of tractors and tractor-drawn tools. The fifth annual Kansas City tractor show was planned for February, 1920, and Mr. Hall was elected secretary of the club and manager of the show for another year. Other officers elected were: President, R. F. Crawford; vice-president, M. R. Vorhees, and J. A. Keating, R. W. Johnston, Harry Kaufmann, G. T. O'Maley and L. T. Yount, directors.

—

Wichita Demonstration Date Pushed Forward

CHICAGO, April 12—It is likely that the Wichita tractor demonstration, which was scheduled for the week of July 21, will be held instead during the week of July 14. The advance in date is probably because of land conditions. The demonstration is being staged by the National Implement and Vehicle Association, of which E. W. McCullough is secretary and general manager.

—

Tractors Needed in France

WASHINGTON, April 12—Farm tractors are urgently needed in France, according to a report received by the United States Department of Labor, and especially those of the heavier types capable of plowing land that has lain fallow for the last four years and which is practically buried under a growth of thistles 2 ft. high.

—

Lifting Canadian Import Restrictions a Spur to Trade

DETROIT, April 12—Reports coming from Ottawa telling of the lifting of restrictions on the importation of automobiles into Canada by the War Trades Board of Canada, if true, are going to cause a great boom in the export business of Detroit automobile makers. Customs officials at Windsor, Ont., Detroit's port of entry into the Dominion, have received no official notice of such action, however, and, in the meantime all war restrictions as pertaining to cars of the $1,250 class and over are still in full effect.

The effect of the lifting of the British war embargo on Canadian goods, thus giving the Canadian manufacturers practically free access to all parts of the British Empire, is already stimulating Canadian as well as United States automobile makers for renewed activities. Detroit manufacturers see in the lifting of the embargo an open road to the British market. This, coupled with the decision of the Crown customs officials at Windsor, who hold that an assembled car, even if assembled from parts made in the United States, may be considered a Canadian car if assembled by Canadian labor, is bringing many branch plants to Windsor and is causing Canadian part makers to plan plant extensions.

It is stated at the Border City Chamber of Commerce, Windsor, that a number of Detroit automotive factories are contemplating Canadian branches.

The Paige-Detroit Motor Car Co. has just announced its intention of establishing a Canadian assembly plant for its cars and trucks. R. D. McCain, traveling representative of the Paige Co., is in Canada looking over the situation and preparing data on the advisability of such a move.

Truck Delivery Possibilities in South America

BUENOS AIRES, April 1—Purchasing representatives have come from Chile to the United States to purchase 60 motor trucks to replace all horse carts in the delivery system of Valparaiso and Rio Santiago, Chile. In South American cities the municipal meat delivery has been generally carried on by horse vehicles, but since the start of the war there has been a growing sentiment in favor of motor trucks.

The city of Buenos Aires is a typical example of this practice, in which beef from municipal slaughter houses at one end of the city is delivered by horse carts to the retail butchers of the city. Buenos Aires uses from 220 to 250 horse carts in this service, and the delivery must be accomplished by 11 a. m. each day. At present these carts are owned by different concerns, and the thought is that they could all possibly be replaced by motor vehicles. What seems to be the greatest objection to the motor vehicle is that the work does not require the trucks for the entire day, and to use them eventually would mean employing them in some other work that portion of the day not needed for meat delivery. This calls for some interchangeable feature of bodies, which has not as yet been worked out successfully.

It was estimated recently that approximately 100 motor trucks of 3-ton capacity would be needed in this service in Buenos Aires alone, as approximately 310 tons of meat have to be delivered each day. The longest trips are 25 miles and the average would approximate 10 miles. Now that the war is over more attention is being given to this matter than formerly.

—

Exhibit at Venezuela

WASHINGTON, April 11—The National Exposition of Venezuela will be held May 15-June 1, and manufacturers of automobiles, motor trucks, farm tractors and parts and accessories will be permitted to exhibit their goods.

—

To Hold Pan-American Meeting

WASHINGTON, April 12—A meeting of the Pan-American commercial conference will be held here either late in May or early in June, and plans are being arranged by the Pan-American Union to invite commercial and financial experts to attend. It is expected that more than 1000 representatives of the various American republics will be present. Sessions will be held at the building of the Pan-American Union here.

—

Trade With German Austria Permitted

WASHINGTON, April 9—Automotive manufacturers can now export automotive products, excepting those of a military nature or character, into German Austria, according to announcement made by the War Trade Board. Any commodities exported must be intended solely to supply domestic needs in that country.

G. M. Proposes Plan for Savings

Will Set Aside Dollar for Dollar With Employees—Classes Mature in 5 Years

DETROIT, April 14—The General Motors Corp. has inaugurated a savings and investment plan for the benefit of employees of General Motors Corp. and subsidiary companies. At the annual meeting of stockholders to be held April 30 in Wilmington, Del., an amendment to the by-laws, calling for the operation of this plan, will be submitted. Only such stockholders as are on record at the close of business, April 9, are entitled to vote on the amendment. The plan has already been approved by the officers and directors. It aims to encourage and assist all employees in the saving and investment of money and to afford them opportunity to become stockholders and share in the development of the business. Excerpts from the plan follow:

All employees who have been in the employ of the corporation or its subsidiaries for 3 months or more are eligible to participate in the plan. Each employee shall have the right to pay into the savings fund each year an amount not to exceed 10 per cent of his wages or salary, and in no event shall the amount so paid exceed $300 per annum. Payments must be made in amounts of $5 or multiples thereof.

The corporation will also establish an Employers' Investment Fund, and will pay into such fund an amount equal to the total net payments made by the employees into the savings fund. The corporation will credit interest semi-annually at the rate of 6 per cent per annum upon all amounts paid into the funds.

The savings and investment funds will be divided into yearly classes, that is, a new class will be formed each year to be designated "Class of 1919," "Class of 1920," "Class of 1921," etc., and each class will mature 5 yr. from the date of its formation; thus the Class of 1919 will mature on Dec. 31, 1924, the Class of 1920 will mature on Dec. 31, 1925, etc.

The amounts paid into each respective class of the investment fund by the corporation will be credited over a period of 5 yr. to the individual employees participating in the corresponding classes in the Savings fund, that is to say:

One-fifth thereof will be credited 1 yr. after the date of the respective payments into the savings fund; one-fifth 2 yr. after the date of the respective payments into the savings fund and so forth.

It is the intention of the corporation to invest and reinvest the investment fund, preferably in common stock of the General Motors Corp., but if this is not readily obtainable, then in such other securities as in the discretion of the board of directors may seem advisable.

Statements will be rendered periodically by the corporation to each employee showing the status of his account in both the savings and investment funds.

Upon giving 15 days' previous written notice, an employee will be entitled to withdraw all or any part of the amount to his credit in both the savings and investment funds.

Withdrawals must be made in amounts of $5 or multiples thereof. In case of withdrawals, the amount so withdrawn by the employee shall be deducted from his most recent payments into the savings fund, and from the credits in the investment fund corresponding thereto, if any. In addition, he shall forfeit the payments made by the corporation into the investment fund corresponding to the payments withdrawn by him from the savings fund, except to the extent that such payments have been credited to him in the investment fund, and such forfeitures shall be charged against his investment fund account. Such forfeitures, however, shall not revert to the corporation but shall remain in the investment fund to be distributed among the employees at the maturity of the class as provided in Section "b" of paragraph 11 hereof.

In the event of the death of an employee, his legal representatives shall be entitled to receive immediately, in cash, the full amount standing to his credit in the savings fund plus a like amount to be paid from the investment fund.

As previously stated, each class will mature in 5 yr. after its formation and at the maturity of each class each employee will be entitled:

(a) To withdraw, in cash, the total amount to his credit in the savings fund; and

(b) Either to withdraw, in cash, the total amount to his credit in the investment fund or to receive his proportion of all securities and cash them in the investment fund of that class, including all forfeitures made by employees who have withdrawn money from the class during the 5-yr. period as provided in paragraph 9 hereof.

Each employee's proportion in distribution will be in the ratio that his total credit in the class bears to the total credit of all employees in the class at maturity thereof. In case of fractional shares, adjustment will be made in cash, valuing stock at current market prices.

Should an employee so desire, he may leave with the corporation all or any portion of the amount of cash he is entitled to receive upon the maturity of each class. The corporation will hold such cash subject to his right to withdraw upon 15 days' written notice and will credit his account with interest thereon, semi-annually, at the rate of 6 per cent per annum.

Likewise, should an employee so desire, the corporation will have the stock which he receives at the maturity of each class, transferred to his name and hold the certificates in safekeeping for his account, which certificates will be delivered to him on demand.

Money Refunded on Leaving Employ

If an employee leaves the service of the corporation of his own volition or is dismissed from such service, such employee will be paid in cash an amount equal to the same amount as said employee would receive if electing to withdraw said savings at that time. However, if the employee so desires, the corporation may in its discretion, if it determines his record to be satisfactory, continue such employee as a beneficiary under this plan to the extent that said employee's payments to the date of dismissal entitle him.

The corporation shall have the right to reinstate any employee who shall have lost his membership in any class if in its judgment the circumstances surrounding the loss of such membership are such as to warrant reinstatement.

While the corporation proposes a continuance of this plan from year to year, the directors shall have the right, from time to time, to modify or entirely repeal the plan, or to discontinue the receiving of payments hereunder, either temporarily or permanently. However, no modification of this plan shall in any way affect the rights of employees hereunder insofar as they may apply to payments theretofore made.

—

Jobbers to Hold Exhibit

CHICAGO, April 15—There will be a business exhibit of the Automotive Equipment Association in this city the latter part of October or first part of November in connection with the annual meeting, as was planned last year and dropped because of the war. This was decided at a meeting of the board of directors Tuesday. The matter of admitting other than members will be decided at the Hot Springs meeting June 2-6. Last year it was voted to admit outsiders if there was any space left after members were taken care of.

An exhibit committee was named, consisting of R. R. Englehart, Davenport, Iowa, chairman; N. H. Oliver, Chicago; Fred Campbell, St. Louis; R. A. Stranahan, Toledo; J. S. Proctor, Minneapolis; L. P. Halladay, Streator, Ill.

The name of the Ways and Means Committee was changed to Board of Governors. Discussion of the handling of the revenue tax was left for the Hot Springs meeting.

Industrial Relations Principles

U. S. Chamber of Commerce Takes Up Problem and Lays Down Thirteen Rules

WASHINGTON, April 14—Concrete realization of the new problems that employers must face is brought directly to them by means of a referendum vote on principles of industrial relations requested by the Chamber of Commerce of the United States. The Chamber has prepared a statement of 13 principles, following a study of industrial relations by a special committee. It is placing these 13 principles together with pros and cons before its members.

The conduct of industrial enterprise with regard to both employer and employee, adjustment of industrial relations, employment, organization, representation, wages, production and administration of employment and management of labor form the basis of these principles, which are as follows:

1. Industrial enterprise, as a source of livelihood for both employer and employee, should be so conducted that due consideration is given to the situation of all persons dependent upon it.
2. The public interest requires adjustment of industrial relations by peaceful methods.
3. Regularity and continuity of employment should be sought to the fullest extent possible and constitute a responsibility resting alike upon employers, wage earners, and the public.
4. The right of workers to organize is as clearly recognized as that of any other element or part of the community.
5. Industrial harmony and prosperity will be most effectually promoted by adequate representation of the parties in interest. Existing forms of representation should be carefully studied and availed of in so far as they may be found to have merit and are adaptable to the peculiar conditions in the various industries.
6. Whenever agreements are made with respect to industrial relations they should be faithfully observed.
7. Such agreements should contain provision for prompt and final interpretation in the event of controversy regarding meaning or application.
8. Wages should be adjusted with due regard to the purchasing power of the wage and to the right of every man to an opportunity to earn a living at fair wages, to reasonable hours of work and working conditions, to a decent home, and to the enjoyment of proper social conditions.
9. Fixing of a basic day as a device for increasing compensation is a subterfuge that should be condemned.
10. Efficient production in conjunction with adequate wages is essential to successful industry. Arbitrary restriction on output below reasonable standards is harmful to the interests of wage earners, employers, and the public and should not be permitted. Industry, efficiency and initiative, wherever found, should be encouraged and adequately rewarded, while indolence and indifference should be condemned.
11. Consideration of reduction in wages should not be reached until possibility of reduction of costs in all other directions has been exhausted.
12. Administration of employment and management of labor should be recognized as a distinct and important function of management and accorded its proper responsibility in administrative organization.
13. A system of national employment offices, with due provision for co-operation with existing state and municipal systems, can be made, under efficient management, and if conducted with due regard to the equal interests of employers and employees in its proper administration, a most helpful agency, but only if all appointments are made strictly subject to the Civil Service law and rules. Policies governing the conduct of a national system of employment offices should be determined in conjunction with advisory boards — national, state and local — equally representative of employers and employees.

Picture Range of Heavy Oil Engines for Variety of Uses

Joint Meeting of S. A. E. and Society of Mechanical Engineers Discusses Problems of Design, Including Ignition, Carburetion and Thermal Efficiency

NEW YORK, April 15—Various phases of the subject of heavy oil engines were illuminated at the joint meeting of the American Society of Mechanical Engineers, New York Branch, and the Society of Automotive Engineers, Metropolitan Section, which was held at the Automobile Club of America on April 9. Dr. Charles E. Lucke of Columbia University was in the chair, and led off with a general discussion of the subject. He said that each of the two societies represented at the meeting was interested in internal combustion engines. This engine is particularly adapted to transportation purposes, on account of the concentration of the liquid fuel, the fact that there is no residue left after the fuel burns, and that the engine lends itself to a great variety of forms, from the light aircraft engine on the one hand to the heavy marine engine on the other. The idea of the meeting was to give a sort of picture of the range involved in the application of heavy oil engines. There were two possible solutions of the problem of internal combustion engines, one being that of adapting the fuel to the engine and the other that of adapting the engine to the fuel. The fuels we are using range very widely in price, from about 30 cents per gallon for gasoline to a few cents per gallon for fuel oil. Then, there are a number of possible fuels which, though not extensively used at present, offer certain possibilities, such as alcohol and benzol. Generally speaking, the lighter the fuel the easier it is to make an engine that will handle it successfully, and vice versa. If we design our engines to consume a fuel of some particular kind the inevitable consequence is that, as the demand for that particular fuel rises, the price increases, and then someone else will make an engine that will burn a different fuel.

Gasoline and Kerosene Costs

In a paper prepared by E. W. Dean of the Bureau of Mines, and read at the meeting by J. S. Smoots, the statement was made that the manufacturing or processing cost is about the same for gasoline and kerosene. The selling cost is largely determined by the proportion betweeen the supply and demand, the cost of manufacture being small. Mr. Smoots exhibited samples of gas oil and of residuum fuel oil, the former being light in color and the latter dark.

Prof. H. Diederichs of Cornell University was to have given a talk on the development of the heavy oil engine, but was unable to be present, and so Prof. Lucke spoke on the subject instead. He said that in the early days of liquid fuel the light constituents of petroleum were a drug on the market. It was a very easy matter to make an engine that would run on these very volatile fuels, all that was necessary being to have a hole in the air pipe through which some of the liquid fuel could be drawn in with the air. As the supply of this volatile constituent decreased a somewhat heavier oil had to be used, and this required a carbureter and heat supply. With the pre-heating of the fuel and air there came a loss in volumetric efficiency. Next, new types of engines were introduced, in which some part of the combustion chamber wall was kept at a high temperature. This was known as the hot surface type of engine, and was developed chiefly in England. The fuel was injected in the form of a spray. Unfortunately this type of engine, in the early days, fouled up very quickly. The great difficulty, however, with the hot bulb or hot surface type of engine was that it was given to pre-ignition. This resulted in a low mean effective pressure. Fuel consumption also was excessive, which was largely due to the fact that the mixture was not homogeneous, some parts of the charge being practically pure air and other parts pure gas.

Injection of the fuel at the end of the compression stroke did away with the difficulty of pre-ignition and permitted of very much higher compression. Late injection, according to Dr. Lucke, is a fundamentally important feature. There are components of crude oil which have a decomposing temperature below their vaporizing temperature. If the spray is very fine, and if it is sufficiently well scattered through the air, then a solid fuel mixture or oil spray mixture will explode, and we can adapt the engine to any fuel we can get. The question then naturally arises, "Can the same sort of engine be developed for heavy work, such as the propulsion of motor ships and for light work such as motor tractors, trucks and automobiles. The speaker did not attempt to answer this question, but intimated that it was one of the problems of the future to adapt the automotive engine to heavier fuels.

Another one of the papers of the evening was by J. M. Hunt, research engineer of the Dayton Engineering Laboratories Co. Mr. Hunt started out by saying that his firm believed in preparedness, and it had looked to them that in a very few years there would not be fuel enough for the automobiles that would then be in use, so they got into the subject to find out what that would do to the ignition problem. The subject of effective ignition could really be divided up under four headings, namely, starting, distribution, vaporization and burning of fuel in the engine, and Mr. Hunt proceeded to discuss these four problems in succession. The problem of starting is not confined to getting a couple of explosions in the cylinder, but getting the cylinder up to its normal temperature. A pre-heater, used to pre-heat the inlet header, would give the desired result, and Mr. Hunt referred to some experiments with the Good pre-heater, which had been described by Dr. Lucke in a paper read before the S. A. E. some two years ago. Another method of solving the problem of starting was to carry two different fuels, a light fuel for starting and a heavy fuel for general running. Problems of distribution are encountered only in multi-cylinder engines. Proper distribution can be attended to after the charge has left the carbureter, and it seems best to incorporate the vaporizing device in the engine itself. The Good pre-heater previously referred to has been extensively tested on a Ford car, fitted with a kerosene carbureter, which has been run 20,000 miles in two years. During this time there has been no mechanical trouble, though it has been necessary to decarbonize the cylinders and to renew the crankcase oil slightly more frequently. The pre-heater has also been tested on a Buick car, which has been run about 12,000 miles to date.

Problems of Vaporization

Vaporization can be discussed under two headings, viz., loss in volumetric efficiency due to heating and the necessity for scrubbing the air against a rough surface. This scrubbing of the air means a further loss in volumetric efficiency, and consequently in the horsepower output.

When it comes to the burning of heavy fuel in an automobile type engine, the most characteristic feature is that the engine is apt to develop a knock. This leads us to the question of what a knock is. It was formerly supposed that a knock was generally due to pre-ignition, but this theory was disproved by experiments at the Dayton Laboratory, and the fact established that knocking is due to a sort of deterioration. Mr. Hunt said that if we want to get rid of crankcase oil pollution, we shall have to raise the temperature of the combustion chamber still higher, and this will further reduce the volumetric efficiency. It will undoubtedly be necessary before long, to devise automotive engines that will operate on gas oil. What is really needed is a sort of priorities board which will tell us just what percentage of all the fuel available, say 5 years hence, can be had for automotive apparatus.

A paper by Mr. Goldingham of the De La Vergne Refrigerating Co., on the heated metal type of heavy oil engine, was read by the chairman. Mr. Goldingham said that this type of engine was often erroneously called a semi-Diesel. Twenty years ago a British manufacturer of internal combustion engines offered a prize to any employee who could produce a heavy oil engine which would run continuously for 10 hours without stoppage. Now it was a common experience to have engines of the heated metal type

operate continuously for six months without stoppage. Great improvements had been made in this type of engine in recent years, which might be summarized briefly under the following headings: (1) More thorough atomization of the fuel, which was injected either by air pressure, or by the solid or mechanical method; (2) improved construction of the vaporizing chamber; (3) force feed oiling; (4) correctly designed air starting mechanism; (5) improvement of the vaporizor lamp.

The rest of the papers of the evening dealt chiefly with the application of heavy oil engines to the wooden ships of the U. S. Emergency Fleet Corporation during the war. Most of the engines used were of the hot-surface type, and it appears that considerable trouble was experienced, which, however, was ascribed to causes not directly connected with the engines. For instance, much green timber was used in the construction of these ships, and the engine bearers often would warp out of place to such an extent that the engine supports would break. Also, it was necessary to get a great many engineers for tending to these engines, and as no experienced men were available, green hands had to be employed.

National Assn. of Truck Sales Managers to Continue

PHILADELPHIA, April 15—The National Association of Motor Truck Sales Managers will continue as a separate body and devote its energies and attention to the problems of merchandising trucks, as hitherto. This decision was reached at the convention of the association held at the Bellevue-Stratford Hotel on Friday and Saturday, after careful consideration of many proposals and suggestions to do otherwise, and to cast its lot, through affiliations, with other bodies.

It was also decided to appoint a committee to take up the question of organizing an association of truck dealers. The committee will determine whether it will be better to strive for the results which such a dealers' organization would yield through a separate truck dealers' association or through the co-operation of the sales managers' association with the National Automobile Dealers' Association. This committee will report at the next convention, which will be held in Detroit. Future meetings of the association will be purely executive in character. They will be devoted solely to discussion of truck-selling problems.

New members were elected to the association as follows: The Vim Motor Truck Co., Fulton Motor Truck Co., Noble Truck Co., Parker Motor Truck Co., Menominee Motor Truck Co., J. C. Wilson Co., Velie Motors Corp., Canadian Ford Motor Truck Co. and Corbitt Motor Truck Co.

Reo Returns to Pre-War Hours

LANSING, April 14—The Reo Motor Car Co. will return to its pre-war working schedule April 19, calling for 9 hours a day with half day Saturdays. During the war period it operated on a 10-hr. schedule.

Sees Possibilities in Turbines

Dake Believes They Hold More Promise Than Do Any Reciprocating Engines

CHICAGO, April 12—At the meeting of the Mid-West Section of the S. A. E., yesterday, the possibilities of steam and gas turbines for vehicle propulsion were discussed in a paper presented by Charles W. Dake, chief engineer of the Pyle-National Co., manufacturers of steam turbines for train lighting. Mr. Dake has spent many years in designing turbines of small size and believes that the turbine offers more for the steam-driven vehicle than does the steam engine.

The steam turbine has many features that make it particularly fitted for the propulsion of motor vehicles, said Dake. The turbine will operate perfectly under initial steam pressures and temperatures of superheat far higher than that under which is it possible to operate any other type of fluid motor for the reason that there are no moving surfaces contracting stationary surfaces within the turbine structure, thus taking advantage of the efficiency gained by the use of high pressures and high superheat. Due to the absence of the friction within the turbine, it is not necessary that internal lubrication be provided, and by the elimination of internal lubrication, the exhaust steam is free from oils and greases; consequently the water of the condensed exhaust steam from the turbine can be returned to the steam generator (boiler) without fear of injury thereto.

The turbine, being a high speed machine, requires a system of reduction gearing. This can readily be accomplished with but slight power loss. A pair of properly generated herring bone gears having a reduction ratio of 10 to 1 has a power loss less than 1 per cent.

While the steam turbine can be readily made reversible, due to its high speed and the time required to bring the rotor at rest and start it revolving in a reverse direction, it is advisable to provide gearing for this purpose.

Unlike the reciprocating engine, the efficiency of the steam turbine remains constant throughout its life. This is due to the fact that no packing is required to prevent leakage of high pressure steam and the absence of wear to parts operating under the steam pressures and actions.

The mounting of a turbine rotor in its bearings and the lubrication of the bearings is very much more simple than is possible with either the reciprocating steam or gasoline engine. Ball bearings lend themselves admirably to high speed turbine operation. The size bearings required for a 40-hp. turbine of the type described below can be operated successfully at speeds as high as 60,000 r.p.m. or peripheral velocities of the turbine rotor of approximately 1832 ft. per second.

The steam turbine is commonly thought of as a constant speed and constant load machine, which, in order to obtain high efficiency, should be operated at high velocities and under constant pressure. This is true of most of the present designs of turbines.

However, with proper design and construction, the turbine will give a high efficiency at greatly varying speeds, loads and pressures. This is accomplished by so designing the turbine that the velocity of the steam jets or motive fluid which exceeds the velocity of the rotor shall be entirely absorbed by the rotor's steam passages, and the steam will come to rest in relation to the movement of the rotor at the instant of its exit, regardless of the velocity of the rotor or the velocity of the steam jet.

The dimensions of the rotor, exclusive of the shaft, for a 40-hp. turbine designed to operate under 1500 lb. gage pressure of steam, or rather the velocities derived from that pressure, would be 7 in. in diameter and 4 in. long, and would weigh but 7 lb. The complete turbine, exclusive of external fittings, would weigh less than ¾ lb. per brake horsepower.

The torque delivered to the turbine rotor of the type in mind increases with the decrease in velocity of the rotor, and decreases with the increase of the velocity. In other words, the velocity of the steam jet is absorbed by the rotor regardless of whether it is revolving slowly, or at top speed; therefore, a vehicle propelled by a steam turbine, as above, can be started from rest and will traverse grades at reduced speeds and as well, if not better, than will one propelled by a reciprocating steam engine.

There is at the present time considerable activity among inventors and engineers to produce a turbine that can be operated by the impulse of the explosive combustion of such a mixture as is used in the reciprocating internal combustion engine. This activity, however, seems to be confined to only types and designs of turbines in use at the present time and no effort, it appears, is given to lines of new thought. This, in the writer's opinion, is a mistake, for it is impossible to produce a turbine employing buckets which will withstand the impact of high temperatures such as are delivered by the gasses of combustion.

However, there is under process of development a turbine of great promise designed to overcome many present obstacles, and to provide higher efficiency than is given by the gas engine. Unfortunately, the writer is not at liberty to disclose the details of this machine owing to the conditions of the patent rights both in this country and abroad, which might be jeopardized by so doing. Nevertheless, a brief description of its possibilities and operation will be more in order than its construction.

The flexibility of this turbine is as great as that of the steam turbine, which I have previously referred to. It will operate at any speed from one revolution per minute to the bursting speed of the rotor. The compression of the gas, which is very high—at times reaching 2000 lb. per square inch—is accomplished without mechanical means, and this while the turbine is at rest.

The initial ignition is accomplished by means of a spark from a battery of two dry cells and then continued by means of a hot tube, which, if desired, may be kept hot during stops and for long periods of time. Regardless of weather conditions, the time required to start the turbine is almost instantaneous, and in no case would it be greater than 30 seconds. The turbine can be started from rest, doing away with all starting mechanisms.

The starting torque is greater than that of the reciprocating steam engine of equal power, operating under permissible steam pressures. A 40-hp. turbine complete, including ignition system, gas compression means, controls and shaft coupling, will develop one actual brake horsepower for each 3 lb. of its weight when operated at permissible speeds.

William J. H. Strong of the Strong Engineering Co., Chicago, the other speaker of the evening, presented the plans that were developed for the Government for steam power plants in airplanes. Mr. Strong's company designed for the government aviation officials a steam plant which at 15,000 ft. altitude weighed about 9 or 10 lb. This included engine, boiler, condensing system, auxiliary pumps and the electrical equipment, the horsepower of the plant being 580. The engine operates on the uniflow principle, and in appearance resembles the King-Bugatti. The boiler is a water tube type, having the individual tubes welded into sections and the sections welded to headers.

$3,199,828 Waste Materials Sold by Army

WASHINGTON, April 11—Waste materials sold by the army during the eight months ending Feb. 9, 1918, totaled $3,199,828, and included:

	Collected, Lb.	Sold, Lb.	Value	Per Cent of Total Amount Collected Sold from June 30, 1918, to Feb. 28, 1919
Non-ferrous metals	4,644,443	4,608,877	$532,536	99
Hides ..	712	687	149	96
Iron	37,877,434	23,847,772	182,343	63
Leather.	2,170,262	277,030	4,877	13
Misc. ..	6,370,173	16,733,981	403,711	263
Rubber.	2,905,527	1,531,029	72,940	53

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:

Muriatic, lb. ...... .02 - .03
Phosphoric (85%) lb. .... .35 - .39
Sulphuric (60%), lb. .... .008

Aluminum:

Ingot, lb. .... .29 - .31
Sheets (18 gage or more), lb. ...... .42
Antimony, lb. ..... .06½ - .06⅞

Burlap:

8 oz., yd. ...... .07
10½ oz., yd. ...... .09

Copper:

Elec., lb. .... .15¼ - .15½
Lake, lb. .... .15⅝ - .15⅞

Fabric, Tire (17¼ oz.):

Sea Is., combed, sq. yd. 1.40
Egypt, combed, sq. yd. 1.25
Egypt, carded, sq. yd. 1.20
Peelers, combed, sq. yd. 1.10
Peelers, carded, sq. yd. .85

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:

Ceylon, lb. .... .09 - .22
Madagascar, lb. .. .10 - .15
Mexico, lb. .... .03¾

Lead, lb. .... .04¾ - .05

Leather:

Hides, lb. .... .25 - .41

Nickel, lb. .... .40

Oil:

Gasoline:
Auto, gal. .... .24½
68 to 70 gal...... .30½
Lard:
Prime City, gal. 2.50
Ex. No. 1, gal.. .95 -1.00
Linseed, gal. .....1.45 -1.48
Petroleum (crude):
Kansas, bbl. ...2.25
Pennsy., bbl. ...4.00
Menhaden (dark), gal. .... .95

Rubber:

Plantation:
First latex pale crepe, lb....... .49
Brown crepe, thin, clear, lb........ .44
Smoked, ribbed sheets, lb...... .48½

Para:

Up River, fine, lb. .56
Up River, coarse, lb. .... .34
Island, fine, lb.... .47½ - .48

Shellac (orange), lb. .60 - .64

Spelter, lb. .... .06½

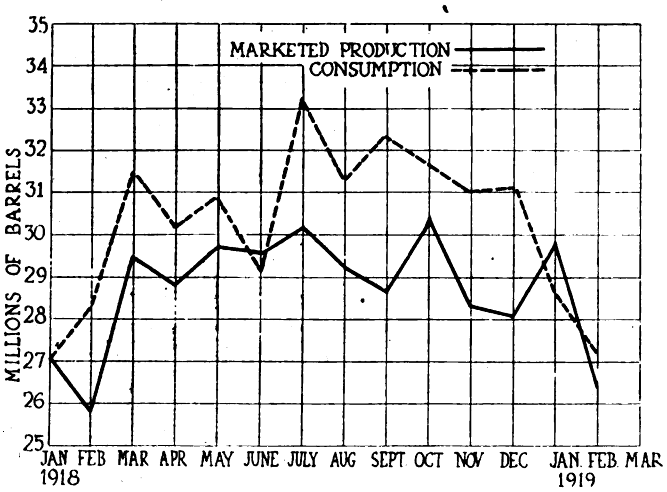
Steel:

Angle beams and channels, lb. .... .03
Automobile sheet (see sp. table).
Cold rolled, lb.... .0625
Hot rolled, lb. ..... .039

Tin .... .71 - .72

Tungsten, lb. 1.00

Waste (cotton), lb.. .12¾ - .17



Estimated monthly fluctuations in marketed production and consumption of crude petroleum in the United States during 1918 *and the first two months of* 1919

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when Seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock................	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock................	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping.........	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping................	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.
Blank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.
Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close, April 12

	Bid	Asked	Net Ch'ge
Auto Body Company......	9	10	..
Briscoe Motor Car com...	13	..	..
Briscoe Motor Car pfd....	50	65	..
*Chandler Motor Car.....	140	142	+14
Chevrolet Motor Car......	199	201	+10
Cole Motor Car Co........	93	105	..
Continental Motors com...	7¾	8¼	..
*Continental Motors pfd..	96	99	—2
Edmunds & Jones com....	15	20	..
Edmunds & Jones pfd.....	75	90	..
Electric Storage Bat......	69	71	..
Federal Motor Truck.....	34	36	..
Fisher Body Co. com.....	58	60	+2
Fisher Body Co. pfd......	92	94	..
Ford Motor of Canada....	285	295	..
General Motors com......	175¾	176¾	+5¼
General Motors pfd.......	91⅛	93⅛	+1⅜
Hupp Motor Car com.....	8¼	8¾	+½
Hupp Motor Car pfd......	96	99	..
Kelsey Wheel Co. com....	35	37	..
Kelsey Wheel Co. pfd....	93	95	..
Manhattan Electric S. com.	..	48	..
Maxwell Motor com.......	38⅝	39⅝	+1⅞
Maxwell Motor 1st pfd...	67¼	68¼	+2¼
Maxwell Motor 2nd pfd...	30¼	31¼	—¼
McCord Mfg. com.........	33	36	+1
McCord Mfg. pfd..........	91	95	..
Mitchell Motor Co........	27	31	..

	Bid	Asked	Net Ch'ge
Motor Products Corp.......	..	35	..
Nash Motors Co. com....	230	250	..
Nash Motors Co. pfd......	95	100	..
National Motor Co........	15	20	..
Packard Motor Car com..	122	125	+2
Packard Motor Car pfd...	99	101	..
Paige-Detroit Motor com..	28½	29½	..
Paige-Detroit Motor pfd..	8¾	9¾	..
Peerless Motor Truck.....	21	23	..
Pierce-Arrow M. Car com.	49½	50½	+3¾
Pierce-Arrow M. Car pfd..	102	104	..
Premier Motor Corp. com.	5	..	..
Premier Motor Corp. pfd..	..	75	..
Prudden Wheel Company..	18	19	..
Reo Motor Car Co........	23¾	24½	+¼
Republic M. Truck com...	39½	41½	..
Republic M. Truck pfd...	91	95	..
Saxon Motor Car com....	6⅝	8⅝	+⅛
Scripps-Booth Corp.	21	25	..
Stewart Warner S. Corp..	91	93	+1½
Stromberg Carburetor Co..	38	40	..
Studebaker Corp. com....	65⅝	66⅝	+1¼
Studebaker Corp. pfd.....	94	97	..
*Stutz Motor Car Co......	56	57	+5⅜
United Motors Corp......	45⅝	47⅝	+⅝
White Motor Co..........	55⅝	56⅝	+1⅜
Willys-Overland com.	29½	30½	+⅞
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co...........	78¾	79¾	+4¼
Firestone T. & R. com....	144	148	—3
Firestone T. & R. pfd....	100	102	—1
Fisk Rubber Co. com.....	137	142	+29
Fisk Rubber 1st pfd......	100	105	..
Fisk Rubber 2nd pfd......	137	142	+30
Fisk Rubber 1st pfd. conv.	105	110	+6
Goodrich, B. F., com.....	66½	67½	+1¼
Goodrich, B. F., pfd......	106½	107½	..
Goodyear T. & R. com....	270	275	..
Goodyear T. & R. 1st pfd.	105½	107	..
Goodyear T. & R. 2nd pfd.	107	108½	+½
Kelly Springfield com.....	126	127	+7½
Kelly Springfield 1 pfd....	95	97	..
Lee Tire & Rubber Co....	27	28	+2
Marathon Tire & Rubber.	55	75	+3
Miller Rubber Co. com....	170	175	—5
Miller Rubber Co. pfd....	102	104	..
Rubber Products Co.......	125	130	—4
Portage Rubber Co. com..	158	162	..
Swinehart T. & R. Co....	77	81	—3
U. S. Rubber Co. com....	86½	87½	+3
*U. S. Rubber Co. pfd....	111⅞	112⅞	+⅝

*Ex dividend.

British Westinghouse Control to Vickers

Through Absorption of Metropolitan Carriage Company in Deal Involving $132,500,000

LONDON, April 1—One of the biggest business deals in which British interests have figured for some time is the absorption by what is known as the Vickers interests of the Metropolitan Carriage & Wagon Co. The event here referred to is not of interest to the motor trade in itself, but the latter company recently acquired a controlling interest in the British Westinghouse Co., Manchester. This company, aiming at a variety of output, is interested in the British replica of the Pittsburgh company's dynamo and starter for vehicles.

This new step by the Vickers Co. through a subsidiary company in their own group, concerned with the B.L.I.C. (late Bosch) magneto, dynamo and starter, is likely to involve the cessation of the corresponding Westinghouse lines. Otherwise there would be virtual competition between these rival wares.

The B.L.I.C. manufacturing side is being transferred from London to a factory in Birmingham, until recently used by the Electric & Ordnance Accessories Co. Up to this time this company has built the Wolseley Co.'s Stellite car, the complete manufacture of which, however, is being arranged for in the Wolseley Co.'s now much extended factory.

The amalgamation or absorption of the Metropolitan Carriage company's business involves a capital of $132,500,000, which will give some idea of the vast financial resources of the Vickers group. Many people read into this expansion of the Vickers interests the intention to be prepared for quitting armaments manufacture, if necessary, in favor of a wholesale concentration on peace industries. By the way, it is reported that the Wolseley and Vickers interests have arranged an alliance with a Japanese engineering company, who will build Wolseley cars for its Far East territories.

New English Insurance Company Emphasizes Service

LONDON, April 1—The Motor Union Insurance Co., one of the leading insurance organizations in writing motor car insurance, has entered the garage and repairshop field. This move comes as retaliation to the Motor Trade Association, which some years ago formed an insurance company as an independent venture for the benefit of its members as well as for the revenue obtained. As the membership of the M. T. A. is large and increasing, the move of this new insurance company means that the number of garages and repairshops will increase.

The insurance company has chosen the subject of service as one of the requirements of its garages and repairshops. Hitherto service has been a sort of counsel of perfection, but the Motor Union Insurance Co.'s scheme makes it obligatory, and also imposes the condition that the garages favored with its patronage shall conform to its standard of equipment and facilities for repairing, etc.

The alternative to these conditions will be for the local dealer to send his work to one of the Union's pivotal depots, as they are to be called, and he will be allowed a trade abatement at a fixed rate or per cent off the price levied on private customers.

Each pivotal depot will be a center for an associated group of repairers and dealers, approved by the Union Insurance Co., which seems to imply that membership of the M. T. A. will be a ban on membership in the new company's pivotal scheme.

Public and private motorists will be the gainers by the proposed competition, much of it centering in the quality of service benefits of the competing parties. Hitherto there can be no gainsaying the fact that the M. T. A. has been regarded by ordinary motorists as being more concerned in pushing up and maintaining prices than in securing a common standard of high grade service. The new issue seems a favorable opportunity to set this matter right.

English Truck Company Adds 6-Cylinder Car

LONDON, April 1—The Straker-Squire Co., manufacturer of the Straker-Squire truck, has purchased one of the Government war factories and plans to concentrate on the manufacture of a 6-cylinder car in addition to one or more sizes of trucks.

The new Straker-Squire "six" with cylinders 80 x 130 has them as separate castings. The reason for reverting to the separate cylinder as compared to the block type is that there is not so much danger of hot spots developing in the individual cylinder as in the block type due to difficulties incidental to misplaced cores and the irregular flow of metal in the block. The car has dial on the dash showing the speed of crankshaft rotation and the speedometer is driven from the gear-box.

The factory purchased occupies 14 acres and was bought at $700,000, which is more than the original cost of construction and equipment by the Government. Formerly the Straker-Squire Co. had a factory at Bristol which was recently sold to the Cosmos Engineering Co., Ltd., which concern at that time had interests in the 6-cylinder car and in reality developed it. The Cosmos company entirely disposed of its interests and is now developing a new car employing a radial engine which also carries several other earmarks of airplane development. Roy Fedden, who designed the Straker-Squire 6-cylinder car, remains with the Cosmos Company.

Aluminum Castings Operations

MILWAUKEE, April 12—The Aluminum Castings Co., Cleveland, probably will discontinue its Manitowoc plant on May 1 and divide the operation between its works at Cleveland and Detroit.

No Guarantee for English Tires

Solid Tires to Be Judged by Performance, Not Guarantee, Is Reason for Decision

LONDON, April 1—The abandonment of a guarantee on solid rubber tires by the British tire makers has naturally aroused a good deal of criticism, and many business organizations do not know just why this step was taken. The guarantee of 10,000 miles on these tires had its origin in the early days of the motor truck when tire costs were about as fluctuating as the mileage was varied. At that period, too, the initial cost of a set of truck tires was a much more serious item than latterly, being often sufficient, in the event of a premature collapse of two or more of a set, to preclude the vehicle concerned from showing a profit on a year's turnover. It is now frequently the experience of users that a set of tires go far beyond the mileage guaranteed.

Reasons assigned for the decision to withdraw the guarantee of mileage are:

That it leads users to expect the guaranteed mileage and nothing more; that it tends towards the production of a stereotyped tire, just capable of fulfilling the guarantee and no more; encourages carelessness on the part of the driver, who regards the responsibility for the tire as solely that of the maker; and that it is necessarily hedged about by technical conditions and stipulations, which in some circumstances are difficult to see.

The British Rubber Tire Manufacturers' Association for the future will be content to allow their products to be judged by the service given as distinct from merely guaranteed.

Considerable assistance in regard to these points is expected from systematic collective research and the British Rubber & Tire Manufacturers' Research Association, which is now in process of formation.

Twin City 12-20 Kerosene Tractor

(*Continued from page 839*)

worm and sector type of steering gear of generous proportions is mounted on the right-hand side of the transmission case, and runs in oil. The size of the steering wheels, and a liberal gear reduction, coupled with the light weight of the tractor and the weight distribution, make it a very easy machine to handle in the field. Stops are provided on the front wheel tie rod to limit the maximum turning angle of the front wheels.

The belt pulley is 16 in. in diameter and has a 6-in. face. It is mounted on the left-hand end of the first countershaft, and is removable. The linear belt speed is 2700 ft. per minute.

The front end of the tractor is supported through coil springs upon a drop-forged steel front axle of I section, with reversed Lemoine steering heads. This axle swings vertically on a center pivot. The front wheels have rolled-steel flanged rim 34 in. in diameter and 6 in. wide. The wheelbase is 84 in., and the weight of the tractor stripped is 4000 lb.

Field tests have proved that a load of 35 per cent in excess of the rating can be easily sustained, and the engine when running at its governed speed of 1000 r.p.m. will develop a maximum of 35 b.hp. on kerosene.

Men of the Industry

Changes in Personnel and Position

Dawson to Manage Gary Truck

GARY, IND., April 12—A number of important additions have been made to the personnel of the Gary Motor Truck Co., although the officers remain unchanged. Frank Dawson has been appointed general manager of the company. He was formerly factory manager of the Randolph Motor Truck Co., Chicago; was later with the Mogul Truck Co., St. Louis, and in 1916 was appointed factory manager for the Master Truck Co. E. Von Rakowski has been appointed chief engineer, and has been closely associated with Dawson for several years past. Theodore B. W. Zumstein has entered the sales department. The Gary company has just closed a contract with the Cooper Motor Co., Kansas City, with branches in Omaha, Tulsa and other western and southwestern cities for more than a million dollars' worth of Gary trucks, to be delivered within the next 12 months. The company will operate as a factory branch and will have exclusive sales of Gary trucks in Missouri, Arkansas, Oklahoma, western Iowa, Nebraska and South Dakota.

Frank W. Haskell, president of the Carborundum Co., Niagara Falls, N. Y., died April 2 at Daytona, Fla. His death was due to heart failure.

J. G. Lude, for six years purchasing agent of the Falls Motors Corp., Sheboygan Falls, Wis., has resigned to become assistant general manager of the Lewis Steel Products Co., Toledo. Angelo R. Clas, formerly secretary-treasurer of the Falls company, has been president and general manager of the Lewis company since Jan. 1.

C. H. Margell, formerly assistant general manager of the Monarch Governor Co., Detroit, has become associated with LeRoi Co., maker of car and tractor engines, Milwaukee, as assistant chief inspector.

G. H. Hamilton, Milwaukee, has been appointed manager of the new export department of the Federal Rubber Co., Cudahy, Wis., which has been established, with headquarters at the Federal company's eastern headquarters, 38 and 40 West Sixty-second Street, New York City. The export business heretofore was handled through the general offices at Cudahy.

R. T. West has been appointed sales manager for the Hession Tiller & Tractor Corp., manufacturer of the Wheat tractor.

Duplex Adds Sales Engineers to Staff

BROOKLYN, N. Y., April 11—V. N. Barton has been added to the sales engineering department of the Duplex Engine Governor Co., and will cover Pennsylvania and the southern states. R. Weston Doherty has a similar position covering New York, New Jersey and New England territories.

Clyde Export Representative on Business Tour

NEW YORK, April 11—In order to keep more closely in touch with their foreign dealers and conditions in the Far East, P. W. Gaylor has left on a trip through that territory for the Clyde Cars Co. He will visit China, Japan, Siam, the Federated Malay States, Straits Settlements, Dutch East Indies, India, etc.

Horning to Speak at Detroit

DETROIT, April 12—At the April 25 meeting of the Detroit Section of the Society of Automotive Engineers H. L. Horning, chief engineer and general manager of the Waukesha Engine Co., Waukesha, Wis., will deliver a talk entitled "Tractor Engines." The meeting will be held in the ballroom of the Hotel Pontchartrain.

John A. Glaspy, who has been manager of the Kelly-Springfield Tire Co. at its Milwaukee branch, has resigned to become assistant general sales manager of the International India Rubber Corp., South Bend.

C. W. Whitston, until recently sales manager of the Panhard Motor Truck Co. of Grand Haven, Mich., has been made district sales manager for the Nelson Motor Truck Co., Saginaw. He will handle the Southwest territory, with headquarters in Los Angeles, Cal.

J. F. Fernihough, formerly district representative for the Bethlehem Motor Truck Co. in the Middle West, will be in charge of the Northwest territory sales of the Nelson Motor Truck Co. Chicago will be his headquarters.

Raymond A. Long, chief engineer of the Columbia Motors Co., who for two years was engaged in Government work, assisting in designing the Militor truck, has returned to Detroit and resumed his duties with the Columbia company.

C. K. Sincebaugh has severed his connection as sales engineer with the tractor equipment division of the Remy Electric Co., and is associated with the Rex Machine Co., Chicago, as general manager.

H. H. Burger has taken charge of the Stewart Products Co., Cleveland, as manager. This company, which has been operated as a Stewart-Warner factory branch, has been changed to a service station.

National Designer Is Back

INDIANAPOLIS, IND., April 12—Lieut.-Col. William Guy Wall has returned to assume his connection as vice-president and chief engineer of the National Motor Car & Vehicle Corp. He has been chief engineer of the National factory for 15 years. He headed that section of the ordnance department charged with design, construction and maintenance of armored cars, tanks, ammunition trucks and artillery tractors.

Allen of Austin Co. Returns to England

NEW YORK, April 15—C. H. Allen, manager of the sheet metal department of the Austin Co., Birmingham, England, and who has been in this country for several weeks purchasing presses for body manufacturers in production quantities, returned to England this week. Mr. Allen has been in sheet metal work for 20 years and has been making a complete study of the different American plants in addition to having ordered 7 special presses for body production work. These are to be used in connection with the production work of Austin Model 20, one of the British war cars.

Pogue Now With Division of Mineral Technology

WASHINGTON, D. C., April 12—Joseph E. Pogue, formerly connected with the Bureau of Oil Conservation, which has recently ceased activities, is now connected with the Division of Mineral Technology in the United States National Museum. This division is carrying on educational work with special reference to the mineral industry. Mr. Pogue, while with the Bureau of Oil Conservation, gave much attention to the question of possible supply of crude oil.

Edge to Re-enter British Industry

LONDON, April 1—S. F. Edge, one of the best known figures in the British motor industry, until his withdrawal 7 years ago from the Napier organization, is expected to return to the industry now that his 7 years' contract to refrain from enterprise in the motor trade has expired. He is expected to take up the manufacture of a fully equipped car that will list at $1500.

C. F. Rouze, formerly sales manager for the Knox-Martin Tractor Co., has been placed in charge of the sales promotion department of the General Motors Truck Co., Pontiac.

Charles Kuehn, who has been with the Packard advertising department for a number of years, has been put in charge of advertising and sales promotion department of the Packard Detroit branch.

K. W. Macrae, for the past 5 years in charge of the Canadian sales for the Saxon Motor Car Corp., has tendered his resignation, to take effect at once.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Chalkis Will Make Lock Washers

DETROIT, April 12—The Chalkis Manufacturing Co., organized during the war by Hugh Chalmers and W. C. Kiser to manufacture guns for the Government, and whose war operations were brought to a sudden halt before they were well started by the signing of the armistice, will shortly enter the automotive parts field. The company will start the production of lock washers within 30 days, and later other lines will be added.

The present Chalkis plant on Mack Avenue has been sold. Nearly $500,000 worth of machinery designed for munition work will revert to the Government. The Detroit Culto-Tractor Co. first proposed locating in the Chalkis plant, but this plan was abandoned some time ago.

The Chalkis Co. will move into the down-town district, having leased the sixth and seventh floors of a new Power building. At a recent election of officers Hugh Chalmers was elected president; W. C. Kiser, vice-president and general manager, and A. W. Lott, secretary and treasurer. Mr. Lott comes to the Chalkis company from the office of A. W. Wallace Co., brokers.

International Rubber to Increase Output 200 Per Cent

SOUTH BEND, IND., April 12—G. W. Odell was elected president and treasurer of the International India Rubber Corp. at a meeting of the board of directors, and he will also continue the general management of the company. Other officers are: Vice-president, Peter E. Studebaker; secretary, J. A. Bennett. The officers and C. W. Truxell and J. W. Ridge form the board of directors.

It was decided at the meeting to go ahead with the plans made last year to extend the length of the main building to 967 ft. This extension with additional equipment will increase the output of the plant about 200 per cent.

Arrow Grip Capital Increased to $500,000

GLENS FALLS, N. Y., April 12—The Arrow Grip Mfg. Co., Inc., has increased its capital from $100,000 to $500,000, and is at present erecting a new factory here.

Aluminum Goods Spending $1,250,000 on Plant Additions

MANITOWOC, WIS., April 14—The Aluminum Goods Mfg. Co., with branch factories in Two Rivers, Wis., and Newark, N. J., will this year invest approximately $1,250,000 in the enlargement of the Two Rivers and Manitowoc plants. Contracts have been awarded for three new buildings at Two Rivers, and another contract will be awarded for a 5-story addition, 160 x 280 ft., here during the coming week. The Two Rivers buildings are: Plant No. 1, 50 x 320 ft., 3 stories; plant No. 4, 60 x 300 ft., 4 stories; warehouse, 44 x 137 ft., 3 stories. The present works here and at Two Rivers each employs more than 1500 operatives.

Japanese Truck Manufacturer Organized

DETROIT, April 11—A Japanese company is being organized to manufacture motor trucks in that country. Through Gaston, Williams & Wigmore, New York City, this company is placing orders with Detroit automotive firms for parts for several experimental trucks which it proposes to assemble at once. The company, with $2,500,000 capital, is buying engines, transmissions, steering gears, wheels, clutches and other parts. Cutting, Armstrong & Smith and the Grey Motor Co. of this city have received preliminary orders for this material and are preparing shipments for New York.

Swedish Company Enlarges Plant

WASHINGTON, April 11—The Scania Vabis Works, Malmo, Sweden, have completed additions to their factory enabling them to manufacture complete automobiles. This company, which manufactures gas engines and electric motors, turned out a production in 1917 valued at $1,622,000.

G. M. Absorbs Michigan Crankshaft

LANSING, April 12—The Michigan Crankshaft Co. is the latest organization to be added to the General Motors holdings. By this deal the National Engineering Co., Saginaw, which was owned by the Michigan Crankshaft Co., automatically becomes General Motors property. Much of the grinding work of Lansing General Motors companies will be handled in the new plant.

The Michigan Crankshaft Co. was organized ten years ago with a capitalization of $50,000. This was later increased to $200,000. With the additional capital it bought the National Engineering Co. at Saginaw. J. W. Wilford will remain at the head of the company, and will continue the management of both Lansing and Saginaw plants.

Branch of General Asbestos Moved

CHICAGO, April 12—The Chicago branch of the General Asbestos & Rubber Co. has been moved into new and larger quarters at 14 North Franklin Street.

Porter-Cable Buys Lathe Company

SYRACUSE, April 12—The Porter-Cable Machine Co. has purchased the business of the Mulliner-Enlund Tool Co. and will move the latter company's equipment to the Porter-Cable plant. The production of Mulliner lathes will be continued. Both Mulliner and Enlund will be connected with the Porter-Cable organization.

Moon Victory Model in Production

ST. LOUIS, April 14—The Moon Motor Car Co. is now in production on its new Victory model, which is to sell at $1,685, and which was first exhibited at the St. Louis show. It is a 5-passenger, 118-in. wheelbase car, equipped with a 3¼ x 4 6-cylinder Continental engine.

New Jumbo Model

SAGINAW, MICH., April 11—The Nelson Motor Truck Co. is getting into production on a new 2-ton tractor. The tractor has a 108-in. wheelbase. All specifications are the same as the regular Jumbo truck. The tractor will be marketed in connection with 3 to 5 and 5 to 7-ton semi-trailers as a 6-wheel unit for heavy-duty work.

This company also proposes to bring out a new 3½-ton truck in about 90 days. The new truck will have a T-V Buda engine, Clark axles, four-speed transmission, unit power plant with drive torque rods and a pressed-steel frame. The manufacture of the regular 2-ton model will be continued.

New 1½-Ton Selden Ready for Delivery

ROCHESTER, April 14—The Selden Truck Sales Co. will commence deliveries of its new 1½-ton worm-drive model on April 21. It is equipped with a 3¾ x 5 Continental Red Seal engine with high tension magneto and Stromberg carbureter. It will sell for $2,185. Tires are 34 x 3½ single, front, and 34 x 5 single, rear. Pneumatic equipment is extra. The wheelbase is 140 in. and the length of the loading space 9 ft. 6 in.

Shipping Board to Use Wisconsin Engine Plant

RACINE, WIS., April 14—A lease taken by the United States Shipping Board, Emergency Fleet Corp., of the plant of the defunct Wisconsin Engine Co. at Corliss, will not affect the possession held by the Corliss Motor Truck Co. of one of the group of buildings which it uses as a factory. The Shipping Board will use the plant for assembling, storage and shipping vessel parts, machinery and equipment. The lease is for 5 years.

National Tractor Now GO

CEDAR RAPIDS, April 14—The National Tractor Co. has changed the name of its product from National to GO, and is bringing out a new machine similar to its older model but equipped with a Waukesha 4½ x 5¾ engine.

D. & L. Will Make Mechanical Appliances

MILWAUKEE, WIS., April 14—The D. & L. Mfg. Co. has been organized at Milwaukee with an authorized capital stock of $50,000 to manufacture tools, dies, fixtures and general mechanical appliances. The incorporators are Henry C. Dorn and Herman L. Luedke.

Calendar

SHOWS

April 16-19 — Waynesburg, Pa. Automobile Dealers' Assn. of Greene Co., Armory. Frank L. Hoover, Mgr.

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and Accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

May 15-June 1—Venezuela. National Exhibit of Venezuela.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-15 — London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December—Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

April 23 - 25 — Walla Walla, Wash. Sectional Tractor Demonstrations.

May 5—Sacramento, Cal. Sectional Tractor Demonstrations, Demonstration Field.

June — Denver, Col. Sectional Tractor Demonstrations.

July—Wichita, Kan., Automotive Committee of National Implement Assn.

Aug. 18—Aberdeen, S. D. Sectional Tractor Demonstrations.

RACES

April 24—San Bernardino, Cal. Rim of the World Hill Climb.

†May 17—Uniontown, Pa., probably 112½ miles.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*June 14—Sheepshead Bay, L. I. Speedway race.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15—Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

†Sanctioned.
*Tentative dates.

CONVENTIONS

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

April 28-May 1—St. Louis, Mo. Chamber of Commerce of United States Convention.

May 1-June 1 — Atlantic City, N. J.—Pan-American Aeronautic Convention and Exhibition — Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

May—Washington, Pan-American Commercial Conference, Pan-American Union Building.

June 23-28—S. A. E. Mid-summer Meeting.

Sept. 22-24—Philadelphia, Annual Convention, National Association of Purchasing Agents, Bellevue-Stratford.

Allen Motor Co. to Boost Production

COLUMBUS, OHIO, April 14.—The Allen Motor Co., of Fostoria and Bucyrus, Ohio, will move to Columbus. It is a $3,000,000 concern with five plants in operation for six years. Its record output is 5000 cars made in 1916 and its pay-roll aggregates $1,000,000 annually. The company hopes to boost its production to 20,000 after it is located in its new Columbus plants.

The factories formerly occupied by the Columbus Buggy Co., will be occupied by the Allen Co. The Scioto Rubber Co. is to be absorbed in the deal. The Allen Motor Co. is at present employing 500 men.

Fordson Dealers Get More

DES MOINES, April 15—The price of the Fordson in Iowa, Nebraska and South Dakota, the territory of the Herring Motor Co., has been advanced to $926, f.o.b. Dearborn, Mich., plus handling charges. The dealer price remains as before, giving the dealer about $40 additional in lieu of an increase in the discount. The increase makes the discount from 15 to 17 per cent.

Kelsey Wheel Addition

WINDSOR, ONT., April 12—A building permit has been granted to the Kelsey Wheel Co. for the erection of an addition to the plant.

Haynes to Have Capacity for 50 a Day

KOKOMO, IND., April 12—Work is to be begun immediately by the Haynes Automobile Co. on the erection of a building 150 x 500 ft., 4 stories high, and of a new forge shop, 70 x 180, following the recent increase of its capital from $3,500,000 to $5,000,000 through the issue of $1,500,000 preferred stock at 7 per cent. Other improvements in the plant are to be made, and when all the work is completed in the fall the normal capacity of the plant will be increased to about 50 cars a day.

General Motors Truck Co. Finishes War Work

PONTIAC, April 14—The General Motors Truck Co. finished its war work in January, when 500 trucks were turned over to the Government, and is now getting fair production for commercial sales. An average of 30 machines is being turned out daily, but plans call for a material increase in production during May and June. This company, having extended its manufacturing facilities last year, does not come in for a split of the General Motors expansion budget.

Maxwell to Retire $145,244

NEW YORK, April 15—The Maxwell Motor Co. is shortly to retire $145,244 of its first preferred stock. This amount is now held by the Central Union Trust Co. of New York as trustee for the company. On May 16 the trust company will receive bids for the retirement of not to exceed 2880 shares of stock.

Eagle Officers Changed

APPLETON, WIS., April 14—Frank Saiberlich, president and founder of the Eagle Mfg. Co., maker of farm tractors, gas engines, etc., has disposed of his interest and will retire. His brother, Oscar, also has sold his third interest, but Edward Saiberlich, secretary and treasurer, remains a stockholder and officer. The new interests are represented by August Knueppel, Nicholas Dohr and Matt Rossmeissl, all of whom are large stockholders in the George Walters Brewing Co.

Dorr-Miller Differential Acquires Tool Company

NEW YORK, April 12—The Dorr-Miller Differential Co. has purchased the interests and plant of the Ward Machine & Tool Co., Detroit, and will correspondingly increase its manufacturing facilities. A part of the plant will be devoted entirely to the special differential for Fords. This type is to be distributed through county agents who are now being appointed.

Columbia to Double Production

DETROIT, April 12—The Columbia Motors Co., while working on plans for a new factory plant, will not build this year but will lease buildings providing sufficient facilities to permit the company to double its production. Extension plans for doubling its floor space would add 100,000 sq. ft. It has orders for 1300 cars and contemplates producing 3000 passenger cars this year.

Maxwell Completes Last Tractor

DETROIT, April 11—The last military tractor was completed by the Maxwell Motor Co. last week, and the company is getting back into full peace production of cars. The machine finished last week was No. 2000, and was a 5-ton model. The original contract called for 3000 tractors, but the early termination of the war cut this number by one-third. This company has already run its passenger car production up to 220 daily.

New Torbensen Axle Officials

CLEVELAND, April 12—J. O. Eaton was elected president, with two vice-presidents, W. J. Baxter and C. F. Hepburn, at the directors' meeting of the Torbensen Axle Co. Other officers are: Chairman of the board, V. V. Torbensen; treasurer, F. A. Buchda; secretary, A. H. Ide; assistant secretary, R. C. Hyatt, and comptroller, M. M. Risberg.

AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Vol. XL
Number 17

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, APRIL 24, 1919

Fifteen cents a copy
Three dollars a year

Stewart CUSTOM BILT **NECESSITIES**

"They're More Than Accessories"

You Owe It to Your Business Success to Sell Stewart Products

We do not infer that it is impossible to achieve success without handling Stewart Custombilt Necessities. But we do say emphatically that you are not reaching, and cannot reach, the highest pinnacle of your possible success unless you become known as a headquarters for Stewart Necessities.

You are in business, we presume, for one prime object—to make money. Then you owe it to your business to avail yourself of every opportunity to make money.

In Stewart Necessities you have the biggest and surest money-making opportunity ever offered a dealer. The demand for Stewart Products is already created for you. They are the best-advertised, best-known, best-liked accessories on the market. All you have to do is be prepared to reap the business harvest this year—to fill the tremendous demand.

Stewart Custombilt Necessities are products you can sell with a clear conscience. They are the best values in motordom. They make good every time, or we will.

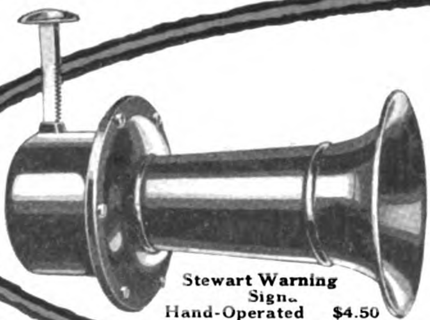
Install a Stewart "Big Ten" section in your store. Tie up with our wide-spread advertising campaign. Carry all the Stewart Products. It's the only way to get all the profits.

You owe it to your business success to sell the Stewart "Big Ten" Custombilt Necessities. Take a big step forward, to-day, by ordering them from your favorite jobber.

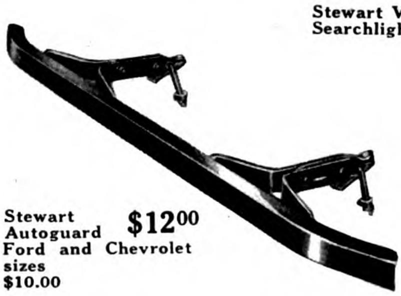
Stewart-Warner Speedometer Cor'n, Chicago

A Nation-Wide Chain of Service Stations

Miss Stewart Custombilt



Stewart Warning Sign..
Hand-Operated $4.50
Motor-Driven - 7.50



Stewart Autoguard $12.00
Ford and Chevrolet sizes $10.00

Stewart V-Ray Searchlight $6.00

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL — NEW YORK—THURSDAY, APRIL 24, 1919—CHICAGO — No. 17

American Report on British Labor Conditions

Findings of the Employers' Industrial Commission of the U. S. Department of Labor

British Government officials and most employers now believe that the best way to arrive at and to maintain agreements with labor lies in strengthening well established systems or organizations of both employers and employees.

There is a marked disposition among workmen to be represented in the national councils by actual workers. They feel that labor union officials have become detached from the atmosphere of the shop and are not in sympathy.

WASHINGTON, D. C., April 21.—The cause of labor unrest in Great Britain today is the demand of the working people for a better industrial day providing not only better wages, but also better conditions of life and labor. This is a brief statement of the basic cause of conditions which are aggravated by the strain of four years of war, the feeling that labor does not receive its proper share of the combined product of capital and labor and the fact that, under the British labor union system, the process of handling grievances is too slow to get adequate and prompt relief.

These conclusions are taken from the report of the Employers' Industrial Commission, appointed by the U. S. Department of Labor to study the labor situation in Great Britain which has just been filed.

The committee found no panacea for industrial unrest. Many of the workmen were found to be critical of and disposed to disregard their unions, believing that the officials of the unions have become detached from the atmosphere of the shops and have thus lost their proper sympathy for the workmen. They also believe that they are not benefiting properly from inventions and improved shop methods.

Inquiries among a large number of workers in many different lines for suggestions for the improvement of conditions resulted principally in demands for employment insurance, health insurance and old age insurance.

It was found by the committee and pointed out in its report that the term labor, which is employed somewhat differently in England, whether used by working men or employers, always carries a recognition of mental as well as of physical labor. Capital is used to define the stockholder who is usually an absentee proprietor, while the term "worker" included every one contributing to the actual management of the business from the managing director to the men who sweep the floors.

Shorter hours of labor form an important factor, and the 44-hr. and 47-hr. weeks, and even 40-hr. weeks, are being demanded.

That housing is playing an important part in the matter of labor unrest was evidenced by the discovery that less than 200,000 workers out of 14,000,000 own their own homes. At the same time

it was found that many workers do not desire homes in England, in contrast to the ambitions of American workmen.

It was found that shop committees, although sometimes difficult to deal with, result in good by bringing about direct contact of employers with employees. The problem appears to be not only that of securing and keeping good shop committees, but also maintaining them under control of large labor organizations. It was because of this problem that the Whitely plan providing the industrial district councils and works committees was formulated.

Beneath the general turmoil and numerous reports of chaos, the commission found no signs of disorder in England and discovered that in general the government, the employers and the conservative employees are agreed; that co-operation between labor and capital is desirable; that conciliation will benefit both the employers and employees in stabilizing business and in preserving regularly organized unions, and that collective bargaining benefits both employers and employees.

Disregarding the radical groups, who, it is thought, are being fostered by foreign Bolshevists, the commission found that the employers are recognizing organization of employees, that both now recognize the need of maintaining production and have discarded the ideas about restricted outputs, and are very much in favor of the Whitely industrial plan. This plan proposes the establishment of industrial councils comprising employers and employees to deal with industrial problems affecting the entire country, district councils to deal with matters of local concern, and works committees made up of workers and the management in each plant to deal with the problems affecting each particular shop.

The commission learned from authorities in England that the radical leaders are opposed to collective bargaining and aim to bring about complete revolution of the present system of society.

Women in industry should not receive the same wages as men, according to the general belief of the British working men, unless they deliver equal value as the men. They point to the fact that unless women produce equal value they will be crowded out of employment if they insist on equal wages.

Following is the complete report of the Industrial Commission, which was composed of E. D. Gundlach, chairman; R. J. Caldwell, Dorre E. Felt, William H. Ingersoll, R. R. Otis and Elden B. Keith, who died while abroad:

Report of the Employers' Industrial Commission

To Hon. ROGER W. BABSON, Director General Information and Education Service, United States Department of Labor, Washington, D. C.:

The commission of employers designated to visit Europe and to report on industrial conditions in order that employers and employees might have the benefit of the longer experience of European—and especially British—employers and labor leaders, submits the following as a statement of its observations in Great Britain:

A Revelation for American Business Men.—What we have learned as to the attitude of the Government toward organizations of labor and organizations of manufacturers and as to the attitude of employers toward the trade unions, and that of labor toward federations of employers, as well as the general system being evolved to handle industrial disputes, proved in more than one respect a revelation to us. We believe it will be a revelation also to those at home, disclosing the promise, we think, of constructive co-operative relations which must result in good for all.

Underneath the seething unrest, as expressed in speeches and in newspapers, we found a remarkable harmony of purpose between Government officials, conservative employees, and practically all employers. These groups are to-day nearly a unit in urging:

First—The spirit of co-operation by recognizing and encouraging organizations of employers and employees; and

Second—The need of maintaining production, former ideas of restrictions on output having been discarded.[1]

The leaders of British industry (the men who control a large share of the world's steel and cotton and other products) and the officials of the great associations of British employers expressed their common verdict as summarized below.

If our observations and findings cause any surprise, our answer can only be that if other American business men will themselves go to Great Britain they will confirm our statements as to the viewpoint of Britain's conservative employers.

Sources of Information

Arriving in London Feb. 4 we presented our credentials to the United States Ambassador. He apprised the British home office, from which we received carte blanche to gather information from any source that seemed to us desirable.

Our next official step was to present ourselves before Sir Robert S. Horne, Minister of Labor, and Sir David J. Shackleton, K. C. B., permanent secretary of the Ministry of Labor.

Both of these gentlemen expressed themselves without reserve. They reviewed the situation in a thoroughly comprehensive manner. This was particularly enlightening, because of the fact that the Ministry of Labor, since its foundation in December, 1916, has successfully devoted a large part of its efforts to adjusting labor disputes and their avoidance.

[1]*All this is predicated on the accepted belief that labor is entitled to more consideration than it has heretofore been accorded.*—THE CHAIRMAN.

Shortly thereafter we were privileged to have an audience lasting several hours with George H. Roberts, at present Food Commissioner and former Minister of Labor prior to Sir Robert S. Horne's appointment a few months ago.

In the meantime, and up to the present, it has been our good fortune to have a continuous series of conferences throughout the day and each evening with members of both Houses of Parliament, the Federation of British Industries, the chairman of the Engineering and National Employers' Federations, and prominent students of industrial problems.

Also on a trip to industrial centers of the north, viz., Birmingham, Sheffield, Manchester and Glasgow, your commission interviewed numerous large employers and officials of labor organizations, groups of workingmen of all degrees of radical and conservative thought. Like the Government officials in London, these employers, the workmen and labor leaders, freely expressed to us their ideas respecting the industrial situation in Great Britain.

We also had the advantage of a conference with the admiral commander in chief of the Rosyth Government Dockyard; also with the chiefs of the municipal tramways, gas works and electric undertakings of the city of Manchester, at a meeting presided over by the lord mayor of that municipality; also with the chiefs of similar municipal services at Glasgow, presided over by the lord provost.

Our search for sources of reliable information and our contact with men rep-

resenting all elements in society, stations in the community, and viewpoints, has been greatly facilitated by the capable efforts of the staff of experts and secretaries who accompanied us.

Summary of the Situation

Here is our summary of the British industrial situation:

In 1914 the leaders of the national labor unions signed an agreement with the Government pledging their organizations not to strike during the war.

But the Government soon found that the existing organizations could not control the workers. Because the hands of the national unions were tied, a succession of unauthorized strikes broke out locally in growing numbers.

Unrest in Individual Shops.—The men in the shops, sometimes through newly elected committees—more often through their regular shop stewards (the name previously given to the representatives of the unions working in the shops)—made successive demands upon their individual employers, either by strike or threat of strike. When an employer gave in to such demands this fomented other demands elsewhere by workers who wanted what others had secured, or more. Against these so-called "unconstitutional" strikes ("unconstitutional" because not authorized by the regularly constituted unions) the national leaders of labor unions seemed well nigh powerless.

The month of the armistice saw the expansion, perhaps more than a beginning, of new forms of organizations of shop stewards among themselves. These men to a large degree, while union men themselves, to-day ignore or defy the orders of the union leaders. By securing concessions from individual employers without regard to the central unions, the shop stewards feel that they have proven their power (temporarily, at least) to the workingmen in the shops.

Radicals Among the Shop Stewards.—Among the shop stewards are the young men of radical temperament and with extremely brief and limited experience in responsibility. They are the ones who are propounding the theories about a new state of society, and among them are the radicals who would eliminate the profit system.[1]

Many of these radical leaders frankly state that they oppose all machinery to bring employers and employees together by collective bargaining, because bargaining and conciliation tend to continue the present system of society.

Opposed to the radical wing of the shop steward movement we find:

First—Employers who are practically a unit in their general attitude;

Second — Regular organizations of labor unions with their leaders; and

Third—Those shop committees that believe in getting together with the employer, not in order to crowd demands until all profits are absorbed by labor, but sincerely and genuinely in order to adjust differences by collective bargaining.

The employers and conservative labor leaders in Great Britain have as their background a prolonged experience in

[1]*It is also to be recognized that among the shop stewards are capable leaders who believe that the demands of the national labor leaders are too modest.*—WILLIAM H. INGERSOLL.

THE COMMISSION'S FINDINGS

1. *EMPLOYERS IN GREAT BRITAIN generally recognize the desirability of bargaining collectively with labor.*

2. *EMPLOYERS nearly all agree that collective bargaining should always be undertaken between associations of employers and the regularly established well-organized trade-unions.*

> *While many manufacturers welcome organizations of workmen in their factories (shop or works committees), they want to limit the activities of such bodies to purely local grievances, and decidedly desire that the committee members come under the discipline of their unions.*

3. *MOST EMPLOYERS freely recognize the right of labor to organize; they regard organization as greatly contributing to the stability of industry. Some large manufacturers declare that they wish to see every workman within the unions, so that they must all come under organization control. Others feel that 100 per cent organization might lead to dangerous types of universal strikes and lockouts. The more conservative employers appear to make no effort to help along organizations of labor, merely dealing with such organizations when they appear on the scene.*

4. *EMPLOYEES IN GREAT BRITAIN are divided in sentiment shading from those who want to maintain the trade-unions along the regularly established so-called "constitutional" lines to ultra-radical socialists.*

5. *EMPLOYEES are nearly a unit, however, in expressing opposition to the use of force. The most radical who desire "now" a complete overturning of the present social structure, usually admit on close questioning that "now" may mean many years. They want to "start" now. Practically none appear to approve of a sudden change as in Russia.*

6. *EMPLOYEES of the ultraradical type look askance at collective bargaining and organizations of labor and capital. They freely express the view that they do not wish harmony between employees and employers, since harmony would help to continue the present system of society.*

7. *EMPLOYEES of the more conservative type (and to your commissioners they appear to represent the vast majority of British workmen) are largely in accord with employers in the desire (1) to head off labor unrest at this period; (2) to strengthen the unions by holding members under control; (3) to increase production for the sake of the nation, workmen included—with no restriction on output except as it affects the health of the worker; (4) to leave control of business policies in the hands of those managing the business.*

8. *GOVERNMENT OFFICIALS appear to be uniformly of the opinion that the Government should function in labor unrest only as an absolutely last unavoidable resort. On the other hand, they maintain the right of the Government to step in when necessary in order to protect public interests against minorities which try to force their terms upon the people.*

9. *IN GENERAL the Government, and most employers and conservative employees appear to be agreed:*

That the spirit of co-operation between labor and capital is highly desirable.

That the spirit of conciliation is important for the benefit of the employer in stabilizing his business and for the benefit of the employee in preserving his regularly organized unions.

That in collective bargaining the right-minded employer will not attempt to return to the pre-war industrial era, and that the right-minded employee will not attempt to crowd his demands to the point at which the stimulus for private business enterprise would disappear.

The spirit of a genuinely better NEW (and not NOVEL) era is thus being fostered by widely varied elements of Great Britain's industrial system.—R. J. Caldwell, Dorr E. Felt, Wm. H. Ingersoll, Robt. R. Otis, and E. T. Gundlach, Chairman.

The more intelligent workers realize that merely advancing wages does not meet requirements if the purchasing power of money is thereby proportionately reduced.

In their demand for a better industrial day, the working people seek not merely small non-essentials, nor commonplace essentials, but a real step forward in their conditions of life and labor.

dealing with each other by organization, and a great majority of them believe that it is best for both employers and employed to treat with each other collectively.

Employers Prefer to See Labor Well Organized—Years before the outbreak of the war the thought of breaking up labor organizations had been practically given up by employers, and the union leaders had abandoned opposition to associations of employers.

As the war measures took away the power of the central organizations over the workmen, the situation which developed seems to have convinced most employers as never before that workingmen are best dealt with by negotiation through large bodies of labor; not necessarily in order to concede to their demands but merely for the purpose of dealing with labor en masse.

For the war showed that irrespective of laws, employers' opposition, or Governmental agreements, workingmen today will find some way or other to act together in groups when their interests are vitally affected.

So the Government officials and most employers now express the belief that the best way to arrive at and to maintain agreements with labor lies in strengthening well-established systems or organizations of both employers and employees. These, they say, can be held responsible and kept to concerted action better than incoherent small groups.

Another point: The shop committees, although often difficult to deal with, proved to many employers that much good resulted from direct contact with their men.

By means of these committees industry avoided the necessity of depending on the detailed and intricate machinery of trade unionism for the adjustment of purely local grievances.

The problem then remained as to how to get and keep shop committees and yet maintain them under the control of the larger labor organizations. An effort in the direction of fitting shop and works committees into larger and more responsible organizations of labor was made by a Government plan, which in the last six or eight months has formed the basis of a great deal of public discussion in Great Britain. We refer to the program set forth in the British documents known as the Whitley reports.

Whitley Plan Explained

Before we came to England our attention was directed to the Whitley reports.[1] They were drafted by a sub-committee of the Committee on Reconstruction appointed by the Prime Minister in 1916.

Briefly the Whitley plan proposes the establishment for each industry of:

1. Joint standing industrial councils made up of representatives of employers and employees to deal with the larger questions that affect the industry throughout the whole country;
2. District councils constituted in like manner to deal with matters of local concern; and
3. Works committees also composed of representatives of the workers in each plant and the management to deal with conditions affecting each shop but not touching the larger aspects handled by the district councils or the national joint standing industrial council. Such matters as shop sanitation, the hours of beginning and ending work, luncheon time and rest periods, are to be dealt with by the works committee.

The Whitley plan is exceedingly elastic. It is not the intention of the British Government to force any cut-and-dried formula upon the industries of the country, but national joint standing industrial councils and district councils are essential to a fully developed Whitley scheme.

Councils in 30 *Industries.*—National joint industrial councils have been formed in 30 different industries, but the fully developed scheme, including district councils and works committees, has been established in only three industries, viz.: Matches, pottery and rubber.

In several other industries works committees have been set up in many establishments in accordance with the recommendations of the Whitley committee. Eventually, these works committees are to be organized by districts and nationally into a true Whitley scheme, but at present they are nothing more than the beginning of such a scheme.

In fact, we soon discovered that the details of the system, which was elaborated in five successive reports by the Whitley committee, as far as being put into operation is concerned now stands in the embryonic stage, and the new machinery has not yet been developed far enough to afford sufficient experience on which to base definite conclusions.

The Whitley plan is viewed with much favor by officials of the Ministry of Labor, which is endeavoring to effect the organization of various lines of industry under this plan.

Various municipally operated public service departments are also proposing to organize under systems based on the general idea of the Whitley plan.

Employers Favor Whitley Plan.—Inquiry developed that the employers, when conversant with the Whitley plan, almost universally favor it; also that employers favor complete union organization of the employed in established labor unions and favor not only collective bargaining, but closer touch with the employed. About the only note of doubt respecting the benefits of the Whitley system, on the part of the employers, relates to the question of the possibility that it might later on lead to undesirable results.

In short, the advocates of the Whitley plan expressed the belief that it would result in complete unionization of all the workers in those industries adopting it; also that it would prevent many strikes. The idea is that small grievances would be adjusted around a council table rather than being allowed to continue as foci of discontent until they grow into grave matters.

Objections of Some Employees.—On the other hand, while some of the higher labor union officials favor the Whitley plan, a large portion of the more radical among the minor labor union officials and the workmen do not indorse it enthusiastically.

Their objection seems to be based, first, on the impression that it would take the place of the regular established labor organizations; and, second, a distaste for Government participation in negotiations and settlements between employer and employed, which the Whitley plan contemplates in certain situations.

Some of the strong and thoroughly organized labor unions, such as the Coal Miners' Union and the Amalgamated Society of Engineers (metal trades), take the position that the machinery of the old established organization and the usual arrangements with the employers afford sufficient means of adjustment of grievances.

Old Established Systems.—In respect to a considerable number of industries both employers and employed explained that they had introduced the equivalent of the Whitley plan years ago. But it usually developed that their arrangements for conference and adjustment of differences between employer and employed did not include the district councils of the Whitley plan, and only in some industries regularly established joint industrial councils. Many of these individual mutual conference arrangements have been very effective in preventing industrial conflict. Some of them have been in operation for many years.

Fortunately, as some declare, England has been experimenting with methods for the betterment of relations between employer and worker so that opportunity has been afforded to witness results over a period of more than a generation. As

[1] *The first (interim) report of the Committee on Relations between Employers and Employed (the so-called Whitley Committee) was made on March* 8, 1917, *and is contained in Bulletin* 237 *of the United States Bureau of Labor Statistics, Washington, D. C. Subsequent reports and the memoranda by this committee are contained in the Monthly Labor Review of the same bureau for May, June, August, September and December*, 1918.

Labor leaders in the Government and leaders among workingmen outside official circles are coming out emphatically against theories of restriction of output.

Most British workers believe they do not benefit in a fair measure in the advantages which inventions and improved methods should provide to all members of society.

confidence was gained by experience, more rapid progress in later years was accomplished. The plan simply carries out and defines more accurately old-established machinery for the adjustment of labor disputes.[1]

The Whitley system was examined with special interest and care by your commission, because this plan is now being furthered by the British Government in the attempts to encourage the get-together spirit of employers and of conservative employees.

Period of Great Labor Unrest

In our interviews we were constantly met with the statement that we had arrived at a time of great labor unrest, and our investigations confirmed this view.

Interviews with many of the workmen tended to indicate that "unrest" is a rather inadequate term. There are many intimations of "direct action" and a complete overturning of the present social structure. But we believe the more extreme demands are largely limited to a class which has been thinking and talking along these lines for years.

The issue, however, is squarely drawn on the demand of the working people to have a better industrial day. They seek not merely small non-essentials, nor commonplace essentials, but a real step forward in their conditions of life and labor.

The relationship in Great Britain between employer and worker is clearly in a state of marked transition. This fact is recognized and accepted by all the country. This process was in its inception before the war and has been renewed with double intensity since the armistice.[2]

We Cannot Report That We Have Found Any Panacea for Industrial Unrest.—For instance, the specially generous treatment of employees, which is possible in connection with exceptional types of highly profitable enterprises, might be impossible in the case of industries engaged in closely competitive operations.

While we do not mean to infer that competition in any industry could be accepted as a reason for denying those engaged in it a reasonable standard of comfort, we did note that some employers, bounded by the horizon of their own experience, seemed to believe that they had discovered or invented methods and practices which will eliminate all industrial conflicts. Their special schemes may be perhaps successfully used under the special conditions of certain plants.

But in this report we are concerned only with principles that may be generally applied for the good of industrial workers, and of industry as a whole.

Causes of the Unrest

The present unrest among the workers is ascribed by different authorities to many separate causes—that most frequently mentioned as the *immediate* cause is the strain of four terrible years of exhausting war, necessitating the most intense labor and excessively long hours for the worker.[3]

Among other alleged causes is a feeling that the worker does not receive his proper share of the combined product of capital and labor. This is universally voiced by the workmen whom we have interviewed.

Workmen Criticize Their Unions—The present condition is partly due also to the fact that grievances through the unions must pass through a rather complicated series of steps, and this procedure, therefore, does not result in prompt adjustment. Ofttimes the conditions contributing to the grievances have disappeared before the decision is consummated.

On the other hand, the shop stewards and committeemen, being in direct contact with the employer, usually succeed in promptly establishing accord between the parties concerned.

There seems to be a marked disposition among the "rank and file" of workers to criticize the present union system because it denies the workmen in the shop an opportunity promptly to rectify grievances, irrespective of their particular craft union. The object of the shop steward or shop committee movement appears to be to rectify this by constituting a shop organization capable of dealing with common grievances.

At the present moment there is rather a widespread feeling among the workingmen that the officials of the labor unions have become detached from the atmosphere of the shop and not in proper sympathy with the workmen. There is a marked disposition among the workmen to be represented in the national councils by actual workers.

The primary organization of unions has heretofore dealt with questions such as wages and hours of labor, which are common to the entire territory, while the shop committees or shop stewards deal with matters peculiar to their own establishments. Sometimes the members of the committee or the shop stewards are those among the men prone to be agitators.

Nevertheless the system seemed to work very well until now, when the men, under the leadership of the stewards and committeemen, are inclined to break away from the leadership and advice of the regular union officials. This condition has resulted in serious strikes and promises of others of still more serious moment to the general community.

All parties seem to agree that the present unrest, often resulting in grave discomfort to the community as a whole, is possible in certain circles only because energetic minorities are able to lead apathetic majorities of workingmen.[4]

Views Expressed by Workmen

Your commission, as stated above, devoted a number of evenings to discussions with different types of workingmen, getting expressions of many widely varied shades of opinion.

One cannot listen to their grievances and hear the stories of their troubles, as voiced by the more intelligent workmen, who are of a very superior type, without being impressed with their sincerity. Periods of unemployment frequently place them in debt, from which it requires years of strenuous effort and self-denial to recover. Many find themselves unable to obtain employment during their later years, after a life-time of constant industry; their wages afford slight means for recreation.

Most of the British workmen believe they do not benefit in a fair measure in the advantages which invention and improved methods should provide to all members of modern society.

The radicals contend that society as now constituted under the competitive system includes many wealthy idlers and a vast system of middlemen which stand between the producer, who is also in a large measure the consumer, and a just

[1] *At a large cotton mill in Lancashire it was stated that for years all differences in the industry had been successfully settled by joint committees, averaging 600 cases per annum. In another industry, no difference had arisen in five years which had not readily been settled without a strike. Another large concern told of 149 out of 150 cases being adjusted without a strike. In not a single instance did I receive an adverse report from either side in any plant where the plan had had reasonable time to become established.*—R. J. CALDWELL.

[2] *The workers, it was found, were greatly dissatisfied with wages, working hours, and housing conditions before the war. But after Aug. 1, 1914, the labor troubles were overshadowed by the greater crisis. Even during the war the workers continued agitation for better conditions. Now that military peace has come the industrial conflict threatens anew with increased vigor.*—R. R. OTIS.

[3] *The strain of the war is an incidental cause in our judgment. The fundamental cause, we believe, is the struggle for better conditions for workingmen. This fundamental is almost world-wide, and Great Britain appears to us as but the index, or perhaps the guide, of far deeper than nationalistic or temporary forces.*—R. J. CALDWELL and WM. H. INGERSOLL. *Shortage of proper amusements, housing, sanitation, and lack of general welfare work for the hundreds of thousands of demobilized soldiers who have either gone back to the shops or are idle, and continuation of some war restriction depriving the working class of many comforts, such as light, certain kinds of food, etc.—all this, to my mind, has had perhaps a more "immediate" depressing effect than some of the more serious, fundamental causes outlined above.*—R. R. OTIS.

[4] *It should be noted that this comment refers only to "certain circles" of labor.*—THE CHAIRMAN.

Less than 200,000 of the 14,000,000 British workers own their homes.

The average workman thinks quite as much of considerate treatment as he does of wages.

Business men freely declared that danger lay in the tendency to "wait for wages to go down" before going ahead with business.

share of what the workman produces. Many of them believe that all profits should be eliminated and that pure socialism is a cure for all their ills.

But when closely questioned along constructive lines they do not seem to have any workable suggestions of what the proposed new order of things should be.[1] They do not state whether or not it might result in a more just, proportionate distribution of the fruits of the combined operation of capital and labor or if it would result in a greater net income and enjoyment of the good things of life to the worker.

Workmen Now Study Economics.—It is obvious that a great amount of study by the workmen is being devoted to the subject and that a section of the younger workmen are being assiduously educated by certain radical groups along socialistic lines of thought. It develops that in one of the cities visited by us there are 14 classes devoted to the teaching of economics, and that a considerable number of workmen attend the classes regularly in preference to the moving picture houses or other recreations.

The theory that this movement is due to foreign propaganda does not seem to be generally accepted, although some employers voice the idea.

Minimum Standard of Comfort.—The more intelligent workers realize that merely advancing wages does not meet requirements if the purchasing power of money is thereby proportionately reduced. This was exemplified to their satisfaction by the experience of the war. Their final desideratum is a wage that will insure a specified minimum standard of living regardless of fluctuations in the cost of commodities.

The workers frequently mentioned the fear of the poorhouse. Security, they said, must accompany all plans to allay labor unrest.

Insurance and Pension Plans.—When asked what substitutes they had to suggest, the reply from quite a few was:

"Unemployment insurance."
"Health insurance."
"Old-age insurance."

These are the things, they said, which the provident would secure for themselves if their circumstances would permit.

It was apparent that the workman thinks quite as much of considerate treatment as of wages, and almost universally the idea was voiced that he is regarded by his employer merely as a "hand" or a number. He feels entitled to consideration and courtesy and very much desires closer *touch and sympathy on the part of the employer. In fact, this phase of the question was usually emphasized by the workman. The little things count, and their neglect magnifies them.*

Lack of Better Opportunity.—The average employee in Great Britain does not expect to rise above the station in which he was born, although a considerable number do become "masters," usually in a small way. Their expectation of always remaining in the same station results in a disposition to think in terms of class rather than individually and tends more toward organization than in America. It makes the British workman less inclined to individual effort than the American workman.

Short Hours of Labor.—The question of short hours of labor was one of the most prominent in all our discussions. In some of the plants we visited the men worked about 54 hours a week—some work more and some less—but one great and successful engineering works adopted an 8-hour day (48 hours a week) 20 years ago. The men in the engineering trades are now working a 47-hour week. They asked for a 44-hour week, and some, in an attempt to provide, as they thought, promptly for a greater number of workers in order to meet the temporary dilemma of unemployment, are now asking for a 40-hour week.

Perhaps a definition should be given of certain phrases current in labor circles of Great Britain, in order that the views of the workmen may be better understood.

Definition of Voice in Management.—Of special significance is the expression, "voice in management." According to the preponderant view of both employers and employees in Great Britain, this phrase signifies only that workmen or their representatives should be heard in connection with the management of matters intimately affecting the workmen, such as the hour of beginning the day's work, a matter on which the shop committees want to be consulted (not length of hours, which is a question for collective bargaining between the unions and the associations of employers), sanitary conditions, safety matters, etc.

In the mind of the average British workman, the phrase "voice in management" does not, therefore, as at present generally understood in America, extend to matters purely commercial or administrative, nor to such questions of business policy as expanding to new markets, purchase of material, selling prices, additional investment in plant, etc. In other words, this phrase pertains to what we call "shop conditions." It does not extend to what are sometimes termed matters of organization and administration.[2]

Definition of "Capital and Labor."—In the expression, "Capital and Labor," the former term as used in Great Britain includes only the stockholder, who is usually an absentee proprietor, even in a close corporation, visiting the works perhaps once or twice a year, if at all. The term "worker" includes everyone contributing to the actual management or prosecution of the business, from the managing director down through superintendent, salesman, office workers, to the men who sweep the floors; emphasis being placed on the fact that "labor" includes both brain workers and manual workers.

The Problem of Housing

Among other matters having direct bearing on labor unrest, we gave our attention to the question of housing. The British Government appointed last year a royal commission to inquire into industrial unrest, and their report was to the effect that bad and insufficient housing played a large part.

Your commission also finds that Great Britain includes in its claims of having fourteen million workmen a large number of clerical men and women in railroad, telegraph, telephone, hotel, and even active clerical men in industrial plants. Out of this 14,000,000 only a very negligible number own their homes. Labor officials approximated the number at less than 200,000. Government officials questioned were uncertain as to the number of laboring men who want to buy homes, while leading realty agents advise it was so insignificant they did not even equip their offices to handle this class of investor.

Reasons for Housing Situation.—They gave numerous reasons for this situation, but the leading ones seemed to be: First, the vested title to land; second, long ground-rent leases, and third, the construction of rows of tenement houses which contained no permanent dividing walls.

Any of these causes would preclude the possibility of conveying to the workman who desires a home an absolute, permanent (fee simple) title to both land and to building.

Other reasons put forward were that the laboring class seldom appeared to have any surplus for home investment, while others did not desire to become identified with any given location, or, expressed differently, tied to any one industrial establishment by virtue of owning a home.

In contrast, it is pointed out that

[1] *It is a matter of opinion as to whether their plan is workable or not. I do not believe it is, but they do; and they are not without a comprehensive scheme of social and industrial organization.*—William H. Ingersoll. *The writer of the text in the report refers to our talks with many men who work at the bench. It is assumed that no one denies that some of the leaders have clearly defined plans.*—The Chairman.

[2] *The above states the idea as commonly expressed to us by many workers. In the language of other workmen, "voice in management" means actual share in the conduct of business. The term has an indefinite variety of meanings.*—The Chairman.

American workmen and clerical men not only desire to own a home but that large numbers of them make every effort in that direction.

Well-posted Englishmen of affairs tell us that in new countries like Canada, Australia, etc., there is a condition similar to that in the United States.

Need of 300,000 Homes.—The British Government now figures the urgent need of from three to four hundred thousand houses for laboring men, and this development is supposed to get under way at once. Yet, under the various housing acts in effect since 1890 the actual construction is as follows: 1911, 464 houses; 1912, 1021 houses; 1913, 1880 houses; 1914, 3335 houses; 1915, 4408 houses.

Also, under these acts individually owned houses of the slum type were made fit by partial condemnation and at the expense of the owners, beginning with 19,463 in 1911 and increased to 67,065 in 1914. Many of these buildings were to take care of war workers.

None of the English housing acts seem to have for their aim the idea of encouraging the workman to own his home, but are almost exclusively rental propositions.

The British Government's present reconstruction measures of underwriting the loss of the present-day cost of building 300,000 houses as opposed to their value seven years hence is a system elaborate enough to warrant special study. But this again does not aim at making the laboring and clerical man or woman a vital part of the community through personal ownership of his home.

No Restriction on Output

A subject constantly discussed in our interviews with Government officials, employers and workingmen was the question of restriction of production and the introduction of labor-saving machinery.

Great emphasis was placed on this topic by the British. The employers naturally plead for high production. Government officials are indorsing this plea; and what is more, the labor leaders in the Government, and also leaders of workingmen outside of official circles, are coming out emphatically against theories of restriction of output.

Again, on this subject, as on others, the radical element stands apart. Some of those who want a fundamental change in society say that under the capitalistic system labor cannot in any event get more than a bare subsistence, and that increased production is simply for the benefit of the capitalists.

"Nation Must Produce to Live."—All others, however, including a large number of those of the "rank and file," so-called, of the workingmen are preaching that the nation must produce in order that the nation may live; and that workmen cannot share in what is not produced.

Practically all labor representatives who believe in continuing the present system of society agree that increased production is in the interest of both employed and employer.

Most of those who favor short hours claim that this is merely for the benefit of the health of the working classes, and arguments are now rife as to whether the total output is decreased or maintained at the same level by a reduction to 48 or 47 hours.

Employer May Be Penalized.—We also found that by agreement between organizations of employers and organizations of workingmen in some highly organized industries, such as the cotton industry, a case may be filed against the employer who, because of bad raw material, is not able to procure a standard output. Such an employer may be penalized by having to pay higher wage rates, so that the workman may make the usual earnings at the prevailing piece-work rates, in spite of poor raw material.

Miscellaneous Topics

Equipment of British Plants.—The various industrial plants inspected indicated that the equipment and organization of the British plants compare favorably with corresponding plants in the United States. It is an interesting circumstance that a very large steel-producing plant in course of construction contained many trains of machinery manufactured in the United States, and the balance of its equipment was built in England under license from and under the supervision of the foremost American designers. Plants developed wholly under British auspices, as a rule, represented a very high state of development.

A Co-operative Organization.—We visited one of the great co-operative commercial organizations which produce and distribute at wholesale and at retail many articles of ordinary consumption. Its turnover amounts to over $60,000,000 annually, and it is not the largest organization of the co-operative type in Great Britain. It operates oil wells, raises tea, manufactures shoes and many other articles. The co-operative feature of this institution pertains mainly to the commercial end of it. Most of the employed are not interested in the institution, although they may purchase a limited amount of stock if they desire. Therefore the labor problems of this co-operative institution, as the managers themselves stated, are similar to those of an ordinary industry.

Holding Back on Non-War Production.—There appears to be in Great Britain hesitation on the part of various enterprises to reconvert to and to go ahead with non-war production. Reasons given are, first, the fear of turmoil in the labor world, and, second, the expectation of lower prices of material and lower wages. It was widely stated that there seemed to be no sound economic basis for the latter expectation.

Business men freely declared that danger lay in the tendency to "wait for wages to go down" before going ahead with business. One of the largest employers in Great Britain, seconded by several others, said that if there was reason to fear serious industrial unrest, it lay largely in this waiting tendency caused by threats of labor disturbances.

Women in Industry.—Women played an important part in industry during the war. There was opposition from workingmen, but this was partly overcome by inviting the female relatives of the workingmen to the plants.

Many people in Great Britain believe that the returning soldier who was replaced by a woman should not now be kept out of his position; hence, hundreds of thousands of women are expecting to go back home or into domestic service.

However, some of the labor leaders themselves, and especially labor men who are now working for the Government, call attention to the fact that equal pay for equal work on the part of women should properly mean equal pay for equal value; that therefore women need not draw the same pay per hour as men; as otherwise women when not capable of delivering equal value would be crowded out of employment.

Improved Conditions of Workingmen.—It seems obvious that during the last hundred years the condition of the workingman in Great Britain has been gradually improving, and that the war will result in acceleration of this process, so that in a few years more progress will be made in a short time than in fifty years of the ordinary course.

Unemployment Insurance.—The unemployment insurance benefit, amounting to 9s. ($2.18) per week for men, and 5s. ($1.21) per week for women, have been superseded for the time being by the temporary out-of-work donations granted by the Government to take care of unemployment growing out of demobilization of the army and of the munition factories. The out-of-work donations amount to 29s. ($7) per week for men, and 25s. ($6.05) per week for women. (The union strike benefit in the engineering trades is about half as much.) In addition to the out-of-work benefits paid by the Government the trade unions pay such benefits, varying from 5s. to 10s. ($1.21 to $2.42) per week.

Minimum Wage.—In Great Britain a minimum wage is established by agreement in the sweated industries, and enforced by the Board of Trade, fines being imposed for violation.

Attitude Toward Ministry of Labor.—It was a matter of some interest to note that while the workingmen seemed to believe that the ministry of labor is pro-capital, the employers seemed to believe that the same department is pro-labor.

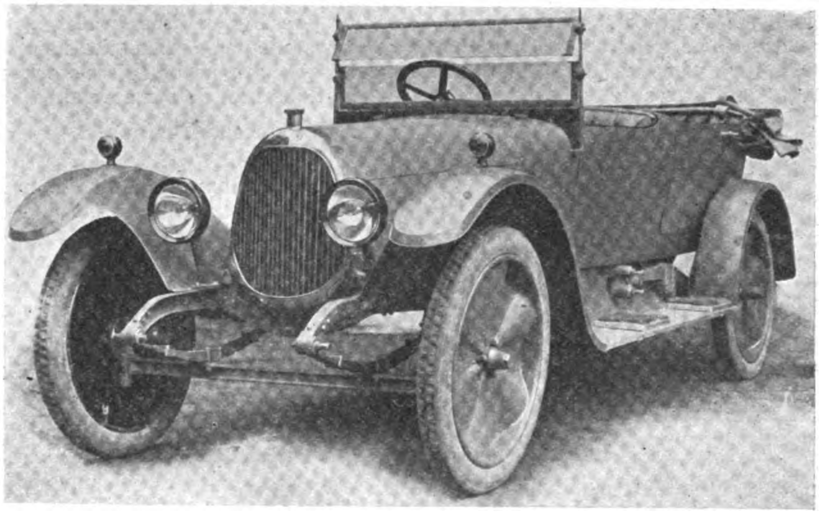
Compulsory Arbitration in Australia.—We were fortunate in meeting on the ship going over Mr. G. S. Beeby, minister of labor for New South Wales, who explained that in his country labor legislation had progressed very far, including compulsory arbitration, special labor courts, unemployment compensation, etc., but that at present the tendency in his country was in the other direction as regards compulsory arbitration, and that it was the general belief that this kind of arbitration had served to intensify labor disputes and increase strikes.

Other Topics Not Covered.—To report even briefly all the matters which came to our notice or indicate all the persons, interviews, and the source from which information was obtained would indefinitely extend this report.

The Angus Sanderson Car

A New British Assembled Product Embodies an Engine with Slipper-Type Piston, Counterbalanced Crankshaft, Integral Cylinder Block and Top Half of Crankcase, and Force-Feed Lubrication—Also a Novel Front-Axle Design

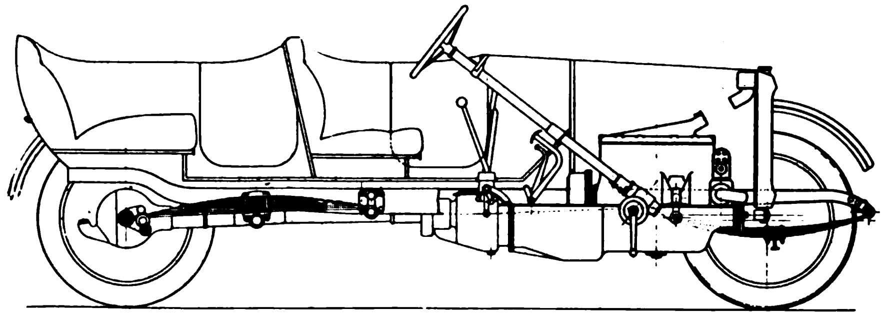
IT is about 10 years since a fair attempt was made in Great Britain to assemble a car from parts made entirely by outside firms, but in which the concern responsible for the car checked up all materials entering into the production of the parts, and in which the limit-gage system of manufacture was used. Such a car was the Weigel, which was virtually a copy of the 40-hp. Itala of that period. That the Weigel car passed off the market was through no fault appertaining to its method of production, for it was an excellent car. After an interval of some years, during which no cars had been assembled from specialized components in Great Britain, a light car produced on these lines is now about to be placed on the market, and it is an interesting coincidence that Frank Woollard, who was the designer of the Weigel car, is also connected with the production of the new car. Mr. Woollard, who during the interval had been associated with the Wrigley Co. of Birmingham, is the apostle of the assembled car in England.



The Angus Sanderson, a new British assembled car

The Angus Sanderson car, to which reference is made in the above, is the product of Sir W. Angus Sanderson & Co., Newcastle-on-Tyne, which has hitherto been engaged in coach building. In the car enterprise the firm has associated with it the Wrigley Co., which will furnish the transmission and the front and back axles; and the Taylor Co. of London, which will supply the engines. Minor components are furnished by other firms. The new car will weigh about 2700 lb., and, equipped with a full roadster body by the Angus Sanderson Co., electric starting and lighting systems, a spare wheel and spare tire, will sell at £450 ($2,250). The wheels are of a new type, with corrugated disk centers, and are said to be considerably lighter than tubular-spoked metal wheels.

Other features of interest in the design are the Ricardo slipper type aluminum alloy piston; the front axle, which is patented by the Wrigley Co., and has T-shaped steering knuckles; also the fact that, with the exception of the central or fulcrum bearing of the rear cantilever springs, all bearings have oil lubrication instead of grease lubrication. The fulcrum bearing referred to is lubricated by means of graphite grease, which is inserted into a hollow pin, which is claimed to hold enough for several months. Interest also attaches to the design of the rear axle, which has a spherical center casing with recessed bolt holes, the object being to obviate all offsets and corners which would tend to retain mud. The differential driving gear can be removed through the back of this housing, and the axle shafts can also be withdrawn without taking the axle down, the latter being of the full-floating type. The lubrication and cleanliness features are of particular importance because the car is specially designed for owner-drivers. It is being fitted with a body which, made before the war under the old-fashioned hand method, would have cost about £150 ($750), and if made now according to the same method would cost about 50 per cent more. The panels are shaped under hydraulic dies, and electric and acetylene welding are being used in joining panels together and for attaching valances and mudguards. The latter are domed and without angled edges.



The chassis of the Angus Sanderson in elevation

An output of 6000 cars is scheduled for the first year, and it is stated that about three-fourths of that number have already been taken up by dealers.

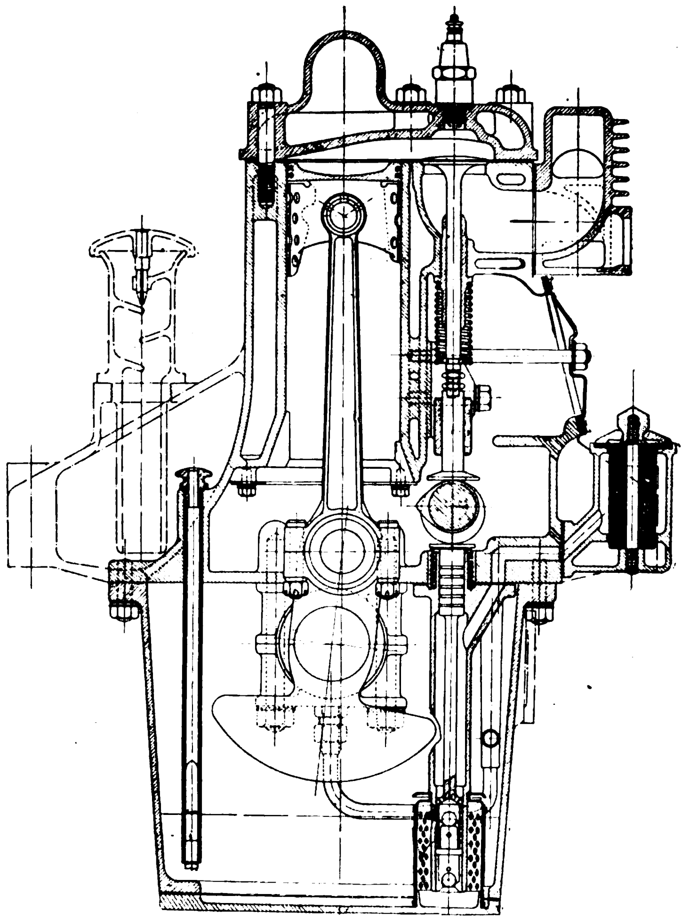
The general design embodies features associated with quantity production practice, but, as the sectional view shows, this is attained without sacrificing stability or a suggestion of the cheap. Details that are new in British car construction include such points as (1) combination of block cylinders with the upper part of the crankcase; (2) careful balancing of the crankshaft by means of counterweights; (3) the sup-

pression of noise (a) by using a specially rigid crankshaft with large journals, and (b) specially cut helical timing gears with cross-gear driven magneto; (4) effective carburetion by a "hot-spot" manifold; (5) specially light pistons of cross-head form (Ricardo's system), with hollow piston pin in a floating bearing, the combination weighing but 12 oz. as compared with 2 lb. for an average cast-iron piston; and (6) the front-axle design and certain details of the rear axle.

The Engine

The four cylinders are block-cast and combined with the upper portion of the engine case. They have a demountable head, valves at the side in common file, and are wholly inclosed by a pressed sheet-metal cover, externally removable tappets with mushroom ends in direct contact with the valve cams. The bore and stroke measure 3 by 5 in. and the S. A. E. rating is about 13.9 hp. Access for removal of the pistons and rods is either through the cylinder top or through the base, which is covered by a large plate. The lower part of the crankcase is of aluminum. The sump has a bottom cover which gives access for the easy removal of the pistons and rods. There are three main bearings for the shaft, with provision for the direct lubrication of each by a plunger oil-pump driven by a cam on the valve shaft. This pump also delivers oil to the timing gears. The latter are of cast iron with helical teeth. The magneto is carried transversely on a bracket and is driven through a flexible coupling by a cross-geared shaft. At the opposite end of the casing is the Lucas dynamo with its armature fore and aft, so that the pulley comes in line with the fan-pulley shaft, both members being driven by a pair of side-by-side pulleys of different diameter on the front end of the engine shaft. The Lucas electric starter is bracketed with the armature fore and aft on the off-side rear corner of the engine, and has pinion engagement for the flywheel periphery, the teeth in which are cut from the solid, the wheel being given an increased diameter for the purpose, corresponding with the width and diameter of the teeth. Both dynamo and starting motor are held in place by a lock-strap across the middle of the cases.

The carbureter is the Zenith, with a horizontal choke-tube and gravity feed from a 7-gal. tank placed under the dash, or, to be exact, fashioned symmetrically so that it forms, so to speak, a continuation of the bonnet curve. The tank has a 3-in. filler cap at both corners, this to facilitate filling and to provide access for cleaning, etc. The water circulation is laid out with the object of insuring ample cooling where most required—about the ignition plugs and the valve throats; also having regard to the reliance on a gravity displacement for its circulation. The radiator is of the vertical tubular form.

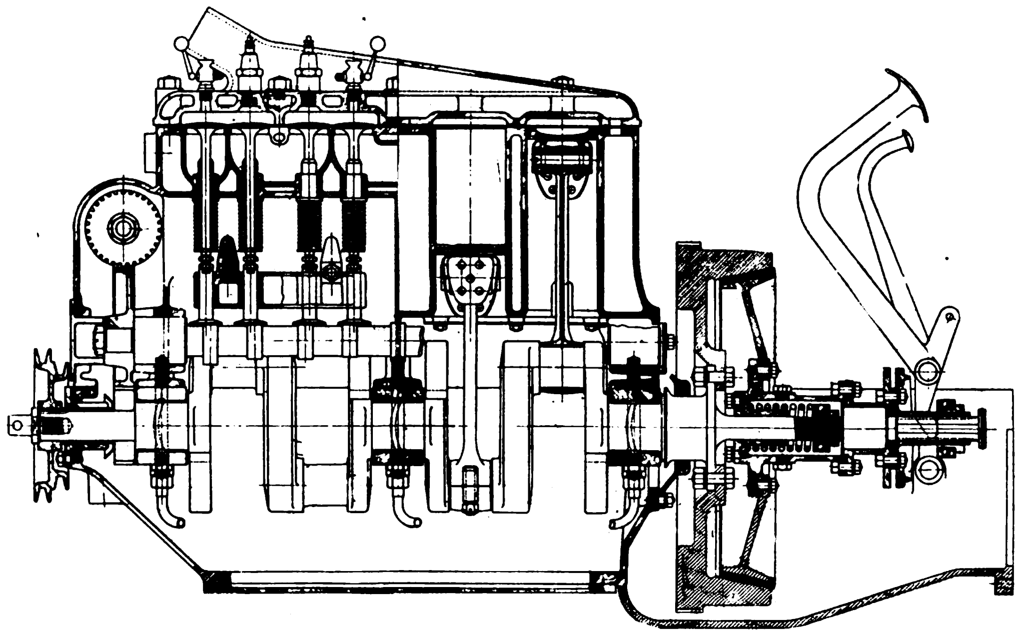


Section of Angus Sanderson engine, showing method of forced lubrication

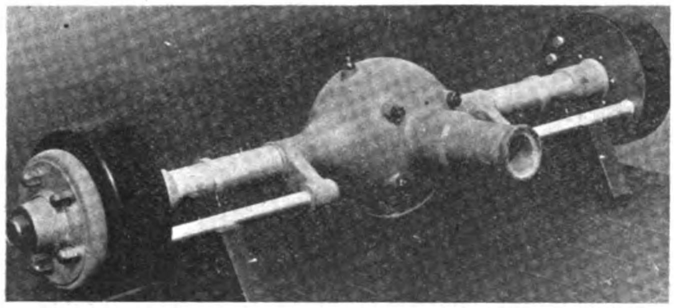
The magneto is of Thomson-Bennett make and has variable timing. Spark and throttle levers are grouped together on the steering post and instead of the conventional toothed sector, a friction lock is used.

Transmission and Drive

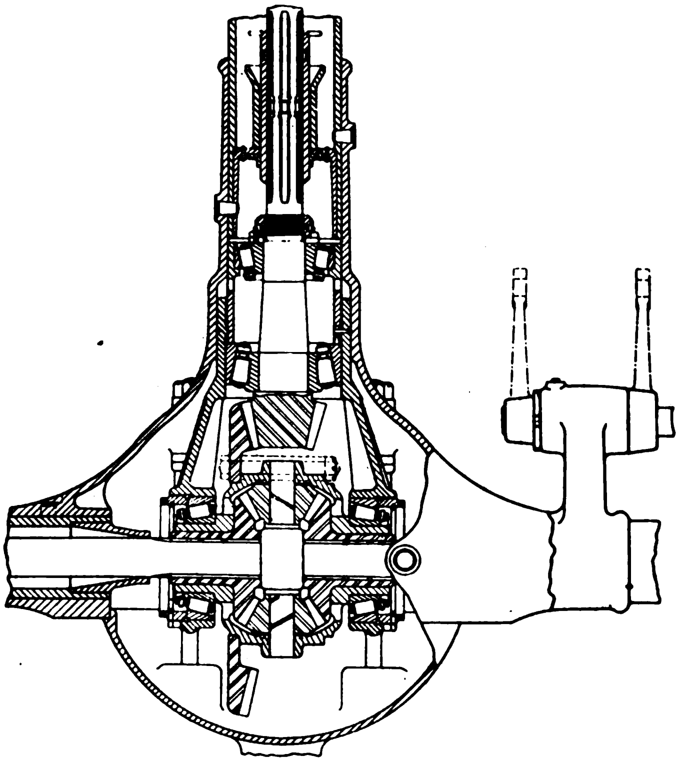
The engine and gearbox are a built-up unit. The clutch is an external cone faced with fabric and made readily demountable by removing some four through-bolts in the clutch members. Clutch rings and arms are one member bolted to a flanged center or boss. The clutch and brake pedals are adjustable. It will be noticed that the clutch spring is inclosed in the



Longitudinal section of Angus Sanderson engine and clutch



Angus Sanderson rear axle with twin side-by-side brakes



Sectional view of the Angus Sanderson rear axle gear housing

flanged casing and that there is a ball thrust behind this spring and another behind the heel of the pedal. There is also a clutch stop or disk brake, and special provision to prevent escape of the lubricating oil from the engine case into the gearcase, and vice versa.

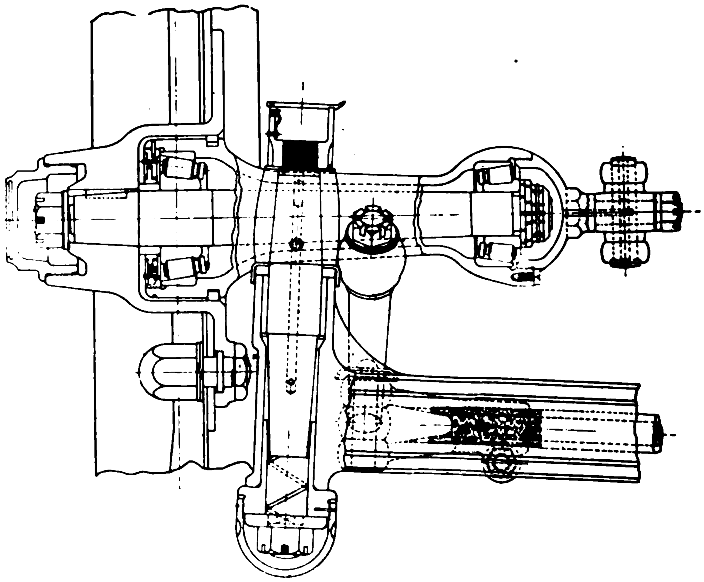
There are three speed gear changes and a reverse, the top speed being the usual direct drive. The primary or sliding gear shaft is carried in ball bearings, except the pilot, which has a floating bronze bushing. The layshaft is carried in bronze bearings and is below the primary shaft. Provision is made to insure the continuous circulation of oil (a thin quality is used throughout this chassis) and to prevent splashing and loss by leakage. The vertical sleeve in which the speed lever works has provision against idle play and clatter and serves as a vent for the heated air. There is provision also in the sliding rods against more than one gear train being meshed simultaneously. The gear ratios are progressive in the order of 4.2 to 1 (top, which is also the back axle gear ratio), 6.8 to 1 (second), 13.8 to 1 (first), and 18.4 to 1 (reverse).

The rear axle unit is a composite of cast steel (center and brake carriers) and wrought sleeves (axle housings). The center casting or axle gear differential box is spherical and devoid of flanges and projections liable to collect mud. Access to this case is from the rear by a cover held with four nuts. By undoing four nuts in the front of the center case the whole of the differential, crown wheel, and bevel pinion, together with the bearings, can be withdrawn from the car case for examination. A micrometer adjustment is provided to the crown wheel and bevel pinion, by which it is possible to obtain an adjustment to within practically one thousandth of an inch. A bevel differential is used, there being two star pinions. A special arrangement exists to prevent the oil leaking from the center case, except in predetermined quantities. It is possible to withdraw the differential shafts by means of a jack nut, which, when rotated, pulls the shaft from the hub shell, the taper on the shaft being reversed to permit of this. The hub shell is held in position by means of the journal bearing and a bush which is free from the hub shell except when the axle shaft is withdrawn. Goodyear detachable wheels of a novel corrugated disk form are used with 815 x 105 mm. Wood-Milne rubber safety tread tires having extra thick treads. The steering wheel has an Exonite-covered rim. The bearings to the swivel pins are widely spaced, and the hubs are carried on rotating stub axles which, it is claimed, practically is equivalent to the semi-floating type of rear axle shaft. Thus it is possible to spread the bearings from twice to two and one-half times the usual amount of spread allowed in the normal type of axle, besides enabling more adequate provision against moisture and grit, and also enables the axle to be lubricated from two points only.

New Rust-Proofing Method

PROF. BARFF in a Swiss engineering journal publishes a method of protecting iron from rusting that is more durable than any yet known. The iron to be treated is exposed at red heat to the action of superheated steam. This gives a surface coating of black iron oxide that is a complete protection against rusting. The protection thus afforded depends on the temperature of the steam and the length of the treatment. The coating is very hard, adheres very firmly and shades off inappreciably into the changed mass of the iron.

If the iron is exposed in a chamber heated to 260 deg. C. for 5 hr. and acted on by superheated steam, a coating is formed that will withstand the action of emery paper for a considerable time. If the temperature is raised to 650 deg. C. and the time of treatment to 6 or 7 hours, the surface coating will resist the action of a file.



Front axle end of Angus Sanderson

Gears for Tractor Construction*

Materials and Dimensions—Importance of Using High Grade Steel on Account of the Resulting Compactness of the Transmission and the Greater Facility of Enclosing It

By E. J. Frost

THAT the tractor has come to stay and is going to be an important factor in the future development of the world, from an industrial and agricultural standpoint, few will dispute. That its manufacture and sale will add tremendously to the wealth and prosperity of those countries capable of producing and marketing it in any considerable quantities, also needs no debate. That the tractor of to-day has in any large measure reached its ultimate development and will satisfy the needs or ideals of the future is very much open to question.

The histories of the passenger car and the truck both point to development covering a period of years, and, judging from the new features brought out each year, the end is not yet. It is therefore unreasonable to suppose that in the short time of experimenting and trying out in actual field service a mechanism will have been developed that will measure up to the requirements of the future.

Fron an engineering standpoint the problem seems to have been approached mainly from two different angles, due to the previous training of what might be called separate schools of engineers. Naturally one of the first to enter this field of endeavor was the man having had training and experience in making agricultural implements, with very little or none in engine, clutch, transmission, differential and radiator design; and it is natural to expect that most of the thinking of this type of engineer would be strongly biased by the previous experience with horse-drawn agricultural implements.

The other type came, naturally, from the passenger car and truck manufacturing interests, and while he might have had all the experience and ability necessary in connection with the power end of the problem, he naturally was lacking in the lore of the implement man.

The Biased Implement Man

It is natural that the implement man should be biased toward the use of cast gears and unprotected internal gears and chain drives, and that to many such strength and ability to resist wear should be represented only by cast-iron, malleable, or possibly steel castings, in most instances large to the point of being cumbersome, and frequently incapable of being properly housed to retain lubrication and keep out dirt.

The subject of upkeep, cost of repairs and accessibility of the parts is going to be given increasing attention by future buyers, and it behooves designers to spend any amount of thought and time necessary to attain the desired ends.

A careful analysis of the physical properties of the cheaper materials sometimes used, as compared with even medium priced alloy steels, will disclose the fact that smaller gears and shafts can be used, giving equal resistance to wear and shock and permitting assembling in much smaller housings, greatly facilitating protection from dirt and making it much easier to apply proper lubrication. I assume, too, that frequently these substitutions can be made with little or no increased expense, due to the decreased size lessening the machine work, and the decreased weight of setting the increase in cost per pound.

In a paper of this character time will not permit of an extended discussion of the varied requirements to cover the entire gamut of tractor design, as in all probability each case would have to be analyzed by itself, taking into account the power, speed, drawbar pull, weight and any other items affecting the required strength; and possibly considerable experimenting and field trials would be necessary to determine proper sizes.

It is apparent even to the casual observer that both extrèmes have been reached, and it is evidently unfair to ask a successful manufacturer of gears to, on the one hand, put his trade mark on and guarantee the durability of another man's design, known to be wrong, because too light, and, on the other hand, compel him to equip his shop with machinery for cutting teeth of a size so large and overpowered as to make it only a question of a season or two before a decided alteration must take place.

Conferences of Engineering Staffs

It would seem, therefore, that the best interests of the tractor manufacturers would be conserved by conferences of their engineering staffs looking, as far as possible, toward standardizing design and materials of construction, in an effort to improve the general average and increase the confidence of prospective buyers.

It also might not be amiss to call for such help as the American Gear Manufacturers' Association can give, and I am sure that I voice the sentiment of those here when I say that we would give nothing short of the best we have.

A carefully made 3½ per cent nickel, low carbon steel suitable for case hardening may safely be used for tooth pressures way in excess of common open-hearth steel, and the same is true of chrome nickel and chrome vanadium; the latter, however, in the hands of those inexperienced in its heat treatment to secure machinability may find considerable difficulty in maintaining uniformly good results, and have to slow down so much in making and cutting the blanks that the work becomes unprofitable.

Higher carbon (40-50) chrome nickel may also be used in many instances, with good results, as such material can be heat treated to give the required physical properties so far as tooth strength is concerned, and when properly made by the mill will give good wearing service, although soft enough so that a new file will bite the teeth.

The only trouble I have found with a steel of this

*Paper read at the American Gear Manufacturers' Convention at Cleveland, April 14-16.

analysis was destruction of the contact surfaces of the teeth due to what is termed "pitting," and the only explanation we could find for our difficulties was that something had gone wrong in its manufacture at the mill.

The chemical analysis showed material up to specifications, and the microscope revealed nothing that we could assume pointed to trouble. However, the trouble existed and in our effort to eliminate the difficulty we experimented with steel of the same analysis, but with the carbon content increased from 0.37 to 0.45.

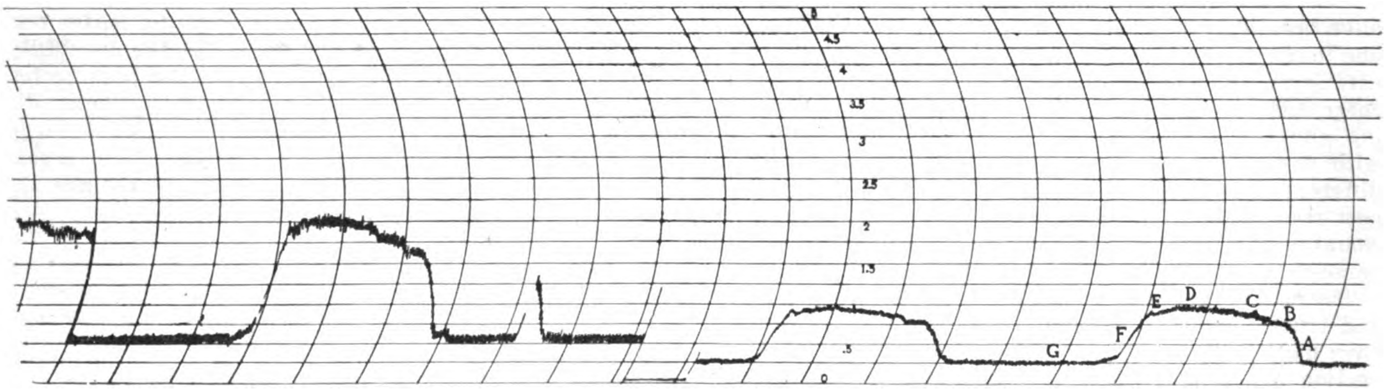
This did not remedy the pitting, and I went so far as to take out a set of gears from an automobile transmission after having been driven 20,000 miles and showing no appreciable wear, and substituting a set made from the chrome-nickel steel of 0.45 per cent carbon, and with the scleroscopic hardness, checked by the Brinell machine, considerably raised, and these failed, showing considerable pitting in 500 miles.

It is therefore evident that where steels are to be used that in service will approach the destructive limits, great care must be taken to see that not only do they check up as to chemical analysis and physical properties as originally determined, but that experiments should be made to satisfy us that the individual batch of steel under consideration will stand up under the proposed load, speed and other conditions.

My criticism of what I saw at the Kansas City tractor show is along two lines: first, there was such a multiplicity of levers, reach rods, valve tappets, links, chain drives and in too many instances gears unprotected from dust and grit, that if an owner spent most of his time wiping up, the tractor never would be clean. Second—and to my mind a serious matter—the bull gears and main drive pinions and frequently other gears, were left unprotected. I imagine this was due to excessive size, which can be corrected only by using better materials of construction which will permit of adequate protection without making the housings too cumbersome.

Electric Graphic Meter for Testing Machine Characteristics

Fox Machine Co. Makes Use of Meter for Testing Finished Machines—Power-Consumption Characteristics of Drill Presses Clearly Brought Out



Sample strip of tape from the Esterline Graphic Meter used in the plant of the Fox Machine Co. for determining power consumption of machine tools. This tape illustrates the characteristics of a multiple spindle machine drilling six ½-in. holes in a 1¼-in. cast-iron plate

An interesting use of the recording wattmeter is made by the Fox Machine Co., Jackson, Mich. The instrument is an Esterline graphic meter and is used for determining the characteristics of finished machines. This company manufactures multiple-spindle drills, milling machines, etc., and it finds graphic records of this kind valuable in determining whether or not the characteristics of the finished machines are as required.

The machine is put on the test stand and the recording meter is connected with it. Then the machine is started, and the power consumed while the machine is doing a typical piece of work is recorded. The record illustrated herewith is from a multiple-spindle drill with six ½-in. drills going through a 1¼-in. cast-iron plate.

In reading the charts, proceed from right to left. Space between the curved lines represents time, and vertical space above the base line represents electric energy in kilowatts.

There are two characteristic curves shown on this sheet, the first being on a scale of one to four and the second on a scale of one to two. That is to say, the records of the curve on the right must be multiplied by 4 to get the correct result in kilowatts, and with the curve on the left the scale readings must be multiplied by 2 to get the consumption.

Both these curves show similar operations. Passing along from right to left it will be seen that as soon as the drills strike the plate the current drawn rises in a practically straight line to a certain value, and then there is a great reduction in the rate of increase. That portion of the curve marked A is where the drill is entering the cast-iron plate.

At point B the drilling operation is well under way, with the full diameter of the drill cutting. It will be noticed that at C on all of these curves there is a slight deviation, which seems to be characteristic of the drilling

(*Continued on page 930*)

Post-War Finance and Our Export Trade

The Effect of the Removal of Governmental Support on Sterling and Franc Exchange—Our Opportunities and Obligations Growing Out of Our Large Foreign Loans

THE American business man is awakening to a realization that the prosperity of the country depends to-day upon increased production. With this realization, and resulting from it, comes also the understanding that we must expand our foreign markets instead of letting them contract. So said Mr. Francis H. Sisson, vice-president of the Guaranty Trust Co. of New York, in an address on our post-war financial problems before the recent Industrial Conference of the New York Business Publishers Association.

In view of this fact, the withdrawal of governmental support from sterling and franc exchange presents one of the most immediate and vital post-war financial problems. It concerns the importer and the manufacturer of domestically consumed products as well as the exporter and manufacturer of goods which are sent abroad, for it establishes an invisible tariff against American goods in England and France, which, sooner or later, but inevitably, said Mr. Sisson, will affect our domestic trade.

Our large foreign loans also present huge problems. Our prosperity, said Mr. Sisson, is now, more than ever, contingent upon the prosperity of other nations. We must understand that our large war-time loans to foreign countries can never be recalled. We have permanently invested abroad. We must also invest a large portion of the interest due on foreign loans in foreign securities. We must help our debtors to rehabilitate themselves; but in doing so we shall be helping ourselves.

There are grave responsibilities in investing in foreign securities, particularly for those who are not experienced at it. Our banks, said Mr. Sisson, realizing that they must assume a large part of this responsibility, are preparing for it by studying the problem carefully and enlarging their facilities for extending service along this line.

But more is needed, Mr. Sisson feels. The banks, and through them the investors, must be supported by the Government. The property rights of its citizens must be protected by the United States. American investors in foreign lands must be assured that, "regardless of the administration in power at Washington, their property rights abroad will be defended, if need be, scrupulously and sternly."

We quote from Mr. Sisson's address:

Despite the heavy financial burdens imposed by the war, America is confronted with an embarrassment of riches—at least so far as indebtedness to this country is concerned. And thoughtful business men throughout the country are beginning to realize that our position as the greatest creditor nation of the world has its serious disadvantages and responsibilities. We gradually are comprehending, also, that whether or not there shall be a formal organization of a League of Nations, we are bound to other peoples by innumerable and far stronger ties than those which any international covenant could impose.

There has, indeed, been no more convincing proof of this fact than that recently provided by the "unpegging" of, or withdrawing of governmental support from, sterling and franc exchange. The larger significance of what was seemingly only a financial operation is daily becoming more apparent. It marks in a dramatic fashion the shifting from a war to a peace basis, not alone in financing, but also in practically every economic phase of international relations. It is one of the most immediate, vital post-war financial problems, and concerns the importer and manufacturer of domestically consumed products as well as the exporter and manufacturer of goods which are sent abroad—for it creates an invisible tariff against American goods in England and France which, sooner or later, but inevitably, will affect our domestic trade. We are awakening to a realization that the prosperity of the country to-day depends upon increased production and, consequently, that it behooves us to expand our foreign markets, instead of letting them contract.

Our Recent Trade Balance

It is true that during January and February of this year the value of our exports has exceeded the value of our imports in record-breaking amounts. The statistics recently issued by the Department of Commerce show that our exports during January exceeded those of any other month in the history of the country, aggregating in value approximately $623,000,000, which was $57,000,000 more than in December, and $118,000,000 in excess of January, 1918. In February of this year our exports were valued at $588,600,000.

These are decidedly encouraging figures, but we must not be misled by a superficial consideration of their significance, and forget what such unprecedented purchasing abroad of our products entails. We cannot continue to ship such enormous quantities of goods overseas unless the buyers pay us for them. There are three ways in which they can settle their bills, namely, by means of goods or service, by gold, or by securities or other instruments of value.

If we are to increase our production, which, as I have pointed out, is necessary to the maintenance of our prosperity, we cannot take goods in full exchange for our products. Besides, we are nearer than any other people to economic independence, and do not need imports in anything like the quantities necessary to settle the trade balance in our favor.

We Do Not Want More Gold

Payment in gold is as impossible as it is undesirable. The value of the excess of our imports over our exports in January alone exceeded the total value of gold produced in all countries, except the United States, during 1918. In addition, we now hold more than one-third of the world's reserve of gold coin and bullion, having added about $1,500,000,000 to our store of the precious metal in the last four years. We could not with safety drain other nations of their remaining low stock of gold, if we would, for as we are already their creditors to the extent of about $12,000,000,000, it is imperative for us to help them maintain their currency on as sound a foundation as is practicable under existing circumstances.

The granting of credits to purchasers of our goods will very materially aid in solving the immediate problem of financing foreign trade, but, at best, it can be only a temporary expedient.

This expedient was necessarily resorted to on a colossal scale during the war, and England was able to weather so successfully the financial storm during the early stages of the conflict and to lend large sums of money to her less fortunate allies because she had extensive credits and investments scattered all over the world.

Before the war England had "invisible exports" amounting to approximately $1,800,000,000 a year, consisting chiefly of interest in foreign investments which totaled about $1,000,000,000. The toll from foreign freight carried in English ships netted her something like $800,000,000. So that while England apparently had an adverse trade balance in 1913 of $670,000,000, in reality she had a favorable balance to the extent of more than $1,100,000,000.

On the other hand, our favorable trade balance of $500,000,000 prior to the war was about equalized by our payment of interest and dividends abroad, freight rates, etc.

Then war came, and Europe, plunged into the most destructive of conflicts, needed in vast quantities the products of our fields, factories and mines. American securities held abroad were sold back to us in wholesale quantities, in order that munitions and supplies might be purchased with the proceeds; more than $2,000,000,000 were lent to foreign governments through private channels in this country, and subsequently, foreign governments floated large loans in our markets.

When we entered the war, the financing of our Allies was naturally taken over by the Government, which advanced credits to them to the extent of more than $9,000,000,000. There remains less than $1,000,000,000 of the fund appropriated by Congress for the purpose to be lent to our Allies.

And it is to meet the situation created by this circumstance that the Government is arranging to aid American export trade by advancing $1,000,000,000 through the War Finance Corporation. Without entering into consideration of the merits of this plan, it will readily be seen that it consists merely of the granting of credits for purchases here and, therefore, can only be in the nature of an expedient, even though the credits extend over a period of five years. Furthermore, if the value of our exports continues to exceed the value of our imports at the present ratio even $1,000,000,000 cannot be effective as a remedy.

While there has been no official statement issued by the British or French Government as to the reasons for withdrawing their support from sterling and franc exchange, respectively, one result is inevitable, namely, the curtailment of the purchase of American goods in France and England. This is probably one of the two principal reasons for the so-called "unpegging" of these exchanges. The other reason was doubtless the high cost of supporting pounds and francs at the figures at which they had been held prior to the withdrawing of Government support.

The Invisible Tariff

Both England and France realize the danger of piling up huge indebtedness for our products on top of the pyramid of such obligations already existing. They are well aware that by permitting exchange to take its natural course, the American dollar must inevitably be at a premium, which means, of course, that less can be purchased in France and England by the dollar than heretofore, and, consequently, buying of American goods will be discouraged. As I have remarked, an "invisible tariff" is thus created against our products. We cannot criticise England or France for taking this protective measure, particularly when we consider that the support of sterling exchange necessitated the purchase by British agents of between $3,000,000,000 and $4,000,000,000 worth of sterling in the American market during the period in which exchange was controlled by the British treasury.

As one English authority recently explained, England "had been bearing the burden of maintaining the relation of sterling to the dollar not only up to the day when the United States came into the war, but ever since. It has been very costly borrowing dollars daily or weekly at 5½ per cent in New York to pay for all the sterling bills offered in London at $4.76 per pound.

"A point often arises in the relation of debtor and creditor when it is the creditor, and not the debtor, who is on the anxious seat," this same authority observed, and he added, "I think that this is the case now in our relation with the United States. At any rate, I am satisfied that it is quite as much the interest of the United States to-day to maintain the relation of dollar to sterling as it is ours to maintain the relation of sterling to dollar, and it is about time to leave the exchange to adjust itself."

It might have been advisable, however, to have cushioned the shock by a gradual readjustment, but that would not have altered the fact that so long as our dollar is at a premium, this country will be a good one to sell in, but a poor one to buy from—which is the vital element not only in the present exchange situation, but also in the whole problem of financing foreign trade.

The Solution

The solution seems to lie, as I have indicated, in the purchase here of foreign securities. We may as well understand now that we can never hope to recall all of our foreign loans, and that, knowingly or otherwise, we have invested abroad on a permanent basis. There is no doubt about our having to invest abroad some of the heavy interest due on foreign loans.

But that should prove to be one of our greatest assets, as it proved to be one of England's when the unparalleled crisis of 1914 shook the foundation of civilization. It means also that we are in world affairs on a scale never dreamed of a few years ago—and we are there to stay. Comprehending that truth, we must take full advantage of it, not only for our own sake, but likewise for that of our debtors. Our prosperity now is more than ever contingent upon the prosperity of other nations. In helping them to rehabilitate themselves we are helping ourselves. And we are amply able to render the needed assistance in the form of foreign investments.

We possess the greatest national resources of any people on earth; our yearly income is greater than that of any other nation, we lead the world in production and commerce; we have the largest total of saving as well as the largest per capita savings—amounting in 1919 to $113.45 a person, and to a grand total of more than $10,800,000,000, which represents an increase of more than $2,225,000,000 since 1914. The amount of "free gold," that is to say of excess reserves, in the Federal Reserve System, which represents the surplus lending power of the system, is sufficient to support a reserve note circulation of more than $1,500,000,000, a significant index to our reserve financial power.

But investment in foreign securities involves grave responsibilities, particularly for the unitiated. Realizing that part of this responsibility will fall upon them, our leading banks, in anticipation of the service which they will soon be called upon to render, are now studying the foreign security problem with a view to affording their customers the largest possible share of protection.

Government Co-operation Imperative

The utmost care must be exercised in determining what foreign securities shall be offered to the American public. We shall have imperative need for expert knowledge of all factors behind these securities. Our banks can be trusted to do their part in this new field, but they cannot perform their functions fully and properly unless they and our investors have the support of our Government.

Aside from the material security which will guarantee the repayment of capital and interest, there is involved the question of property rights. These rights must be protected by the United States Government. It is high time that a policy which would afford such protection be formulated and put into practice—not perfunctorily, but actively and earnestly—so that our investors in foreign lands will be assured that, regardless of the administration in power at

(*Continued on page* 934)

Fordson Tractor Assembly Wholly on Progressive Plan

PART I

Parts Move from One End of Assembly Building to Other Along Moving Chain—Sub-Assemblies Fed from Side

By J. Edward Schipper

PRODUCTION of Fordson tractors is now running at the rate of 300 per day. A new plant, completely surrounding the present one, is being constructed, and as each new unit in the plant is finished it is occupied in accordance with a well-defined plan of expansion.

The entire works may be considered as made up of two departments, production and assembly. Each of these has been added to in turn. After the manufacturing facilities have been increased and the latest in tools and production systems installed, the manufacturing end will push the assembly, causing perhaps an extra shift on that department. At the present time, however, the pendulum has swung the other way, and what will practically be the ultimate assembly system of the plant has just been put in operation.

The new method of assembly incorporates the latest ideas in progressive methods and goes beyond that of the Ford passenger car plant. The system is not yet completely in use, as the new assembling building is hardly a month old; nevertheless the principles are here and their description forms a wonderful story of up-to-date assembly methods as applied to tractor manufacture.

The assembly department occupies a long, rectangular building, approximately 1000 by 190 ft. Down the length of the building pass the chain systems used in assembling the principal units, so that the tractor starts at one end of the building in the form of rough parts and leaves the other end in the form of a finished tractor. There are two principal main assemblies to the Fordson tractor. One of these is the engine, the other the transmission housing. When these two are bolted together on the housing flange at the rear of the engine there is only little left to put on the tractor, outside of the radiator, seats, accessories, etc. This being the case, the assembly system is naturally laid out so that engine assembly and the transmission housing assembly travel along parallel lines until both are complete, whereupon the lines of

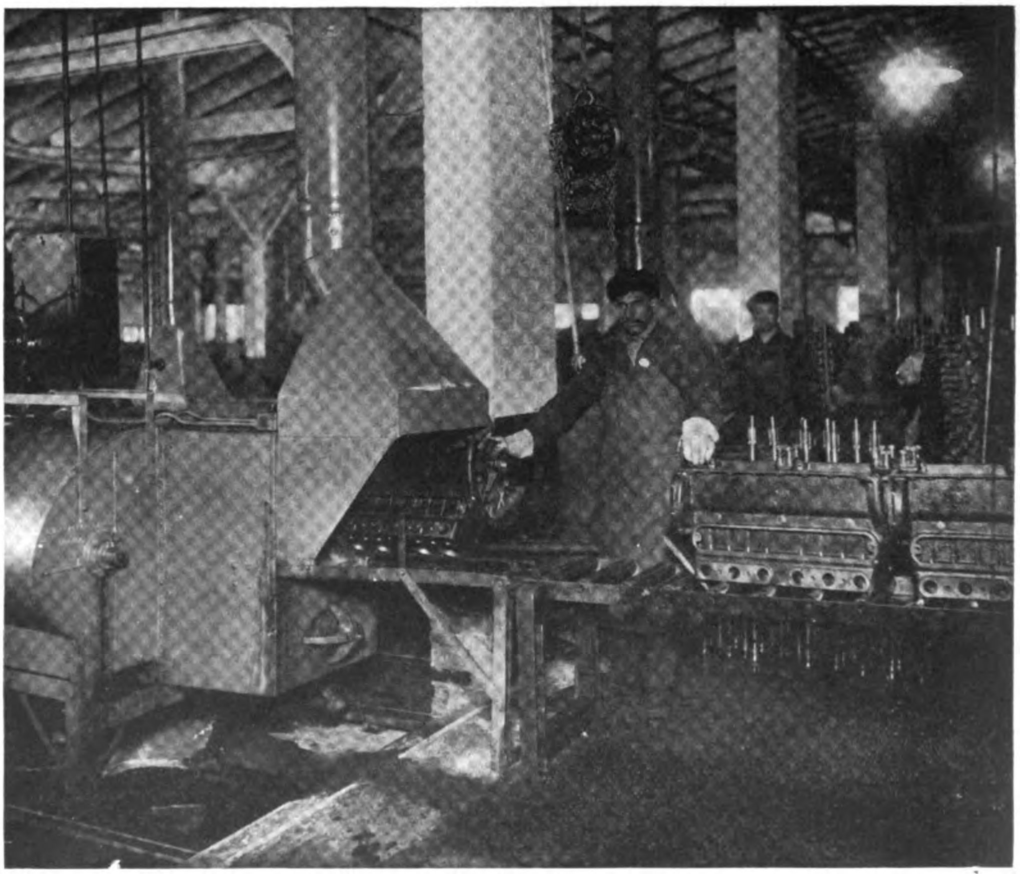


Fig. 1—Cylinder blocks leaving the gravity roller conveyor of the machine shop department and entering the assembly department through the washing machine

Fig. 2—Cylinder blocks leaving washing machine on overhead conveyors to beginning of assembly tracks

through its various steps, we can follow the engine block from the time it enters the assembly building until it reaches completion, and then follow the transmission housings until they reach completion, where we will see how these are joined together to form the finished tractor. The tractors are then run under their own power into the paint shop, painted and sent off on their way. The large general map herewith will show how the assembly department is laid out, and this should be studied to get a general impression of the large rectangular assembly space with its track systems carrying the parts along, step by step, until they are completed.

The cylinder blocks leave the final machine-shop inspection room on the gravity roller conveyor and come directly to the beginning of the assembly line on this same conveyor. They have been completed in every respect and have the main bearings and caps in place. The machine-shop roller conveyor terminates at the beginning of the assembly conveyor and is shown in Fig. 1, where the fin-

travel of the two units converge and they pass along the final portion of the assembly line together until they leave the end of the chain as completed tractors.

Assembly starts as soon as machining of the two large units is completed. There is therefore no necessity for storing such big parts as engine blocks, the large castings which contain the transmission and rear axle parts and the rear axle housings. The latter are large conical-shaped castings which cannot be stored conveniently.

The assembly department adjoins the machining department, so that the machine-shop conveyors which have passed the raw material along as it goes through each succeeding machining operation to the final inspection leave the final inspection department and directly enter the assembling department. The two long lines of assembly become apparent immediately at the entrance to the assembly building. One line takes the engine blocks; the other line takes the transmission housings.

Tracing the assembly

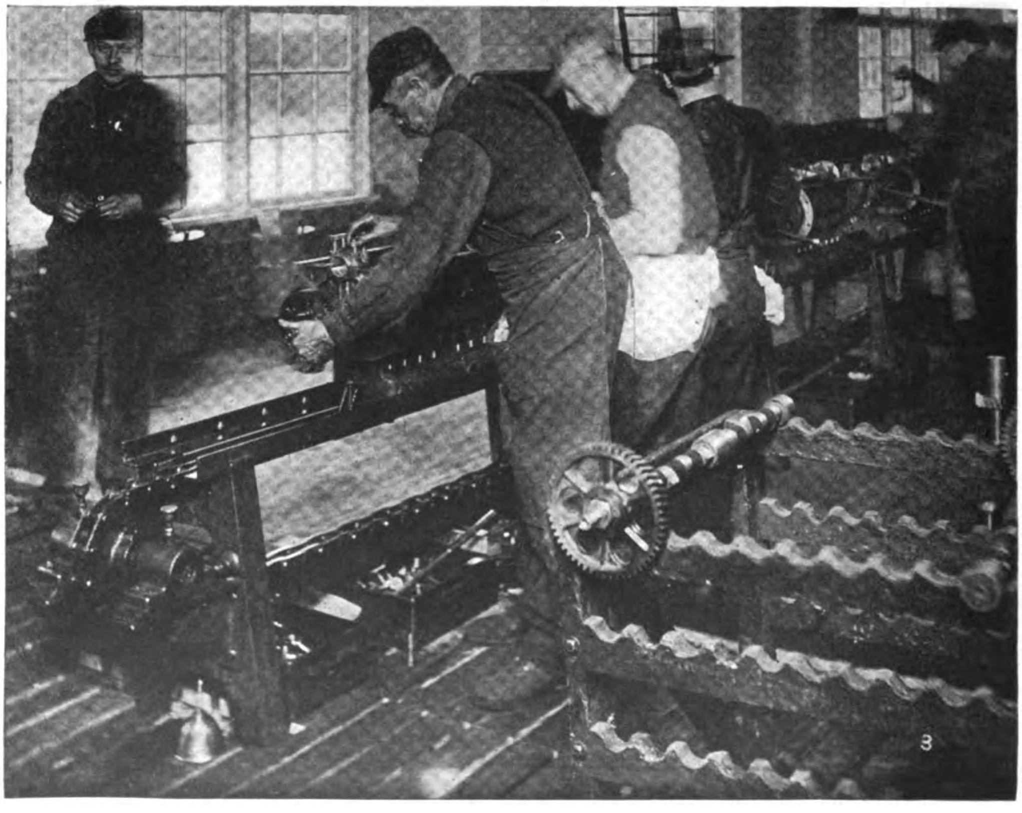


Fig. 3—The first step on the assembly chain is to fit the cam and crankshaft, meshing the timing gears properly. Note the rack for camshafts just behind the operator

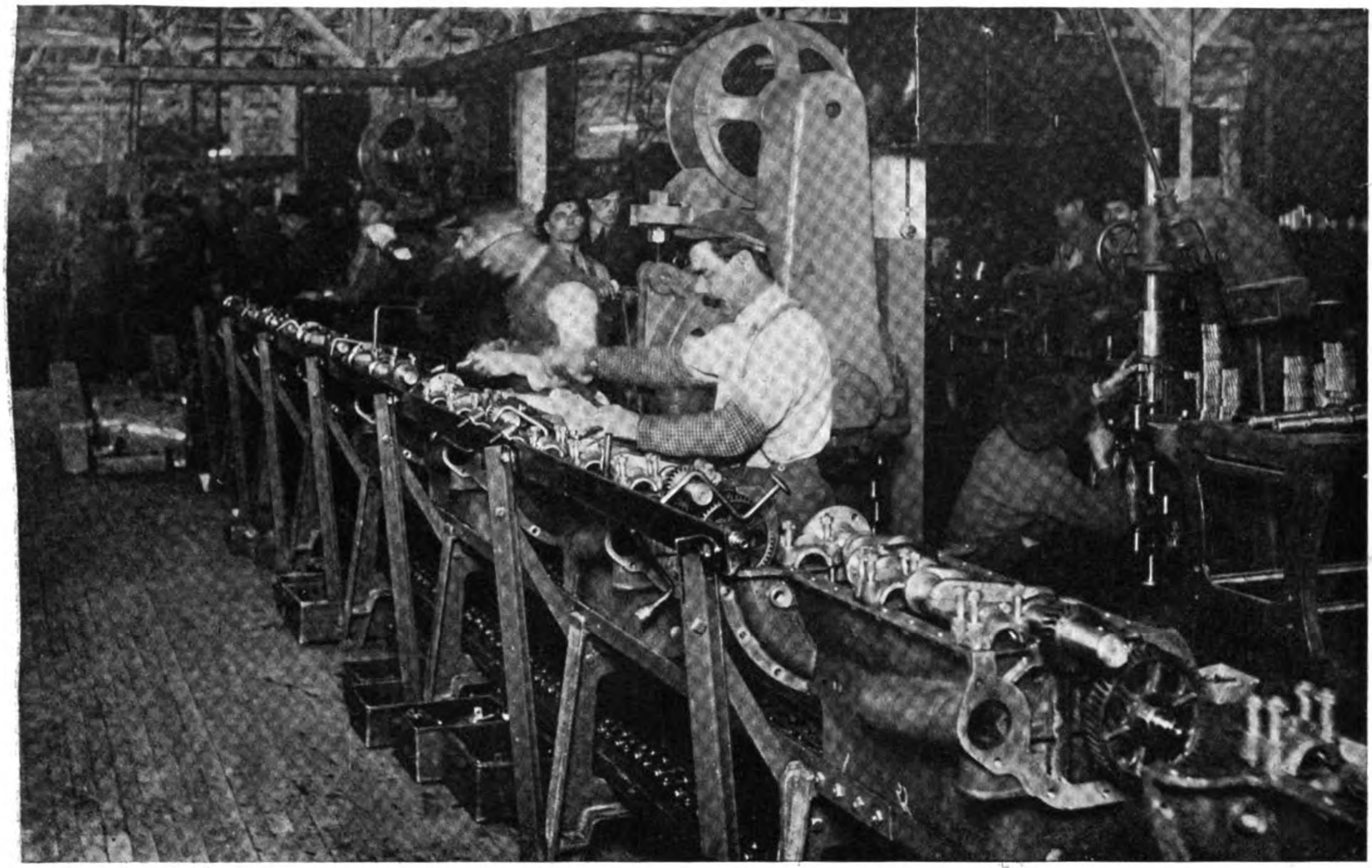


Fig. 4—First section of cylinder block assembly chain, where bearings are adjusted

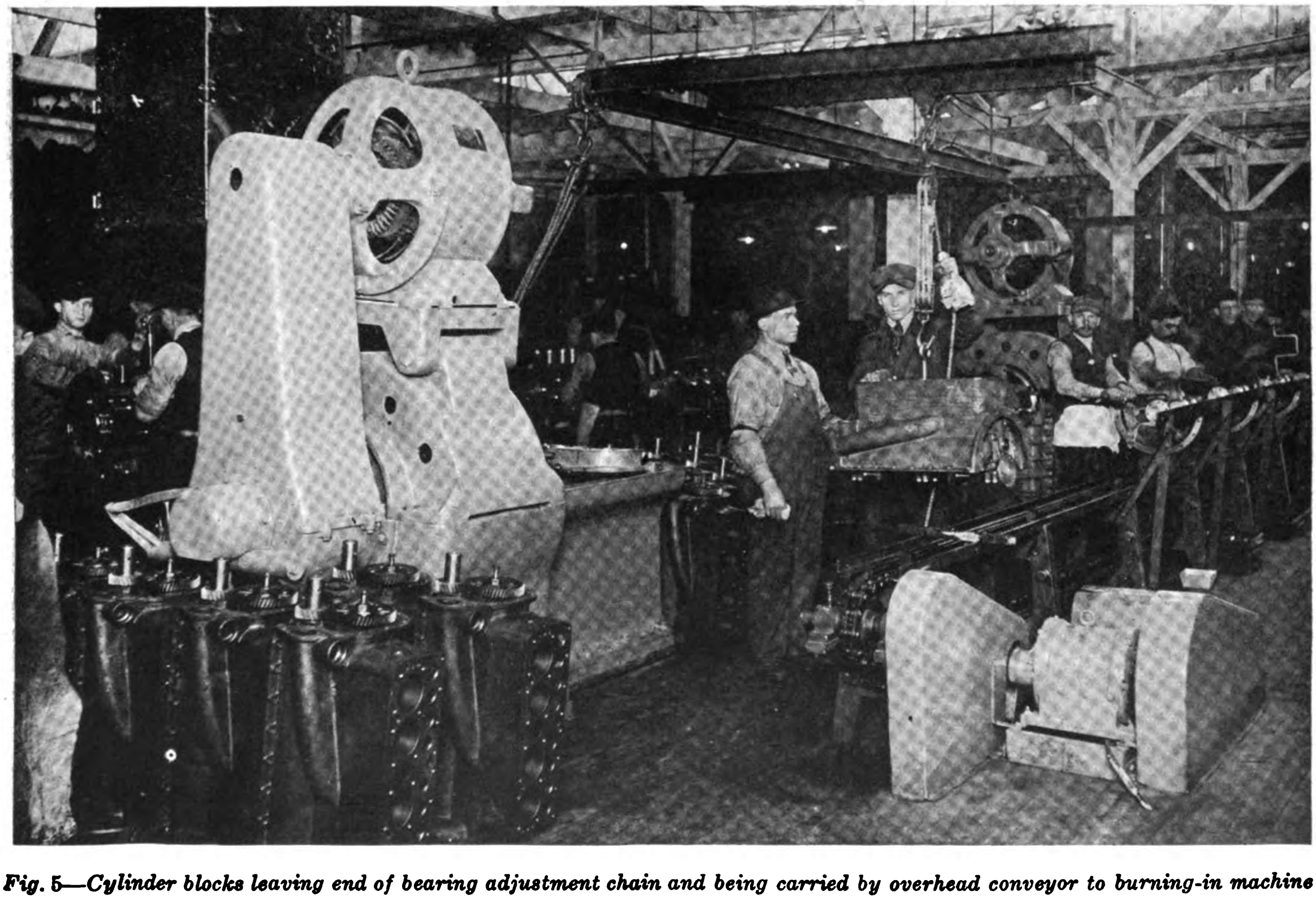


Fig. 5—Cylinder blocks leaving end of bearing adjustment chain and being carried by overhead conveyor to burning-in machine

ished blocks may be seen coming down the gravity conveyor and entering the assembly building at the start of the assembly conveying system. The assembly building is defined in Fig. 1 by the large brick pillars which divide it from the machine shop.

Immediately the blocks enter the first of the assembly lines they are passed through a large washing machine, electrically driven, in which they are washed in a strong boiling alkaline solution. The washing machine, which is partly shown in Fig. 2, is a product of G. S. Blackesley of Chicago, and is capable of handling forty of these blocks per hour. The boiling solution is thrown against the block by means of two large paddles, and the cylinder blocks leave the other side thoroughly cleansed of all grease and dirt. A few chips may remain, but the man who takes the cylinder blocks out at the other end of the washing machine conveyor has an air hose handy, with which they are blown away. This is illustrated in Fig. 2, where the cylinder block, having passed through the washing machine and been inspected by the workman with the air hose at the end of the machine, is ready to start along the assembly chain, which is shown at the left of the illustration just begining its journey down the line. The closeness with which these blocks follow one another may be realized when we see, in Fig. 2, one block just starting on its journey on the chain, another block being carried over from the washing machine conveyor to the end of the chain by means of the overhead hoist, while the third block has already come out of the washing machine and is ready to be conveyed along the line.

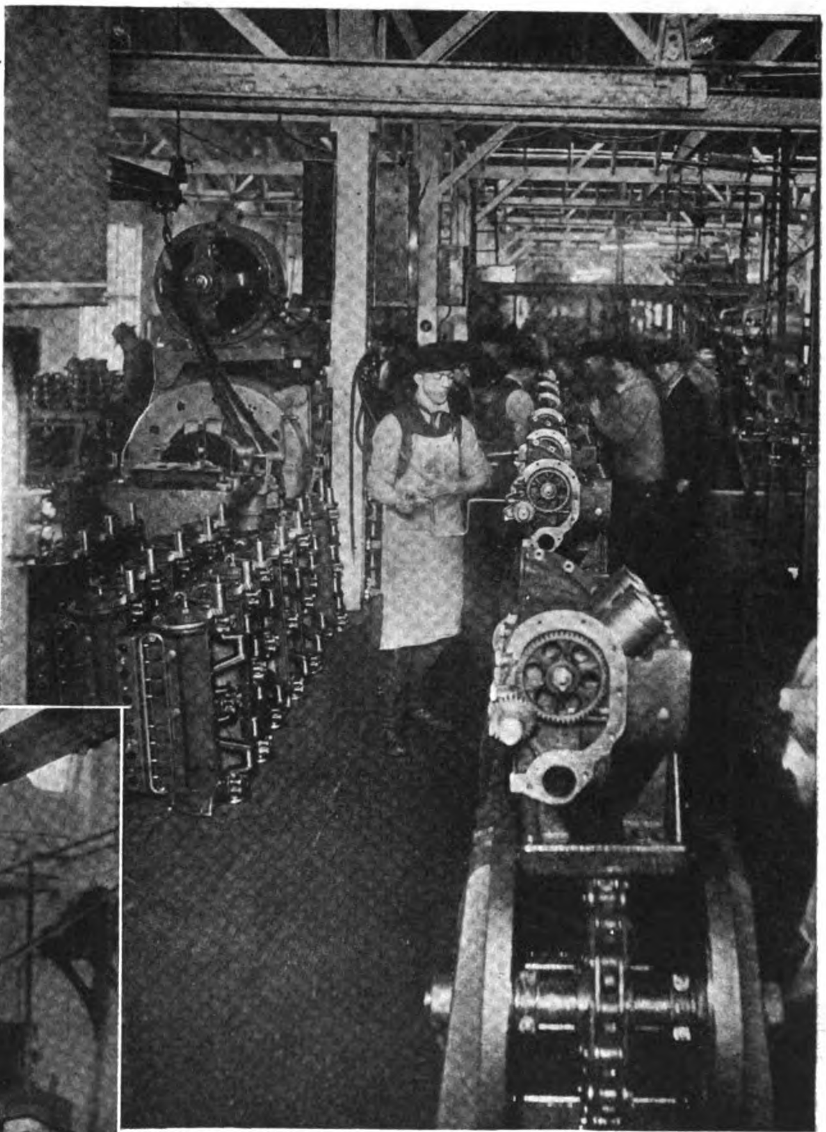


Fig. 7—The second length of the cylinder block assembly chain, showing pistons put loosely on top of block

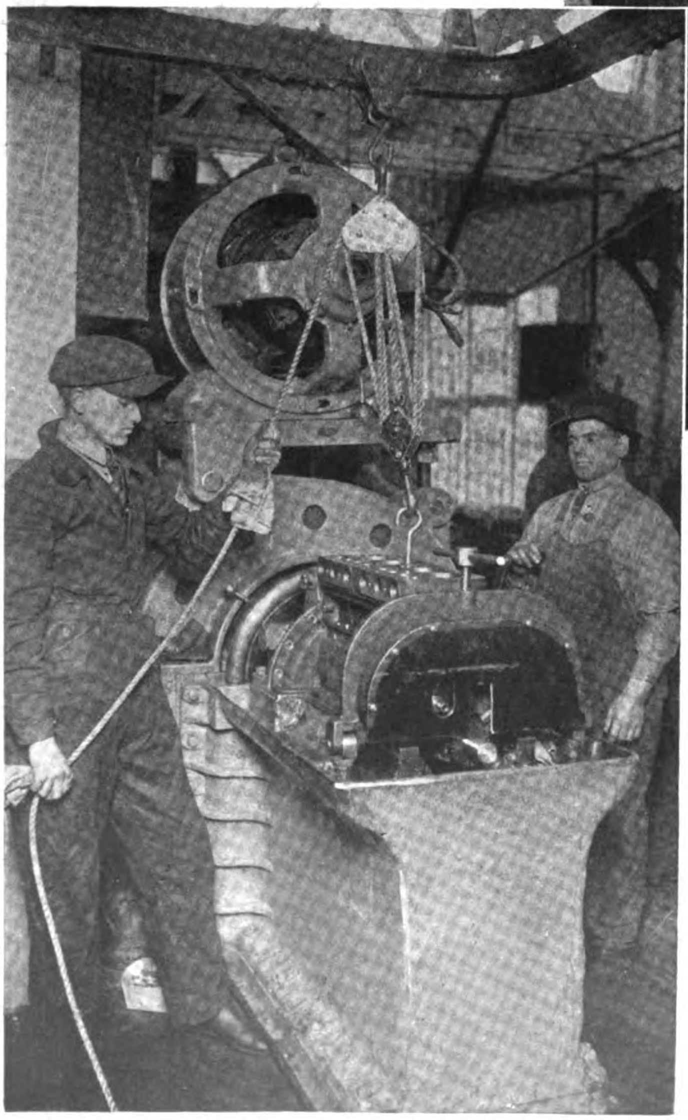


Fig. 6—Cylinder block on the bearing burning-in machine, where the crankshaft bearings are burnished before being finally adjusted

The assembly chain for the cylinder block is in two parts. There is, first, a short chain which carries the block through the preliminary stages of assembly, including the fitting of the crankshaft. Then there is a break in the chain where the crankshaft is "belted in," and, finally the long length of chain which carries the block on to completion.

When the cylinder block is placed on the chain the first operation is to slip the camshaft into place. In the foreground of Fig. 3 is shown a rack which carries the camshafts, placed in a handy position to the operator, who reaches behind, picks up a camshaft and slips it into

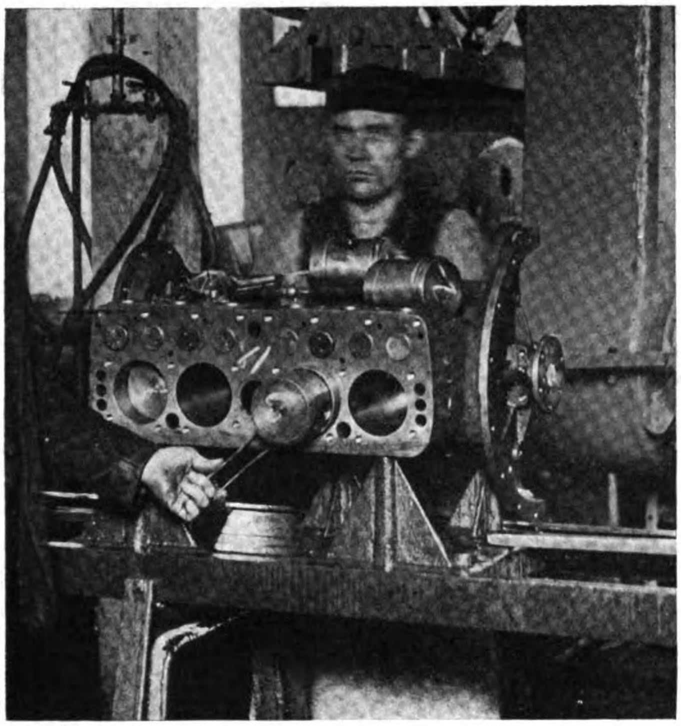


Fig. 8—Note operators on both sides of track, one man slipping piston in and the other putting connecting-rod bearing caps in place

place. He then reaches to another rack in close proximity (not visible in the picture) and picks up a crankshaft and puts it into position.

As will be noted, the timing gears are already in place on the camshaft and the crankshaft. These gears were put on with an arbor press, located close behind the assembly chain, as indicated in the map. The first operator places the camshaft in position and meshes the camshaft timing gear properly with the crankshaft timing gear before the chain carries the block away from him. Whereupon the next operator tightens the main bearing cap screws with five shims under each bearing. After the blocks have traveled about 45 ft. on this first length of assembly chain and have been worked upon by about eight men they come off ready for the bearing "burnishing" machines. Fig. 4 shows most of this length of track. It also shows the arbor press in the background, where the timing gears are pressed onto the crankshaft before they are assembled. This will give an idea of the close proximity of this work to the assembly chain, the head of which can be seen in Fig. 4, and is readily apparent in Figs. 2 and 3.

An interesting feature in the assembly is the method used in burning in the bearings. The engines come off the end of the chain, as shown in Fig. 5, and are immediately lifted up by an overhead L-shaped carrier, shown in the illustration, and carried over to a burnishing machine. One of these, which is not yet in operation, but which will be shortly, is shown in the left foreground. The other can be seen in the background and is more clearly illustrated in Fig. 6. The step illustrated in Fig. 6 is simply a burnishing operation for the crankshaft, there being no pistons or connecting rods in the block. The machine is driven by an electric motor through a large reduction, since the torque necessary to start the crankshaft is very high. It requires about 30 sec. to burnish the bearings, and then the block is ready to go on its way to the next section of assembly chain, where the pistons and connecting rods are assembled.

The blocks are taken off the burnishing machine and slid immediately over to the next section of the conveyor chain for assembly, of which a general view is shown in Fig. 7. Here it will be noticed that men are working on both sides of the chain. This allows two operations to go on at the same time, one on one side and the other on the other side of the engine, and practically doubles the capacity of the conveyor chain.

An instance of this is very noticeable where the pistons and connecting rods are fitted and the caps slipped on. The pistons and connecting rods are slipped in through the top of the block which is lying on the right side of the track, as shown in Fig. 7, while the caps are put on the bottom of the rods, almost simultaneously, from the left side of the track. As the block is put on the beginning of the conveyor chain, shown in Fig. 7, a set of four pistons is picked up by an operator standing at the beginning of the track and laid upon the block. The block shown in the foreground of Fig 7 has these four pistons lying in place. The valves are then slipped in, and as the work progresses the rods, which have been fitted to the pistons, are put in, and the other parts of the engine in the usual order of engine assembly.

At the present time the rods and pistons are assembled on a separate bench alongside the conveyor chain. An operator will pick the set of four pistons off the block, take them over to the bench, fit the rods to them, come

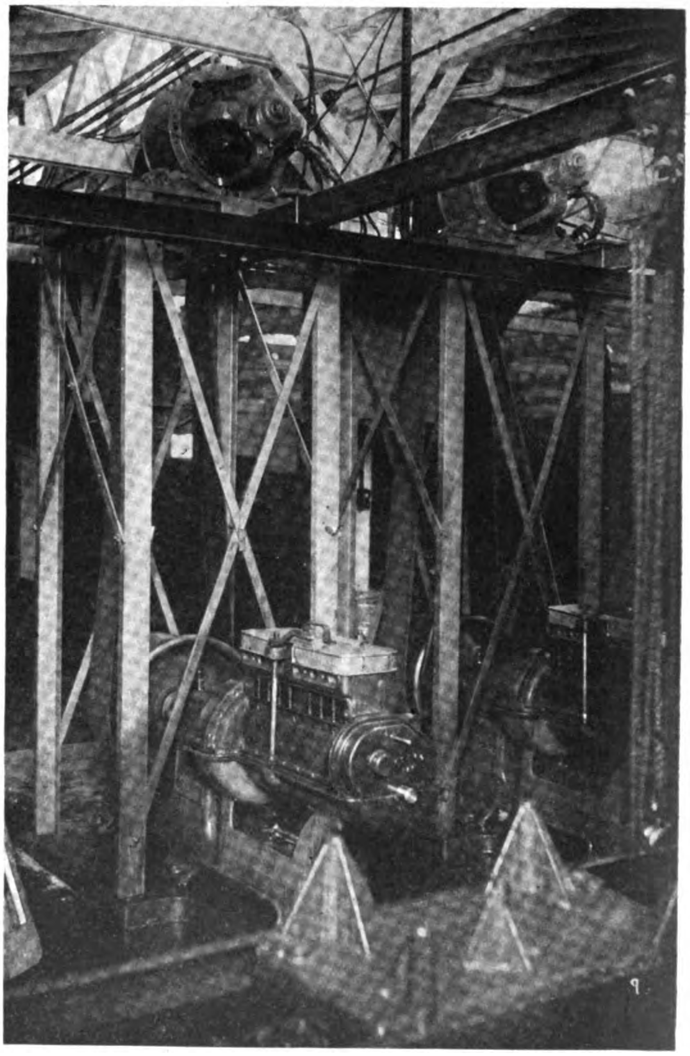


Fig. 9—Belting-in motor with sheet metal top and base formed like oil pan on belting-in machine. There are twelve of these machines to take care of the production

back to the block—which has traveled some distance during his absence—and fit them in place.

Fig. 8 shows the assembled pistons and rods lying on top of the engine blocks. One piston assembly has already been put in place at the left end of the block, while the second is just being fitted. The other two are lying on top of the block. An ingenious pincher-shaped device is used for clamping the rings, so that it is easy to slip the piston into place. This can also be seen in the illustration. As the pistons are slipped in, the operator on the other side of the chain puts the caps into place, inserting the necessary shims for a trial fit, and then taking out the shims necessary to get the engine to turn over properly.

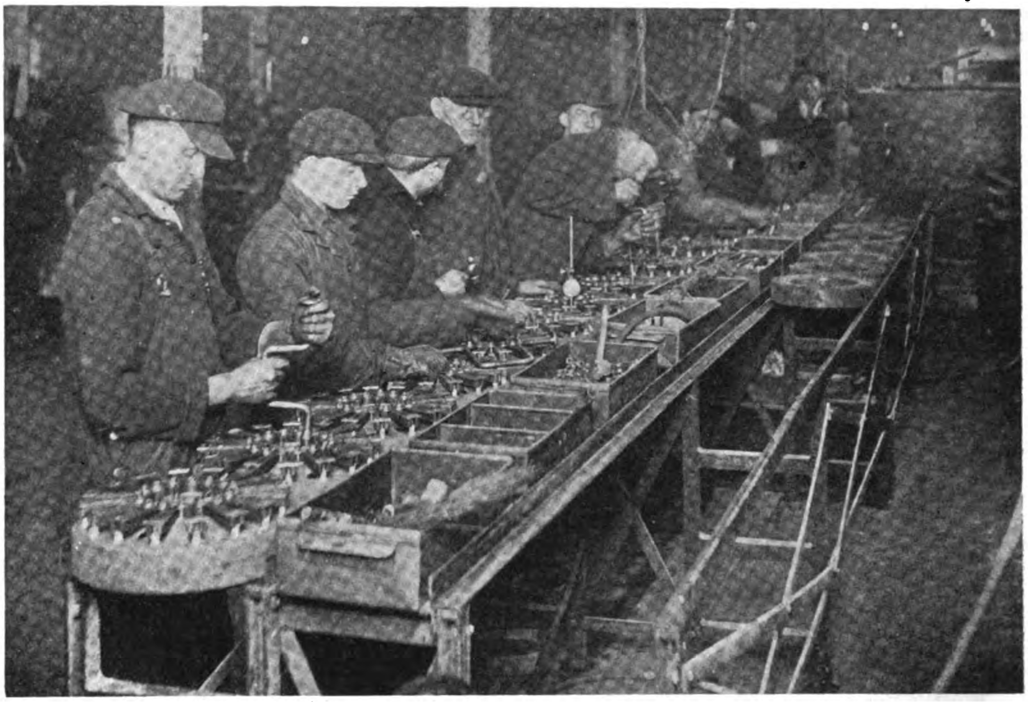


Fig. 10—Sub-assembly of magneto. Note unassembled flywheels on racks and operators working along bench progressively

As the track travels along the operator follows this work himself until he has the bearings properly adjusted; that is, this small portion of the work is not exactly progressive, as the same man fits the bearings from beginning to end, so that he is posted as to the fit and does not leave the next man to make an unnecessary set of experiments to see how tightly the bearings fit before he goes on with the next step in the work. Similarly, one man will follow the connecting rod bearings down through the next belting-in process, traveling along with the chain until he has adjusted the bearing to a satisfactory fit. Fig. 9 shows this belting-in process.

At the present time twelve machines are being used to "belt-in" the engines. These machines have a table, formed exactly like a crankcase, and the engine is mounted directly upon it without the head in place, but with the pistons, valves, shafts and timing gears all completely assembled. In order to stop the oil from splashing out of the tops of the headless block, a sheet-metal head is clamped over the cylinder block. The engine is then given a thorough "belting-in," the length of the run depending on the necessities of each individual case to secure a proper work-in of the bearings. The twelve "belting-in" machines, however, are more than ample to take care of the present production of 300 per day. In

(*Continued on page* 930)

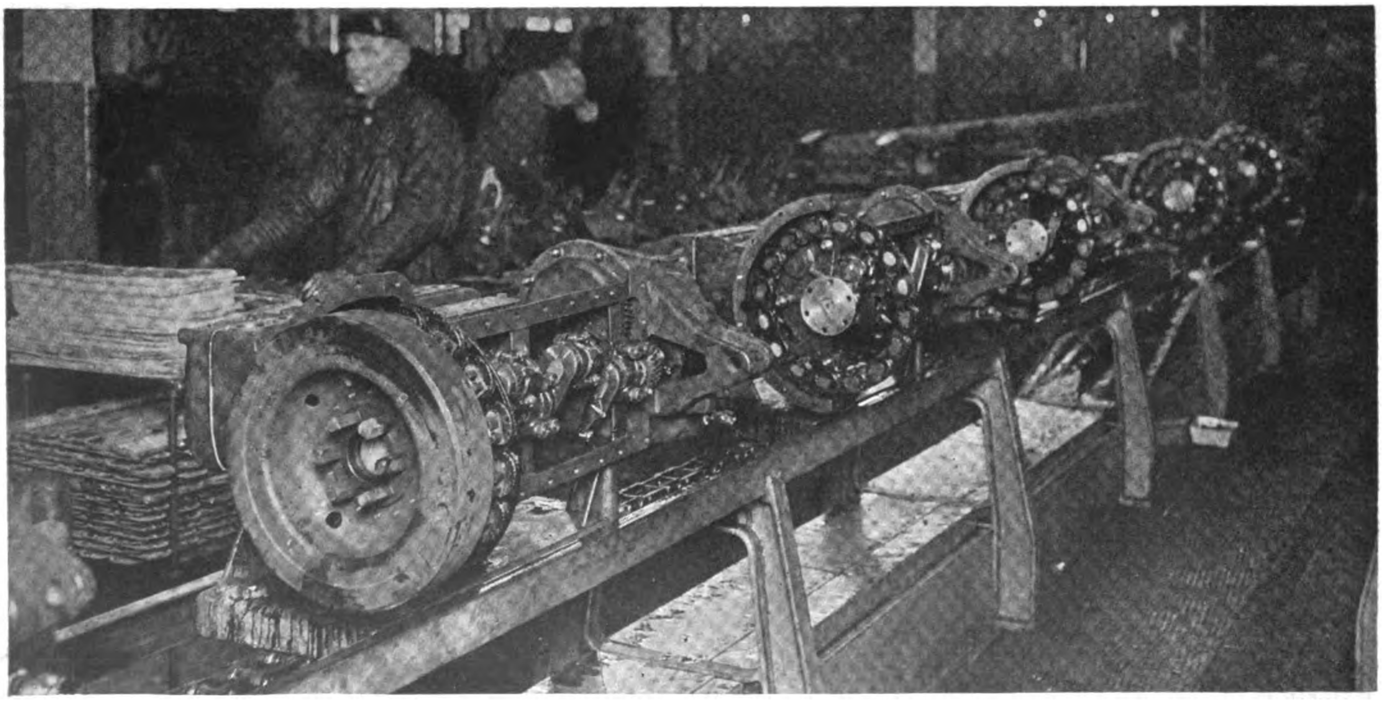


Fig. 11—Cylinder blocks coming along chain ready to have the field plates with the field coils bolted upon them; after which they are ready for the magnetos

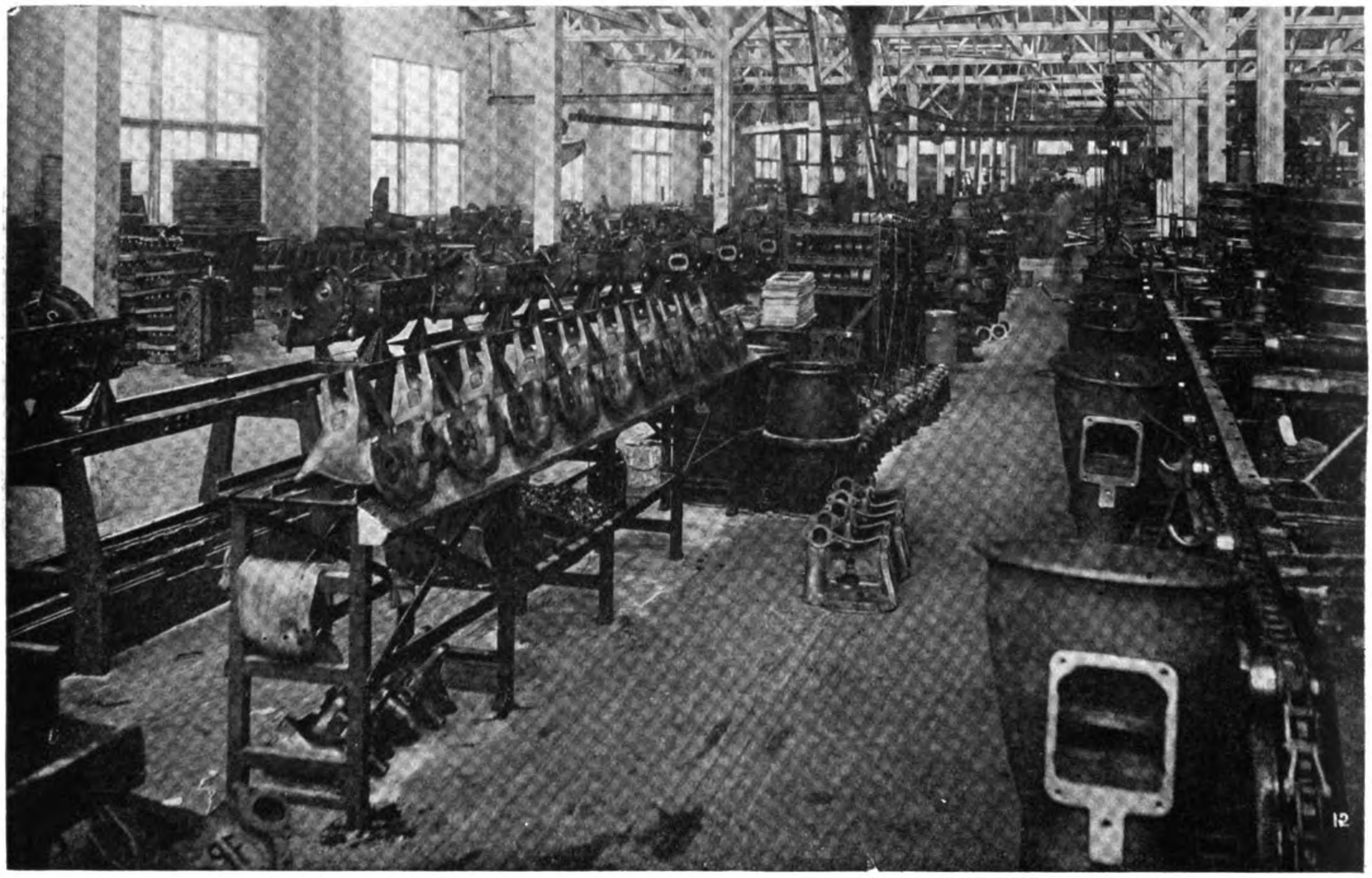


Fig. 12—View of cylinder block track with rack of timing gear housings in foreground

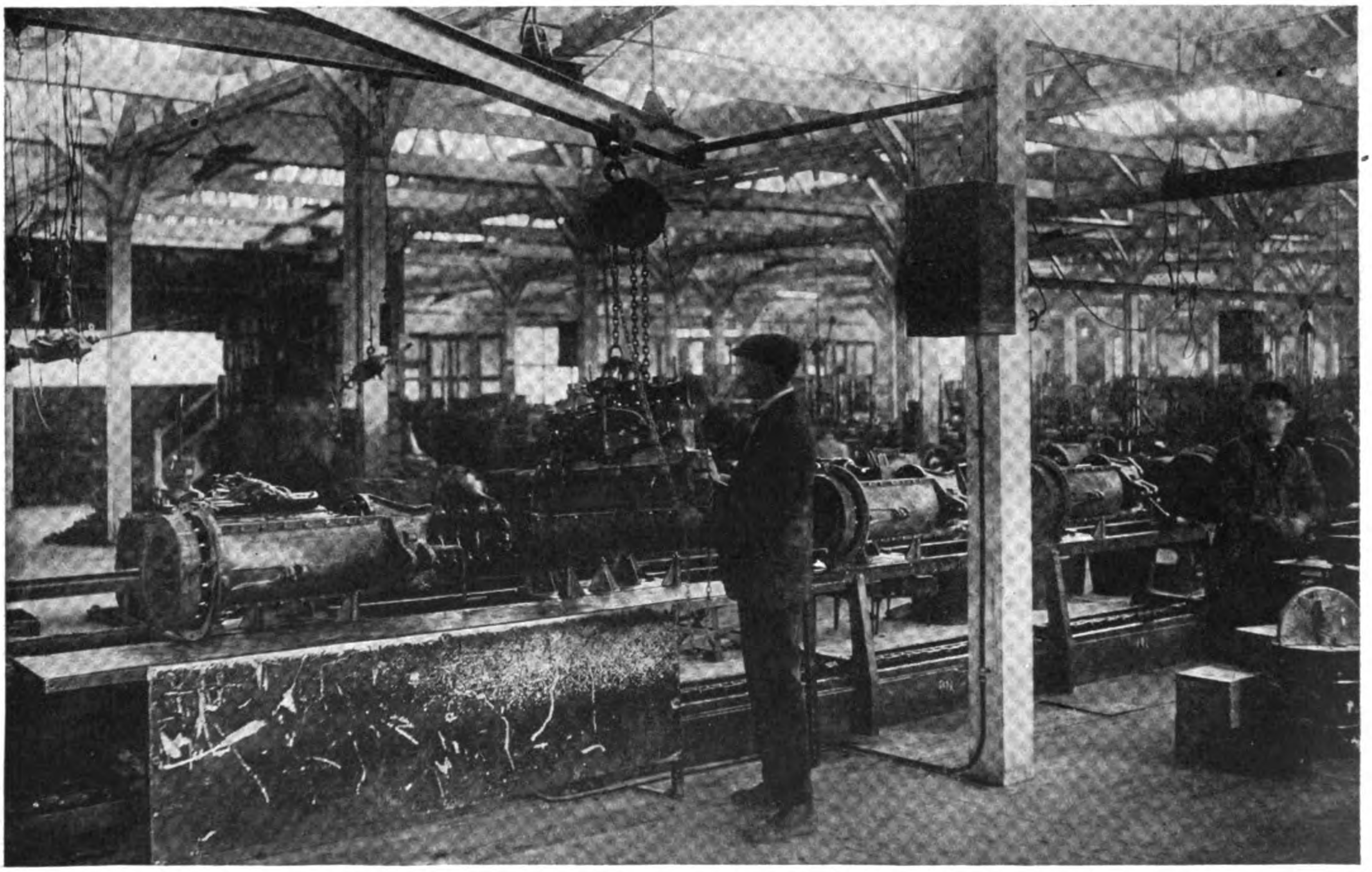


Fig. 13—Finished engine coming off end of engine assembly chain to be carried on overhead track to tractor assembly

This English truck loaned to the American army is one of many sent to Reconstruction Park for salvage

M. T. C. Salvage Park in France

PART II

An American War Factory in the Heart of France—3500 Employees—Built in 65 Days—Was 120 Miles Behind Front—Engine Department Overhauls 100 Engines Per Week—1000 Jobs Weekly Output—Manufactures New Parts

By W. F. Bradley*

THE statement that the motor salvage park gets out on an average 1000 jobs a week gives little information, for a job may vary from a slight body repair to making several thousand gears, this latter operation comprising the making of the dies, the forging of the blanks, and machining and heat treating. Ford commutators were not coming over in sufficient quantities at one time, so an order was put in for 5000 of these to be made. This constituted a job. A certain four-wheel-drive truck could not be kept supplied with steering arms; thus a job ticket went through for 8000 of these to be forged, machined and bushed. At the beginning of the present winter, hood covers were required, and 13,000 of these were produced in the park.

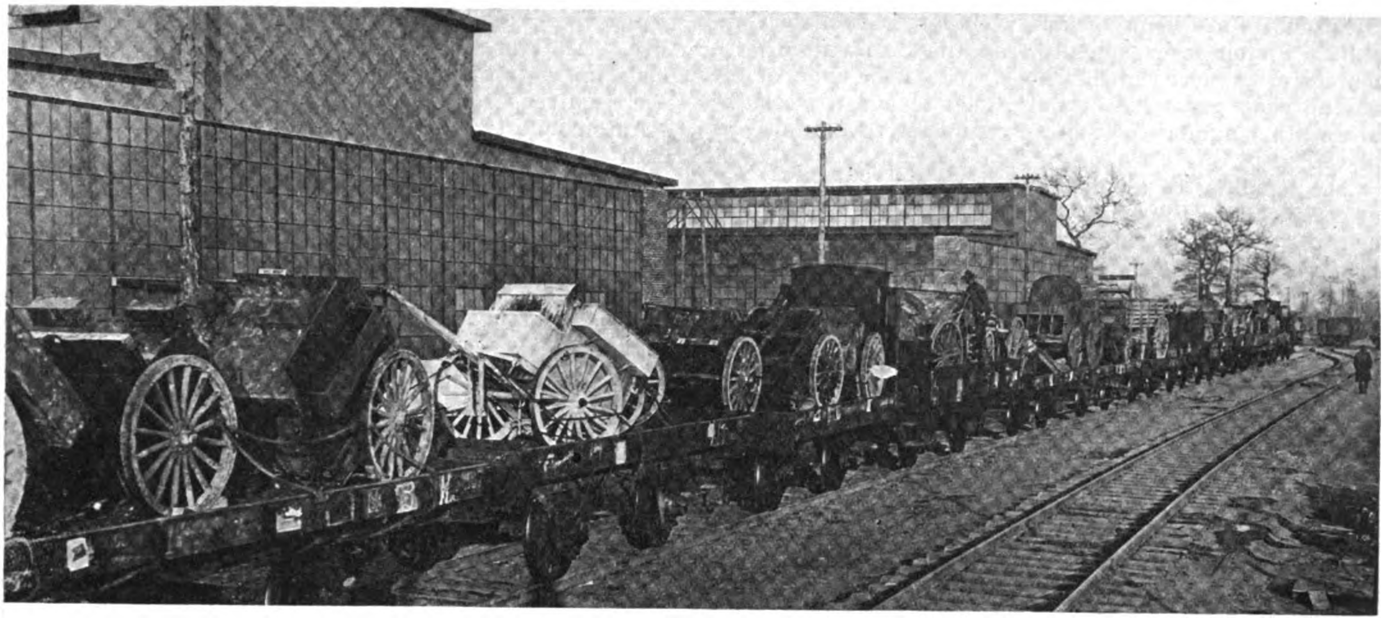
The following will serve to give some idea of the amount of work done in the salvage park. On the week previous to my visit, which was stated to be just a normal week, the staff had completed 78 trucks, which had gone in in all kinds of conditions and had gone out fit for service on the front. It had put 72 light cars into serviceable condition. It had rebuilt 43 motorcycles and 19 bicycles. It had turned out 146 animal-drawn vehicles and completed 363 miscellaneous jobs. These latter might have been anything from a special bushing to several thousands of some part produced on the automatics.

*EDITOR'S NOTE—*W. F. Bradley has studied motor transport during the war in France, Belgium and Italy and has been associated with this department of war since 1914. He assisted in the purchase of many automobiles and trucks for the A. E. F. in the summer of 1917 and personally superintended the overland delivery of many Fiat vehicles for our army. He made a minute investigation of the salvage park described in this article.*

These jobs are really a manufacturing proposition and do not come under the heading of salvage. Work in this field begins with the reception of the wrecked material brought in direct by rail, and by complete train lots from the front. There are probably 5 or 6 miles of track inside the park, so that wrecked material can be handled as rapidly as it is brought in. The task is rendered difficult, however, by reason of the necessity of receiving wreckage while the ground is in course of preparation; a field with railroad tracks through it and no loading platforms does not constitute ideal conditions.

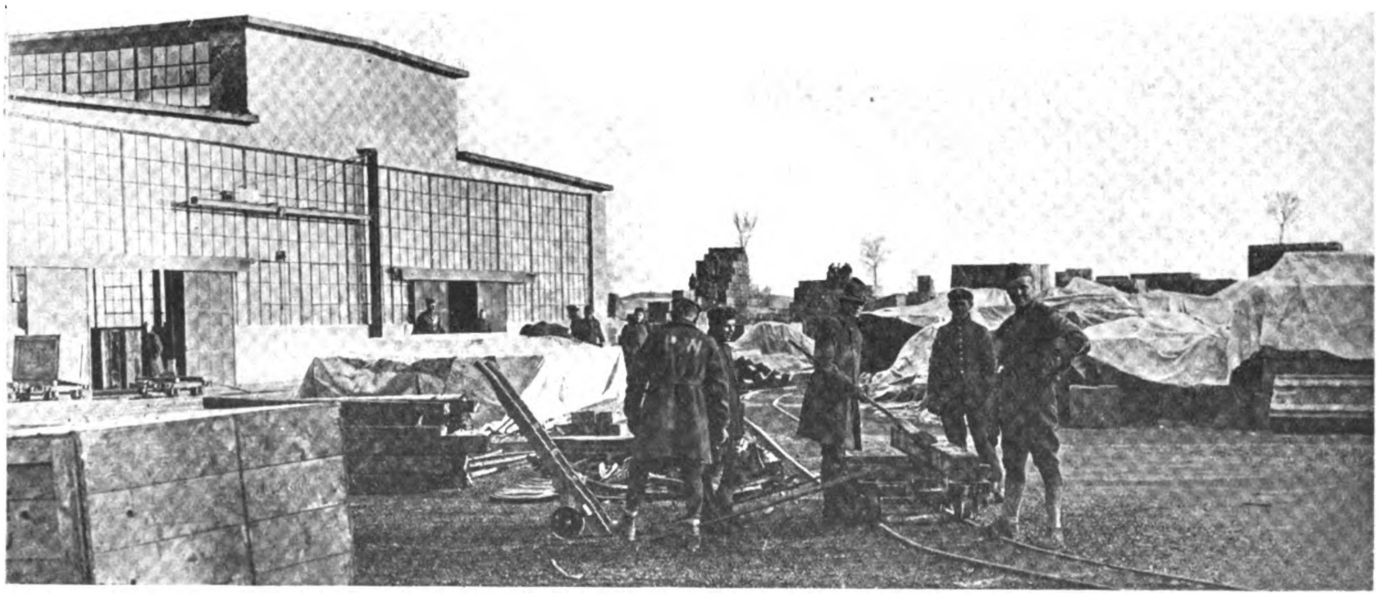
The Salvage Program

The material to be salvaged is either dumped on the ground or lifted out by steam crane and then sorted and passed on by experts. Motorcycles go into one sector; trucks, according to make, into another; touring cars are a separate lot, and Quartermaster horse-drawn vehicles have their own department. An automobile which has been abandoned at the front nearly always reaches the salvage park in skeleton condition. After it has been thrown on one side somebody discovers the need for a magneto. Another person removes the carbureter. A third takes out a few valves or valve caps. All the grease cups are stolen by the natives if they are not removed by the mechanics. Fan belts are never allowed to remain. In nine cases out of ten, when the park receives the automobile it can no longer be treated as a repair job, but has to be handled on salvage lines. Its engine is taken out and sent to the engine shop. There is no work in a factory at home that the salvage park cannot perform.



A trainload of Quartermaster horse-drawn vehicles at Motor Reconstruction Park

Stacks of gasoline drums at Motor Reconstruction Park. These drums were sent in for repair



German prisoners helping unload boxes at Motor Reconstruction Park

Crankshafts are being welded with very satisfactory results. Pistons are expanded, machined and fitted with new rings produced in the shops. When the chief of the engine shop gives his output as 90 to 108 a week, he means this number of motors completely overhauled as above.

The handling of a salvage park of this nature is full of complexity. In comparison, the salvaging of soldiers' clothing, shoes and rifles, of which much has been heard, is mere child's play. The greatest care is necessary in order to produce useful units out of the wreckage which is turned in. Unless there is skilled treatment, a park of this nature will merely accumulate big stocks of certain components and produce very few complete vehicles. The object aimed at is to get out of the wreckage the greatest number of complete vehicles and to have the smallest amount of dead stock. This is far from being a simple task, and although it is being handled in a very intelligent manner, stocks will accumulate.

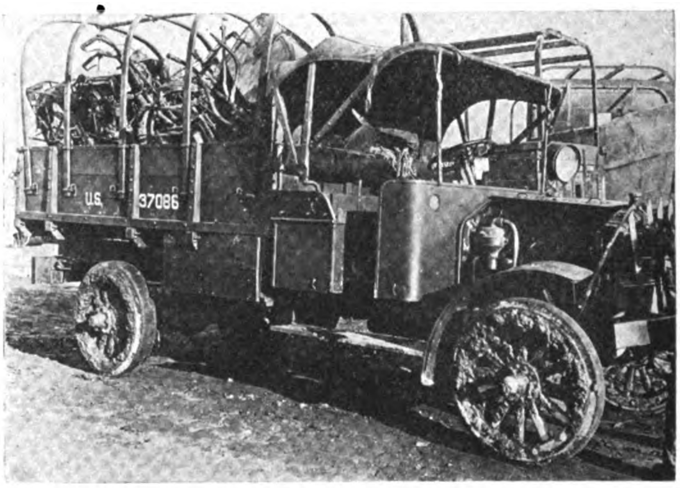
Very much depends on the decision of the officers who pass on the wreckage as it comes into the park. Should the automobile be in fairly good condition, it receives a job number to be rebuilt, in which case it goes out again with its own engine, its own gearset and its own rear axle. Such cases, however, are comparatively few. The next case may be a truck which has caught fire and has had one or more of its wheels destroyed and its frame member warped by heat. In such a case the engine, gearbox and rear axle are ticketed as separate jobs and sent to their respective shops for complete overhaul, after which they go into stock.

Certain parts on an automobile wear out or break and cannot be repaired. Springs come under this category. Therefore a complete spring manufacturing department has to be kept in operation, making for stock the types of springs most needed. Bronze bushings are in practically the same case, and also are in regular manufacture. All kinds of brass and aluminum castings are made in the park, but iron castings are obtained, whenever required, from a French foundry.

Automobile tires are treated in exactly the same way as in the big repair factories at home. After being mended in these shops the tires go into the stores for reissue in exactly the same way as new stock.

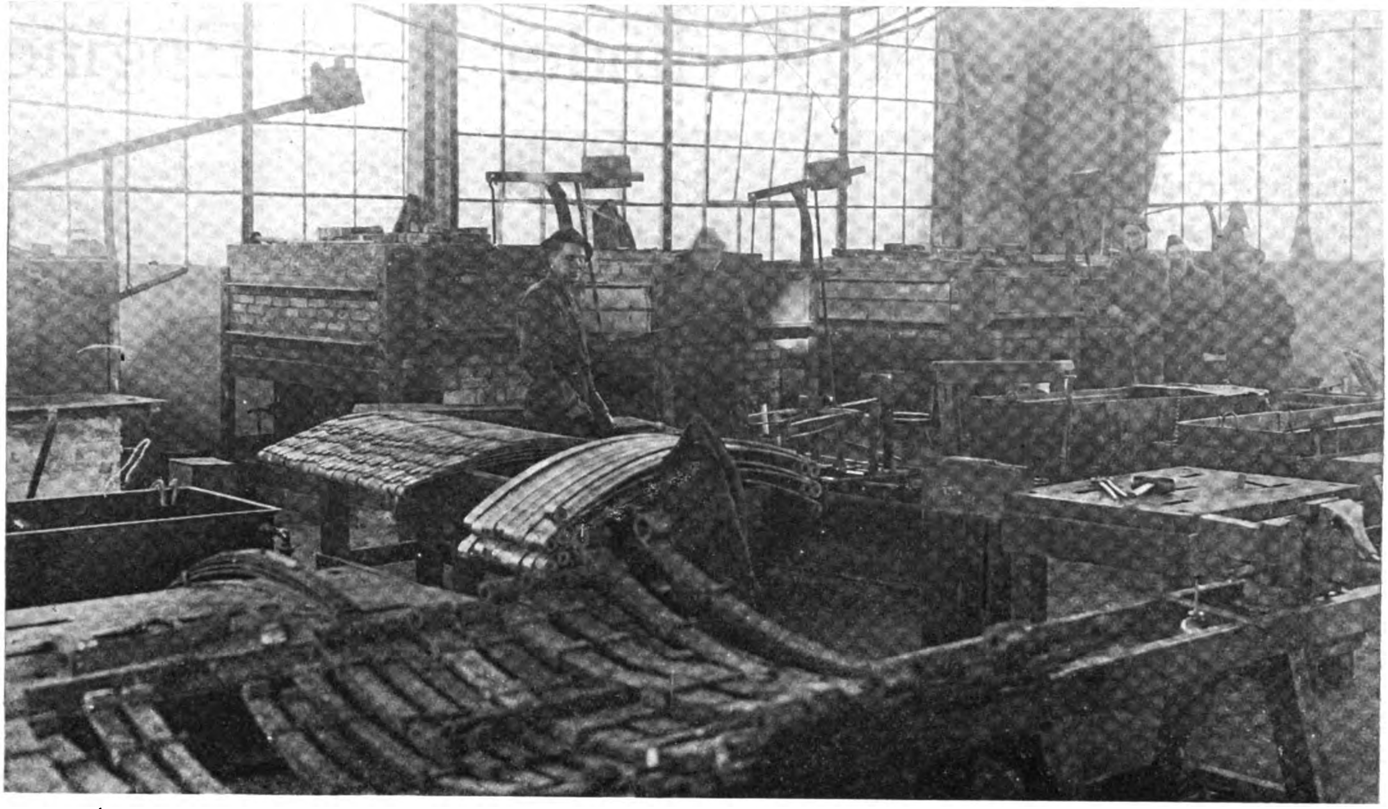
War Storage Depot

In addition to salvaging, the park is designed to act as one of the main automobile supply depots for the forces in the field. The stockroom, 300 by 400 ft., has its 120,000 sq. ft. of floor area divided into alleys, with one class of article in each, and the bins or lockers marked

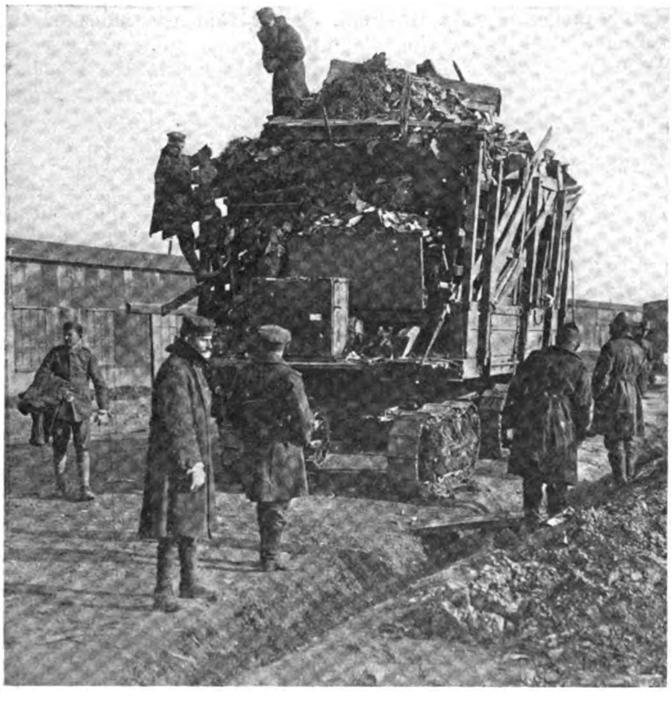


A typical truckload of wrecked motorcycle parts

Part of the main stockroom at Motor Reconstruction Park



Spring-making department at Motor Reconstruction Park



A huge creeper type tractor and its German crew at Motor Reconstruction Park

according to make. The general arrangement is the same as that in the big automobile factories at home, but instead of parts for only one make, there are complete parts for 41 different makes always in stock ready to meet requisitions.

Running along the outside of one end of the main stockroom are car lines from which new goods are received. At the opposite end of the building are dispatching counters with huge boards suspended above them showing Colombey, Dijon, Paris, etc., and immediately outside another set of car lines for dispatching. Everything is up to date, including small electric freight cars for running about the stockroom.

When the salvage park was established there was neither light nor power in the neighborhood. The original intention was to erect a Diesel engine, and preliminary arrangements were made for this, but the supply of crude oil having failed, or its procurement having become difficult, a 1500-hp. steam turbine engine had to be decided on. While the foundations for this were being laid, fourteen G. E. gasoline-electric groups, developing 700 hp., were procured and installed in a temporary building. These engines provided all the light and power for the entire park.

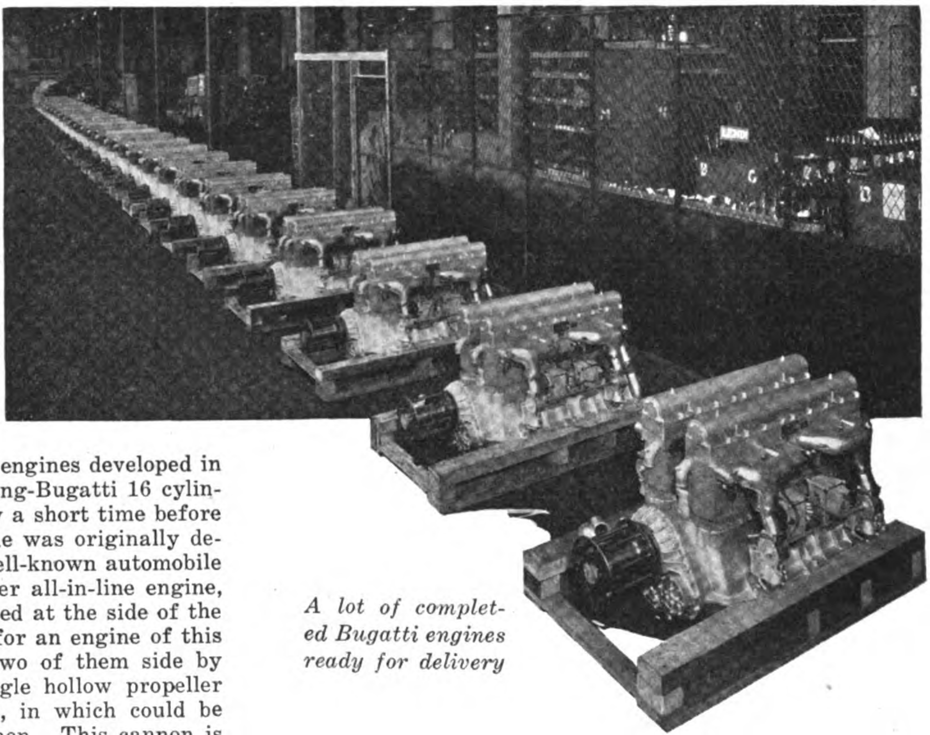
Naturally the park has need of a considerable amount of local transportation. This is covered by 119 trucks, 15 touring cars, 25 motorcycles, 5 Holt tractors, and 7 Holt caterpillar trailers.

ACCORDING to French patent, No. 484,177, of E. Balzarini, a new method is disclosed for improving the action of sparking coils. In the method of construction usually adopted the secondary current often persists after the primary winding has been re-established by the interrupter, and the inverse current at the make suddenly damps out the secondary current that is still flowing, and then reverses its direction. This has several drawbacks, and in particular diminishes the efficiency of the apparatus.

The modification now proposed consists in providing two similar primary windings, put alternately into circuit by the interrupter, the connections being such that the successive primary currents magnetize the core of the sparking coil in opposite directions. Thus the electromotive force in the secondary circuit at the make agrees in direction with the existing flow of current. The result is that the current in the secondary circuit is rectified by a high-tension commutator. It would seem, though, that any advantages gained would be discounted by the reduction in efficiency due to the use of double primary coils.

King-Bugatti 16-Cylinder Aero Engine

Consists Virtually of Two 8-Cylinder All-in-Line Engines Mounted on a Common Crankcase and Geared to a Common Propeller Shaft—Designed to Permit 37-Mm. Cannon to Shoot Through Hollow Propeller Shaft



A lot of completed Bugatti engines ready for delivery

ONE of the most interesting aviation engines developed in connection with the war was the King-Bugatti 16 cylinder, which went into production only a short time before the signing of the armistice. This engine was originally developed in France by Ettore Bugatti, a well-known automobile designer. Bugatti first built an 8-cylinder all-in-line engine, with a geared-down propeller shaft, located at the side of the engine. There was found to be no need for an engine of this type, and so Bugatti décided to place two of them side by side, on a single crankcase, using a single hollow propeller shaft between the two sets of cylinders, in which could be mounted a standard French 37-mm. cannon. This cannon is loaded with buckshot, and its use had been proven very efficient by Guynemer, hence it had been decided to build planes on which this cannon could be mounted.

Bugatti then built a 16-cylinder experimental engine, which was tested in France on the block, and later was brought to this country together with the 8-cylinder model, the two being taken to Dayton, Ohio. The 16-cylinder engine broke down at once on the dynamometer test and developed serious defects, such as a crack between the valve seats in the cylinder castings and improper operation of the lubricating system. The engine was at once rebuilt by the French engineers who were sent along by Bugatti. In the meantime, it was realized that the engine was not a production job, and the defects mentioned, as well as structural weaknesses in the propeller shaft mounting, made it necessary to completely redesign it. This task was entrusted to Charles B. King.

The new design incorporated pressure lubrication, a ball-bearing mounting of the propeller shaft, a dry crankcase system, cylinder castings so made that the valve seats were properly cooled, water spaces in the casting cored out instead of being drilled out as in the French design, etc.

An engine to this design was built at the works of the Duesenberg Motors Corporation in Elizabeth, N. J. At the time the rebuilding of the French engine was completed, the first King-Bugatti engine was also ready for the test block. A one-hour full power test was made on the French engine, and horsepower curves were plotted, after which the engine was removed from the test block and put in storage as Government property. The King-Bugatti was then put on the test stand and given a very thorough test. Production of King-Bugatti engines was begun at the Duesenberg plant, and at the time the armistice was signed 40 engines had been officially tested and accepted by the Government.

With a cylinder bore of 110 mm. and stroke of 160 mm. (4.33 x 6.3 in.), the engine has a piston displacement of 1484.3 cu. in. The first engine accepted by the Government was put through a 50-hr. block test with a club. It ran through ten periods of 5 hr. each, consisting of ½ hour's running at 410 hp. at 2000 r.p.m., and 4½ hours' running at 369 hp. at 1886 r.p.m. The compression ratio used is 5:1.

The cylinders are of iron, cast in blocks of four. They are bolted to the crankcase without the use of a gasket. The water jacket is cast integral, except that the sides of the cylinder block below the inlet and exhaust ports are covered with a cast aluminum plate fastened by screws and packed with a gasket. The cylinders are cast with separate exhaust ports. One inlet port supplies two cylinders. Two outlet and one exhaust valves are used.

The entire combustion space is machined, with the exception of a very small recess near the inlet valve seat. The tops of the cylinder blocks are machined, making an oil-tight joint with the camshaft housing without the use of a gasket.

Provision is made for a liberal circulation of water in the neighborhood of the valve ports, seats and guides. There are two spark plugs per cylinder, which are located at the side of the combustion chamber in close proximity to the inlet valves, and are well cooled by the circulating water.

Crankcase

The crankcase and oil pan are of cast aluminum. The case is well ribbed. All bearings are supported from the upper part of the case, the bearing bushings being held in place by caps which extend almost the full width of the case. Each cap supports two bearings. They are all of cast aluminum, with the exception of the center bearing cap, which takes all the thrust of the crankshaft. This is a steel forging.

The oil pan has a central web running its entire length. This greatly assists in preventing the current of air caused by the revolving crankshafts from drawing up the oil which is constantly draining into the pan. There is also a cross web between each cylinder block which runs well up the sides of the oil pan. These cross webs have an opening at the bottom at their center, allowing the oil to drain to the ends of the pan on either side of the web running lengthwise. A breather is attached to the top of the crankcase near the front end between the cylinder blocks.

Provision is made at the rear end of the case for attaching a 37-mm. cannon, the barrel of the cannon projecting through the hollow propeller shaft.

The piston is of aluminum and has two ring grooves above the piston pin. Two ⅛-in. wide rings are placed in each of these grooves. The rings require a pressure of 10 to 12 lb.

applied on a diameter at right angles to the slot to bring the ends of the 30-deg. slot to within 0.010 in. of the closed position. The lower ring is beveled, being placed in the groove with the sharp edge down so that it acts as a wipe ring, forcing the oil on the down stroke into an oil groove cut just below the ring groove. The land between the bottom of the ring groove and the oil groove is 1/64 in. wide and it is 1/32 in. smaller in diameter than the land above this ring groove. This forms a free passage for the oil to the oil-collecting groove. Eight 3/32-in. holes are drilled around the piston, connecting the oil groove with the interior of the piston. These holes slope down at an angle of 60 deg. with the axis of the piston, carrying the oil wiped from the cylinder wall to the interior of the piston. A slot ⅛ in. wide by 1/16 in. deep is cut from the oil groove to the piston pin hole at both ends, thus lubricating these bearings. Two ½ in. wide by 1/32 in. deep oil distributing grooves are cut around the piston.

Piston Pin

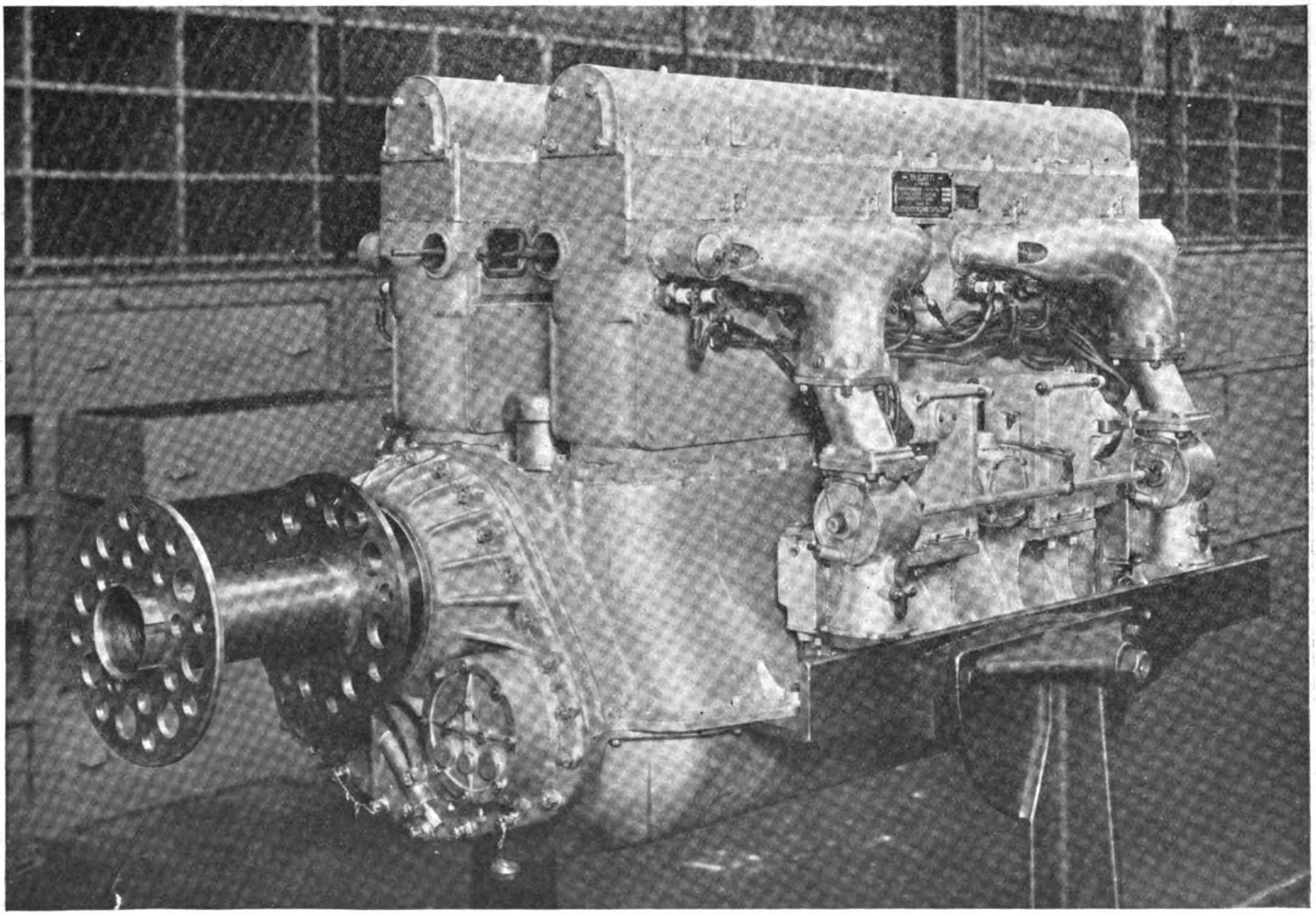
The piston pin floats in both the connecting-rod bushing and the piston. Bearing in the piston is directly on the aluminum. It is held from endwise motion by an aluminum plug pressed into each end. These plugs are drilled axially with a ⅜-in. hole which allows a certain amount of oil from the cylinder wall to enter the hollow piston pin. The ends of these plugs where they bear against the cylinder wall are turned to a spherical seat of a radius equal to the radius of the cylinder bore. In operation the piston pins turn more or less. Two ⅛-in. holes are drilled through the wall of the pin. These holes, when in a certain position, register with an oil groove in the connecting-rod bushing, allowing a certain amount of oil to enter the hollow piston pin, and when in the lower position allow the oil which is pocketed in the pin to run out onto the connecting-rod bearing.

The connecting rod is a steel forging machined all over. It is of H cross-section. The small end bearing is a bronze bushing pressed in position, having one straight oil groove 3/32 in. wide by 1/32 in. deep, running to within ¼ in. of the ends of the bushing. This groove is in communication with a 13/32-in. drilled hole in the connecting rod through a ⅛-in. hole. Oil collects in the pocket formed by the 13/32-in. hole and is led to the bearing through the ⅛-in. hole.

The big end of the connecting rod is fitted with a bronze bushing which is babbitt lined. This end is split at right angles to the rod on the center line of the bearing, the cap being held in position by two ⅜-in. chrome nickel steel bolts. The bushing is relieved at the parting line by five grooves, 3/16 in. wide, about ¾ in. long, 3/64 in. deep, cut on a 7/16-in. radius with a center on the parting line. The rod half of the bushing has no oil groove; the cap half has a circular oil groove entirely around it cut on the center line of the bushing and registering with the oil feed hole in the crankpin. This groove is ⅛ in. wide by 1/32 in. deep. The bushing in the cap is kept from turning by a dowel pin with an enlarged head. This head enters a countersunk hole in the cap, the small end entering the hole in the bushing when it is placed in position. This end is of such a length that it does not project through the bushing. The pin is thus locked in position and cannot drop out on the shaft.

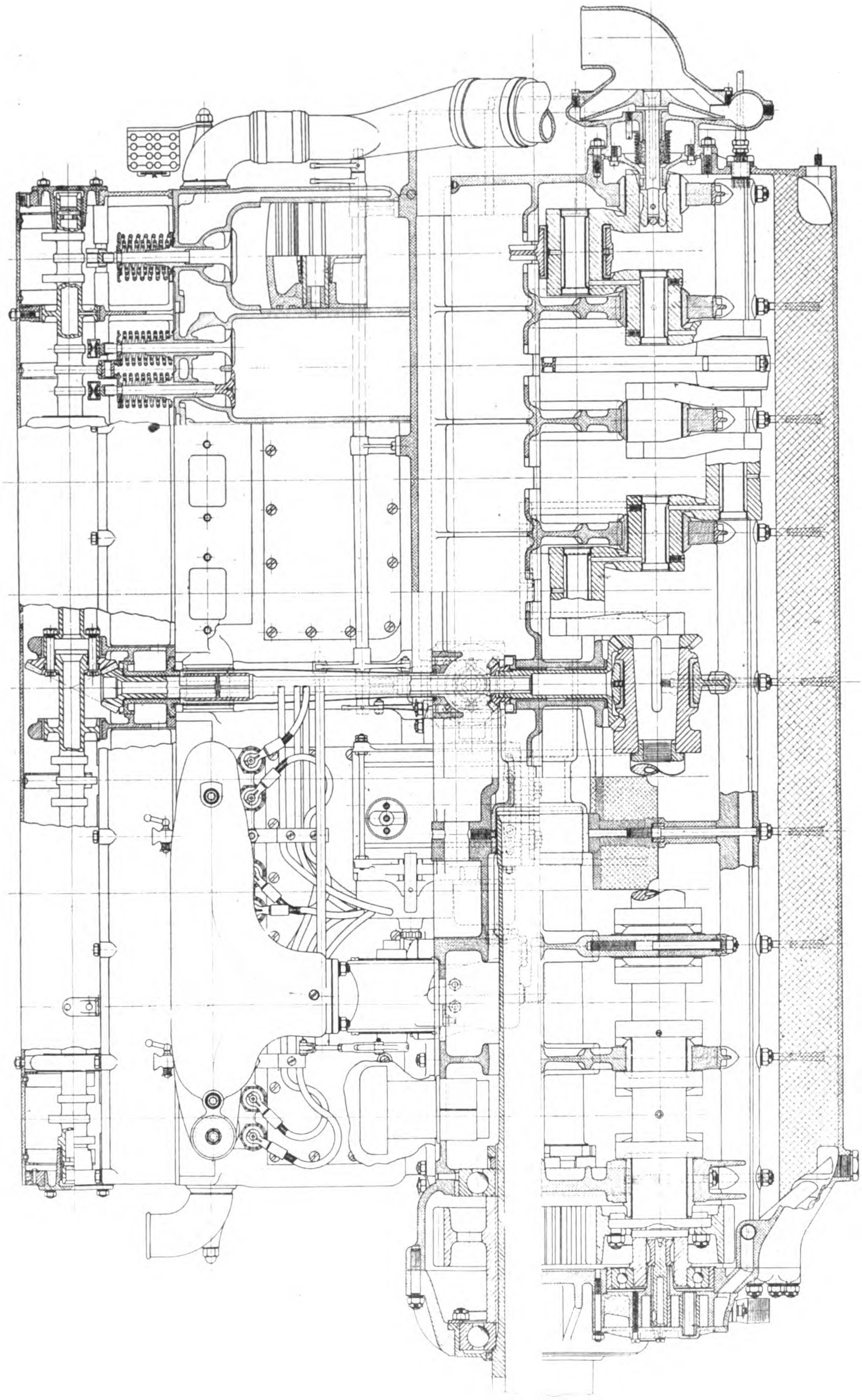
Crankshaft

The crankshaft is made in two pieces, connected at the center by a taper and key drawn up with a nut. Each section of the shaft forms a four-cylinder shaft with the throws all in one plane, the throws of the two sections being assembled at right angles. In assembling, the rear end of the front half is immersed in boiling water; the tapered end of the rear section, which is cold, is then slipped into position, and the parts are drawn together by the nut, using a long-handled wrench. The rear end of each complete shaft has clutch teeth cut on it for attaching a starter.



The 16-cylinder King-Bugatti engine, viewed from the propeller end

Bugatti 16-Cylinder Engine in Section



This engine has a bore of 110 and a stroke of 160 mm. The above sectioned elevation shows numerous details of construction

All end thrust coming on the shaft is taken by the center bearing, all other bearings having about 1/16 in. clearance at both ends. All bearings, including the connecting-rod bearings, with the exception of the center main bearing, are undercut. This results in a total shortening of the shaft of approximately 4 31/32 in. and in a considerable saving in weight.

The crankshaft main bearings are bronze bushings, babbitt lined. These bearings are not relieved at the parting line, and there are oil grooves only in the lower halves of all but the center bearing. These have a 3/32 in. wide by 1/32 in. deep circular oil groove entirely around them. This groove registers with the oil hole into the hollow crankshaft bearing. As this oil hole is drilled through both walls of the bearing on a diameter and as the oil groove in the bushing extends through 180 deg., there is aways a free passage for the oil from the bearing into the hollow crankshaft.

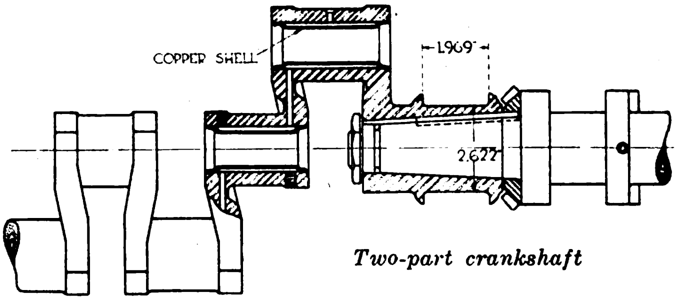
In assembling the completed crankshafts in the crankcase, they are placed in such relation to each other that if No. 8 throw left is on top dead center No. 8 throw right will be 45 deg. past bottom dead center. Both cranks turn clockwise viewed from the rear of the engine.

The propeller driving gears are bolted to the crankshaft with nine bolts equally spaced, the bolt holes being drilled in a certain relation to the gear teeth. This makes it possible to use the same gear on either shaft, with a maximum error in the setting of the shafts of 20 minutes.

Valves

The inlet and exhaust valves work in cast-iron guides pressed into the cylinders. Liberal water space is provided in the cylinder head in the neighborhood of these guides.

The exhaust valve stem is hollow from the head to within a short distance of the necked portion at the upper end. The hole is closed at the head end by a short, threaded plug screwed in below the surface of the valve, the recess then being filled level with the surface of the valve by welding. This closes the hole tightly and locks the plug in position. The lower end of the exhaust valve stem is of larger diameter than the upper end. Both the large and small diameters take a bearing in the valve guide. At the shoulder formed by the junction of the two sizes of stem three 3/32-in. holes are drilled at an angle of 30 deg. with the axis of the stem, sloping toward the head of the valve and connecting with the drilled hole in the stem. At the upper end of the stem just below the necked portion a 5/32-in. hole is drilled through



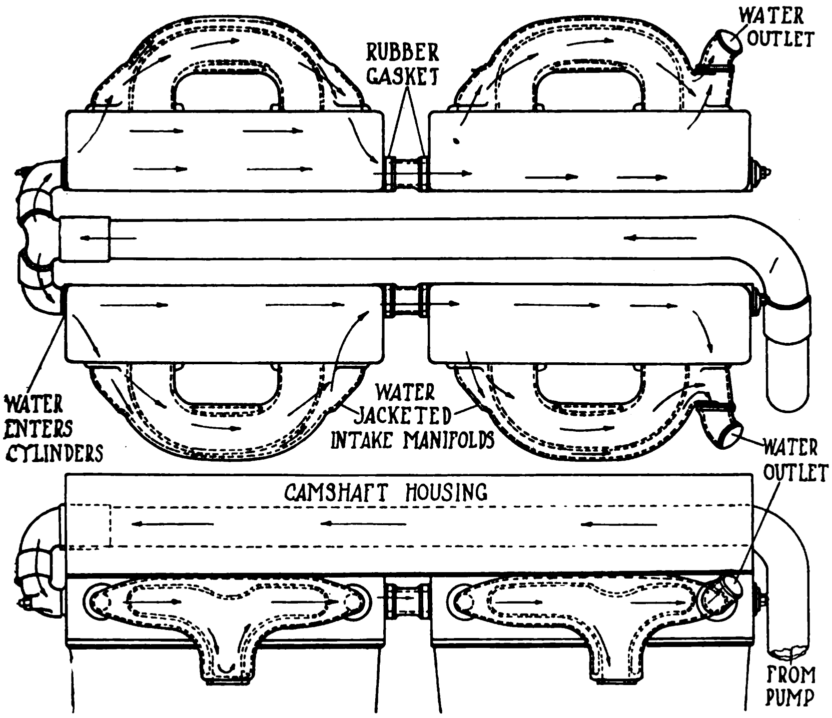
Two-part crankshaft

the wall of the stem. The movement of the valve up and down in the guide causes a pumping action, the transfer of air within the valve stem being thought to cool the steam to a certain extent. This drilling also lightens the valve.

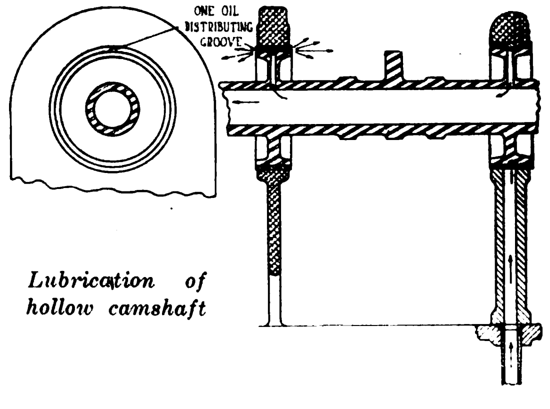
The valves are operated by an overhead camshaft through a rocker arm. These rocker arms are pivoted on steel shafts which are slid into drilled holes along both sides of the camshaft housing. There are four of these rods to each housing, each one-half the length of the housing. The ends of the rods butt together at the center, the outer ends being flush with the ends of the camshaft housing and covered by the end bearing support for the camshaft when this is bolted in position. The rods are thus prevented from moving lengthwise. They are a tight enough fit in the drilled hole in the camshaft housing so that there is no turning motion. The outer end of each rod is tapped for a wrench to be used in withdrawing the rods from the housing.

Each rocker arm operates one valve. The arms are forgings and the pivot bearing on the rod in the camshaft housing is not bushed. The cam operates on the large roller, which is of hardened steel, taking a bearing on the hardened steel pin. This pin is held in the rocker arm by spinning the metal of the arm around the beveled end of the pin. The small roller operates directly on a cap placed over the end of the valve stem. This roller is of hardened steel and takes a bearing on a hardened steel pin the ends of which are soft and spun over into a bevel at the outer edges of the hole in the rocker arm.

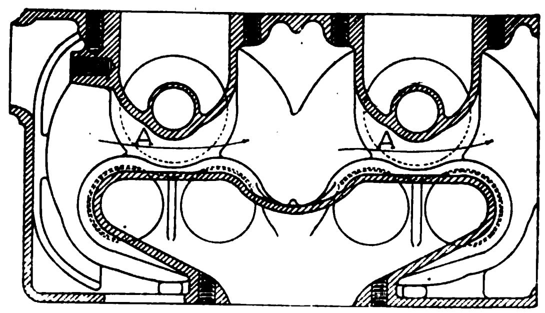
The end of the valve stem has a cap slipped over it, the upper end of the cap being hardened. The proper clearance, 0.015 in. for both the inlet and exhaust valves, is obtained by placing shims in the cap. Three different steel shims are used of 0.003 in., 0.005 in. and 0.010 in. thickness, the first



Illustrating direction of water flow



Lubrication of hollow camshaft



Cooling of the valves

being octagonal, the second hexagonal and the third round, so that the different thicknesses may easily be picked out by eye.

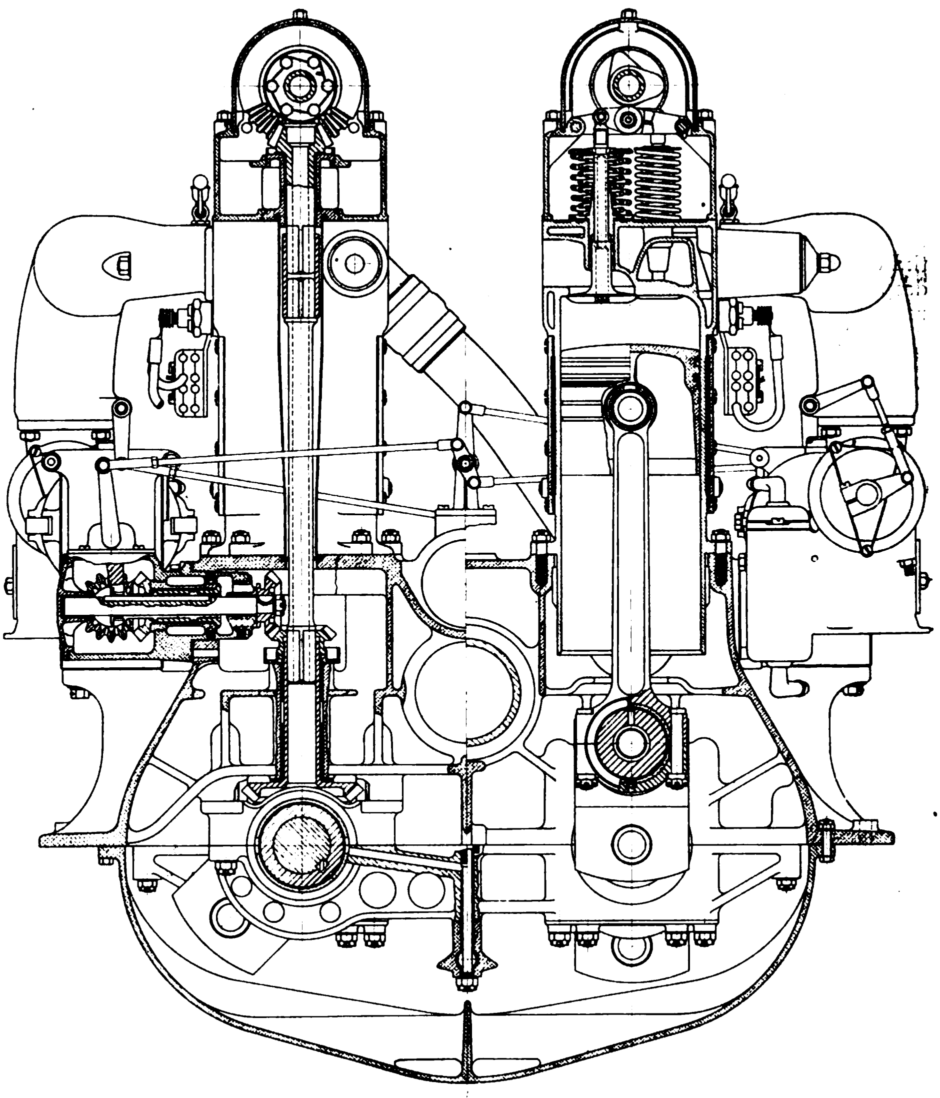
The upper valve spring retainers have a central tapered hole, the large end being on top. The valve stems are necked, and a tapered split collar is slipped into the necked portion of the stem, large end up. This taper is the same as that of the hole in the spring retainer. The pressure of the valve springs forces the retainer against the tapered collar, which is prevented from moving by the shoulder on the valve stem, thus locking the retainers into position.

Camshaft Drive

There are two overhead camshafts, each one running the full length of the two cylinder blocks. Each shaft is made of two separate shafts joined near the center by six bolts passing through flanges on the shaft. These bolts also hold the camshaft gear in position. Each complete shaft is carried in ten plain bearings in a removable camshaft housing. The two housings are of aluminum and each one is bolted directly to the top of the cylinder blocks without the use of a gasket by twenty ¼-in. studs.

The first camshaft housings had a sheet aluminum cover, but a later housing is made entirely of cast aluminum with a cast aluminum cover plate at the side running the entire length of the housing.

Each camshaft is operated through a bevel gear driven by a vertical shaft between the two cylinder blocks, which in turn is driven by a bevel gear on the crankshaft. The gear on the crankshaft is pressed in position and in addition is held by a key. The thrust of this gear is taken by the crankshaft center bearing. This gear meshes with a bevel gear which drives the vertical shaft, the thrust of the gear being taken on a bronze, babbitt-lined bushing pressed into the aluminum crankcase. This gear has a long shank which acts as a bearing for the gear, and has a fine external thread cut at its upper end. This upper end has a square broached hole, the hole having a definite relation to a marked tooth of the gear. The bearing for the upper end of the shank of this gear is a bronze bushing, babbitt lined, pressed into the crankcase. The upper end of the bearing is cupped to form an oil well which catches the spray in the crankcase which is led to the bearing. The magneto driving shaft driving gear is screwed onto the thread at the upper end of the shank, the adjustment of the gear being obtained by means of the thread.



Transverse section of engine, showing camshaft and magneto drive

This gear has a square broached hole, the same size as the hole in the shank of the gear it is screwed to, and is locked in position by dropping the camshaft driving shaft into position, this shaft having a squared section at both ends, the lower end fitting into the square hole in the magneto driving shaft driving gear and the square hole of the shank of the camshaft driving shaft gear. The gear on the camshaft meshes with a gear having a long shank with a squared section at its lower end, the square being cut with a definite relation to a marked tooth on the gear. This gear takes a bearing in an aluminum, babbitt-lined bushing which is held in position in the camshaft housing by a large, flat-head screw.

This bushing also takes the thrust of the bevel gear. The upper end of the vertical camshaft driving shaft and the lower end of the camshaft driving gear are connected by a coupling consisting of a square piece of steel with a square broached hole fitting over these square ends.

The teeth of all the gears being marked for the meshing position, they may be easily assembled in the proper positions for correct timing. (*To be continued*)

French Tractor Results

ON a certain farm in the Seine-et-Oise Department of France (says *Le Genie Civil*) a State-owned Titan tractor of 20 hp. carried out part of the reaping at the agreed contract price of $6.75 per acre, this price including hire of tractor, driver, oil, grease, and twine. It cut 62.5 acres of winter wheat, 37.5 acres of spring wheat and 27.5 acres of oats, a total of 127.5 acres. The winter wheat, which was a very thick growth, was particularly difficult to reap. It was sometimes only possible to work on three, and even two sides, thus increasing the fuel consumption. The other expenses of the farmer were 80 cents per acre which, added to the $6.75 agreed price, makes $7.55 per acre. The work done per day was only 7½ acres.

On another farm a 20-hp. Titan tractor reaped a quarter of the crop—136 acres out of 544. The tractor operated a McCormick reaper of 7 ft. cutting-length. The ground being level in this case, it would have been possible to make the tractor drive a reaper-binder of 9.2 ft. cutting-length, or even two ordinary reaper-binders. Not counting binder twine, the cost of work with the tractor came out at $3.18 per acre, while animal traction only cost $3. This slight difference is more than compensated for by the increased speed of working.

The Engine of the Side Car Motorcycle

PART II

An Analysis of Features of Cycle Engine Construction in a Paper Presented to the Institution of Automobile Engineers by E. Caudwell

THE internal cam, which has been largely favored, while it has certain advantages in permitting the use of rather longer bearings with a more compact timing gear, has not much else to recommend it.

Fig. 3 shows the exhaust cam and rocker of a well known engine, and Fig. 4 the lift, velocity and acceleration curves, plotted for 3000 r.p.m. of the crankshaft. It will be noted that the lift curve is unsymmetrical, due to the displacement of the roller in relation to the center of the cam. The roller moves on an arc about the rocker center, and this causes it to approach the cam as the valve lifts and to recede as it closes. The velocity therefore rises to a higher value during the opening period. Most interest is attached to the acceleration curve. As the valve is opening this rises to 6000 ft. per second per second. Taking the weight of the moving parts at 0.7 lb., it requires a spring strength of 130 lb. to compel the valve to follow the cam.

Since such a spring is a practical impossibility for this size of engine, it follows that the valve jumps at this point and then lags behind the cam. As the valve is closing, the lift curve, instead of approaching the base line asymptotically, cuts across it, indicating such an extremely rapid change of velocity that the acceleration curve runs up toward infinity, approximating to a rectangular hyperbola, so that its final values cannot be plotted. While this effect is reduced by the elasticity of the parts and the lag of the valve, it is clear that the valve closes with a considerable amount of shock and noise, while it is worth noting that engines with internal cams have always been the worst offenders in breaking valves.

A constant acceleration cam is also shown. The spring strength required for this is 58 lb., and though the areas during opening and closing are not so large, there would be a considerable gain in efficiency, quiet running, and probably increased power at high speed, since the timing would be more accurate.

These diagrams also show why, when tuning up an engine for high speed work, the first thing to do is to enormously strengthen the valve springs.

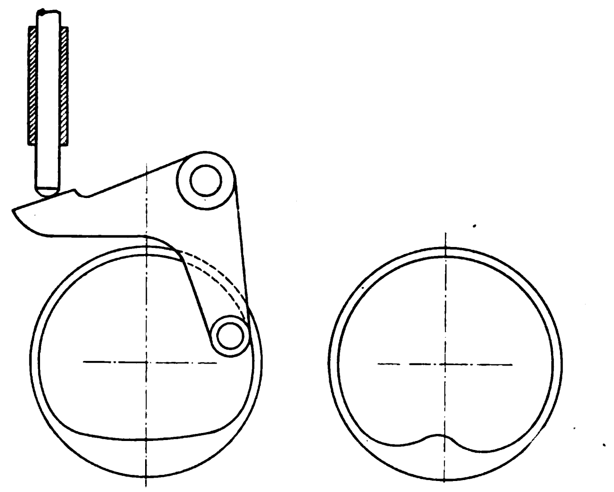


Fig. 3—Exhaust cam and rocker of well-known motorcycle engine

Tappets also have an extraordinarily short life, and after a few hundred miles running develop a large amount of side play. This is often aggravated by the offsetting of the valve from the center of the tappet, resulting in very heavy side loads, while the diameter of the tappet is always much too small, frequently being only 6 mm.

It should be noted that a flat twin engine and a four-cylinder engine both permit of good design of the valve gear; in the former case a camshaft can be mounted in the crankcase over the crankshaft with plenty of room for ball bearings, and a good width of timing wheel and cams.

The four-cylinder engine with its valve gear in front is also practically unrestricted, so that there are no difficulties in the way of bringing the valve gear for these types up to car standards.

Weights of Engines

The single-cylinder engine is the heaviest of any type for its power output. This is largely on account of the heavy flywheels required, especially when placed inside the crankcase. One popular engine weighs 68 lb., but the average for most other makes is 85 lb. The Vee twin-cylinder engines are somewhat better, the average weight being about 100 lb. for a one liter engine (61 cu. cm.).

No weights are available for the flat twin engine, but it should have a good power-weight ratio on account of its small crankcase and large and therefore light flywheel.

These engines all require an unnecessarily heavy transmission on account of the fluctuations in crank effort, and this should be borne in mind when judging an engine on the question of weight.

The four-cylinder engine is the lightest of all, and its even crank effort and adaptability to a high speed gearbox have a large effect in reducing the weight of the transmission. The four-cylinder Henderson engine is the largest in use to-day, having a piston displacement of 1170 c.c. Yet the complete power plant—engine, clutch and gearbox, with kick starter, magneto, carbureter and muffler—only weighs 128 lb.

The ratio of bore to stroke is a matter on which little originality has been shown. About a decade ago, when the A. C. U. fixed 500 c.c. as the limit in capacity for the 3½-hp.

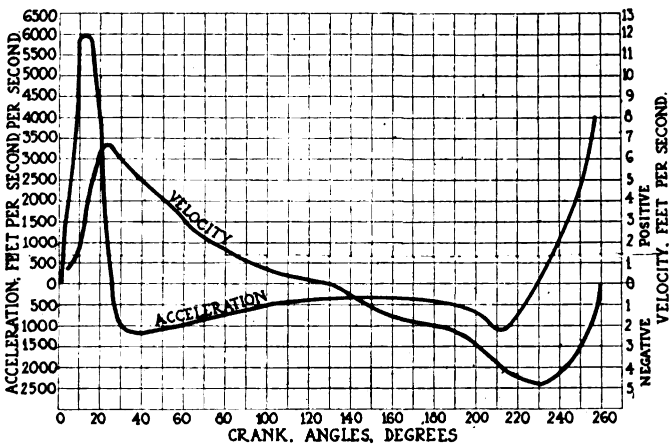


Fig. 4—Lift, velocity and acceleration curves for 3000 r.p.m. of the crankshaft

Four-Cylinder Henderson Engine

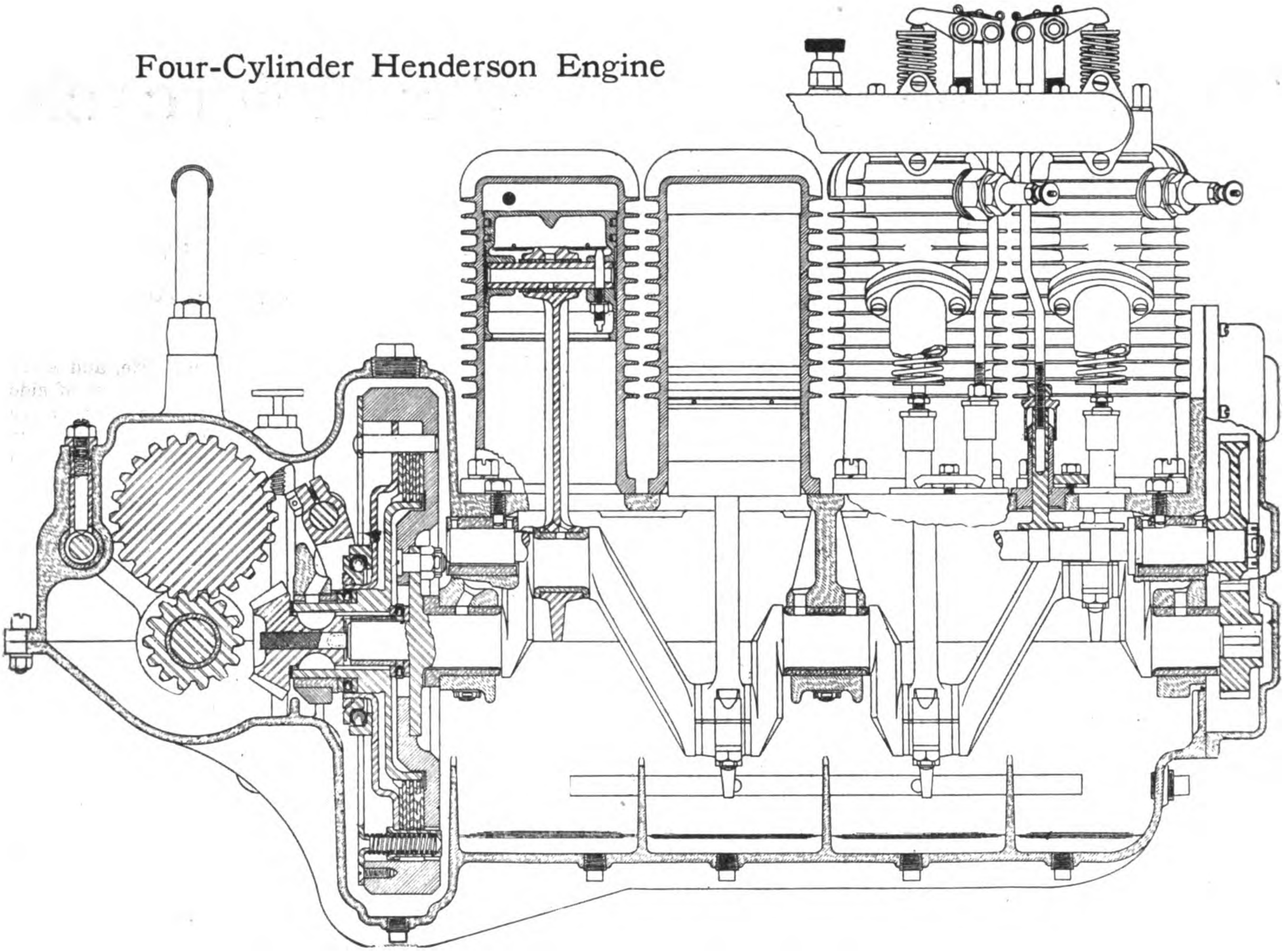


Fig. 5—Longitudinal section through Henderson engine, clutch and gearbox

class in races and competitions, one well known maker gained numerous successes with an engine 85 mm. bore by 88 mm. stroke. As a consequence this engine was treated with the sincerest form of flattery, namely, imitation, and many people since then seem to have regarded these dimensions as a sort of standard. Aside from one or two notable exceptions, there is no sign that any effort has been made to improve design by an alteration in the stroke-bore ratio, although with car engines average practice has settled down to the employment of a stroke 1.5 times the bore. Theoretically, neither balance nor crank effort is affected by the stroke, as the unbalanced force depends entirely on the point in the stroke at which the connecting-rod and crank are at right angles, *i. e.*, the ratio of connecting-rod length to stroke. For any given piston swept volume the crank effort and torque are also both independent of the stroke, as may be seen by an inspection of the fundamental horsepower formula P.L.A.N/33,000, which shows that for any given speed of revolution and any given mean effective pressure, the horsepower developed depends on L $\times$ A; in other words, the volume of the cylinder, so that if this is a constant, the power output must always be the same, and cannot be affected by the ratio of L to A.

It is often stated that a long stroke engine pulls better than a short stroke engine, but other conditions being equal this idea is a fallacy, because the average crank effort or torque is a function of the horsepower, being in inch-lb. for a four-stroke engine 63,025 times the horsepower divided by the revolutions per minute. So we see that the torque also is constant for any given volume of piston displacement, and is independent of the length of stroke and area of the piston so long as they produce the constant volume.

However, a lengthened stroke has a good effect in smoothing out the crank effort curve, as a small reduction in the cylinder diameter means a considerable increase in the stroke without a proportionate decrease in the weight of the reciprocating parts. Since the acceleration is proportionate to the stroke, we get a larger relative inertia force, which has the effect of reducing the peaks on the crank effort diagram, and therefore the ratio of the mean effort to the maximum variations. As it is generally convenient to employ a relatively shorter connecting-rod on a long stroke engine, this increases the aforementioned effect, since, as the ratio of connecting-rod length to stroke is decreased, the inertia forces become larger during the first and smaller during the second portion of the stroke. A longer stroke also gives a larger wall area for cooling surface. Further, for a limited width of engine, a decrease in the cylinder diameter is distinctly advantageous to other aspects of the design, allowing more space for adequate sizes of the valve operating mechanism.

In order to show that it is possible to build a power unit complying in a large measure with the conditions laid down at the commencement of this paper, Figs. 7 and 8 give longitudinal and cross sections of the 7-hp. F. N. engine. The bore and stroke are 52 mm. and 88 mm. respectively, and an inspection of the drawings will show that the engine contains all the usual features of a light car engine with the same relative proportions. The general layout of the machine is also on car lines, a flywheel, a clutch, a three-speed gearbox, and a final drive by shaft and bevel being employed. The crankshaft is of the two bearing variety with ball bearings, and there are two camshafts on opposite sides of the cylinders, which are T-headed. The magneto is of the usual car type with the distributor incorporated. The wheelbase of the machine is not excessive, but if the magneto had been placed at the side of the engine it could easily have been made 5 in. shorter, thus bringing it down to the average 6-hp. Vee twin-cylinder engine, namely, 56 in.

The lubrication system, which is also worthy of mention,

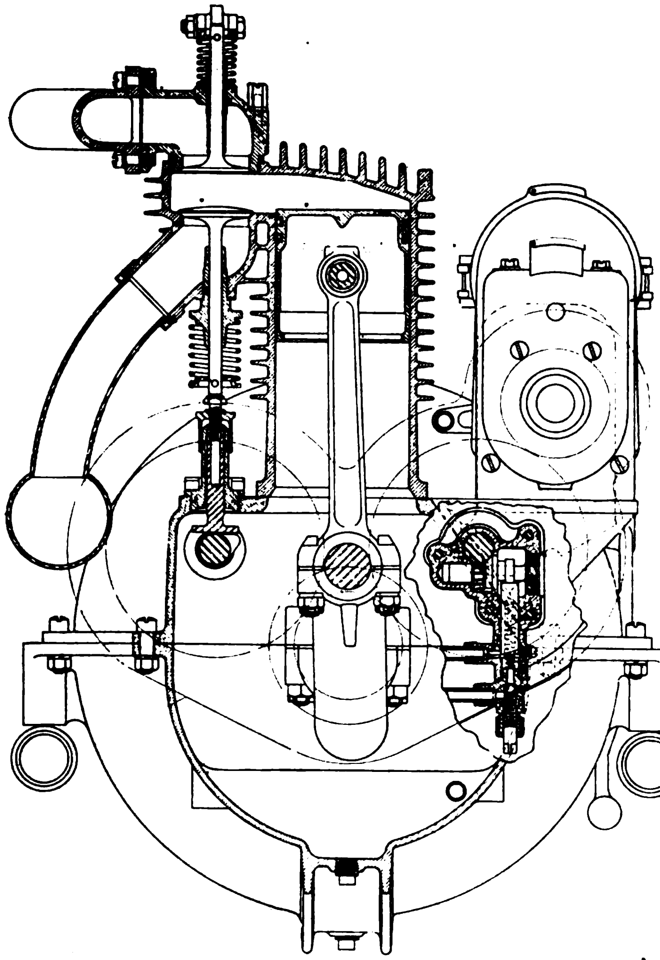


Fig. 6—Cross section of Henderson engine, showing lubrication features

consists of a special type of gear pump driven from the front end of the inlet camshaft; it draws oil from the sump and delivers it to troughs under the connecting-rods; these troughs are pressed in one with the filter plate, and the surplus oil runs through to be used over again.

As an indication of the extreme care which has been used in the construction of this engine, it should be noted that wherever studs have been employed on the crankcase they are not screwed into the aluminum, but into large steel bushes which are screwed in and pinned to prevent them from rotating.

Figs. 5 and 6 show the four-cylinder Henderson power plant. This represents another type of design, as the engine, clutch and gearbox are built as a single unit, and the drive is taken from the end of a cross shaft by a single roller chain to the rear wheel. The bore and stroke of the engine are 2¾ in. and 3 in. (63.8 mm. and 76 mm.) respectively, which give 1170 c.c. cylinder capacity. An L-head cylinder is used with the exhaust at the side and an overhead inlet valve operated by a rocker and push rod. Lubrication is automatic by means of a pump, and plain bearings are used throughout.

It will be noted that this engine also closely follows car practice and all its parts are of ample proportions and straightforward design.

As a further proof that a four-cylinder engine is not unduly long, it should be mentioned that although 28 in. by 3 in. wheels are used, the wheelbase is only 59 in.

Summary

To sum up the conclusions arrived at, we see that our requirements are fulfilled in the largest measure, and about equally, by the flat twin and four-cylinder engines. The flat twin engine has certain advantages in the way of fewer working parts, but, as generally placed, the cooling of the back cylinder is very inefficient and the cylinder is also inaccessible; in fact it cannot be removed without taking the engine out of the frame. It is noteworthy that at present there are no air-cooled flat twins in use of over 750 c.c. cylinder capacity. There is no reason, however, why below this size the engine cannot be placed transversely across the frame as has already been done by one maker, though the engine in this case is very much smaller. While a fairly large engine would certainly present a difficulty for solo use when placed in this manner, for the side-car machine there are no objections and many advantages, as it solves the cooling difficulty and also the question of accessibility; then, too, the crankshaft is in the right position for employing a proper car type of clutch and gearbox with final drive by a shaft. In order to keep the engine short, it is necessary for the stroke to be less than the bore, and as a 750 c.c. flat twin engine can easily be made less than 20 in. overall, it will go in the width of a side-car machine, many of which are 21 in. wide over the footboards. In larger sizes the overall dimensions of the engine begin to present difficulties, and we then come into the sphere of the four-cylinder engine. The even crank effort of this type is of great importance to the comfort of the rider and also in permitting the use of a light and durable transmission system, which also follows naturally from the disposition of the engine in the frame. The engine is also very adaptable to correct frame design, as it can easily be carried by a duplex tubular construction or a channel or pressed cradle when they develop.

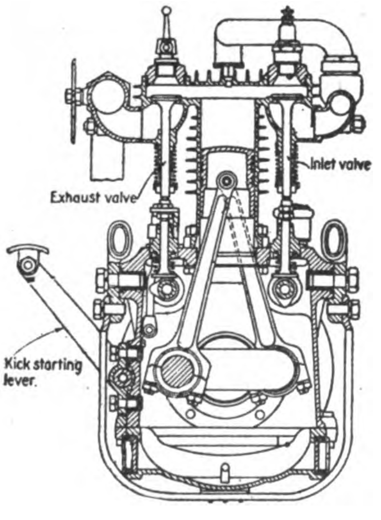


Fig. 7—Cross section of F N engine

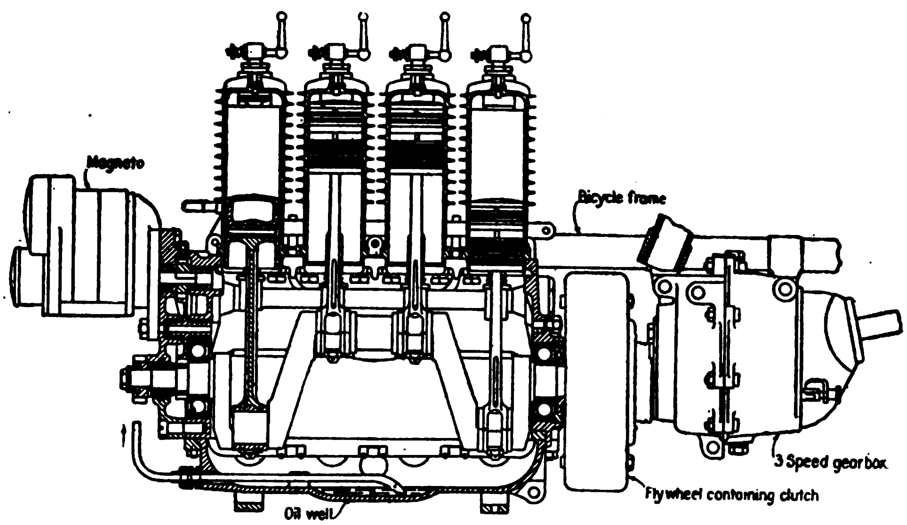


Fig. 8—Section of F N four-cylinder engine, with two-bearing crankshaft

Determining Correct Location of Brake Levers

Brakes Generally Not to Blame for Pedal Motion Due to Torque and Spring Action

By Walter C. Baker*

BECAUSE manufacturers using brakes which have proven entirely satisfactory in times past have altered their design from one using a torque member to one employing the Hotchkiss drive, and have experienced trouble in braking action, blaming it on the brakes, it has been necessary to devise some means of demonstrating that the trouble actually was not in the brakes themselves but in the manner in which these brakes were hitched up. Not only has this trouble occurred when the change was made to the Hotchkiss drive, but when the spring in this case was moved from a position above the axle to one below, many times causing engineers to say the brakes were inefficient.

In the discussion which follows I will attempt to show what most generally causes the trouble in braking action, and how it may be remedied by simply changing the rods and their locations; and it is believed that the analysis of braking action will be of great interest to all engineers connected with the design and production of automobiles.

In the design of motor vehicles employing what is known as the Hotchkiss drive, both of the passenger and commercial type, engineers have, in many cases, either failed to consider rods and levers, and braking action, or they have considered them insufficiently or incorrectly. The result has been that in a great many cases the brakes have either been inadequate or too severe. Almost universally is it true that, while at some one point and in one direction, the brakes may operate perfectly, yet at most other points or in the opposite direction the braking action is very poor.

Brake Rod Gage

Many annoying features characterize the brake that is incorrectly hitched up, in addition to the danger that always exists while driving. In all cases redesigning the brake rods and levers correctly will eliminate these disagreeable features, and to enable one to locate these centers correctly, I have designed and had constructed a brake rod gage.

It is not commonly known that somewhere in or about the rear axle there exists a transverse axis about which all torque action of the rear axle takes place. When a torque member is used, this axis is usually forced to coincide with the center of the rear wheels and axle.

When no torque member is used, as is the case with the Hotchkiss drive, this torque axis lies outside the axis of the rear wheels, and for ideal action of the brakes, the rear brake rod center should lie on this transverse torque axis, while the front brake rod center should be placed at a point which most closely approximates the center of the curve through which this torque axis moves, relative to the frame, when the car is in various positions above the axle, due to load and road conditions.

To correctly locate these points by graphical means or calculation with the information we have at present is an impossible task. They are more nearly located by tests on the car while in action, and to make such tests more productive of correct results a brake rod gage of some sort should be used.

The brake rod gage I have been using consists of several interchangeable rods, of various lengths, graduated every inch, and operating through a dial gage which indicates any lengthening or shortening of the rods, when placed by means of convenient attachments in the position of the brake rods themselves.

Action of Gage

The cause and effect of the elongation or shortening of the rods is explained in the discussion which follows.

Let us denote the torque axis by T. This is the axis

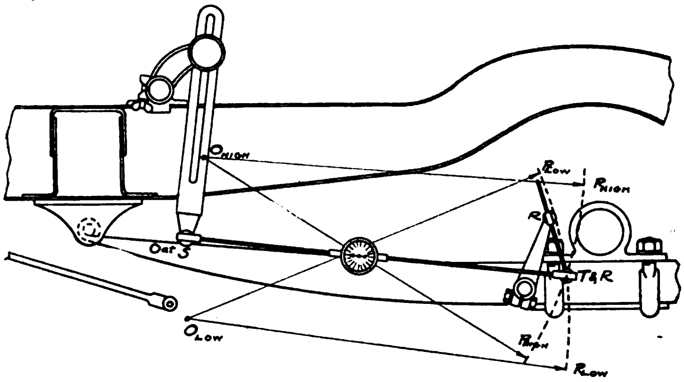


Fig. 1—Indicating conditions where O and S do not coincide

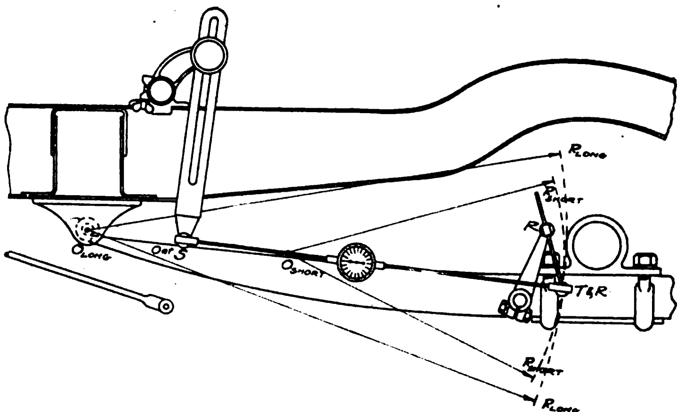


Fig. 2—Rod too short, due to front center O being located behind spring axis, or too long, due to its being located in front of S

*Paper read before Cleveland Section, Society of Automotive Engineers, April 18.

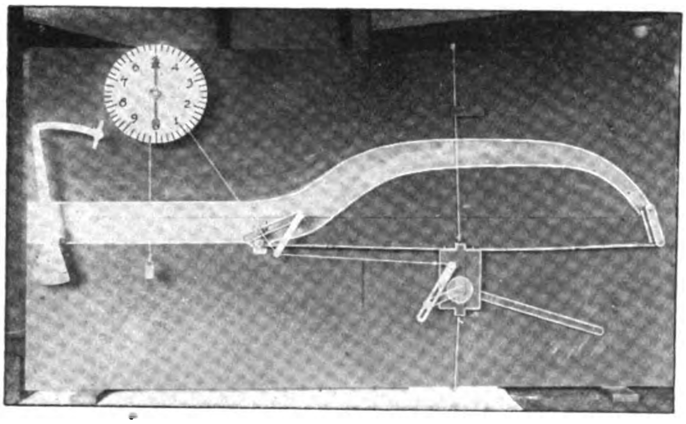


Fig. 3—View of demonstration apparatus used by Mr. Baker at Cleveland to show principles of brake layout gage

about which all torque action takes place while it in itself remains stationary, as referred to rear axle. It is plain then, that if the rear brake rod center were fixed on this axis, as far as torque is concerned, there would be practically no action of the brakes themselves due to the fact that the point of application of braking force is nearly stationary.

Let us assume, however, that the rear brake rod center is not correctly placed, and that it lies outside the torque axis on some axis such as *R*, then there must be some movement of *R* and *T* when torque action takes place.

Suppose we are looking at the car from the left-hand side, with the car traveling forward, the rear brake rod center *R* will move in a counterclockwise direction when the brakes are applied. If the rear brake rod center *R* happens to be above the torque axis *T*, such motion will tend to shorten the distance between *R* and the front brake rod center *O*. If the rear center *R* is below the torque axis *T*, the distance between *R* and front rod center *O* will tend to be greater. But since *R* and *O* are rigidly connected by a rod, *O* is forced to move with *R*, and consequently moves forward or backward, depending on the relative position of the rear rod center *R* with reference to the torque axis *T*. Of course, whatever tendency to shorten or lengthen the pull rod there may be when the car travels forward is reversed when the car travels backward and brakes applied.

With the brake rod moving forward and backward like this, one of two things must take place. Either there is a corresponding movement of the brake pedal and hand lever, multiplied by the leverage ratio, or, the brake levers of the rear axle are being operated upon independent of any voluntary action of the driver. Very often in cases of extreme movement of the rod, motion of the car in one direction automatically applies the brakes, or at least makes them grab severely, whereas, motion in the reverse direction makes it almost impossible to apply the brakes, due to the pedal in its extremes being in contact with the floorboard, thus limiting the radius action.

When the rear brake rod center *R* lies either in front of or behind the torque axis *T* on a line from the front rod center *O* to *T*, the action due to torque is usually very good, because what motion there may be is mostly up and down, which does not materially change the distance between the rear and front brake rod centers. This motion would, of course, increase as the distance of the rear center *R* from the torque axis increased, and when this became very great the change in the distance between *R* and the front center *O* would be considerable.

It is plain, then, that the only point at which there would be practically no motion of the rear axle is at the torque axis *T*, and a point on this axis is the ideal location of the brake rod center *R*.

In order to locate the torque axis *T*, let us employ the brake rod gage. The gage may be mounted either vertically or horizontally. It is shown here mounted horizontally. After the gage is mounted, a torque effort is exerted on the axle by some means. In this case, to show the action clearly, I have attached a rod to what would correspond to the axle housing, and by displacing this rod a torque effort is exerted sufficient for our purposes.

With the front center *O* of the gage rod fixed, any movement on the part of the rear center will be shown on the dial indicator, until adjustments are made which will so place this point that extreme movement in torque will have same indicator readings.

With this much having been done with the gage horizontal, it is then placed in a vertical position with the rear center still at the point just found. The locating process is then repeated. In the first case the rear brake rod center was confined to a horizontal plane containing the torque axis *T*, and in the second case, while not moving out of this horizontal plane, it is further confined to a vertical plane containing *T*. The rear center is thus forced to lie at the intersection of these two planes, or on the torque axis *T*.

We have been determining the best position for the rear brake rod center. Very often it is not possible to actually reach this point, due to the obstruction of other parts. When such is the case, the next best thing is to place it as near the actual torque center as possible and in a line with the torque center and the correct position for the front brake rod center *O* with normal load on springs. In order to do this the spring axis (*S*) must first be located, before which we must consider the action of the springs.

Car Action Due to Load and Road Conditions

When the car assumes various positions above the axle due to load and road conditions, it deflects or flattens the springs, whichever the case may be, and as they deflect or flatten the distance from the front eye to the spring seat shortens or lengthens respectively.

Since the axis of the front spring eye is held rigidly in position as regards the frame, the axle and all points on the axle member describe curves relative to the frame when successive positions are assumed on the frame above the axle. This curve that any one point describes is not an arc of a circle, because of the lengthening effect of the

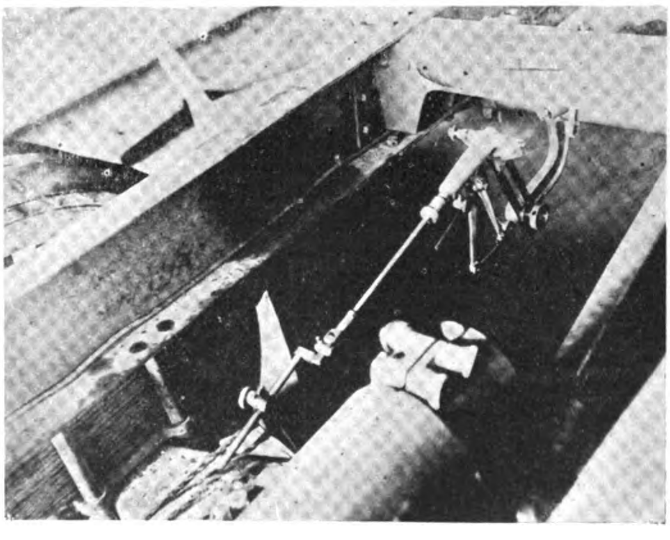


Fig. 4—Brake layout gage mounted on Class B truck

spring as it flattens. The curve is one which resembles an epicycloid, but for convenience in explanation the real curve has been exaggerated as shown here by the black line.

Since any point on the torque axis also moves in this curve, let us assume that this black line indicates the real path of the torque axis *T*. With the rear center of the brake rod *R* on the torque axis *T*, it is ideal for the front end to be at the center of a circle which most nearly approximates the curve described by *T*. This will maintain very nearly a uniform distance between the torque axis *T* and the front center *O*, and there will be practically no effort exerted to move the pedal or operate the brakes, independent of voluntary action of the driver.

If, however, the front brake rod center *O* does not lie on the spring axis *S*, we have a condition similar to the one shown in Fig. 1. Let us assume that under normal load the condition is at *T*. With the front center at *O* instead of *S*, the front center *O* will be forced to move in a circle about the countershaft a distance equal to the difference at any given position between the arc described by the torque axis and the circular arc described by the rear center about the front rod center *O* as a center. If *O* is above the spring axis or too high, a heavy load will have a tendency to loosen the brakes, making it impossible, if the front center is very high, for the operator to apply the brakes. Or often, when it is possible to set the brakes with the load on, when the load is removed the brakes will be so firmly set it will be impossible to release them. This can easily be seen from the figure. Under full load, the difference between the curves is such as to throw the front rod center forward, while at the check position in rebound the difference is such as to pull it back. When the front center is too low, as in this case, the effects are just the opposite. When a load is applied the brakes become set, and when it is removed they are loosened. Often, in such a construction, when the brakes are set and a load is put on, it becomes impossible to release the brakes without removing the load, or when it is possible to set the brakes after the load is on, when the load is removed the brakes are loose.

Incorrect Length of Rod Causes Error

Further than this, there is an error due simply to incorrect length of rod. If the front rod center *O* is behind the spring axis *S* as shown in Fig. 2, thus making the rod too short, the application of a full load has a tendency to tighten the brakes because the difference between the curves at the extreme is such that the rear center is pulled forward. When the front rod center is in front of the spring axis *S*, thus making the rod too long, the tendency is to loosen the brakes, because the difference between the curves in this case is such as to push the near center back.

Of course, there would usually be no real action upon the brakes as long as the pedal movement was unrestricted, because such errors will first be absorbed by pedal movement until the full sweep of the pedal has been reached. Designers have many times used a slotted rod or clevis to overcome this. But this movement is often so much that it is objectionable, as well as being actually a feature of reduced safety when quick and positive action of the brakes is reached.

However, the effect is much less when a rod is simply too short or too long than when *O* is too high or too low.

Now to locate the correct position of the front brake rod center *O* by means of the gage, we proceed as follows:

Assuming that the correct position of the rear brake rod center *T* has been determined, we fix it firmly by means of the necessary attachments. We then apply the load, making the frame assume various positions above the axle, or for an easier demonstration, making the axle assume various positions under the frame.

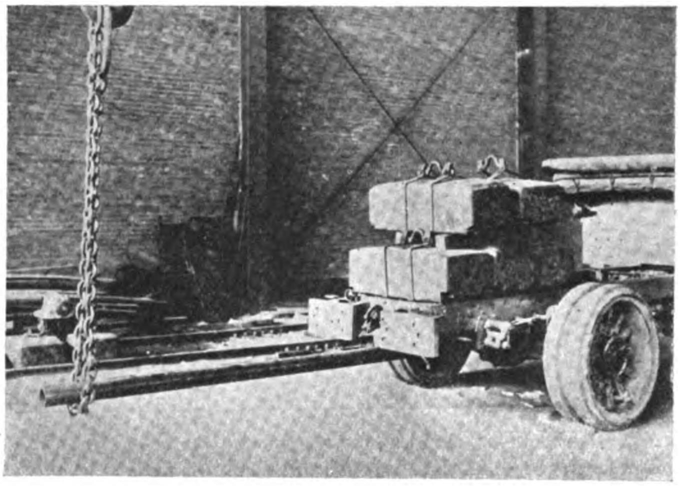


Fig. 5—Method of securing torque by chain fall and long lever on Class B truck. Note load to secure normal position of spring

The curve described by the torque axis *T* not being an arc of a circle, there are only three points which will be common to the arc through *T* at normal load about the spring axis *S* as a center. In other words, there are only three positions of the car above the axle where the brake action will be perfect, though if the front center *O* is placed at the spring axis *S*, the error at all other points will be reduced to a minimum, usually not exceeding a few thousandths of an inch, and will not be noticeable in action. For best results those points of perfect action should be chosen, first at normal load, and secondly, at points about three-fourths of the total movement of the spring either way from normal, or, in other words, the other two points should be located when the load is three-fourths the difference between normal and full load extreme position, and three-fourths the difference between normal and no-load extreme position respectively.

As the load is applied, readings are taken on the dial indicator, at the three points just mentioned, and are recorded in hundredths of an inch. When the three points have been reached, the records taken will indicate the relative position of the spring center *S* from the front brake rod center *O*.

For instance, suppose the front brake rod center *O* is too high, *O* moves in an arc about the countershaft *C*. The rear brake rod center *R* tends to move in an arc about the front center *O*, but it actually moves along the curve described by the torque axis *T* relative to the frame. Since under full load the difference between these curves is such as to push the rod forward, and since in the gage the front brake rod center is held stationary and the rod merely allowed to telescope, the change that takes place will be indicated by the dial gage readings. Under full load the rod will shorten and under no load or at check position it will lengthen.

Suppose at normal load the reading on the dial is 0.52 in. and at full load it has increased to 0.71 in. and finally at no load or check position due to the rod lengthening it has decreased to 0.36 in. Since the check position reading 0.36 in. is less than the full load reading 0.71 in., it indicates that the difference between the curves at check position was such as to pull the rod backward, and consequently shows that the front brake rod center is too high. Therefore, when the check position reading is less than the full load reading the front brake rod center is too high. From similar reasoning, if the full load read-

ing is less than the check position reading, the front brake rod center is too low. If the front brake rod center O is at the correct height the two readings will be the same, though both may be wrong for correct rod length.

If the front brake rod center O were on a circular arc described about the torque center T, and also passing through the spring center S, the rod would be of the correct length, regardless of the distance of the front center above or below the spring center, because its length would always be equal to the distance between the torque center and spring center, which is always correct for rod length. An arc about the front brake rod center O, in this case, which passed through the torque center T, under normal load, would reach just as far beyond the curve described by T at one extreme as it would fall short of it at the other. In that case the dial readings would show that the differences between each of the extreme rod lengths and the length at normal load were the same; as for instance, full load 0.67 in., normal 0.50 in., and check position 0.43 in. The differences between each of the extreme position readings and the normal readings are the same, or the sum of the extremes is equal to twice the normal. The latter method of handling the readings is the correct one, because if the rod were too short or too long but at the correct height, the difference between the extreme readings and normal reading might be the same in number of spaces passed over, but one would be a positive difference and the other a negative. This can readily be detected by simply adding the extremes and comparing the sum with twice the normal. If the sum of the extremes exceeds twice the normal the rod is too long; if less, the rod is too short.

Thus with a single set of readings we may determine our error in two directions, which enables us to make adjustments in two directions accordingly, after which we will take a second set of readings.

After the gage has been used several times it becomes an easy matter to approximate the correct amount of adjustment necessary. Usually a sufficiently correct location of the brake rod center can be accomplished in two or three readings.

When the gage was first constructed, a set of formulas was worked out which gave the correct amounts of adjustments necessary to place the front rod center at the correct position. But these formulas were rather complex and employed constants depending on the nature of the spring, and their solution usually required considerable time. After several comparative trials, it was discovered that an adjustment of the apparatus usually required less time and was more apt to be free from errors than the solution of the formulas. Consequently the formulas have been discarded in favor of simple adjustments of the apparatus, and, to further facilitate matters, easy means of adjustment have been provided on the gage.

From this one can readily understand it is not a difficult matter to have practically perfect acting brakes. When these centers are correctly located for any of the various styles or designs of chassis, one will find no further trouble with brakes due to spring action on rough roads, varying loads and Hotchkiss drive.

Testing Gasoline Content of Natural Gas

THE Bureau of Mines, Department of the Interior, has designed at its petroleum experiment station at Bartlesville, Okla., a testing apparatus for determining the gasoline content of natural gas. This apparatus is now in use and has been found to give exceedingly good results on gases containing as little gasoline as 10 gal. per 1,000,000 ft.

A valuable feature of this apparatus is that, with four compartments, the last compartment can be used as a test to see that the absorbing medium of the first three compartments has completely removed the gasoline from the gas. This is accomplished by keeping the percentage of saturation in the fourth compartment around a fraction of 1 per cent. Under such a condition an individual test can be made on the discharge gases from the first three compartments in which the saturation almost always rises to a point between 1 per cent and 11 per cent of the total volume of the liquid.

In a test made recently to determine the value of certain gas in the notoriously dry gas field of southern Kansas the apparatus checked itself consistently, proving recoverable yields from 10 gal. to 60 gal. per million.

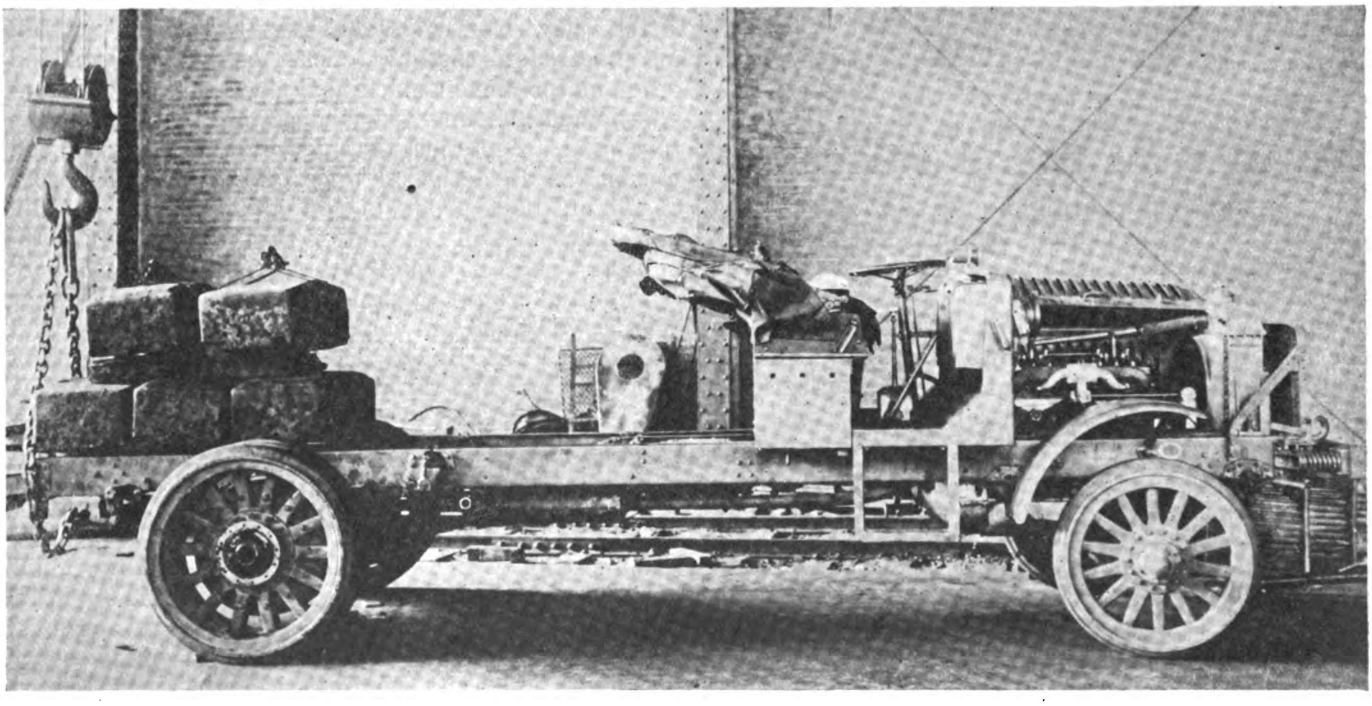


Fig. 6—Chain fall and weights used to locate spring center on government Class B truck and to secure different degrees of deflection

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, April 24, 1919 No. 17

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland— Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address - - - Autoland, New York
Long Distance Telephone - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - One Year, $3.00
Canada - - - One Year, 5.00
Foreign Countries - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Engineering Standardization

IN the past, engineering standardization in the United States has been confined to particular industries. The most notable example of such work is undoubtedly that carried out by the Society of Automotive Engineers, but effective work has been done also by the Electric Power Club, the Master Car Builders' Association and other organizations. As the advantages of standardization become apparent from its results on the industries by which it was adopted first, other industries are taking it up, and one of the latest associations to devote their attention to the subject is that of the gear makers.

So far there has not been in this country a body having control of engineering standardization in general and seeking to correlate the efforts of the different groups working in that line. That there is need for such a body is quite apparent. The chief reason is that each of the standards committees standardizes not only the products of its particular industry but also the raw material and semi-finished products which are used by this industry and purchased from outside sources. Now, these same raw materials and semi-finished products are used also by other industries, and if each of the industries taking up standardization should formulate its own standards for such materials, standardization, instead of a blessing, would prove a curse. A case in point is that of steel. The Society of Automotive Engineers has standardized a great many steels used in the manufacture of automobiles and other automotive apparatus. It has assigned a number to each steel, given the required chemical composition, worked out suitable heat treatments and made a beginning in tabulating the physical properties of these steels as affected by heat treatment.

Now, steel is used by all or practically all of the engineering industries, and if any considerable number should attempt to draw up standard specifications without regard to what has already been done it would lead to endless confusion. Even a change in the numbers which are used to designate certain grades of steel would be objectionable.

It is mainly because certain matters calling for standardization are of such wide import that there is need for a general standardization committee representing the entire engineering world. Such a committee, we understand, has been formed from the membership of the five great engineering societies. The actual work of standardization, the creative work, as it were, must necessarily be done by men in very close touch with the particular industry or branch of industry to which the standards apply, but there is a promising field for the general organization in supervising the work of the different branches so as to avoid overlapping of effort.

A National Automotive Body

LEGISLATION such as that which resulted in the new North Dakota law, providing that all purchasers of tractors, trucks, passenger cars and other motor-driven machinery shall have a "reasonable length of time" for inspection and testing before final acceptance, emphasizes forcibly one good reason for an active alliance of the manufacturers of all of these products—an affiliation on a truly national basis, an association comprehensively automotive. There are many other reasons equally good.

The makers of tractors, trucks and passenger cars have much in common. Their interest and well-being are linked closely together at many points. They can do much more for themselves as members of their individual industries by working together as members of a group made up of all. United action in matters of legislation, particularly, would be immeasurably more effective than individual effort. The matter of guarantees is a basic consideration which can be, and undoubtedly should be, worked out to a standard and uniform form of warranty. In patent matters, production methods, shipping, export, merchandising and many other problems which its potential members are called upon to solve, a National Automotive Chamber of Commerce could be of very great and very general benefit.

Steam for Tractor Work

IN view of past experience with steam in the automobile and traction engine fields it seems strange that there should still be such staunch adherents of this motive power as we occasionally hear from. Steam had a good chance in the automobile field and lost out. It had the traction engine field all to itself, yet according to latest reports the steam traction engine is rapidly becoming a thing of the past. In spite of these historical facts there are people who believe that if a steam vehicle or a steam tractor built in the light of the experience of the past twelve years were placed on the market, it would prove a tremendous success. The question naturally suggests itself why steam, if it has such obvious advantages as are claimed for it, did not succeed when it had all the chance in the world; but this will be met by the latter-day enthusiast with the rejoinder that its failure was not the fault of the system but of the men who sponsored it.

The strongest argument put forward by the steam champions is that regarding fuels. As long as gasoline was plentiful there was little chance of the internal-combustion engine being replaced by another type. But gasoline is becoming scarce, relatively speaking, as is shown by the rising price, and the heavier distillates, and eventually perhaps even the crude oil, must be resorted to for use as motor fuel. We know of methods of utilizing these heavy fuels in internal-combustion engines, but unfortunately engines running on such fuels are not flexible. Steam power retains its flexibility irrespective of the fuel used. The heavier petroleum fuels are subject to a number of inherent disadvantages such as dirt and ill smell. As the supply of gasoline becomes inadequate and the price in consequence rises the heavier fuels no doubt will be adopted first for commercial types of vehicles. In fact, this has happened already, in that most farm tractors are at present designed to burn kerosene. It must be admitted, however, that much of the kerosene-burning equipment put out at present handles the fuel rather unsatisfactorily. This difficulty might be overcome by burning the kerosene under steam boilers.

Old-style steam traction engines were of very heavy construction and unsuitable for use on moderate-sized farms. This objection it is proposed to overcome by entirely redesigning the power plant, basing it on automobile and similar experience. The question then would come up as to how such lightly constructed power plants would stand the heavy vibration on tractors. Inability of the piping of a steam system to stand up under severe vibration was the greatest drawback of the early steam cars. This difficulty was gradually overcome, but there is a great deal of difference between the spring-suspended passenger car frame and the rigidly supported tractor frame.

A complete change in the system of motive-power production would certainly be a radical step, but developments in the fuel situation may compel radical changes within another decade.

Road Construction

DURING the war the building of improved roads, which had received a mighty impulse in this country during the previous five years, lapsed more or less owing to the scarcity of labor and transportation and the high cost of materials. Now that the war is over there is every reason why road building should be resumed with vigor. There is no doubt that the country is prosperous. Our exports each month exceed the imports by enormous sums. Up to date our country has lent to allied Governments nearly ten billion dollars. Additional loans are being placed here by foreign Governments right along, and the money lent them does not leave the country, but is spent here for produce, raw materials and manufactured articles. Consequently the country does not lack the capital to finance road construction.

Road work would help in solving the problem of unemployment during the transition period. While eventually the industries of the country will be quite able to absorb all of the labor released by the Army, the munitions plants and the shipyards, the change from a war to a peace footing naturally takes time, and during the interval it will be difficult to find employment for all unless the Government decides on extensive construction work. The National Government has a certain moral responsibility to lighten the hardships of the transition period as much as possible, and the state governments share in this responsibility.

Many of the roads constructed previous to the war, and which have borne heavy traffic during the past two years, are in sad need of repairs. It is a known fact that a well-surfaced road, when holes once develop in it, goes to pieces very rapidly unless it receives immediate attention. During the past two years this was in many cases impossible, and many of the improved State roads have got into bad shape. These should be repaired at once.

Aside from repair work, the road-building programs of the several states that were interfered with by the war should be resumed immediately. The country has the necessary money, men and materials, and in no other way could it invest its surplus energy and its surplus wealth to such advantage as in the building of a well-constructed highway system.

Latest News of the

Protest Government Steel Price

Leaders of Industry Want Return to Supply and Demand—Alloy Steel Market Easy

DETROIT, April 22—That the Government must withdraw its minimum of $2.60 on steel in order to stabilize conditions, is the opinion of industrial leaders in the automobile field. These men feel that present prices are largely inflated, due to the establishment of the Government minimum, and that as soon as Washington allows them to get back to a supply and demand basis, business will move along far more stable lines.

Many of these industrial leaders have visited the mills and find them working far below capacity, showing that the demand is not of such a volume as would normally cause the maintenance of this high price. It is also apparent that if the price were allowed to come down to its own level, the mills would find an increase of business volume at once.

The alloy steel market is exceptionally easy, and automobile and parts manufacturers are finding no difficulty in securing quick delivery on all of the alloy steel they desire at reasonable prices. The only alloys which are causing any apprehension are the vanadium products, due to an alleged shortage of vanadium in this country. It is stated that ferro-vanadium which was stored in this country by the Vanadium Co. of America has been practically used up. It is also stated that but very little vanadium has been brought into the country during the past 2 years, on account of the lack of ships, and furthermore there has been a slip, or landslide in the valleys containing the ore producing the highest percentage of vanadium. Miners, therefore, have been compelled to use the ores containing much lower percentages until such time as the slip can be cleared away.

There is no one in the industry who feels competent to judge exactly what is going to happen to steel prices. In the first place, no one knows what Washington is going to do, and in the second place, conditions are such that all sorts of theories can be drawn from the situation, all of which sound reasonable, but are not conclusive. The opinions of leading purchasing agents in the field vary widely. There are some who even believe that the price of steel is due to take an upward rise on account of the release of heavy buying orders which have been held up during the government adjusting period.

It is believed that as soon as Washington removes its restrictions on the steel price, labor cost and living cost in the mill area will drop also. It is felt that the Government is unduly supporting labor and encouraging it in demands which prevent a firm adjustment.

Pending action by Washington, matters appear as if they were going to remain in their present uncertain state, resulting in a general tendency for buyers to use every precaution to protect themselves in advance releases.

$400,000 in First Overland Profit Share

TOLEDO, April 22—Willys-Overland employees Monday received $400,000 in checks in the company's first distribution of profits under the 50-50 profit-sharing plan announced in January. Approximately 15,000 shared in the profits, representing 9,843 at the plant here. The others are employees scattered throughout the country. The $400,000 represents 8 per cent of the wages paid during the first quarter of the year.

Maxwell-Chalmers Merger Effected

DETROIT, April 23—It is stated here by a high official of the Chalmers Motor Car Co. that the proposed merger between that company and the Maxwell Motor Car Co. has been effected. Details have not been made public. It will probably take about 10 days to work these out.

In New York, banking interests are non-committal, and in a statement given out to-day the merger is neither denied nor affirmed. The statement says: "It is true that the respective boards of directors of the Maxwell and Chalmers companies view favorably a combination of their interests, and those in control of affairs of both companies have been working toward that end, but the matter has not yet progressed sufficiently to make announcement of the details of the plan."

Rickenbacker Welcomed in Chicago

CHICAGO, April 23—Eddie Rickenbacker, spoken of by Lieut.-Col. H. M. Byllesby and George M. Graham in their welcome to America's ace of aces as "the epitome of the motor industry's effort in winning the war," was the guest of honor at a banquet to-night at the Congress Hotel, given under the auspices of the Chicago Automobile Trade Assn. About 800 men connected with the automotive trade in Chicago and the Middle West were present.

Hubbard Machine in SKF Industries

NEW YORK, April 22—The Hubbard Machine Co. will also be included in the consolidation, taking in the SKF Ball Bearing Co., the Hess-Bright Mfg. Co. and the Atlas Steel Ball Co., under the name of the SKF Industries, Inc.

Millions Being Invested in Canadian Plants

American Factory Sites Sought in Border Cities Under 6½% Preferential Tariff Lure

DETROIT, April 22—Every indication points to the establishment of scores of branch factories in Canada by United States manufacturing plants. At Windsor, Ont., it is estimated that $12,000,000 will be spent by Detroit, Toledo and Michigan companies alone. According to the Border City Chamber of Commerce, 93 big corporations are negotiating with that organization for factory sites in Windsor and its neighboring border cities.

General Motors Corp. is preparing to invest $6,000,000 in a plant at Walkerville, buildings totaling approximately $3,000,000 to be erected this year. The Maxwell-Chalmers Co. will spend $1,000,000 in new units and additions to its present plants. The Champion Spark Plug Co. proposes a $300,000 factory at Windsor, and the Auto Specialty Co., St. Joseph, Mich., contemplates a $250,000 establishment. Kelsey Wheel Co. is building additions which will nearly double present production. Motor Products Co. will soon start work on a big plant to care for Canadian trade. The Canadian Steel Corp. is progressing steadily with its $40,000,000 plant at Ojibway.

The Republic Motor Truck Co., Alma, Mich., has decided to locate its Canadian plant at London, Ont. A building site there has been selected and work on the new establishment will start immediately. During the course of erection an old munition factory will be used for the stocking of parts and possibly some assembling in a small way until the new factory is ready.

The 6½ per cent preferential tariff, which Great Britain has put in effect to assist the Dominion in expanding her export trade, is the bait drawing American manufacturers to the border cities.

This tariff supersedes the embargo on Canadian goods, giving them free access to the British Isles and all British possessions. The ruling of the British War Board, that articles assembled in Canada are to be considered Canadian goods, has reacted very favorably upon the American manufacturer, who sees in a Canadian assembly plant an open road to the British foreign market.

The movement of automotive parts makers, which is causing them to establish branches in Canada, gives the Detroit automobile manufacturer the opportunity to build his car in Canada from Canadian made parts almost complete with the exception of a few major units.

Automotive Industries

Lack of Skilled Labor in Detroit

Return of 85th Division With 3000 Skilled Mechanics Eagerly Awaited—Local Restlessness

DETROIT, April 22—There is a marked and rapidly growing labor shortage in this city and vicinity. Three months ago there were 35,000 men out of work and Detroit was wondering what to do with its returned soldiers. To-day Detroit is clamoring for the return of the 85th Division, now on its way home, and which includes nearly 3,000 of Detroit's skilled mechanics. Unskilled labor is plentiful.

The situation in neighboring towns is similar. In Flint, Jackson, Lansing and other small industrial centers in Michigan and Ohio there is a demand for skilled workers. Toolmakers are a rarity. And yet labor in this vicinity is restless. Toledo is the focal point of unrest, and has a number of strikes in various industries now in progress. Detroit also has a number of workers in various industries out, but only one prominent concern in the automobile business has been affected, and this strike has been practically broken.

Toledo Feels Effects, Too

In Toledo the workers at the Bock Bearing Co. are out, demanding higher wages and an 8-hr. working day. The workmen at the Willys-Overland Co. have presented a set of demands calling for wage increases, running up in some instances as high as 40 per cent. The demands were refused by the Overland company, which is at the present time making a thorough reclassification of its wage rates to bring them in line with what is paid at other plants in similar lines. These will be finished within a few days. In addition to this, the company made its first quarterly distribution of profits yesterday, amounting to $400,000. This had a marked steadying influence on the workmen, and it is thought that the unrest will soon blow over.

At the Wadsworth Mfg. Co., Detroit, where a great many closed Ford bodies are manufactured, 1500 automobile body builders have quit. This company refused to recognize the union and has taken practically all the heart out of the strike by to-day announcing a profit-sharing plan, with a minimum wage scale of $6 per day, patterned exactly after the Ford plan. This concern operates 8½ hr. per day, with no work Saturday afternoon. No shut-down was necessary, as the Ford Motor Co. continued operations with its own workmen.

What troubles there are are confined to the large centers. In the smaller manufacturing towns the stable element, composed of older men and men who are property owners, is in a much greater proportion. Outside agitators are not successful in the smaller towns, and there is a far greater feeling of content. Furthermore, the co-operation between municipalities and labor is much closer, because in the smaller towns the manufacturing element has a greater control of the city's affairs. The result is that matters are conducted along lines which are of the greatest advantage to the workmen. An example of this is shown in the case of Flint, where co-operation with the merchants and manufacturers resulted in a 15 per cent decrease in the average living cost.

It is the younger element which is at the bottom of most of the trouble, and the returned soldier is not idle either. Hundreds of young men who, while single, lived very well on their wages, married immediately upon their return from service. They have gone back into the shops, and while their pay-checks are somewhat larger than before the war, the extra expense of a wife and home has caused the wage problem to become one of vital importance. When a movement for increased pay is started these young men may usually be found backing the movement to the limit.

The soldier is also returning with his head full of exaggerated high-wage stories picked up overseas and in training camps. He had heard of high wages paid during the war and expects the same scale to be continued. He thinks practically every man in the shops received from $10 to $12 daily, and it is hard for him to believe that most of the high-wage stories were myths. In certain trades experts working on a piece basis did make exceptionally large wages, but such cases were but a moderate percentage.

These men apply for jobs and at the outset are disappointed with the scale. They are continually quitting and going elsewhere, hoping to better themselves. This attitude spreads to others, and as a result the labor turn-over this spring is 50 per cent more than last year. A great many of the automobile workers are joining the United Automobile, Aircraft and Vehicle Workers' Union, which is a new but strong organization and which, like a great many new organizations of this kind, seems anxious to test its strength.

Goddard Joins Militor

NEW YORK, April 24—H. A. Goddard has been appointed director of sales and advertising of the Militor Corp., New York, which last week was merged with the Knox Motors Co., Springfield, Mass. For several years Mr. Goddard was connected with the Standard Parts Co., Cleveland, as export manager and eastern representative, located in New York, and later in charge of sales for the State of Michigan, with offices in Detroit.

English Import Bars Let Down

To Permit Entry Until Sept. 1, 1919, of Five-twelfths of Automotive Apparatus Imported Between Jan. 1 and Sept. 1, 1913

NEW YORK, April 24—England has let down the bars against American automotive products. Effective immediately, the Controller of Import Restrictions will allow entry into England under license of 50 per cent of the number of motor cars, motor trucks, motorcycles and accessories imported between Jan. 1, 1913, and Sept. 1, 1913.

The restriction to this amount is to be maintained until Sept. 1, 1919, and applies also to forgings and castings for motor vehicles. Spare parts, however, are to be admitted freely under license, but only for renewal purposes and to repair such vhicles as are now in use. All imports are to be licensed in proportionate monthly quantities.

Each importer must apply for an individual import license and submit a sworn statement as to his imports during 1913. According to a cable from Consul-General Robert P. Skinner, London, the term automobiles is stated to cover motor vehicles of all kinds. Though trucks are not specifically mentioned, it is understood that they are included.

First information regarding the letting down of the bars came to the N. A. C. C. in a cable from C. C. Hanch, who is at present representing that body in England. This has since been confirmed by the Bureau of Domestic and Foreign Commerce in Washington.

Records of this bureau are not arranged by calendar years. However, the following figures will give some idea of American imports during the 1913-1914 period:

	1913		1914	
	Number	Value	Number	Value
Cars	2,783	$2,893,785	6,992	$5,615.487
Trucks	184	119,468	203	189,099
Motorcycles.	1,036	203.734	1,604	320,009
Parts	...	922,866	....	1,282,388

If the five-twelfths referred to means the months of April, May, June, July and August, then half of the sum of the two years, divided by two to give one-half year, approximately, will permit about 40 trucks and 1120 passenger cars to be imported.

Would Break Patent Licensing Plan

Locomobile Sues N. A. C. C. Over Agreement—Alleges It Hampers, Not Helps

NEW YORK, April 23.—The Locomobile Co. of America, whose president, Andrew L. Riker, was a vice-president of the National Automobile Chamber of Commerce at the time that body proposed and adopted its patent cross-licensing plan, and who is at present a member of that body's patent committee, is suing the National Automobile Chamber of Commerce for annulment of the entire cross-licensing agreement.

The importance of the suit may be judged in part by the fact that in principle it involves some 500 patents, which, since the agreement became effective Jan. 7, 1916, have been pooled by the 112 members of the association.

The suit is entirely a friendly one. The relations between the Locomobile company and the N. A. C. C. have always been entirely cordial. The Locomobile company believes, however, that the patent cross-licensing plan operates to defeat inventive genius and to "obstruct and prevent the natural development of the automobile." It is also alleged that the "inevitable effect of the agreement is actually to prevent the members of the respondent (N. A. C. C.) from making any effort toward, or incurring the expense of, developing and devising new inventions and obtaining patent protection therein, since, by so doing, the entire automobile industry is forthwith, by the terms of the agreement, given an equal right in and to the new inventions without paying any consideration therefor, not even to the extent of reimbursing the party who devised, developed and patented the invention, or any part of the cost thereof."

In further detail the complaint alleges that the arrangement tends to prevent manufacturers maintaining desirable and necessary engineering departments; that it has deterred members from developing new inventions and that in consequence of this and other charges a "great injury has been done to the automobile industry and the normal progress of the art has been interfered with, obstructed and impeded instead of being promoted as public policy requires."

The complaint alleges further that because of the situation which it outlines, the Locomobile company cannot, "with proper regard to its own interests, continue originating and experimental work and devising and working out inventions."

It is also claimed that the agreement operates as an undue and unlawful restraint upon trade and that it was "so conceived and put into effect by a few members of the respondent who conspired together to induce manufacturers of motor vehicles to execute the agreement not for the purpose as alleged therein, of avoiding patent litigation, but to secure to the respondent a virtual monopoly in and the control of the patent field of the industry, thereby increasing its power and influence therein and giving it the authority to dispose of property of incalculable value."

The Locomobile company asks in its complaint:

1—That the respondent, National Automobile Chamber of Commerce, its attorneys, counselors, officers, agents, employees and servants be enjoined from taking any steps to enforce the cross-licensing agreement referred to in the bill of complaint as against the "Locomobile" Company of America, or any other signer thereof, or from granting any licenses or taking any further action under the terms and provisions thereof, all until the further order of this Honorable Court.

2—That this Honorable Court shall order and decree that the cross-licensing agreement referred to in the bill of complaint is null and void in law, and that it be canceled and all rights acquired by any parties thereunder be restored to those parties who granted such rights under the terms of the aforesaid agreement.

3—For such other and further relief as to this Honorable Court may seem meet.

The complaint recites in detail the modus operandi of the agreement, which in brief is as follows:

The agreement was not to become effective until at least 61 manufacturing members had put into the pool at least 300 patents, and between April, 1915, and Jan. 7, 1916, this condition had been complied with and the agreement became effective on the latter date. It is to remain in force until Jan. 1, 1925.

Patents are designated "A" when they are what may be termed development patents, and "B" when they cover design "of a striking character, involving a radical departure, or a radical change, from what is known and resulting from an inventive effort of a high order, rather than a mere improvement. . . ."

Members were required to pool only their so-called "A" patents, in return for which they were given the privilege of using some 500 other "A" patents which already had been placed in the pool.

French Factory Adopts 8-Hour Day

Gnome & Rhone First to Introduce Change

PARIS, April 1—The Gnome & Rhone aviation and automobile company introduced the 8-hour day this week, with one shift. In this factory work now begins at 7:45 a. m. and finishes at 4:15 p. m., the workmen having half an hour for lunch, this time being paid them at full rates.

This is the first time a single shift 8-hour day has been tried in France. Laurent Séguin, head of the Gnome factory, concluded that there was considerable inefficiency under the 10-hour day, which began at 7 in the morning and finished at 8 at night with a 2-hour stop at midday for lunch. Under this system life was monotonous. Two of the best hours of the day were lost in eating, or in going to and returning from home. After the heavy midday meal there was at least one hour during which inefficient work was accomplished.

Before the single shift 8-hour day could be adopted it was necessary to provide dining halls for the men. Under the French factory act it is forbidden for workers to eat in the shops. Since the armistice, the Gnome company has been able to transform some of its buildings into dining halls, where men can eat without going off the premises and without any loss of time.

"Reasonable Time" to Inspect Tractors

North Dakota Law Permits Buyers to Rescind Sale on Machines "Not Satisfactory"

FARGO, N. D., April 22—Hereafter North Dakota farmers who purchase tractors are to be given a "reasonable time" in which to decide whether they are satisfactory or not.

At the last session of the North Dakota Legislature a bill was slipped through giving them this privilege, and the bill has been signed by Governor Frazier. Under the terms of the measure the purchaser is given "a reasonable time after delivery for the inspection and testing" of the machine, "and if it does not prove to be reasonably fit for the purpose for which it was purchased the purchaser may rescind the sale." Following is the complete text of the bill:

Section 1. Reasonable time to discover defects. Any person, firm or corporation purchasing any gas or oil burning tractor, gas or steam engine, harvesting or threshing machinery for their own use shall have a reasonable time after delivery for the inspection and testing of the same, and if it does not prove to be reasonably fit for the purpose for which it was purchased the purchaser may rescind the sale by giving notice within a reasonable time after the delivery to parties from whom any such machinery was purchased, or the agent negotiating the sale or made delivery of such personal property or his successor, and placing the same at the disposal of the seller.

Section 2. Provisions contrary to the preceding section void. Any provisions, any written order or contract of sale or other contract which is contrary to any of the provisions of this act is hereby declared to be against public policy and void.

Some little apprehension is felt over the indefinite language of the bill. It is thought that interpretations will be generally in favor of farmers who may be disgruntled or dissatisfied over some little thing which might ordinarily be fixed at very small expense.

Despite the possibility of remedying such slight defects, however, the bill specifically gives the farmer the right to refuse the manufacturer the privilege of making them. Tractor men feel that they face a serious situation.

As a companion to this law another was passed by the same legislature and also signed by the Governor which provides that manufacturers selling tractors in North Dakota must maintain at least one supply depot within the State and keep in it a full and complete stock of repairs. Following is the text of the measure:

Section 1. On and after the taking effect of this act it shall be unlawful for the manufacturers of any gas or oil burning tractors, steam or gas engines, harvesting and threshing machinery, automobiles and auto trucks to sell or deliver within this state any such gas or oil burning tractor, steam or gas engine harvesting and threshing machinery, automobile or auto trucks without having first established at least one supply depot within the state where shall be kept constantly on hand a full and complete supply of repairs for the same.

Any manufacturer selling or delivering or causing to be sold or delivered any such machinery in violation of this act shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined not less than $25 and not to exceed $200 for each offense.

Legal Standards for Gasoline Proposed in California

Three Bills Now Before State Legislature Fixing Standard Specifications for Fuel and Lubricants and Providing for Inspection and Analysis Are Opposed by Automotive Trade and Oil Producers

SACRAMENTO, April 17—Three separate efforts to standardize gasoline specifications by legislation are represented by as many different bills now before the California State Legislature. These bills seek to define gasoline and fix a standard of quality. One of them also defines distillate, fixes a standard for this product and provides for its coloring "in a manner sufficient to show clearly if one part of same is added to seven parts of gasoline." The third bill is entitled "an act to prevent the manufacture, sale or compounding of adulterated or misbranded gasoline, benzine, naphtha, lubricating oils and greases, etc., and to regulate the traffic therein and providing for their inspection, analysis, standard grades and standard tests."

These bills are naturally meeting with the opposition of the trade in California and it is expected that they will receive due attention from the industry as a whole because of the widespread consequences which would result from misdirected attempts at legislation of this kind.

In his report on these bills, filed with the Committee on Oil Industries, G. M. Swindell, secretary of the Chamber of Mines and Oil of California, said the following:

There are three bills before the present session of the California State Legislature which propose to fix specifications for gasoline and make certain other restrictions in connection with petroleum products.

Defines Quality of Gasoline

Senate Bill 127, introduced by Charles W. Lyon of Los Angeles, provides that the standards of quality and strength for gasoline, benzine, and certain other petroleum products shall be those adopted or that may be adopted by the U. S. Bureau of Mines, with the proviso, however, relating to gasoline, that it shall have a specific gravity of 60 deg. Baumé.

Discussing the principal provisions of this proposed bill, it might be said, first, that the U. S. Bureau of Mines does not fix standards, and cannot reasonably be presumed to fix standards in the future. Furthermore, if the Bureau of Mines were to fix standards for gasoline, it is certain that the qualified technicians on the bureau's staff would not mention gravity as a controlling factor of such specifications.

The gravity test for gasoline, as every automotive engineer and practically every business man interested in the automotive industry understands, was cast into the discard long since—it being amply demonstrated as of no scientific nor practical value. It is also a well-known fact to both automotive engineers and oil refiners that, even though scientific investigation had not demonstrated the fallacy of this test, the constantly increasing demand for gasoline of the quality manufactured years ago (with no corresponding proportionate increase in gasoline-producing crude petroleum) would have made the price of that particular product prohibitive; or, with a limited supply available, the development of the automotive industry in its various branches would have been seriously hampered.

Assembly Bill 108, introduced by Assemblyman Samuel Knight of San Bernardino, merely proposes to establish a standard for gasoline of 60 deg. Baumé at 60 deg. Fahr.

Introduced by a Layman

This bill, introduced by a layman, is typical of the lack of knowledge of the average man, even the average user of gasoline, of what would constitute gasoline specifications. It is not believed at this writing that it will be given any consideration by the legislature.

Senate Bill 711, introduced by Senator W. B. Shearer, at the request of the State Superintendent of Weights and Measures, as originally introduced, is also typical of what may be expected from superficial knowledge of such a complicated subject.

As originally introduced this bill defined gasoline as "a petroleum product obtained through the distillation of crude petroleum, water white, refined and free from all impurities." Its provisions, if it had been enacted as originally prepared, would have entirely eliminated casing-head gasoline from the California markets, and during 1918 we produced over 600,000 barrels (over 25,000,000 gallons) of this product, which was scientifically blended with distillate, a refinery product, and helped take care of the enormous demand for gasoline during that year.

One of the few sensible matters in this proposed bill was that its proponents specifically set forth that gasoline should be subjected to test in accordance with the distillation method set forth in Technical Paper 166, U. S. Bureau of Mines. However, later the chemist for the Superintendent of Weights and Measures decided that he would prefer not to use any cotton on the bulb of the thermometer, as prescribed in this method of testing, and proposed to incorporate an amendment eliminating its use.

It was originally planned to contest the passage of this bill because of its inconsistencies and incongruities; also because of the lack of knowledge of the situation shown by its proponents. However, better counsel prevailed, and after a number of conferences with the Superintendent of Weights and Measures, he was finally persuaded to amend the proposed bill in some particulars, substituting the so-called "navy specifications" with a 428 deg. end point for those he proposed. He at first "stood pat" on his definition of gasoline, but at to-day's writing he is convinced of the inadvisability of eliminating casing-head gasoline as a part of the available supply, and has intimated, somewhat reluctantly, that he will submit an amendment with that idea in view.

The chemist for the superintendent has also agreed to a specification of 10 milligrams of cotton on the bulb of the thermometer.

Bill Rewritten

The bill as originally proposed has been practically rewritten, and is now under consideration by the committee of the California state senate, in its amended form. As amended, after the several conferences with the superintendent of weights and measures, we have a reasonably logical bill against which we can present arguments and have eliminated its ridiculous features.

There are certain broad aspects connected with this question of fixing specifications in which both automotive engineers, the automotive industry and the oil refining industry are interested.

The particular problem confronting the oil industry to-day is one of utilization of petroleum and its products to the best possible advantage, consistent with the laws of supply and demand, and having in mind a desire to maintain reasonable and uniform prices to the consumer.

The principal outstanding fact for consideration is the production in California of gasoline-producing crude petroleum. Gasoline is not made from crude petroleum, but is extracted from it. No cracking processes have yet been developed to handle our asphalt-base crude oil, though thousands of dollars are being spent monthly by the California refiners to perfect such processes. It will be conceded, in the light of production figures which I will give you, that the development of such processes will aid materially in the solution of our problem, and may even permit California refiners to help the Middle West and East.

We produced in California in 1918 in excess of 100,000,000 barrels of crude petroleum.

Of this production, approximately 50 per cent has no extractable gasoline content, and was burned as fuel under the locomotive and industrial boilers of the territory we serve.

According to statistics compiled by the Pacific Coast Petroleum Administrator, operating under the U. S. Fuel Administration, our total production of gasoline in 1918 was 7,000,000 barrels.

This production was made up of 6,400,000 barrels from refineries and 600,000 barrels of casing-head gasoline.

It has been the custom of California refiners to accumulate appreciable stocks of gasoline during the winter months, to enable them to care for the demand when the "peak-load" arrives, during the months from June to November.

Our production for 1917 was 5,700,000 barrels, and on Jan. 1, 1918, we had in stocks on hand 813,443 barrels. However, notwithstanding a production of 7,000,000 barrels in 1918, an increase over 1917 of 1,300,000 barrels (with no corresponding proportionate increase in gasoline-producing crude), we only had available on Jan. 1, 1919, in stocks on hand, 573,372 barrels.

And this situation developed during a period when every effort was made to curtail the use of gasoline and eliminate its waste. Furthermore, this stock on hands of the large refining companies, and our small refineries, notably in the southern part of this state, are operating to-day on a day-to-day basis in supplying their trade, and have been unable to accumulate any stocks to care for the certain increased demand to come in summer.

In California, with a constant decrease of stocks on hand; an enormous increase in the price of gasoline-producing crudes; with a 24-gravity oil selling at $1.30 per barrel at the well; facing a yearly increase in consumption of between 20 and 30 per cent; and with no immediate indication of any increase in gasoline-producing crude production, we are face to face with a problem which requires the most careful and serious consideration when one considers the fixing of gasoline specifications to endure for a period of two years.

If the proposed specifications were contained in a city ordinance, there would be little or no criticism. City ordinances can be promptly corrected to meet changed conditions, but a state law remains in effect for a period of two years, and must be subject to continual and deliberate violation, or the users of the product in that state must be deprived and shipments made to localities lacking onerous restrictions, or those with which it is impossible to comply.

A Problem for Business Man and Engineer

This is a mutual business problem, not legislative, and must be solved by representatives of the automotive and oil industries. The refiners can only furnish the automotive industry with the extractable gasoline in the crude produced; and automotive engineers must provide power-producing engines which will use to advantage the power product available. The question is really one of securing thermal efficiency, and it is to this feature of the problem that automotive engineers must direct their attention.

The pressure upon the oil industry, both the production and refining departments, of the demands from the automotive industry, has caused a material change in the supply of motor fuel, and there is a real danger of reaction to the disadvantage of the consumer.

It is obvious that when you fix by law the quality of a product, you must of necessity automatically regulate the price of that commodity, provided the supply and demand continue uniform; but should the supply decrease, or should the supply remain normal and the demand increase, it necessarily follows that some one must be deprived of the product, or more naturally, that the constantly increasing demand will force higher prices for the available product.

Exports of Cars, Trucks and Parts by Countries for February, 1919

Countries	Commercial Number	Commercial Value	Passenger Number	Passenger Value	Parts Value
Belgium	...	......	3	$12,400	$1.710
Denmark	5	$13,035	36	48,289	4,653
France	670	3,035,379	82	281,131	203,788
Greece	10	25,720	21	38,906	23,949
Italy	1	2,731	1	1,500	500
Netherlands	...	......	...	......	190
Norway	31	75,175	26	28,874	7,271
Portugal	...	......	2	3,500	2,098
Spain	1	1,145	36	43,665	9,497
Turkey in Europe	59	97,305	27	13,878	13,026
England	9	14,247	3	2,836	760,302
Scotland	...	......	...	......	13,111
Ireland	...	......	...	......	700
British Honduras	...	......	...	......	781
Canada	128	132,873	281	290,788	579,102
Guatemala	...	......	...	......	269
Honduras	1	300	...	......	990
Nicaragua	...	......	4	3,616	2,187
Panama	1	550	6	6,150	5,819
Salvador	...	......	7	9,346	1,206
Mexico	47	42,416	203	149,536	45,324
Newfoundland	...	......	5	5,779	362
Barbados	...	......	3	2,499	159
Jamaica	...	......	1	1,000	4,716
Trinidad	6	3,300	9	5,670	7,163
Other Br. W. Indies	3	1,650	1	595	2,547
Cuba	34	92,429	...	290,807	141,141
Virgin Islands	1	3,350	...	......	74
Dutch West Indies	...	......	4	2,737	250
French West Indies	1	1,800	2	2,151	3.660
Haiti	1	550	21	22,344	930
Dominican Republic	...	......	5	9,346	1,627
Argentina	11	21,794	213	324,193	38,287
Bolivia	...	......	...	......	536
Brazil	5	9,765	121	148,673	87,869
Chile	3	7,672	64	152,919	57,331
Colombia	...	......	3	2,301	4,375
Ecuador	...	......	2	2,734	2,242
British Guiana	...	......	2	1,025	992
Dutch Guiana	...	......	...	......	41
Peru	4	10,540	77	147,961	24,845
Uruguay	1	1,070	25	38,106	17,621
Venezuela	2	1,360	24	27,346	10,920
China	19	45,530	112	145,383	19,379
British India	6	11,700	44	58,428	60,214
Straits Settlements	7	21,150	2	2,055	21,538
Other Br. East Indies	...	......	...	......	16
Dutch East Indies	23	62,923	72	72,911	33,542
French East Indies	...	......	16	19,736	......
Hongkong	16	19,792	30	38,493	1,342
Japan	183	292,294	199	265,508	31,520
Siam	...	......	35	27,464	630
Turkey in Asia	10	14,500	10	6,978	2,756
Australia	16	15,678	493	447,408	135,291
New Zealand	43	78,372	222	225,262	84,662
Other British Oceania	...	......	...	......	802
French Oceania	...	......	...	......	50
German Oceania	...	......	...	......	67
Philippine Islands	38	90,627	131	125,943	55.130
British West Africa	2	3,276	...	......	1,077
British South Africa	4	18,544	140	159,483	86,574
British East Africa	...	......	1	982	271
French East Africa	...	......	1	800	8,547
Morocco	...	......	...	......	6.121
Portuguese Africa	...	......	...	......	134
Egypt	...	......	...	......	5,917
Total	1,403	$4,270,542	3,041	$3,719,485	$2,699,741

This table supplements the one which appeared in the March 27 issue of AUTOMOTIVE INDUSTRIES, *and gives figures for all of the individual countries, including those generally grouped under the collective heading "Other Countries."*

Foreign Trade Boom Continues

WASHINGTON, April 19—Exports and imports for March continue to show a large increase as compared with previous months, according to figures received by the Bureau of Foreign and Domestic Commerce. Exports for March totaled $605,000,000 as compared with $508,000,000 in February and $523,000,000 in March, 1918.

For the 9 months ended March, 1919, exports totaled $4,991,000,000, an increase of $600,000,000 over the corresponding period last year. Imports for March totaled $268,000,000 as against $235,000,000 in February and $242,000,000 for March, 1918.

Government Opposes Gasoline Combine in Trinidad

WASHINGTON, April 19.—The government of Trinidad, British West Indies, has taken steps against a gasoline combine by which prices of gasoline have been increased to 48 cents per gal. The consumption of gasoline in Trinidad is 360,000 gal. a year, used chiefly for automobiles, and up to two years ago local dealers buying their supplies from the United States, paid 28 to 34 cents per gal. About that time local oil companies formed a pool, and in order to develop and protect the local companies, the government granted them exclusive use of a government warehouse, following which the combine immediately advanced prices to 48 cents.

Evidence produced at a recent lawsuit proved that gasoline sold locally for 48 cents cost only 18 cents, with an excise tax of 6 cents, making a total of 24

cents. The Trinidad government has given the local companies 30 days' notice to discontinue storage of gasoline in the government warehouse, and has invited storage of American gasoline. This offer will be accepted as soon as shipping rates, which are now prohibitive, are reduced.

Can Ship to Leeward Islands

WASHINGTON, April 19—Exporters in the United States can now ship into the British Leeward Islands, all prohibitions against importations having been removed on all commodities.

Can Ship Tractors to Tunis

WASHINGTON, April 19. — Farm tractors, parts and accessories can now be shipped freely without import licenses to Tunis.

Exports of Automobile Tires, by Countries, During February, 1919

Country	Value
Belgium	$14,026
Denmark	1,670
France	61,336
Greece	21,858
Norway	26,356
Portugal	1,115
Spain	56,228
Turkey in Europe	47,512
England	176,878
British Honduras	1,288
Canada	46,688
Costa Rica	449
Guatemala	11,831
Honduras	1,676
Nicaragua	2,664
Panama	58,984
Salvador	15,178
Mexico	71,836
Newfoundland and Labrador	167
Barbados	2,243
Jamaica	20.060
Trinidad and Tobago	7,519
Other British West Indies	620
Cuba	166.085
Danish West Indies	50
Dutch West Indies	241
French West Indies	14,751
Haiti	5,686
Dominican Republic	4,545
Argentina	56,546
Bolivia	1,478
Brazil	86,349
Chile	119,129
Colombia	13.550
Ecuador	4.078
British Guiana	424
Dutch Guiana	175
Peru	40.817
Uruguay	69,105
Venezuela	19,588
China	6,421
British India	154,904
Straits Settlements	69.103
Other British East Indies	773
Dutch East Indies	57,977
Hongkong	12.477
Japan	20,414
Turkey in Asia	9,306
Australia	10,315
New Zealand	208,699
Philippine Islands	111.604
British West Africa	340
British South Africa	11,478
British East Africa	14,822
French Africa	1,600
	$1,941,012

Rubber Imports Again Double

28,223 Tons Twice February Figures—Highest March Record in Years

NEW YORK, April 18—Rubber imports for March reached a figure not attained by any single month in the past four years. The 28,223 tons of crude rubber brought in last month more than doubled the 14,079 tons for February, and as compared with 17,161 tons for March, 1918, showed an advance of 11,062 tons.

The Rubber Association of America has compiled the following list of importation figures for crude rubber for the past four years:

	1916 Tons	1917 Tons	1918 Tons	1919 Tons
January	9,162	12,788	16,084	7,235
February	1,597	10,162	13,108	14,079
March	10,070	18,624	17,161	28,223

John Simmons Adds Truck Export Line

DETROIT, April 21—The John Simmons Co., New York, which exports hardware, machinery, plumbing supplies and other similar lines, is establishing a truck division and proposes not only to export motor tucks but to act as truck distributer in the New England States. Last year the company took over the export sales of the Nelson Truck Co., Saginaw, and the experiment was so successful, especially in the Latin-American countries, that this year it is going into the truck business on a large scale.

The Simmons Co. has just signed with the Nelson Co. to handle its distribution in all New England States, New York, eastern Pennsylvania and the northern half of New Jersey. Its export territory includes central and southern Europe, all of Asia, British Isles, Norway, Sweden, Denmark, Mexico and eastern South America.

G. E. Lyons has been made sales manager of the truck division. He was formerly with the eastern office of the Garford Truck Co. Hoyt Spelman will have charge of the export department. He has been connected with the export department of the Simmons Co. for a number of years.

The Simmons Co. will start immediately to build a warehouse on Long Island. It will be 80 x 100, constructed of concrete, steel and brick.

Exports of Tractor Engines During February, 1919

Countries	Number	Value
France	561	$768,915
Turkey in Europe	10	14,564
England	810	560,879
Canada	413	407,621
Guatemala	2	1,160
Honduras	1	920
Mexico	44	39,051
Barbados	1	1,450
Cuba	9	10,250
Dominican Republic	1	1,699
Argentina	13	16,556
Brazil	27	10,240
Chile	1	2,050
British Guiana	1	2,000
Peru	25	38,875
Uruguay	21	16,500
British India	3	2,359
Straits Settlements	2	926
Japan	10	58,458
Australia	29	27,405
New Zealand	21	14,852
Philippine Islands	82	78,373
British South Africa	68	8,704
Morocco	90	61,345
Total	2,245	$2,145,152

1135 Tractors Sold by Canada at Purchase Price

OTTAWA, ONT., April 19—In 1918 1135 farm tractors were purchased by the Canadian Food Board of the Department of Agriculture. The price paid was $750 f.o.b. Dearborn. No duty was paid. The retail price to farmers in Ontario, Quebec, Nova Scotia, New Brunswick, P. E. I., British Columbia, was $750 f.o.b. Dearborn. The price to farmers in Manitoba, Saskatchewan, Alberta, was $795 f.o.b. point of delivery. They have all been sold.

Conference on Weights and Measures

WASHINGTON, April 19.—A conference on weights and measures will be held here at the Bureau of Standards May 21-24. Officials are being invited from the various states, together with representatives of industry, and the discussions will relate to the present independent State legislation on weights and measures, the possibilities of changing present standards, etc.

British Manufacturers Striving for Greater Permanence in Magnetos

LONDON, April 8—Though claims are being made for the superiority of British magnetos over the former Bosch machines, engine manufacturers are not entirely agreed upon this in that the average performance of the British-made magneto is not so high as it should be. The trouble lies apparently in the magneto lacking the required ratio of permanence of coercivity in the magnets. There is a strict ratio between these two necessary, and it is in this direction that the British magneto specialists are making special efforts.

One of the points investigated is the substitution of chromium steel for tungsten steel. Bar magnets of chromium steel, stored for a year without being exposed to any disturbance, kept their magnetic moment constant within 0.3 per cent and less. In all the cases the changes observed were within the limits of the experimental error in the second half of the year.

As regards constancy to heat variations, concussions and temperature coefficient, the chromium steel proved equal to tungsten steel, but in respect of coercive force and permanence the best chromium steel did not come up to the best tungsten steel. The temperature coefficient of the magnetic moment diminishes with increasing content of dissolved carbon and was found to be zero in a 1.4 per cent carbon steel.

To investigate the suitable ratio of length to diameter in the case of bar magnets, a chromium steel originally 22 cm. long and 0.6 cm. in diameter was gradually shortened to a length of 2.4 cm. This shortening raised the temperature coefficient from 2.4 per cent up to 4.2 per cent. The ratio of length to diameter, *l/d*, was also found not to be without influence on magnetometer determination of the coercive force. When the value of *l/d* fell below 10, these determinations gave too low values.

—

American Automobiles Dominate in Dutch East Indies

WASHINGTON, April 21—The American automobile dominates the markets of the Dutch East Indies and will probably continue to do so, according to Consul A. E. Carleton, who reports that there are 12,000 cars in use in the country, and that since 1915 practically nearly all imported and sold have been of American manufacture. Previously Italian and French cars were popular. Imports in the last three years have averaged 2500 cars per year.

Special requirements for automobiles in the Dutch East Indies, which should be considered by American manufacturers, according to Consul Carleton, are an adequate cooling system, as the climate is tropical; a powerful flexible engine, because of the numerous hills and long distances, and powerful springs, because of the rough roads. Manufacturers will also do well to give more thought to the details and finish of both engines and bodies.

The truck market is comparatively undeveloped. There are only 200 in the country. Motorcycles are quite common in Batavia and Weltevreden. Government construction of highways has just been undertaken in Java, and numerous roads are being built.

—

Men Needed for Air Service

WASHINGTON, April 21—The Air Service of the United States Army is in need of mechanics, including airplane, airplane engine, bench and radio makers, tool makers, metal workers and coppersmiths, balloon and airplane fabric workers, cabinet makers and balloon riggers. Enlistment in the Air Service offers advantages to the skilled mechanics, who in a majority of cases are given non-commissioned officerships. Enlistment can be made for one year if a man has had previous experience in the Air Service. Enlisted men can also learn to fly if they are physically fit and have sufficient mechanical knowledge.

—

Perfex Radiator Makes Statement of Financial Condition

RACINE, WIS., April 19.—The Perfex Radiator Co., which on March 28 was made defendant in involuntary bankruptcy proceedings in the Federal court at Milwaukee, has filed schedules showing assets of $1,248,506, and liabilities of $227,319.

Wages in Industry Decrease 8.6 Per Cent

WASHINGTON, April 21—A decrease is notable in the wages paid in the automobile industry in comparison with the months of December, 1918, and January, 1919. A decrease is also apparent in numbers employed. During the month of January, 1919, 50 car makers employed 117,844 workers, as compared with 124,902 in December, 1918, a decrease of 5.7 per cent, while at the same time the wages for January, 1919, totaled $3,041,762, as compared with $3,329,139 in December, 1918, a decrease of 8.6 per cent.

Similarly, a decrease of wages greater than the decrease of workers is reported by other industries, such as car building, boots and shoes, cotton finishing, iron and steel and paper manufacture. The iron and steel industry, for example, laid off 1.6 per cent of its workers and at the same time decreased its wages 5.1 per cent.

—

New Company to Make All-Steel Wheels

KENOSHA, WIS., April 21.—The Kenosha Wheel & Axle Co. is being organized with an authorized capital stock of $550,000 as a development of the Whitcomb Tool & Machine Co. The new company will specialize in internal spur-gear drive axles and a new type of all-steel wheel for commercial cars. James A. Whitcomb, proprietor of the old concern, will be president and manager of the new company. For the present the Whitcomb shops will serve as a factory, but a site is being purchased whereon to build a complete new manufacturing group.

—

Fulton Stock Not to Be Sold in Michigan

DETROIT, April 22—The Michigan Security Commission has refused permission to the Fulton Motor Truck Co., Farmingdale, L. I., to sell its stock in Michigan. The stock has not been approved by the commission, which threatens to bring suit against Torrey & Co., Inc., New York brokers, who have just started a sales campaign here.

—

Refined Dixie Flyer for $1,365

LOUISVILLE, KY., April 21.—The Kentucky Wagon Mfg. Co. has brought out a refined model of its Dixie Flyer, which is to sell for $1,365, with either touring or roadster body. Among the improvements are the use of a slightly larger engine with forced feed lubrication and a hot-spot manifold; fan driven from the generator shaft; larger universals; improved brake and clutch pedals; Bower roller bearings in all wheels; oil cups instead of grease cups. The external appearance of the car has been considerably improved through the use of a straight-line body with square type radiator.

The engine is a four-cylinder Spillman, driving through a Borg & Beck clutch to a Grant-Lees three-speed gearset, and floating axle. The engine is equipped with a Dyneto two-unit electric lighting and starting system, with a Bendix gear. The ignition system is Connecticut. The wheelbase is 112 in., and tires are 32 x 4. Equipment includes an eight-day clock, Motor-Meter, and the usual tools.

—

Briscoe Up to 75 a Day

JACKSON, MICH., April 17—The Briscoe Motor Corp. turned out 50 cars daily during March. This figure has been increased to 75 this month. New contracts during the past few days have been received from Brooks Motor Co., Baltimore; the Kline Motor Co., Louisville, Ky., and the Briscoe-Syracuse Sales Co., Syracuse, N. Y.

—

Eccolene Increases Capital

DETROIT, April 19.—The Eccolene Mfg. Co., maker of Eccolene, has increased its capitalization from $10,000 to $500,000. Plans call for the sale of $300,000 of common stock and $200,000 of preferred 7 per cent accumulative stock. An advertising and sales campaign will be started soon.

—

Combination Truck-Tractor on Market

CHICAGO, April 21—A new type of combined industrial truck and tractor is being marketed by the Clark Tructractor Co., Chicago. It is a three-wheel, gasoline-driven vehicle for industrial purposes in and around factories and other large organizations. It is equipped with a 4-cylinder, 3⅛ x 4½ engine, dry-disk clutch, three-speed selective gearset, internal-gear drive, and may be fitted with either cargo or dump body or platform. The machine weighs 2050 lb. and has a capacity of 1½ tons. The wheelbase is 72 in.; tread, 35½ in., and the overall length, 112 in. It will operate at from ¼ to 15 m.p.h. The selling price is $1135.

—

Graham Trailer for $400

EVANSVILLE, IND., April 21—Graham Brothers have placed on the market a 2-ton four-wheel trailer to sell at $400. It is equipped with Hess axles, with the wheels mounted on Bock roller bearings. Springs are semi-elliptic and wheels carry 32 x 3½ pressed-on solid tires. The loading space is 118 x 59 in.; side racks are 22 in. high. The three side and end sections are removable.

—

Schwartz Buys Emil Grossman Business

NEW YORK, April 18—L. M. Schwartz, formerly vice-president and sales manager of the Emil Grossman Mfg. Corp., has purchased the right, title and goodwill in that company and with it has acquired the trademark "Ever Good" identified with the Grossman lines of bumpers, mirrors, fan belts, wiring sets, etc., and also the trademark "Red Rib," designating lines of ignition cable and lamp cord. Schwartz's activities commence immediately under the former trade name (the Emil Grossman Mfg. Co.) and at the same address, Bush Terminal, Brooklyn, N. Y.

Latin America Offers Opportunities

January and February Automotive Exports Indicate Great Increase in 1919 Trade

NEW YORK, April 19—During the twelve months ending December 31, 1918, our exports of cars, trucks and parts to the Latin-American Republics had a total value of $18,976,637. The value of our exports during January and February, 1919, was $4,141,479. Throughout these periods we have had to face troubles and delays caused by severely limited shipping facilities and by restricted factory production.

If it be assumed that both these adverse conditions are factors which will have to be contended with during the remainder of the present year—an assumption which is absolutely against the weight of evidence—and that we are merely able to maintain the pace set by our January and February export figures, we still will be approximately 30 per cent ahead of our 1918 total at the end of the calendar year 1919.

Three months ago the Shipping Board allocated 455 vessels having a combined capacity of over 1,000,000 tons to Latin-American routes, but unfortunately had to withdraw them immediately in order to divert their tonnage to relieving the European food shortage.

When this need ceases to exist, it is anticipated that all these ships will operate in Latin-American service. Their capacity will be supplemented by that of a series of 12,000-ton freighters and yet a further series of converted transports of an individual capacity of from 8,000 to 15,000 tons, a service amply sufficient to link up our ports with those of Central and South America on a basis which will eliminate delay and insure prompt shipment.

There is no lack of orders for shipment of automotive products to Latin America, and given adequate shipping facilities there is no reason why the 30 per cent increase now indicated may not be expanded to 100 per cent or more.

Exports of Cars, Trucks and Parts to Latin-American Republics During the Calendar Year 1918

Country	Cars No.	Cars Value	Trucks No.	Trucks Value	Parts Value
Argentina	1,628	$1,673,137	45	$40,707	$2,100,114
Bolivia	15	29,187	16	41,116	7,303
Brazil	1,108	856,374	37	42,481	221,835
Chile	1,734	2,315,386	154	239,621	659,544
Colombia	126	95,677	4	7,385	26,864
Costa Rica	41	20,100	....	......	2,772
Cuba	1,780	2,638,001	557	1,109,368	1,065,816
Ecuador	63	73,953	6	10,420	8,558
Guatemala	15	21,914	1	1,312	6,336
Haiti	92	59,098	10	9,664	21,650
Honduras	11	15,443	4	2,017	10,262
Mexico	1,915	1,539,263	397	524,035	506,747
Nicaragua	69	51,829	3	8,251	6,305
Panama	65	55,187	45	44,573	56,855
Paraguay	....	....	....	....	719
Peru	626	823,762	100	246,392	116,721
Salvador	62	77,184	3	10,561	9,970
Santo Domingo	220	169,285	19	16,497	59,120
Uruguay	1,351	799,787	15	13,512	137,991
Venezuela	118	104,942	7	7,100	57,134
Total	11,039	$11,419,509	1,423	$2,374,512	$5,182,616

Trade Resumed with Many Countries

WASHINGTON, April 21—A complete list of certain countries in Europe with which trade was prohibited during the war and with which business can now be resumed has been made public by the War Trade Board as follows:

Siberia,
Alsace-Lorraine,
Palestine,
Mesopotamia,
Serbia and Rumania,
Finland,
Szecho-Slovakia,
Bulgaria,
Turkey and Black Sea ports,
German Colonies,
The occupied territory of Germany,
Adriatic ports,
Albania and Montenegro,
Luxemburg,
Croatia,
Slavonia,
Bosnia,
Herzegovina,
Dalmatia,
Poland,
Esthonia,
German Austria.

Commercial Air Navigation in South Africa

WASHINGTON, April 19—South African authorities are making bids for airplanes released in England from war work, and plan to use them for commercial purposes in South Africa. Plans include the establishment of an air service, both passenger and mail, to more remote centers, and a fast mail service between Cape Town, Johannesburg, Durban and Port Elizabeth. Preparations have also begun for establishing an air route between London and Cape Town by way of Egypt. A demonstration flight will soon be made. Landing places and gasoline stations are being established between Cape Town and Broken Hill, in German East Africa and in Egypt, the landing places being 400 miles apart. The London-Cape Town route will be by way of Paris, Marseille, Rome, Crete, Alexandria and then over Africa. Handley-Page machines, capable of carrying a crew of 7 and 30 passengers, will be used. It is expected that the flight can be made in 6 days as compared with the present ocean mail service of 18 days.

Italy's Motor Service Links Up Railroads

PARIS, April 19.—Italy possesses 8700 miles of broad-track railroad and 8070 miles of automobile routes, over which a regular service is run to time-tables. This big development of automobile passenger carrying and goods service is largely explained by the fact that Italy is a mountainous country in which railroads can only be built with difficulty. Most of the main railroad lines follow the coast, leaving the center of the country undeveloped. This defect has been remedied by the creation of automobile lines which link up with the railroads.

The development of public-service cars for goods and passengers began about 10 years ago on the initiative of the Fiat Co. At the present time, of the 400 officially recognized routes, 350, with a mileage of 6950, are fed exclusively by Fiat vehicles.

Exports of Cars, Trucks and Parts to Latin-American Republics, During January and February, 1919

January, 1919

Country	Cars No.	Cars Value	Trucks No.	Trucks Value	Parts Value
Argentina	232	$247,388	28	$60,800	$345,854
Bolivia	...	......	...	......	5,592
Brazil	48	70,659	...	......	46,019
Chile	73	139,064	1	3,282	42,372
Colombia	17	29,068	...	......	9,757
Costa Rica	...	......	...	......	4
Cuba	91	197,856	82	154,016	181,342
Ecuador	2	2,925	2	3,900	1,339
Guatemala	5	4,300	4	9,900	368
Haiti	22	18,558	...	......	4,314
Honduras	...	......	...	......	249
Mexico	163	217,934	73	113,019	50,853
Nicaragua	...	......	1	4,000	1,507
Panama	3	2,180	1	1,430	2,740
Paraguay	...	......	...	......	......
Peru	31	58,413	...	......	16,261
Salvador	2	3,300	...	......	1,061
Santo Domingo	11	16,598	1	2,523	1,468
Uruguay	44	108,673	1	2,600	45,969
Venezuela	20	34,396	...	......	4,181
Total	764	$1,151,312	194	$355,470	$761,250

February, 1919

Country	Cars No.	Cars Value	Trucks No.	Trucks Value	Parts Value
Argentina	213	$324,193	11	$21,794	$38,287
Bolivia	...	......	...	......	536
Brazil	121	148,673	5	9,765	87,869
Chile	64	153,619	3	7,672	57,331
Colombia	3	2,301	...	......	4,735
Costa Rica	...	......	...	......	......
Cuba	213	290,807	34	92,429	141,141
Ecuador	2	2,734	...	......	2,242
Guatemala	...	......	...	......	269
Haiti	21	22,344	1	550	930
Honduras	...	......	1	300	990
Mexico	203	149,536	47	42,416	45,324
Nicaragua	4	3,616	...	......	2,187
Panama	6	6,150	1	550	5,813
Paraguay	...	......	...	......	......
Peru	77	147,961	4	10,540	24,845
Salvador	7	9,346	...	......	1,206
Santo Domingo	5	9,396	...	......	1,627
Uruguay	25	38,106	1	1,070	17,621
Venezuela	24	27,346	2	1,360	10,920
Total	988	$1,241,128	137	$188,446	$443,873

U. S. Air Equipment Classified

13,057 Engines "Active," 10,858 "Obsolescent" and 2763 Held to Be "Obsolete"

ACTIVE

Planes	Engines
Curtiss JN-4-H	Hispano-Suiza, model I
Curtiss JN-4-HBO	Hispano-Suiza, model E-12
Curtiss JN-6-HO	Le Rhone, 80 hp.
Curtiss JN-4-G	....
Curtiss JN-4-G	....
Curtiss JN-7-H	....
Curtiss JN-6-HB	....
D.H.-4	....
U.S. D-9-A	....
S.E. 5	....
V.E. 7-4-C	....
Martin Bomber	....
Hydros	....
Le Pere	....
Handley Page	....
Sopwith-Dolphin	....
Caproni	....

OBSOLESCENT

Planes	Engines
Curtiss JN-4-A	Curtiss OX-2
Curtiss JN-4-B	Curtiss OOX-3
Curtiss JN-4-D	Curtiss OX-5
Canadian JN-4	Hispano-Suiza model A
Thomas Morse Scout with Gnome engine	....

OBSOLETE

Planes	Engines
Curtiss R-4	Thomas Morse 8
Curtiss R-2	Curtiss model 0
Curtiss N-8	Curtiss OXX
Curtiss twin	Curtiss OXX-2
L.W.F.	Curtiss M-8
Standard J-1	Sturtevant 5-A
Standard L-2	Hall Scott A-5-A
Standard R-6	Hall Scott A-7-A
Martin R	Lawrence
Standard E	Clerget 9
Heinrich's C-1	Curtiss V-2
Aero Marine	Curtiss VX
Boeing	Wright 6 cyl.
Martin TT	Samson M-9
Martin R-6	Renault 12
Standard H-2	Renault 8
Standard H-3	Sturtevant 4 cyl.
Sturtevant F-4	Aero Daimler 6 cyl.
Bristol Fighter	Curtiss type S
Burgess Hydroplane	Le'aviateur 8

WASHINGTON, April 19—The Air Service has classified all airplanes and engines as either "active," "obsolescent" or "obsolete," and has placed 10,414 service engines, 2612 service planes, 2643 training engines and 2103 training planes, of which 80 per cent are new, in the active class. Obsolescent engines total 10,858, of which 42 per cent are new, and 2904 training planes, of which 17 per cent are new. Obsolete engines total 2763, of which 59 per cent are new and unused, and 2018 obsolete planes, of which 51 per cent are new.

A number of Curtiss and Standard models and Bristol Fighters, about which a great storm centered during the war, besides other planes, are classified as obsolete. The Bristol Fighter, it will be remembered, was found unserviceable, because, as pointed out in AUTOMOTIVE INDUSTRIES, the American officials selected it for the Liberty engine when that engine weighed 700 lb. in its experimental stage, but was too heavy—weighing 850 lb.—when it was finally installed.

Improved Curtiss planes, the Martin Bomber, the La Pere and several British planes are named as active, as are several Hispano-Suiza engines and the Lehrone.

By active planes are meant those which are maintained, repaired and re-ordered by the government for the Air Service. Obsolescent planes are those which are not regarded as worthy of re-order, but which will be used so long as repair parts are readily available, and they can be easily overhauled until in the judgment of the officer in charge they should be discarded. Obsolete planes and engines including those found dangerous or lackin in speed or other qualities.

Herewith is the complete list, showing the active, obsolescent and obsolete planes and engines.

Herewith is the table showing number of planes and engines on hand of each of the three classes, those new and those used but in flying condition, together with those which are out of commission.

	New	Used, but in Flying Condition	Out of Comm.	Total	Per Cent New	Per Cent Useable	Per Cent Not Useable
ACTIVE							
Service engines.....	9,725	412	277	10,414	93	4	3
Service planes......	9,264	198	150	2,612	86	8	6
Training engines...	1,997	491	155	2,643	76	18	6
Training planes....	740	1,019	344	2,103	35	48	17
OBSOLESCENT							
Training engines...	4,541	4,417	1,900	10,858	42	41	17
Training planes....	498	1,854	552	2,904	17	64	19
OBSOLETE							
Engines	1,638	116	1,009	2,763	59	4	37
Planes	1,037	68	913	2,018	51	4	45

Cancel Air Service Contracts

WASHINGTON, April 17—During the week ending April 5 more than $4,000,000 worth of Aircraft Production contracts were canceled, making a total of $500,679,617 of suspended and canceled contracts since the armistice. Following is a summary of the total cancellations up to and including April 5, 1919:

	Value
Engines and parts...............	$275,616,187
Airplanes and parts.............	166,081,004
Chemicals and chemical plants..	18,334,715
Instruments and accessories.....	10,868,841
Balloons and supplies............	9,314,963
Fabrics, lumber and metals......	7,228,778
Miscellaneous	13,235,129
Total...........................	$500,679,617

Vedrines Killed in Paris-Rome Trip

PARIS, April 21—(Special Correspondence)—Jules Vedrines, the French aviator, who was the first to make a landing on the roof of a building, was killed instantly today when his machine, on its way for a non-stop trip from Paris to Rome, dropped in the Department of Drôme at Les Fouillouses, about 225 miles from Paris. The machine, which weighed 5½ tons, was wrecked. It is thought that the accident was due to the plane collapsing in the air.

Postal Service Has 1,381 Vehicles

These Are in Use in 20 Cities—Bids Asked for Supplies and Parts

WASHINGTON, April 19—The United States Post Office is asking for bids on motor vehicle and aviation supplies to be filed not later than May 12. Supplies are required for 1433 cars and trucks, and include pneumatic non-skid casings, both fabric and cord, grey and red inner tubes of all sizes, inner patches, rims, solid, demountable and pressed-on tires, steel for demountable rims and hard base cushion tires of all sizes, fire extinguishers, hub odometers, spark plugs and porcelains of all sizes, graphite, grease, oils, automobile soap, radiators, 9000 gal. of Liberty aero oil and 175,000,000 gal. of aviation gasoline.

In order to provide information for bidders a list of the cities in which government owned motor vehicles are now being operated is given together with the number, type and size of the vehicles, as follows:

Atlanta
2 Ford, 750 lbs.
18 Commerce, 1-ton

Baltimore
15 Ford, 750 lbs.
14 Commerce, ¾-ton
4 G.M.C., 1½-tons
2 Packard, 3-tons

Boston
68 Ford, 750 lbs.
23 White, ¾-ton
14 Packard, 1½-tons

Brooklyn
71 Ford, 750 lbs.
20 White, ¾-ton
5 White, 1½-tons
5 White, 3-tons

Buffalo
25 Ford, 750 lbs.
2 G.M.C., ¾-ton
8 Lippard-Stewart, ¾-ton
1 U. S., 1½-tons
2 Brockway, 1½-tons

Chicago
166 Ford, 750 lbs.
10 Studebaker, ½-ton
35 White, ¾-ton
62 White, 1½-tons
2 Packard, 1½-tons
20 White, 3-tons

Cincinnati
23 U. S., 1½-tons
1 White, 3-tons

Columbus
10 Ford, 750 lbs.
6 White, ¾-ton
5 Packard, 1½-tons

Detroit
37 Ford, 750 lbs.
1 Overland, ½-ton
1 Reo
5 Buicks, ¾-ton
10 Packard, 1½-tons

Indianapolis
14 Ford, 750 lbs.
4 Studebaker, ½-ton

Jersey City
3 Ford, 750 lbs.
1 White, ¾-ton

Nashville
7 Ford, 750 lbs.
4 White, ¾-ton
3 White, 1½-tons

New York
98 White, ¾-ton
10 White, 1½-tons
42 White, 3-tons
75 Packard, 1½-tons
25 Ford, 750 lbs.

Norfolk
12 Dodge, ½-ton
9 White, ¾-ton
1 White, 1½-tons

Philadelphia
68 Ford, 750 lbs.
49 White, ¾-ton
12 G.M.C., ¾-ton
9 G.M.C., 1½-tons
8 White, 1½-tons
6 White, 3-tons
2 Kelly-Springfield, 3-tons

Pittsburgh
28 Ford, 750 lbs.
30 White, ¾-ton
2 White, 1-ton
8 Packard, 1½-tons
1 White, 1½-tons

Richmond
11 G.M.C., 1½-tons

St. Louis
47 Ford, 750 lbs.
14 G.M.C., ¾-ton
3 White, ¾-ton
1 White, 1½-tons
6 G.M.C., 1½-tons

Scranton
7 Ford, 750 lbs.
4 Commerce, ¾-ton

Washington
50 Ford, 750 lbs.
11 White, ¾-ton
1 White, 1½-tons
1 G.M.C., ¾-ton
1 G.M.C., 1½-tons

Bids will be opened at 10 a. m., May 12, and prices are to be quoted on the unit of each quantity called for under each item. Deliveries must be made within 30 days after orders are placed or otherwise specified by the Government.

Eisemann Reaching Normal Production

NEW YORK, April 21—The Eisemann Magneto Co. is rapidly reaching normal production. The plant is at present operating at full capacity, with part overtime. Orders on hand will keep the plant at full capacity for some time.

England Showing Interest in Commercial Aviation

LONDON, April 21—Some conception of the hold which commercial aviation is getting on the British nation is indicated in the expected transcontinental flight and also in the displays of London business houses. The Selfridge store has recently had a big attraction in a special Handley-Paige fuselage adapted from bomb-carrying for passenger flight. It has a saloon-body accommodating 17 passengers, as well as another person in a cock-pit in the nose of the craft, a pilot and assistant pilot. The complete machine, except for the passenger accommodation, is similar to the bomber, and is fitted with two Rolls-Royce engines, each of 350 h.p. fixed between the main planes, which will drive it at about 100 m.p.h. The extreme length of the fuselage is 62 ft. 6 in., and about one-third of this is occupied by the saloon, the height of which is 6 ft. 6 in. The span of the upper main plane is 100 ft., and the height from the ground to the top of the king-post is 23 ft. The weight of the machine, fully loaded, is about 6¼ tons.

At a luncheon which followed the opening ceremony, Mr. Handley-Paige stated that a number of these machines were now ready for use, and would be put into service, carrying passengers to the Continent as soon as the Air Convention, now under consideration at Paris, is signed. A new company, he said, had been formed for the purpose, and eventually he hopes to be able to convey passengers and goods to all parts of the world.

—

First De Haviland on Exhibit

WASHINGTON, April 21—The first De Haviland 4, U. S., designed and built by the Dayton-Wright Airplane Co., has been placed on exhibition at the National Museum in this city. The plane has been used in more than 4000 flights, has been in the air 1078 hours, and traveled more than 11[illegible],000 miles. It carries full military equipment, including camera, oxygen bottles, machine guns, etc.

This is the type of airplane that was severely criticized during the war, but more than 1800 of which were delivered in France and used extensively.

—

Engine Dynamometer to Be Established

WASHINGTON, April 18—The National Advisory Committee of Aeronautics will erect an airplane engine dynamometer at Langley Field for the purpose of testing airplane engines.

—

Chicago-New York Flight in 7 Hours

NEW YORK, April 22—Capt. E. F. White, an army aviator, flew from the landing field of the Aero Club of Illinois, Ashburn Field, Chicago, to Hazelhurst Field, Mineola, L. I., in a non-stop flight lasting 6 hours and 50 minutes. Captain White left at 9:50, Central time, yesterday morning and landed here at 5:40, Eastern time, yesterday afternoon, making an average speed of 106.38 miles an hour, covering a distance of 727 miles. Express train time for the same distance is 18 hours.

The record flight was made in a De Haviland 4 biplane, equipped with a 12-cylinder Liberty engine, and was made for the most part at an altitude of 12,000 ft. In recognition of "the demonstration of the practicability of airplanes for fast transportation," the Aero Club of America will award a medal to the aviator, to be presented during the Aeronautic Convention at Atlantic City, on May 4.

—

Suspend M. A. M. A. Rule for Atlantic City Airplane Show

NEW YORK, April 21.—The Motor and Accessory Manufacturers Association rule with regard to shows was suspended insofar as the airplane exhibition at Atlantic City is concerned, at the monthly directors' meeting, so that members of the M. A. M. A. may exhibit.

—

Aero Gas for Airplanes Only

WASHINGTON, April 18—The use of high test aeronautical gasoline for any purpose other than airplane consumption has been prohibited by the Director of Air Service, who has issued an order prohibiting its use in passenger cars, trucks, motorcycles and for cleaning purposes in the army.

—

Air Service Buys Free Balloons

WASHINGTON, April 19—The Air Service has ordered 36 free balloons to be made out of the surplus kite balloon fabric. These will be used for early training of fliers and especially to instruct them in meteorological phenomena.

—

Landing Fields and Airdromes for Massachusetts

BOSTON, April 18—The Massachusetts legislature has been asked to provide suitable airdromes and landing places throughout the State in order that aviation may be developed in this territory. A bill designed to give the Highway Commission power to license aviators and also to pick out places on which to land has been introduced.

—

Inter-City Reliability Run

CHICAGO, April 14—The long-promised inter-city reliability run in which dealers and owners from Chicago, New York and other cities were to compete, seems probable of accomplishment this year, with teams from New York and Chicago as contestants. According to the plans announced Friday by the Chicago end of the contest, there will be two teams from this city, one representing the Chicago Automobile Club, and the other the Chicago Athletic Association. The date probably will be June 13 and 14, and the route will be from New York City into Massachusetts, and return to New York.

Air Service Disapproves Competition for Money

WASHINGTON, April 21.—The Air Service has refused to allow any army fliers and airplanes to compete for the Pulitzer or other trophies at the Pan-American Aeronautical exhibition which will be held at Atlantic City in May. Reasons given are that the demobilization, reorganization, Victory Loan campaign and consequent reduced personnel prevent the Air Service from taking part in this exhibition. Announcement made by Major General C. T. Menoher, Director of Air Service, also states that as an additional reason the Air Service considers it an improper use of the time of fliers and government property to compete for purses and individual prizes.

"The Air Service," stated Major General Menoher's announcement, "will give favorable consideration to any project of this sort which has for its object aerial performances without remuneration for development, charitable or co-operative purposes of an international, national, State or civic character, but must adopt as a War Department policy disapproval of any project which involves competition of air service teams or individuals with private clubs or enterprises for money or other prizes or trophies."

—

Pulitzer Trophy for Airplane Contest

NEW YORK, April 18—A Pulitzer trophy to be awarded annually for airplane competition has been offered by Ralph, Herbert and Joseph Pulitzer, Jr., according to a statement made by the Aero Club of America. The nature of the competition will be decided yearly by the Aero Club. This year it will be awarded for the longest non-stop flight from any point to Atlantic City or from Atlantic City to any other point during May, while the Aeronautic Convention is going on there. The prize will be held for a year by the winner, but must be won three times to become the permanent possession of the competitor.

—

Government Not Exempt from Revenue Tax

NEW YORK, April 7—It is likely that the Internal Revenue Bill will hold that sales of passenger cars and trucks made to the Federal government, or to the various state governments, are not exempt from the new war revenue tax. Under neither the old nor the new law are there any provisions specifically exempting the government. Under the old law, however, government purchases have been held to be exempt. Under recent interpretations of the new law, such sales apparently are not exempt. It is pointed out, however, that when dealers are approached by a state regarding the purchase of a car the dealer may pass the order along to the factory and act as a commission man, instead of taking title to the car, and then reselling it. The National Automobile Chamber of Commerce points out that under such a plan no tax will apply.

Fordson Tractor Assembly

(*Continued from page* 900)

fact, each machine can readily handle 50 per day or more if it is required, which means that, on an 8-hr. basis, 15 min. is considered ample running-in time.

The block is then put back on the track by means of the overhead carriers and the castellated nuts on the ends of the bearing cap studs are wired and locked in position. With these bearings adjusted and in place, the main work of assembling the engine is practically over, as this is the most delicate part of the job.

The engine now is ready to have its accessories and housings placed upon it. The magneto assembly is a part of the flywheel and, therefore, is handled as a sub-assembly. It is a progressive bench operation, as will be seen from Fig. 10. An angle-iron carrier is utilized, and the assembly is carried on, step by step, down the bench, as illustrated. Fig. 10 shows the work in progress, looking at it from the end when the assembly is completed. The unfinished flywheels are in a conveyor rack behind the bench. There are eight men on this job, assembling Fordson magnetos, and they assemble one every 1½ min. The finished magnetos are conveyed to the traveling rack, where they meet the engine just as it has had its field plate bolted on, as will be seen in Fig. 11. These field plates are also a sub-assembly, having the field coils mounted in place. This sub-assembly is considered a manufacturing operation and is done in the shop department.

There is but little beyond routine work left to do to the engine after it leaves this point. The oil pan is bolted in place, the head put on, manifold fitted and the carbureter and intake are bolted in place, all of these parts having been prepared and placed at convenient points along the line. The timing gear housing also is placed on the engine before it leaves this chain, having been stored in racks alongside of the track at about the proper height so that but little lifting effort is required to get it over to the tracks.

Fig. 12 shows these timing-gear housings on their rack ready to be bolted on the engine, and further down the track some of them may be seen in place. At the right of Fig. 12 may be seen how the transmission track is keeping parallel with the engine track right through. When the engine is completed and reaches the end of the track it is picked up by an overhead carrier and brought over to the beginning of the tractor assembly department, where it meets the transmission completely assembled and ready to be united with the engine assembly to form the tractor.

(*To be continued*)

Dividends Declared

Kelly-Springfield Tire Co., New York, has declared a cash dividend of $1 per share, and a stock dividend of 3 per cent on common, payable in common, on May 1 to stockholders of record April 15. Fractional shares will not be issued. Negotiable warrants which may be exchanged with other warrants aggregating in face value one share of the common stock will be issued representing fractional shares.

Packard Motor Car Co., Detroit, regular quarterly dividend of 2 per cent on common, payable April 30 to stockholders of record April 15.

Truscon Steel Co., Detroit, quarterly dividend, 4 per cent on common, payable April 15 to stockholders of record April 5.

The Willys-Overland Co., Toledo, regular quarterly dividend, 25 cents a share, payable May 1 to stockholders of record April 15.

Fisher Body Corp., Detroit, 1¾ per cent, quarterly, payable May 1 to stockholders of record April 22.

Highways Transport Committees Reorganized

WASHINGTON, April 19—The Highways Transport Committee of the Council of National Defense has been reorganized so as to include direct representation from the Office of Public Roads, of the Department of Agriculture, the Bureau of Markets of the Department of Agriculture, the Post Office Department and the Department of Commerce. The committee as reorganized comprises:

John S. Craves, of the Council of National Defense, chairman.
James I. Blakslee, fourth assistant postmaster-general.
J. M. Goodell, consulting engineer, Office of Public Roads.
James H. Collins, investigator in Market Survey, Bureau of Markets.
R. S. MacElwee, second assistant chief, Bureau Foreign and Domestic Commerce.
Charles W. Reid, executive secretary, and G. B. Clarkson.

The committee will be assisted by the Highways Transport Committee Advisory Board, comprising:

William Phelps Eno of Washington, D. C.
Prof. Arthur H. Blanchard of New York.
C. A. Musselman of Philadelphia.
Raymond Beck of Akron, Ohio.
John T. Stockton of Chicago.

Special co-operation and attention is going to be given to the short-haul problem as connected with the U. S. Railroad Administration, and rural motor express as related to interurban electric line and waterways traffic.

Explosives for Road Building

WASHINGTON, April 21—All surplus TNT and other explosives owned by the War Department and which can be used for building highways and other similar works have been turned over to the Department of the Interior. A portion of the explosives will be used for clearing lands if the soldiers' settlement bill is passed by the next Congress to allow farm lands for honorably discharged soldiers.

New Russel Internal Gear Axle

DETROIT, April 19—The Russel Motor Axle Co. will shortly commence delivery of a new internal gear drive axle for heavy duty trucks.

22 Indianapolis Racers So Far

NEW YORK, April 21—Although the entry lists are open until May 1, the Contest Board of the American Automobile Association has already received 22 official entries for the annual 500-mile Liberty Sweepstakes to be run off on the Indianapolis speedway May 31. The drivers and the special cars they will pilot are:

Driver	Car
Clifford Durant	Chevrolet special
Dorio Resta	Sunbeam
W. W. Brown	Richards special
Earl Cooper	Stutz
Eddie O'Donnell	Duesenberg
Kurt Hitke	Roamer-Duesenberg
Ralph DePalma	Packard special
Denny Hickey	Stickel special
Arthur Thurman	Thurman special
Ralph Mulford	Frontenac special
Jean Chassagne	Sunbeam
Jules Goux	
Louis Chevrolet	Peugeot
Tommy Milton	——
	Duesenberg
Eddie Hearne	Durant special
Louis LeCocq	Roamer special
H. C. Simmons	Hudson special
Elmer P. Shannon	Mesaba special
J. M. Reynolds	Hudson special
Wilbur D'Alene	Duesenberg special
Ray Howard	Peugeot special
Eddie Pullen	Hudson special

Films to Further Safety and Highway Development

WASHINGTON, April 21—Motion pictures will be used extensively in the United States by the government through the Visual Instruction Section of the Department of the Interior to further highways construction, highways safety and other matters of national interest. The National Automobile Chamber of Commerce has been requested to secure films from the manufacturers and furnish them to the Department of the Interior for this work. Lists of films will be compiled in the near future.

Distribution of films, it is expected, will be made through various university extension divisions and other organizations such as boards of education in the various states and communities. Films will be distributed free by the government. Motion picture machines are to be purchased by the individual community.

Electric Graphic Meter

(*Continued from page* 892)

deviation, which seems to be characteristic of the drilling operation. It may be that at this point the chip begins to clear itself; it may be that the change in power consumed is due to some characteristic of the drill spindle; or it may even be due to hardness in the iron plate at that point.

When the curve reaches point G the drill begins to pierce the bottom of the plate and the friction decreases, causing the curve to drop, until at E the drill breaks through and the curve rapidly falls off along the line F to the no-load level at G. The amount of current drawn at G indicates the frictional horsepower required to drive the machine idle.

It will be seen that it takes an average of a little less than 4 kilowatts to force the six spindles through the 1¼-in. plate.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. .... .02 - .03
- Phosphoric (85%) lb. .... .35 - .39
- Sulphuric (60%), lb. .... .008

Aluminum:
- Ingot, lb. .... .29 - .31
- Sheets (18 gage or more), lb .... .42

Antimony, lb. ..... .07 - .07⅛

Burlap:
- 8 oz., yd....... .07⅛- .07¼
- 10½ oz., yd....... .09⅛

Copper:
- Elec., lb. .... .15¼- 15½
- Lake, lb. .... .15¾- 15⅞

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.40
- Egypt, combed, sq. yd. 1.25
- Egypt, carded, sq. yd. 1.20
- Peelers, combed, sq. yd. 1.10
- Peelers, carded, sq. yd. .85

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
- Ceylon, lb. .... .09 - .22
- Madagascar, lb. .. .10 - .15
- Mexico, lb. .... .03¾

Lead, lb. .... .04¾- .05

Leather:
- Hides, lb. .... .25 - .41

Nickel, lb. .... .40

Oil:
- Petroleum (crude):
  - Kansas, bbl. ...2.25
  - Pennsy., bbl. ...4.00
- Gasoline:
  - Auto, gal. 24½
  - 68 to 70 gal..... .30½
- Lard:
  - Prime City, gal.2.45 -2.50
- Ex. No. 1, gal.... .95 -1.06
- Linseed, gal. ....1.53 -1.56
- Menhaden (dark), gal. .... .95

Rubber:
- Plantation:
  - First latex pale crepe, lb. .... .49
  - Brown crepe, thin, clear, lb. .... .46
  - Smoked, ribbed sheets, lb..... .48

Para:
- Up River, fine, lb. 56
- Up River, coarse, lb. .... .34
- Island, fine, lb.... .47½- .48

Shellac (orange), lb. .60 - .64

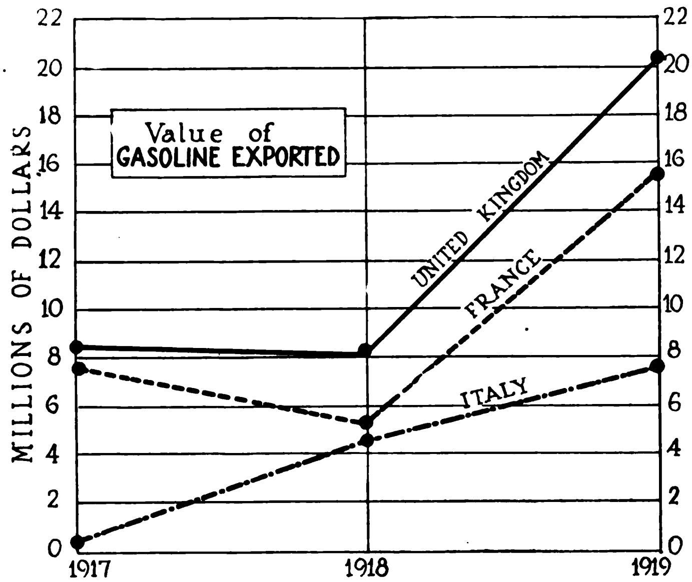
Spelter, lb. .... .06½

Steel:
- Angle beams and channels, lb... .03
- Automobile sheet (see sp. table).
- Cold rolled, lb....0625
- Hot rolled, lb.......039

Tin .... .72½

Tungsten, lb. 1.00

Waste (cotton), lb.. .12¾- .17



This chart indicates the enormous increase in value of gasoline exported to the United Kingdom, France and Italy during the period immediately preceding the signing of the armistice

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when Seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock...............	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock...............	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping.........	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping...............	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.
- Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close April 19

	Bid	Asked	Net Ch'ge
Auto Body Company......	9	10	..
Briscoe Motor Car com...	14	..	+1
Briscoe Motor Car pfd....	50	65	..
•Chandler Motor Car.....	144⅛	146⅛	+4⅛
Chevrolet Motor Car......	199	201	..
Cole Motor Car Co.........	93	105	..
Continental Motors com..	7⅝	8	—⅛
Continental Motors pfd...	96	99	..
Edmunds & Jones com....	15	20	..
Edmunds & Jones pfd....	75	90	..
Electric Storage Bat......	69	71	..
Federal Motor Truck.....	34	37	..
Fisher Body Co. com.....	62¾	64¾	+4¾
Fisher Body Co. pfd......	92	94	..
Ford Motor of Canada....	310	320	+25
•General Motors com.....	179¼	180¼	+3¼
•General Motors pfd......	91⅜	93⅜	+¼
Hupp Motor Car com.....	8¼	8¾	..
Hupp Motor Car pfd......	96	99	..
Kelsey Wheel Co. com....	35	37	..
Kelsey Wheel Co. pfd.....	93	95	..
Manhattan Electric S. com.	..	48	..
Maxwell Motor com.......	38½	39½	—⅛
Maxwell Motor 1st pfd....	66½	67½	—¾
Maxwell Motor 2nd pfd...	30¼	31¼	..
McCord Mfg. com.........	34	37	+1
McCord Mfg. pfd..........	95	100	+4
Mitchell Motor Co.........	30	34	+3
Motor Products Corp.......	..	35	..
Nash Motors Co. com.....	230	250	..
Nash Motors Co. pfd......	95	100	..
National Motor Co........	16	20	+1
Packard Motor Car com..	135	145	+13
Packard Motor Car pfd...	99	101	..
Paige-Detroit Motor com..	29½	30½	+1
Paige-Detroit Motor pfd..	8¾	9¾	..
Peerless Motor Truck.....	23	25	+2
•Pierce-Arrow M. Car com.	50	51	+½
Pierce-Arrow M. Car pfd..	102	104	..
Premier Motor Corp. com.	5	..	..
Premier Motor Corp. pfd..	..	75	..
Prudden Wheel Company.	21	22	+3
Reo Motor Car Co........	23¾	24½	..
Republic M. Truck com...	40½	42½	+1
Republic M. Truck pfd...	91	95	..
Saxon Motor Car com.....	7¼	9¼	+⅝
Scripps-Booth Corp.	21	25	..
Stewart Warner S. Corp..	92⅞	94⅞	+1⅞
Stromberg Carburetor Co.	38	40	..
Studebaker Corp. com....	69½	70½	+3⅞
Studebaker Corp. pfd.....	94	97	..
•Stutz Motor Car Co......	54⅝	55⅝	—1⅜
United Motors Corp.......	46½	48½	+⅞
White Motor Co...........	55⅞	56⅞	+¼
Willys-Overland com......	29⅞	30⅞	+⅜
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co..........	77½	79½	—1⅛
Firestone T. & R. com....	140	145	—4
Firestone T. & R. pfd....	100	102	..
Fisk Rubber Co. com.....	135	140	—2
Fisk Rubber 1st pfd......	100	105	..
Fisk Rubber 2nd pfd......	137	142	..
Fisk Rubber 1st pfd. conv.	105	110	..
Goodrich, B. F., com......	66½	67½	..
Goodrich, B. F., pfd......	108	110	+1½
Goodyear T. & R. com....	280	287	+10
Goodyear T. & R. 1st pfd.	105½	107½	..
•Goodyear T. & R. 2nd pfd.	105	107	—2
•Kelly Springfield com....	121½	122½	—4½
Kelly Springfield 1 pfd...	95	97	..
Lee Tire & Rubber Co....	26½	27½	+½
Marathon Tire & Rubber..	55	75	..
Miller Rubber Co. com....	170	175	..
Miller Rubber Co. pfd....	102	104	..
Rubber Products Co.......	125	130	..
Portage Rubber Co. com..	158	162	..
Swinehart T. & R. Co....	77	81	..
U. S. Rubber Co. com....	85¾	86¾	—¾
•U. S. Rubber Co. pfd....	109½	110½	—2⅜

•Ex dividend.

Bradley Is Back

NEW YORK, April 22—L. M. Bradley, former manager of the Motor and Accessory Manufacturers' Association, who was obliged to leave his position about Jan. 1 and go to Daytona, Fla., because of a breakdown following influenza, has returned to New York. He has regained his health and will make his future plans public soon.

Pennybacker on Highways Work for A. A. A.

WASHINGTON, April 19—J. E. Pennybacker, director of roads, has resigned as chief of management of the United States Bureau of Public Roads to devote his energies to American Automobile Associations highway work.

Rydehn Made Superintendent of Bantam Factory

BANTAM, CONN., April 19—Stuart S. Rydehn has been appointed superintendent of the factory of the Bantam Ball Bearing Co., succeeding Edward H. Cox, who resigned.

Fred W. Thomas, formerly chief engineer for the Olympian Motors Co., Pontiac, Mich., has opened a consulting and sales office at 335 Guardian Building, Cleveland.

W. R. Eaton, formerly district sales manager of the Moon Motor Car Co., St. Louis, has resigned to become president of the Aconite Tire & Rubber Co., St. Louis.

Frank R. Farnham has been elected vice-president of the Rex W. Wadman organization. He was formrely sales and advertising counsel of Hollister-White Co.

R. A. Loftus has been made factory representative of the Hession Tiller & Tractor Corp., Buffalo. He was previously assistant sales manager of the Cleveland Tractor Co. He will immediately proceed to organize the sales force in the Eastern section of the United States.

Matt R. Korshin, who for a number of years was Eastern district sales manager for the Atterbury Car Co., Buffalo, has become Western sales manager for the Selden Truck Sales Co., Rochester, with headquarters at 2334-2336 Michigan Avenue, Chicago. He succeeds A. R. Kroh, who left to become associated with the Goodyear Tire & Rubber Co., Akron. As Western sales manager, Mr. Korshin will be in charge of the dealer organization in Illinois, Indiana, Wisconsin, Minnesota, North and South Dakota.

H. P. Schuyler, for the past five years district sales manager of the American Ever Ready Works, has resigned to become manager of the accessories department of the Northern Electric Co. of Minneapolis and Duluth.

Men of the Industry

Changes in Personnel and Position

Duplex Engine Governor Adds to Force

BROOKLYN, April 21—J. K. Cravens has been appointed sales manager of the Duplex Engine Governor Co. He was formerly connected with the Excelsior Motor & Mfg. Co., Chicago, the F. A. Ames Co., Owensboro, Ky. and more recently with the Wright-Martin Aircraft Co., New Brunswick, N. J.

George L. Ritter, who has been with the company for several years, has been promoted to assistant sales manager. J. N. Ryan, recently discharged from the Air Service as a pilot, will cover New York, New Jersey and New England. R. Weston Doherty, who, it was recently announced, would cover this territory, will not be connected with the company.

Charles G. Jerosch has been appointed manager of the export office of the Corbitt Motor Truck Co., Henderson, N. C., which has recently been opened at 66 Leonard Street, New York City.

H. S. Lyons, who for two years prior to his entry into the Aviation service had charge of the sales of C-H electric devices in the territory covered by the Chicago office of the Cutler-Hammer Mfg. Co., Milwaukee, has received his discharge and returned to the employ of the company, doing sales work in the magnetic shift department.

C. N. Bradford, for two years in charge of cost and efficiency of Briscoe Motors Corp., Jackson, has been made head of the cost and efficiency departments of the Auto Body Co., Lansing.

Edwin Denby, president of the Denby Motor Truck Co., Detroit, late major of Marines, has resumed his duties as head of his company after 18 months service.

Arthur J. Peebles, former special representative of the Goodyear Tire & Rubber Co., has been made general sales manager of the Armstrong Rubber Co., Garfield, N. J. He was former secretary of the Ohio Automobile Trade Association, and an active worker in the affairs of the old National Automobile Trade Association. The Armstrong company has recently completed a new factory and anticipates a production of 800 tires and tubes a day during the coming year.

M. T. Langlais, associated with the L. Peacock Auto Co., distributors of Service trucks in San Francisco and Oakland, died last week.

Changes in Savage Arms Management

NEW YORK, April 18—A. E. Borie has resigned as president of the Savage Arms Corp. and has been elected chairman of the board of directors. This step was taken because his multiplicity of interests in this and other companies do not permit him to devote the necessary time to the duties of that position. W. L. Wright, formerly vice-president and general manager, succeeds him as president. F. R. Phillips has been elected vice-president. F. R. Pleasanton remains general works manager and Arthur F. Hebard has been appointed general sales manager. F. R. Schaefer remains sales manager of the products manufactured at the Sharon, Pa., plant, which include frames, axles, transmissions and other parts for cars, trucks and tractors. Brockholst Mathewson will represent the company in Detroit.

These rearrangements in organization are a clear indication of the company's complete change from war to commercial basis.

W. E. Marvel of the Service Motor Truck Co., has been appointed district manager for the company in Utah, Colorado, Wyoming and parts of Mexico and Idaho.

W. C. Biddle, assistant sales manager of the Franklin Automobile Co., Syracuse, N. Y., has resigned to form the Branklin-Biddle Co., Toledo, dealers in Franklin cars. Mr. Biddle has been with the company since 1913. E. P. Johnson, a member of the sales force since 1915, will succeed him as assistant sales manager.

O. S. Tweedy, vice-president and general manager of the L. A. Young Industries, Inc., Detroit, has resigned, to take effect May 1. He was formerly with the United States Tire Co. He has not yet announced his future plans.

U. S. Rubber Elects

NEW YORK, April 22—Samuel P. Colt was elected chairman of the United States Rubber Co. at its organization meeting. Officers are: President, Charles B. Seger; vice-presidents, James B. Ford, Homer E. Sawyer, Elisha S. Williams, J. Newton Gunn, Ernest Hopkinson and W. G. Parsons; treasurer, W. H. Blackwell; comptroller, W. G. Parsons; secretary, Samuel Norris; assistant secretary and treasurer, John D. Carberry; assistant comptrollers, H. B. Hubbard and W. O. Cutter. The executive committee is composed of Chairman Samuel Colt, Vice-Chairman Lester Leland, Charles B. Seger, James B. Ford, Walter S. Ballou, and Nicholas F. Brady; and the operating council of Charles B. Seger, chairman, the vice-presidents and Theodore Whittelsey.

Auto Specialties Canadian Branch

ST. JOSEPH, April 19—The Auto Specialties Co. will build a branch factory in Windsor, Ont. It will be a duplicate of its plant here.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Republic New 8-in-1 Body

ALMA, MICH., April 19—The Republic Motor Truck Co., this city, has brought out a standard all-purpose farm body designed especially for Republic trucks for general use on the farm. There are eight complete types of bodies combined in one, all of these bodies being secured by adjustments which one man can make in a few seconds.

The body is made of kiln-dried hardwood lumber and can be used as a platform body with head board and end gate; as a platform body with extension side boards, head board and end gate; as a platform hay rack with the side boards sloping to support the hay; as a regulation wagon box with removable sides and end gate; as a combination grain, apple and potato box with two-sections, tight removable sides or as a three-section tight removable side box, or as a combination stock and basket rack box. The body can also be used as a straight cattle rack type suitable also for transporting cotton.

The body will sell for $200 in No. 2 size, 11½ ft. long, or $175 in No. 1 size, 9½ ft. long. The weight of the body is 650 lb. Larger sizes can be secured to order. The bodies are painted in the lead ready for shipping.

B. & W. to Make Radiators

CHICAGO, April 18—The B. & W. Manufacturing Co., recently organized to build radiators, is capitalized for $600,000. Its officers are: President and treasurer, Lawson W. Wright, Evanston, Ill.; vice-president, Gage P. Wright, Mitchell, S. D.; secretary, Charles H. Blenkiron, Mitchell, S. D. The officers, with J. C. Blenkiron, Frank Wright and Paul M. Young, form the board of directors.

The active management of the business will be in charge of S. D. Briggs, who has been connected with the H. S. Franklin Mfg. Co., the Buick Motor Co., Pence Automobile Co. and the Hupp Motor Car Corp. C. E. Brelsford, formerly with the Splitdorf Electric Co., will represent the company in the East, with headquarters at Detroit. R. H. Cory will handle the Western territory, with headquarters at the Chicago office. Fenton L. Howard is the engineer and Philmore F. Spery factory superintendent. The factory and offices are at 5235-5257 Ravenswood Avenue.

Production is already under way and the company reports that contracts have been closed for 40,000 radiators. F. H. S. & Co., manufacturers' agents, with offices in the Grant Park Building here, will handle the sales to jobbers.

New Plant for Copper Products

CLEVELAND, April 18—The United States Copper Products Corp. will soon be housed in a new manufacturing plant, which will be completed and in operation by May 1. The first unit is nearly finished and covers 200 x 350 ft.

Two New Jordan Bodies

CLEVELAND, April 21—The Jordan Motor Car Co. has made a number of refinements in its chassis and has brought out two new bodies, one a roadster to be styled "Playboy," and the other a touring model, to be styled "Jordan Silhouette." Both are straight-line types with slanting windshields and narrow, vertical hood louvres.

Bristol Builds Passenger Plane

WASHINGTON, April 22—The Bristol Airplane Co. of England has constructed a new passenger airplane, according to a commerce report from London. The plane has a seating capacity for 14 passengers in addition to the necessary mechanics and pilot. On its trial trip it carried 12 passengers, pilot and one mechanic, climbed 6200 ft. in 7 min. 15 sec., with an air speed of 125 m.p.h. The passenger salon is ventilated to avoid drafts.

The machine stands 20¼ ft. high and from tip to tip measures 81½ ft. It weighs 16,500 lb., the power being sufficient to lift this load to a height of at least 3 miles and at 10,000 ft. to give the airplane a speed of 113 m.p.h. The engine houses are built on the middle of the three pairs of wings. On each side there are two 410-hp. engines, the total power being 1640 hp. Flight can be maintained by any two of the four engines should the others break down.

Maibohm Will Move to Sandusky

RACINE, WIS., April 18—When its $175,000 plant is completed at Sandusky the Maibohm Motors Co. will move its entire organization to that city. The executive offices and a portion of the manufacturing end have already been moved, occupying temporary quarters in Plant No. 5. The new plant will comprise approximately 75,000 sq. ft., and is expected to be ready for occupancy in about 60 days. The site consists of 17 acres.

Saginaw to Handle G. M. Properties

SAGINAW, April 19—The Saginaw Products Co., a division of the General Motors Corp., has been organized as a holding company and will conduct the business of the Jackson-Church-Wilcox Co., the Saginaw Malleable Iron Co., and the Central Foundry Co. Articles of association have been filed showing a capitalization of $10,000 and listing as stockholders George H. Hannum, manager of local General Motors interests, Henry L. Barton and H. H. Rice, Detroit.

Details of Olds New Buildings

LANSING, April 21—The addition of five new buildings, with a combined floor space of 1,000,000 sq. ft., costing, with equipment, $4,500,000 and meaning an increase of more than 2,000 employees, is the 1919 expansion program of the Olds Motor Works. The project is a phase of the $37,000,000 expansion program of the General Motors Corp. recently announced by President W. C. Durant.

The five additional units do not include the new engine plant just completed and now in production. When this new plant reaches capacity output, it will require 800 more men. Two new axle plants will be built. Each of these will be 140 x 750. One will be built at once. The other will go up this summer.

Each unit will employ from 750 to 800 men. Both will be 1-story with a narrow second story running the entire length of the building on the east. This floor will be devoted to recreation rooms for employees, dining rooms and offices for axle department foremen and their clerical help. The axle plants will be built of brick, steel and glass. The plants will cost approximately $1,325,000 each.

Each will contain complete heat-treating departments and electrical sub-stations, equipped with transformers and switch boards controlling all machinery. The two plants will have a floor space of 267,000 sq. ft. All Oldsmobile axles will be made here as well as axles for all other General Motors passenger car units with the exception of Buick. The two units will be separated by a railroad track and each will have a loading dock 16 ft. wide.

The assembly plant will be lengthened by a 4-story addition, 91 x 600, which will give this building a total length of 1840 ft. Each floor of the extension will provide 54,600 sq. ft.

A sheet metal manufacture and enameling plant will be built. This will be 1-story, 180 x 480, with a 2-story wing, 90 x 360. It will be concrete and steel with a saw-tooth roof and cost $400,000, and its equipment $150,000. It will bring into use 155,000 sq. ft. of floor space. Under the present arrangement there is a large space left between the main assembly building and the warehouse. Before the concrete shipping docks were built last year, a track ran between the two buildings. Now that shipping has been taken care of elsewhere, the tracks have been removed and a new building to occupy this space is rapidly nearing completion. This establishment is to be 71 ft. wide by 700 ft. long and will accommodate the sewing and trimming departments. This building and new equipment which will be added to that already in use will cost $125,000.

Last year the company installed a new heating plant, which is equipped with two 500 hp. Erie City boilers with automatic stokers. This plant will now be doubled in size. This also involves additional water tanks for the sprinkler system.

In addition to the new units, the entire present Oldsmobile plant will be overhauled. A complete system of elevated electric trucks will be installed. They will be operated by storage batteries. A number of other units have been planned, but when they will be built will depend upon future business conditions.

White Machine Works Doubling Facilities

EAU CLAIRE, WIS., April 21—The A. E. White Machine Works, manufacturing automotive parts, supplies and accessories, has completed plans for erecting a 2-story, 50 x 120-ft. plant. The company is employing 50 men in night and day shifts. When the new plant is finished the force will be increased to more than 100. The line of truck and tractor appliances will be enlarged to include several new designs.

Calendar

SHOWS

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and Accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

May 15-June 1—Venezuela. National Exhibit of Venezuela.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-15 — London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December—Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago, International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

April 23 - 25 — Walla Walla, Wash. Sectional Tractor Demonstrations.

May 5—Sacramento, Cal. Sectional Tractor Demonstrations, Demonstration Field.

June — Denver, Col. Sectional Tractor Demonstrations.

July 14—Wichita, Kan. Automotive Committee of National Implement Assn.

Aug. 18—Aberdeen, S. D. Sectional Tractor Demonstrations.

October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

RACES

April 24—San Bernardino, Cal. Rim of the World Hill Climb.

†May 17—Uniontown, Pa., probably 112½ miles.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*June 14—Sheepshead Bay, L. I. Speedway race.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15—Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

†Sanctioned.
*Tentative dates.

CONVENTIONS

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

April 28-May 1—St. Louis, Mo. Chamber of Commerce of United States Convention.

May 1-June 1 — Atlantic City, N. J.—Pan-American Aeronautic Convention and Exhibition — Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

May 21-24—Washington — Conference on Weights and Measures — Bureau of Standards.

May—Washington, Pan-American Commercial Conference, Pan-American Union Building.

June 2—Chicago, Ill.—Natl. Gas Engine Assn. Hotel Sherman.

June 23-28—Ottawa Beach, Mich. —S. A. E. Mid-summer Meeting.

Sept. 22-24—Philadelphia, Annual Convention, National Association of Purchasing Agents, Bellevue-Stratford.

Buy Parts for Army Truck Maintenance

WASHINGON, April 18.—The War Department continues to place orders for large amounts of tires, gasoline, spare parts and repair parts for the maintenance of trucks and cars in the army, both abroad and in this country. Among the contracts recently placed were orders to the Packard Motor Car Co. for parts valued at $106,584; Fisk Rubber Co., $156,777; Goodyear Tire & Rubber Co., tires and tools, at $853,000; Nash Motors Co., spare parts, at $126,000. Following is a list of contracts placed recently:

Continental Rubber Co., Erie, Pa., 3500 pr. tires at $4.20, $14,700.

Fisk Rubber Co., New York, 4833 casings, with tax, $156,777.13.

Union Oil Co., Los Angeles, 70,000 gal. gasoline at 19 cents, 3500 gal. at 18½ cents, 90,000 gal. aviation gasoline at 22 cents, 8000 gal. Liberty Aero oil at $0.445, 100 gal. trans. lubricant at 24 cents; total, $37,331.50.

Goodyear Tire & Rubber Co., 4000 tubes, $6,987.93; casings, including tax, $846,113.90.

Firestone Tire & Rubber Co., Akron, 1000 casings at $9.86 plus packing, $9,871.10; 230 tires at $32.37, $7,445.10; 8600 tubes plus packing, $14,501.32.

The Mathers Spring Co., Toledo, 170 cart front springs and 170 part rear springs, $7,553.18.

Muncie Gear Works, Muncie, Ind., repair parts to maintain 2000 military trucks, $17,671.40.

Locomobile Co. of America, Bridgeport, Conn., spare parts to maintain 1195 Riker trucks, with tax, $60,463.03.

Packard Motor Car Co., Detroit, spare parts, including tax, $106,584.41.

Premier Motor Car Corp., Indianapolis, Ind., mounting 1021 steel ammunition bodies on Nash chassis, at $17.19, $17,550.99.

Kissel Motor Car Co., Hartford, Wis., mounting 406 steel ammunition bodies on F. W. D. chassis, at $17.19, $6,979.14.

Continental Motors Corp., Muskegon, Mich., various parts, $5,411.16.

Pierce Arrow Motor Car Co., Buffalo, spare parts to maintain 1454 trucks with tax, $39,060.42.

Nash Motor Car, Kenosha, Wis., spare parts to maintain 3827 trucks, with tax, $126,232.98.

Four Wheel Drive Auto Co., Clintonville, Wis., spare parts to rebuild 150 trucks, including tax, $60,737.58; spare parts to maintain 1939 trucks, including tax, $64,825.07.

Cadillac Motor Co., Detroit, spare parts, with tax, $78,767.93.

Michigan Malleable Iron Co., Detroit, 500 sets wheels with skid hooks for 3-ton trucks, $74,392.12.

Fairmont Tool & Forging Co., Cleveland, 8000 kits tool for trucks, $31,200.

Michigan Boosts License Fees

LANSING, April 19—Car truck and motorcycle licenses in the state of Michigan may be boosted by the state legislature 10 cents per 100 lb. on passenger cars and from 15 to 25 cents per 100 lb. on all trucks, in addition to an increased tax on truck horsepower of from 15 to 25 cents. The horsepower tax on passenger cars remains unchanged.

The license increase is embodied in a substitute measure for the Evans bill. In addition to the increase in the license cost of all cars and trucks, a straight tax of 50 cents per 100 lb. is provided for all trailers. It is estimated that the revenue from the increased tax will amount to approximately $800,000 per year. The bill, it is said, will meet with little opposition in the house and senate.

Post-War Finance

(*Continued from page* 894)

Washington, their property rights abroad will be defended, if need be, scrupulously and sternly.

Another very vital post-war problem is that presented by the precarious financial condition of the railroads. Its multiple ramifications affect every phase of our business life. And the situation grows more desperate every day. During 1918 the deficit piled up under Government operation, and which is to be met out of taxation, was in excess of $200,000,000; to which has been added more than $70,000,000 during the first two months of the present calendar year. Yet rates are 25 per cent higher and the service poorer than ever. It is true that in February the gross earnings of the railroads increased $61,000,000 over the corresponding month in 1918, a gain of 21 per cent; but operating expenses, which a year ago had run close to gross revenue, increased $62,600,000, or 24 per cent. And the net operating income of the railways for February was nearly $37,000,000 less than the compensation guaranteed by the Government. In January the deficiency was $55,000,000.

Under the sympathetic management of the Railroad Administration, which recently granted a further wage advance of $65,000,000, wage increases of $910,000,000 have been allowed. During the last three years wages have increased $1,260,000,000 and have more than absorbed all additional revenues obtained from higher rates charged for freights and passenger traffic. A revolving fund of $500,000,000, which was voted to meet capital requirements, has become a dissolving fund in the face of railroad necessities. To meet the losses in operation and capital requirements of the roads, a sum aggregating more than $1,000,000,000 for the period covering Government control has already been required in Government funds to be raised from tax resources.

The country was promised, by those responsible for this debt, that vast economy in operation would be effected, which would show convincingly the wisdom of their plan. Experience has proven that the economies effected have been negligible in comparison with the expense added; and that, on the whole, less efficient service—less satisfactory to the public and less promising for future needs—has been rendered at a largely increased cost to the taxpayer.

Progressive Assembly
Fordson Tractor

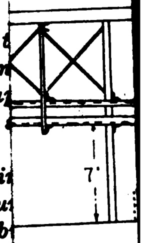
THERE are two principal parts in the Fordson tractor, the engine and the large transmission housing which really takes the place of the frame. The assembly system, broadly speaking, consists of two parallel lines of conveyors, one carrying the engine block and the other the transmission housing until they are ready for bolting up on the final assembly conveyor. Beginning at the left of the plan herewith the machined parts first pass through electrically driven washing machines and then proceed to the assembly conveyors. The camshaft and crankshaft are fitted first to the engine block, after which it is run in a burning-in stand. From this point the conveyor chain is fed by overhead chutes with flywheel, fan pulley, magneto and the other parts forming the engine.*

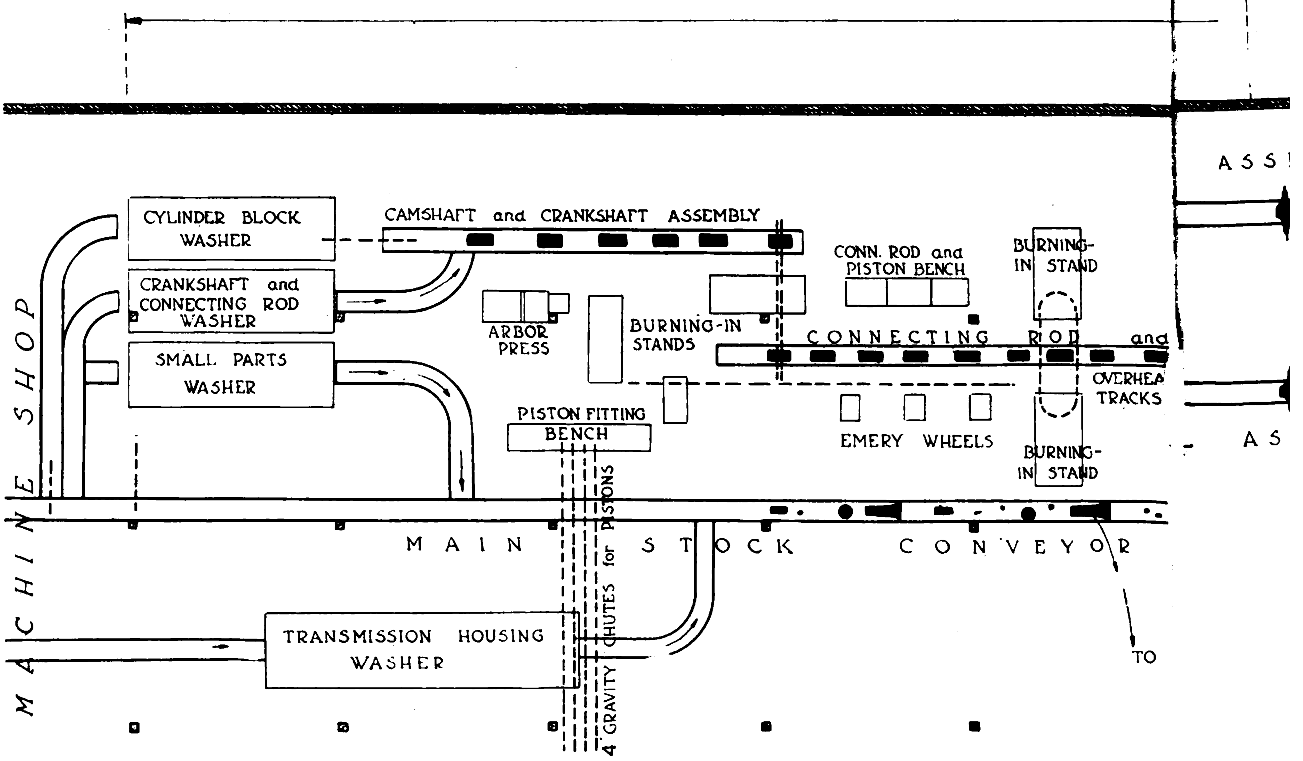
Meanwhile the transmission housing has been picked up from the main stock conveyor and hung open end up on the first of the housing assembly chains where the gears and clutch are dropped into place. The housing is then swung into a horizontal position on to the next step of the conveyor train, where the worm and rear axle are inserted, the axle housings bolted in place by electric bolt drivers. This part and the engine block are now ready for bolting up. They are

transferred t
drop them on
for bolting u
small parts
conveyor.

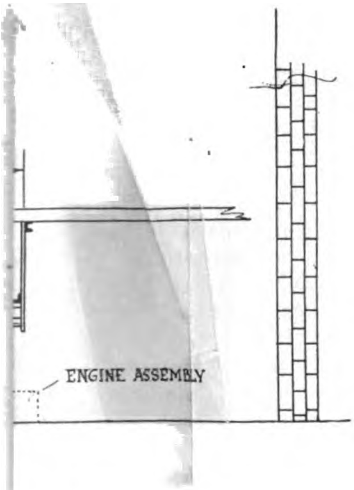
A most i
consists of u
side of the b
tion they wil
of the pits a
with no loss
outside recei
of an overhe
of gasoline a
mounted on a
engine. The
shop, where
paint. At the
which starts

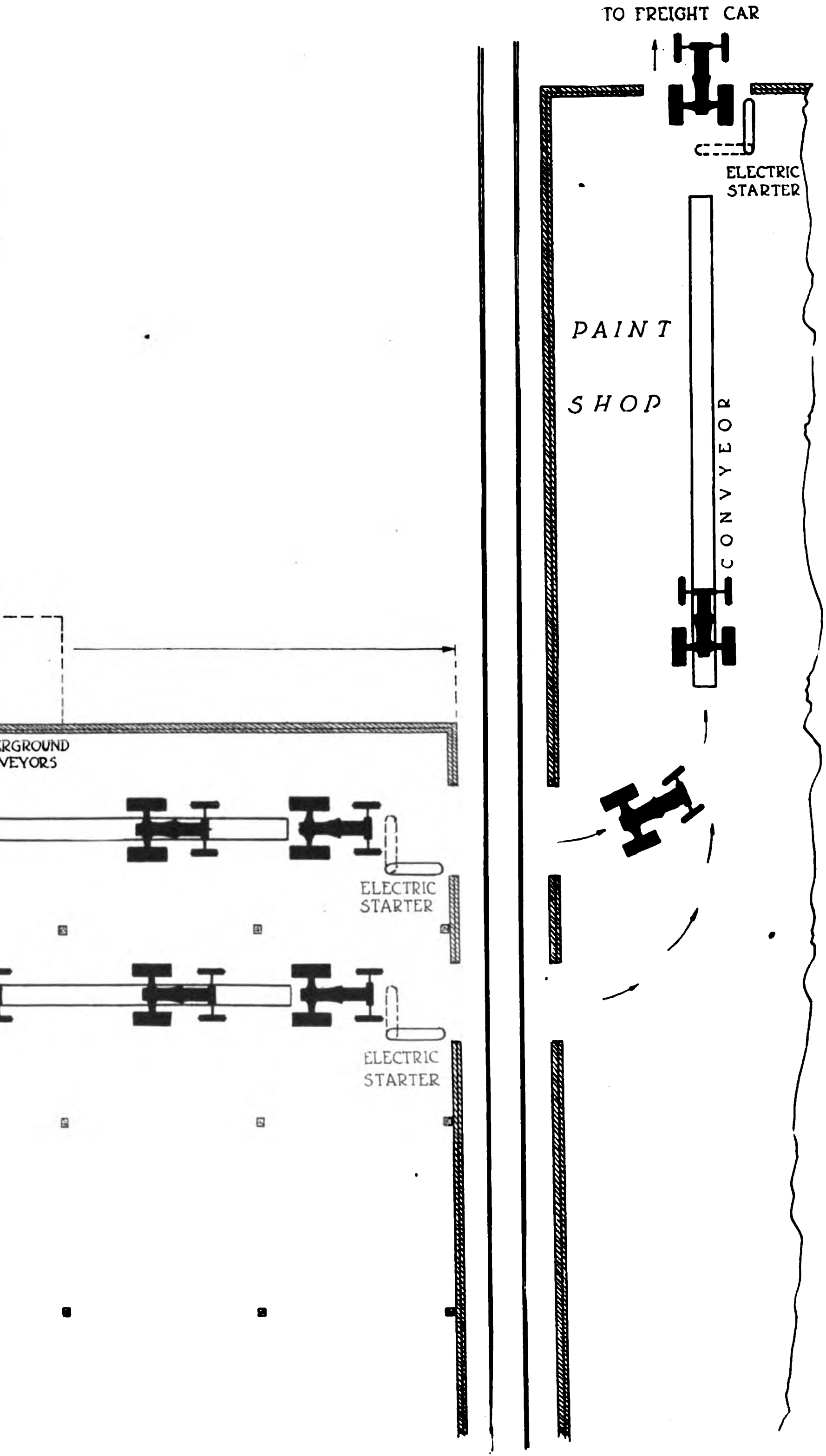
used to s
tween whic





ipply
h the


ENGINE ASSEMBLY


TO FREIGHT CAR
ELECTRIC STARTER
PAINT SHOP
CONVYEOR
LEFT REAR WHEELS
RIGHT REAR WHEELS
FRONT WHEELS
FUEL TANK
UNDERGROUND CONVEYORS
MBLY
FUEL TANK CHUTE
ELECTRIC STARTER
EMBLY
ELECTRIC STARTER
GRAVITY CONVEYOR
for REAR WHEEL HUBS

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

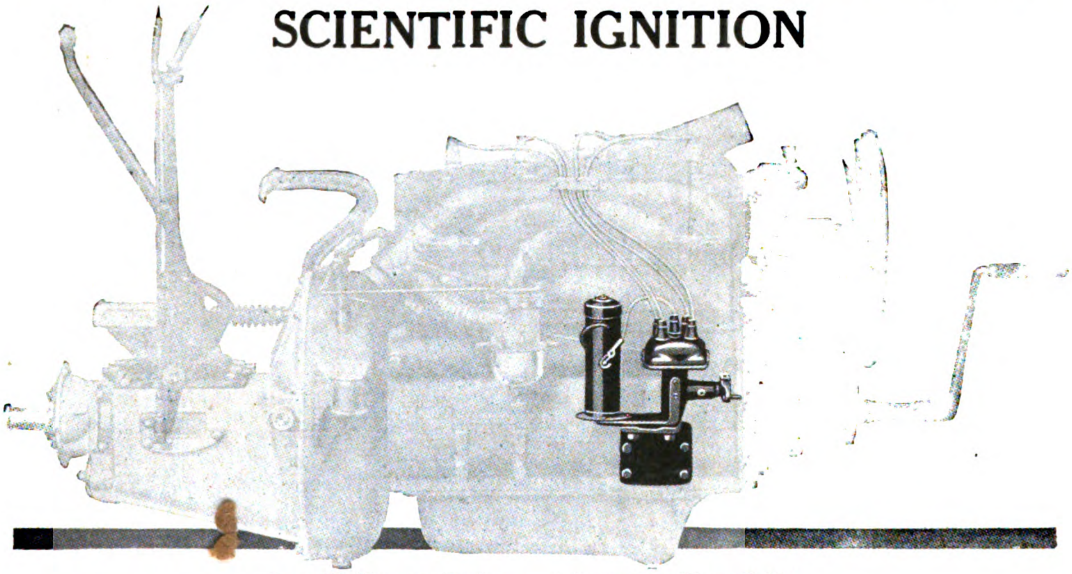
Vol. XL
Number 18

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MAY 1, 1919

Fifteen cents a copy
Three dollars a year

Simple in Construction — Unfailing in Performance

ATWATER KENT
SCIENTIFIC IGNITION



Type CC Magneto Replacement System on Maxwell Motor

TYPE CC Magneto Replacement System fits snugly on the base provided for the magneto. Very little work is required to install it.

The system is so simple that it rarely needs attention.

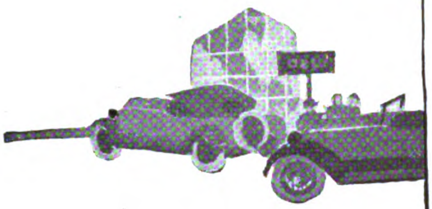
Quoting from a car owner's statement: That after 41,000 miles of operation, he thought the system had better be overhauled, although there was really nothing the matter with it that he could discover, as it was sparking as regularly as the day it was installed (several years ago).

Write for copy of our booklet, "Selling Atwater Kent Ignition"

ATWATER KENT MFG. WORKS *Philadelphia*

SEE YOUR DEALER OR WRITE TO 4938 STENTON AVENUE

CONTINENTAL MOTORS
Powerful as the Nation
AMERICA'S STANDARD



The Most Important Question: "Has it a Red Seal Continental Motor?"

With the buyer of a motor truck or passenger car today, the time for experimentation is past—he demands a vehicle of *proved* worth.

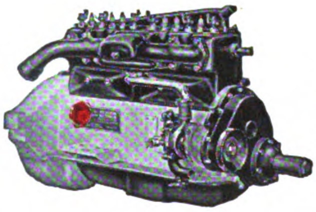
Naturally, therefore, his first thought is of the motor. And the most important question is:

"Has it a Red Seal Continental Motor?"

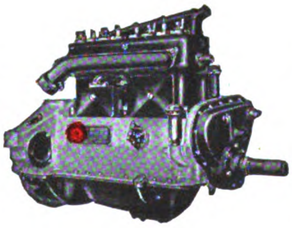
He knows that a motor which for more than a decade and a half has stood the test of service, in hundreds of thousands of automobiles and trucks, under the most exacting demands of peace and war, is a motor upon which he can absolutely depend.

The Red Seal Continental Motor has stood *this test of past performance*—in power, in speed, in economy, in all-round reliability. As a consequence, more than 160 successful manufacturers of automobiles and trucks have selected this motor—and upwards of 15,000 dealers have approved their judgment by handling Continental-motored cars. Tens of thousands of owners will have no other motor.

Look for the Red Seal on the motor in the car or truck you buy—it's your unfailing guarantee of motor dependability.



America's Standard Passenger Car Motor. Look for the Red Seal Nameplate.



America's Standard Truck Motor. Look for the Red Seal Nameplate.

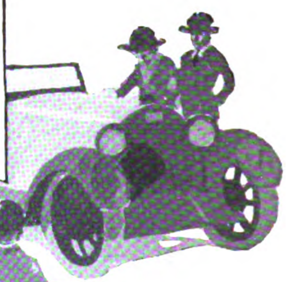
CONTINENTAL MOTORS CORPORATION

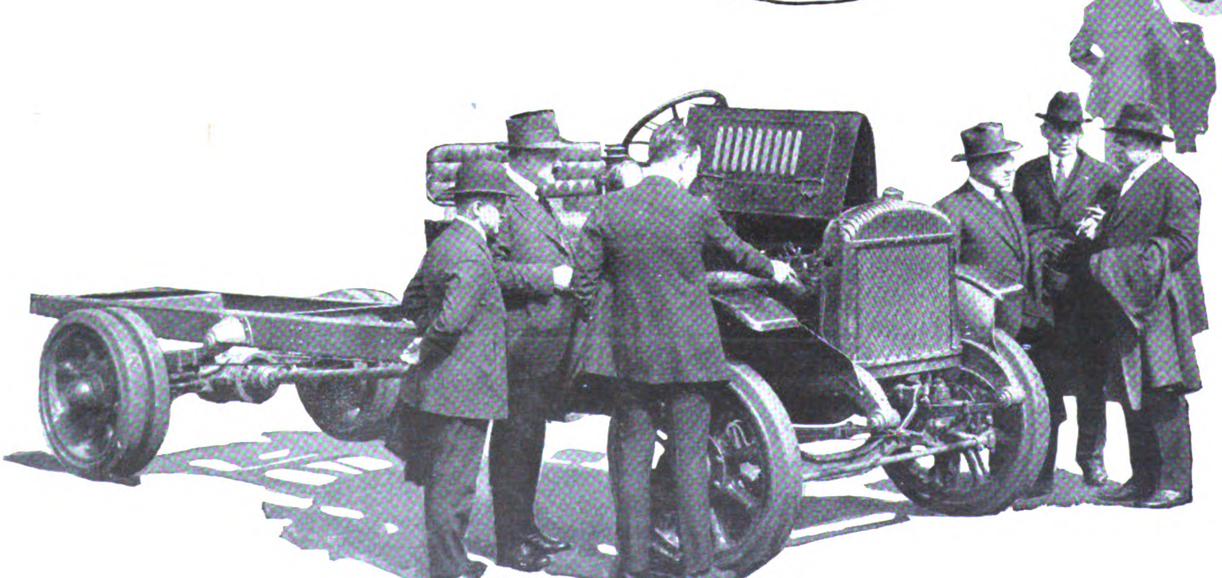
Offices: Detroit, Michigan

Factories: Detroit—Muskegon

Largest Exclusive Motor Manufacturers in the World.

Continental Motors





AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, MAY 1, 1919—CHICAGO No. 18

Less Government Interference

Is the Demand of Foreign Trade Convention

Imperative That Ships Be Sold Soon to Americans—Cannot Look to Allies for Export Business—Best Opportunities in Latin America and Other Neutrals—Reciprocal Trade Essential

By Allen Sinsheimer

CHICAGO, April 25—Prompt sale of the American merchant marine to Americans and speedy return of the railroads to their owners are vital to the success of our export trade.

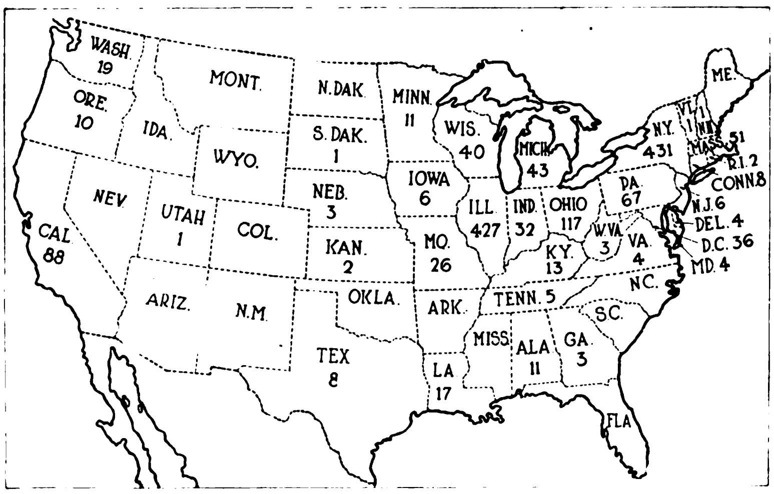
Less Government ownership and interference with industry are necessary to insure success to America's foreign commerce.

These major conclusions and a unanimous demand for a prompt statement by the Government of its policy toward industry were dominant features of the Sixth Annual Foreign Trade Convention held here this week. Widespread applause attended every demand for less Government interference in business.

That we cannot look to our Allies for export business, that we must purchase raw materials from the neutrals with whom we do an export trade, that Latin America and some of the European neutrals and the Orient will form the chief outlets for our export, that cash against document at New York is harmful practice and poor business, and that we may look to Germany for keen competition in the neutral trade are others of the most vital developments of the convention.

The Allies are not going to buy more than they absolutely have to from the United States. It would not be good business for either at this time if they did. Their policy is one of self-defense and they must buy little and sell much for the next 3 or 4 years if they are to stabilize their financial positions, and this in turn will eventually mean more speedy repayment to the United States of the outstanding war debts.

Only legitimate and stable foreign trade is built on a reciprocal basis—we must buy from those who buy from us. We must purchase raw



Number of delegates from the various States present at the National Foreign Trade Convention. In addition there were many from abroad. Almost every country in the world was represented by a delegate from its American agency

materials from those nations to whom we sell finished products. This means that they will have the cash to pay for our exports and it insures a sound exchange basis. We cannot now buy raw materials from our Allies. They need them all and more for reconstruction. We can buy raw materials from the neutrals, and it is to them in turn we must look for export business.

Latin America, Scandinavia and Norway and the Orient will all be excellent markets for American products in the opinion of the various speakers. Latin America, which has been buying from us on a greatly increased scale since the outset of the war, will undoubtedly continue in great part to import American products. In some few instances Great Britain, France and Italy may undersell us, but in the main, and particularly in the automotive field, we will undoubtedly hold our own and increase. The readiness of American automotive manufacturers to supply now and our quantity production and low prices are important factors.

The Scandinavian countries are friendly to the United States as a result of the war. The British censorship seriously affected the feeling toward her, and it was said at the convention that the Scandinavian manufacturers are looking to the United States for many commodities.

Prosperity through the war has greatly increased the buying power per capita of the Orient, and we can secure cash there for our products and in addition give credit quite freely and in safety.

These are fields that the Allies cannot well sell to for some time to come and give promise of great and successful business for the United States.

Consequently, with the debt of France so great that it is about $1,000 per capita, with Italy laboring under the burden of debt and minus natural resources of iron and coal, and with Great Britain forced to control her imports until she can well establish her exports, American industry should for the time being give up expectations of a large export business to those countries and concentrate its energies on the neutrals, and particularly those from whom we can buy raw materials for conversion to finished products.

The practice of selling for cash against document at New York means first a continuation of the gold stream that has been pouring into the United States and upsetting seriously the financial exchange, and secondly, in view of the money markets of the world and the need for us to extend long credits, it is a bad business principle to-day.

German Competition

Because the hatred of neutrals will likely be less than that of the Allies, Germany plans her first commercial onslaught toward the neutral countries, and the United States should prepare to meet German competition possibly more strenuously than the competition of the Allies.

France, as was told at the convention, is to-day in dire need of long credit. The French nation has lost $7,000,000,000 worth of buildings, $12,000,000,000 of agricultural and industrial land and facilities and almost $5,000,000,000 in other properties and cannot hope to pay off her indebtedness or pay cash for commodities for years to come. She does hope to some extent to pay for imports with raw materials, as, for example, potash, of which she has 300,000,000 tons secured by the return of Alsace-Lorraine.

German Export Trade

German export trade, it is thought, will be directed toward the neutrals and that we may look for keen competition from her. The German manufacturers fear that the hatred of German products will continue for some years to keep them out of the markets of the United States, Great Britain, Italy and France, and consequently they look to the other countries.

That all export problems and our big national problems must now enter into the consideration of every individual industry planning foreign trade, that the Webb-Pomerene Act will, without question, be the biggest single factor for development of American trade, that direct selling is the only logical method for selling abroad, that foreign advertising can be successful, but requires most careful handling, and that the shipping situation must soon be cleared up and lower shipping rates set were other important developments of the sessions.

European Neutrals' Trade

They offer our best trade areas. Neutral countries in Europe are favorable to U. S. A. trade. They have grown wealthy during the war. Their shelves are empty. Credits must be extended and cash against documents is not the best method of building up foreign trade. Exclusive selling agencies should be placed in each country.

Direct selling in export trade, discussed an entire afternoon in the convention by over 500 delegates, is the only satisfactory way to carry on export business, according to the opinions of experienced concerns. Many of the speakers who have been in export trade for 20 years have just recently returned from Europe, where they have been studying post-war conditions.

By direct selling is not meant sales to the consumer by the maker, but rather the operation of his own selling organization by a manufacturer which can be done either by:

1. Branch houses.
2. Representatives and jobbers.
3. Exclusive agents.

The manager of your export business should be an American familiar with American manufacture and business, and his staff should be native to the country in which he is located. Branch houses allow for better control of the stocks on hand, better service and cultivation of the buyer to a higher degree than through a foreign agent. Advertising, too, can be handled more advantageously through a branch house.

Where an exclusive agent is used he should be well established in the trade engaged in and loyal to the United States. Generally the longer such an agent is established the more reliable he becomes. He should be assisted when first starting by one or two men sent by the manufacturer who can aid him with sales and advertising help.

Many local problems arise in connection with direct selling. In England and France sales are often very small and good representation is very necessary. In the hardware industry sales to consumers often average $2.50, which emphasizes the need for competent representation. Selling costs in England and France are 15 per cent higher than in the United States. Direct sales in Latin America demand a thorough study of the people.

Practically a unanimous approval and optimism prevailed with regard to the Webb Act allowing combines for foreign trade, and it was stated frequently that it would be the most vital aid to building up American foreign commerce by allowing our manufacturers to combine and compete fairly with foreign trade. It was also the

general opinion, with few exceptions, that the various legal interpretations that are possible will not be used to obstruct foreign commerce and that the bill, as it stands, is of particular significance, since it is the first direct concrete and co-operative aid that our Government has extended to industry.

That our shipping bottoms will be ample to care for our foreign trade once they are safely in the hands of American owners was a universal opinion. Shipping rates, it was also said, will not be reduced until after the shipping situation is settled, and until then must continue to some extent to interfere with export trade.

Advertising abroad must be done directly by the manufacturer and not through a dealer, to secure the most successful results, and can be made most profitable if it is properly and carefully handled. Too many manufacturers have plunged either with too little or to much money into advertising campaigns in the various countries without first making a careful survey of the field and inquiring into the mental and material conditions of the people, their customs, peculiarities and systems. No two countries can be sold on the same plan of publicity. Each must be surveyed and analyzed separately. The population, buying power per capita and all local conditions must be considered.

Successful Advertising

Advertising can, however, be done most successfully if sufficient attention is given the subject and the appropriations are properly divided and expended through some advertising agency familiar with the countries in question and capable to judge the proper media.

One of the best examples of how foreign trade differs to-day from that of yesterday, and means that the export manager of an automobile factory, for example, must also consider numerous of our big national problems and many other exports that are far removed from the automobile industry, lies in the usual war condition that has set up a situation calling for special care with regard to every material and product. We will have to give consideration to every item for export separately and intensively. Thus the statements made that raw materials should be worked at home and not exported, though in the main form a sound conclusion, met with a reasonable contradiction in the discussion by Fred I. Kent, vice-president of the Bankers Trust Co., who stated that the shipments and prices of raw cotton from the United States to Great Britain will play a most important part in all of our export business to that country and in its imports to us and in our financial relations.

Great Britain, he said, will first have to control her imports until her exports are re-established. A flood of imports now against her much decreased exports will only serve to send her further lower in the financial scale and tend to make her position still more unstable. She will have to ship to the neutrals to whom she is in debt before she ships to the countries that owe her. And it will take her a long time to pay her American indebtedness, because to keep her foreign commerce alive she must buy raw cotton from us in huge quantities and at fair prices. This will continue her as a debtor nation to the United States. Great Britain must have raw cotton in order to make textiles for China, India and other countries. These offset her imports from those countries. If we do not sell her the raw cotton at normal prices Great Britain will not be able to compete abroad with her textiles, be unable to pick up her world trade rapidly and possibly ruin her foreign commerce that is now practically vital to her future. If we do sell raw cotton at fair prices to England it means that her world trade will revive rapidly, she will be able to meet her American obligations more quickly, will increase her financial income, enrich her and increase our exports to her and allow her to speedily pay off her war indebtedness to us.

Consequently in this instance it appears that the export of automobiles and the relaxation of the existing embargoes and curtailments against our automotive products is directly influenced by this problem of cotton. Sufficient cotton at fair prices will apparently mean earlier relaxation of restrictions against American automotive commodities.

France's Economic Error

France, said Mr. Kent, is making an economic error in her attempt to make all possible products within her boundaries instead of manufacturing those which her climate, geographical situation and resources best warrant. Continuance of her present course, he believes, will tend to further diminish French foreign trade because no country can manufacture for export without buying abroad for manufacture, for any length of time and do it profitably. The French indebtedness to us would be more quickly reduced if she would work to establish her reciprocal foreign trade instead of attempting only to develop export business.

The extreme importance of our various national problems in their relation to foreign trade was emphasized particularly in the matter of labor and of Government ownership. The deep feeling against continued operation of the railroads and merchant marine by the Government was evidenced frequently by the widespread applause of every statement favoring the return of the roads to their owners and the sale of ships to American concerns and individuals.

The inability of export managers to make prompt deliveries because of existing railroad conditions was stated often. The present high costs of freight transport are an important

The Webb Law

A practically unanimous optimism and approval of the Webb Law prevailed. Confidence was expressed that the bill is the most important single factor for the development of export business. Majority of opinions were that the Government will not interpret the provisions of the bill from a strictly legal viewpoint to create pitfalls for the combines organized under it unless they engage in dishonest or unfair practices. The tendency of lawyers to emphasize its legal frailties was decried.

Opportunity for Oriental Trade

The Orient, prosperous as a result of the war and untouched by the post-war problems, offers important opportunities for American export trade. We can sell for cash and we can purchase raw materials in the Orient to be manufactured into products that can be resold there. This means a stable financial condition of exchange. American manufacturers should concentrate their energies to a large extent now on the development of the Oriental trade.

Competition by the Allies

A healthy competition for foreign trade by Great Britain, France and Italy against the United States will do more to create a stable financial world condition than a widespread commercial victory by our Government. We should welcome the competition. Apathy on the part of any of the Allies should be decried. Great Britain will be probably the first to enter into a keen competition, but her entrance cannot be expected for some time.

barrier to competition with foreign firms in prices.

That the governmental policy of continuing war contracts now for the purpose of providing workers with labor and wages was proclaimed most likely being fair, but, it was stated by Homer Ferguson, president of the Newport News Shipbuilding Co., the system of maintaining the cost-plus contracts and the consequent high war wages fixed by the Government was unstable and unsound. Many of his shop workers he said had filed income taxes ranging between $5,000 and $9,000 dollars for last year and were now earning between $100 and $175 a week engaged on work that is being provided solely to keep them employed. This he and others pointed out tends to keep up our entire wage scale and consequently our selling prices and is seriously harmful to our competition in the markets abroad. It means such high prices for ships, for example, that unless a great part of the cost is at once written off, the ships cannot operate profitably and must work at a great loss even at prices far in excess of foreign scales.

Return of Ships to Private Owners

Unanimous approval was expressed for some method whereby the ships now owned by the Government would be sold to American firms at reasonable prices and on reasonable terms.

The present unstable labor condition was referred to by every speaker and practically every discussion terminated with a denunciation of the bolshevistic tendencies, now so threatening and tending to prolong the existing labor problems and consequently increasing the difficulties of export trade.

The need for governmental declaration of its future policy toward business and expression that Government interference with business should cease were statements made frequently. Edward N. Hurley, speaking at the banquet, emphatically denounced Government interference and the present tendency of many business men to seek too much Government co-operation. "Business," he said, "should not get into the habit of relying upon the Government to solve difficulties which can be overcome by ordinary business skill and honest methods." He also demanded that our Government should state its position and policy toward industry and labor clearly and promptly, and referring to the Webb Act which many lawyers speaking at the convention claimed is too full of legal complications and threatens to create a quicksand in which industry will find itself mired, he stated that "most business problems require common sense rather than legal reference and require good judgment and honesty of purpose rather than reference to the courts."

That the Webb Act is important not only as the first concrete evidence of our Government's intention to aid business, but also as a practical vehicle on which our foreign business can ride to prosperity speedily and wholesomely was the expression of the majority of business men and some lawyers present.

There is no question in the mind of the Federal Trade Commission, stated John Walsh, former chief counsel of that body, but that Congress intended the act primarily as a method to promote foreign trade, as is indicated in its title, "An Act to Promote Foreign Trade and for Other Purposes," and the Commission, he stated, does not intend to quibble over every possible legal interpretation and will insist only that our foreign business under the Webb Act will be fair and honest. The passage of the bill, he said, indicates the Government's desire to aid foreign trade development and the provision included in the bill providing that when a concern violates its intent the firm will first receive notice of such violation together with suggestions and recommendations for changing its policy or structure is itself another indication that the Government has the highest respect for American business integrity and has adopted a policy of co-operating with rather than persecuting our business world.

The Balance of Trade, and Exchange

The pound sterling, released from a fixed rate of exchange, is losing in value, and in consequence imports into Great Britain take on an added cost to the consumer. It is prophesied the pound sterling will decrease to $4. This means an 18 per cent increase at least in the selling price of American commodities in Great Britain. With the apparent sanction of the British Government to the decreased value of the pound sterling it can be assumed that this action is intended to construct a protective wall against imports to take the place of a tariff which Great Britain lacks.

Eventually this policy will stabilize exchange rates and create normal trading and finally permit a healthy American-British foreign commerce.

Our Allied Trade

We may be out of European trade for a time, but when Europe becomes normal there will be greater trade opportunities than before the war. Our Allies must control imports until they re-establish export trade. We must prepare to take European securities and buy their merchandise de luxe in return for our trade—there is something more than profit in foreign trade.

No Obstruction of Business Intended

He stated that more than 80 combines have already taken advantage of the Act and include all varieties of business. The Commission, he stated, after an exhaustive study of the bill found it was unreasonable to suppose that Congress had intended to obstruct our foreign commerce and he defined the Act as a means of promoting export trade along fair and legitimate lines and said that manufacturers following honest principles would find no Government interference because of possible legal variations.

"When the Commission," he said, "has reason to believe than an export trade association has committed an act or made an agreement which is in restraint of trade within the United States or which is in restraint of the export trade of any domestic competitor of such association or where such association has entered into any agreement or done any act in this country or elsewhere which artificially enhances or depresses prices in this country of products exported by the association or where the same substantially lessens competition in this country or otherwise restrains trade therein," which are the various restrictions of the Webb Act, "it will conduct an investigation." If it concludes that there has been a violation of the law it may make recommendations to the association for readjustment of its

business to accord with the law. "Thus for the first time in our history a penalty is not provided for violation of a law of commerce but in its stead is a recommendation for readjustment which may be acted upon by the Attorney General if not complied with. Congress evidently recognized by the passage of this provision that business men are generally anxious to maintain the highest ethics of trade, that violations are seldom international and will be promptly corrected when attention is called to them."

Import trade by a combine under the Webb Act, he stated, is not permitted. But, he said, Congress must have had in mind, when passing the bill, the many powers that are granted a corporation under its charter, and it is evident that a Webb combine can engage in the operation of wharves, warehouses, elevators, ships and many other activities incidental to its export trade. Two forms of organization are most common under the bill, one being the corporation formed of the various manufacturers each as stockholders, and the other being merely a simple agreement of a number of manufacturers to engage in export business.

A more pessimistic view was taken by L. H. Bissell of Chadbourne, Babbitt & Wallace, who stated the bill was filled with pitfalls for any combines formed under it. The problems he presented, however, he appeared to answer quite completely and satisfactorily. These were chiefly of that variety that come under the name of strictly legal interpretations. Suppose a combine, he asked, of American producers ship so much of their production abroad that they diminish the home supply, forcing up domestic prices, would not this be a violation of the Act which prohibits enhancement or depression of prices and restraint of trade? He answered this by stating that if manufacturers agreed upon a reasonable amount of their product for export prior to engaging in export trade each year there would probably be no interference by the Government regardless of the effect on price or trade at home.

Can a combination of American manufacturers undersell another American combine also under control of the Webb Act or any American exporter abroad, without interfering with the restraint of trade clause, if the foreign underselling ruins the competitors' business at home? was another question presented. It was answered that any underselling abroad would be allowed so far as it was honest and fair and based purely on production and sales costs.

That Webb combines could also sell products cheaper abroad than at home was thought permissible provided that it was done to meet foreign competition, but would not be allowed if without justification.

He also defined "foreign nations" as used in the Act to mean that the Webb concerns may sell to the Philippines but not to Hawaii, Porto Rico or Alaska, and the use of the word "navigation" he interpreted as "commerce" and allowing for both import and export business by the combines under the Act. He did not believe American manufacturers could manufacture abroad for export under the Webb combine plan but could properly assemble parts shipped from this country abroad for export sale. The combines, he also stated, could not sell materials in this country even though for manufacture here for export, but might be allowed to sell finished products to concerns in this country for export by them.

Allen Walker of the Guaranty Trust Co., who, it was stated, has organized 90 per cent of the combines now operating under the Webb Act, is very optimistic and assured that the Federal Trade Commission does not intend to restrain American manufacturers except where it becomes seriously necessary. He stated that American combines organized for export and representing similar industries, should be careful to avoid difficulties which could arise by the playing off of one combine against the other by foreign competitors. His fear of this possibility is so great that he urges the creation of single large combines to represent an industry rather than several smaller ones, and pleaded for abolition of petty jealousies between manufacturers.

The general impression gathered, however, from the various discussions marks the Webb Act as a most important aid to the development of American foreign trade, and the viewpoint taken, aside from that of a few lawyers, can be said to have been very optimistic.

The unpegging of the pound sterling and its consequent decline to $4.60, and the general unstable exchange condition, was a matter of considerable concern. Predictions were made several times that the pound sterling will likely go down to $4 and that Great Britain is planning the decline as a sort of protective measure to take the place of a tariff. The decline of the pound sterling has the effect of increasing prices of all products imported, since the importer must pay 4 per cent more (on the basis of $4.60) to the manufacturer from whom he imports. This means that the British public will pay from 4 to 10 per cent more for the commodities imported and has the effect of decreasing the imports. A decline to $4 would have the effect of raising the price paid to American manufacturers by 18 per cent. For ex-

Shipping Rates Remain

There is no likelihood of shipping rates declining until the general shipping situation is clarified and until the merchant marine of the world reverts to a normal condition. Private ownership of American ships now controlled by the Government will be a quick step toward stabilization of shipping rates.

Best Selling Methods

Direct selling, which means foreign sales through a direct representative, either in the form of a branch, an agency or a jobber, who should be an American citizen, is the best method for promoting foreign trade. No two countries should be placed under one branch. Under the American executive there should be a staff of native salesmen.

Government Interference Dangerous to Industry

"Combinations of Government with industry are as dangerous as Church with State," said Edward N. Hurley, striking one of the major topics of the convention. There was widespread approval of every demand for the return of the railroads to their owners and the sale of the American merchant ships to American individuals. Denunciation of the present practice of the American business man to seek too much Government aid was made frequently.

Parcel Post Trade

Great Britain has parcel post service to 195 countries and U. S. A. to 94. To become a truly great exporting nation we require the steadying and unending aid of an adequate parcel post system. Special attention must be given to small trial orders. Express charge on a 3-lb. package from Chicago to Johannesburg is $15.40, and parcel post from London to Johannesburg for the same weight is 84 cents.

ample a truck now selling for export at $2000 would bring the American maker 500 pounds sterling and the importer would be forced to sell the truck for at least $375 more than the usual retail price, and probably at $500 to $1000 more to make up the extra interest charges, etc.

Consequently the exchange situation is another of the many matters that will affect our exports and is another argument for the establishment of American banks abroad both for simplification of payment, decrease of costs of payment, and for the maintenance of sound exchange rates.

Although many American fabricated products are expected to decline in export with the re-entry of Great Britain in the field, chiefly because British prices are lower, as, for example, with brass goods which Great Britain sells for 20 per cent less, it is not expected that this will be the case with American automotive products; because while they are fabricated commodities they are in an exceptional position due to the fact that American makers are able to supply now and have long been established on a quantity production and low price basis. The automotive industry consequently is one that should be putting its best foot forward, engage in intensive foreign merchandising and make every effort for not only holding but increasing its trade.

Commercial education for foreign trade was given particularly close attention, and emphasis was laid on the need of a good general education as a basis for all members of the export organizations. Considerable discussion ensued with a decided tendency to favor the use of American salesmen abroad and particularly men speaking plain American English, possessed of average American honesty, application and intelligence, who, it was stated, would, when backed with fair prices and the best goods, easily outsell the men who ape foreign manners, customs and peculiarities. Men should be taken from within the home organizations, it was stated, to fill vacancies in the export departments, and should be those who can bring with them thorough knowledge of the production system and home sales plans of the company.

The use of foreign salesmen was decried. Many American concerns lost their export trade organizations with the beginning of the war because they had been employing foreign salesmen.

James W. Hood, president of the Allied Machinery Co., pointed out that England, Italy, France and Germany have never entrusted their export business to foreigners and said American industry must lay a foundation of complete independence from every other nation in all matters involving export trade.

He stressed the importance of developing foreign trade for those of our products which are specialties and believes these will find a ready market the world over. The importance of watching the stocks maintained in the foreign branches and agencies and of turning these at least three times a year, he said, cannot be exaggerated.

Discussion of the use of trade acceptances in export business developed that very little has as yet been worked out so far as foreign business is concerned. The only use of foreign trade acceptances has been made in the Orient, where the concerns draw on the mercantile distributers in the United States. "There was no reason," it was said, "developed to show that foreign trade acceptances cannot become more universally used nor why trade acceptances originating here and drawn on companies abroad should not find their way into the discount market."

Attention of all American industry to the important relation of airships to export business was demanded by Professor Hiram Bingham, lately a colonel with the A. E. F., connected with aviation. He told of the discovery of helium, which a few years ago cost $1,600 a cubic foot to produce as compared with 10 cents a cubic foot now, that to supply the Army prior to the new discovery would have cost $36,000,000,000, as compared with $200,000 now. Great Britain, and especially the Vickers Co., Ltd., are preparing to utilize the new discovery and this country should not neglect it, especially as the supply of helium is in the United States.

England is already building huge dirigibles, arranging ports, light houses and routes, and unless American industry awakens it will find the British manufacturer going to Pekin or Calcutta, as the case may be, in 3 or 4 days to close a contract that American makers will lose because it will take them 3 or 4 weeks to make the same journey.

Great Britain beat the United States in the selection of coaling stations for its marine, and forced us to take what was left, and we will find ourselves in the same situation with regard to aviation if we do not promptly recognize the value of the new discovery.

The use of advertising for promoting export trade was declared entirely feasible and highly successful by several speakers. The use of American trade export publications, it was stated, is particularly successful, and products ranging from high priced machinery to 25 cent cans of talcum powder are being successfully sold by export papers. The use of foreign local newspapers and weeklies is successful, although Sunday newspapers have not the power they possess in the United States.

Billboards, handbills, export publications, local papers, postal bulletins, street

Latin America

Latin America offers the greatest field for export trade. European makers for many years will not be in a position to meet the demands in South America and Central America. All have made money during the war. We must buy their raw materials in return for our manufactured products. Crating instructions must be followed more closely for Latin America than any other country.

Foreign Advertising Successful

Foreign advertising is not a matter of dollars, but of intelligent survey and analysis. Small or large sums can be successfully used for advertising, either in American trade, export publications or local newspapers or weeklies, provided the advertisements are properly written and illustrated and conform to the customs, peculiarities and systems of the individual country for which they are intended. No two countries can be successfully sold by any one advertising plan—each must be separately surveyed and analyzed.

Foreign Trade Dependent on Credit Elasticity

A flexible system for the handling of foreign finances is essential to the welfare of American export, for our foreign trade cannot expand without an elastic system, allowing for simple and easily extended long term credits. We must have a system that gives individual consideration to the customs of individual countries. The use of trade acceptances in the foreign field will simplify our credit problems. Complete machinery for collection and distribution of foreign credit information and for financing transactions and for handling payments is now available.

car and railroad station advertising has all been found profitable, stated Frank A. Arnold of the Frank Seaman Company. He told also that the advertising agencies have awakened to the fact that they must be able to tell prospective advertisers all details of foreign countries, about their population, customs, and buying power per capita. To analyze foreign advertising, for example in Latin America, it is essential to consider that 50 per cent of the people are illiterate and can be best appealed to by photograph and illustration.

Sense Appeal Successful

The sense appeal has been found particularly successful, and the appeal to sight by means of ads portraying automobiles with georgeous upholstery and brilliant finish has been profitable.

Good advertisements cannot be written in English and translated. All agreed on this. In such instances they lose their vigor and force. They should be written originally in the language of the people for whom they are intended. Native artists can better illustrate the advertisements. Color should be emphasized, and the Latin American artist knows how to do it. Trade marks should be played up, price should be prominent and all text or descriptive matter should be brief.

The use of cut-outs, calendars, postcards, souvenirs and attractive illustrative trade literature to be distributed by the local dealer has been found an excellent plan. The greatest stress, however, was laid on export trade publications, which it was stated the natives regard as a monthly or weekly catalog of the American products of the industry represented, and which they regard highly in the case of reputable papers.

The use of local newspapers in Argentina, Brazil, Peru, Australasia, South Africa and the Far East was found profitable by Howard G. Winne, Johnson Overseas Co., who stated that billboards, posters, and handbills were liked in China, posters in Argentina, railroad station advertisements in Uruguay and Argentina, and street car displays in Brazil. He emphasized the need for manufacturers to spend their own appropriations and not send them to dealers for their use for advertising.

Advertising in Foreign Countries

Numerous questions were asked as to the best means for dividing appropriations through the various countries of the world, and all were agreed that in the case of a virgin field it is essential to first make a theoretical survey and an arbitrary appropriation which can later be regulated by results. The keynote of the discussions appeared chiefly to be that a manufacturer planning to advertise abroad should do as he would in his home market—make a survey, analysis, secure experts, use the authoritative trade publications as a medium and for advice, consult advertising agencies, and keep free from uninformed so-called foreign experts.

FOREIGN TRADE REMARKS BY BIG MEN

We are badly inoculated with self-interest in relation to foreign trade policy and imports.—E. A. BRAND, *Tanners' Council of U. S. A.*

—

Europe's action in imposing restrictions is dictated by a policy of self-defense. She will buy little and export much in order to stabilize her position.—JAMES E. FARRELL, *president United Steel Corp.*

—

With the decline of foreign commerce decay sets in.—EDWARD PRIZER, *president Vacuum Oil Co.*

—

We are eager to sell goods abroad, but this is upon the assumption that we will get something for them. As individuals we want cash, but a nation's sales are never made for cash and cannot be.—FRANK A. VANDERLIP, *National City Bank.*

—

Business should not get into the habit of relying upon the government to solve difficulties which can be overcome by ordinary business skill and honest methods.—EDWARD N. HURLEY.

—

If you want foreign trade you must go after it. You cannot get it by sitting in your office and looking at a map of the world.—JOHN J. ARNOLD, *First National Bank of Chicago.*

—

Trade is reciprocal business in and out. Sales only do not mean trade. It has to work both ways.—E. J. PARKER, *The Parker Co.*

Enlargement of our maritime insurance companies was urged in a discussion of this subject, where it was told that many foreign customers, particularly in Latin America, preferred to insure themselves through British companies or other foreign concerns because they earn a commission that they do not secure when the American exporter insures through an American company. The placing of insurance with Lloyds of England was decried because it places our ships under their control and forces our shippers and ship owners to comply completely with British inspectors' demands.

Free Ports

The feasibility of establishing free ports similar to that of Copenhagen was discussed, to permit the importation of materials that could be manufactured into finished products at factories located within the free zone and then exported without incurring duty or tariff. A sort of manufacturing zone, in other words, located within a district similar to the Customs districts where goods are held in bond, was advocated. The history of New York's development and its difficulties to secure legislation for completion of a tunnel under the Hudson and East Rivers, were related.

The discussion emphasized that there would be danger of foreigners importing raw material to their own factories established in such zones and re-exporting the finished product in competition with American manufacturers. It was agreed that the scheme mentioned needed much investigation before any decision could be made.

The difficulties of granting foreign credits, the possibility of exporters combining to obtain data for establishing bureaus to furnish foreign credit and the assistance that should come from our government were among the problems discussed under the head of foreign credits and credit information. "We must look," said E. E. Pratt of the Overseas Products Co., "to the government for a consistent foreign policy with reference to the establishment of stable government and the preservation of the existing economic system throughout the world."

Packing for the A. E. F.

The methods used by the A. E. F. to overcome packing problems were related by Captain H. R. Moody of the U. S. Army, who gave several concrete examples, among which was the army system of handling the Packard truck. "It was found that the original 5-ton Packard truck completely set up occupied 1,000 cu. ft., and after experiments we found that the truck could be dismantled without seriously interfering with reassembly overseas. It was packed in a crate to occupy 268 cu. ft., thus allowing four trucks to go where one had been shipped before.

The convention closed following a decision to hold the next annual meeting in San Francisco, and with a vote of thanks to the various officials.

Willys Profit-Sharing Plan on 50-50 Basis

Establishes Community of Interest Between Workers and Employers—First $400,000 Has Been Distributed

By J. Edward Schipper

THE plan of the Willys-Overland Company to divide the profits of the company over and above the amount reserved for interest upon capital on a 50-50 basis would have been considered sufficiently revolutionary to be ridiculous 4 or 5 years ago. It has been adopted in the past 2 years by a number of concerns and is not even radical enough to be questioned as a general plan. The main interest of the plan arises from the fact that this is perhaps the largest organization by which it has been adopted and is an organization directly in the automotive field. For the same reason the details of the plan should be considered very carefully and the advantage or otherwise of each provision should be noted, for the benefit of the other industrial establishments in this field. While this is no longer radical but ouly good practice, the best of practice being always far ahead of the general method, it is a clear and important mark of progress in the new relations which are being established between employer and employee.—*Harry Tipper.*

ONE of the most important developments in the newer relationship between capital and labor is the profit-sharing plan now in operation at the plant of the Willys-Overland Co. in Toledo. John N. Willys announced last January that he would introduce for the years of 1919 and 1920 a fifty-fifty profit-sharing plan. Summed up in a few words, this plan is outlined in the following statement: "That after permanent capital and permanent labor have each been justly compensated, having due regard to the cost of each (the cost of capital and the cost of living), the additional profits accruing from the joint employment of permanent capital and permanent labor shall be divided equally between them—fifty-fifty."

The thought underlying the John N. Willys plan, which is published in detail herewith, is to create among the men the feeling that they are working with the company instead of for it. The Willys-Overland Co. is taking its employees into partnership and splitting its profits on a fifty-fifty basis.

How this will work out remains to be seen. The first $400,000, representing one-half the profits of the first quarter, has just been distributed. Ten thousand Overland workers have received checks for their share in these profits. The indications are that the plan is going to work well, but with many thousand workmen, large numbers of whom are foreigners, it is not possible to reach them all through the printed word. It is therefore necessary to bring the message home to them by spoken word, often in their own language, and the Willys-Overland Co. is holding meetings five times a day, taking 500 men at a time and instructing them in the details of the fifty-fifty plan.

Some amazing results have been found. When the committee of five, appointed from the ranks of the employees, first started to tell the laborers of the plan, they found that outside agitators, taking advantage of the inability of some of the workmen to understand English, had given distorted ideas as to what the plan meant; and a marked change of attitude and a rapidly growing enthusiasm for the plan developed among these men as soon as it was made clear to them.

An interesting instance may be cited. One of the machine workers—a boy seventeen years of age—approached one of the committeemen and said: "Is it true that we are going to share one-half of what the company makes?" When the committeeman informed him that it was true, the seventeen-year-old workman replied: "Then why don't you turn out your lights during the noon hour?"

Needless to say, his suggestion was quickly acted upon, which resulted in a great saving in current, due to the turning off of thousands of lights throughout the great Overland plant. This is only one instance in many. Hundreds of suggestions and interesting questions are pouring in daily to the office of L. M. Ellis, the chairman of the fifty-fifty committee.

Picking a committee from the ranks of the workmen, so as to be sure that men of high intelligence and knowledge of sociological conditions would be found, presented an interesting problem, and it was solved in an equally interesting manner. The company announced that the committee of workmen to serve on this committee would be selected from those who sent in the best suggestions regarding the working out of the fifty-fifty plan. Sixty-three writers were picked as logical candidates for the committee, and one by one they were called into the office for an interview. An idea of the quality of the men who were called in may be gained from the first five who entered.

The first was a graduate in sociology from an eastern

(*Continued on page* 944)

The Willys-Overland Profit-Sharing Plan

PROFIT DISTRIBUTION PERIODS

Five distributions of profit to employees shall be made each year. The first four of these shall be based on a conservative book inventory and the fifth on the regular annual inventory:

No. 1. Distribution in April, for January, February and March.

No. 2. Distribution in July, for April, May and June.

No. 3. Distribution in October, for July, August and September.

No. 4. Distribution on Dec. 24, for October and November.

No. 5. Distribution in March of the following year to include December, the difference between book and annual inventories, and other adjustments.

Distributions 1, 2, 3 and 5 shall be made as early in April, July, October and March as the necessary records can be completed.

Separate profit-sharing checks shall be distributed.

PERMANENT LABOR

1. Every employee, after 6 mos. of continuous service, shall become a profit-sharer and be classed as "Permanent Labor." In the first distribution thereafter he shall receive a share of the profits which have accumulated from the date of his employment to the close of the period which is being distributed.

2. However, for the purpose of establishing the distributions of April and July, 1919, on a fair basis, profits earned by the company between January 1, 1919, and March 31, 1919, shall be distributed in April to employees who were on the company's employment records for the pay period ending Dec. 18, 1918, and who gave continuous service in January, February and March, credit being given these employees for 3 months' previous service.

Profits earned between April 1, 1919, and June 30, 1919, shall be distributed in July to employees who were on the company's employment record Feb. 1, 1919, and who gave continuous service in February, March, April, May and June, 1919, credit being given these employees for 1 month's previous service.

CONTINUOUS SERVICE

3. Employee's record of continuous service shall not be affected by absence on account of sickness or injury, or if it is by the consent of employer. Absence from work for two consecutive days or three times in 30 days without report and acceptable excuse shall automatically remove an employee's name from the continuous service record.

4. Record of employees absent in military service shall be considered as continuous, provided they make prompt application for re-employment after their discharge from military service. If the date of their application for re-employment is more than 10 days after date of discharge from military service, their eligibility for the continuous service record shall be determined by the Fifty-Fifty Division.

5. If any employee leaves the service of the company after being qualified for profit-sharing for 6 months' continuous service, his record shall be held open until the next distribution, when a final profit-sharing check shall be mailed to his address.

6. If an employee is discharged, the Fifty-Fifty Division shall determine distribution of profits upon the merits of the case.

Note.—The provisions of paragraph three shall take effect April 1, 1919, and shall not operate against an employee's continuous service record before that date.

BASIS OF DISTRIBUTION

In distributing profits, no salary or wage shall be considered as in excess of $5,000 per annum.

As stated in paragraph one of Permanent Labor, employees shall receive payment of profits in the first distribution after the completion of their first 6 months of service with the company. During the 6 months, a share of profits shall be credited to each employee's record, beginning with the date of his employment.

Distribution of profits to permanent labor shall be on the following basis:

FIRST FOUR DISTRIBUTIONS

If profits to be distributed in periods Nos. 1, 2, 3 and 4 amount to 6 per cent or more, but less than 8 per cent, on the total of wages paid in the period to employees whose names are on the last payroll of the period, 6 per cent of the wages paid shall be credited to each employee's record, except that no employee's share shall be less than 4 per cent per hour for each hour worked in the period. If the amount is in excess of 6 per cent, this excess shall be transferred to Distribution No. 5.

If profits to be distributed are 8 per cent or more, but less than 10 per cent, 8 per cent shall be credited, as indicated in preceding paragraph, no employee's share to be less than 4½ cents per hour for each hour worked in the period. The excess, if any, above 8 per cent, shall be transferred to Distribution No. 5.

If profits to be distributed are 10 per cent or more on total wages paid in the period, 10 per cent shall be credited, as indicated in previous paragraph, no employee's share to be less than 5 cents per hour for each hour worked in the period. The excess, if any, above 10 per cent shall be transferred to Distribution No. 5.

If profits in any one period do not equal 6 per cent on the total of wages paid in the period, no payment shall be made for this period (except under Paragraph five of permanent labor), but this amount of profit shall be transferred and added to the profit of the following period.

DISTRIBUTION NO. 5

This shall be based upon profits to be distributed for December, adjustment of book and annual inventories and accumulation of excesses from previous periods. It shall be credited on the basis of the percentage of its total amount to the total amount of wages paid in the year to employees who work in December.

Length of service with the company shall be rewarded by giving an employee an addition of 1 per cent per month to his share of No. 5 distribution for each month of continuous service in excess of 12 months after Jan. 1, 1919, until a maximum shall thereafter be added to such employee's share of each No. 5 Distribution.

PERMANENT CAPITAL

Permanent Capital is the net book value of the assets of the company, not including Good Will, Patents, Trade Marks, etc.

Statement of Dec. 31, 1918, shows the Permanent Capital of The Willys-Overland Co. to be the sum of $79,668,232.92.

COMPENSATION

In arriving at the "Just Compensation" to Permanent Capital, as related to our 50-50 profit-sharing distribution, there must be established—

1. An average rate for depreciation, based on general standard accounting practice, subject to approval of certified public accountants;

2. A reserve for contingencies or "Rainy-Day Fund," at an estimated rate;

3. A just return to invested capital, or cost of securing the necessary capital for investment in the industry.

university and had been a professor of sociology in the University of Illinois, but is now working in the Overland shop. The second is a graduate chemist. The third is a man holding a civil engineer's degree. The fourth was formerly an Irish editor on a German paper, a man whose keen wit and knowledge of human nature made him at once an acceptable candidate for the committee. The fifth has been president of the Toledo Socialist Club and is a keen student of sociological conditions.

With men of this mental caliber coming from the ranks of the workmen, it is evident that the fifty-fifty plan was submitted to the keenest type of minds before it was presented to the workmen. These men having both wide experience and at the same time being fully aware of shop conditions and the psychology of the shop employee, are the best possible judges that could be found, and their endorsement of the plan is a strong prophecy for its success.

John Willys in this plan has taken a long step away from what has been all too common in the past—the treatment of labor as a commodity and not as a group of human beings. This is the basic principle upon which this scheme has been laid out. It is common knowledge that the smaller the shop the less frequent are labor troubles, and the reason is not far to seek. Here capital is in such contact with labor that the capitalist or his representative, the president of the company or other officers, know the men in the shop by their first names. There is a point of human contact which is impossible in the vast industrial institutions which have grown up in the automobile business. Just as soon as this personal contact is established and labor becomes human to the employer, labor troubles become less if the employer is a man of proper disposition and character.

Establishing Point of Contact

Such close intimacy is impossible in a great organization such as the Willys-Overland. In its place there must be some other point of contact. This Mr. Willys is attempting to establish through a community of interest. He is making it as much of interest to the laborer in his plant to have the Willys-Overland Co. show a large profit as it is to the capital element in the concern. When workmen begin to feel that when they waste material or tools they are not only cutting down the profits of the concern but they are taking money out of their own and fellow employees' pockets, they become more careful. This has already been illustrated by the example of the seventeen-year-old worker and the lights. It was shown again in the Overland forge shop, where, when the workmen were informed that for every Overland car $7 is represented in the scrap pile, they were astounded and are already hunting means of reducing this scrap percentage.

Analyzing the plan which is printed herewith in detail, it will be seen that there are five distributions of profit, distribution No. 1 taking in the first quarter, No. 2 the second quarter, No. 3 the third quarter and No. 4 the months of October and November. The distribution for the month of December is made in the following March, and at the same time adjustment is made between the estimated and the actual inventories, and other adjustments. This adjustment No. 5 is popularly termed among the workmen "The Jack Pot." This "Jack Pot" is exciting a great amount of interest and discussion among the employees.

During the first three periods of the year and the last two months of the fourth period, the distribution is made on a straight percentage or time basis, as will be seen under the head "First Four Divisions." All excesses of profits over the percentage distribution go into distribution No. 5. Besides this, 1 per cent is added for each month of continuous service in excess of 12 months after Jan. 1, 1919, until a maximum of 50 per cent is reached. This gives a growing and attractive offer under the No. 5 distribution and not only does it reward the steady employee up to 50 per cent of his pay, but it offers an interesting chance of making a considerable bonus, should the profits of the company be exceptionally heavy.

Some typical questions which are being asked by the workmen, and which are published in *The Willys News*, a paper circulated among employees, are given below. These bring out clearly the thoughts which are in the minds of the men in discussing the fifty-fifty plan. The questions and answers follow:

Question No. 1.—*"Is the six months' continuous service feature fair to the employee who works four or five months during the busy season, and is then laid off when the dull season comes on?"*

Answer.—"The committee has asked Clarence A. Earl, first vice-president, to state what effect the future policy of the company will have on this condition. Mr. Earl makes the following statement:

" 'Our production will soon be limited to two models of a character which will be in demand practically the entire year. We also anticipate so great demand for these that our present capacity and the number of employees must be largely increased. We recognize the great advantage, both to our employees and the company, of continuous production the year around and that was one of our principal reasons for reducing our line to these two models of popular character.

" 'Therefore, there should be no reason why every employee should not have a continuous record of more than 6 months. If there is temporary slackness in a department the foreman can keep the employee on the continuous record until there is work again. Even if an employee should leave a department, for good reason, he will be given first consideration on openings in other departments and his continuous record will not be broken because he changes his clock number.

" 'Granting that conditions which have existed heretofore may have justified this employee's question, it is certainly the policy of the company to do everything possible to change these conditions.' "

Question No. 2—*"I do not understand the last paragraph of the section on 'Basis of Distribution.' Can you give an example of its application?"*

Answer.—"That section reads: 'Length of service with the company shall be rewarded by giving the employee an addition of 1 per cent per month to his share of No. 5 distribution for each month of continuous service in excess of 12 months after Jan. 1, 1919, until a maximum of 50 per cent is reached. This maximum shall thereafter be added to such employee's share of each No. 5 distribution.'

"We believe the following example will show what is meant: If an employee has a continuous service record of 24 months on Dec. 31, 1920, his total wages of say $1,200 for 1920, will be multiplied by 112 per cent and this increased amount, $1,344, would be used as the basis for computing his share of No. 5 distribution, payable in March, 1921. The 150 per cent maximum, on the above basis, would be reached in 1924."

Question No. 3.—*"I do not understand the* 8 *per cent (four and a half cent minimum) distribution. I have worked* 500 *hrs. in January, February and March, and my total wages for those months is* $300. *What will be the amount of my fifty-fifty check?"*

Answer.—"Eight per cent on the amount of your wages is $24; four and one-half cents per hour on your total hours worked is $22.50. You will therefore receive the larger amount, $24."

Question No. 4.—*"Will the profit-sharing checks be considered as a part of the employee's wages?"*

Answer.—"Absolutely no. Mr. Willys, in his announcement, plainly stated, 'These plans will have no influence on periodical adjustment of wages.' "

Organization Plans Should Appear in Time of Industrial Peace

Their Justification Is Increased Production Per Man—Variability of Human Element Is Important Consideration

By Harry Tipper

THE problems which have come up before the manufacturer, in connection with the task of keeping his labor harnessed and producing under conditions that have come to be normal, have caused us to act upon these problems because of the necessity of arriving at some solution in each individual case. It has not been possible to study the situation with sufficient care in many cases to permit of arriving at a solution which would form a basis for future harmony.

When a strike is declared by the men in the shop, or when a grievance has been submitted by the union, either locally or nationally, that particular strike must be settled or that particular grievance must be solved, even though the solution of the grievance, or the settlement of the strike, do not offer any hope of removing the cause of the discontent or laying the basis for adjustment of future disputes before they reach the point of final action. The length to which this necessity of meeting the immediate problem may carry the manufacturer is illustrated by the story of conditions in Great Britain during a portion of the war when the factories were under the control of the Ministry of Munitions.

Compromises Handicap General Solution

It was decided to give piece workers a bonus to cover the increased cost of living. This was done after a series of conferences with the labor organizations and the manufacturers. At the same time it was decided to give a flat percentage increase to the day workers in the shops, so that they would have the benefit of the increased pay in the same way as the piece workers. About every so often a new body of workers brought to the attention of the Government the fact that they had not been included in this increase, until the sweepers and the night watchmen had brought their case to the Government with sufficient force to require their inclusion.

Not long after the skilled workers came back with this original proposition as a demand for further increase. They said: "A year ago we were making 30 per cent more than the helpers, and now we are only making 18 per cent. We need a further increase in the bonus to re-establish former relations," and the whole question of wage increase was reopened, of course. This necessity for meeting the individual and the general problem at all times has forced compromises which have worked against the study and attention which must be given in order to secure a logical basis for the general solution.

It has been stated in these articles, in the earlier part of their development, that no organization changes which attempt to provide machinery for the discussion and agreement upon these points can be made at a time when an immediate necessity has arisen and be of any service in warding off that necessity. If workers are about to present their grievance in respect to wages, or hours, or anything of that kind, and the manufacturer brings out a plan for profit sharing, for joint committees and conferences, etc., at that particular time, the plan which he is bringing out will suffer because of the problem which lies immediately ahead and the attitude of the worker's mind at that moment.

No Suspicion of Motive Wanted

Organization plans which are built up in the hope that they will establish a permanent machinery for the purpose of discussion and examination of these matters must be promulgated at a time when there is no immediate fight on hand and when there can be no additional suspicion of the manufacturer's motive.

In the severity of the warfare which has characterized the industrial development of the last three or four years and the hasty decisions upon problems which have been made we have lost sight of the fact that, no matter what form the organization may take, it must, in the end, justify itself by securing a better production per unit per man, and that it should be based, therefore, upon a study of the factors which govern production and the relative importance of those factors.

The public, as buyers, are interested in the effect on costs to them, and have no particular interest in the division of those costs. This has been illustrated amply since the armistice was signed by the general attitude of all manufacturers or producers, each of whom can tell you many reasons why the price of his own product cannot be reduced, and also inform you of the products which he buys at a cost that he considers entirely unjustified by circumstances and explainable only by profiteering.

The farmer knows the cost of producing his

wheat and other crops, and he can inform you in great detail of the necessity for the price which he is securing. He believes, however, that the price of many of the implements which he buys and the equipment which he must use is unjustifiably high and should be reduced.

The director general of railroads is contemplating a freight increase necessitated by the financial statement of the year's operation. It is considered probable that these rate increases will be necessary to meet the costs of running the railroads. At the same time, the director general refuses to accede to a definite price on steel, expecting that it will and should be reduced further in order to become what is termed normal.

Increased Production Justification of Plans

The object of all organization work which attempts to provide a more logical and harmonious grouping in the industrial plant is to eliminate those indefinite but very real costs due to strikes, personal grievances, absences from work, and to eliminate the equally obvious costs which arise from the lack of incentive and, therefore, the lack of any attempt to use the worker's full capacity. When they are fully developed, these organization plans, therefore, must justify themselves by increasing the unit production per man, enabling his wages to be increased without increasing the final costs, and without eliminating the necessary profit on the capital.

It should be recognized in dealing with human conditions that time is an important factor in their development toward harmony and efficiency, and no immediate effect can be expected which will justify the hope with which the organization changes have been established. The more indefinite factors which affect the total production per man have been neglected for so long, not because of their unimportance, but because of their intangibility, that it will require special work to bring out, as the by-product of organization changes, the increased efficiency per man, which is the ultimate necessity of the case.

Production Depends on Individual

The actual production per man varies between different individuals, and on different days with the same individual. It varies between different shops and different departments in the same shop. It varies with the character of the work, with the character of the surroundings and with the immediate conditions in those surroundings. Up to the present, the average which has been produced has been the only basis upon which the future production can be measured, and this basis has been accepted, although it is obviously a very unscientific basis upon which to predicate production efficiency.

The necessity for the careful and conscientious study of the habit of mind, the aspirations, even the subconscious necessities, of the workers, as well as their living conditions, surroundings at work and the necessities of labor conditions rise out of the fact that it is largely by the examination of these intangible factors that production efficiency can be increased in the future.

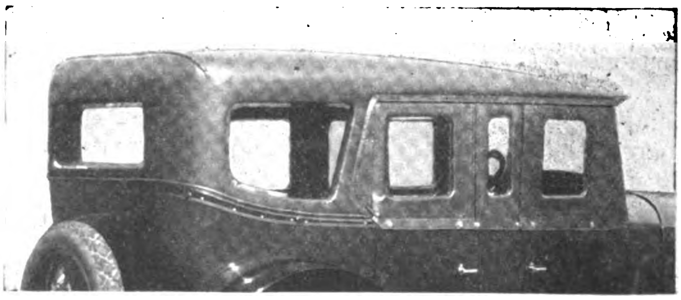
Up to this time the increase of production has come not so much out of the study of the man as it has come out of the development of the machine. When work had to be speeded up and provided at a low cost per unit, new machines have been built which have undertaken the operations in larger quantity in less time and with less handling required. But this development, by the improvement of machines, has arrived at the stage where it is able to affect the production cost only by minute percentages and in connection with minute subdivisions of the total operation. The improvement will constantly grow as human ingenuity is put to the problem of meeting increased cost of production by the development of more rapid and effective machinery.

This development of machinery, however, will not relieve the warfare that exists, the difficulty of maintaining an efficient organization of men, the large turnover among the average workers nor any other of the human problems which lie in front of us. Neither will it take the place of the improvement in production which can be secured by the study of the human element in industry.

During the war it was demonstrated that 50 per cent, 75 per cent and 100 per cent increase in the production from certain machinery could be secured without difficulty when the workers were sufficiently interested in the matter to speed up their own operations, and expend the necessary energy. Such percentages of improvement as this, arising from the satisfaction of just one human desire entering into the work, indicate the field for investigation which lies before the manufacturer and which offers great rewards in production improvement as it is properly investigated and translated into organization operations.

A New Closed Top

At some of the recent Midwestern automobile shows, a new closed top, known as the Class Top, was exhibited by the Consolidated Top Co. of Cleveland, Ohio. At the Detroit show it was shown on a King Foursome car. The half-tone cut herewith shows the appearance of this top. The advantages claimed for it are that it is light and non-rattling, and gives plenty of light for the interior of the car. The windows are all of plate glass. The side curtains are removable, and the valance, that is, the strip against which the doors and curtains abut, can be taken off, leaving the machine of neat appearance when driven without the curtains. Ordinary storm curtains may be used with this top as a protection against rain during the warm season.



Class top shown by Consolidated Top Co.

Michelin steel disk wheels

Disk Wheels for Passenger Cars

Four Years of War Experience Have Shown the Value of Steel Disk Wheels—Michelin and Fiat Leading European Manufacturers—Michelin Wheel to Be Introduced Here

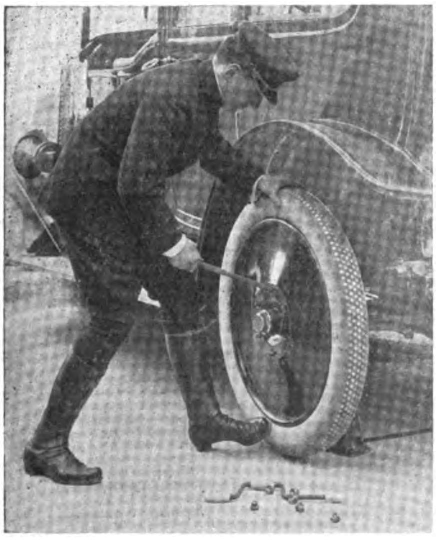
By W. F. Bradley

STEEL disk wheels are a coming feature of French passenger carrying automobiles. Four years' war experience has shown the value of the disk wheel. During the war the two biggest producers of steel disk wheels have been Fiat in Italy and Michelin in France. The former firm equipped all its 1½-ton pneumatic-tired trucks and the great proportion of its touring cars with steel disk wheels. Michelin produced steel disk wheels for a large number of French makes of 1½-ton trucks and for many makes of staff cars. Now that the war is over Michelin is profiting by experience gained and is preparing to produce his disk wheel for touring-car purposes. The programs already laid out indicate that an important number of French manufacturers will adopt the Michelin steel disk wheel as standard equipment.

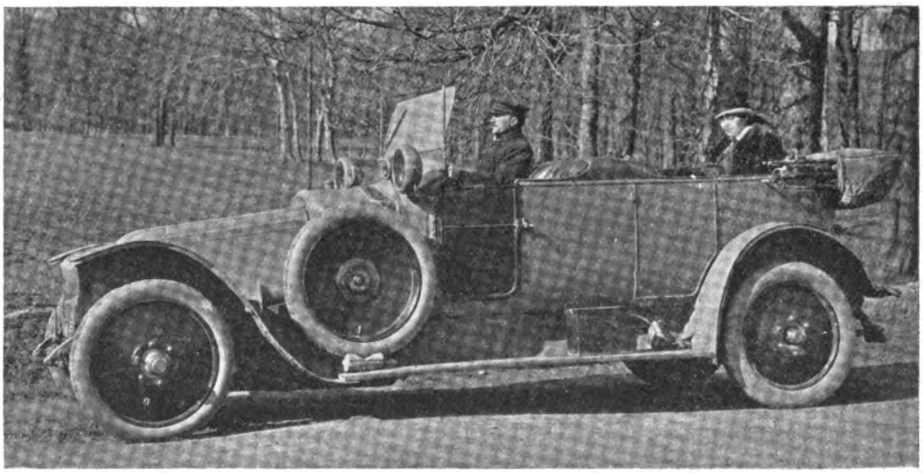
Although similar in general appearance, the Fiat and the Michelin disk wheels are different in construction. Fiat builds up the wheel with three disks, two of them being small and of equal diameter, and riveted to the thin, full diameter disk, which in turn is riveted and spot-welded to the rim.

The Michelin wheel is composed of a single disk, which is stamped out hot under the press and then turned down in the lathe, so that the cross-section becomes thinner as it nears the outer circumference. A wheel which has a thickness of 5 mm. (0.2 in.) at the center tapers to 2½ mm. (0.1 in.) at the outer edge. This outer edge is turned over so as to be at right angles to the main wall of the disk, and is then riveted and welded to the rim. This construction enables the total weight of the wheel to be reduced considerably without any weakness, and has the advantage of removing weight at the most desirable point, namely, near the outer circumference. Attachment is by means of 4, 6 or 8 studs, according to the size of the wheel. These studs, which are fixed in the permanent hub, are of the same diameter throughout their length. The corresponding holes drilled in the wheel, however, have beveled edges, and the nuts by which the wheel is held in position have beveled bases. These two beveled surfaces not only serve to center the wheel in the studs, but have a self-locking effect and make unnecessary the use of spring washers under the nuts. A right-hand thread is used for the right-hand wheels and a left-hand thread for the opposite side.

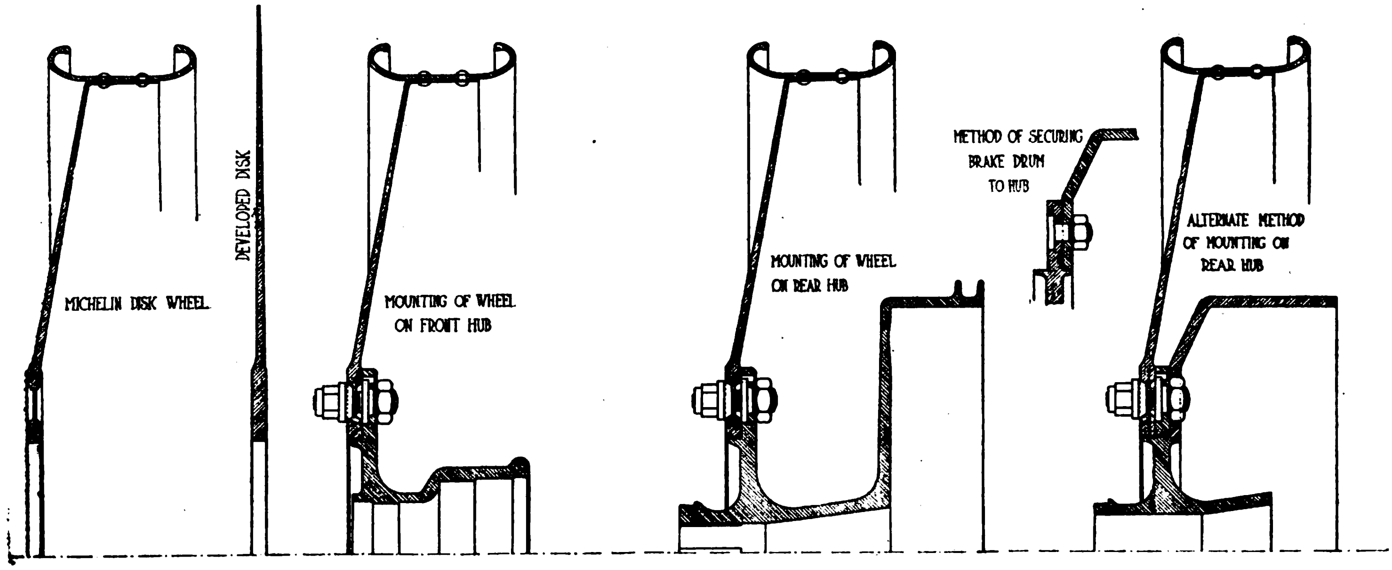
Advantage claimed for this wheel is greater strength than is possible with any wood wheel. The weight is the same as for a wood wheel. There is free radiation of heat through the disk, which tends toward cool running of the tires. Careful experiments have been made in this connection by the Michelin company, which states that the



Fitting Michelin steel disk wheel



Renault car equipped with Michelin steel disk wheels



Sectional views of Michelin steel disk wheel types

tires run perceptibly cooler and that the degrees of heat at various points on the circumference of the disk can be accurately measured. The disks become cooler as the center is reached. The locking arrangement is simple and cannot possibly get out of order.

The usual tool is a brace, but if this is lost any ordinary wrench can be used. The disks are ideal from the standpoint of cleanliness, and add to the streamline appearance of the car.

The European tendency is toward detachable wheels as distinct from detachable rims. Clincher beads are used to the total exclusion of straight-side tires. The argument of European manufacturers is that with the fixed rim and detachable wheel, equipped with clincher tires, a very much lighter wheel is obtained than with the American system of detachable and demountable rims. The European public has never had any experience of straight-side tires, and thus is not in a position to judge of the value of a detachable rim. The argument is also advanced that under the European system of detachable wheels a complete wheel is always available in case of a wheel breakage, whereas under the American system if a wheel breaks the car is held up until another wheel can be procured.

With the Michelin type wheel duals can be fitted very readily and all the wheels are interchangeable. The French are convinced that the dual idea is preferable to big singles. The only precaution is that the two duals shall be fitted as close together as possible. If the clearance is only just sufficient to prevent the walls of the tires chafing, no trouble will be experienced by stones lodging between the two and cutting the walls of the tires. This has been fully borne out by war experience.

The Michelin company will introduce the detachable steel disk wheel to the American market with straight-side beads in place of clinchers. Having proved successful and popular in Europe, and having stood up to all the tests imposed by war conditions, it is believed that this type of wheel will find ready adoption in America. It is a most interesting proposition from a manufacturing standpoint, for while there are many details which must be given careful attention, as has been shown by four years' war experience, the cost of production is low. All Michelin wheels are interchangeable. This simplifies the position of the dealer, who has only to keep in stock wheels of given sizes, without any thought as to the car on which they have to be fitted.

In order to facilitate fitting, Michelin supplies two standardized tools—a brace for tightening the nuts and a tubular lever for lifting the wheel on to the studs. This lever is passed through one of the holes drilled in the hub of the wheel and slipped over one of the studs. In this way the wheel is both guided and levered into position.

Use of War Trucks in Industry and on the Farm

THE contention is made in an article in *Der Motorwagen* of Feb. 20 that many army trucks received such rough treatment that they will be of little use in commercial work. Such abuse causes fatigue of the material employed. This question of fatigue is, of course, taken into account when a vehicle is being designed, but, of course, the stresses ordinarily provided for will, in many cases, have been considerably exceeded owing to the mishandling the vehicles will have gone through.

The overloading, which will generally become apparent by marked, permanent deformations of the various parts of the vehicle, will have as concomitant a depreciation of the properties of the material, especially its strength, by unsuitable treatment in field repairs, *e. g.*, wrong heat treatment and the like, which will leave no external traces behind.

If a "demobilized" truck, then, is to be made even partially reliable as a vehicle for peace purposes, it will not suffice to simply repair it in the ordinary way and re-varnish it, afterward passing it over to the customer. Every firm of repute will certainly see that all the most important components, even those exhibiting no external damage, are tested for strength. This is easier said than done; for a strength test with the Brinell machine can only indicate local strength at the particular place where the test is taken. Again, difficulties arise in heat-treating the parts owing to risk of spoiling machined parts and to shrinkage after heating.

There is, of course, the possibility of making a systematic endurance test of the valuable parts under working conditions on the test ground, but this method, besides being expensive and taking time, gives no reliable data for the value of the part tested.

After all these considerations, the writer comes to the conclusion that in view of the fact that the German reputation for quality has still to be maintained, demobilized trucks, etc., should be hired out by the government to help in the next harvest and get over the shortage of draft animals, and then sent back to the factories that built them, and scrapped.

Thus the heavy vehicle industry would be able to get a certain amount of raw material at a time when materials are extremely short. In this way firms would be able to supply practically new vehicles (or at least very good "rebuilds") to business people in a small way and to farmers.

Sparking Power of Magnetos

Oscillograms Showing Electromotive Force Across Contact Points of Breaker and Current Flowing in Ignition Circuit for Five Different Points of Interruption

By Harry F. Geist, E. E.

IN an article on "Generation and Storage of Energy in Magnetos," published in AUTOMOTIVE INDUSTRIES, Vol. XL, page 411, the writer derived some rules regarding the range of energy storage in magnetos designed for ignition purposes, and illustrated a graphic method (Fig. 7) for determining the stored energy range.

It is the purpose of this article to present an analysis of the energy delivery in the ignition spark by a magneto, for different armature positions over its energy range, showing the amount of the energy delivered, its ignition power, the duration of energy flow and various other characteristics, including coincident losses.

This analysis will be based upon oscillographic records taken directly from the ignition spark, and inasmuch as the same magneto was used as in the above mentioned article, this analysis may be regarded as a continuation of that article.

There is a very marked difference between the amount of energy stored in a magneto (and apparently available for a spark) at any particular armature position and the amount of energy of the spark produced when the circuit is suddenly interrupted while the armature is in that position. This difference is due to the fact that the spark, which represents the energy dissipation during the change from short circuit to open circuit, has a duration of only a few thousandths of a second, and being the result of a very quick magnetic readjustment, the attending iron losses are very heavy.

It will furthermore be shown that for armature positions in the early part of the sparking range, when the machine is generating energy for storage at a high rate, an interruption of the circuit for a spark will not only result in an expenditure of the stored energy, but the spark will also receive energy that is generated directly due to the motion of the armature during the sparking period. This latter point is a very important consideration where springs are used in driving the magneto.

In order to illustrate the study of the ignition spark and to show the true sparking range of the magneto, the oscillograms, Figs. 1, 2, 3, 4 and 5, are presented as records of sparks taken at five different armature positions within the energy range of the magneto. These positions are 10, 40, 70, 100 and 120 deg. respectively beyond the vertical position, at a speed of 600 to 625 r.p.m.

As the duration of the spark is only a few thousandths of a second, in making these oscillographic tests, the photographic drum was revolved at a high speed, so that the phenomena occurring during sparking would be drawn out sufficiently along the time ordinate, and measurements could be made from the record with a fair degree of accuracy. The speed of the drum was from 1000 to 1200 r.p.m. The armature of the magneto was rotating at only about half the speed of the film drum, and in order to insure that the phenomena of sparking would be recorded on the film free from other disturbances, it was necessary to "time" the make and break igniter with the oscillograph just as "timing" would be done on an engine, and it was also necessary to have a switch key in series with the oscillograph shutter circuit for manual control, so that only one spark would be recorded during the operation of the set-up. With this synchronized test arrangement, a simple change in the relation of the armature to the igniter gave the results for the different armature positions desired, for each successive test.

The oscillograph used was a three galvanometer type instrument, so that it was possible to take a record of three electrical forces simultaneously.

In each of the five oscillograms presented, the upper curve shows the voltage across the contact points of the igniter and represents therefore the electromotive-force curve of the spark. During the period of closed contacts, the voltage was, of course, nil, so that the instant when the igniter contacts separate is indicated on the oscillograms by the rise of the voltage curve from the zero line. This point is denoted on the oscillograms by the vertical line marked "Break."

The general nature of the induced voltage curve is the same in all five records. It is shown how the voltage of the spark increases very rapidly toward its maximum as the energy is dissipated in the spark, and then drops off to the open circuit voltage value for the particular position the armature happens to be in, until the con-

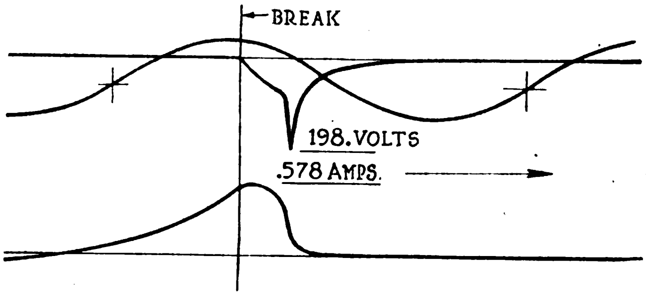


Fig. 1—Armature about 10 deg. beyond the vertical position

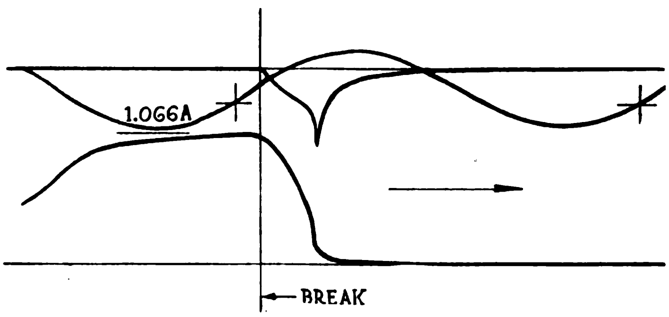


Fig. 2—Armature about 40 deg. beyond the vertical position

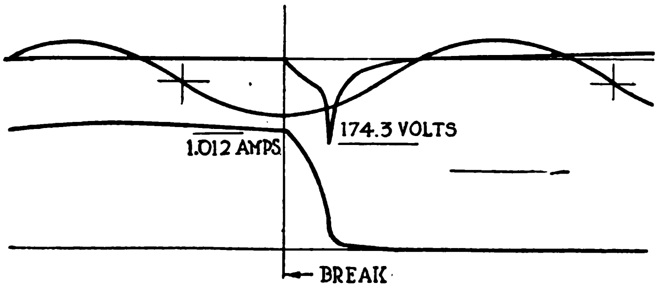


Fig. 3—Armature about 70 deg. beyond the vertical position

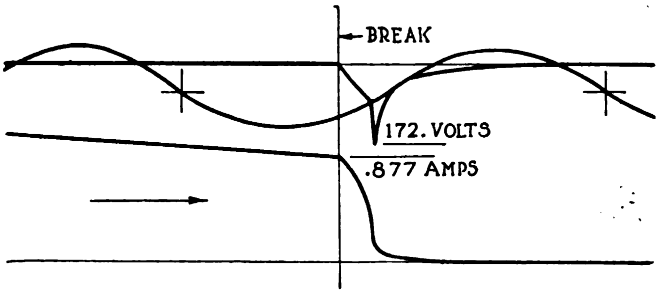


Fig. 4—Armature about 100 deg. beyond the vertical position

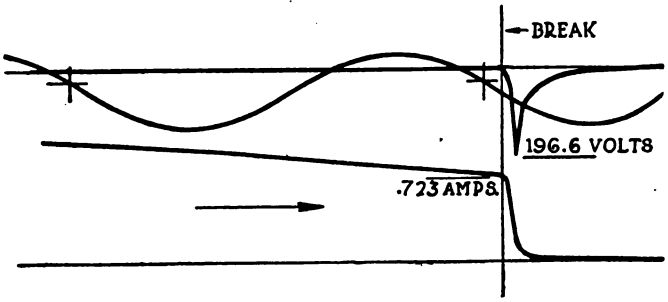


Fig. 5—Armature about 120 deg. beyond the vertical position

tacts close again. It is this induced e.m.f. maximum that tends to break down ignition insulations. Special attention is here called to the fact that this e.m.f. does not attain its peak value until practically all of the energy has been spent in the spark.

The lower curve in each case shows the current generated during the closed circuit periods, up to the instant of contact point separation, as indicated by "Break," and the manner in which the current continues to flow through the circuit formed by the spark, dropping off as the stored energy of the circuit expends itself in the spark. The period required for the current to drop to zero is therefore a direct measure of the duration of the spark.

The third curve, which is practically a sine wave, represents an ordinary 60-cycle lighting circuit wave, and is therefore a direct time calibration of the oscillograms in that the distance between crosses in each case represents 0.01666 second. The arrow shows the sequence of events.

Fig. 1 of the article referred to in the opening paragraph of this article shows an uninterrupted short circuit current wave of this same magneto, for one complete revolution of the armature and at practically the same speed at which these five sparks were taken, so that the generated currents in these five oscillograms represent the same current wave. This fact served as a check on the determination of the armature positions at which the sparks were received.

A study of Fig. 1 of this article shows that, following the interruption of the circuit, the current rises slightly to a maximum value of 0.578 ampere from 0.508 ampere at the instant of break. This current increase during sparking is due to the fact that at the 10 deg. armature position the magneto is generating energy at a very high rate, as is manifest from the rate at which the current increases just before interruption, and the additional circuit resistance at the beginning of the spark is not sufficient to check the current generation immediately. This means that energy is generated and delivered directly to the spark.

The sparks of the oscillograms, Figs. 2, 3, 4 and 5, have the characteristics of low tension sparks and show the current drop following break immediately.

Theory of the Spark

Before entering upon a quantitative analysis of the data presented in these oscillograms, it may be advisable first to develop some of the theory of electrical sparks of this nature into usable laws in the form of mathematical equations to which this data will be applicable.

When the energized circuit is suddenly interrupted to produce a low tension spark, the separation of the contact points drawing out the spark is equivalent to suddenly inserting additional resistance into the circuit. It is evident that this spark resistance r_s is a variable. It is, therefore, evident that during sparking the resistance of the complete circuit will be the sum of the coil resistance R and the spark resistance or $(R + r_s)$.

It is a well-known fact that the rate at which electrical energy is expended in a circuit having resistance is equal at any instant to the product of the instantaneous current flow squared and the simultaneous resistance value. The power or rate of energy expenditure in this case, neglecting iron losses for the present, is

$$p = i^2R + i^2r_s, \qquad (1)$$

where i denotes the current at any instant.

In equation (1), i^2R represents the rate at which energy is lost in the coil at any instant, while i^2r_s represents the power of the spark for the same instant. If the current is expressed in amperes and the resistance is expressed in ohms, then the rate of loss and the power will be in watts.

Inasmuch as we are interested at this time more particularly in the power of the spark, it will be better to separate it from equation (1) by the following equation

$$p_s = i^2r_s \qquad (2)$$

Owing to the fact that r_s cannot be ascertained by direct measurement, this equation for the spark power is not usable in its present form, but we know that the induced voltage across the contact points must be equal to the voltage drop across the contact points at any instant; that is, equal to the product of the current flow and the resistance, or

$$e_s = i\,r_s, \qquad (3)$$

so that equation (2) can be rewritten in the form

$$p_s = e_s\,i \qquad (4)$$

In this equation e_s and i are the varying voltage and current, respectively, for the spark as recorded in the oscillograms, Figs. 1, 2, 3, 4 and 5, so that it is evident that from the data contained in the records it is possible to calculate the power of the spark for any part of its duration.

When it is considered that the total duration of the spark is only a few thousandths of a second, the remarkable nature of these oscillograms must be apparent.

We also know that in an electrical circuit in which energy is expended at a rate P, for a period of time T, the amount of energy expended will be

$$W = PT = EIT. \qquad (5)$$

If P is expressed in watts and T in seconds, W will be expressed in joules.

Under the conditions here considered, the current and the voltage vary, so that the power varies during the life of the spark. The energy equation of the spark is therefore

$$W_s = \int_o^t p_s \, \delta t = \int_o^t e_s \, i \, \delta t \qquad (6)$$

in which the limits o and t express the duration of the spark in seconds of time, o being the instant of "break."

From equation (6) it is seen that, if the manner in which p_s varies with t can be determined for the whole duration of the spark, the total amount of energy represented in the spark is readily obtainable by integration in electrical units which can be converted into heat units by simple multiplication.

By applying the data represented in the five oscillograms to equations (4) and (6), the power and the total amounts of energy of each of the sparks can be determined, as well as other sparking characteristics that will be shown in the calculations.

Quantitative Analysis of Oscillograms

To illustrate the study of the oscillograms, and the use of the equations presented, the spark represented in Fig. 2 may be analyzed as follows:

A series of vertical lines 1/32 to 3/64 in. apart are first drawn from the base line up covering the entire period of sparking; that is, this series of lines covers the period required for the current to drop to zero. The period of sparking is thereby divided into a number of small increments of time δt.

By measuring the time represented by the distance from the line of "Break" to each of the series of lines in succession, and measuring also the current and voltage at each of the instants represented by these parallel lines, then multiplying these simultaneous current and voltage values as per equation (4), and plotting the products obtained against the time after the break, we obtain the power-time relation of the spark directly.

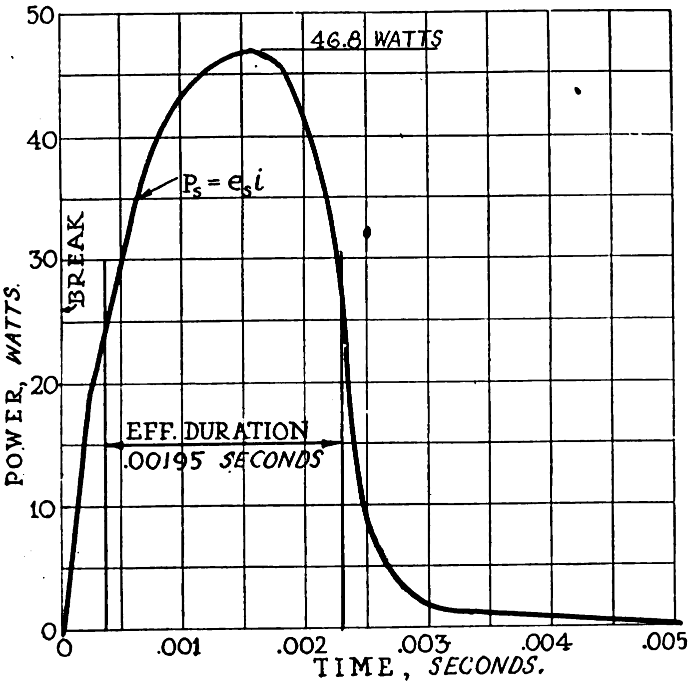


Fig. 6—Spark power curve, showing effective and total duration

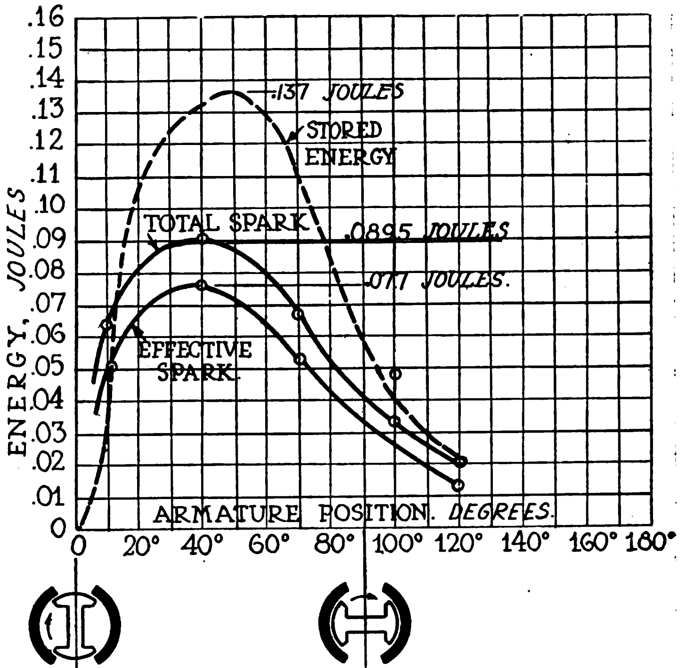


Fig. 7—Showing the true sparking range at constant speed

Such measurements and calculations based on Fig. 2 are given in the following tabulation:

t Seconds	i Amperes	e_s Volts	p_s Watts	r_s Ohms
0.0000	1.066	00.00	00.00	00.00
0.000191	1.047	14.95	15.65	14.28
0.000381	1.018	24.90	25 35	24.42
0.000571	0.970	34.85	33.80	35.90
0.000762	0.931	42.30	39.40	45.50
0.000952	0.864	49.80	43.10	57.70
0.001143	0.806	54.80	44.20	68.10
0.001333	0.739	62.20	46.00	84.20
0.001524	0.672	69.70	46.80	103.50
0.001714	0.604	74.70	45.20	123.50
0.001905	0.509	84.60	43.10	166.00
0.002095	0.423	94.60	40.00	223.00
0.002285	0.192	122.00	23.41	635.00
0.002476	0.096	127.00	12.20	
0.002666	0.058	92.10	5.30	
0.002857	0.038	69.70	2.68	
0.003100	0.029	54.80	1.58	
0.003430	0.024	34.85	0.85	
0.003810	0.019	24.90	0.48	
0.004190	0.014	19.90	0.29	
0.004570	0.010	14.94	0.14	
0.005330	0.000	9.96	0.00	

Besides the calculated spark power, this tabulation shows calculated values of the spark resistance, which are obtained by dividing e_s by i. These present an idea of how the spark resistance increases during the life of the spark.

The relation between p_s and t shown in the above tabulation is plotted to scale in Fig. 6.

A study of this spark power curve reveals the manner in which the spark power increases from zero at the instant of "break" to its maximum value of 46.80 watts and then drops off again to zero as the energy is dissipated.

From this maximum value of 46.80 watts, it is evident that the power of an ignition spark from this magneto is momentarily equal to the power of a good-size incandescent lamp. This power being concentrated in a small arc, the intensity of the heat must be very great.

The total duration of this spark is about 0.00533 second, though it is apparent from Fig. 6 that most of the energy is spent in less than half that time.

It has been the observation of the writer that, to be effective, under the usual conditions of service the power of the spark must exceed 25 watts.

In Fig. 6, the period during which the power of the spark exceeded 25 watts is included between the two parallel lines, and measures about 0.00195 sec.

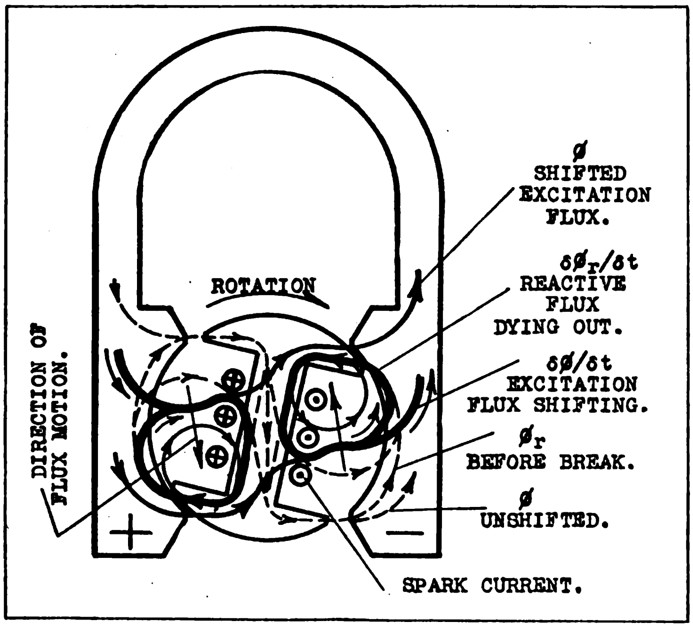


Fig. 8—Induced voltage producing spark current is caused by the flux shifts $\delta\ (\phi + \phi_r)/\delta t$

In order to determine the energy represented in the spark as per equation (6), it is only necessary to ascertain the area enclosed by the power-time curve and the zero power line and to multiply that area by the joules (watt-seconds) per unit of area as determined by the coordinates of the power curve.

Such an integration may be made by adding up a series of products obtained by multiplying the spark power by the increments of time, but the simpler method is to measure the area enclosed by the curve by means of a planimeter and to multiply the area obtained by the energy per unit of area.

Fig. 6 was measured by means of a planimeter, and the total energy of the spark was found to be

$$W_s = 0.0895 \text{ joule.}$$

In like manner, by measuring that portion of the spark between the effective time limits, the effective energy of the spark was found to be

$$W_s \text{ (eff.)} = 0.077 \text{ joule.}$$

From these two values it is seen that 86 per cent of the total spark energy was delivered at a rate exceeding 25 watts.

In a like manner, all the sparks represented in the other oscillograms were analyzed, and showed the following tabulated results as to maximum power, total energy, effective energy, percentage of effective to total energy and effective duration.

Spark at	Max. Power, Watts	Total Energy, Joules	Eff. Energy, Joules	Eff. Total, Per Cent	Effective Duration, Seconds
10°	44.25	0.0659	0.0497	75.4	0.00146
40°	46.80	0.0895	0.0770	86.0	0.00195
70°	46.12	0.0669	0.0557	83.2	0.00148
100°	37.80	0.0472	0.0346	73.3	0.00107
120°	36.90	0.0218	0.0138	63.3	0.00040

A study of the above results shows that all the sparks reached a comparatively high maximum power, but it will be noticed that before and after the 40 deg. position, which seems to be about the position for maximum spark in this magneto, the amount of energy involved in the spark drops off quite rapidly with an accompanying shortening of the effective duration. The last two sparks were low in energy and of short duration and would be very poor for ignition service.

In the total and effective spark energy values for the five different sparks at known armature positions, we have data with which to plot the true sparking range of the magneto for the speed at which it was tested.

The above energy data are plotted against armature position in the curves shown in Fig. 7. Included in this figure in dotted line is also the stored energy curve shown in Fig. 7 of the article referred to in the opening paragraph of this article.

In general, the difference between the amount of stored energy for any armature position and the amount delivered to the spark for the same armature position gives directly the amount of energy spent in iron and copper losses during sparking.

For the early armature positions, *i.e.*, in the neighborhood of 10 deg., this does not hold true, because, as previously pointed out, energy is generated and delivered directly into the spark. However, for the 40 deg. position, a very good idea of the amount of the losses accompanying sparking can be obtained.

Losses Coincident to Sparking

The total loss for the 40 deg. position is seen to be the difference between 0.137 joule stored and 0.0895 joule delivered and equals 0.0475 joule, or 34.7 per cent of the energy available and 53.1 per cent of the total energy actually delivered.

Of this amount, the copper loss was found by the use of the equation

$$W_c = \int_0^t i^2 R\, \delta t, \qquad (7)$$

which for the 40 deg. position gives an energy loss of 0.0058 joule. Copper loss during sparking is therefore seen to be very small.

The iron loss by difference is therefore

$$W_f = 0.0417 \text{ joule}$$

or 30.4 per cent of the energy stored and 46.5 per cent of the total energy delivered to the spark.

This high iron loss can be attributed to the very quick shift of magnetic flux in the magnetic circuits of the machine during the very brief period in which the phenomena of sparking occur, and it would seem that there ought to be room for considerable improvement in magnetic circuit design in this type of magneto, inasmuch as the machine analyzed is representative of the type.

Magnetic Motion During Sparking

Fig. 8 is shown to give an idea of the magnetic shift that takes place during sparking. This diagram shows the loops of reactive flux dying out across the turns of the coil on both sides of the machine, in the direction of the arrows indicating flux motion. As the reactive flux dies out toward the magnetic center on each side of the coil, the excitation flux will also sweep across the coil turns to take its natural path from the lower tip of the positive pole up through the armature core to the upper tip of the negative pole. In making this sweep it follows the reactive flux in motion, so that the induced voltage producing the spark current is caused by the combined flux shifts represented by the expression $\delta(\theta + \theta_r)/\delta t$ as shown. The magnetic lines shown in dotted lines illustrate the magnetic flux distribution just before the "break" took place.

The fact that practically all the flux reverses its path completely in the armature core and sweeps across the total embrace of the pole pieces in the very short interval of about 0.002 second ought to explain why the iron loss during sparking is relatively very high.

It may be of interest to know what factors determine the duration of a spark resulting from the interruption of an energized circuit.

Every electrical circuit has what is known as a time-constant that expresses the time required for the energy to increase or decrease in response to changed conditions.

This time-constant is roughly defined as being proportional to the inductance of the circuit divided by the circuit resistance, and the relation is such that if the inductance is expressed in henrys and the resistance in ohms, T will be the time in seconds for the energy to go through a certain percentage of the total change due to a change in circuit conditions. In its general form it is expressed as follows:

$$T\text{, seconds} = \frac{L\text{, henrys}}{R\text{, ohms}} \qquad (8)$$

It will, however, be found that T is a fair criterion of the sluggishness or the alertness of an electrical circuit.

The instantaneous resistance of the circuit during the sparking phenomena was shown to be $(R + r_s)$, so that the time constant of the circuit for any instant during sparking becomes

$$T = \frac{L}{R + r_s} \qquad (9)$$

From this equation it is evident that the circuit "quickens" as r_s increases during the life of the spark, as shown by the values of r_s given in the table calculated from Fig. 2.

As an example of the use of equation (9), the following substitutions are made in that equation.

The inductance L of the circuit for the 40 deg. armature position of the magneto tested was shown in Fig. 6 of the article previously referred to, to be about 0.138 henry. The resistance of the winding was 4.02 ohms. Taking the value of the spark resistance at the instant one-half the effective energy was spent as an average value, the resulting value of T as the time-constant for that instant ought to be about equal to the effective duration of the spark. The value of r_s equal to 84.2 ohms at an instant 0.001333 second after break is taken as about an average value. These values substituted in (9) give the following results:

$$T = \frac{0.138}{4.02 + 84.2} = 0.001565 \text{ second.}$$

Comparing this value with the 0.00195 second actually required for most of the energy to spend itself in the spark, and allowing for the limitations in the use of T for specific calculations, it is very evident that the prominent factors in equation (9) do control the duration of the spark.

These two prominent factors are the inductance of the circuit and the spark resistance. Of these two factors, the inductance depends upon the design of the circuits of the machine, while the spark resistance depends for its value at any instant upon the amount of contact point separation and the energy involved.

Since the energy available is independent of the rate of spark point separation, it is evident that the quicker the contact points separate the quicker the energy will be spent in the spark and the higher its power will tend to be. The spark will also increase in volume for higher rates of contact point separation. Thus it is seen that a magneto of this type depends in a measure upon the igniter for the character of its behavior, as well as upon its own characteristics.

In the case of a high-tension magneto, an analysis of the sparking ability can be made in the same general way as that herein shown for the low-tension magneto, by making similar tests upon the interrupted primary circuit with the condenser disconnected. It would also be preferable to make the tests with the secondary removed if possible. The results thus obtained, supplemented with tests made with the secondary in place and the condenser connected and including records of the high-tension spark current, would give a very complete analysis of the high-tension type machine.

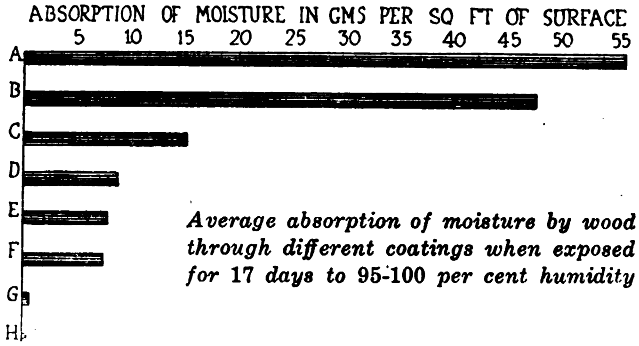
Aluminum Leaf to Moisture-Proof Wood

A VERY effective agent for moisture-proofing wood has been found in an aluminum leaf coating. This coating practically insulates the wood against any change in atmospheric conditions, and is therefore particularly valuable for use where exceedingly accurate form and balance must be maintained, as in an airplane propeller.

The comparative effectiveness of aluminum leaf, spar varnishes, enamels and other water resistant finishes tried out by the Forest Products Laboratory is shown in the accompanying graph. Aluminum leaf coating, it will be seen, is about 25 times as moisture resistant as the average spar varnish.

Two types of aluminum leaf finishes have been used, which are about equally impervious to moisture. One makes use of spirit varnish and the other of oil varnish, the successive coats being as follows:

Spirit Varnish Type—Filler plus 1 or 2 coats of orange shellac plus 1 coat spar varnish used as a size plus 1 coat



Average absorption of moisture by wood through different coatings when exposed for 17 days to 95-100 per cent humidity

aluminum leaf plus 2 coats of orange shellac with desired color plus 1 coat spar varnish.

Oil Varnish Type—Filler plus 1 or 2 coats spar or rubbing varnish plus 1 coat spar varnish used as a size plus 1 coat aluminum leaf plus 2 coats spar varnish or enamel.

Coating wood with metal leaf is not nearly so slow a process as laying leaf in sign-making. As soon as the size reaches the right condition, the leaf can be applied directly from the book without the aid of gilders' tips or necessity of skilled workmanship. The time required to apply leaf to a propeller should not be more than 40 or 50 minutes, and this could be reduced as the finisher becomes more experienced.

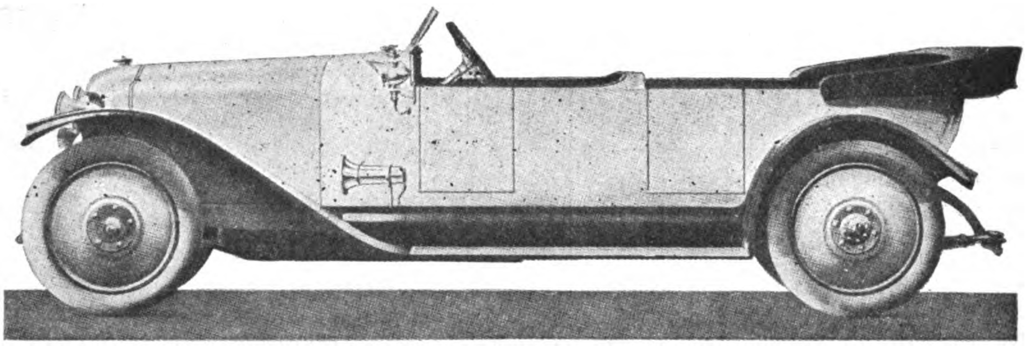
It is important to allow the size to reach the proper condition before attempting to lay the leaf; the right point is just before the varnish sets dust free. The time required to reach this condition varies with the type of varnish used, but for spar varnishes it is usually from 1½ to 2 hours after application. The workman will soon learn how to judge the condition of the size by touching it lightly with his fingers. The size will dry much quicker if it is thinned about one-fourth with turpentine. It should be applied as sparingly as possible.

To apply the complete finish of the spirit varnish type requires in the neighborhood of 10 hours and to dry the various coats about 90 hours, making the total time about 100 hours. The oil varnish finish takes longer to dry and would probably total 240 hours. The latter finish is possibly the more durable coating.

BALL bearings have been extensively adopted in Germany during the war on account of the scarcity of oil and the small quantity required by this type of bearing, it being found possible to run continually for six months on one charge of oil. Reduced friction and the fact that these bearings could be made entirely of steel, when brass and other suitable metals were difficult to obtain, also contributed to their general adoption.

New DeDion Eight-Cylinder Model

Many Former DeDion Features Discarded—Gearbox Unit with Engine and Rear Axle of Conventional Design—Gear Drive for Camshaft



THE type H G DeDion-Bouton, which is one of the new post-war models, is an eight-cylinder design, with 70 x 120 mm. cylinders, and is made with 134⅜-inch wheelbase. It incorporates many innovations in DeDion-Bouton construction, among which might be mentioned hinging the gearbox as a unit with the engine and the use of a conventional type of rear axle in which the drive-shafts are carried in the axle housing instead of the dual type of DeDion formerly used, which incorporated a solid one-piece construction for supporting the load and the differential carried on the frame with cross-shafts driving to the wheels.

In 8 weeks a series of 250 chassis will be under construction in the Paris factory and deliveries will start in America toward the end of May.

The greatest changes made are the elimination of chains in the motor for driving the camshaft and accessories, and the driving of these by gear. The camshaft is made with sixteen cams instead of eight. In other words, there is a separate intake cam for each pair of cylinders. Formerly small levers were interposed between the cams and the valve tappets, but these have been eliminated and now the tappets bear directly on the cams.

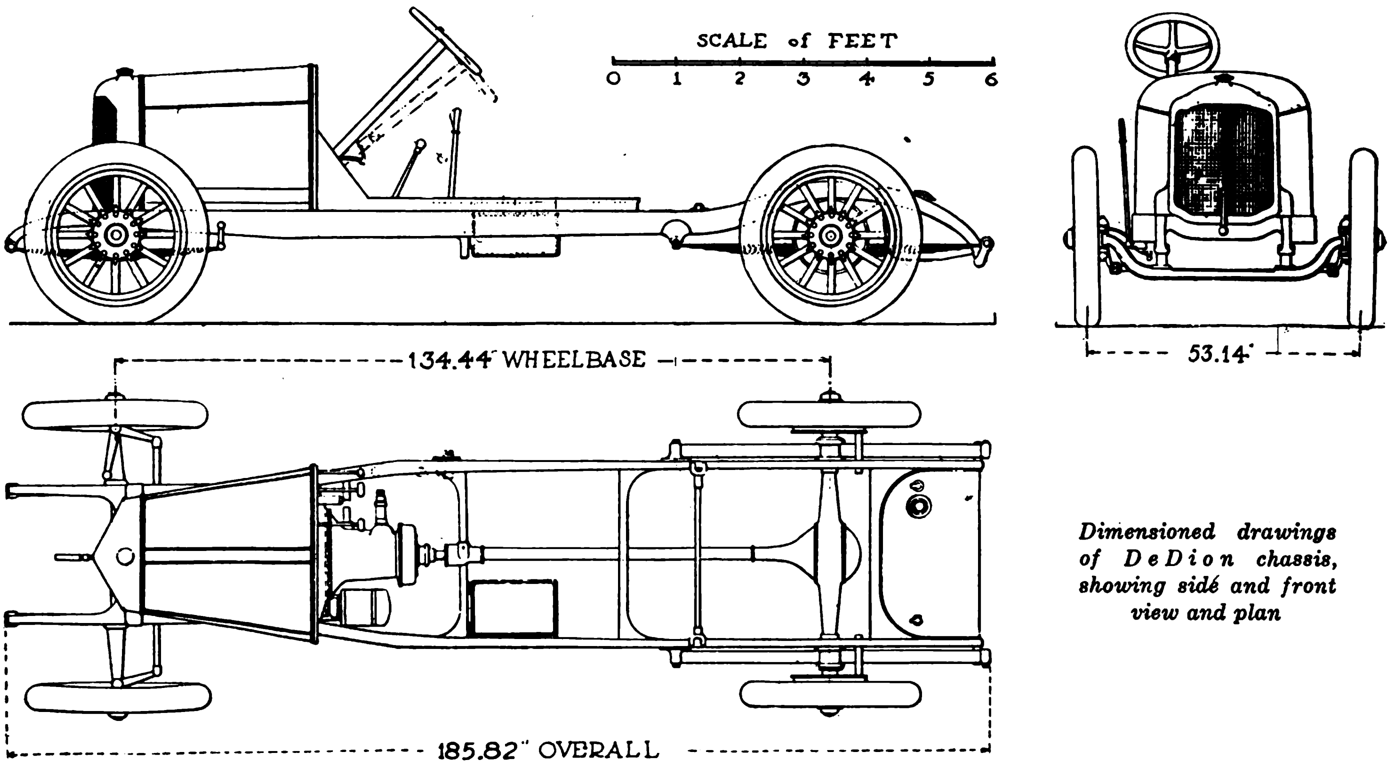
Larger hollow wrist pins are used. Pistons are made of special aluminum alloy, which formerly were of cast iron. Larger diameter valves are used and are placed in side pockets, the same as formerly. The valve stems do not parallel the cylinder bore, but are placed at an agle thereto, so as to reduce the volume of the valve pocket.

The electric lighting and starting system is the DeDion-Bouton, of 12 volts, with dynamo and starter in one unit mounted on the gearbox to the left side and driven by a silent chain.

A new design of clutch is employed, permitting of passing from fourth to low as easily as it was formerly to go from fourth to third at 20 m.p.h. No couplings are used between the engine and the clutch.

Either Michelin disk wheels or special demountable artillery wood wheels are furnished. The tire sizes are 880 x 120 mm., which is approximately 34 x 4½.

A hollow aluminum steering wheel, finished with baked enamel, is used. The worm and sector type of steering gear is used. There are three brakes—expanding serv-



Dimensioned drawings of DeDion chassis, showing side and front view and plan

ice type on rear of the gearset and expanding type on the rear axle, both sets being faced with Raybestos. Adjustable control pedals are used. The accelerator pedal is used for the first time by DeDion.

Special flat semi-elliptical springs are used front and rear, the rears measuring approximately 59 inches in length and the fronts 39 inches. Fan belt drive is used. There is a four-speed gearbox with shaft in a vertical plane. The rear axle is a floating type with stamped housing and helical gears.

The radiator is a V-type with a core housed in a red copper frame. Thermo-syphon cooling is used. The steering gear is on the right side. The hood is made in two parts and separately hinged so that one can be entirely removed without disturbing the other. Pressure or vacuum fuel feed is used. When pressure feed is used there is an auxiliary tank on the dash, of 50 litres, or a little over 13 gal.

The speedometer is driven from the gearset brake-drum. The chassis with 1500 lb. of dead weight in passengers did over 60 m.p.h. The tread is standard of 56 in.

In August the DeDion-Bouton company will have a new eight-cylinder, 12-30 hp. car which will follow the same general design as this model, which is rated at 18-40 hp. In December DeDion-Bouton will market a Grand De Luxe model with sixteen cylinders. The DeDion-Bouton factory has been trebled in capacity since 1914. It has recently purchased the Vinot et DeGniguand plant and also purchased a lumber yard and distillery so that they will have capacity for their large new plant which is contemplated. A new body building plant has been built.

DeDion-Bouton will shortly open up a New York salesroom under the direction of E. Lascaris and J. H. Stelling as sales manager, both of whom have been with the company for many years.

A Striking British Post-War Car

THE car illustrated is a product of the Arrol-Johnston Co. of Dumfries, Scotland. It is remarkable for being well out of the ruck of pre-war European car design and for having much in common with American practice. Mechanically its chief features are overhead valves in a detachable cylinder head, a 2:1 stroke bore ratio, a four speed and reverse gear with central lever control, a spiral bevel gear axle and center fulcrumed cantilever spring suspension in the rear. Another characteristic is the remarkable lightness, the chassis complete with tires and electric starter and generator weighing only 1344 lb., and the complete car well under 2000 lb. A glance at the layout will show traces of American influence, making for cheapening and expedition of quantity production. The car has been well received, where seen, but it will be some time before deliveries can be looked for.

There are four cylinders with overhead valves and a demountable head. The bore and stroke measures 75 mm. by 150 mm. (nom. 3 in. by 6 in.). The equipment includes a separate unit dynamo and electric starter, h.t. magneto ignition, carbureter, forced water and oil circulation, the water pump being enclosed and of special design, and the oil pressure-fed to all bearings.

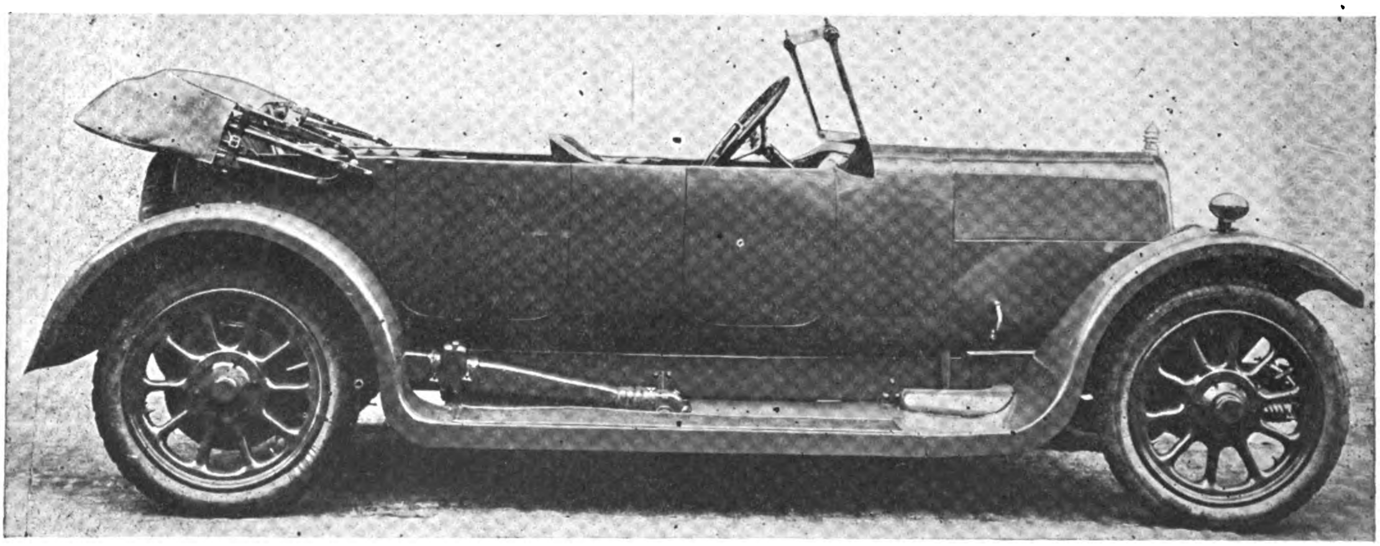
The clutch is an internal cone faced with asbestos fabric. There are four changes of speed and a reverse, with central gate change lever; i. e., the lever is over the gearbox. A special lubrication system is fitted, dispensing with the usual practice of removing the gearbox lid for filling. The rear axle drive is by a spiral-bevel gear, with special provision for self-lubricating, the hubs being furnished with self-adjusting oil retainers and ball bearings.

The steering gear is a worm and sector with special provision for adjustment. The hand wheel is 18 in. in diameter, and the steering post contains in a special casing the control levers and speedmeter and oil gages. The steering rods have a novel form of oil-retaining joint which dispenses with the hitherto-used dust-excluding gaiters. The fore axle is a high-grade steel forging and has a special form of oil-retaining swivel, and in this and other respects the layout is designed for easy steering.

There are two brakes, the one being behind the gearbox and the other (a pair) within the rear wheel hubs. The shoes are interchangeable and measure 15 in. in diameter.

The frame is of channel section pressed steel of extra depth and is cross-tied by tubes secured in suitable socket flanges. The fore suspension is on flat leaf springs and the rear is on flat cantilever type leaf springs. The before-noted special self-lubricating means in this connection need only be recalled. The wheels are of steel and detachable and shod with 820 mm. by 120 mm. tires (nom. 32 in. by 4¾ in.).

The wheelbase and track measure 10 ft. by 4 ft. 8 in. There is a minimum ground clearance of 10 in., and the frame is 20 in. from the ground. The chassis has a gross weight of 1344 lb. It is interesting to note that only two sizes of bolts and nuts and two diameters in ball bearings are used.



New Arrol-Johnston car, the chassis of which is suggestive of American practice. The sales price is $3,500

King-Bugatti 16-Cylinder Aero Engine

PART II

Consists Virtually of Two 8-Cylinder All-in-Line Engines Mounted on a Common Crankcase and Geared to a Common Propeller Shaft—Designed to Permit a 37-Mm. Cannon to Shoot Through Hollow Propeller Shaft

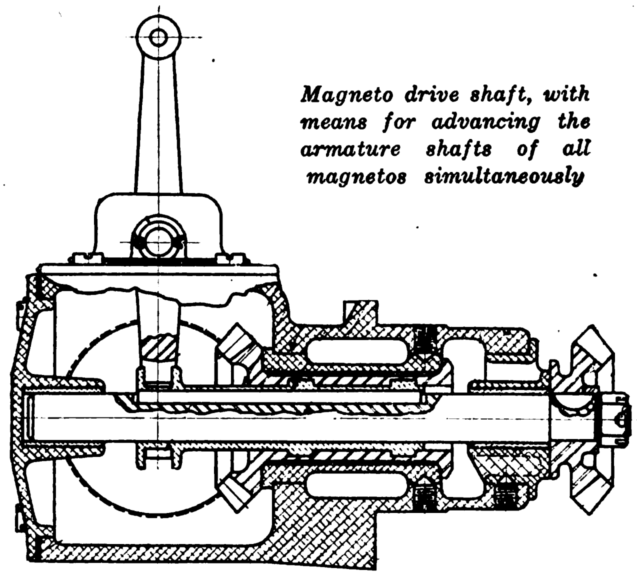
FOUR specially designed Miller carbureters are used, each supplying one block of four cylinders through separate water-jacketed manifolds. They are set low so that gravity feed may be used.

The throttle valve is of the barrel type. the axis of all valves is parallel with the center line of the engine, the two carbureters on each side of the engine being operatd by one shaft which is connected to the valves at each end through adjustable couplings. The shafts on the two sides of the engine are connected so that all four valves move in unison, the valve opening being synchronized by means of the adjustable couplings.

Gasoline is drawn into the jet through the small hole in the bottom of the threaded end, mixing with a certain amount of air sucked in through the four holes drilled in the barrel of the jet just above the threaded portion. This air is taken from the outside through the upper 3/16-in. hole in the jet holder and passes down around the outside of the jet to the four holes mentioned above. The major portion of the air enters the carbureter through the lower end of the venturi, which is 3 in. in diameter, passes up around the jet bar holder, combining above this with the rich mixture from the jets to form the proper mixture for combustion.

Assembly of the altitude valve is shown. This valve operates by turning a lever which is attached to the altitude control valve. This valve has two openings in its seat, which when in the open position register with two similar openings in the stationary cover, thus making two free passages to the outer air.

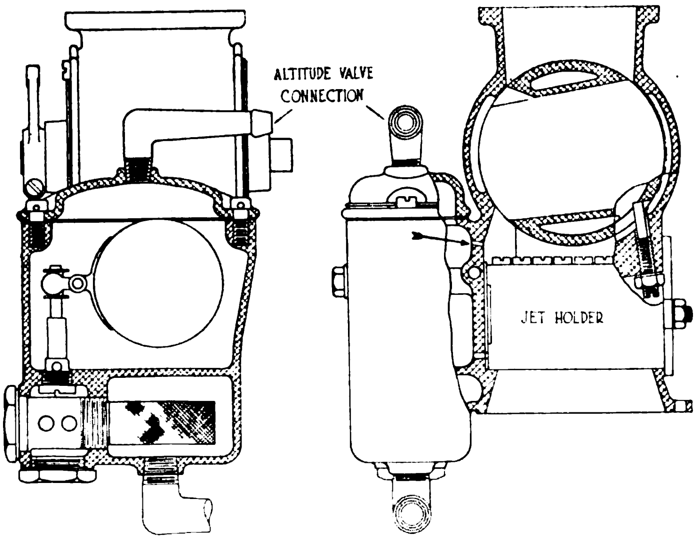
There are four outlets, one of which connects to each of the four elbows, opening directly into the top of the float chamber. The float chamber is always in direct connection with the venturi through a 5/64-in. drilled hole opening into the venturi about ¼ in. above the jet holder and into the float chamber well above the gasoline level. Opening the altitude control valve decreases the vacuum in the float chamber, thus increasing the flow of gasoline through the jets.



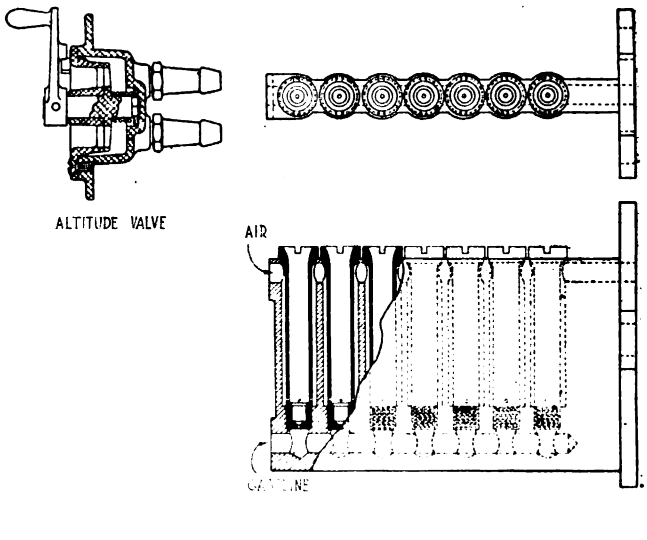
Magneto drive shaft, with means for advancing the armature shafts of all magnetos simultaneously

Ignition is by four Dixie 800 magnetos, two on each side of the engine, driven from the vertical camshaft driving shaft by bevel gearing. All magnetos turn clockwise. Two Titan A-C spark plugs are used per cylinder, located in the side of the combustion chamber.

The rear magneto on the right-hand side supplies current to the rear plug in each of the eight left-hand cylinders, the front magneto on the right-hand side supplying current to the front plug in each of the eight right-hand cylinders. The same arrangement is followed with the magnetos on the left-hand side, so that the two magnetos in either side will fire all sixteen cylinders. Magnetos are set for a maximum advance of 38 deg.



Two sectional views of Miller carbureter



Detail of altitude control valve and multiple nozzle

The bevel gear on the magneto shaft is fitted on a taper with a key. The gear has eight keyways, six spaced 48 deg., one spaced 42 deg. and one spaced 30 deg. This in combination with the gear teeth allows the magneto to be set within 1⅛ deg. on the crankshaft.

The magneto advance and retard mechanism is shown in one of the illustrations.

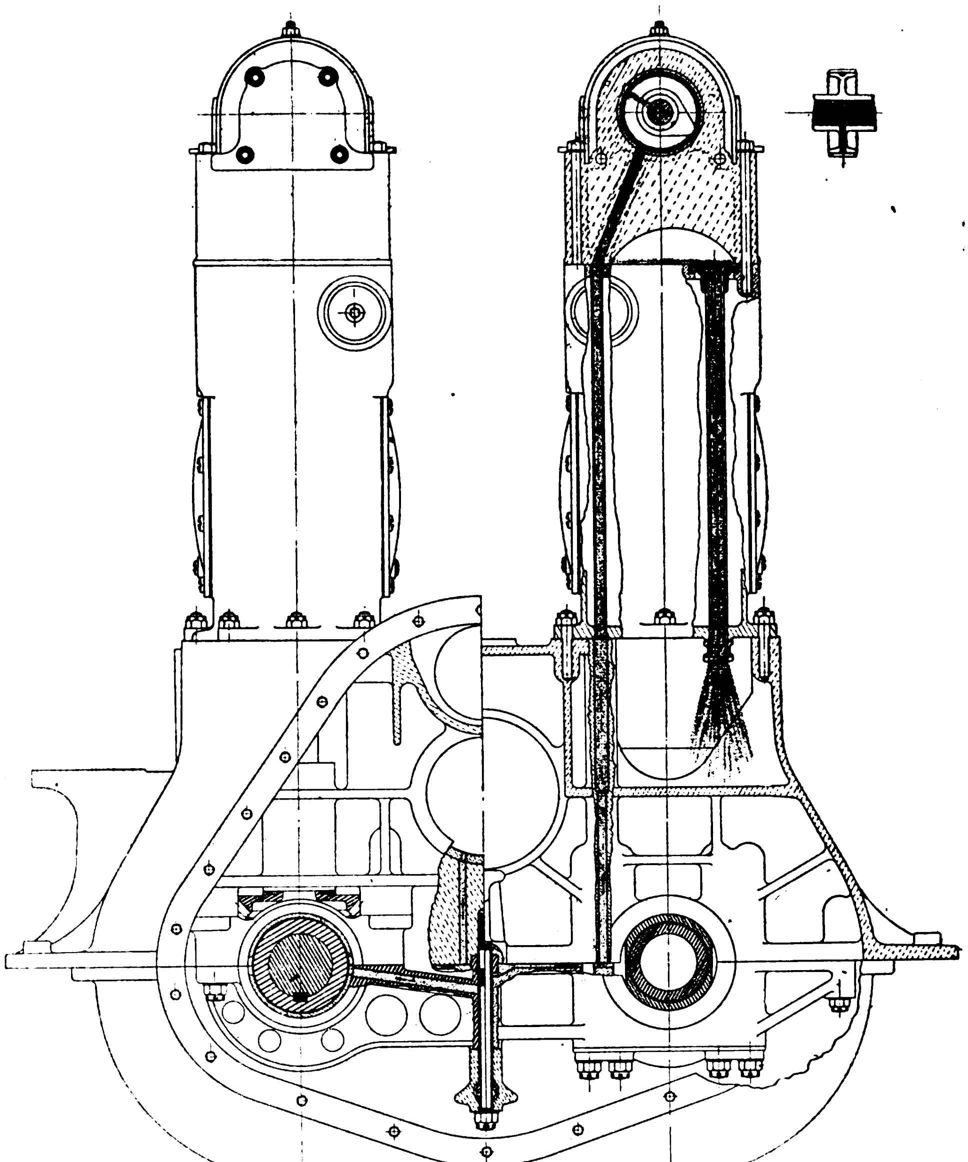
The bevel gear within the housing meshes with the gears on the magneto shafts. This gear has four internal helical grooves sliding over splines on a sleeve which is keyed to the driving shaft but may be moved along the shaft by a lever. The movement of this sleeve revolves the magneto driving gear in relation to the shaft driven directly from the crankshafts cut, thus advancing or retarding the magnetos. The levers on the two sides of the engine are operated from one shaft located above the crankcase between the cylinder blocks, the connections to the levers being through adjustable yokes so that the magnetos may be synchronized.

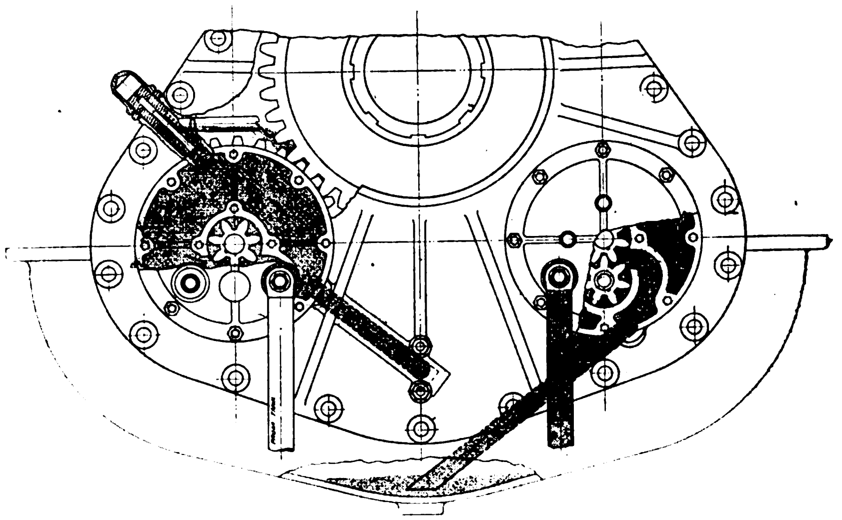
Oiling System

Oiling is by means of pressure feed and spray. There are one pressure and one scavenging pump, both of the gear type. These are located at the front of the engine, driven directly from the crankshafts through a pin and slotted coupling. This coupling is squared to the pump shaft, but is not pinned, thus relieving the shaft of any end driving pressure. The gears in both pumps are the same, except that the scavenging pump gears have a wider face.

Oil, after passing through a strainer, is drawn from the supply tank by the pressure pump, which is driven from the right-hand crankshaft. This oil is forced into the pressure line running the entire length of the crankcase. An adjustable pressure-regulating valve is located in the crankcase front gear cover. It is of the poppet valve spring-seated type and discharges the excess oil directly onto the propeller shaft driving gears. This valve is generally set so that the pressure gage, which is connected to the rear end of the main oil line in the crankcase, registers about 30 lb. This valve has holes drilled through the head so that there is always a certain amount of oil discharged onto the gears.

From the pressure line the oil passes up around the studs which hold this line in position to an oil passage cut along the top surface of the crankshaft bearing cap. For the center crankshaft bearing this oil is carried through a drilled hole. These passages carry the oil to all the main crankshaft bearings. All the main crankshaft bearings





Sketches showing details of lubrication system

Weights, Dimensions and Other Data of King-Bugatti Engine

GENERAL DATA

Material of cylinders	Cast iron
Bore	4.33 in. (110 mm.)
Stroke	6.3 in. (160 mm.)
Stroke—bore ratio	1.455 : 1
Area of one piston	14.725 sq. in.
Total piston area	235.6 cu. in.
Swept volume of one cylinder	92.768 cu. in.
Displacement of motor	1484.288 cu.in.
Compression ratio	5:1
Normal brake horsepower	410 at 2000 r.p.m.
Ratio propeller to crankshaft speed	.666 : 1

VALVES

Number per cylinder	Two inlet and one exhaust
Outside diameter, inlet	1.535
Outside diameter, exhaust	2.263
Port diameter, inlet	1 27/64 in.
Port diameter, exhaust	2 3/64 in.
Width of seat, inlet	.057 in.
Width of seat, exhaust	.108 in.
Angle of seat	10 deg.
Valve lift, inlet	.653 in.
Valve lift, exhaust	.700 in.
Diameter of stem, inlet	.357 in.
Diameter of stem, exhaust (large)	.591 in.
Diameter of stem, exhaust (small)	.4355 in.
Length of vave, inlet	5 17/64 in.
Length of valve, exhaust	5 13/32 in.
Length of spring in position, inlet (small)	2 7/64 in.
Length of spring in position, inlet (large)	2 15/64 in.
Length of spring in position, exhaust (small)	2 27/64 in.
Length of spring in position, exhaust (large)	2 27/64 in.
Main diameter of coils, inlet spring (small)	57/64 in.
Main diameter of coils, inlet spring (large)	1 9/32 in.
Mean diameter of coils, exhaust spring (small)	1 9/32 in.
Mean diameter of coils, exhaust spring (large)	1 23/32 in.
Clearance valve stem	.015 in.

CYLINDERS

Overall height of cylinders	10 27/64 in.
Length of projection in crankcase	3 1/16 in.
Width of cylinder casting at head over water jacket space	5 7/16 in.
Width of cylinder casting at barrel over water jacket space	5 1/16 in.
Length of cylinder casting over water jacket	19 5/32 in.
Thickness of flange (base)	7/16 in.
Number of studs per block of four cylinders	20
Diameter of stud	5/16 in.
Thickness of water jacket side wall and head	5/32 in.
Thickness of combustion chamber wall	13/64 in.
Thickness of cylinder barrel, above flange at water jacket	3/16 in.
Thickness of cylinder barrel, above flange below water jacket	7/32 in.
Thickness of cylinder barrel below flange	9/64 in.
Thickness of valve ports	5/32 in.
Diameter of port at valve, inlet	1 27/64 in.
Diameter of port at valve, exhaust	2 3/64 in.
Inlet port at flange (for two cylinders)	2 9/32 x 1⅜ in.
Exhaust port at flange (for one cylinder)	2 3/64 x 1 31/64 in.
Number of spark plugs per cylinder	2

PISTONS

Material	Aluminum
Length of piston	4 1/16 in.
Length to diameter ratio	.938 : 1
Position of rings	Above gudgeon pin
Width of rings	⅛ in.
Width of land	¼ in.
Distance from bottom to center of gudgeon pin	2 1/6 in.
Thickness of head at center	¼ in.
Thickness of head at edge	⅜ in.
Thickness of wall at bottom	⅛ in.

GUDGEON PIN

Diameter of gudgeon pin	1 5/64 in.
Thickness of wall	.164

CONNECTING ROD

Type	Plain
Length between centers	10 7/16 in.
Ratio length to crank throw	3.313 : 1
Small end bearing	Bronze bushing
Outside diameter of bushing	1 3/16 in.
Length of bushing	2 3/32 in.
Length of small end of rod	2 3/32 in.
Outside diameter small end of rod at end	1 11/32 in.
Outside diameter small end rod at center	1½ in.
Type of section	Eye
Depth (small end)	1¼ in.
Depth (large end)	1 7/32 in.
Width	⅝ in.
Thickness of web	5/32 in.
Thickness of flange (small end)	5/32 in.
Thickness of flange (large end)	13/64 in.
Large end bearing	Bronze babbitt lined
Inside diameter bushing	2 3/16 in.
Outside diameter bushing	2½ in.
Length	2 9/64 in.
Thickness of babbitt	3/64 in.

CRANKSHAFT

Number of crankshafts	2
Number of bearings (plain)	9
Number of bearings (ball)	1
Cylinder centers (in block)	4 17/32 in.
Cylinder centers (between blocks)	15/32 in.
Crank pins (outside diameter)	2 3/16 in.
Crank pins (inside diameter)	1⅛ in.
Length	2 11/64 in.
Main Bearings—	
Outside diameter, Nos. 1, 2, 3, 4, 6, 7, 8, 9	2 3/16 in.
Outside diameter, No. 5	2⅝ in.
Inside diameter, Nos. 1, 2, 3, 4, 6, 7, 8, 9	1⅛ in.
Length, Nos. 1, 2, 3, 4, 6, 7, 8 bearing bushings	1 9/16 in.
Length No. 9 bearing bushing	2 19/32 in.
Length No. 5 bearing bushing	1 31/32 in.
Ball Bearing—Hess-Bright Monarch No 6211	
Crank webs	
Width	3 17/32 in.
Thickness	43/64 in.
Radius of fillets	3/32 in.
Weight of one complete shaft	96½ lb.

CAMSHAFT

Diameter of shaft	1 in.
Inside diameter	11/16 in.
Number of bearings	10
Diameter of bearings Nos. 1 and 10	1 in.
Diameter of bearings Nos. 2, 3, 4, 5, 6, 7, 8, 9	2¼ in.
Length of bearings Nos. 1 and 10	1 5/16 in.
Length of bearings Nos. 2, 4, 7, 9	⅝ in.
Length of bearings Nos. 3 and 8	¾ in.
Length of bearings Nos. 5 and 6	27/32 in.
Width of cam face	5/16 in.
Number of cams per cylinder	3

CAMSHAFT BEVEL GEAR

Pitch diameter	3¾ in.
Number of teeth	30
Pitch	8
Width of face	¾ in.
Diameter of bolt circle	1 23/32 in.
Number of bolts	6
Diameter of bolts	5/16 in.

CAMSHAFT HOUSING

Material	Aluminum

CAMSHAFT DRIVING SHAFT

Diameter	¾ in.
Wall thickness	⅛ in.

CRANKCASE UPPER HALF

Material	Aluminum
Thickness of wall	3/16 to 5/16 in.
Thickness of supporting flange	⅜ to 7/16 in.
Center distance of motor support bolts	24¾ in.
Number of motor support bolts	12
Diameter of motor support bolts	⅜ in.
Center to center of crank shafts	10¼ in.
Height of case	9.055 in.

CRANKCASE LOWER HALF

Material	Aluminum
Thickness of wall	3/16 in.

LUBRICATION

Type	Forced feed and spray
Type of pump	Rotary gear
Number of pumps	One pressure, one scavenging
Oil pressure	30 lb.

PRESSURE PUMP

Number of teeth	7
Pitch	6
Outside diameter	1½ in.
Width of face	13/16 in.
Ratio of pump speed to crankshaft speed	1 : 1

SCAVENGING PUMP

Number of teeth	7
Pitch	6
Outside diameter	1½ in.
Width of face	1¼ in.
Ratio of pump speed to crankshaft speed	1 : 1

IGNITION

Type	Magneto
Number	4
Make	"Dixie 800"
Firing order	1L, 7R, 5L, 4R, 3L, 8R, 7L, 2R, 4L, 6R, 8L, 1R, 2L, 5R, 6L, 3R, 6L, 3R.
Number of plugs per cylinder	2
Type of plug	Titan A. C.
Advance	38 deg.
Magneto rotation	Clockwise

COOLING SYSTEM

Type	Water cooled
Pump	1 Centrifugal
Inside diameter of inlet and outlet elbow to cylinders	1½ in.
Number of inlets	2
Number of outlets	2
Water temperature inlet	150° F.
Water temperature outlet	160° F.

WATER PUMP

Material	Aluminum
Inside diameter of inlet	2¼ in.
Inside diameter of outlet	2 3/16 in.
Diameter of impeller	5⅞ in.
Number of blades	8
Ratio pump speed to crankshaft speed	1 : 1

REDUCTION GEARS

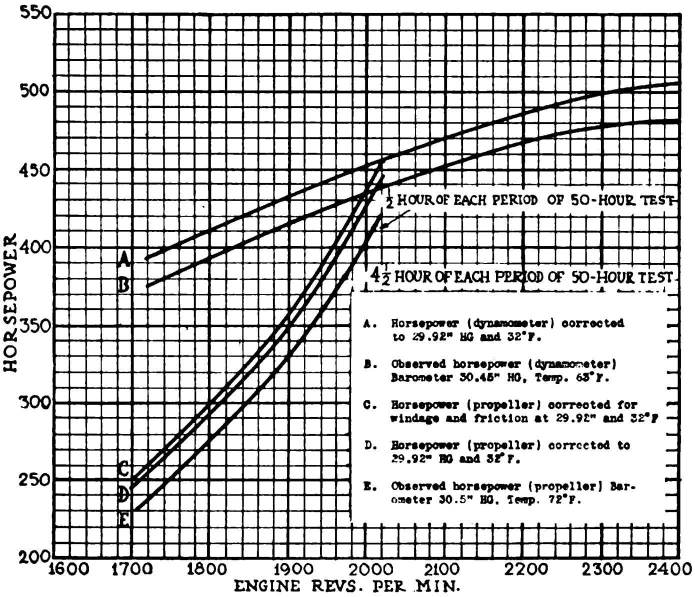
Crankshaft Propeller Drive Gear—	
Pitch diameter	5.6 in.
Pitch	5
Number of teeth	28
Width face	2⅜ in.
Diameter bolt circle	3 17/32 in.
Number of bolts	9
Diameter of bolts	7/16 in.
Propeller shaft gear:	
Pitch diameter	8.4 in.
Pitch	5.0 in.
Number of teeth	42
Width face	2⅜ in.
Number of splines	8
Width of splines	.405
Height of splines	.094

PROPELLER SHAFT

Number of bearings	3
Type of bearings	Two ball; one plain
Ball bearings	No. 6219, special width, Hess-Bright
Plain bearing	Bronze babbitt lined
Diameter of bearing	3 7/16 in.
Length of bearing	1½ in.
Thickness of babbitt	1/32 in.
Outside diameter at gear (over splines)	3¾ in.
Outside diameter at rear end	3 5/16 in.
Outside diameter at propeller	3 31/64 in.
Inside diameter	2 61/64 in.
Diameter propeller flange	9¾ in.
Thickness flange	7/16 in.
Thickness loose flange	9/32 in.
Length of bearing loose flange on shaft	¾ in.
Diameter of bolt circle	7¾ in.
Diameter of bolts	⅝ in.
Number of bolts	8

U. S. Bugatti 16-Cylinder Engine; Weights of Parts

	Lb.	Oz.
Completely assembled engine, dry, without exhaust stacks	1170	
Crankshaft with propeller drive gear, bolts and nuts, bevel gear and oil passage shells	96	5
Cylinder assembly with valves, valve springs and retainers, and all studs	79	
Piston	1	11
Valve rocker assembly	0	5
Piston ring	0	1
Gudgeon pin with aluminum plugs	0	9
Connecting rod, complete with cap, bushings, bolts and nuts	3	8
Water pump assembly complete	6	2
Water pump impeller	0	9
Oil pump assembly, complete, pressure	2	6
Oil pump assembly complete, scavenging	3	6
Magneto "Dixie 800"	16	13
Magneto gear housing assembly complete	3	14
Carburetor assembly complete	5	0
Inlet manifold	7	2
Camshaft assembly complete	10	2
Inlet valve with springs and retainer	0	9
Inlet valve	0	4
Exhaust valve with springs and retainer	1	1
Exhaust valve	0	8
Valve rocker assembly	0	5



Engine full throttle horsepower and propeller horsepower

and pins are hollow. All even-numbered main crankshaft bearings have a 3/16-in. radial hole drilled entirely through them. All the crankpin bearings have a 3/16-in. radial hole drilled from the inside to the central hole. A 13/64-in. hole is drilled in the web, both sides of even-numbered main crankshaft bearings connecting the central hole in the main and pin bearings. A copper shell is placed in these central holes and the ends are spun over, making an oil-tight joint. These shells are necked in the central portion so that a tubular oil space is left.

Oil from the passages in the crankshaft bearing cap is forced into this tubular oil space through the 3/16-in. holes which register with this passage twice per revolution. From here the oil passes to the pin bearings, the leakage from these bearings being thrown on the cylinder walls and piston pins, thoroughly lubricating these parts.

Four vertical holes are drilled in the crankcase web connecting with the oil passages in crankshaft bearing caps Nos. 3 and 7. These holes register at the top of the crankcase with copper tubes which pass through the cylinder water jacket space, registering at the top of the cylinder block with four holes drilled in the webs of the crankshaft housing. These holes register with an oil groove of 3/64 in. radius cut entirely around camshaft bearings Nos. 3 and 8, right and left. A No. 35 drill hole connects the oil grooves with the interior of the hollow camshaft. Oil is thus carried under pressure to the hollow camshaft. From the hollow camshaft the oil passes to camshaft bearings Nos. 1, 2, 4, 5, 6, 7, 9 and 10 through a No. 35 drill hole. Camshaft bearing bushings Nos. 2, 4, 7 and 9 have a 3/32 in. by 1/32 in. oil groove cut full length of the bearing surface, the drilled hole in the camshaft bearing registering with this groove once per revolution, causing a small stream of oil to shoot out both sides of the bearing, thoroughly lubricating the cams, valve rocker shaft, rollers and valve stems. Camshaft bearing bushings Nos. 5 and 6 have a 3/32 in. by 1/32 in. oil groove cut from ¼ in. of the outer edge to the inner edge, the drilled hole in the camshaft registering with this groove once per revolution. Oil from this groove in the rear bearing lubricates the thrust surface of the camshaft bevel gear, while the small stream from the front bearing thoroughly lubricates the camshaft and camshaft driving gears and the camshaft driving gear bearings.

A 3/16-in. hole is drilled in the crankcase web connecting with the oil groove in No. 6 crankshaft bearing cap and registering with a 1/16-in. drilled hole in the propeller shaft rear bearing bushing. This thoroughly lubricates this bearing. The oil flowing from this bearing returns to the sump by gravity.

The camshaft and magneto driving gears in the crankcase are lubricated by spray. The gearing in the camshaft housing is packed in grease. The crankshaft and propeller shaft ball bearings are lubricated by spray. Oil which drains to the bottom of the camshaft housing is returned by gravity to the crankcase through twelve pipes passing through the cylinder water jacket space. Oil which drains to the front end of the sump is returned to the oil tank by the scavenging pump. Oil which drains to the rear end of the sump is returned to the oil tank by gravity.

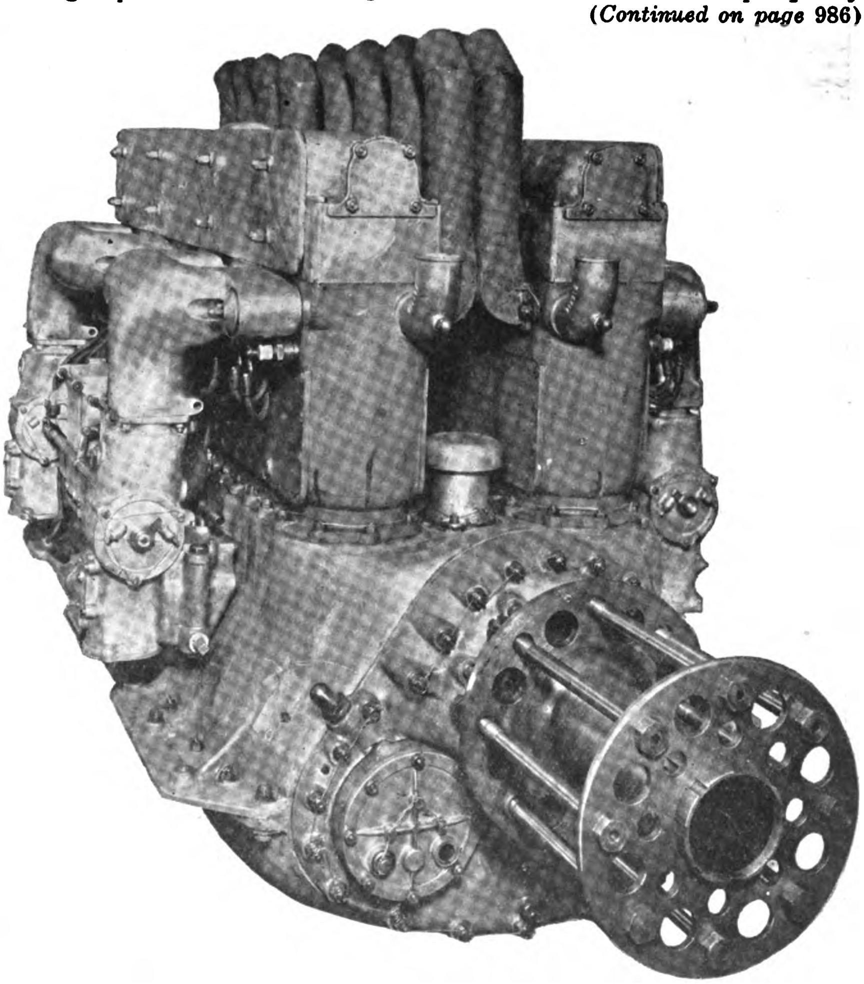
Cooling System

Cooling water is circulated through the engine by means of a centrifugal pump, driven from the rear end of the left-hand crankshaft by a pin and coupling, the same as used on the oil pump.

The cooling system from the pump inlet to the outlet elbows on the front cylinders holds 4¼ gallons of water. The pump impeller is 5⅞ in. in diameter, with eight vanes, the web being drilled with eight ⅝-in. holes on a circle of 2 in. diameter to equalize the water pressure.

The pump shaft is packed with a graphited asbestos rope packing, automaticlaly held under compression by a coiled spring acting on the gland. The pump shaft is hollow, the rear end being in direct communication with the water in the pump case. Water entering the shaft is forced out to the shaft rear bearing surface through a ⅛-in. hole. Any leakage of water past the asbestos packing is drained outside of the crankcase through a ⅝-in. cored hole in the water pump body.

(Continued on page 986)



Propeller end view of complete King-Bugatti engine

Fordson Assembly Wholly on Progressive Plan

PART II

Cylinder Block and Transmission Housing Assemblies Travel Along Parallel Lines Until Complete—Two Lines of Complete Tractor Assembly

By J. Edward Schipper

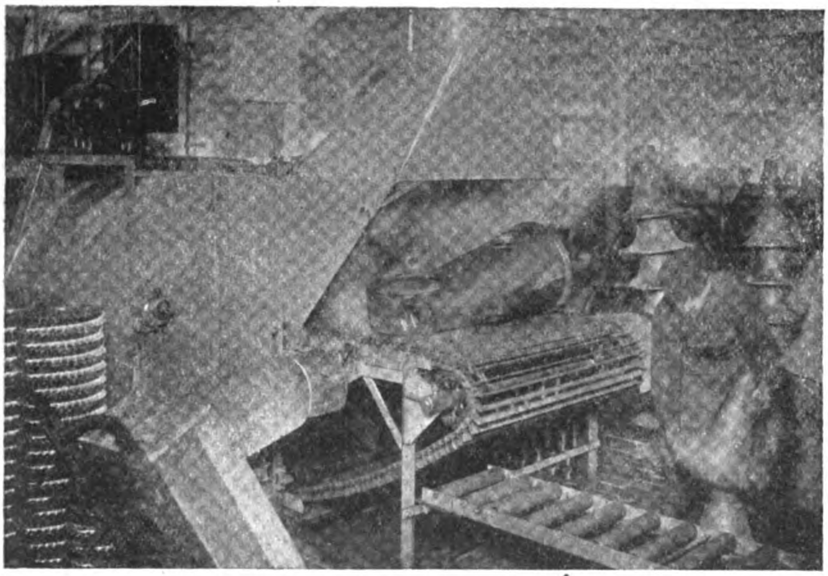


Fig. 14—Beginning the assembly of the transmission and rear axle. The roller conveyor comes from the manufacturing department, and the first operation is that of washing

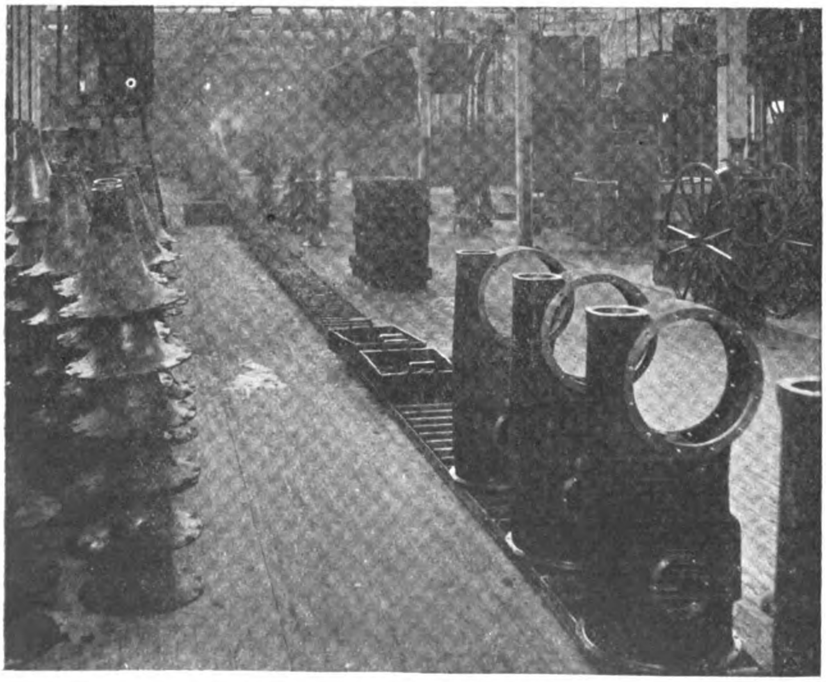


Fig. 15—Looking backward toward the washing machine, showing the incline down which the parts slide to the beginning of the transmission assembly track

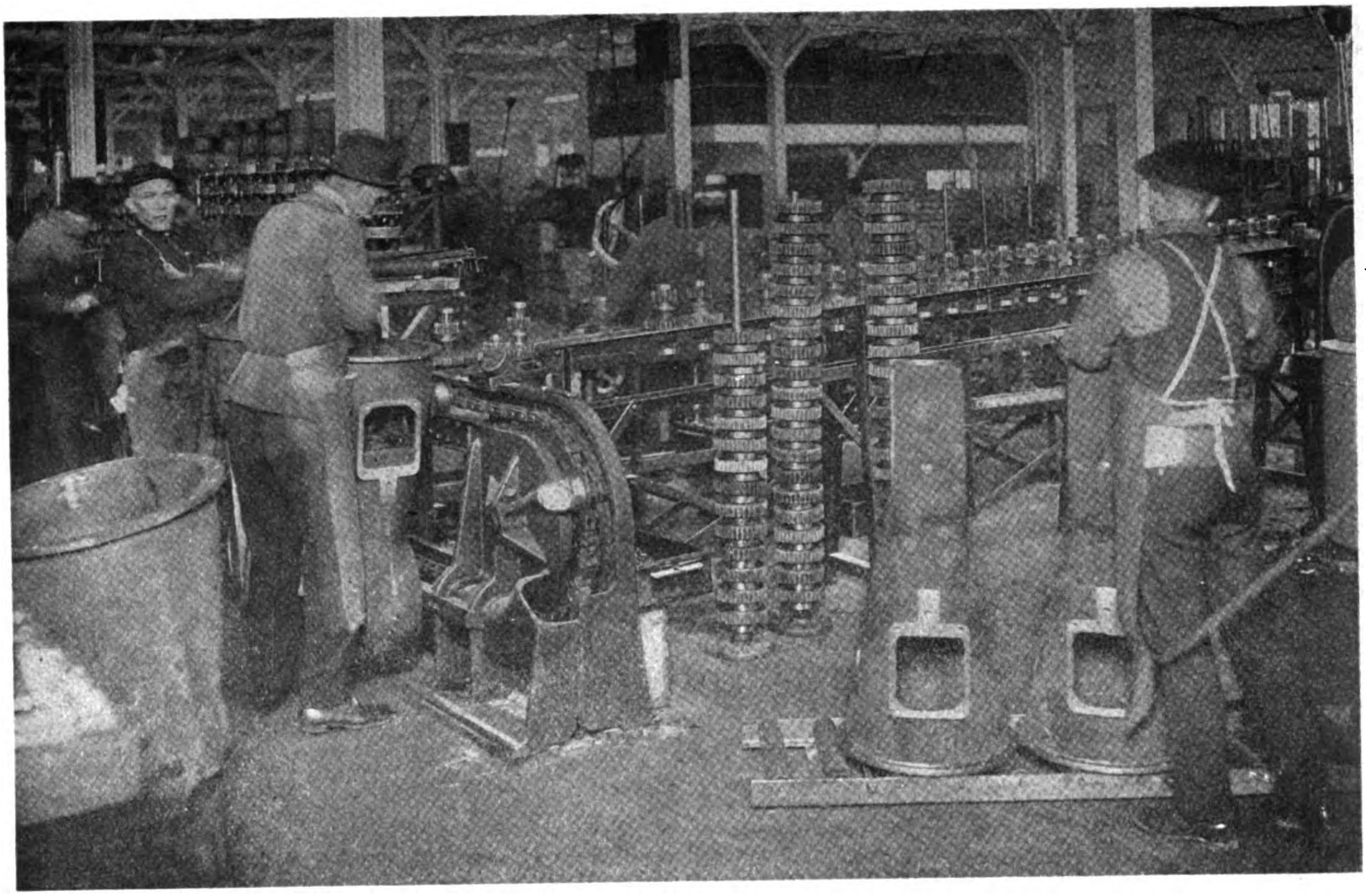
ALL the large castings and heavy parts used in the assembly of the transmission and rear axle which are in any way likely to be soiled or greasy from manufacture are put through the large washing machine shown in Fig. 14. In this illustration one of the big castings used as the body of the Fordson tractor, and which houses the transmission and rear axle gears, may be seen starting through the washing machine. The operator is just lifting up a rear axle housing from the gravity conveyor from the manufacturing department ready to put this through the washing machine, and thus the heavy parts all pass through as indicated.

The way they leave the washing machine and run down a slope to bring them to the assembly line is seen clearly in Fig. 15, which is looking back toward the washing machine. The slope is apparent in the background, and as the different parts come down the line they are picked off the gravity roller conveyors and put in proper position for assembly. The rear axle housings have gained a little, and are shown here stored. The two pans on the conveyor contain small parts which have been washed.

As will be noted in Fig. 15, the large castings are allowed to remain on the conveyor, and, as a matter of fact, everything is timed according to these. They pass along the conveyor and reach the foot of the slope at the point shown in Fig. 16, which is the commencement of the transmission assembly chain.

One of the hooks upon which the transmission housing is caught up has just come around on the track wheel, and is apparent in the foreground of the photograph. The gears which are ready for assembly, and which have been previously assembled on their shafts by means of arbor presses, come down on the sloping carrier to the assembly tracks. The men only work on one side of this track. Transmission gears are assembled in place with the casting vertically held by the hook on the conveyor chain, hence the operator can drop them into place without excessive effort, and the hook carries the casting along in this position.

After the completion of all assembly work which can be done with the casting in an upright position, there is a turnover carrier



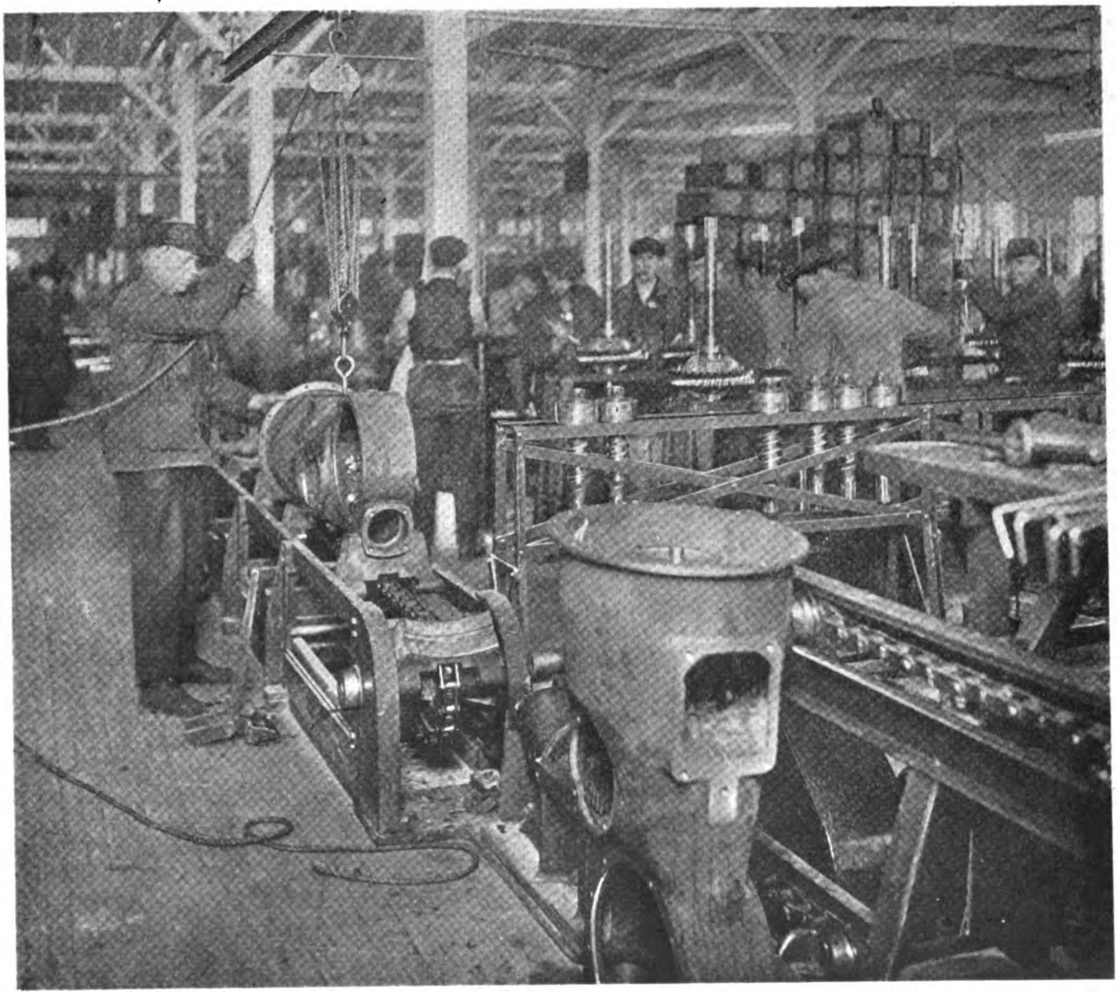


Fig. 16 — Looking ahead at the beginning of the transmission and rear axle assembly. Note the hooks on the chain which pick up the transmission housing and note the carriers from the arbor pressing department carrying the shafts with the gears in place

Fig. 17 — When the first assembly operations are complete, with the transmission housing in a vertical position, they turn over horizontally to the next section of the transmission assembly chain. This view shows the housing just about ready to turn over, and one is turned over in the background. Also in the background can be seen the preliminary sub-assemblies on the worm shaft and rear axle

Fig. 18—Section of the transmission housing assembly track, showing how the men work on both sides and how the nuts and bolts are carried in pans beneath the track. The bearings and bearing cases are held in containers close to the track Men are working on both sides of this track, performing symmetrical operations

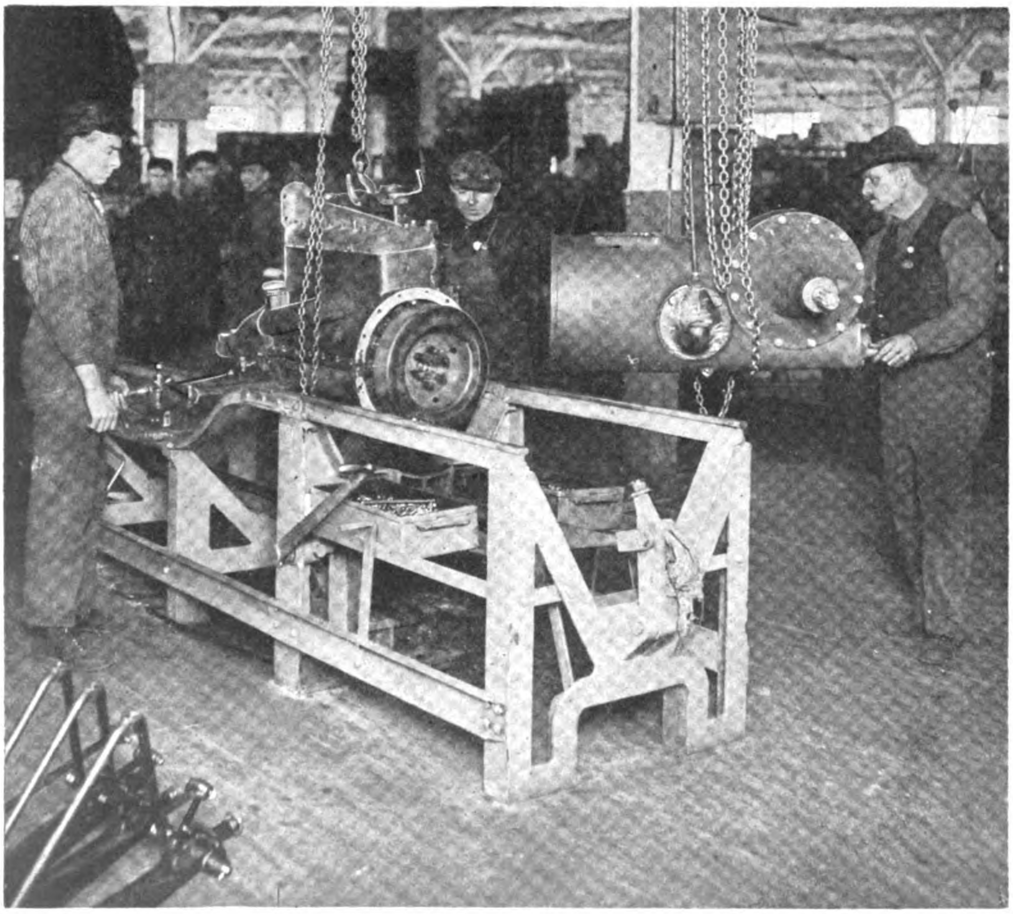


Fig. 19—When the completed transmission housing assembly reaches the end of the chain it is swung over to the beginning of the tractor assembly track. This starts out with a stationary stand upon which the halves are first bolted together before they are pushed down an incline and enter upon the moving track

which allows the casting to swing over horizontally. As shown in the foreground of Fig. 17, there are no intermediate steps between the vertical position and the horizontal position of the large transmission housing. It is immediately turned over on its side. The first operation to take place when in this position is to put in the final drive parts, including the worm shaft, worm wheel, etc. In the background of Fig. 17 may be noted the parts for the final drive coming down on the sloping racks utilized as feeders to the transmission chain.

On the transmission assembly, men are working on both sides of the chain in the same way as on the engine assembly, and it is interesting to note the storage beneath the chain of the necessary bolts, nuts, soft hammers, etc., for the operations performed above that point. Fig. 18 shows this very clearly, the pans beneath the track being continually filled by men assigned to this duty, who come along with scoops full of bolts, etc., to keep the pans replenished. The axle shafts

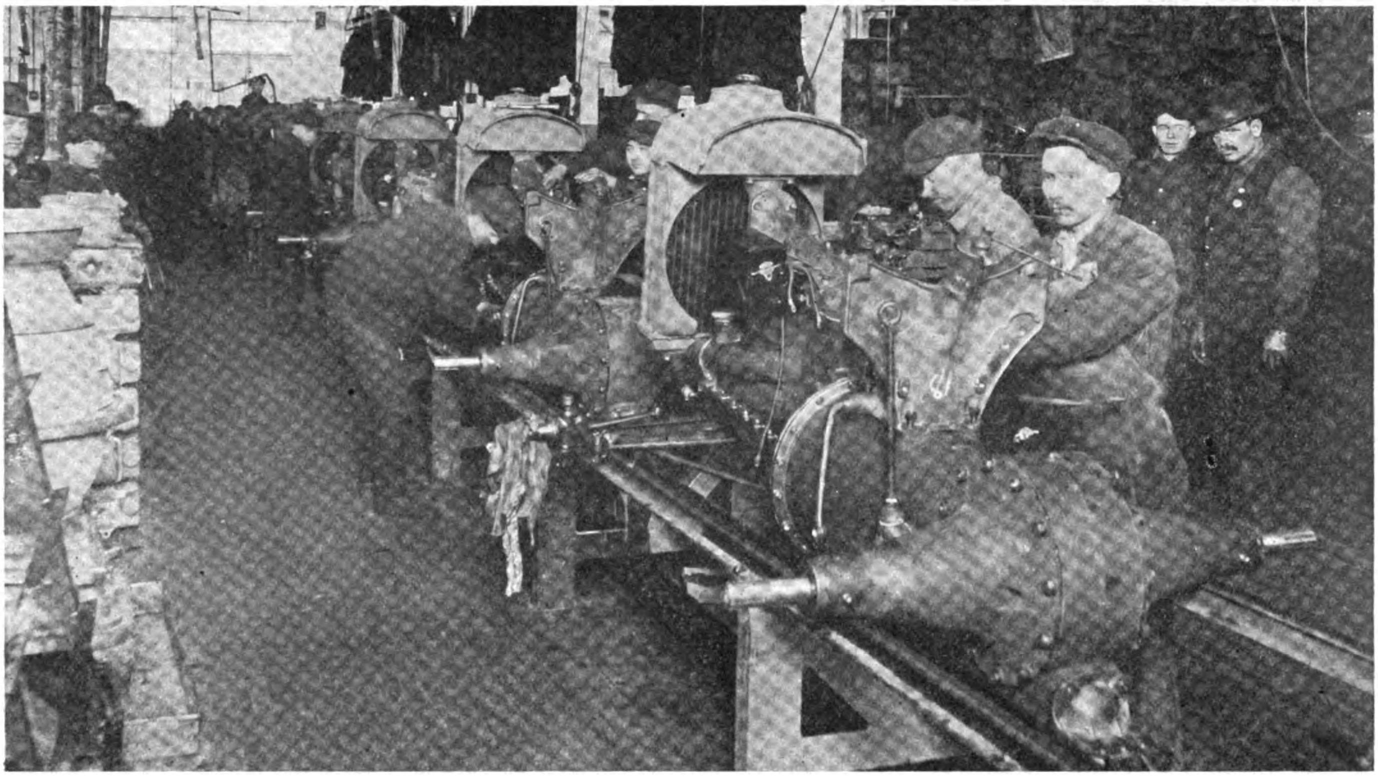


Fig. 20—Tractors moving along the tractor assembly track. In the foreground is a tractor which has just come down the incline and started on the track, and way in the background can be seen the open door through which the finished tractors leave the building

are shown here in position, and the next step, a little further on, is also seen in Fig. 18, which is putting on the rear axle housing. When this has been completed the transmissions are finished and are ready to be carried over to the beginning of the tractor assembly chain.

Final Tractor Assembly

An overhead crossover accomplishes this work. There are two tractor assembly chains and the finished transmissions and engines are fed alternately from each of the single engine and transmission lines to one of the tractor assembly chains. Fig. 19 shows the stand at the end of one of the tractor assembly chains ready to begin its journey down the final assembly tracks. This stand is stationary. One man brings the engine over, another the transmission, while men at the stand are ready to bolt the flanges together. While this is going on the coil box is brought over and mounted on the side of the engine. To the

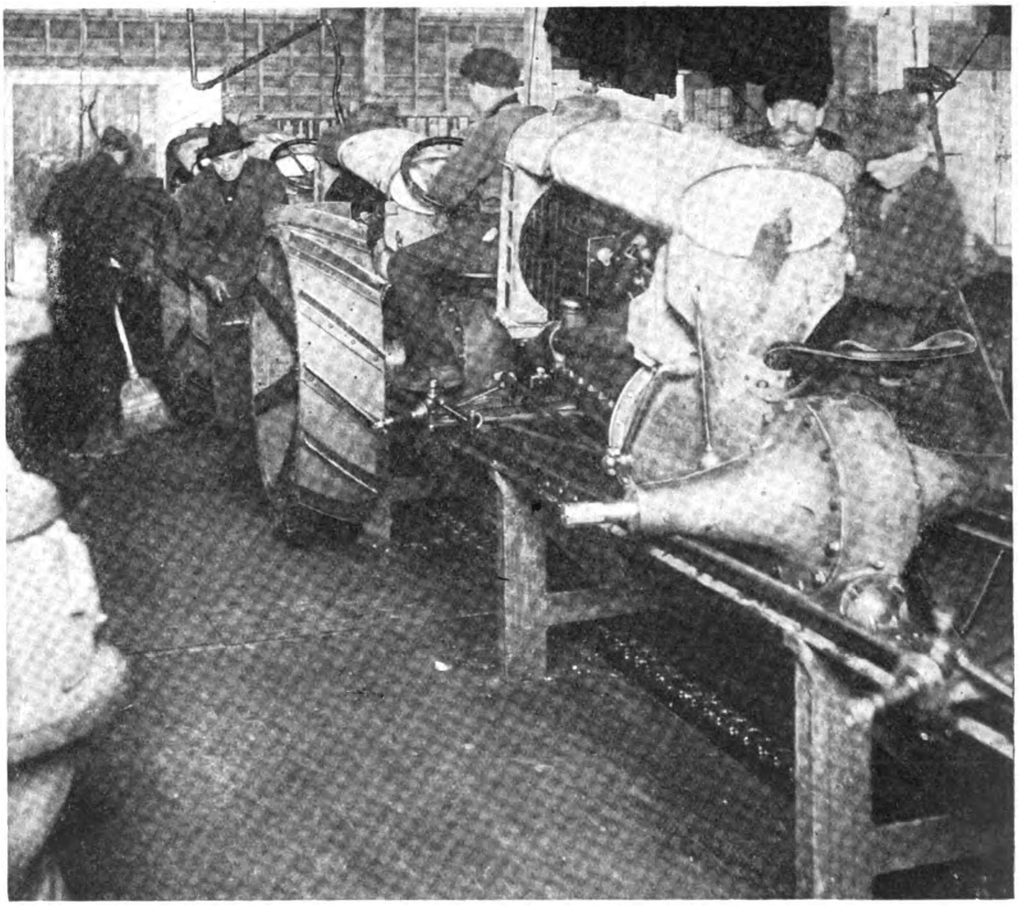
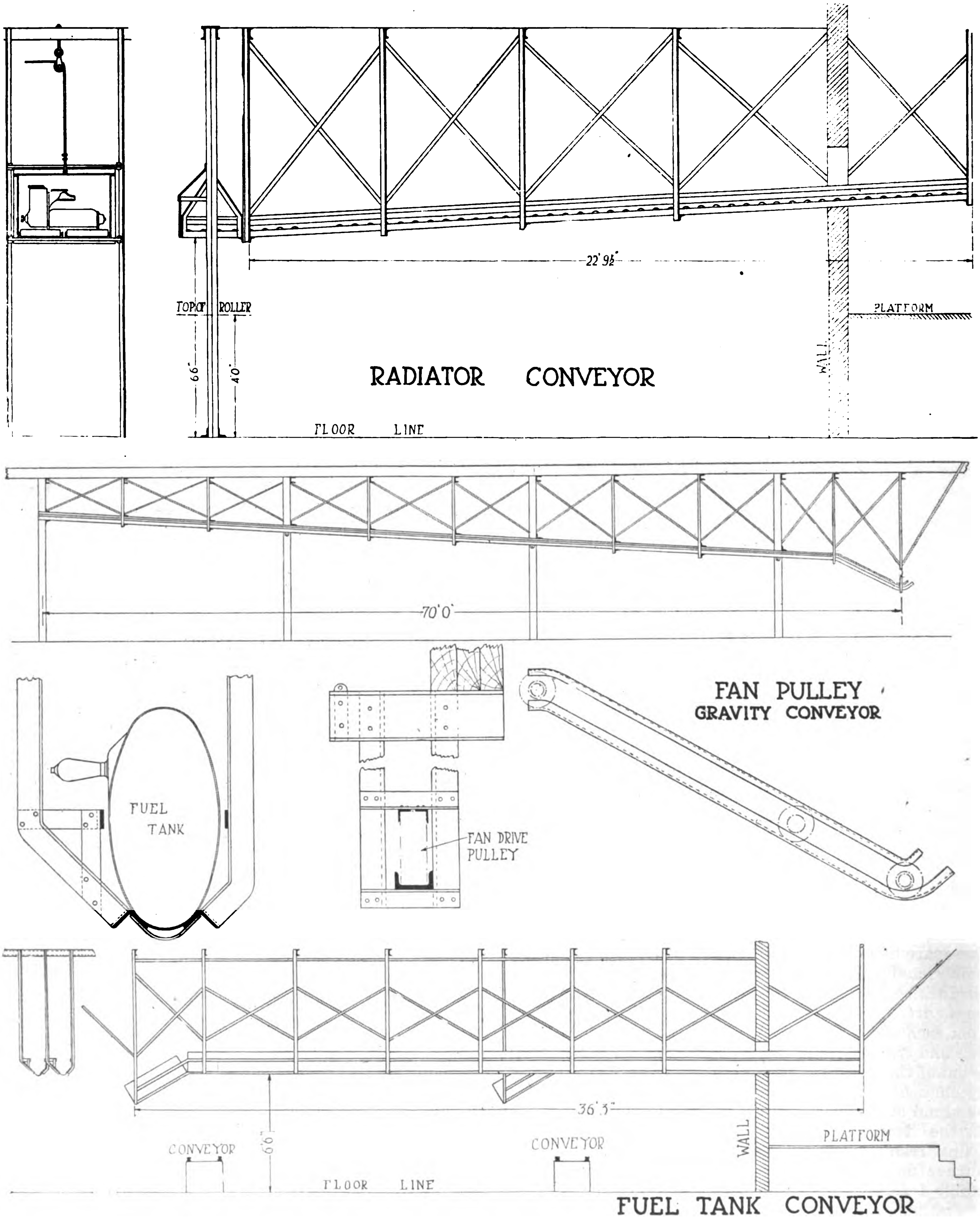


Fig. 21—The end of the tractor assembly chain, at which end the wheels and accessories are put on and oil, gasoline and water put in place so that the tractor can be started. In the background is seen a tractor with its wheels in position



Overhead Conveyors Used in Assembling the Fordson Tractor

The upper one for the radiator is of the gravity roller type and is provided with a counter-balanced elevator at the end, which automatically drops the part to a convenient height for the workman. On removing the radiator the elevator returns for the next one.

Small circular parts such as the fan pulley are rolled between two sloping channel irons, extending from the machine shop to the assembly department.

The fuel tanks are supplied from outside the building. They slide on two angle irons with guide strips at the side.

Fig. 22—Left—Tractors at the end of the assembly row. Here they are ready to be started. At the left of the illustration is shown the machine for doing it. This is a swinging electrical cranking machine which fits over the starting crank handle. Fig. 23—Right—Electric cranker in position turning over engine while it is receiving water

left of the illustration may be seen one of the men with the coil box ready to bring it to the proper position. The stationary stand at the end of the complete tractor assembly track is slightly higher than the track itself, so that when the flanges are bolted together and the preliminary operations on the stationary rack are completed, it is only necessary to push the tractor down the slope, where it is carried on rails to the track, which picks it up and starts it along for the next operation.

The commencement of this journey is shown in Fig. 20, where a view is given down the line of assembly. The doors seen in the background show where the tractors are finished. The foreground shows the first steps along the moving chain. The radiators are put on, the coil boxes in place, fans, steering gears, control mechanism, tank, steering wheel, etc., go on step

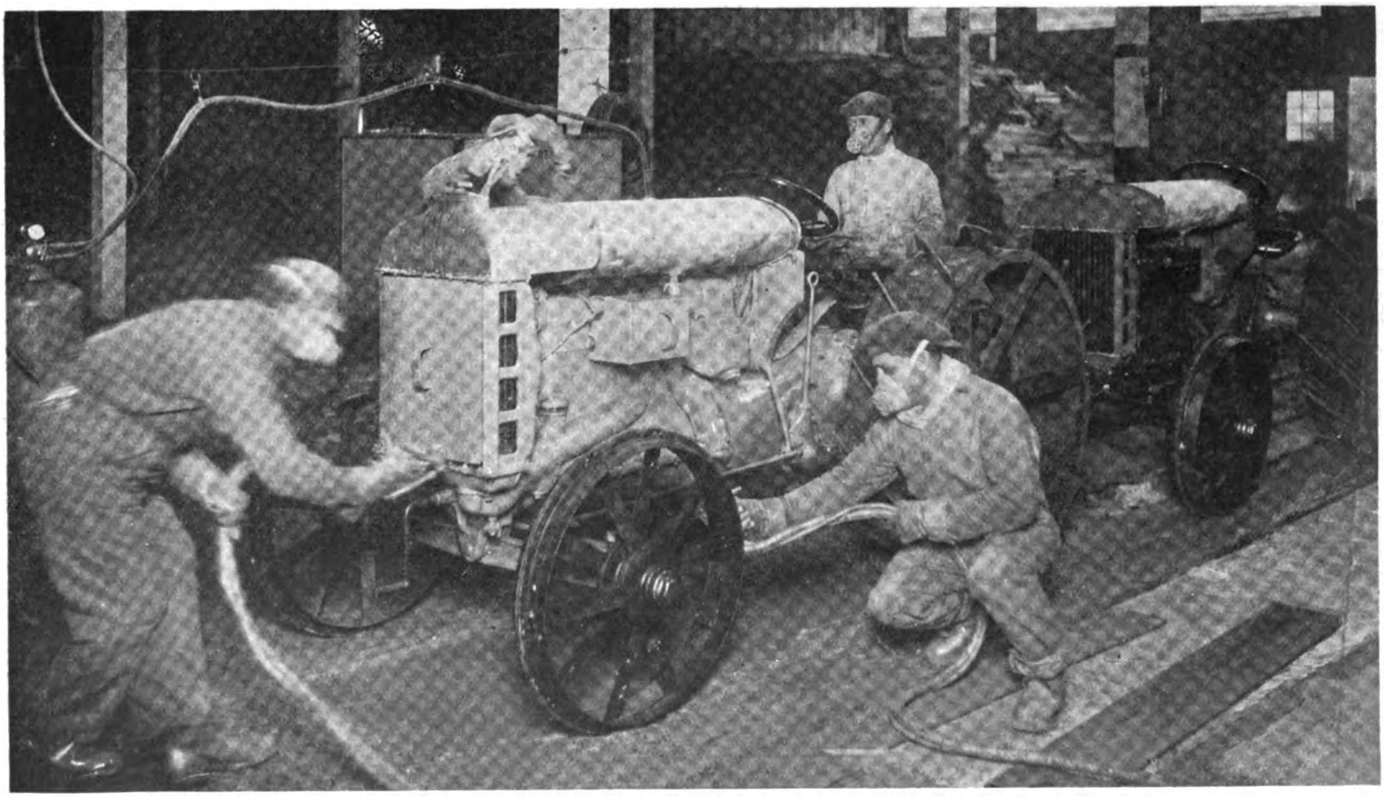


Fig. 25—Tractor in the paint shop being spray-painted by a gang of men wearing gas masks. It takes 2 min. to spray a tractor, and there are two gangs at work

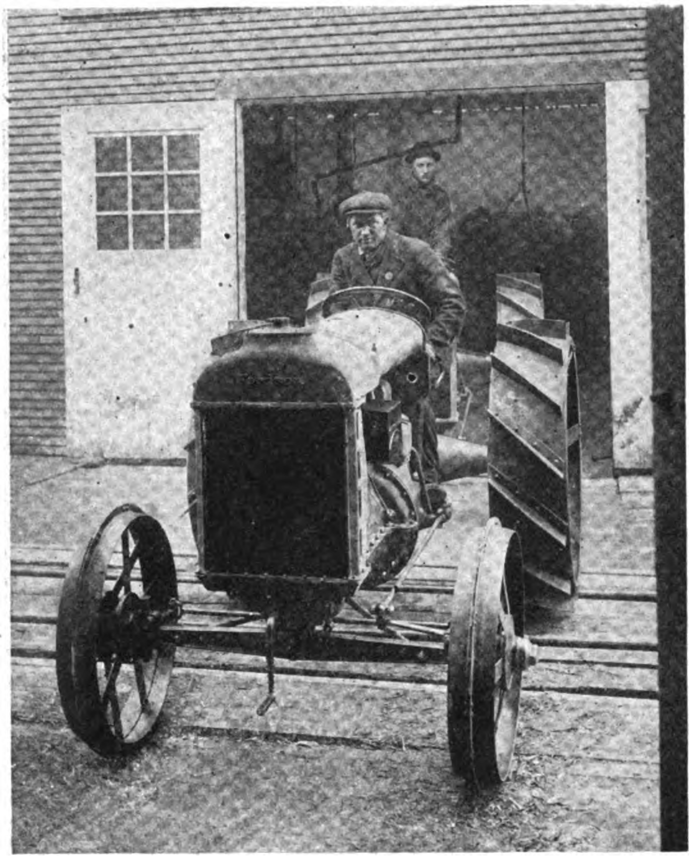


Fig. 24—The finished tractor being driven out of assembly building across a small alley into the paint shop

by step, and the materials are stored always at a point along the chain where they will be required for assembly. Eventually the wheels which go on the tractor will be fed from underground and come up on an elevating conveyor which will bring them directly to the right place. At the present time, as a temporary arrangement, they are rolled in, but this will not last much longer.

Fig. 21 shows the tractor ready for its wheels, and, in the background, a tractor which has its wheels already in position. Here the wheels are bolted tight, the accessories all mounted in position, the radiators filled with water and sufficient gasoline is put in the tank for an ordinary running which the tractors receive immediately after they leave the assembly chain. Fig. 23 shows the tractor immediately after it has left the end of the assembly chain. It is now ready to start, and the device shown at the left of the illustration incorporates a very ingenious method of cranking the engine. This is a beamed-shaped construction with a starting crank, as illustrated. It is swung into the tractor as shown in Fig. 22, and the electric motor started, whereupon the tractor engine is cranked vigorously until firing begins. Timing several of these showed that it required an average of 15 to 18 sec. to start a tractor. As soon as the tractor engine is started a driver-inspector steps into the seat and drives the tractor out of the assembly shop door, as shown in Fig. 24, where it passes across a narrow alley into the paintshop.

The painting is done by two gangs of four men each. These men are equipped with gas masks, and it requires 2 min. for a gang of men to paint a tractor. As soon as the tractors are painted they are driven away.

Wartime Investigations in Wood and Glue

UNDER the stress of war and the necessity of furnishing aircraft to the fighting front in large numbers and in a short time, it was found necessary to supplement the information available on wood and glue by extensive additional research work on these two important construction materials. It was found in many instances that factories taking Government contracts for aircraft and wagon work had in their desire to help neglected to go into the situation thoroughly and found themselves unable to produce on schedule. The rigid Government inspection showed them that their equipment was inadequate to meet the special demands placed upon it, and their knowledge of the peculiarities of the material was not sufficiently exact.

Many varied difficulties were encountered. Vehicle manufacturers had trouble drying stock. Lumber for wagons to be used in the hot, sandy sections required more thorough drying treatment than lumber for wagons to be used in more moist districts, and it was necessary to dry heavy stock quickly. Propeller manufacturers found that making propellers involved a great many more variables than the mere gluing of laminations and shaping the block—internal stresses occurred that caused warping and open joints in seemingly perfect blocks. Though they had been using glues for many years, they soon discovered that there was a wide difference between high-grade laminated work and the class of work ordinarily accepted as commercial standard. It is not surprising that the panel manufacturers making aircraft plywood for the various governments had some little difficulty at first in meeting aircraft specifications.

While waterproof glues have been in existence for some years, they were not well known and little information was at hand as to the correct procedure for their successful use. During the war the Forest Products Laboratory of the U. S. Forest Service at Madison, Wis., has been working on problems that seemed to give trouble to the plants engaged on war contracts. Much help has been given manufacturers, and a large staff of specialists has been engaged in obtaining information and developing new ideas in the uses of glues and wood.

Automobile Standardization in Great Britain

FOR some years there has been a somewhat ambiguous position with respect to automobile standardization in Great Britain. The Institution of Automobile Engineers no doubt wished to emulate our S. A. E. and take charge of this work, but inasmuch as there is an Engineering Standards Committee in Great Britain which is in control of all standardization in connection with mechanical engineering, this was out of the question. An agreement has now been reached between the Institution of Automobile Engineers, the Society of Motor Manufacturers and Traders and the Association of British Motor and Allied Manufacturers, in regard to the future handling of all technical matters connected with the automobile industry and the relations between the industry and the British Engineering Standards Association.

In 1917 the Technical Committee of the Motor Industries was founded by the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders as an administrative body to consider matters in connection with standardization, research, etc., and to co-ordinate investigation in connection therewith. By the arrangement just come to this committee will be disbanded, and the functions exercised by it will in future be carried out by a Technical Committee appointed by the Association of British Motor and Allied Manufacturers. The latter body was formed to look after the commercial interests of the British automobile building firms, and it has agreed to conditions which will insure that the technical qualifications of that committee shall be properly safeguarded.

The FORVM

Advantages of Steam

By Sewall Morse

IN the March 20 issue of AUTOMOTIVE INDUSTRIES Dr. C. P. Schwarz wrote interestingly of the possibilities of steam power from a thermal standpoint. When competition began between the steam engine and the internal combustion engine for supremacy in motor vehicle use, it was claimed that the "gasoline engine" was much the simpler and simpler to operate, besides being far more economical of fuel. Manufacturers of automobiles propelled by gasoline engines, taking advantage of the ignorance of the public in relation to these engines, pointed to the numerous undesirable features of the early steam automobiles and then triumphantly pointed to the new power which was soon to make steam power a matter of history, and announced that "all you have to do is to turn the crank and go." Eventually the manufacturers of steam cars, with one exception, gave up the game. This exception was slow to improve, but to-day it is not only demonstrating, I am informed, that a steam-propelled car can accomplish as much with 1 gal. of kerosene as the average gas car of equal weight does with 1 gal. of gasoline, but is cheaper in maintenance, has few troubles, is mechanically simpler than the gas car, is safer in emergencies and simpler to control.

There is not a low-priced steam car in the market, yet such a car offers no serious problems in its conception. The writer has been informed by men who know the market that there is a big waiting demand for a low-priced steam car, and a salesman of gas cars was recently heard to say that he believed a steam car at $1,000 or less would be the best selling proposition in the pleasure car field to-day. The important advantages of steam power for the propulsion of trucks and tractors are known to all mechanical engineers, and the use of coke, coal or crude oil for fuel is possible. With simplicity, reliability, durability and fuel cost in its favor, does it not seem that motor vehicle manufacturers and others who have the necessary capital are blind to the possibilities offered by steam in the motor-vehicle field?

From a thermal standpoint there are possibilities, both in steam generation and use, that can be utilized, and by means practical for motor vehicle use, that will result in thermal efficiencies at least equal to that of the best automobile gas engines now in use. This statement is made as a result of long study of the many problems relative to the economic generation and use of steam in small power plants and the designing of means for its accomplishment.

Ideal efficiency in the steam engine is first limited by the temperature of the steam that it is practical to use. While this limit is to be regulated for the use for which the outfit is intended, there is positive assurance that an astonishing efficiency can be obtained from steam outfits of 100 hp. and less, that such outfits can be made practical, of low cost and adapted to the use of any liquid or solid fuel. The limit of efficiency, where the highest efficiency is essential, as in aviation uses, would seem to be dependent upon a steam temperature that would permit of cylinder lubrication. However, suitably designed steam engines have been continuously operated with steam at from 800 deg. to over 900 deg. Fahr., and for short periods at higher temperatures, with no resultant injury whatsoever to pistons or cylinders; and it is not unlikely that an engine can be designed that can be successfully operated with steam at any temperature that it is practical to produce. That steam power can be made practical for aerial uses the writer has not a doubt, and that a steam-power plant can be produced that will approximate the light weight and the high efficiency of recent aviation engines there are good grounds for assuming. The possibility of light weight and high efficiency with steam power, with its better condition for reliability and safety, seems to merit greater attention in aviation circles than has, apparently, been given it.

With steam at extreme temperature it must be anticipated that valves will, after a time, score and leak, but a steam engine will operate with leaking valves, although at lower efficiency, and leaking valves can be repaired or replaced; but for motor vehicle use steam of high pressure and a practical superheat can be used with perfect satisfaction, and, with kerosene or crude oil for fuel, with a resultant general economy, combined with reliability, mechanical simplicity and simplicity of control. There are reasons to doubt that this can ever be accomplished with the internal combustion engine.

Cooling Fan Problems

By Louis Schwitzer

President, Automotive Parts Co.

REFERRING to Mr. Hoyt's article on Radiator Cooling Fans, his statements with regard to end thrust are incorrect and the charts showing the amount of it are misleading. Mr. Hoyt states that a fan running in free air will produce a certain end thrust, but when this fan is placed back of a radiator the end thrust is increased about 25 per cent, depending on the restriction of the air passage. It is an established fact and a physical law that the pressure exerted by a moving air column, the end thrust, is a direct function of the air velocity. In other words with the increase of air velocity, the pressure or the end thrust increases. If a fan is placed behind a radiator the air velocity produced by the fan is considerably less than in free air, on account of the restriction. If Mr. Hoyt's contentions are correct, then if the intake were restricted to such an extent that no air could be delivered the thrust load would be infinitely larger. This is absurd.

The charts in Figs. 5, 6, 7 and 8 also show that the end thrust drops faster than the air velocities; in other words, by restricting the inlet the thrust load will be diminished faster than the air velocity. All the curves in Figs. 5, 6, 7 and 8 show thrust loads of fans moving in free air. The manufacturer is interested only to know what thrust loads are produced in a fan behind a radiator, and not in free air or in a wind tunnel.

From actual tests and measurements on nearly 400 different makes of passenger cars, trucks and tractors, the writer has found that on about 80 per cent of these the maximum average air velocities obtained through the radiator are below 1500 feet per minute; on about 17 per cent the velocity is between 1500 to 1900 feet per minute and on only 3 per cent it is above 2000 feet per minute. The highest ever found was 2200 feet per minute. These are the air velocities which must be taken into consideration in determining the thrust loads in radiator fans under actual operating conditions.

It will be found from Mr. Hoyt's chart Fig. 5 that on a 16 in. fan, considering even the maximum obtainable average air velocity of 2000 feet, the thrust load will be not more than 3 pounds. On an 18 in. fan as per Mr. Hoyt's chart, Fig. 6, it will be about 3¼ pounds. For 20 in. and 22 in. fans (Figs. 7 and 8) Mr. Hoyt does not show air velocities as low as the maximum actually obtained with these sizes of fans on automotive vehicles. In Fig. 8 the velocity and end thrust curves start with 2600 feet per minute and a corresponding end thrust of about 6.8 pounds. I do not believe a single truck or tractor can be found where air velocities of 2700 feet per minute through the radiator can be measured. In passenger cars, where this or higher air velocities through the radiator can be produced, it is done at high vehicle speed only. At these speeds, however, the initial air velocities produced by the motion of the vehicle tend to drive the fan and balance the end thrust produced by the fan itself.

In any event, it is shown by charts (Figs. 5, 6, 7, 8) that the thrust loads in radiator fans for the air velocities actu-

(*Continued on page* 983)

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL. Thursday, May 1, 1919 No. 18

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address - - - - - Autoland, New York
Long Distance Telephone - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - One Year, $3.00
Canada - - - - - One Year, 5.00
Foreign Countries - - - - - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Intelligent Governmental Co-operation Needed

THE welfare of American industry should be the chief consideration of the next Congress. The world struggle for commercial supremacy now beginning will be won by that country which extends the most complete and most intelligent governmental co-operation to its manufacturers. This means that Congress must consider every form of governmental aid, financial, legislative, practical and direct, for American industry. It means, if America is going to win, or even hold her own in the great commercial conflict, that there must be a complete removal of the present obstacles thrown in the path of industry by ancient governmental systems.

An automobile manufacturer recently inquired of a government department for important information. The department had about 75 per cent of the data needed. To send them incomplete was useless. To secure the remainder meant an expenditure of a small amount of money. To get approval for the expenditures required 40 days. When the manufacturer was finally given the information it had ceased to be of value.

The fault in this and other similar cases lies in a system which was designed to insure wise and proper expenditures of great sums for battleships and the like, but which, in its inflexibility, reacts harmfully in its application to minor matters.

If governmental departments are to be of benefit to American industry it will be necessary for them to be as keenly awake, energetic, efficient and flexible as American industry itself, else we shall have the equivalent of a huge organization with one-half operating on a modern quantity production basis and the other stifled by antiquated methods.

Employers' Industrial Commission

IN last week's AUTOMOTIVE INDUSTRIES was published a report of the commission which was appointed by the U. S. Department of Labor and sent abroad by the Government to study the British labor conditions. This commission was composed of employers of labor and this report is worthy of careful study by manufacturers in this country. That study should be considered with the article on labor conditions in Great Britain which appeared in the April 17 number so that the commission's findings can be read in the light of the differences between the position in Great Britain and in this country.

Perhaps the most important and interesting fact in connection with this commission's report lies in the appointment of such a commitee by the Government as an evidence of the importance of such a study for the benefit of all parties in this country. As far as we have been able to find out, it is the first time in the history of the United States that a commission of employers has been appointed by the Government to study labor conditions in a foreign country, and this method of attempting to arrive at the meat of the situation promises well for future Governmental activities.

We would call special attention to the statement of the commission that the British worker thinks in terms of class rather than individually and tends more toward organization than in this country. The importance of this item in connection with the machinery for the settlement of labor disputes was indicated in AUTOMOTIVE INDUSTRIES of April 17.

It is also worth while to note the definition of capital and labor as found by the commission, which is very different from the customary interpretation in this country. It will be noted that "capital" includes only the stockholder, or the invested capital, and that the term "worker" includes everyone contributing to the actual management, emphasis being placed on the fact that labor includes both brain workers and manual workers.

Altogether the report is worth consideration, particularly as the traditions in Great Britain will be quoted a good deal in this country in the discussions which take place on our conditions.

Fundamentals in Foreign Trade

WHEN one of the speakers at the Foreign Trade Convention last week emphasized that "There is more than profit in foreign trade," he set in vibration a thread of thought that was instantly appreciated, and one that plays a more forceful rôle in foreign trade than is generally acknowledged, namely, that in foreign trade it is just as essential to have regard for the countries you are doing business with as for your own selfish ends.

This sentiment found expression with another speaker recently returned from an investigation through Europe who expressed his deepest thought in the words, "Getting cash against documents at seaport is not the best method of building up foreign trade."

Other speakers expressed this in a variety of ways. It found outlet in one session by the statement that American concerns must be prepared to extend credits much in advance of what they have done in the past and perhaps to a large extent substitute such for the cash-against-document practice followed now. They must be prepared to buy foreign securities, particularly from European allies.

The initial step toward greater extension of credit was expressed in the exhortations of many that officers of our companies and executive heads make extended trips to study new markets. This is essential. Heretofore too many firms have engaged mere hirelings to establish business in Latin-American countries merely because they were familiar with Spanish or had made a trip or so for other lines of industry.

Such is not the fundamental way to establish foreign trade. Such men too often shift from concern to concern and from industry to industry to be of value as representatives in establishing foreign connections. If the head man of the concern will make the investigation, will meet face to face the men he is to do business with, will investigate the standard of business morals, will look into the credit systems of foreign countries, will study the characteristics of the people and will bring back to the Board of Directors a complete picture of the foreign field, then will the reasons for greater extension of credit to such rational limits as 90 or 120 days be better understood and then will it be better appreciated why cash-against-document at seaport is not the surest way to foreign trade success.

There is too wide a gap between the foreign buyer and the American manufacturer. One has not met the other in his home town. One does not clearly enough realize the difficulties of the other. Neither realizes the complete nature of the relationship that exists between them. Neither writes just as good a business letter as he would if they were better acquainted.

The foreign buyer and the American manufacturer are literally oceans apart in their conceptions of service. The foreign buyer has problems that the manufacturer may have heard of but does not comprehend. He does not think intelligently about them. Many makers would never have so persistently insisted on not fitting magnetos to their cars for certain parts of foreign trade if they had known the field.

Many manufacturers would have realized how super-important it is to give more careful attention to crating goods for Latin-American countries than for European countries, solely because those republics are not so uniformly fitted with transportation systems as the old cities of Europe. Frequently, crating that will do for one South American country will not do for another because the transportation systems are fundamentally different. One size of crate is satisfactory on the east coast but may be impossible on the west coast and neither may do for inland points where some of the system of transportation may be by horseback.

Many manufacturers fail to realize that the service question in one part of a South American country can be satisfied in one way, but quite a different policy must be followed in other sections. A case in question is Argentina. The larger cities have service stations and service capacity, but several hundred miles back in the country the thought of service does not exist. The facilities for it are not there. This calls for differences in equipment, as some parts of equipment demand much more service than others.

A better acquaintanceship between manufacturer and foreign merchandiser and foreign consumer is the open sesame to increased foreign trade and more permanent foreign trade. This acquaintanceship must be through the board of directors of the manufacturers. A hireling will not do. The very spirit of manufacture must be instilled into the director who makes the foreign investigation, and he in turn must bring back to his company the spirit of the foreign people, the spirit of their business fabric and a visualization of their complete business structure.

Latest News of the

Better Co-operation Urgent Need for Greater Commercial Development

U. S. Chamber of Commerce Meeting Urges Revision of Laws to Fit New Industrial Era—Points Out Necessity of Co-operative Regulatory Control—1100 Attend

By Allen Sinsheimer

ST. LOUIS, April 30.—Special Telegram.—Government, capital and labor must recognize that American industry is entering a new era in its history, and must completely revise laws, organizations and perspectives to accord with the new order.

There must be abolition of the antiquated laws that have failed to keep pace with the higher standards of industry,

There must be legal approval of co-operative industry, of associations of manufacturers or combinations not for price-fixing but for industrial progress, as, for example, with the Webb bill, which should be duplicated for domestic industry.

There must be less Government interference with business and more co-operative regulatory control. Railroads should return to their owners as quickly as Congress can pass legislation providing for Governmental control of rates and regulations.

The American marine must be sold to Americans and be distributed to provide bottoms for every section of the nation.

There must be recognition that a union of labor is as justifiable as a union of capital in the form of a corporation, and labor must be regarded under the new business ethics as a fellow servant with capital and not as a commercial commodity.

Must Develop Foreign Trade

Foreign trade must be developed as a vital factor to the health of our industry, and we should look for our export trade not to the Allies, who need their own raw materials and have not the cash to spare to buy from us, but to South America, the Orient and the European neutral countries. The Allies cannot buy abroad until they can first develop their exports and sell abroad.

These were the major points developed at the convention held here this week by the United States Chamber of Commerce, which was attended by 1100 delegates from every section of the country, and during which papers were read on practically every problem of industry.

That America must prepare to make huge investments abroad to stabilize exchange and trade; that the Government should pay interest on all payments of war contracts that are unduly delayed; that a comprehensive road construction and maintenance policy should be formed at once; that price fixing by the Government should cease in favor of the law of supply and demand; that the Federal Trade Commission should be a purely advisory body and end its prosecutions of industry; that government should be made most economical by a budget and should select its executives and all employees with more regard to their capabilities to assist industry; and that the nation must be educated by all agricultural and industrial bodies to value and understand foreign trade, were among other important recommendations that came from the various discussions.

Good from Anti-Trust Laws

"Nothing is more certain," said Secretary of Commerce William C. Redfield, "than that there has been a great change for the better in the ethics of trade since the anti-trust laws came into being. Business has outgrown the laws intended to control it and in the future will be more co-operative than competitive. A new business standard has commenced, hardly formulated yet, but none the less really operative, whereby industry and commerce recognize three-fold obligations to the public, including the Government, to labor and to business itself.

"Trade associations to deal with common problems working for progress are essential to our business welfare."

The establishment of a Federal Highway Commission, federal appropriations for building and maintaining highways, continuation of the Federal Road Aid Act beyond 1921, and the expenditure of federal funds for highways of a permanent type only, are advocated in the resolutions presented by the highways committee of which F. A. Seiberling is chairman.

The railroads must be returned to their owners, stated Senator A. B. Cummins, but not until legislation providing for a permanent policy of control and regulation has been enacted by Congress. To return the roads now would be to endanger the entire financial structure of the nation. They form 8 per cent of the nation's wealth and if returned now to be operated at existing high costs would be likely to work great harm.

Other addresses were made by Maurice Casenave, head of the French Commission; Joy Joyce Broderick, of the British Embassy, and Lieut. Constantini of the Italian Mission. They told of the financial and other material damage caused by the war and of the need for control of imports until domestic and export trade are established.

There are no discriminations against American products, stated all these speakers, as in favor of products from any other countries, except, possibly, from some colonies, and it is the desire of each of the Allied countries to resume foreign trade with us just as quickly as conditions allow.

Numerous other discussions on all subjects were held, including talks on Housing, Foreign Investment, Payment of War Contracts, Highways, Industrial Training, Industrial Production, Domestic Distribution and Retail Distribution. Numerous resolutions are being considered and will be voted on to-morrow.

S. A. E. Research Committee to Study Fuel

NEW YORK, April 25—A meeting of the Research Committee of the Society of Automotive Engineers was held at Society headquarters in this city yesterday. At the previous meeting, held at the Bureau of Standards in Washington on April 11, it was decided to combine the Committee on Fuel Research and the Committee on Research in General, under the name of the Research Committee.

From the meeting held yesterday, it appears that this Research Committee will concern itself, for the present at least, mainly with fuel problems. A preliminary or sub-committee was appointed, consisting of Samuel A. Miles, chairman; Dr. E. W. Dean of the Bureau of Mines; and Dr. H. C. Dickinson of the Bureau of Standards, with the object of interesting the different industries affected by the fuel problem.

Two Ballot Cars for Indianapolis Leave France

PARIS, May 1—(Special Cable)—Two Ballot cars for the Indianapolis race, accompanied by Wagner and Bablot, are leaving Havre by the *Espagne* on May 3.

W. F. Bradley, special correspondent of AUTOMOTIVE INDUSTRIES, has already cabled that the four Ballot cars left France on April 26. However, from information which has just reached AUTOMOTIVE INDUSTRIES from another source, it would appear that only two cars are actually on the way, the two now advised completing the Ballot team.

Automotive Industries

Industrial Principles In Treaty of Peace

Recommendations of Commission on International Labor Legislation Adopted by Supreme Allied Council

WASHINGTON, April 29—The State Department to-day announced that the nine clauses proposed by the Commission on International Labor Legislation had been adopted by the Supreme Allied Council for insertion in the Treaty of Peace.

The clauses proposed by the commission were somewhat amended, chiefly in phraseology, before being adopted. They now form a part of the Treaty of Peace and are in the nature of recommendations rather than being obligatory upon the nations. The principles thus endorsed by the Supreme Allied Council are the 8-hour day, a weekly day of rest, abolition of child labor, equality of pay for men and women for work of equal value, and "the right of association for all lawful purposes" of workmen and employers.

The text of the clauses incorporated in the Peace Treaty is given below. They were preceded by a preamble in which it is asserted that "the high contracting parties, recognizing that the well being, physical, moral and intellectual, of industrial wage earners is of supreme international importance, have framed a permanent machinery associated with that of the League of Nations to further this great end."

First—The guiding principle that labor should not be regarded merely as a commodity or article of commerce.

Second—The right of association for all lawful purposes by the employed, as well as by the employers.

Third—The payment of the employed of a wage adequate to maintain a reasonable standard of life as this is understood in the time and country.

Fourth—The adoption of an eight-hour day or forty-eight-hour week as the standard to be aimed at where it has not already been obtained.

Fifth—The adoption of a weekly rest of at least twenty-four hours, which should include Sunday whenever practicable.

Sixth—The abolition of child labor and the imposition of such limitations on the labor of young persons as shall permit the continuation of their education and assure their proper physical development.

Seventh—The principle that men and women should receive equal remuneration for work of equal value.

Eighth—The standard set by law in each country with respect to the condition of labor should have due regard to the equitable economic treatment of all workers lawfully resident therein.

Ninth—Each State should make provision for a system of inspection, in which women should take part, in order to insure the enforcement of the laws and regulations for the protection of the employed.

Without claiming that these methods and principles are either complete or final the high contracting parties are of opinion that they are well fitted to guide the policy of the League of Nations, and that if adopted by the industrial communities who are members of the League and safeguarded in practice by an adequate system of such inspection, they will confer lasting benefits upon the wage earners of the world.

The conclusions of the Commission on International Labor Legislation were drawn up in two parts for presentation to the Supreme Allied Council. The first part was a convention providing for the establishment of a permanent World Labor Conference in association with the League of Nations, the second part was made up of a declaration of principles regarding the rights of workers throughout the world which were suggested for inclusion in the Treaty of Peace and, as mentioned above, were so included in somewhat amended form.

To Meet Annually

A meeting of the Labor Conference is to be held annually, and it is recommended that the first meeting be held at Washington next October.

In the permanent organization, the Commission recommended that there be two distinct parts: The International Labor Conference; and the International Labor Office controlled by a governing board.

The International Labor Office will be located at the seat of the League of Nations and will be a part of its administrative organization. The governing body controlling it will comprise 24 members, 12 of whom will be representative of governments, six elected by a conference of employers and six by a similar conference of workers.

Car Imports to France Permitted with 45% Duty

PARIS, April 19—Automobile imports into France, which were prohibited by official decree, April 1, 1917, will be admitted on a 45 per cent duty within a very short time, according to information received from very reliable quarters. This duty is a temporary measure and will remain in force for 18 months only. At the end of this time the custom tariffs will be revised. The 45 per cent figure is only looked upon as a war measure to enable French manufacturers to get into production.

Only a short time ago it was believed that the French would adopt a 45 per cent duty against America and a lower duty in favor of other countries. This idea, which was mooted by the automobile manufacturers and presented at the meeting of the Inter-Allied Automobile Association, has evidently been abandoned as impracticable.

Standard Landing Field Specifications

WASHINGTON, April 30 — Major General Charles T. Menoher, Director of Air Service, has prepared complete specifications for standardized landing fields. It is planned to make these public at the Southeastern Aeronautical Congress which will be held at Macon, Ga., May 2 to 10. The Congress has been arranged through the co-operation of 9 southern states and some 243 commercial organizations covering the South.

Reservations for Summer S. A. E. Meeting

NEW YORK, April 30—Reservations for the Summer Meeting of the Society of Automotive Engineers, which is to be held at the Hotel Ottawa and cottages, Ottawa Beach, Mich., June 23-27, are coming in at a rapid rate. All reservations are to be handled entirely through the S. A. E. office in New York. Accommodations are entirely on the American plan. Following are the rates, for four days of the meeting, namely, June 23, 24, 25 and 26:

Per person (2 or more in one room, without private bath)	$28.00
Per person (2 or more in one room with private bath)	*36.00
Children under five years (in room with parents)	12.00
Children under ten years (in room with parents)	16.00

*This rate applies in case of occupants of rooms containing or immediately adjoining private bath.

Ottawa Beach is about 30 miles from Grand Rapids, Mich., on the east shore of Lake Michigan. It can be reached direct by boat to Holland (from Chicago) on the Pere Marquette Railroad, to Holland, or by Michigan Central, Pere Marquette, Grand Trunk or Grand Rapids and Indiana Railroad to Grand Rapids, and thence by electric through Holland to Macatawa.

The meeting proper will open on Monday evening, June 23, with a business session. This will be preceded by a meeting of the Standards Committee at 10 a. m. Monday.

Provides State Tractor Tests

OMAHA, April 29—Two bills passed by the session of the Nebraska legislature just closed have an important bearing upon trade in passenger cars, trucks and tractors in this state. It is believed that the general effect will be a tendency

to concentrate the trade in the larger cities of the state.

House Bill No. 85 provides that no tractor shall be sold in Nebraska until a sample machine has been tested by three competent engineers of the state university at Lincoln, who shall report to the state railway commission. The commission will compare this report with the specifications and claims of the manufacturer or agent as set forth in advertisements or sales arguments, and shall deny permit for sale if these specifications or claims shall be found false.

The ruling of the commission shall apply only to the particular make of machine under consideration, and not to the whole or other product of a company which manufactures other machines, which do meet specifications and claims.

The commission is also given power to deny sales permits for any tractor on complaint of any two bona fide customers, properly substantiated, that an adequate service station, with full supply of parts, is not maintained within the state. The law becomes effective July 15.

The second bill, Senate File No. 86, declares the sale, trade or disposition of any automobile or tractor void unless the necessary supplies and repairs are carried at some point within the state, being very similar to the first measure. It differs in voiding the sale after consummation as against forbidding sale beforehand. This law is effective July 18.

Tax Not Required on Original Equipment

NEW YORK, April 30—It is not likely that the manufacturer of tires, tubes, parts and accessories will be required to pay a tax on these products under the new War Revenue Bill, when they are supplied to car or truck manufacturers as original equipment. The War Revenue Bureau has not issued any formal rulings as yet, but this is the interpretation placed on the measure by the National Automobile Chamber of Commerce. Manufacturers of such products who supply tires, tubes, parts or accessories to manufacturers of vehicles for paid replacements or repairs, however, will be required to pay a tax.

It is suggested that parts and accessory makers bill the car and truck manufacturers with tires, parts and accessories at the regular price, with a notation on the bill that the 5 per cent War Tax may be added later if the Government so orders. Commissioner Roper has ruled in a letter to a member of the National Automobile Chamber of Commerce that when a part on which a tax has been paid is returned for credit, the amount of the tax may be deducted from the next tax return.

Tone New President of Carborundum

NIAGARA FALLS, April 30—Frank J. Tone has been made president of the Carborundum Co., succeeding the late Frank W. Haskell. George R. Rayner is vice-president, succeeding R. B. Mellon, Pittsburgh. F. H. Manley retains the office of treasurer.

Detroit Union Workers Demand 44-Hr. Week

Formal Demonstration to Claim Wage Increase—Growth of Organized Labor

DETROIT, April 29—On May 1, organized labor in Detroit will wait upon employers with a demand for shorter working hours and increased wages. On the same day a mass meeting will be held at the Arena, where Arturo Giovannitti of New York City, and James H. Fisher of Butte, Montana, both affiliated with the International Workers of the World, will speak. A demand will be made for the release of all workers convicted and imprisoned for labor activities. A number of unions will march from their halls to the scene of the meeting but no general parade will be held.

The general demand will be for a 44-hour week and the adoption of new wage rates, embodying increases from 10 to 25 per cent. Whether there will be a general demonstration is not known. It is said a majority of the unions will participate, and, if that is so, approximately 90,000 workers will be involved. Detroit Federation of Labor officials declare Detroit is now 60 per cent organized, and thousands are joining the movement weekly.

The Typographical Union and the Electrical workers will walk out on that date, it is said, unless demands now before employers are granted. The printers want $42 a week minimum, and a 42-hr. week. The Electrical Workers want a $40 minimum wage and a 40-hr. week. Foundry workers are already on strike in 13 plants. The United Automobile, Aircraft & Vehicle Workers of America called a strike recently at the Wadsworth Mfg. Co., builder of Ford sedan bodies, and approximately 2,000 men are out.

It is said that unless this strike is adjusted quickly, and the rights of the men to a voice in the determination of the conditions of employment upheld, the strike will spread to 25 000 automobile workers. This union, which is now 22,000 strong, is considering calling a general strike. The Wadsworth company is now paying a minimum wage of $6 daily but refuses to recognize the union or deal with the existing shop committee. Several discharged men must be reinstated before the men will return to work. The company is endeavoring to operate with strike-breakers, but is encountering great difficulty, and its production has been greatly curtailed.

The labor movement in Detroit has expanded 100 per cent in the last year. Over 56,000 new members have been taken into the ranks. The United Automobile, Aircraft & Vehicle Workers of America numbered 5,000 one year ago. The membership has now passed the 20,000 mark. Approximately 500 new members are being taken in every week. Machinists, who had one local with 1,500 members last year, now have 4 locals with 10,000 members. Boilermakers were not organized a year ago. They now have 6 locals and several thousand members. The building trades unions have doubled their membership. Twenty-five per cent of the skilled workers were organized a year ago. Now over 60 per cent are organized.

Curtiss Appoints Eleven Commercial Aircraft Distributers

NEW YORK, April 30—The Curtiss Aeroplane & Motor Corp. has entered upon the production of aircraft for commercial purposes and has so far completed its arrangements as to establish 11 distributers in the United States and several in foreign countries. Sales headquarters have been opened at 52 Vanderbilt avenue under the supervision of J. P. Davies, formerly an officer in the U. S. Air Service. Distribution will follow closely the plan of the Willys-Overland Co. with which the Curtiss company is affiliated. Following are the principal distributers and their territories:

American Trans-Oceanic Co., 505 Fifth avenue, New York—Greater New York, Long Island, Westchester County, Rockland County, Fairfield County, Conn.; Hunterdon, Somerset, Middlesex and Monmouth counties, N. J., and the State of Florida. P. L. Freeman is manager.

Curtiss Eastern Airplane Co., 130 South Fifteenth Street, Philadelphia—States of Pennsylvania, Maryland and Delaware, and Cumberland, Salem, Gloucester, Camden, Mercer and Burlington Counties, N. J. G. Sumner Ireland, president and general manager.

Curtiss Southwest Airplane Co., 804 New Wright Bldg., Tulsa, Okla.—State of Oklahoma and northern counties in Texas. B. L. Brookins, general manager.

Curtiss Northwest Airplane Co., 701 Metropolitan Bank Bldg., Minneapolis—States of Minnesota, Montana, South Dakota and North Dakota. W. A. Kidder, general manager.

Curtiss Tri-State Airplane Co., 274 Shelby Street, Memphis—States of Tennessee and Arkansas and northern counties of Mississippi. W. S. Thompson, general manager.

Curtiss Humphreys Airplane Co., First National Bank Bldg., Denver—States of Wyoming, Colorado, Utah and New Mexico. I. B. Humphreys, general manager.

Curtiss Aircraft Co., Atlantic City, N. J.—Cape May, Atlantic and Ocean Counties, N. J.

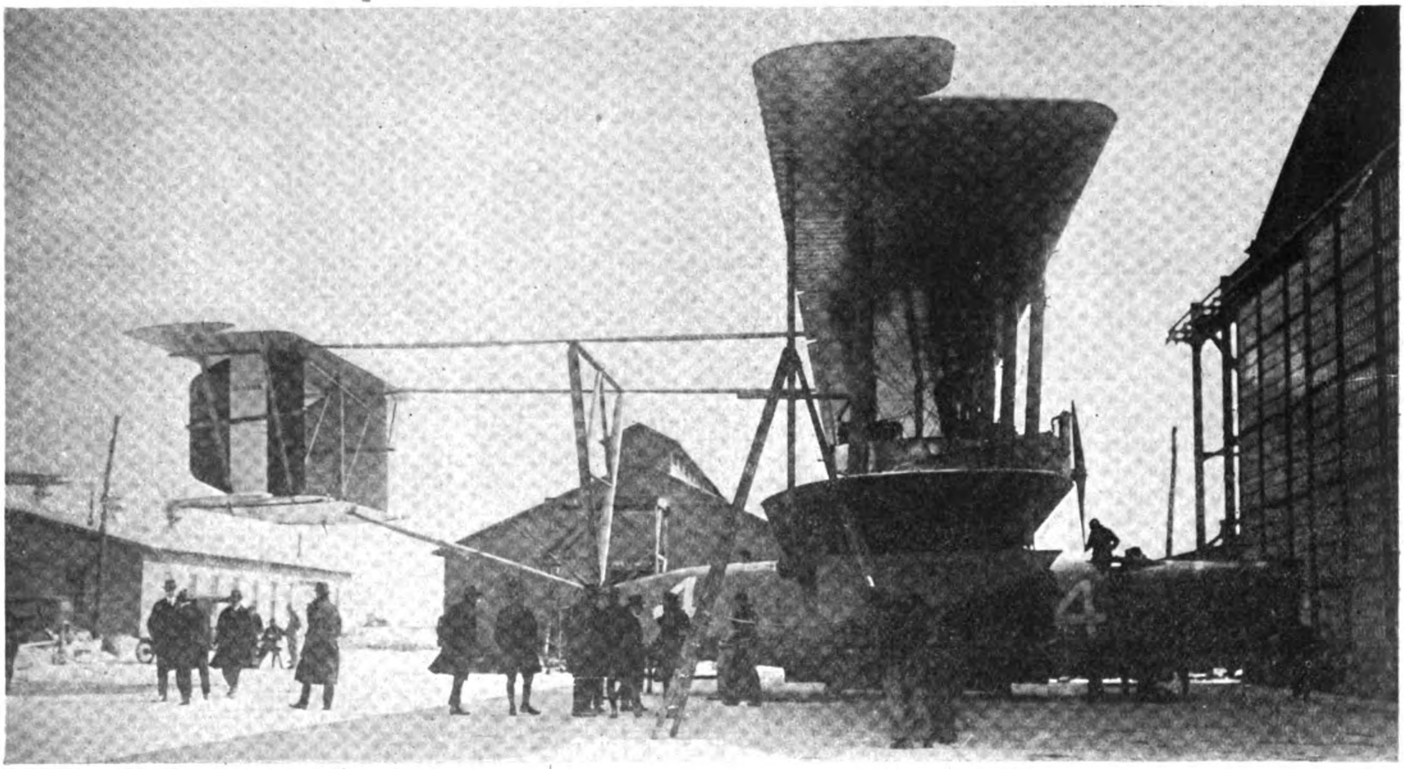
In addition to these, distributers have been appointed for Norway, Sweden, Finland and the Philippine Islands. George W. Browne, manager of the Overland agency in Milwaukee, and the Gibson Co., Overland dealer in Indianapolis, have been appointed local Curtiss dealers. A branch office has been opened in Chicago with George W. Browne as western representative.

The Curtiss company has adapted a number of its planes for commercial uses. Among these are the JN-4D-2 type which was used almost exclusively for training purposes by the American and Canadian governments; the MF flying boat; the HS-2L flying boat; the H-16-A flying boat; the 18-B land machine and a new three passenger plane which has been developed particularly for passenger service and which is styled "Oriole."

It is expected that within a short time a number of used machines of the JN type will be placed on the market at from $2,000 to $5,000. Prices of the other models have been set as follows:

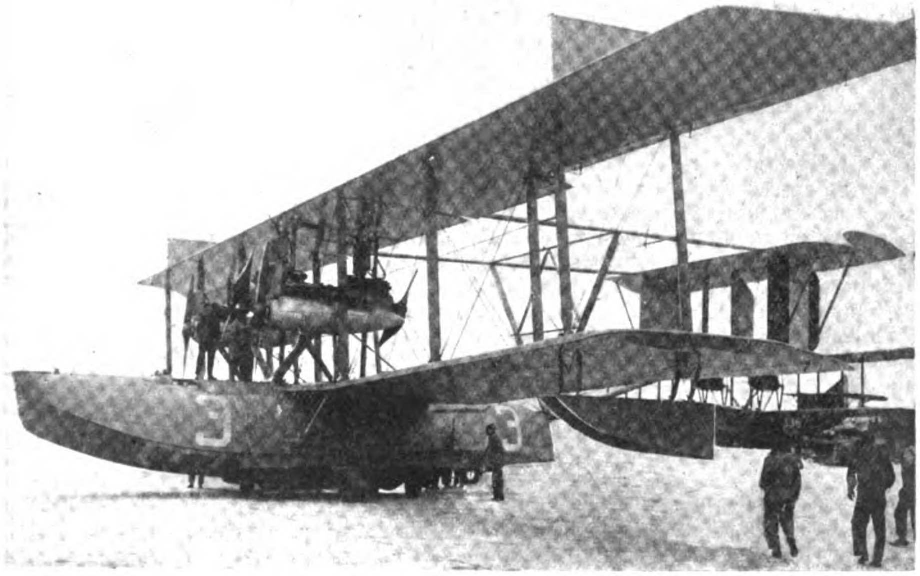
MF, flying boat	$10,000
HS-2L, flying boat	25,000
H-16A, flying boat	40,000
18-B, land plane	25,000
Oriole, land plane	7,500

Putting Final Touches on Navy's Transatlantic Fliers



THREE navy planes will be started at the same time from Newfoundland, probably within a week. They are the NC1, NC3 and NC4. The route will be from Rockaway Beach, L. I., N. Y., to Newfoundland by way of St. Johns, where a stop will be made, and from Newfoundland by way of the Azores, where a stop will be made, to Portugal. The three boats are identical, the principal dimensions being:

Wing spread (upper)	114 ft.
Wing spread (lower)	126 ft.
Wing width	12 ft.
Wing area	2880 sq. ft
Between wings	14 ft.
Overall length	68 ft. 3 in.
Hull length	44 ft. 9 in.
Weight, empty	15,100 lb.
Weight, fully loaded	28,500 lb.
Gasoline capacity (10 tanks)	1890 gal.
Speed	79 knots
Power	4 Libertys



Adopt G. M. Savings Fund Plan

WILMINGTON, DEL., April 29—Stockholders of the General Motors Corp. met here to-day and voted to adopt the Savings and Investment Fund proposed for the benefit of employees. All directors were re-elected.

Briscoe to Design French Car of American Parts

DETROIT, April 29—Benjamin Briscoe, of the Briscoe Motor Corp., Jackson, Mich., has been elected a director of the Bellanger Frères, Paris, France, and will design a moderate priced automobile for the French company along French lines but of American parts to a large extent. He has opened an office in Detroit, and has with him Rodolphe Stahl, an engineer who has been in his companies for nine years.

Briscoe is looking for a small factory to be used as a mechanical laboratory. The Bellanger Frères Co. was one of the smaller automobile companies of Paris before the war, but due to the fact that it was one of the companies selected by the French government for war work, it became one of the largest engineering works in France.

Mr. Briscoe has not severed his connections with the Briscoe Motor Corp., of which he is one of the principal stockholders, a director and a member of the executive committee.

New York Office for Willys

TOLEDO, April 29—Permanent offices of President John N. Willys of the Willys-Overland Co. have been opened at 1710 Vanderbilt-Concourse Building, New York. Mr. Willys expects to remain in New York most of the time directing the affairs of the Overland and allied companies.

Thousands of Unfilled Orders on Books

Demand for All Car Makes Ahead of Supply—Dealers Oversold —Used Car Problem

DETROIT, April 25—There is a tremendous shortage of automobiles in all sections of the country. While the factories are now making nearly as many cars per day as in former years and their production will be normal within 30 days, the unusual demand has swamped them.

The Ford Motor Co., owing to its production facilities and intensive merchandising system, is perhaps the best criterion of conditions everywhere. For the last 4 years this company has had approximately 100,000 unfilled orders on hand at all times. It is now getting into normal production again, and on April 24 it had 69,994 unfilled orders for immediate shipment. These orders are increasing daily in spite of the fact that the company is now running 2600 cars and will be producing 3000 cars daily within the course of the next 10 days.

The condition is almost similar with the Cadillac Motor Car Co., which has approximately 4500 unfilled orders on hand. The company is increasing production as fast as possible, but officials state that it will be several months before they will be able to catch up with the demand. The Cadillac company conducts its own sales and distribution work here. This station, which cares for the Detroit district only, is 100 orders behind and is selling its cars as fast as they are received.

The Paige-Detroit Motor Car Co., running approximately 70 cars a day, is unable to begin to supply the demand. If this company could double production tomorrow it would still take months to catch up.

The Hudson Motor Car Co. proposes to manufacture 20,000 Essex and 20,000 Hudson cars this year. It has 20 dealers who have sold their entire allotment for the year. The company is rushing work on its new Essex plant, and it is probable that both Hudson and Essex production will be materially increased if present conditions continue.

Willys-Overland Co., Toledo, has many distributers who have sold their entire allotment. The company is arranging now to get into production upon its new model, a light four, and it is planned to do this without curtailing in any way the production of its other lines. The company is now running approximately 600 cars a day, while its orders for machines are several thousand cars ahead.

While the Packard Motor Car Co. is just getting into production its dealers in every section are pressing for cars. Work at the plant is being pushed to the limit, but owing to the fact that the company has lost several months, due to the necessity of practically remodeling the entire plant to again handle peace work, its production is bound to fall far below demand. This company makes 15 different body types and the demand is good for all.

The Hupp Motor Car Co.'s production schedule calls for 18,000 cars this year. The demand to date is practically 50 per cent greater than production. Sales officials say 30,000 Hupmobiles could be sold within the next 8 months if the factory was able to produce them. This year's production is 50 per cent greater than that of any previous year. The company has 2500 unfilled orders on its books to-day.

So great is the demand for Dodge cars that the company is now teaching its dealers to turn down orders gracefully without antagonizing the trade. The production system used by Dodge Brothers is rather unusual in that it fixes no set production for the year, aiming to produce just as many cars as possible. The company is now running between 500 and 550 cars daily, yet it is hopelessly behind in orders.

The Reo Motor Car Co., Lansing, has orders ahead for 4000 cars. Owing to the immense amount of work necessary to make the shift from war to peace, this company is not yet in full production. In certain departments a great deal of Government machinery is stored, and it will be some time before entire facilities will be available. The car shortage is very pronounced in every section, sales officials declare. The company is now running approximately 60 cars a day, but owing to its inability to reach capacity production at present, no annual production schedule has been made. The company has 1800 distributers, 90 per cent of whom have sold their quota for months.

The Used Car Problem

The used car is developing an unusual situation. Few people purchased any cars during the war. Fifty per cent of the car purchasers turn in their used cars as part payment for new ones. As a result the used car market is flooded. The demand for cars is so great, however, that buyers are snapping up every desirable machine, whether new or used. While this is the situation at present, it is already apparent that before the end of the year the average dealer is going to have a large stock of used cars on hand, and it is going to be necessary for him to specialize in the merchandising of used cars more than ever.

The factories are already coaching their distributers in used car merchandising methods, advocating new painting, some remodeling and, in many cases, custom-made bodies as a means of promoting sales. With present conditions existing, even cars of obsolete models are being quickly snapped up after being attractively fixed up.

New Ford Factory May Be in Cleveland

CLEVELAND, April 25—This city is petitioning Henry Ford to locate one of his proposed new automobile factories here. Petitions are in circulation, one enthusiastic booster alone securing 1300 names.

New Ford Officials Fill Vacancies

Ryan Succeeds Hawkins—Mayo Probable New Chief Engineer—Other Changes

DETROIT, April 26—New executives have taken hold of the important posts at the Ford Motor Co., to fill the positions of those who have lately resigned. In repairing the holes caused by resignation, the Ford company has taken men from within the organization.

Norval A. Hawkins, who was chief of sales almost from the time the Ford car was made, has been succeeded by William A. Ryan, his former assistant. Two years ago the Ford company abolished its retail sales department, and since that time has been merchandising its cars through a distributers' organization. Mr. Ryan has been in charge of building up this distribution and dealers' organization for several years, while Mr. Hawkins, who supervised the entire department in a general way, devoted most of his time to retail sales.

It was unofficially stated at the Ford plant that William B. Mayo, construction engineer, will succeed C. Harold Wills, former chief engineer, who resigned a few weeks ago. Mr. Mayo is at present directing all engineering work, assisted by M. M. Wibel, who has been connected with the engineering department for several years. Charles Morgana, Jr., who was in direct charge of the engineering department under Mr. Wills, resigned, and is now associated with his former chief in a new automobile project. Mr. Wibel was Mr. Morgana's assistant.

John R. Lee, who was in charge of the social, welfare, profit-sharing and bonus departments, has no successor as yet. C. A. Brownell, advertising manager, has assumed some of Mr. Lee's former duties, it is said. The rest of the work is being handled by his former assistants.

Mr. Wills states that he is going in business for himself. Owing to the personal friendship between Mr. Wills and Mr. Morgana, it is apparent that Mr. Morgana resigned wholly to join Mr. Wills in his new venture.

Trial of Ford Street Car

DETROIT, April 26—Henry Ford's proposed internal combustion engine street car will operate on a track the same as an ordinary street car. It will not be equipped with pneumatic tires but with steel flange wheels, and will have a carrying capacity as great as that of the present trolley.

If Dearborn township officials grant Henry Ford's application for a blanket franchise to operate a line in that township, the internal combustion street car, suggested as Detroit's solution for traction trouble, will be given a practical working demonstration. If the franchise

is granted work on the line will start within 6 months and cars will be in operation within 18 months. Three cars of the proposed internal combustion type are now under construction at the Fordson tractor plant at Dearborn.

Sale of War Vehicles in England

LONDON, April 10—Of the 80,000 trucks under the control of the War Department, 35,000 are American. A number of American trucks are in private use here, though sometimes the drivers are in khaki, presumably awaiting formal demobilization. At a sale at auction this week a number of trucks and motorcycles were disposed of. These were not war-used American vehicles, but a miscellaneous group which the American army had used here exclusively. The disposal of American war trucks from the front does not appear to have been decided on. Meanwhile there are frequent public sales of British war and transport trucks, and apparently there are thousands now lying idle here in various stages of repair. Some American cars, little more than junk, were recently auctioned, and surprisingly good prices were obtained.

The high prices ruling for used vehicles are reflected also in the tractor sales, Fordsons and Titans apparently commanding high prices, in some cases up to 75 per cent of their original cost. This fact merely indicates an unsatisfiable demand because of the closed market. Intrinsically many of these high priced used vehicles are overvalued now as when first sold.

British Truck Discount Rates Decided

LONDON, April 11—There has been much discussion in British trade circles, especially among the dealers, as to the rights of truck buyers to a discount from the manufacturers. With the progress of the trade and the growing demand for service facilities, which the truck manufacturer could not provide on the scale necessary, came the dealers' opportunity to have the discount question reopened. Now it has been agreed that private buyers of British made trucks will be treated as follows:

To the owner or buyer of one vehicle, no discount; two to five vehicles, 2½ per cent; 6 to 10 vehicles, 5 per cent; 11 vehicles and upward, 7½ per cent, agents to give the same terms and to buy at a flat discount of 10 per cent with rebates. A buyer of 50 vehicles will receive the full discount to the exclusion of agent's commission on terms to be arranged by the manufacturer.

Unusual Demand For Labor

SAGINAW, Mich., April 28—The government employment office reports an unprecedented demand for laborers from local plants. Nearly 100 men are placed at work daily and the office is encountering considerable difficulty in finding suitable men. Not even during the war did the employment office experience a greater demand for men than at present.

Sixth Annual Foreign Trade Convention

Government Control of Industry Decried—Allies Need Long Credit—Reciprocal Trade Advocated

CHICAGO, April 25—The Sixth Annual Foreign Trade Convention closed here to-day following a meeting of 1700 delegates, who crowded every session and displayed a keen interest in the development of American foreign trade.

Demand that the U. S. Government should keep its hands off industry, made by Edward Hurley and others, met with the unanimous approval of all. Less Government ownership and interference with industry was practically the keynote of the meeting.

America cannot look forward to a large export business with her Allies and must be prepared to extend long term credit, abolish cash against document at New York, and invest in large amounts in the securities of our Allies. Great Britain, France and Italy cannot allow imports without danger to their existence until they have established their export business.

A reciprocal trade was waged by practically every speaker on the basis that export business cannot be healthy unless there is both purchase and sale, both import and export, and it is good business for the United States to buy its raw materials for conversion into finished products from those countries to which it exports them.

Neither Great Britain, France nor Italy can spare raw materials, and any export business we could do would only serve to further aggravate the present unstable conditions.

The convention was presided over by Alba B. Johnston, president of the Baldwin Locomotive Works, and O. K. Davis, secretary of the association. James E. Farrell, as president of the association, opened the meeting.

Numerous papers were read relating to advertising, foreign exchange, direct selling, shipbuilding and other subjects pertinent to export trade.

A banquet was held, attended by all of the delegates, presided over by John J. Arnold of the First National Bank of Chicago. It was voted to hold the next convention at San Francisco in 1920.

French-American Banking Corp. to Promote Trade Between France and U. S.

NEW YORK, April 29—The French American Banking Corp. has been organized with a capitalization of $2,000,000. Half the stock is held by American interests and the other half by French. It is intended to promote trade between the two countries by facilitating banking advantages in each.

The Comptoir National d'Escompte de Paris holds 50 per cent of the stock, and the First National Bank of Boston and the National Bank of Commerce in New York each holds 25 per cent. The incorporators are: James S. Alexander, president of the National Bank of Commerce in New York; Daniel G. Wing, president of the First National Bank of Boston; Maurice Silvester, American representative of the Comptoir National d'Escompte de Paris, who will be president of the new company, and others. There will be 12 directors, 6 representing the American and 6 the French group.

Highways Transport Committee on Peace Basis

WASHINGTON, April 29—The Highways Transport Committee of the Council of National Defense has been reorganized on a peace basis. It will continue its work of promoting the greater use of the motor truck for merchandise transportation. It consists of the following: Chairman, John S. Cravens of the Council of National Defense; James I. Blakslee, fourth assistant Postmaster General; J. M. Goodell, consulting engineer; James H. Collins, investigator in Market Survey; R. S. MacElwee, second assistant chief, Bureau of Foreign and Domestic Commerce; executive secretary; Charles W. Reid; director of the council, ex-officio, Grosvenor B. Clarkson. It will be assisted by the Highways Transport Committee Advisory Board composed of William Phelps Eno, Washington; Prof. Arthur H. Blanchard, New York; C. A. Musselman, Philadelphia; Raymond Beck, Akron, and John T. Stockton, Chicago.

269,727 Cars in Canada

REGINA, Sask., April 28—In 1914 there were only 67,415 automobiles in all Canada. By the close of 1918 that total had been swollen to 269,727. Ontario has the largest number of cars of any province in Canada, 109,734. Quebec is second in population, but has only 28,338. Saskatchewan in 1918 had 47,239 cars. Saskatchewan with only a third of the population of Quebec has 66 per cent more cars.

Lundane in Charge of Black & Decker New York Office

NEW YORK, April 30—G. R. Lundane has been placed in charge of the office of the Black & Decker Mfg. Co., Baltimore, just opened in the Equitable Building, 120 Broadway, and will supervise its sales for New York City and the state of Connecticut. Mr. Lundane was formerly service manager for Thos. B. Jeffery Co., Kenosha, Wis., and has recently been connected with Findeisen & Kropf Mfg. Co., Chicago.

United Brass & Aluminum Gets Foundry

PORT HURON, April 28—The United Brass & Aluminum Mfg. Co. is erecting a gray iron foundry addition. The proposed foundry will be 72 x 100 ft. and will be ready within 90 days.

Mystery Surrounds Details of Relaxation of British Embargo

Situation Is Complicated by Absence of Definite Details Relative to the Extent to Which American Automotive Manufacturers Can Take Advantage of New Regulations—Efforts Being Made to Obtain Ruling

NEW YORK, April 29—Although details additional to those published in AUTOMOTIVE INDUSTRIES of April 24 concerning the relaxation of automotive import restrictions by the British Government are now available, the position is yet far from clear.

As matters stand at present, manufacturers who were either not in existence or were not exporting in 1913 are precluded from sending their products into the United Kingdom under the terms of the relaxation. Another point which has been raised, but which as yet remains unanswered, concerns the status of British distributers or dealers representing American automotive manufacturers.

It would appear that application for license to import must be made by the British agent of the American maker—not by the latter. It is anticipated that trouble may arise in the case of a dealer who in 1913 was handling a car which is now eligible under the new ruling, but who no longer continues to sell that car. The question has been asked "Has the dealer of 1913 power to make the application for license in view of his 1913 status, does the right to apply for license go with the change of agency. to the 1919 dealer and what is the position of the first-named dealer (the 1913 man) if the car he now handles is not eligible for importation under the relaxed restrictions?"

The National Automobile Chamber of Commerce has cabled England, asking for further information on these points, and it has also asked for a conference with the Department of State officials and with Prof. Kennedy, commercial attache at London, who is now in the United States. At this interview it is proposed to ask for the admission of makes of cars which were not imported into the United Kingdom in 1913, to secure, if possible, an increase in the imports allowed by the British and to obtain a relaxation of the French import restrictions.

In this connection the War Trade Board at Washington has issued the following circular:

"The War Trade Board announce, for the information of exporters in the United States, that they have been informed that the Controller of Import Restrictions of Great Britain has issued notice that British import licenses will be issued admitting into Great Britain automobiles up to 50 per cent of the number (or shipping measurements) of the quantity imported up to September 1, 1913. Each importer must apply for an individual import license and submit a sworn statement as to his imports during 1913.

"Under this ruling the term 'automobile' covers motor vehicles of all kinds, including cycles and accessories.

"In making the above announcement the War Trade Board wish to call attention to the fact that they are not in a position to speak authoritatively on foreign import restrictions, but are merely transmitting the above information for the convenience of those on the War Trade Board's mailing list.. Inquiries with regard to foreign import regulations should be addressed to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., as that Bureau endeavors to keep informed on the import regulations of foreign governments."

Inasmuch as the U. S. Government records relating to the export of automotive products are compiled on a basis of the fiscal year, which ends June 30, and as the annual volumes dealing with the subject do not give the figures month by month, it is not an easy matter to arrive at totals of our 1913 exports to the United Kingdom covering the period from January 1 to September 1.

A search among the actual monthly records of 1913 has revealed the following data:

Automobiles Imported by the United Kingdom from the United States

1913	Number	Value
January	374	$258,463
February	431	359,799
March	633	462,696
April	373	292,167
May	473	354,686
June	386	289,457
July	300	232,792
August	461	374,098
	3,431	$2,624,158

The following figures, compiled by the Bureau of Foreign and Domestic Commerce, represent our automotive exports to the United Kingdom for the calendar year 1913, as distinct from the fiscal year.

	Number	Value in Pounds Sterling
Complete cars	3,619	744,392
Chassis only	328	71,270
Tires, not imported with vehicles	...	224,428
Other parts	...	500,988
	3,947	1,541,078

Pending the arrival from England of full details concerning the relaxation of import restrictions, together with a definite pronouncement as to the actual conditions imposed, their nature and a definition as to what firms are likely to be affected adversely, either because they were not exporting to the United Kingdom in 1913 or for other reasons, there is but little to be said either in the way of criticism or commendation.

Every effort is being made to obtain official rulings on the various points which are now open to misconstruction and no time will be lost in communicating the results to American automotive products makers.

8,000 Tractors Shipped to Canada in Two Months

OTTAWA, Ont., April 26—According to figures compiled by Dominion authorities, more than 8,000 tractors were shipped into Canada by United States manufacturers during December and January. During the year 1918 21,691 American-built tractors were exported to Canada, 12,805 in 1917 and 3,693 in 1916. There is no import duty on tractors, and it is believed there will be none for the remainder of the year. Canadian tractor makers, however, are insisting on the replacement of the import duty, as but a few hundred tractors were made in Canada during 1918, chiefly because of American competition.

Russian Trade with U. S. Encouraged

NEW YORK, April 29—The commercial department of the representative of the Russian Soviet government in the United States has been organized to encourage American manufacturers in the possibilities of trade with Russia. Circulars containing complete lists of former exports to Russia and present needs are being distributed for this purpose. American agricultural machinery, tractors, plows, harvesting machines, etc., are mentioned as especially suited to Russian needs. Factory, mining and road-building machinery, electrical supplies, cars and trucks are among the American manufactures that would find a ready market in Russia. The organization will make purchases in the United States of materials needed in Russia and will also undertake the sale of Russian materials here.

Surplus Copper Sold

WASHINGTON, April 30—Surplus stocks of copper held by the War Department are to be sold by the United Metals Selling Co., New York City. This material will be sold over a period of time, at current market prices, and will be marketed in such a way as not to affect prevailing price or conditions.

British Council on Imports Appointed

Board of Trade Investigating Imports Restrictions — Demand for Cars Stimulates Action

LONDON, April 29—The president of the Board of Trade, Sir Albert Stanley, has taken the unusual course of investigating the imports restrictions problem by appointing a council, the usual proceedings here in such matters being to refer them to a committee either of members of the Legislature or one solely representative of the business and commercial interests concerned.

The council to deal with these matters has appointed five subcommittees, which will deal with as many groups of commodities. Motor trade interests share with manufactures of wood the task allotted to the third subcommittee.

Machinery and hardware have the fourth subcommittee for their investigations. The Protection on Tariff party's interests appear to be disproportionately looked after as regards the motor imports group; at least two of the members, Edward Manville and Sir Alfred Bird, being well-known protectionists, the former chairman of the Daimler interests and president of the Association of British Motor & Allied Manufacturers, whose chief policy, it seems, is to put a ring around the British trade in the interests of his co-manufacturers. Sir Alfred Bird is a director of the Lanchester company.

However, it may be taken for granted that the importing motor trade interests will make every effort to state their case, which as time goes on is growing stronger in consequence of the increasing call for cars and the swelling chorus of public dissatisfaction with the dog-in-the-manger attitude of the Government in its efforts to please the British manufacturer, who so far seems to have made little effort to begin manufacturing.

One of the defenses made for this procrastination is the state of unrest in the labor world, but it so happens that there are at hand some details of the result of the Ford action in starting the year with a 40-hr. week, whereas the new national standard working week is 47 hr. in most trades and 44 in a very few branches.

The following details are taken from a note in the current number of the *Motor Trader:*

It is, of course, common knowledge that on Jan. 1 a 40-hr. week was inaugurated in the Ford factory, with a minimum wage of 45 cents per hour. A workman with 6 months' service to his credit receives a bonus of 6 cents per hour, so that while "probationers" draw $18.33 per week the minimum weekly pay for the longer service man is $20.83. Some 80 per cent receive more than that.

"When the new scale of pay came into operation and the working hours were reduced from 48 to 40 per week, the two factors combined were found to be equivalent to an increase in wages of 38.8 per cent. At the end of January the increased cost per car for labor was not 38.8 per cent, but 10 per cent, and at the end of February it was only 3 per cent.

"Here we have proof sufficient that it is possible to combine in a British works short hours with an almost undiminished output, and a high wage. Yet if there is one plea more than another now being voiced in the public press, it is that British manufacturers cannot compete because their workers will refuse to speed up production to make up for the shortened working week and higher rates of production costs.

Sir Percival D. Perry, the head of the British Ford interests, in his explanation of the situation notes the effect of the restriction on imports. He said that if the Government in December last had removed the embargo on colonial imports, instead of waiting until early March, it would have been possible to obtain from the Ford factory in Canada certain components which would have increased the output from the Trafford Park, Manchester, works very materially. The difficulty of obtaining them left the English company no alternative but to organize the factory on the basis of a weekly production of 350 cars rather than the 500 which would have been possible.

If the embargo had been removed the price of the Ford car here would have been raised to $1,000 and not to $1,250.

Gray & Davis Has $248,415 Surplus This Year

BOSTON, April 29—In the balance sheet of Gray & Davis, Inc., for the year ended Dec. 31, 1918, the profit and loss deficit of the past two years has entirely disappeared and a surplus of $248,415 appears for the first time. The complete statement issued follows:

ASSETS

	1918	1917
Plant, equipment, etc...	$633,506	$622,691
Investment	....	253,405
Good will, patents, etc..	300,841	308,264
Cash	111,518	77,176
Accounts and notes receivable	285,868	260,198
Inventories	842,178	842,808
Liberty bonds	450,000	....
Ford starter, etc.......	....	86,250
Preferred stock in treasury	10,581	....
Advance payments	....	7,938
Prepaid expenses	18,840	19,039
Profit and loss deficit...	....	221,635
Total	$2,653,332	$2,739,404

LIABILITIES

	1918	1917
Capital stock	$1,961,300	$1,850,000
Accounts and notes payable	150,900	798,169
Dividends unpaid	61,866	....
Expenses accrued	32,962	52,203
Reserve for bond redemption	7,500	6,667
Reserve for munition contract	190,589	....
Deposits on contract....	....	32,363
Surplus	248,415	....
Total................	$2,653,332	$2,739,404

Big Tractor Future in Argentina

Must Overcome Competition with Horses and Cheap Labor—Plenty of Education Needed

NEW YORK, April 26—George E. Reed, a partner of Pratt & Co., Buenos Aires, Argentina, which has been connected with the sale of automotive apparatus in Latin America for many years, sailed to-day for Buenos Aires, after spending several weeks in America, arranging for new lines of merchandise, one of which includes the Argentine rights on the Cleveland tractor. Pratt & Co. has Argentine rights on Delco light. A few years ago it handled cars, trucks and accessories, but is now handling only tractors and electric lighting outfits in the automotive field.

Expects Big Tractor Development

Mr. Reed expects a big development in the tractor field in Argentina, which is essentially an agricultural country. He expects the growth to be rather slow, as the heavy traction engine type of farm tractor used in Argentina some years ago made anything but a favorable impression, largely because of the service problem connected with it and the difficulty of securing competent mechanics to keep the machines working. The tractor industry was very materially slowed up because of this.

There are one or two other conditions that will hold tractor sales at a slow pace. Foremost is the price of gasoline, which is selling at $1.50 per gallon, in the central part of the country, although selling at 67 cents per gallon from curbside pumps in Buenos Aires. This fact, placed beside the cheap price of farm labor, indicates what the Argentina dealer has to face. Horses in the central part of Argentina, or "the camp," as it is usually called, are selling from $8 to $9 apiece, and farm help, competent to handle horses, can be had at $13 a month. Food for the horses is practically negligible in that they are generally on pasture all the time. It is expected that a competent person to operate a tractor will have to be paid $30 a month or more.

But the greatest tractor problem is going to be that of service. Some of the farmers are hundreds of miles from railroad stations, and in general the farmers in the farming vicinity around Buenos Aires and Rosario are much farther from the small town than in America. In Argentina the capacity of the small town dealer to give service cannot be compared with that of America, so that it is going to be a man's job to put a tractor across in Argentina, which will undoubtedly be one of the greatest tractor markets outside of the United States and Canada.

Full Instructions Needed

Mr. Reed thinks that what is needed most in the merchandising of tractors in Argentina are very complete descriptive catalogs, instruction books, maintenance

charts and price lists in Spanish. For the Argentina farmer these books will have to be much more elementary than the corresponding books in America. The field of the tractor has been established in the United States and development started. In Argentina it has yet to be established.

The average farm in Argentina is many times as large as the American farm. In fact, there are many farms that contain 9 square miles, or 5760 acres. Such farms offer good opportunities for the tractor. It is not certain just what type of tractor will be most suitable for the Argentina field, and this can be determined only after considerable experience.

Mr. Reed says that Argentina is short of cars, owing to the fact that the port of Buenos Aires has been practically closed since early in January, due to political and social conditions. Business is very slow throughout the agricultural or camp area, as there are no buyers for wheat, meat and wool, the products of the farms, and in consequence the farmers are not purchasing as they normally would. In spite of this, the majority of the salesrooms in Buenos Aires are practically empty of automobiles.

Some months ago there was what literally amounted to a tire "war" in Argentina, due to most of the dealers being overstocked, which started price cutting. Argentina is very heavily stocked with tires to-day, and the present year will, in all probability, not be a profitable one for tire trade.

—

Decrease in Army Expenditures

WASHINGTON, April 28—The Aircraft Production division decreased its expenditures in March, 1919, by 38 per cent as compared with the average previous month's withdrawals from the treasury. Military aeronautics decreased 52 per cent. Military aeronautics expended $2,518,000 and aircraft production $11,082,000 in March, 1919. Average monthly withdrawals for previous months were $18,000,000 for aircraft production and $5,230,000 for military aeronautics, these averages being for the months of July 1, 1918, to Jan. 31, 1919. Total expenditures for the army in March, 1919, were $494,241,000 as compared with an average monthly expenditure of $850,866,000 for the preceding seven months.

—

Reconstruction Information Offered to Industry

WASHINGTON, April 28—The Reconstruction Research Division of the National Defense Council is now ready to give the business world whatever information relative to reconstruction it has been able to compile. The division has charge of all the federal official bodies and has access to information relative to foreign reconstruction activities and also data relative to domestic business, which has been gathered during the war by the various war administration boards. Manufacturers who are desirous of securing any of this information can do so by applying to the committee.

Completing Delivery of War Orders

Over 90% of Some Equipment Turned Over—Small Amount Not Finished

WASHINGTON, April 26—Delivery of airplanes, compasses, propellers, cameras, balloons and machine guns ordered by the War Department averages over 90 per cent of the orders placed. Delivery of motor trucks, aviation fabrics, bombs and engines, etc., averages between 51 and 90 per cent of the orders placed, and deliveries of balloon fabrics, Hispano-Suiza 300 hp. engines, etc., average less than 51 per cent of the orders placed. Of the 4846 DeHaviland-4 planes which were ordered 4842 have been delivered, and of the 62,075 machine guns ordered 57,660 have been delivered. Seventy-seven motor truck units' outfits were ordered, of which 69 have been delivered. Following are the statistics showing the status of the Air Service orders on March 23, 1919:

	Orders	Deliveries	Per Cent
Deliveries of Over 90 Per Cent			
De Haviland-4 planes....	4,846	4,842	99.9
Compasses	12,650	12,644	99.9
Cameras, gunnery training	1,609	1,599	99.3
Oak lumber (1000 ft.)....	311	308	99.0
Balloons, kite type "R"..	910	898	98.6
Spare (train) propellers..	33,631	33,064	98.3
Gun yokes	20,607	20,007	97.1
Oxygen apparatus	6,100	5,609	92.0
Lewis machine guns......	43,950	40,294	91.7
Vickers machine guns....	18,125	16,366	90.3
Deliveries of 51 Per Cent to 90 Per Cent			
Motor truck outfits......	77	69	89.6
Airplane fabrics (1000 yd.)	11,568	10,263	88.7
Hispano 180 hp. engines..	6,000	5,075	84.5
Handley-Page laminations	2,000	1,660	83.0
Hydrogen cylinders	172,800	142,300	82.3
Cameras, observation ...	1,351	1,051	77.8
Oxygen tanks	17,000	13,077	76.9
Synchronizing devices ...	24,226	17,650	72.9
Bomb sights	16,544	11,630	70.3
Bomb releases	15,850	10,362	65.3
Flare bracket holders....	23,037	14,542	63.1
Cherry lumber (1000 ft.)..	1,006	618	61.4
Gasoline gages	1,450	858	59.2
Cable (1000 ft.)..........	3,310	1,720	52.0
Flares	162,248	83,000	51.2
Winches	236	121	51.2
Deliveries of 51 Per Cent or Less			
Cotton (1000 .yd.)........			
Mahogany (1000 ft.).....	22,352	9,984	44.7
Balloon equipment units.	400	87	21.8
Hispano 300 hp. engines..	500	101	19.2

—

Value of Surplus Supplies Sold

WASHINGTON, April 25—Sales of surplus supplies, as reported to the Director of Sales to April 11, include:

Airplanes	$999,237
Non-ferrous metals and scrap.......	746,709
Ferrous metals and scrap..........	255,509
Oils, grease, etc..................	183,993
Motors and vehicles................	1,256
Motor vehicle accessories..........	839
Trucks and trailers	519

—

Hanch Acquainted with French Problems

PARIS, April 15—C. C. Hanch, who has been representing the National Automobile Chamber of Commerce at the Inter-Allied Conference of Automobile Manufacturers, left Paris to-day for London. It is the intention of Mr. Hanch to sail for America from Liverpool on May 3. During his stay in France Mr. Hanch was in close touch with the leading automobile manufacturers.

Among the subjects which have been discussed are standardization, regarding which the French are now particularly interested: the diminution of taxes on automobiles; the dates of the national shows and the treatment to be accorded to foreign exhibitors.

The value of standardization is fully appreciated by the French manufacturers and a wonderful opportunity now presents itself for working hand in hand with the Society of Automotive Engineers. There is a danger that the French makers will tackle standardization purely from their own standpoint and thus set up standards which will have nothing in common with those in force in America and England.

—

French Government to Go Into Production

PARIS, April 16—A project is afoot to make use of a portion of a new state arsenal at Roanne for automobile and aviation production. In the technical report which has just been issued it is stated that the shops erected for the production of 75 mm. shells are particularly suited for aviation engine and automobile parts in big series. These shops are particularly well provided with Gridley automatics.

The "Verdun" building and 155 mm shell shops are suitable for agricultural implements and tractors. For these latter it is proposed to make use of trucks and tractors returned from the front. The "Marne" buildings are designated as suitable for aviation and automobile spare parts. The presses in these buildings are capable of handling all the stampings necessary for agricultural implements and tractors.

Car manufacturers are protesting against the state coming into direct competition with their industry by this proposed transformation of the Roanne arsenal.

—

Tractor Imports to France to Stop July 1

PARIS, April 16—Agricultural tractor imports into France will be prohibited on July 1, if French makers are in a position to meet national requirements, is the official statement made by Minister of Ravitaillement Boret.

At the present time not only are tractor imports permitted, but the Government is buying American machines and selling them to groups of French farmers. In addition to this, as has already been said, the Ministry of Agriculture is offering a subsidy equal to half the cost of the machine to purchasers of tractors who give the necessary guarantees that the tractors will be kept at work.

It is doubtful if the French makers will be in a position to meet requirements by the date indicated. The biggest producers at the present time are Renault, De Dion-Bouton, and Latil, but others who are rapidly getting into production are Peugeot, Schneider, Paris General Omnibus Co., Delahaye and Gnome & Rhône.

Want Discriminatory Tariff Against American Cars

Inter-Allied Congress Indicates Desire of European Manufacturers for Protection Against American Automotive Products— Government Support Doubtful

PARIS, April 10—The discriminating attitude of European automobile makers against America in the recent inter-allied automobile conference here, when a 10 per cent duty among European Allies and a 45 per cent duty against America was discussed, shows the attitude of the European maker toward America. No vote was taken in the Congress, and had there been, the European representatives could have out-voted America 13 to 1.

The English makers are reported to be the prime movers in this discriminatory tariff against America. France is hesitating on the question and Italy is indifferent because of the progress she made in automobile and truck production during the war. This lack of uniformity of views and broadly diversified interests are in themselves sufficient reason why a discriminatory policy against America cannot hope to find favor in the eyes of European governments. The British public is already well nigh disgusted with the exorbitantly high prices the British makers are asking for their automobiles and also the slowness with which they are getting back into their manufacturing stride.

Hanch Visits Italian Factories

Charles C. Hanch, American delegate to the congress, returned to Paris this week after a trip through Italy, where he visited the automobile factories in Turin and Milan. It is his intention to remain in Paris for a couple of weeks, during which time he will be in touch with the French automobile manufacturers and American officials now in France. At the end of this time he will go to England for two weeks before sailing for home.

The presence of Mr. Hanch in Europe has given an opportunity to the automobile manufacturers to discuss completely the somewhat difficult question of import duties as they affect them individually. A certain amount of misapprehension appears to exist as to what really took place at the inter-allied conference attended by accredited delegates from France, England, Italy, Belgium and the United States. This can be attributed to a rather unfortunate attempt on the part of the French officials to maintain undue secrecy; the inevitable consequence was that an effort was made to pierce the veil.

European Makers Want Protection

Throughout Europe there is a feeling, varying in intensity, that the automobile industry ought to be protected against foreign competition for a certain period. In a small degree the European manufacturers want protection against one another, but they all want protection, for a period varying from a few months to a few years, against America. English manufacturers are the most resolute partisans of a system of protection against America. It is believed that the English delegates at the automobile conference were responsible for the suggestion that there should be reciprocal duties among the Allies, on a basis of 10 or 15 per cent, but that in no case should the duty be lower than that in force before the war. The practical outcome of this would be that France, England, Italy and Belgium could work together on a moderate basis of 10 to 15 per cent duty, while against America there would be a 30 or 45 per cent duty, with the impossibility of America dropping her duty in order to put herself on an equality with the Europeans. In other words, there would be a minimum tariff among European nations and a maximum tariff in all these countries against America.

This suggestion is only important as a revelation of the working of the minds of European automobile manufacturers. It appears therefore that on this question the congress limited itself to a complete exchange of views, when Mr. Hanch took the opportunity of advising the European makers on American opinion and conditions.

It is but a natural outcome of the events of the last 5 years that the European automobile industry should now be in a state of unpreparedness and dissatisfaction. While in America the whole of the automobile industry was controlled and transformed from peace to war conditions, according to a uniform plan, in Europe the conditions varied according to the countries and also according to the factories in those countries.

French Production Ceased During War

In France the whole of the factories were shut down at the beginning of August, 1914, by the law calling every man to the colors. Trained engineers and unskilled laborers went into the army on the same footing and often with the same rank. It was not long before the folly of this plan revealed itself and engineers and skilled workers were called back and returned to the factories to make shells or other war equipment ordered by the Government. There could be no question of building automobiles for private use, for the right to travel by automobile practically ceased with the outbreak of the war. While the automobile factories were making shells, trucks for the French army were being bought in America. As the war progressed the automobile factories gradually changed over from shells to aviation engines, tanks, trucks, tractors, staff cars and other similar material for which they were more suitably equipped. The outcome was that when the armistice was signed a few French automobile factories were making shells, many were building aviation engines, some were on tanks and a small number on more or less purely automobile work.

In England conditions were different. Military service being voluntary in 1914, automobile manufacturers tried to avoid accepting war contracts, their idea being, evidently, that the war could not possibly last more than a few months, and at the end the advantage would lie with the man who had kept his organization together. The Government had to force the automobile manufacturers into war work, this work consisting at first in the production of shells. Later the development was similar to that of France, the factories being big producers of aviation engines, while trucks were being purchased in large quantities in America.

Italy's Truck Program

Italy had an entirely different experience. Coming in later, the Italian Government had time to profit by the mistakes of France and England, for instead of converting their automobile factories into munition works and going to America for trucks, they intensified the production of their automobile factories on automobile work, and were able to meet not only all their own army automobile requirements, but to supply immense quantities to France and also important numbers of vehicles to England and even to the American army.

Finally, the Belgian industry was picked clean by Germany. Of the three leading European nations Italy enjoys the most favorable position, thanks to the original foresight of her Government. In both France and England there are some factories which have changed their organization so little that at the present moment they are capable of producing more automobiles than immediately before the war. On the other hand, there are establishments which have not built an automobile for 4 years and cannot get back into production in less than a year.

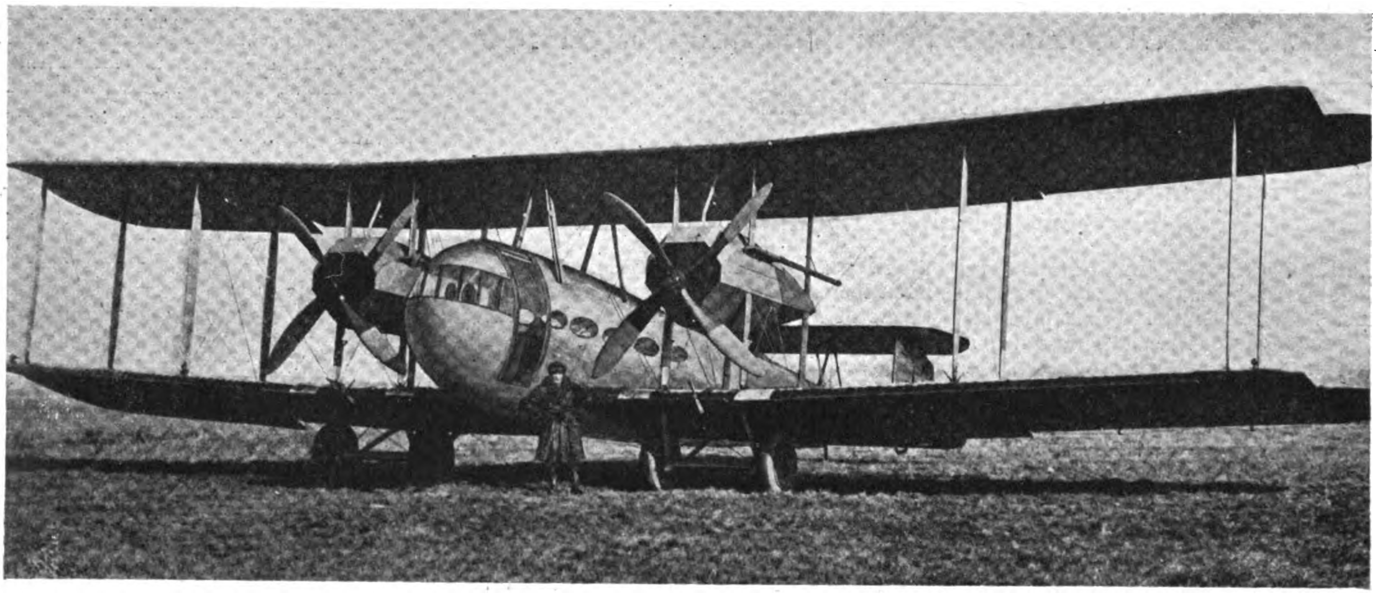
The European markets are not equally favorable to American imports. American automobiles always have been and always will be difficult to sell in Italy, while during the war Italy has become an important automobile exporting nation. From the American viewpoint France is a better field, but still a very difficult one to do business in. Finally England always has accepted American automobiles readily and is prepared again to purchase them in quantities.

Dividends Declared

Pennsylvania Rubber Co., Jeannette, Pa., eleventh quarterly dividend, 1¾ per cent on preferred, payable June 30 to stockholders of record June 15.

Borg & Beck Offices Moved to Chicago

CHICAGO, April 29—The Borg & Beck Co., which recently opened a factory here, has moved its offices from Moline to 914 S. Michigan avenue. The plant at Moline will be continued.



Vickers airplane with large twin engines

New British Airship

WASHINGTON, April 25—Vickers, Ltd., of London has announced the approaching completion of the R-80, a new rigid airship, which it is believed will fly the Atlantic with ease. It is expected that the machine will be ready for trials in May. It has been designed entirely by Vickers. The ship has bow-mooring attachments that will permit it to be moored out from a tower in such a manner that it can turn in any direction and lie with the wind. Four cars are attached to the hull—a forward control car and machinery car, and two wing cars for machinery fitted on opposite sides of the ship. There are 4 Wolseley-Maybach engines of 240 nominal brake horsepower each. The airship will carry a crew of 16 and will have accommodation for a good number of passengers.

British Car on Co-operative Basis

LONDON, April 10—With the purchase of the Bell Motor Co., Ravensthorpe in Yorkshire, by the Co-operative Wholesale Society, the production of a popular priced car on a co-operative basis will be inaugurated. The C. W. S. has been in existence since 1864, organized to buy goods wholesale and sell it to societies forming its membership. Production is expected to begin at once. No details of organization or production have been disclosed.

Co-operative Production to Compete with American Car

LONDON, April 10—British motor manufacturers who have decided to pool their interests in a standard product for the largest range of mass production, and the similar step taken among the French trade, is largely intended to help realize the advent of a successful competition in price and quality with the American car in the colonial market. The Buick six, for instance, can be landed in Australia from the United States for $2250, whereas the British Rover and Arrol Johnston cars, now listed at $3,500 even in Great Britain, bring at least $500 more in Australia. Competition at such rate is out of the question. The colonies are independent of the mother country in their domestic affairs, and it is all too probable that while our manufacturers are holding back restarting the industry and blaming the workers and everybody else but their own lack of confidence, courage, energy and prevision, the American trade will reap the harvest of cars in territories peculiarly British, and having a preferential tariff for British goods.

New Muffle Forms for Heat-Treating

LONDON, April 1—War-time products demand advanced and varied forms of muffle for heat-treating pieces several feet long. Some of the muffles thus called for were quite small and were adapted for heating electrically, but for the most part gas was used for the larger sizes. One type of muffle evolved is vertical, after the fashion of a retort in which the article to be treated is suspended.

The exclusion of air is so complete and the gases so well directed from contact with the pieces being treated, that they invariably emerge without the scale and soft-spots incidental to scaly pieces. Crank and cam shafts and axles are being annealed and otherwise restored after crystallization through protracted use.

The virtues of this new type muffle appear to be due to a combination of perfect sealing of the retort-like chamber, the presence of an inert gas, and suspension of the piece (or pieces) as opposed to the alternative practice of resting the piece (or pieces) in contact with the muffle floor as in the horizontal muffle.

These vertical muffles or retorts were much used in the war for treating airplane-struts and landing chassis and their possible value is being inquired into by cycle and motor makers, because of the seeming greater freedom from distortion of parts thus treated.

Standardization Work in England Undergoing Changes

LONDON, April 3—The standardization work of the Institution of Automobile Engineers has been undergoing several changes, and because of this has slowed up a good deal. This work has been carried on by a joint technical committee representing the interests of the motor industry and also the engineers. The technical committee of the Society of Motor Manufacturers & Traders has turned its functions over to a technical committee to be formed by the Association of British Motor & Allied Manufacturers, which means that a complete division of all the committees and sub-committees working on automobile standardization will have to be made, and the complete work will correspondingly be retarded for some time.

Because of this all engineering matters related to the automobile industry will be referred to the technical committee of the Association of British Motor & Allied Manufacturers. This committee will form the only means of communication between the automobile industry and the British Engineering Standards Association, which is the one organization in Britain that approves of standards. Once a standard is issued by this association it is immediately accepted by the manufacturers of the country.

More Room for Union Truck Co.

BAY CITY, Mich., April 28—The Union Motor Truck Co. has increased its capital stock to $500,000 and a new factory will be built at once. The company was organized 3 years ago. A small company began experimental work, putting the first Union truck on the market a few months later. Manufacture on a small scale continued, but because of the war the company found great difficulty in getting material. This difficulty has been removed and during the last few months it has received more orders than it can turn out with its present facilities.

Harper Sons & Bean Enter Car Field

LONDON, April 10—The firm of Harper Sons & Bean, Ltd., established in 1826 and employing some 10,000 persons in 3 plants in the Birmingham-Wolverhampton area, and whose output was principally stampings, forgings and castings, recently acquired the patterns, jigs and other manufacturing rights in the Perry light-car. There is also intended to be listed early next year a special new model styled the Bean car, designed for mass production. Meanwhile up to about 2000 of the Perry light-car, suitably improved, will be put through for the season 1919-20.

The company's shops are 600 ft. long and the foundry has an output of 1000 tons of castings a week. The company for many years has supplied a vast quantity of stampings to the motor trade and also, to a smaller extent, numbers of completed components, such as front-axle assemblies, etc. It is rumored that the mass production car will be listed at $1000 and will be specially suited for the colonial trade.

Copeman Laboratories Reorganized

FLINT, MICH., April 25—The Copeman Laboratories, Inc., has been purchased by New York and Detroit banking interests and the business will be continued by the new stockholders under new management.

Lewis Searing of New York, formerly vice-president and general manager of the Denver Engineering Co., Denver, Col., has been elected president and general manager and has already assumed active control of the business. L. G. Copeman, formerly president, has been elected to the board of directors. Production will start at once.

Detroit Culto-Tractor Locates

DETROIT, April 26—The Detroit Culto-Tractor Co., a new company incorporated at $1,500,000 for the manufacture of a farm tractor to sell at $755, has leased the Indian Village garage on Jefferson Avenue, and is converting it into a manufacturing plant. The company plans to be in production by May 1, turning out 25 machines daily. It claims orders for 3700 machines. The company will confine its efforts to assembly at first, some machining and finishing work.

The officers of the company are: President, J. J. Rowe; vice-president, H. M. Jerome; second vice-president, H. B. Kramer; secretary and treasurer, P. H. Kramer. S. M. Duffield is sales manager and S. R. Du Brie chief engineer. Mr. Jerome will be production manager.

The tractor is a three-wheel device with a single drive wheel, and was briefly described in the March 20 issue.

Goodrich Additions Total $93,000

AKRON, April 25—The Goodrich Tire & Rubber Co. has taken out permits for the construction of fireproof brick buildings to total $93,000. A machine shop, costing $49,000; an addition to a substation on Falor Street to cost $15,000, and two additions to present buildings costing $29,000 will be built at once.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Austin Touring Car Sells for $2,475

BIRMINGHAM, ENGLAND, April 9—The prices of the Austin 20, one of England's post-war models, anticipated as one of the production jobs of the country, have been determined. The chassis list at $1,975, the touring car at $2,475, the coupe at $2,975 and landaulet at $3,125.

Durant Denies Ford Purchase

DETROIT, April 26—W. C. Durant, president of General Motors Corp., emphatically denies that the corporation is to buy out Henry Ford's interest in the Ford Motor Co, as reported in some of the daily papers.

"There is absolutely no truth in the report that the General Motors Corp. has acquired or is negotiating for possession of Henry Ford's holdings in the Ford Motor Co.

"You may deny the report emanating from New York to this effect just as strongly as you wish and sign my name to it."

Republic to Build in Canada

LONDON, ONT., April 26—The Republic Motor Truck Co. will put up a factory here as its Canadian headquarters. A site has already been chosen and the erection of the new plant will commence immediately. During the course of construction an old munition plant will be occupied.

National Body Mfg. Co. Newly Organized

NASHVILLE, TENN., April 25—National Body & Mfg. Co. has been completely reorganized as the National Body Mfg. Co., with a capitalization of $50,-000, and will immediately start production of five-passenger bodies. H. O. Blackwood, owner of the H. O. Blackwood Tire Co., Nashville, Tenn., is president of the concern, the other officers being Charles R. Wood, Nashville automobile dealer, and Pollard Caldwell, the president of the Sterling Candy Co., vice-presidents, and J. N. Moorehead, secretary-treasurer.

S K F Industries a Holding, Sales and Engineering Company

Editor AUTOMOTIVE INDUSTRIES:

Through an unfortunate slip in our copy department a recent news item was sent you announcing in error that the reorganization of our interests, effective May 1, would be a physical consolidation of the underlying companies. The new company, S K F Industries, Inc., will be simply a holding, sales and engineering organization.—S K F Industries, Inc.

1,000,000 Fords Planned for One Year

DETROIT, April 29—The Ford company is now about to hit its full production stride. From 1300 cars daily this company has run production up until an average of 2600 cars were turned out each day this week. According to production officials, May will see production boosted to the 3000-car mark, and every effort is now being made to increase this to 4000 daily to meet the unusual demand.

In November the Ford company was operating on practically 100 per cent war basis. Ford did not wait for the cancellation of his contracts, but suspended all war operations the day after the armistice was signed. As a result he began to get back into peace production several weeks before any other automotive company in this district. This foresight enabled him to be operating on a 50 per cent basis by the first of the year, and he will hit his full production stride long before the other companies have fully recovered. On April 24 the Ford company had on hand 59,994 unfilled orders, and this total is increasing every day. From Aug. 1, 1919, to Aug. 1, 1920, the Ford company plans to manufacture 1,000,000 cars.

Splitdorf Closed for Inventory

NEWARK, N. J., April 25—The Splitdorf Electrical Co. has finished all Government work at its main plant, and has closed down temporarily for inventory. Manufacturing activities will be suspended until May 5, when the Government inventory is complete.

Chevrolet Turning Out 700 Cars Daily

DETROIT, April 24—The Chevrolet Motor Car Co. is manufacturing on a set schedule of 700 cars daily. Sales officials declare the demand far exceeds production.

Schwartz Electric Back to Horns and Other Supplies

ADRIAN, MICH., April 26—The Schwartz Electric Co., which, during the war produced munitions, has returned to peace activities: manufacture of automobile horns and other motor supplies. The company has orders now to supply 32 car manufacturers. At present some departments are working 13 hours daily. If sufficient labor could be obtained, night shifts would be put on. The company is making 1800 small horns a day, 800 large ones, 1000 circuit breakers, and 1200 push buttons. Cord assemblies are also being manufactured.

Service Products Corp. Will Make Radiator Fans

INDIANAPOLIS, April 26—The Service Products Corp. has recently been organized with $50,000 capital to manufacture radiator fans for cars, trucks and tractors, with the following officers: President, Harry J. Enders; secretary and treasurer, R. B. Parrott, and chief engineer, R. C. Root. Annular bearing fans will also be featured.

Men of the Industry

Changes in Personnel and Position

Cole Foreign Representative Abroad

INDIANAPOLIS, April 28—Pablo Homs, export manager of the Cole Motor Car Co., will leave early in May for a trip to important foreign commercial centers to establish export facilities for the company. He has secured distribution for the Cole in Europe, South America, Australia, Mexico, Cuba and the West Indies, subject to the removal of restrictions on private trade. It is estimated that between 10 and 20 per cent of the Cole output will be exported in 1919.

Major T. P. Searight, director of H. M. Hobson, Ltd., London, makers of the Claudel-Hobson carbureter, is now in this country on a business visit.

Capt. W. J. Pearmain, late instructor of artillery, First Army, A. E. F., has returned from France and has been appointed experimental engineer with the Wallis Tractor Co., Racine. Before going overseas Captain Pearmain was in charge of the experimental department of the Mitchell Motors Co.

J. F. Richman, former superintendent and factory manager of the Cole Motor Car Co., Indianapolis, is now manufacturing manager of the Allen Motor Car Co., Fostoria, O.

Arthur Kirkland, formerly with the Bureau of Aircraft Production, has been appointed sales engineer of the Detroit Tool Co.

J. S. Holihan, former sales manager of the Standard Motor Truck Co., Detroit, has joined the sales force of the Garford Motor Truck Co., Lima, O.

J. Berge, formerly of the Stewart Warner Speedometer Corp., has been appointed chief engineer of the speedometer department of the Champion Ignition Co., Flint.

R. B. Huffard of the truck department of the International Harvester Co., Chicago, has been engaged by the Handy Motor Truck Co., Detroit, as consulting expert.

Sid J. Black is vice-president in charge of sales of the Cleveland Automobile Co., which is erecting a factory for the manufacture of the new Cleveland car.

William M. Farans has been appointed special representative for the State of New York for L. Sonneborn Sons, Inc., oil refiners. He has just been released from duty as chief petty officer in the Navy.

R. E. Manly, of the Manly Sales Co. at 6253 Ellis Avenue, will have charge of the Chicago office just established by the Fulflo Pump Co., Blanchester, O.

John F. Neville is now with the Hilo Varnish Corp., Brooklyn. He was formerly with W. A. Tottle & Co., Inc., Baltimore, and Jas. A. McCafferty & Sons, Brooklyn.

DeLisser Made Ajax President

NEW YORK, April 30—Horace DeLisser has been made president of the Ajax Rubber Co., succeeding H. L. McLaren, who resigned recently. C. R. Collins, advertising manager, severed his connection with the company a few weeks ago. His successor has not yet been appointed.

Hunt New Sales Manager for Disteel Wheels

DETROIT, April 30—George H. Hunt has been appointed sales manager of the wheel division of the Detroit Pressed Steel Co. For several years Mr. Hunt was manager of the branch here of the Stromberg Carbureter Co. and for the past year was local representative of the Edward G. Budd Mfg. Co., Philadelphia, and the Budd Wheel Corp.

Steward Slosson has been appointed Pacific Coast manager of the Rubber Products Co. He was for several years Coast representative for Firestone motorcycle tires. The Rubber Products Co. is increasing its manufacturing and storage space at its Barberton, O., factories. Additional office space is also planned.

F. H. Prescott has been appointed designing engineer on motor and generator equipment for the Remy Electric Co. Before going into Government service as second lieutenant in the Engineering Reserve Corps, he was a designing engineer in the automobile equipment section of the Westinghouse Electric & Mfg. Co.

Martin K. Whalen has joined the force of the International India Rubber Co., South Bend, as its southern representative. He has been acting as special representative for the Century Plainfield Tire Co.

Paul LaCroix, general manager of the Rubay Co. plant, Cleveland, has been elected vice-president of the company.

R. A. Fisher, for 18 months with the flying corps, has joined the sales and engineering force of the J. R. Stone Tool & Supply Co., Detroit. Before entering the service he was connected with the Curtiss Aeroplane & Motor Corp. and the Continental Motors Corp.

W. D. Bell, Detroit, who recently resigned from the Parker Rust Proof Co., is now connected with the Wilson Foundry Co., Pontiac, where he has charge of the board contract department.

Stephen T. Gorman has taken charge of the office of the Ladish Drop Forge Co., recently established at Detroit.

Lee to Manage Saxon Factory

DETROIT, April 28—Harry S. Lee, during the war superintendent of the Wright-Martin Corp., Long Island City, has been made factory manager of the Saxon Motor Car Corp., Detroit. Before entering government service he was manager of the Aluminum Castings Co.

H. G. Semmons, prior to the war with the Studebaker Corp., has joined the Chevrolet Motor Car Co., Flint, as assistant sales manager.

Ernest L. Kreamer, advertising manager of the Oakland Motor Car Co., Pontiac, before resigning to enlist in the army, is now a member of the Howe, Fordham & Kreamer Co., Chicago, a new law firm.

A. G. Drefs, just out of government service, has opened offices in the Book Building, Detroit, under the name of Drefs, Cunningham & Drefs. The company will act as consultants for automotive industries on problems of organization, production, distribution, finances, accounting and general taxes.

C. V. Durham, with the Buick Motor Car Co., Flint, for many years, has been promoted from general superintendent to works manager of the plants.

H. E. Westerdale, sales manager of Heath-Duplex department of McCord Mfg. Co., with Ward Keller, eastern sales manager, has resigned to form the Lexington-Ohio Co., Cleveland, to handle Lexington cars.

J. C. Given, southern district manager of the L. A. Young Industries, Inc., Detroit and Shelbyville, Ind., has been appointed sales manager of the power division.

Andrew V. Terek, recently released from the Naval aviation service, has returned to the Bantam Ball Bearing Co., Bantam, Conn., as master mechanic in charge of the upkeep of the factory.

Frederick Robinson, who for many years was vice-president and general manager of the J. I. Case Threshing Machine Co., Racine, died April 23 at the age of 57. He had been ill several years, for this reason retiring in 1915, but remaining a director of the Case company.

James Viles, chairman of the board of directors of the Buda Co., Harvey, Ill., and father of L. M. Viles, president of that company, died in Chicago, Sunday, of a complication of diseases at the age of 64. He became president of the Buda Co. in 1907.

Gasoline Legislation Defeated

SAN FRANCISCO, April 26—As a result of opposition of the trade associations and the Chamber of Mines and Oil in California, Senate Bill No. 711, which proposed to establish gasoline specifications has been defeated. It was brought

out in opposition to such legislation that the price of gasoline and its quality are matters of supply and demand, and that legislative tinkering will only result in complicating a situation which calls for the gravest scientific study.

According to late quotations, gasoline is now sold at service stations in San Francisco at 20.5 cents a gallon. The price in Portland, Seattle and Tacoma is 21.5 cents.

—

Cooling Fan Problems

(*Continued from page* 967)

ally produced in automotive apparatus will not exceed from 2 to 3 pounds in 16 in., 3 to 4 pounds in 18 in., 4 to 5 pounds in 20 and 22 in. fans.

With regard to the bearing question, I believe it is a universally known fact that cup and cone bearings, as at present supplied in radiator fans, are the cheapest bearing to make and can be bought for between 8 and 12 cents each, according to size. A great many have been used, because there were no other types of fans on the market. However, the cup and cone type is disappearing rapidly, as it was the cause of the most irritating trouble and failures. Its life is short, especially when abused. To drop a fan with cup and cone bearings on the floor, or drive it with only slight force into its supporting bracket, means the destruction of the races. The same applies to ball thrusts. Plain thrust bearings with automatic adjustment according to thrust load are the most successful. In a recent test at a motor factory, the plain thrust bearing ran for 109 hours at 1500 r.p.m. *without lubricant* with only a few score marks, while the cup and cone bearing under exactly the same conditions lasted only 11 hours.

Mr. Hoyt also states correctly that not one out of ten people driving a car ever oils the fan. They will much less adjust stuffing boxes, especially when these stuffing boxes require special size wrenches and are most inaccessible. On adjustable stuffing boxes you will find invariably the felt squeezed out between shaft and stuffing nut, thus providing a wig oiler to drain the oil to the outside.

Self-contained felt arrangements on the inside of the hub, which throw the oil which they wipe off the shaft back into the bearing, are the only successful type and most simple.

The radiator cooling fan, the most important cooling unit, the highest speed part and at the same time the most neglected one on any automotive apparatus, must be built simple, rigid, foolproof and free from delicate adjustments (which will never be made) to give continuous and carefree service.

—

Truck Sales Managers Will Meet in July

DETROIT, April 28—The National Association of Motor Truck Sales Managers will meet here the latter part of July, as decided at the quarterly convention of the organization held in Philadelphia last week. The date of the Detroit meeting will be given out later.

Haste in Presentation of Claims Urged

Machinery for Settlements Temporary—No Statements Received by Ordnance After May 15

DETROIT, April 28—Approximately 70 per cent of war claims in the Detroit district are still unpaid. Aircraft and ordnance contract adjustment officials, whose organizations have been in operation 5 months, say it will be months before final settlement of all claims is made. The boards are now devoting their attention to hurrying the contractors into presenting their claims in proper form before May 15. Whether all claims will be in the hands of the boards by that date is a serious question and it is becoming more and more apparent that unless some of the big contractors speed up and file at once, they will be obliged to seek redress in the Court of Claims at Washington.

Of the 1500 claims coming under the jurisdiction of the Aircraft Board, 200 are still out. Packard, Lincoln, Ford, Fisher Body, Wilson Body, Willys-Overland, Buick and Cadillac are among them. Trouble in securing proper information from sub-contractors is given as one cause of delay in the presentation of these claims. It is estimated that only 30 per cent of all aircraft claims submitted to Washington for final approval have been paid. A large number of claims have been in Washington six weeks but no word as to their final disposition has been received.

Ordnance officials say 86 of their total claims have been filed. Fifty per cent of these have been passed upon by the Detroit board, but only 35 per cent have been approved at Washington. The Ordnance Board will receive no more claims after May 15. The Bureau of Aircraft Production claims officials have received no specific orders to refuse claims filed after a certain date. This board is urging contractors to file between May 15 and June 30, as after June 30 the board will be unable to promise immediate action. In a letter to Ordnance Board officials, Benedict E. Crowell, acting Secretary of War and Director of Munitions, declares that claims must be presented prior to May 15, as the present adjustment organization may not be in existence after that date.

He states: "It is nearly five months since these organizations were set up, and since their machinery was available for the process of adjustment. Nevertheless claims aggregating nearly one half of the total amount of money involved have not yet been formally presented. The organization which is handling this matter is essentially civilian in character and composed of men who have come into the department merely for the purpose of the war and who remain in this work only at a great personal sacrifice and at the urgent request of the department.

"I do not feel that I can continue indefinitely to impose that hardship and have determined that all contractors who desire to avail themselves of the existing organization in the department for the settlement of their claims must present them prior to May 15, as after that date the method of handling the claims will necessarily be changed owing to the impossibility of continuing the present personnel."

Both boards are making 50 and 75 per cent settlement in certain cases. When a contractor is hard pressed for money and when a preliminary inspection convinces the officials that the claim has been properly executed and is probably correct, an advance settlement of half or three quarters is made, the remainder being paid if the claim is found correct.

—

Attempt to Standardize French Tires

PARIS, April 15—At the present moment a vigorous attempt is being made to reduce tire sizes to the following: 815 x 105, 880 x 120, 935 x 135 and 955 x 155. In addition there will be one size for small light cars, but it is not certain whether this will be 710 x 90, 765 x 90 or some size which will interchange with the Ford. It is felt that five pneumatic tire sizes are sufficient to cover the entire automobile field. Michelin is using all its influence in favor of these sizes and is offering advantages in price on these standard sizes.

—

F-5-L Flying Boat Makes 20-Hour Flight

WASHINGTON, April 26—An F-5-L naval seaplane carrying Lieutenant Commander H. B. Grow and three ensigns made a non-stop flight covering a distance of 1250 miles in 20 hr. 10 min., establishing an American record for time and distance in that type machine. The machine was equipped with two 400-hp. Liberty engines, and made an average speed of 60 m.p.h. The flight was made at the Hampton Roads naval base and the distance covered equalled that across the Atlantic from Newfoundland to the Azores, the expected transatlantic route.

Although unsurpassed in America, a 24-hr. record was made in Germany before the war. Boehm, starting from the Johannisthal field, outside of Berlin, made a non-stop flight in a seaplane lasting 24 hr. 12 min., on July 10, 1914, but covered only two-thirds the distance. An H.S. seaplane, with full naval equipment, on regular patrol duty off Queenstown, Ireland, made a flight lasting 9 hr. 37 min., which stood as the record until this latest 20-hr. achievement.

—

Aviation Insurance Risks Undertaken by English Company

LONDON, April 18—The Aviation Insurance Association, an insurance organization controlled by a committee representing Lloyds, the Eagle Star and British Insurance Dominions Insurance Co. and Excess Insurance Co., has been formed to underwrite the specific risks incurred in flying. The risks include:

damage to aircraft or from other aircraft, damage to cargo, accidents to anyone in the machine or to persons or property on the ground injured by articles falling from the aircraft. This is the first time that aviation insurance has been placed on the level with other forms of insurance. A fixed tariff has not yet been established, but a schedule of rates is being prepared which will not be as prohibitive as flat rates would be.

Another English aviation insurance scheme has developed through a pool of 31 English insurance companies. In view of the heavy risks, the combined resources of the whole group will stand behind any of the policies issued by the individual companies.

Ballot Cars for Indianapolis

PARIS, April 28—(*Special Cable*)—Four Ballot cars comprising the Thomas team sailed from Paris on the Savoy on April 26 on their way to Indianapolis. These cars are to be driven by René Thomas, winner of the 1914 Indianapolis race, Albert Guyot, Louis Wagner and Bablot.

These four machines are special racing mounts which have been designed, built, tested and shipped in 90 days. They were designed by Henry, designer of the Peugeot cars. These cars are fitted with 8 vertical cylinders of 74 by 140 mm. bore and stroke. This number of cylinders has been selected because of the special conditions at Indianapolis, where rapid acceleration is an essential quality. The entire design was laid out with Indianapolis conditions in view.

The Ballot Co., responsible for these machines, is the leading engine manufacturer in France. Before the war it introduced engines only to the requirements of automobile assemblers. During the war the firm has been engaged in the production of aviation engines and special engines for lighting sets, pumps, machineshop trucks, and other similar products.

It was not until Dec. 24, 1918, that the Ballot Co. decided to enter for the Indianapolis race. Actual designing did not begin until Dec. 27. The four Ballot cars will remain in America for about 4 months after the Indianapolis race.

Coatalen Arrives with Sunbeams

NEW YORK, April 28—Louis Coatalen, managing director and chief engineer of the Sunbeam Co., England, arrived here this morning bringing with him the two racing Sunbeams which are to make their appearance at the Indianapolis track on May 31, driven by Dario Resta and Jean Chassagne. Mr. Coatalen expects to return to England as soon as possible after the race.

Stewart-Warner Doubles Profits

CHICAGO, April 28—Net profits of the Stewart-Warner Corp. for the first quarter of 1919, ended March 31, were $549,653, against $227,582 for the same period of 1918.

Reliability of Aerial Transport Essential

English Aerial Transport Committee Sees Only Limited Business Under Present Conditions

LONDON, ENGLAND, April 1—Since the signing of the armistice innumerable forecasts and articles on commercial flying have appeared in the press, mostly inspired by those at the head of the airplane manufacturing business, who are faced with the problem of finding an outlet for their production.

The majority of these have taken a rather optimistic view of the prospects. In spite of this everything to-day points to post-war aerial industry being carried on by only those firms having substantial and large interests in some business other than aircraft, which will serve them as a means of support in the event of their not getting sufficient contracts in the aeronautical line to keep their heads above water.

When the Civil Aerial Transport Committee was formed to propose to the Air Ministry the steps to be taken, the tone of its report was in strong contrast to some of these expansive predictions. That portion of the text which was made public stated that while the committee was of the opinion that the carriage of mails, and in some cases passengers also, besides certain kinds of light merchandise, might be successfully developed, the total amount of business in sight along these lines would be incapable of absorbing even a small portion of the present output in its highly developed condition.

From the pilots', and in fact from everyone's point of view, reliability is the primary essential in an airplane, and so far, though many statements have been made to the contrary, the present-day type of airplane is far from being what one might term thoroughly reliable.

In order to attain reliability, what is most needed is that the engine should have a margin of power. This means that with the engine running smoothly at about half throttle, and consequently undergoing no appreciable strain, the airplane should maintain both its forward speed and its height. Even a motor car engine, which is far heavier and more substantialy built, could not be expected to last long were it run constantly on full throttle, as is the case in an airplane.

So far no airplane engine has been produced which pretends to yield any appreciable margin of power, and until such an engine is put on the market it is scarcely worth while to consider the question of aerial transport from a commercial point of view. Further, it is hardly too drastic to say that the expenditure in overhauls, crashes, etc., would be so great as scarcely to allow any appreciable profit to be realized.

On the other hand, as regards mail carrying over long distances, and to a certain extent passenger carrying, there appear to be great possibilities, even for the present-day type of machine.

Over short distances, such as from London to Liverpool, it remains for the private individual to choose as to whether he is going to send his letters by train, which takes 5 hours, but is infallible, or whether he is going to send them by airplane and pay probably 8 or 10 cents more, which takes about 2½ hours, half as long as the train, but about one-sixteenth as reliable. Where long distances, such as from England to India, are involved, airplanes will prove to be invaluable.

It is impossible for any large firm to rely solely on aircraft production at the present time for its subsistence. The Government has many more airplanes than it knows what to do with at the moment, and the life of an airplane will be considerably long under peace conditions.

8 Uniontown Entries

UNIONTOWN, PA., April 28—Before appearing on the Indianapolis speedway on May 31, a number of the speed cars and their drivers will start the season on the track here on May 17. Among them are two Roamer specials and three Hudsons. Cliff Durant will drive his Chevrolet special. No foreign entries for this event have yet been sanctioned. Those already scheduled are:

Driver	Car
Louis LeCoq	Roamer special
Kurt Hitke	Roamer special
Eddie Pullen	Hudson special
Ira Vail	Hudson special
Harold Simmons or J. R. Hogan	Hudson special
Cliff Durant	Chevrolet special
Wilbur D'Alene	Duesenberg special
Dennie Hickey	Stickel special

Indianapolis Entry List Lengthens

NEW YORK, April 29—A third Peugeot has been entered for the 500-mile Indianapolis event for May 31, to be driven by Arthur Klein. Barney Oldfield, although out of the racing game himself, is putting his old racing car, the Oldfield special, into the hands of Roscoe Sarles for the occasion. The complete list of cars and drivers officially entered with the Contest Board of the American Automobile Association includes:

Drivers	Cars
Clifford Durant	Chevrolet special
Dario Resta	Sunbeam
Jean Chassagne	Sunbeam
H. C. Simmons	Hudson special
J. M. Reynolds	Hudson special
Eddie Pullen	Hudson special
W. W. Brown	Richards special
Eddie O'Donnell	Duesenberg special
Wilbur D'Alene	Duesenberg special
Tommy Milton	Duesenberg special
Kurt Hitke	Roamer-Duesenberg
Jules Goux	Peugeot special
Ray Howard	Peugeot special
Arthur Klein	Peugeot special
Louis LeCocq	Roamer special
Ralph DePalma	Packard special
Earl Cooper	Stutz special
Ralph Mulford	Frontenac special
Louis Chevrolet	
Denny Hickey	Stickel special
Arthur Thurman	Thurman special
Elmer P. Shannon	Mesaba special
Eddie Hearne	Durant special
Roscoe Sarles	Oldfield special

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb....... .02 - .03
- Phosphoric (85%) lb. .... .35 - .39
- Sulphuric (60%), lb. .... .008

Aluminum:
- Ingot, lb. .... .29 - .31
- Sheets (18 gage or more), lb. ...... .42

Antimony, lb. ...... .07 - .07⅛

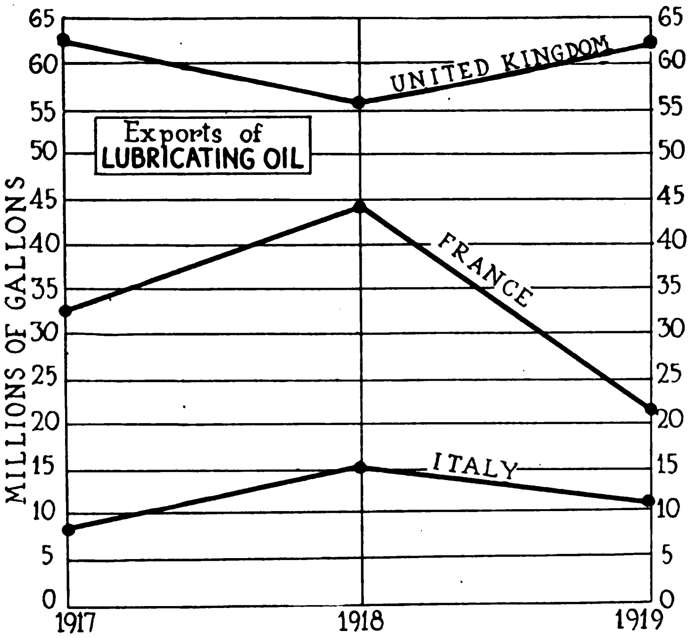
Burlap:
- 8 oz., yd........ .07⅛- 07¼
- 10½ oz., yd........ .09⅛

Copper:
- Elec., lb. .... .15⅝- .15½
- Lake, lb. .... .15¾- .15⅞

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.40
- Egypt, combed, sq. yd. 1.25
- Egypt, carded, sq. yd. 1.20
- Peelers, combed, sq. yd. 1.10
- Peelers, carded, sq. yd. .85

Fibre (⅛ in. sheet base), lb. .... .50

Graphite:
- Ceylon, lb. .... .09 - .22
- Madagascar, lb... .10 - .15
- Mexico, lb. .... .03¾ .



Although our exports of lubricating oil to the United Kingdom fluctuated but little during the periods covered by this chart, France's supply dropped by one-half during the last seven months as compared with the previous like period

Lead, lb. .... .04¾- .05

Leather:
- Hides, lb. .... .25 - .41

Nickel, lb. .... .40

Oil:
- Petroleum (crude):
  - Kansas, bbl. ...2.25
  - Pennsy., bbl. ...4.00
- Gasoline:
  - Auto, gal. .... .24½
  - 68 to 70 gal..... .30½
- Lard:
  - Prime City, gal.2.45 -2.50
  - Ex. No. 1, gal.... .95 -1.06
- Linseed, gal. .....1.53 -1.56
- Menhaden (dark), gal. .... .95

Rubber:
- Plantation:
  - First latex pale crepe, lb. ..... .47
  - Brown crepe, thin, clear, lb. ..... .45½
  - Smoked, ribbed sheets, lb. ..... .46½
- Para:
  - Up River, fine, lb. .56
  - Up River, coarse, lb. .... .34
  - Island, fine, lb.... .47½- .48

Shellac (orange)), lb. .60 - 64

Spelter, lb. .... .06½

Steel:
- Angle beams and channels, lb..... .03
- Automobile sheet (see sp. table).
- Cold rolled, lb....0625
- Hot rolled, lb.....039

Tin .... .72½

Tungsten, lb. 1.00

Waste (cotton), lb.. .12¾- .17

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when Seconds up to 15 per cent. are taken per 100 lbs.
Automobile body stock................	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock................	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping.........	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping................	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Blank Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.

Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close April 26

	Bid	Asked	Net Ch'ge
Auto Body Company......	9	10	..
Briscoe Motor Car com...	14	..	..
Briscoe Motor Car pfd....	50	65	..
•Chandler Motor Car......	142	144	—2⅛
Chevrolet Motor Car......	209	211	+10
Cole Motor Car Co.........	93	105	..
Continental Motors com...	8¾	9⅛	+1⅛
Continental Motors pfd....	96	99	..
Edmunds & Jones com....	15	20	...
Edmunds & Jones pfd....	75	90	..
Electric Storage Bat......	75	77	+6
Federal Motor Truck.....	34	37	..
Fisher Body Co. com.....	59	61	—3¾
Fisher Body Co. pfd......	92	94	..
Ford Motor of Canada....	320	330	+10
•General motors com......	180¼	181¼	+1
•General Motors pfd......	91	93	—⅜
Hupp Motor Car com.....	8⅜	8¾	+⅛
Hupp Motor Car pfd......	96	99	..
Kelsey Wheel Co. com....	35	37	..
Kelsey Wheel Co. pfd....	93	95	..
Manhattan Electric S. com.	..	48	..
Maxwell Motor com.......	39½	40½	+1
Maxwell Motor 1st pfd....	69	70	+2½
Maxwell Motor 2nd pfd....	31½	32½	+1¼
McCord Mfg. com.........	34	37	..
McCord Mfg. pfd..........	95	100	..
Mitchell Motor Co.........	33	35	+3
Motor Products Corp.......	..	35	..
Nash Motors Co. com.....	230	250	..
Nash Motors Co. pfd......	95	100	..
National Motor Co........	16	20	..
Packard Motor Car com...	146	149	+11
Packard Motor Cor pfd...	99	102	..
Paige-Detroit Motor com..	34½	35½	+5
Paige-Detroit Motor pfd..	9	9¾	+¼
Peerless Motor Truck.....	27	29	+4
•Pierce-Arrow M. Car com.	50¾	51¾	+¾
Pierce-Arrow M. Car pfd..	102	104	..
Premier Motor Corp. com.	5	..	..
Premier Motor Corp. pfd..	..	75	..
Prudden Wheel Company.	21	22	..
Reo Motor Car Co.........	26½	27¼	+2¾
Republic M. Truck com...	43½	45	+3
Republic M. Truck pfd....	91	95	..
Saxon Motor Car com.....	7	9	+¼
Scripps-Booth Corp.	21	25	..
Stewart Warner S. Corp..	92¾	94¾	—⅛
Stromberg Carburetor Co..	38	40	..
Studebaker Corp. com.....	75½	76½	+6
Studebaker Corp. pfd.....	94	97	..
•Stutz Motor Car Co......	56	57	+1⅜
United Motors Corp.......	47	49	+½
White Motor Co..........	57¾	58¾	+1⅞
Willys-Overland com.	32	33	+2⅛
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co...........	90½	92½	+13
Firestone T. & R. com....	140	145	..
Firestone T. & R. pfd....	100	102	..
Fisk Rubber Co. com......	135	140	..
Fisk Rubber 1st pfd.......	100	105	..
Fisk Rubber 2nd pfd......	138	142	+1
Fisk Rubber 1st. pfd. conv.	105	110	..
Goodrich, B. F., com......	71	72	+4½
Goodrich, B. F., pfd.......	107	109	+1
Goodyear T. & R. com....	280	287	..
Goodyear T. & R. 1st pfd..	105½	107½	..
•Goodyear T. & R. 2nd pfd.	106	107½	+1
•Kelly Springfield com....	123⅛	124⅛	+1⅝
Kelly Springfield 1 pfd....	95	97	..
Lee Tire & Rubber Co....	32	33	+5½
Marathon Tire & Rubber..	55	75	..
Miller Rubber Co. com....	170	175	..
Miller Rubber Co. pfd....	102	104	..
Rubber Products Co......	125	130	..
Portage Rubber Co. com..	158	162	..
Swinehart T. & R. Co....	77	81	..
U. S. Rubber Co. com....	87	88	+1¼
•U. S. Rubber Co. pfd....	111⅜	112⅜	+1⅞

•Ex dividend.

Calendar

SHOWS

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and Accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

May 15-June 1—Venezuela. National Exhibit of Venezuela.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-15 — London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December—Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

May 6-12—Sacramento, Cal. Sectional Tractor Demonstrations, Demonstration Field.

June 8-14—Denver, Col. Sectional Tractor Demonstrations.

July 14—Wichita, Kan. Automotive Committee of National Implement Assn.

Aug. 18-22—Aberdeen, S. D. Sectional Tractor Demonstrations.

October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

RACES

May 1—Atlantic City, N. J.—Airplane races — Aeronautic Convention.

May 3—Atlantic City, N. J.—Airplane races — Aeronautic Convention.

†May 17—Uniontown, Pa., probably 112½ miles.

May 30—Atlantic City, N. J.—Airplane races — Aeronautic Convention.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*June 14—Sheepshead Bay, L. I. Speedway race.

July 4—Atlantic City, N. J.—Airplane races — Aeronautic Convention.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15—Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

†Sanctioned.
*Tentative dates.

CONVENTIONS

April 28-May 1—St. Louis, Mo. Chamber of Commerce of United States Convention.

May 1-June 1 — Atlantic City, N. J.—Pan-American Aeronautic Convention and Exhibition — Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

May 21-24—Washington — Conference on Weights and Measures — Bureau of Standards.

May—Washington, Pan-American Commercial Conference, Pan-American Union Building.

June 2—Chicago, Ill.—Natl. Gas Engine Assn. Hotel Sherman.

June 23-28—Ottawa Beach, Mich. —S. A. E. Mid-summer Meeting.

Sept. 22-24—Philadelphia, Annual Convention, National Association of Purchasing Agents, Bellevue-Stratford.

King-Bugatti 16-Cylinder Aero Engine

(*Continued from page* 959)

The front bearing on the pump shaft is lubricated by spray from the crankcase, which collects on the shaft bushing support and drains down into a ⅛-in. hole leading to the bearing. Any oil leakage from the front end of this bearing returns to the sump, any slight leakage from the rear end of the bearing is drained outside the crankcase with the water leakage from the rear bearing.

There is one water inlet to the pump, of 2¼ in. inside diameter, while the single outlet is of 2 3/16 in. diameter. Water from the pump is forced up into an aluminum pipe with one branch leading to the rear end of each of the rear cylinder blocks, water entering the cylinders at the top of the water jacket on the exhaust side. A certain amount of the water circulates through the inlet manifold jacket, the remainder filling the cylinder water jacket space.

The propeller shaft is driven through a spur gear splined to the shaft meshing with a gear on the front end of each of the crankshafts, both crankshafts turning clockwise. The propeller shaft is hollow and is carried in three bearings, a ball bearing either side of the gear and a plain bearing at the rear end.

The front gear cover, the ball bearings and the gear are assembled complete as a unit before mounting in the engine. The ball bearings are Monarch Special Width Hess Brights, being narrower than the standard bearing. The front bearing is mounted in the gear cover and takes all the propeller thrust as well as a certain part of the radial load. The rear bearing slides into a retainer in the crankcase, being free to move endwise, carrying radial load only. The hub of the gear acts as a spacer for the ball bearings, the latter being held in position on the shaft by two nuts with a locking plate between. Mounting is such that the ball bearings and gear are easily and positively assembled, there being no danger of injuring the ball bearings by screwing the retaining nuts too tight.

Provision is made for attaching two gun control mechanisms, one at the rear end of each of the camshaft housings, driven directly from the camshafts through a slotted coupling. The tachometer drive may be taken from either end of the two camshafts. It operates at camshaft speed through a slotted coupling. When the gun control mechanism is used the tachometer drive is taken from the rear end through the same type of coupling as when driven directly from the end of the camshaft.

Timken Bearings and Spiral Timing Gears on Fords

DETROIT, April 24—The Ford Motor Co. is now supplying Timken roller bearings to Ford dealers to replace the ball bearings in the front wheels. The introduction of these bearings came with the detachable wheels, and this bearing is made interchangeable with the old type ball bearing so that the replacement can be made without changing any other parts.

The spiral timing gears which were incorporated into the design of the engine at the time the electric starting and lighting system was placed on the enclosed models have now been made standard on all the cars.

Sundstrom Now Rex Machine

CHICAGO, April 28—The Sundstrom Mfg. Co. is now the Rex Machine Co., manufacturing Rex automotive air equipment besides dies and tools.

U. S. Relaxes Cable Censorship

NEW YORK, April 28—Cablegrams from persons in the United States to Central or South America, including Mexico, Cuba and the West Indies, may now pass uncensored. The United States has also stopped censoring cable messages to or from points within British, French or Italian territory. Likewise cablegrams from all parts of the world and Central or South America are no longer censored by the United States. In addition, messages from the Far East, except those sent through Vladivostok, are not subject to American censorship.

British, French and Italian censorship, however, is still in operation, so that uncensored cablegrams from the United States are subject to the regulations of the French, Italian and British officials.

British Censorship Relaxes

WASHINGTON, April 29—Modification of British censorship, permitting the use of private code in cablegrams from the United States to South America passing through London, is announced by the Navy Department.

Mertzanoff Handles Automotive Exports

NEW YORK, April 29—C. E. Mertzanoff, formerly in charge of the export department of Mitchell Motors Co., is now acting as export manager for the American Motors Corp., Plainfield, N. J., makers of the American Six; the Seneca Motor Car Co., Fostoria, Ohio, building a 4-cylinder five-passenger car and the Piedmont Motor Car Co., Lynchburg, Va., building sixes and fours. He acts in a similar capacity for the Economy Body Sales Co., New York, makers of dump bodies for commercial cars, and the E. & W. Mfg. Co., Milwaukee.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 19

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MAY 8, 1919

Fifteen cents a copy
Three dollars a year

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, MAY 8, 1919—CHICAGO No. 19

Airplane Supply System of the American Army in France

How 46 Complete Flying Squadrons Were Organized, Equipped and Maintained

By W. F. Bradley

PARIS, April 20—Having decided that the military might of Germany should be smashed, it appealed to the imagination of the American citizen to drive home the most crushing blow by way of the air. Probably, when that resolution was taken, the great majority of the people of the United States never realized how difficult, how complicated, how full of unseen obstacles was the program they had placed before them.

The business of raising soldiers is as old as the world, and although the Kaiser and his advisers believed they had surpassed all possible competitors in this branch of activity, England first demonstrated that a healthy young manhood can be transformed into an armed force in a few short months, and the American nation on coming into the fray still further demonstrated this fact. There may be military tradition behind the Kaiser's troops, but they have had to admit themselves crushed and defeated by men who put on the uniform with no other object than to get rid of a bully.

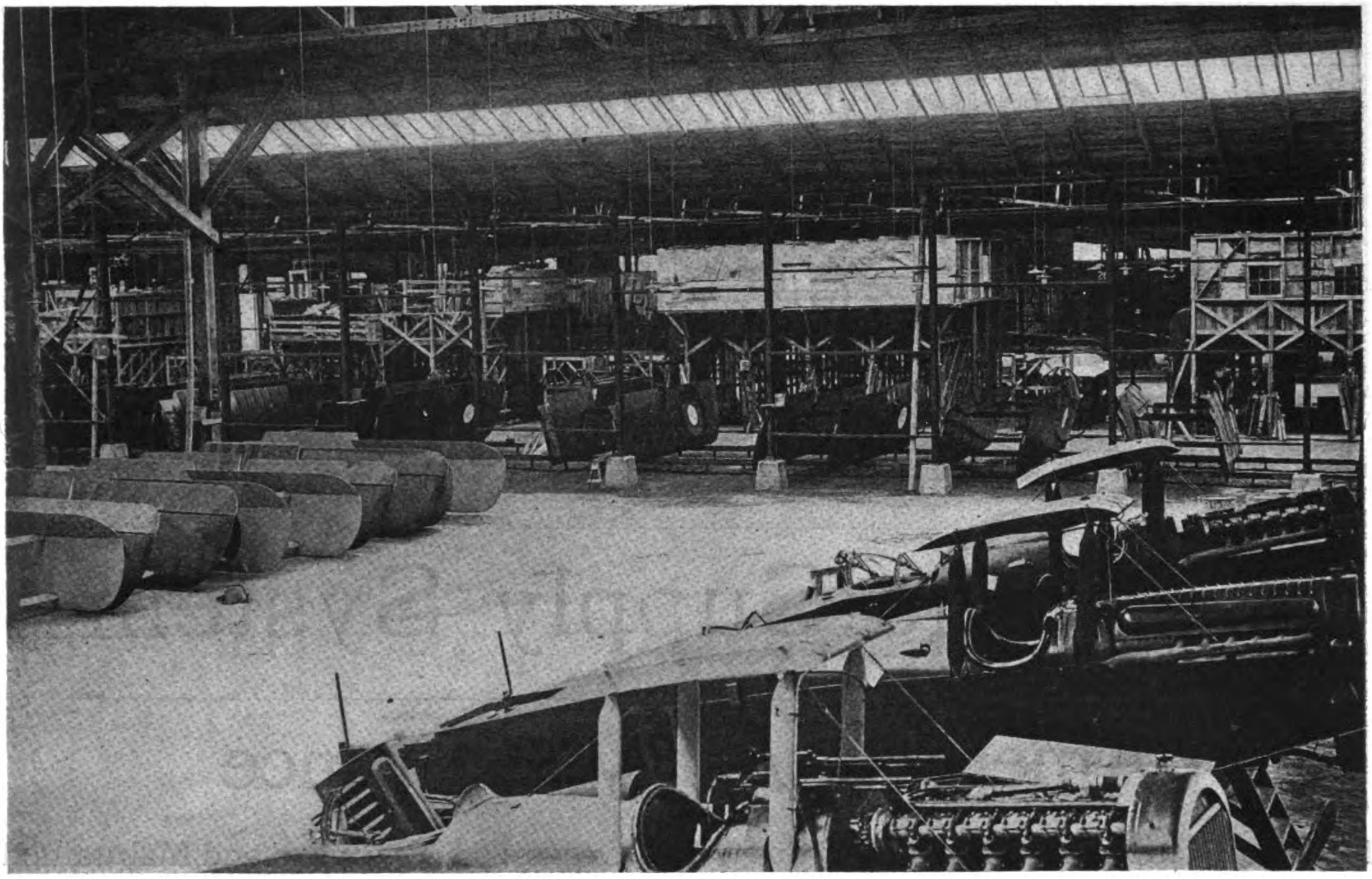
The creation of an aerial army brings up problems of an entirely different order. Teaching an army to fly is in itself a big job; but it is not by any means the biggest. A flyer needs an airplane, and America possessed none; an airplane needs an engine, and America had never built any. An airplane built to-day is out of date six months hence, so far as military operations are concerned.

This means that you cannot just sit down and copy the best available, then go ahead and produce them. While you are building you must be working on something which you know will make your present machine look like a back number. When you have got your airplanes it is necessary to learn how to use them. This lesson has to be learned while you are using them. Further, all that was ever known about the military use of airplanes has been learned since the summer of 1914.

Compared with the Allies, the task of the American Air Service was one of compound complication. The real lessons are learned at the front; they are corrected at the rear. And America was separated from the front by a distance of 3000 miles, across which communication was always

ACHIEVEMENTS OF AMERICAN AIR SERVICE

Starting right at the bottom of the ladder, with no personnel, little accumulated experience, no formulated organization, the Supply Section of the Air Service had provided for all the wants of an active air force composed of 2017 flying officers, 528 ground officers, and 29,774 enlisted men. It had constituted and sent into active service over the lines a total of 46 complete flying squadrons; it had in operation 12 squadrons of all-American planes; it had received 6476 airplanes, of which number 3261 were service planes; it had erected and put into operation, for assembly, repair, and salvage of material, workshops bigger than the largest automobile factories in the United States.



The airplane assembly shops at Romorantin on the day of the armistice

slow and often difficult. Despite all these unusual and difficult conditions, the American Army in the field was always furnished with all the aerial supplies it required. On Nov. 11 it could be shown that every requisition of the army had been met, that there was a big supply of machines in reserve to meet urgent calls, and that a huge scheme of supply had been completed which would have permitted of a tremendous increase of the flying forces of the American army.

Exceptional Achievement in One Year

At home the Supply Section of the Air Service, with little accumulated experience, tackled the problem of the aviation engine and in a little more than one year had designed, perfected, and built to the extent of 3,000,000 hp. a successful aviation motor which was operating not only over the American lines but in planes belonging to the Allied powers. During the same period the total horsepower of steamship engines built in the United States was only a fraction of the total of aviation engines. Yet steam engine production is a standardized and old-established industry, whereas previous to 1917 there was no aviation engine industry in America, and few of the men who ultimately made good in this line had ever seen a modern flying machine or engine.

To appreciate correctly the effort of America to strike at Germany through the air, it is necessary to take a stand in Paris. This may appear to be a deviation from the main track, for the great effort starts away back in the pine forests of Oregon and culminates in the Argonne, the Somme and the Chateau-Thierry district. The American line thrown across the Atlantic and striking the

ORLY FIELD

Airplane Production Center, No. 1

For Assembling and Equipping Foreign Built Planes for American Army

Work begun..............March 31, 1918
First planes dispatched to front..3 weeks later
Highest daily production...............95
Total planes dispatched to American front up to Nov. 11..................1,800
Personnel of field....323 officers, 2,283 men
Total distance flown by ferry pilots ....403,000 miles

ROMORANTIN

Airplane Production Center, No. 2

For Assembling and Equipping American Built Planes

Work begun.................March, 1918
First airplane dispatched......April 18, 1918
Highest daily production...............60
Total planes dispatched May 11 and Nov. 11.........................1,213
Damaged planes received in 8 months..1,184
Planes repaired and redelivered into service 796

French coast at Bordeaux and Saint-Nazaire continues in a northeasterly direction across the center of France, leaving Paris a considerable distance to the north. The headquarters from which the main stream of supply was directed to the American army was established in the town of Tours. Yet the Air Service supply organization abandoned Tours and went over 100 miles further north to the French capital.

French Machines on Original Order Never Delivered

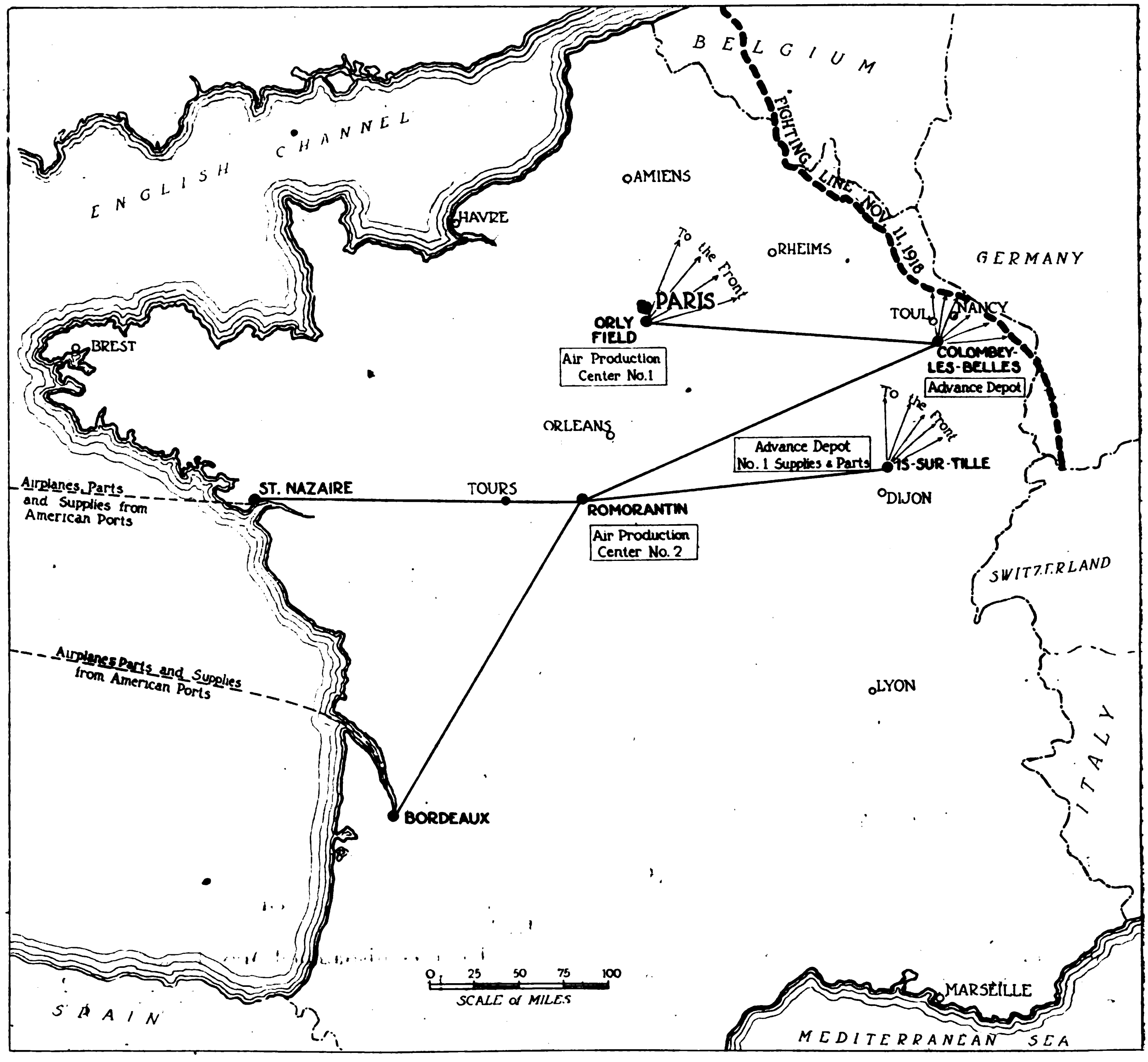
The activities of the American Air Service in France date back to the summer of 1917, when the Bolling Mission arrived in Europe. At that time the American effort was nebulous; it was striving to assume a concrete form, to evolve itself into a powerful working organization. At the end of about three months the Bolling Mission ceased to exist, after having placed a contract in Europe for 5000 airplanes, and having made clear to itself, and probably to the authorities at Washington, the great difficulty of the task of creating a big aerial force.

The 5000 machines France was to supply to the American army never materialized. Nobody is specifically to blame for this, for if America was slow in providing the raw and partially finished material she had to furnish under this contract, the French at that time showed a lack of faith in the American effort. They, who had been through the mill, knew the enormity of the task and were well qualified to estimate the length of time which would be necessary for America to bring an aerial force into existence.

Creating an American Air Force

Meanwhile America was working, but when the year 1918 opened the fact had to be faced that the American program was a long way behindhand, and that practically no supplies were being received from European sources. The mistake had been made at home of overestimating the speed with which an aerial force can be created. There are natural limits to all developments,

(Continued on page 1013)



Map of France, showing how the American army was supplied with airplanes from two production centers, Orly, at which foreign-made machines were assembled, and Romorantin, where the all-American planes were produced. The airplanes were flown from these points to the front through advance depots near the fighting line

Business Needs Leadership and Government Co-operation

Many Problems Unsolved—Centralized Government Departments Necessary for Foreign Trade—Railroads and Merchant Marine Under Private Owners

THE UNITED STATES CHAMBER OF COMMERCE CONVENTION AT ST. LOUIS

By Allen Sinsheimer

ST. LOUIS, May 1.—Concrete suggestions for return of the railroads to their owners and for sale and distribution of the merchant marine to Americans and positive governmental acknowledgment that the anti-trust laws are antiquated and not in accord with modern business needs were the most important developments of the U. S. Chamber of Commerce convention at St. Louis.

The convention included more than sixty speakers on eighteen major and forty related problems, and the great majority offered problems and acknowledged obstacles to industrial growth, while but few stated concrete recommendations for them. It was a statement heard frequently that either many of the problems do not exist and consequently have no solution, or there is a need for business leaders who can step forward now and guide the nation through its post-war infancy.

That the government must recognize the necessity for new legislation and for greater co-operation with industry because of the after-war conditions was said to be the vital need of business at this time.

Effect of War on American Business

Government action is necessary for new legislation that will fit the new era of our business history and for new departments to meet the new needs of industry.

America's entrance into world trade is producing closer industrial, commercial and diplomatic contact with foreign nations, and new government departments and policies must provide ample assistance to our manufacturers so they can overcome all problems abroad that usually come within the province of government.

That no solution can be found to the problems of business and that they are numerous and each vitally important were other developments of the sessions. Every speaker acknowledged that a new era of business history is before the nation, and demanded complete revision of policies, organizations and perspectives from government, capital and labor.

WE paid three billion dollars for our Marine during the War. The British Marine cost a little over one billion dollars. The entire Merchant Marine of the World cost two billion dollars. It is absolutely necessary that a considerable portion of the cost of our Marine be written off, if our ship owners are to compete abroad.—HOMER FERGUSON, *President, Newport News Shipbuilding Co.*

A COUNTRY starting out on the all-tax theory has been taught by experience that it was impossible for them to raise the funds required without recourse to huge loan operations, and then conversely the "all-loan" champions amongst the nations found that it was foolhardy and suicidal to try to finance a war without raising a large portion of its cost by increased taxation.—PAUL WARBURG.

The growth of business and its new standard of higher business ethics must be met by the government with new laws. Combination has been replaced by co-operation and the anti-trust laws of the last century are antiquated, inadequate and obstacles to trade development. The government must recognize this by legislation, approving of co-operative associations for combinations of manufacturers, not for price-fixing or monopoly, but for scientific industrial advancement. It should extend every co-operation to business and cease its interference with business.

That the railroads should be returned to their owners as soon as legislation is enacted that will protect the public, the government and the weaker railroads, was agreed by all speakers, including Walker D. Hines, Director General U. S. Railroad Administration, Senator A. B. Cummins and others.

The American merchant marine must be sold to Americans and on a basis that will insure bottoms for every section of the country requiring them.

Organized labor, it was stated, is here to stay. There must be recognition that a union of labor is as justifiable as a corporation, which is a union of capital. Labor must be regarded as a fellow servant with capital and not as a commercial commodity. Wages are not the only factor in the contentment of labor. Good living and working conditions are equally important and sometimes more so.

Our domestic business and conditions of employment will only be stable if we develop our foreign trade. But we should not look, it was emphasized, to the Allies for

business. They need their own raw material and cannot spare the cash to buy from us. We should look for our largest export trade to South America, the Orient and the European neutral countries. We can only do export business for the next few years with the Allies if we will make investments in private and public enterprises in those countries and accept these as payment for our trade. The Allies cannot buy abroad until they can first develop and re-establish their export trade and sell abroad.

Other important points developed and recommendations made were:

That the government should pay interest on all payments of war contracts that are unduly delayed.

That a comprehensive road construction policy should be formed.

That the Industrial Board for price fixing should be encouraged.

That the Federal Trade Commission should be purely advisory.

That the government should compile a yearly budget and that governmental employees should be selected with regard to their ability to serve industry.

That there should be established a centralized government department to take over the existing fifteen agencies now connected with exports.

That there should be industrial training for labor.

That there should be active participation by commercial bodies for securing employment for returning soldiers.

That the education of the American public to the value of foreign trade, to the importance of making investments abroad, and to the reasons why we cannot now look to the Allies for development of our export business should be vigorously carried out.

Resolutions were considered by the convention for appropriation for industrial training, a business cabinet for the President, a centralizing agency for all government bureaus concerned with foreign trade, cost accounting by the government, reorganization of the Federal Trade Commission, continuation of the Industrial Board for price fixing under George Peek, for the payment of interest on overdue government payments, and for new forms of blanks for federal taxation, all of which were referred to the new board of directors of the Chamber for further consideration and action.

Resolutions passed included:

a—Revision of federal laws dealing with business to clearly define rights, limitations and obligations.

b—Employment of soldiers, sailors and marines in the community where they were employed prior to entering the service.

c—New legislation necessary to safeguard our social and business structure during the readjustment from war to peace.

THE government has no justification for attempting to run the business of others until it can run its own business successfully.
—GOVERNOR EDGE, *New Jersey*.

WHAT BUSINESS ASKS OF THE GOVERNMENT

LEGISLATION that will approve of associations of manufacturers into combinations for the purpose of developing and improving industry, which in turn means abolition of such laws as the Sherman Act, which is declared antiquated and not in keeping with the standard of ethics of modern industry.

Reorganization of the Federal Trade Commission to form a larger and purely advisory body.

Sale of American merchant marine to Americans and on a basis that will insure fair distribution of bottoms to every section of the country needing them. Prices of sale to be below the war cost of the ships to allow ship owners to compete with foreign trade.

Modification of sea laws to allow all officers of the American marine to be Americans.

Government subsidy for ship owners if necessary.

Special bureau under Department of Commerce for water transport.

Centralized department that will co-ordinate the work of the fifteen bureaus now handling various details of foreign commerce.

Establishment of Federal Highway Commission, federal appropriations for the construction and maintenance of national highways, federal road building aid for the states beyond 1921, federal approval for road construction when the roads are of a permanent character only.

Compilation of a yearly budget of government expenses and financial condition.

Greater exercise of care in the selection and appointment of government employees who work in bureaus that co-operate with or aid business.

Return of railroads to their owners after Congress formulates legislation providing for a consolidation of railroads into competing combinations comprising both weaker and stronger roads and to protect the public, the government and the owners.

A vigorous, aggressive policy that will enable our exporters to meet and overcome all obstacles abroad whether of a commercial or diplomatic nature.

Revision of laws to clarify them so all manufacturers can know their rights.

COLLECTIVE bargaining is here to stay.—WILLIAM C. REDFIELD, Secretary of Commerce.

YOU can't man the work unless you house the man.—WILLIAM S. MILLENER, Manager, Williamsport, Pa., Board of Trade.

d—Objection to the entrance of the Government into any field of transportation, communication, industry or commerce or any business that can be successfully undertaken and conducted by private enterprise.

e—The extension of banking and insurance under government supervision to encourage foreign trade

f—Development of a policy for protection of American citizens, enterprises and investments abroad to encourage foreign investment and stimulate export trade.

g—Return promptly of the telegraph and telephone properties to their owners.

h—Creation of a federal highway commission, substantial appropriations for construction and maintenance of a national highway system, continued federal road aid to states beyond 1921 and government approval for highway construction only when the roads are of a permanent type.

i—Development of a comprehensive system of waterways to co-ordinate the waterways and railways of the country.

j—Conservation of the water power resources of the United States.

k—Establishment of a national budget, to be compiled yearly and to simplify government expenditures and provide economy.

l—Power to the President to veto any separate items or provisions contained in an appropriation bill.

That the railroads should not be returned to their owners until legislation to safeguard them has been passed by Congress was urged by Walker D. Hines in a comprehensive speech in which he outlined a definite plan for their return. He agreed, he stated, with the other speakers that it is to the best interests of the nation that the railroads be operated under private ownership.

As a permanent solution to the problem he stated that the railroads should have a fair return on the fair value of their property, and this value must be determined before legislation is passed. With 180 railroad companies operating generally at the same rates regardless of cost of operation and with many earning but 2 per cent and others as much as 10 per cent, it is clear, stated Mr. Hines, that the legislation must provide for protection to the weaker road. Mr. Hines analyzed the subject further.

Five propositions in all enter into the railroad problem: First, the absence of standards of rates, etc.; second, the wide disparity between the weak and the strong roads; third, the absence of any point of contact between the government and the private management; fourth and fifth, the public suspicion of over-capitalization and fear of exploitation.

All of these can be overcome by a compulsory consolidation of the railroads into a few large competitive systems with from twelve to twenty combinations in the three great sections of the country, the West, East and South. Each system or combination should combine the strong and weak roads to secure a fair average in the general situation. There should be an official capitalization. There should be arrangements for government representation on the board of each combine. There must be compulsory combination to insure that the stronger roads combine with the weaker ones. A plan of this kind, properly framed by Congress, will allow the return of the railroads to their owners without hardship or loss to the government, the public or the owners.

Union Labor to Stay.

Union labor is here to stay, and the anti-trust laws are antiquated and obsolete and a direct obstacle to the development of American industry, said William C. Redfield, Secretary of Commerce. Business has outgrown the laws intended to control it, he stated. American business of the future will be more co-operative than competitive.

"Nothing is more certain," he said, "than that there has been a great change for the better in the ethics and methods of trade since the anti-trust laws came into being. There are few elements of good in a strictly competitive state of business. If competition is the life of trade, in its extreme form it may also be the death of trade. If we attempt to end monopoly by insisting upon competition we provide that which will itself create monopoly. Laws intended to restrain trade may restrain promotion of trade. There is a new business standard whereby industry and commerce recognize three-fold obligations to the public, to the business itself and to labor, and industry is frankly endeavoring to adjust itself to these and must have government assistance. We cannot keep the new wine of trade in the old bottles of law.

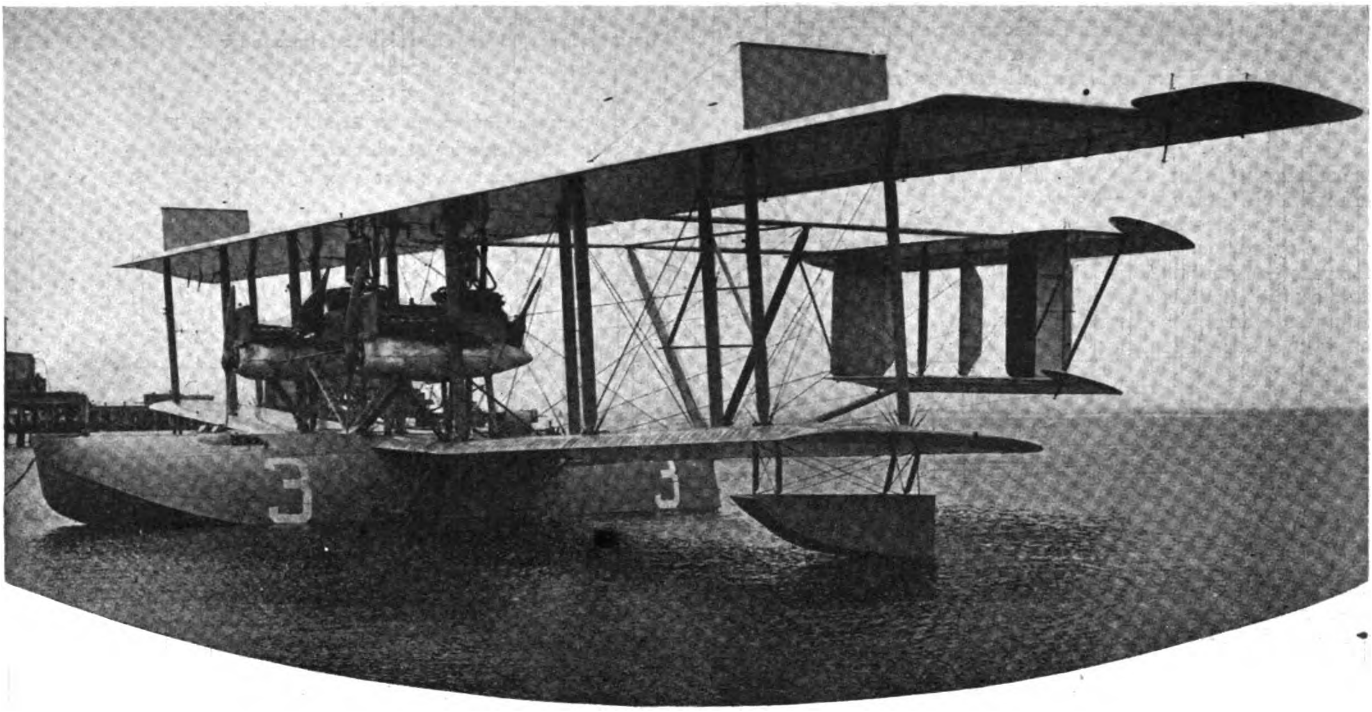
"With the new ethics of trade has come an altered view of labor, now recognized as the fellow servant and not as a commercial commodity. Collective bargaining is here to stay, and a corporation, which is a union of capital, it is now recognized, is no more or less justifiable than a union of labor.

"There is open to us a new course taking advantage alike of the strength of competition and combination and lacking the weakness of both. It is co-operation, within the industry and from the government. We do not have to look very far to see clear signs of the coming of this thing I have called co-operation. The Webb Law

(*Continued on page* 1022)

THE middleman is the specialized distributer of commodities between the producer and the consumer and his function is a product of normal and natural industrial development. He is a necessary link in the chain which reaches from grower or producer to consumer.—DR. W. F. GEPHART, Washington University School of Commerce.

THE war has brought an understanding of the present immediate need of highways development. The co-operation of towns, counties and states to build roads to form a national highway from coast to coast is needed and will be of the greatest advantage to the community as well as the entire country.—T. M. DUFFEY, Indiana Highway Engineer.



Navy Planes Ready for Ocean Flight

Heavy Head Wind Delays Departure—Fire Damage to Two Machines Repaired Within 24 Hours—Technical Details of the Planes

ROCKAWAY, N. Y., May 6—Unfavorable weather conditions prevented the start of the three NC flying boats on the first leg of their transatlantic trip which had been scheduled for early this morning with the proviso "weather permitting." A 30.5 mile an hour wind was blowing, and as it was an almost direct head wind it would have greatly retarded the progress of the machines. The distance of this first stage of the proposed route, to Halifax, is only 540 miles, and with a head wind of 30 miles per hour not much over 35 m.p.h. actual flying speed could be counted on, which would have made the time required for the flight 15½ hr. Commander Towers explained that the center of high pressure, which had been at Chicago, and the eastward progress of which they had counted upon to assist them toward St. John's, the final "jumping off point," had moved with much greater speed than expected and any advantage that might have been gained from it was lost. The decision not to make the start to-day was based not only on the weather conditions at the point of departure, but on weather reports from points all along the proposed route which were received via Washington.

A gasoline blaze in the hangar housing the big machines early yesterday morning came near seriously delaying the start of the enterprise. While some of the enlisted men were filling the fuel tanks of one of the machines some gasoline spilled on the floor suddenly caught fire, and the blaze was communicated to the left-hand wings of the NC-1, which were damaged to such an extent that they had to be replaced. While the blaze started suddenly, and no one seems to be able to give a positive explanation of its origin, the supposition is that a spark produced in the wiring or at the commutator of an electric motor used in pumping the "gas" into the tanks of the planes was the cause. The damaged wings of the NC-1 were replaced by the corresponding wings of the NC-2, a machine that has been used mainly in experimental work and which it was not intended to fly across the ocean. The NC-4 had its tail surfaces damaged by the fire, but the framework of the tail planes was not weakened, hence a repair could be made by simple recovering, which was done with great dispatch.

At dawn this morning the NC-1 was at the water's edge, apparently ready to start off at a moment's notice. The NC-4 was standing some distance back, in the open space between the two immense hangars which have been housing the "transatlantic" planes, and all of its engines were belching flame, evidently undergoing a tuning-up process. The NC-3 was inside one of the hangars and a crew of mechanics was just completing the installation of a new port-side engine, the original engine having developed a loose bearing.

Ocean Flight Planned in 1914

Last night, when it was expected that the start would be made the first thing this morning, one of the newspaper men assembled at the air station put a number of questions to Commander Towers in connection with the proposed trip. To the question as to whether he considered the work in the line of his regular duty, as a patriotic task or as work done in the interest of science, he said that he regarded it as in the nature of special duty. The Navy, which had been planning for the trip since 1914, had launched the enterprise for the scientific and technical data it promised to furnish. Asked as to whether he would want to make a prediction as to the outcome of the trip, Commander Towers said that he had been in the Navy too long to pose as a prophet; however, if the painstaking work of all those who had been engaged in preparing the planes for the long flight counted for anything, the attempt certainly should lead to success.

This morning, just before it was announced that the start would not be made to-day, a telegram was received by

Commander Towers at the Rockaway air station from Secretary of the Navy Franklin D. Roosevelt, reading as follows:

"Congratulations on speedy repairs. The Navy wishes you and your officers and men all success in this first organized effort to cross the Atlantic in air. I wish I were with you. Good luck."

As indicated, three planes have been prepared for the transatlantic flight, the NC-1, NC-3 and NC-4. In this designation NC stands for Navy-Curtiss, the design being due to co-operation between the aircraft engineers of the Navy and of the Curtiss Aeroplane Company, and the machines having been built at the Curtiss experimental plant in Garden City, L. I. Each plane is equipped with 4 high-compression Liberty engines.

The standard crew will consist of five: one commanding officer who will be the navigator, two pilots, one radio operator, and one engineer. An additional member will be carried in the crew of each seaplane as far as Newfoundland, in order that minor mechanical difficulties which might occur in the first part of the trip could be quickly remedied, and, further, to provide a reserve of personnel in case of any sickness among the regular crews, while waiting in Newfoundland for the start.

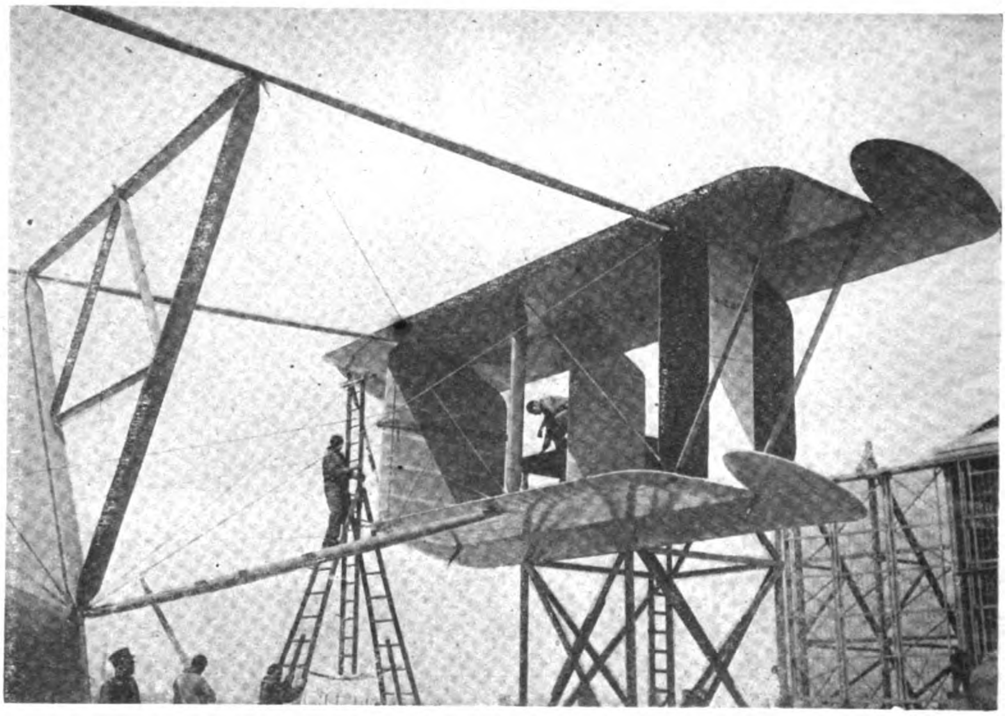
The crews will be as follows:

CREW NO. 1

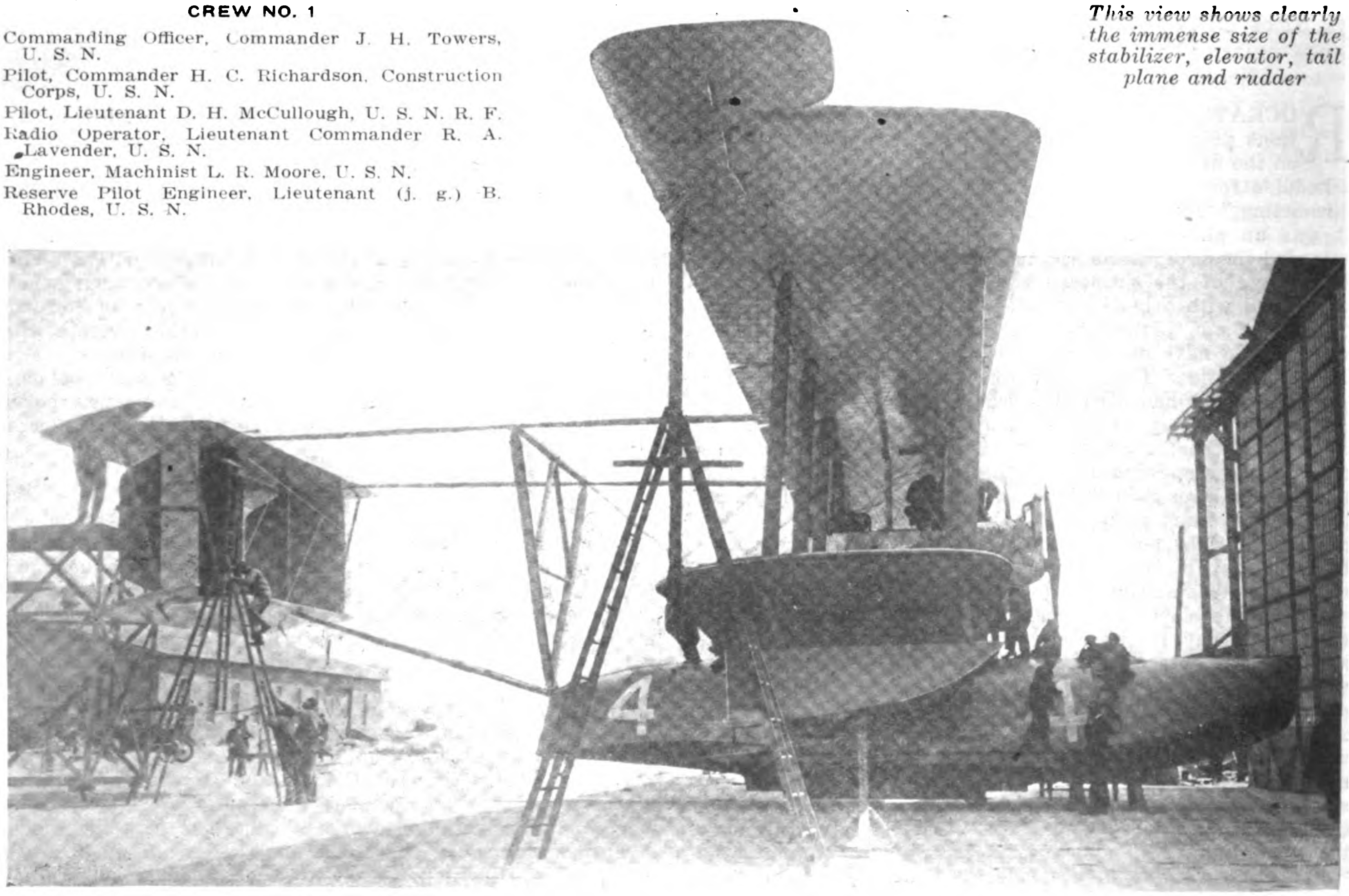
Commanding Officer, Commander J. H. Towers, U. S. N.
Pilot, Commander H. C. Richardson, Construction Corps, U. S. N.
Pilot, Lieutenant D. H. McCullough, U. S. N. R. F.
Radio Operator, Lieutenant Commander R. A. Lavender, U. S. N.
Engineer, Machinist L. R. Moore, U. S. N.
Reserve Pilot Engineer, Lieutenant (j. g.) B. Rhodes, U. S. N.

CREW NO. 2

Commanding Officer, Lieutenant Commander A. C. Read, U. S. N.
Pilot, Lieutenant E. F. Stone, U. S C. G.
Pilot, Lieutenant (j. g.) W. Hinton, U. S. N.
Radio Operator, Ensign H. C. Rodd, U. S. N. R. F.
Engineer, Chief Special Mechanic E. H. Howard, U. S. N.
Reserve Pilot Engineer, Lieutenant J. L. Breese, U. S. N. R. F.

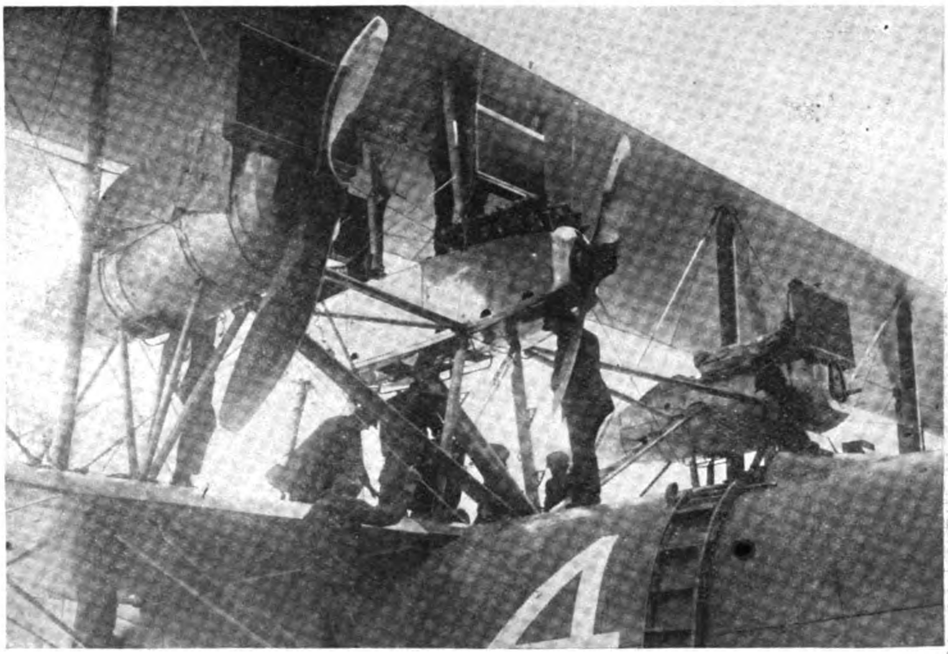


This view shows clearly the immense size of the stabilizer, elevator, tail plane and rudder

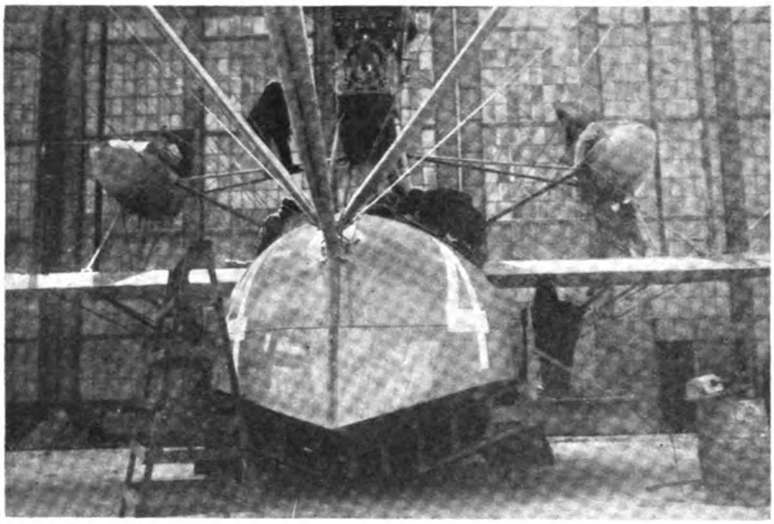


Side view of the NC-4, showing the method of supporting the tail structure from the top wings and hull

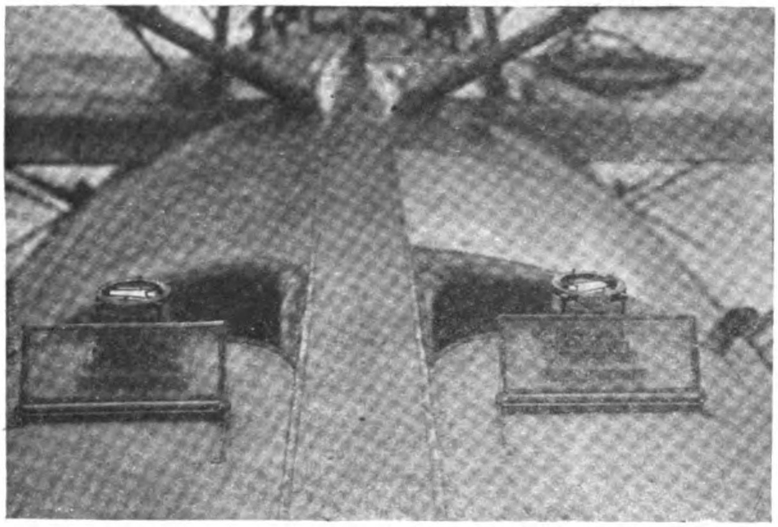
Commander J. H. Towers, who has charge of the whole expedition



The four engines are mounted in nacelles which are thoroughly braced to the wing spars, the hull and to each other



Showing stern end of hull with Vee-shaped keel surface



The two pilots are seated side by side and each has his own compass

CREW NO. 3

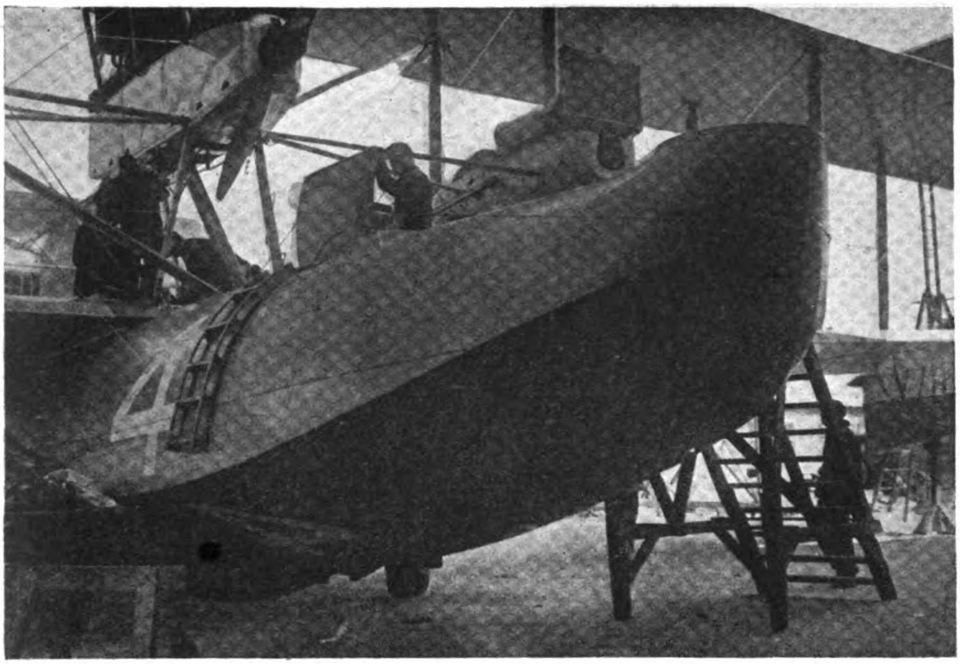
Commanding Officer, Lieutenant Commander P. N. L. Bellinger, U. S. N.
Pilot, Lieutenant Commander M. A. Mitscher, U. S. N.
Pilot, Lieutenant L. T. Barin, U. S. N. R. F.
Radio Operator, Lieutenant (j. g.) H. Sadenwater, U. S. N. R. F.
Engineer, Chief Machinist Mate C. I. Kesler, U. S. N.
Reserve Pilot Engineer, Machinist R. Christensen, U. S. N.

Lieutenant Commander R. E. Byrd, U. S. N., will go in a division commander's seaplane as far as Newfoundland in connection with special navigational experiments, Chief Machinist's Mate E. S. Rhodes will be an extra member of the crew of one of the other seaplanes as far as Newfoundland.

Itinerary of Proposed Flight

As now planned, the trip will end in Plymouth, England, and will be made in five stages. Of this the first stage, from the Naval air station at Rockaway, N. Y., to Halifax, Nova Scotia, measures 540 nautical miles in length; the second stage, from Halifax to Trepassy, Newfoundland, 460 miles; the third stage, Trepassy to Horta, Island of Fayal, Azores, 1200 miles, or to Punta del Gado, Azores, 1350 miles; the fourth stage, Horta or Punta del Gado to Lisbon, Portugal, 750 or 800 miles; the fifth stage, Lisbon to Plymouth, England, 775 miles. The actual transatlantic flight will be from Trepassy, Newfoundland, to Lisbon, Portugal, and no great effort will be made to get to Trepassy as quickly as possible. Whether the stop in the Azores will be made at Horta or Punta del Gado will depend upon weather conditions when these islands are reached. It is figured that an average speed of 65 nautical miles per hour can be maintained, irrespective of wind conditions. Arrangements have been made to have base ships with the necessary gasoline, oil, etc., at the various ports en route, and these ships are provided with special equipment so that refueling can be accomplished quickly.

Some of the chief specifications of the NC boats have already been published in AUTOMOTIVE INDUSTRIES. These machines have a span of 126 ft.



Forward end of hull, showing navigator's pit

from wing tip to wing tip for the upper wings and 114 ft. for the lower, there being a 6-ft. projection of the aileron on each side. The width of the wings is 12 ft.; the gap, 14 ft. at the center and 12 ft. at the outer tips of the lower wings. The overall length from front end to rear end is 68 ft. 3.5 in., while the length of the hull is 44 ft. 9 in.

The weight of the plane, empty, including wireless installation and all navigating instruments, is 15,100 lb., while in flying condition, with full load, the weight is 28,500 lb. This makes the load per unit of wing surface approximately 12 lb. and gives a ratio of useful load to total load of 47 per cent. It is estimated that when carrying full load the boats can develop a maximum speed of 79 nautical miles per hour and at light load 84 nautical miles per hour.

Fuel is stored in 10 tanks, of which 9 are built into the hull and one is in the upper wing above the hull. Each of the tanks in the hull has a capacity of 200 gal., and the gravity feed tank in the upper wing has a capacity of 90 gal., making the total capacity equal to 1890 gal., which is equivalent to 11,400 lb. Disregarding the effect of the wind, this gives a cruising radius of 1476 nautical miles. Lubricating oil to the amount of 900 lb. is stored, and the crew and provisions make up about 1000 lb. of additional load. Each crew consists of 5 men—two pilots, 1 navigator, 1 wireless operator and 1 engineer. The gasoline tanks are of aluminum and the fuel piping is partly of aluminum and partly of copper. The weight of the gasoline system is 6 lb. per gallon of gasoline carried. The engines weigh 825 lb. each and the weight of the empty hull is 2650 lb.

Small Wooden Propellers Drive Gasoline Pumps

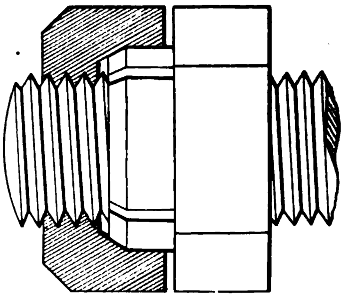
The ailerons have an area of 265 sq. ft.; the stabilizers, 267.6 sq. ft.; the elevators, 240.1 sq. ft., and the rudders, 69 sq. ft. The wing tip pontoons weigh 95 lb. each and have a displacement of 1800 lb. each. Small wooden propellers are used for driving the gasoline pumps, and the electric generator used to furnish current for ignition, etc., is driven by the same means. The gasoline pumps are in duplicate, and in addition a hand-operated auxiliary pump is provided. The current from the generator is fed to storage batteries. In addition to furnishing current for ignition the generator also supplies current for operating the wireless set, a complete lighting system for the interior of the boat and for wing tip and tail lights, as well as for lights for night landing. The wireless operator and engineer are located in the main after-compartment just aft of the gasoline tanks. Each is provided with a complete instrument board and each has a cylindrical upholstered stool, with back rest, weighing 5 lb. complete, within which can be stored the small hand tools required for emergency work.

The pilots are in the hull just forward of the gasoline tanks. Complete sets of instruments are provided, including one compass for each pilot. Flying control is by the dual Deperdussin system, with side-by-side seating. The navigating station is in the front end of the boat hull, and the navigator is provided with a chart board, charts and ordinary navigating instruments, including compass and sextant. A complete wireless installation, including a telegraph, a telephone and a wireless direction indicator, is provided. The sending radius is approximately 300 miles while in the air and 100 to 150 miles while in the water.

The main structure of the hull and wings is of western spruce, and most of the metal wing fittings and structural fittings are of chrome-vanadium steel, with an ultimate strength 150,000 lb. per square inch. All flying, landing and control wires are standard woven aeroplane cord wire. The wings are covered with linen and are treated with the regular fabric dopes. Streamlining forms of Micarta are used on the wing struts, while the landing and flying wires are streamlined with rubber covered with rubberized fabric. The main keels of the boat hulls are of oak or rock elm, while most of the hull structure is of spruce and the planking of spruce or cedar. The turtle back covering is of cedar or of cotton wood-birch 3-ply veneer.

The Drake Lock-Nut

An improved lock-nut has been designed by George F. Drake of San Francisco and is being manufactured by the Drake Lock-Nut Co., Cleveland, Ohio. The illustration herewith shows a cross-section of the lock-nut on a bolt, illustrating its principle and application. It will be noted that there is an ample wrench-hold to turn up the nut and pull the work into place. After this has been done, the upper locking member is turned down, and, the contact occurring on a 25 deg. angle at the top of the boss, which is made flexible by slotting, the lower member is securely locked on the bolt at the point of adjustment first obtained, without transferring the load from the lower member to the upper member.



This is explained by the fact that the two members never contact or seat in a horizontal plane at the bottom or top of the boss. The seat or contact occurs on the annular bevel at the top of the boss, and the interior annular bevel in the upper member. The bevel being 25 deg. (and in larger sizes 20 deg.) the radial component of the pressure between the two members will be much greater than the axial component. This results in the flexible fingers of the lower member locking on the bolt without transferring the load already hanging there.

In screwing the lock-nut in place, the corners of the "hex" can easily be matched up. The total height of the Drake lock-nut is said to be equal to that of a standard nut with check-nut. These lock-nuts are made in ¼ to 1-in. S. A. E. sizes, and ¼ to 2-in. U. S. S. sizes.

What Detroit Is Doing To Solve the Housing Problem

Serious Shortage of Homes Is Causing Excessive Labor Turnover—A Situation That Has Become Critical—Community Housing Corporation Organized

> **Detroit's Housing Problem**
>
> *A present shortage of 30,000 houses. Rooms and apartments almost unobtainable.*
>
> *Rents 50 per cent or more higher than a year ago.*
>
> *Labor turnover at high-water mark.*
>
> **What Is Being Done**
>
> *Community housing corporation organized.*
>
> *Many manufacturing concerns undertaking exterior building operations.*
>
> *Investigation of rent profiteering.*

SO serious has the housing situation in Detroit become that the city commission, the banks and the big industrial companies are uniting in a vigorous housing campaign. Thousands of houses must be built this summer and rent profiteering must be abolished if the manufacturing interests of the city hope to keep the workingman content with his job. The labor turnover in every plant is reaching a new high mark and is now greater than at any time in the city's industrial history. This, employment officials declare, is more directly due to the home shortage than to any other cause. Hundreds of workers, unable to find proper abode near the scene of employment, are obliged to live from 6 to 10 miles away, and it is only natural, as employment agents point out, that they quit to take jobs in factories nearer home, whenever they get the opportunity.

The Detroit Real Estate Board estimates that there is a shortage of 30,000 homes. Even the rooming houses and hotels are full. One of the larger hotels, which has been in receivership, has just petitioned to have the receivership removed inasmuch as profits during the last few months range from $10,000 to $15,000 monthly. Hundreds of men are spending all of their spare time looking for houses or flats without result. Rents on single rooms run from $4 to $10 a week. It is almost impossible to get a furnished three or four-room apartment for less than from $12 to $15 weekly, while unfurnished homes and apartments range from $50 a month up. It is estimated that these prices are nearly 50 per cent higher than two years ago.

In direct contrast are conditions at Windsor. While the Canadian city is also suffering from a home shortage, rooms are renting at $2.50 and $3, apartments at from $5 to $10 weekly, while homes and flats are going at from $30 to $35.

It is this situation that is causing Detroit to act to secure immediate relief. While the housing problem is a serious one in every manufacturing center in Michigan and Ohio, in Detroit it has already become critical. Detroit proposes to organize the Community Housing Corporation to finance the construction of 10,000 homes at once. General Motors Corporation will build approximately 2000 dwellings, while Henry Ford is continuing his house-building campaign, both at Highland Park and at Dearborn, on a greatly increased scale. The Gemmer Manufacturing Co., the American Blower Co., the Canadian Bridge Co., D. M. Ferry Seed Co. and the General Necessities Co. are but a few of many companies which propose to build at once.

Mayor James Couzens, former partner of Henry Ford, urges that the Community Housing Corporation conduct its building work on a great enough scale to cover the entire shortage this year. A committee has been appointed to formulate preliminary plans. A. A. Templeton, president of the Board of Commerce, is chairman of this committee. No decision has been reached on its proposed capitalization, but this will be between $10,000,000 and $30,000,000. This capital stock will be absorbed by the large employers of labor. By this arrangement Detroit hopes to centralize its building activities. It is pointed out that the success of the plan hinges on the willingness of large employers to take their profits, not from the actual construction of homes but from the benefits accruing from more contented workmen in homes of their own. The business will be conducted upon a margin of profit just sufficient to furnish a safe surplus.

If the corporation undertakes the construction of only 10,000 homes, an expenditure of at least $30,000,000 faces the proposed organization. It is argued that a $1,000,000 corporation, or even one with a capital of $5,000,000 or $10,000,000 without some rotating plan based on marketing of mortgages, land contracts or securities representing it, would soon have its entire capital tied up in construction.

For this reason a second organization, the Community Housing Mortgage Corporation, will be formed with a capital stock of $1,000,000 to engage in buying, selling and otherwise dealing in mortgages and land contracts and other securities arising directly and indirectly from the activities of the Community Housing Corporation. These activities would include dealing in securities, which, not being exclusively the product of the housing corporation, could not be legally handled by that corporation under existing Michigan laws.

The management of the corporation will be placed in the hands of a commission of 15 members, which will select the officers. The new organization will be patterned somewhat along the lines of the Bankers Commer-

cial Securities Corporation, New York City, and the Continental Guaranty Co. of New York and Chicago, both organized by large banking interests in those cities. They have sold more than $60,000,000 worth of collateral trust debentures.

An Investigation of Rent Profiteering

In the meantime, while these two corporations are being organized to bring the city housing relief, Mayor Couzens is conducting an investigation into exorbitant rentals in Detroit. He has a committee at work and a great deal of data is being collected. He is also going deeply into the legal phase of the affair and is threatening criminal action in certain cases.

There was practically no building work to speak of during the war period. Since the armistice and up to the present time, building operations were greatly curtailed because of the high prices of lumber, steel and other contracting and plumbing supplies. It has just been within the last two months that construction work of all kinds began in earnest. Detroit is just one year behind and nearly every other city in the country is in the same fix.

Industrial conditions here are nearly normal now. There is a demand for nearly everything manufactured in this city and the demand is going to keep the concerns pushed to the production limit for months to come. There is now a shortage of labor. Some companies are already advertising for men in other cities. If the manufacturing situation continues, it will be necessary for the Board of Commerce to conduct an extensive advertising campaign to bring labor to Detroit, and with labor urgently needed, Detroit is facing the extended problem of housing these additional men. There is plenty of work in Detroit but there are no houses and the warm days are going to cause hundreds of tents and temporary abodes to spring up in all the manufacturing districts of the city.

Banking Interests to Assist

The banking interests are now awakening to the true situation. They are relaxing from their "safety first" policy which practically barred a workingman from securing money to build a home. Before the war it was possible for a trustworthy man to go to a bank and receive financial aid. Until a few weeks ago this practice was greatly curtailed. Uncertain business conditions, the unsettled affairs of the peace conference and the high cost of materials, etc., caused the banks to become more cautious than usual and the worker who sought an initial payment for a home was usually asked to wait until mid-summer.

Even the contractors had a hard time getting financial aid. In many sections of the city one will find excavations complete and foundations finished for new homes. Work, however, has apparently been suspended for several months. Investigation usually reveals the fact that the contractor had accepted an initial payment from the prospective owner and started the work, hoping to secure the rest from the bank. When more cash was required, the contractor found that his bank was opposed to financing the project under existing conditions. Thus work stopped until such a time as the money would be available.

There is no question but what the home shortage is hitting industry hard. Men are leaving Detroit in large numbers because there is no place here for their families. Every employment agent in Detroit is thoroughly alive to the situation and the co-operation of the big industries in the proposed municipal housing project is genuine.

What the Gemmer Co. Has Done

The Gemmer Manufacturing Co., maker of automotive parts, is one of the most progressive firms in handling the housing situation. This company, employing 500 men, determined upon the policy of every employee owning his own home, nearly one year ago. It has been pushing the project and aiding its men in every way since. Its method of doing this is being used as a model for other companies.

This company has no set building fund. It merely arranges with its bank to provide Gemmer workingmen with the necessary capital and the company itself guarantees the bank sufficient security to cover the loan. This progressive policy has not cost the company a cent. The company will even go so far as to get the cash for the employee when his personal efforts in this direction might fail. The company works its building program through the Society of Savings, the organization of the Board of Commerce and through the Detroit Real Estate Board. Practically every married man in the Gemmer company's employ owns or is contemplating owning his own home.

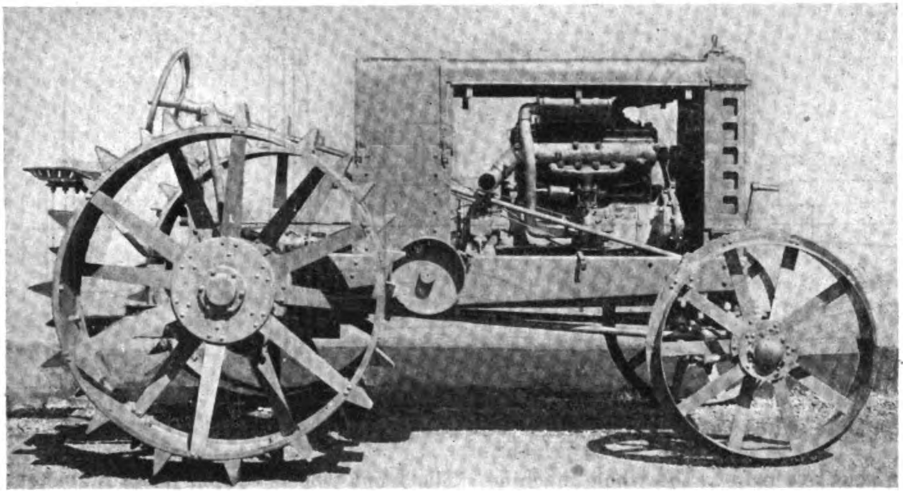
At Lansing, Flint, Pontiac and Saginaw conditions are also very bad. The General Motors Corporation is greatly relieving the situation in these cities by its housing program, which calls for the building of hundreds of homes in each place. Akron, O., the rubber center of the nation, has a great home shortage. The situation here is almost as critical as in Detroit. Hundreds of men are walking the streets and sleeping wherever they get a chance. Even single rooms are at a premium. The city has brought 700 contractors in from Philadelphia and a huge building project is under way. It is estimated that at least $10,000,000 worth of new buildings will be required in Akron alone.

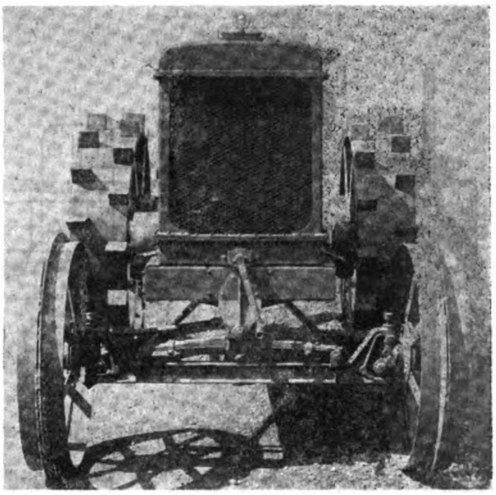
Martinsyde Airplane for the Transatlantic Flight

Major Morgan, who will pilot the Martinsyde across the Atlantic, in conversation with two rival pilots. The photograph was taken at St. John's, Newfoundland

Champion Tractor an Assembled Product

Components Comprise a Buda Engine, Fuller Transmission and Chicago Rear System—Designed with a View to Elimination of Unnecessary Weight and Ready Accessibility of Parts





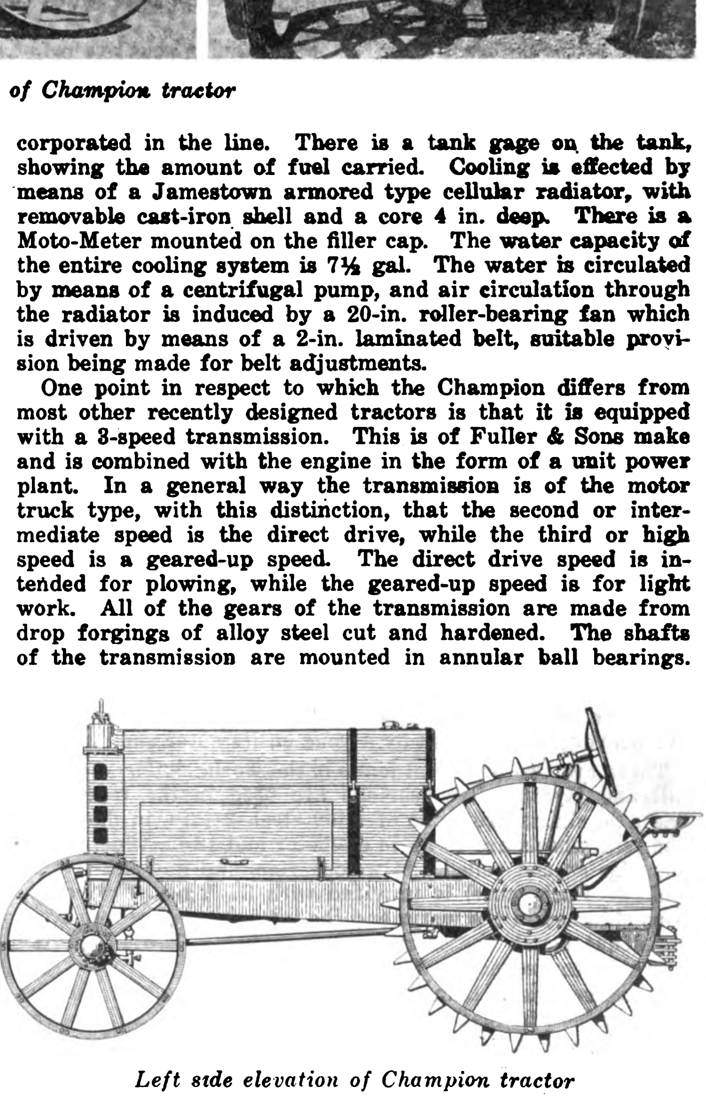
Side and front views of Champion tractor

THAT it is now possible to assemble a farm tractor complete from parts offered in the market is proved by the example of the Champion tractor, which made its debut on the market at the Kansas City tractor show. This machine is the product of the Champion Tractor Co., Argo, Ill., and is manufactured from designs by Reed & Glaser, Indianapolis. Elimination of surplus weight and the possibility of removing any unit without disturbing adjacent ones have been some of the main objects aimed at by the designers. Practically all of the units are manufactured by firms which have established a name for themselves in related industries. All shafts are mounted on ball or roller bearings, and the bearings used are said to be of very liberal size for the loads they have to carry. All of the wearing parts are completely enclosed, and the tractor as a whole is of simple and clean-line design. It is quite light in proportion to the power it is capable of delivering on the drawbar.

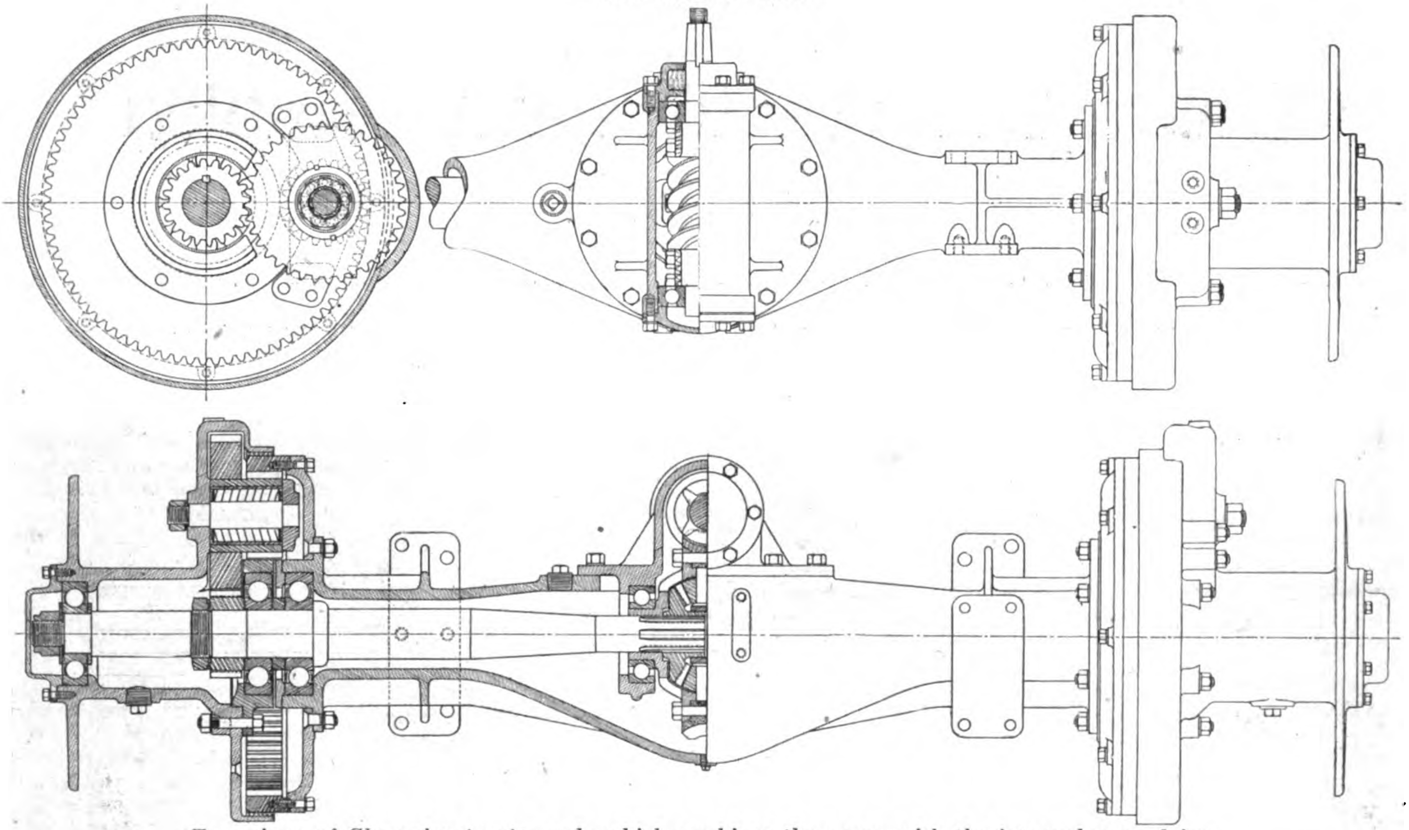
A Buda 4-cylinder special tractor type of engine is fitted, with a bore and stroke of 4¼ x 5½ in. respectively. It is unnecessary to go into the details of construction of this engine, as a full description has appeared in a former issue of AUTOMOTIVE INDUSTRIES. Suffice it to say that the engine is provided with a Pierce automatic governor which maintains a constant speed of 1000 r.p.m.; it delivers from 29 to 32 hp. on the belt, while the drawbar horsepower attains a maximum value of 17½, and a constant value of 14 can be depended upon. There is full force feed lubrication to all engine bearings, from a gear type pump which produces a pressure of 30 lb. The total weight of the engine, including the regular equipment, is 800 lb.

The tractor exhibited at Kansas City was designed to burn gasoline, though the Buda tractor engine will also handle kerosene. A Carter vertical 1¼-in. carbureter, U. S. A. type, is fitted and connects with the gasoline tank of 26½ gal. capacity. The fuel tank is located back of the engine space and is of such form as to continue the outline of the bonnet. All air drawn into the carbureter is passed through a dry type enclosed air cleaner. Fuel is fed from the fuel tank to the carbureter by gravity, a fuel strainer being incorporated in the line. There is a tank gage on the tank, showing the amount of fuel carried. Cooling is effected by means of a Jamestown armored type cellular radiator, with removable cast-iron shell and a core 4 in. deep. There is a Moto-Meter mounted on the filler cap. The water capacity of the entire cooling system is 7½ gal. The water is circulated by means of a centrifugal pump, and air circulation through the radiator is induced by a 20-in. roller-bearing fan which is driven by means of a 2-in. laminated belt, suitable provision being made for belt adjustments.

One point in respect to which the Champion differs from most other recently designed tractors is that it is equipped with a 3-speed transmission. This is of Fuller & Sons make and is combined with the engine in the form of a unit power plant. In a general way the transmission is of the motor truck type, with this distinction, that the second or intermediate speed is the direct drive, while the third or high speed is a geared-up speed. The direct drive speed is intended for plowing, while the geared-up speed is for light work. All of the gears of the transmission are made from drop forgings of alloy steel cut and hardened. The shafts of the transmission are mounted in annular ball bearings.



Left side elevation of Champion tractor



Two views of Champion tractor axle which combines the worm with the internal gear drive

Control of the different speeds is on the sliding selective principle, through a ball-handled vertical lever convenient to the driver. The clutch is of the dry disc type, 11 in. in diameter and is entirely enclosed. It is controlled by the usual foot lever and is normally in engagement. From the transmission the belt drive is taken off. The belt pulley is 12 in. in diameter, with 6 in. face, and the belt speed is 2600 ft. at 850 r.p.m. of the engine. The pulley is located on the right-hand side of the tractor.

It is in regard to the final drive and the rear axle construction that the Champion tractor differs from most others now on the market. There is a double reduction of speed, the first reduction being through a worm and wheel and the final reduction through a spur gear mechanism. A live rear axle is used, and all of the driving gears are completely enclosed. The number of reductions is four when driving on the high gear, three on the plowing speed, four on low and four on the reverse. The reduction ratios are as follows: High, 33.76:1; second, 57:1; low, 97.58:1; reverse, 154.98:1. From the sectional views herewith the arrangement of the final drive can be clearly seen. The axle shaft carries a spur pinion at the inner side of the wheel hub. This pinion meshes with the larger one of two adjacent spur gears mounted on a stud secured into the inner hub flange of the driving wheel. The smaller one of the spur gears rolls on a stationary internal gear carried by a circular plate bolted to a flange on the axle housing. The two planetary spur gears are mounted on a Hyatt bearing and the stud carrying this bearing is supported by a yoke on its outer end.

There are two universal joints in the worm shaft. Annular ball and Hyatt roller bearings are used in the rear axle. The axle shafts are made of alloy steel, 2½ in. in diameter. The rear wheels are 48 in. in diameter and 12 in. wide. They comprise special rolled and welded rims and flat, hot-riveted spokes. Each wheel is provided with 30 lugs. The reductions obtained in the worm and the internal gear respectively are about equal, the worm reduction being 7.75:1 and the internal gear reduction 7.5:1.

A pressed steel channel section frame is used, the channel side members increasing in depth from the front to the rear and fastening at the rear end to lugs on the rear axle housing. The use of this frame permits of removing the transmission and the engine bodily from the tractor without dismantling the whole machine. The front wheels are 32 in. in diameter by 6 in. width of rim and are also of the built-up type. Steering is effected by means of a large hand wheel through a Wohlrab worm and nut irreversible mechanism.

The wheel base of the Champion tractor is 80½ in. and its tread at the rear is 58 in. The total width is 70 in. and the total length 130 in. The front axle, which is of I section design, is braced to the frame by two long radius rods which have a ball joint at the forward end of the transmission casing. The frame is supported upon the front axle through the intermediary of a semi-elliptic spring, which is provided with oblong eyes at both ends so as to provide for the necessary spring play without the use of shackles.

The drawbar hitch is adjustable both laterally and up and down. To the rear end of the platform is secured a bracket with a number of rearwardly extending superposed lugs, between any two of which a transverse bar can be placed. Concentric holes are drilled through all of the lugs, and a pin can be inserted to hold the crossbar in place. This crossbar is drilled with a number of holes along its length which provide for lateral adjustment of the hitch.

The total weight of the Champion tractor is 3190 lb. It is designed to handle three 14-in. plows and a 24-in. thresher.

Roberts Priming Cock

THE Roberts Brass Mfg. Co. has brought out a dustproof priming cock which is very similar to other priming cocks except that the handle, which is a stamping, has a small circular cover plate integral with it. This is twisted over so as to cover the top of the priming cup when the cock is closed. This prevents the settling of dust in the cup and is sold for use with automobiles, motorcycles, trucks, tractors, motor boats, etc.

Fuel Limitations of Tractor Engines*

Methods of Overcoming Common Tractor Engine Troubles Pointed Out in Review of Design

By H. L. Horning

Chief Engineer, Waukesha Motor Co.

FOUR-CYLINDER tractor engines seem to be rapidly becoming standard. There is a slight increase in the use of overhead valves, but the L-head cylinder is the most popular. Ford, Overland, Maxwell, Studebaker, and Dodge cars are greatly in the majority on farms, and farmers are familiar with this type of engine. Tractors are not built for nor operated by engineers, and many elements of design in a tractor for use in the next five years must be determined from an economic viewpoint. Besides, it can be shown that with the knowledge we now have a very close, if not equal, result in power and economy can be obtained with an L-head as with a valve-in-the-head engine for truck and tractor use, within the limits of 90 lb. m.e.p. and 0.62 lb. fuel consumption per horsepower-hour at speeds within 10,000 r.p.m.

Tractor Forms—Tractors vary considerably in form and design. There are four general types of tractors:

A—Automobile type, of which Ford, G.M.C., Heider, R. & P. are representative.

B—Cross engine type, of which the Huber, Parrett and Case are representative.

C—Special purpose type, of which Holt, Best, Cleveland, Trundaar, Yuba, Bullock are types of the Caterpillar forms, while the La Crosse and Bates Mule, together with other unique forms, particularly designed for certain service form the others of this class.

D—Farmer type, such as Gray and Nilson, many of the International, Avery, E. B. models are built on the basis of long field experience, and give general satisfaction.

Engine—Four-cylinder, vertical, L head.

Transmission—Four speeds, three forward and one reverse.

Method of Propulsion and number of wheels—Four wheels.

Service Problems with Relation to Fuel

It is unnecessary to go into engine design, as there are many engines giving fair success. It has been thought advisable to deal at length with the list of troubles with engines which have been found to demand the greatest amount of attention from the farmer.

The list below is taken from an investigation by the Department of Agriculture, covering 2179 reports.

TRACTOR-ENGINE TROUBLES

Magnetos	299
Spark plugs	110
Carbureters	104
Bearings	80
Cylinders and piston rings	61
Valves and springs	43
Lubrication	29
Starting	28

We will now proceed to consider each of the foregoing from a broad standpoint, and to particularly point out the relation of fuel to these difficulties.

Magnetos—There is no doubt that magnetos are liable to troubles which are due to the conditions of tractor service in which this beautifully made device is expected to stand out all winter or through April showers and function immediately on demand of the careless owner. With present fuels it is difficult to ignite the mixture, owing to defects in carburetion. A number of tests show that with present systems of carburetion as much as 20 per cent of the fuel fails to contribute to the power output. This loss affects the results through rapid coating of spark plugs with the carbon of incomplete combustion. Magnetos do not benefit any more than the motors generally from carbon coating and short circuit of the plug. Reports of service men indicate that magnetos are often blamed for conditions arising from carbon deposits in the cylinders.

Spark Plugs—Closely related to magneto difficulties are those in which the spark plug is involved. When we are told that upward of 100,000,000 spark plugs are sold annually, we realize the difficulties which present engine construction and the necessity of using low grade fuels impose upon the spark-plug manufacturer. Generally speaking, a spark plug in a tractor engine is seldom exposed to the temperature stresses of an aviation motor, and yet one of the controlling factors of power production in tractor engines is the preignition of the mixture due to high spark plug temperatures. This, of course, applies to the electrodes which attain high temperatures. Present fuels contain heavier elements which have end points from 367 deg. Fahr. upward, and these break down easily. Good designing may eliminate preignition largely, but fuel limitations cause many of the objectionable spark plug difficulties discussed under the heading of detonation. While the tractor spark plug with poor designing of cylinders with respect to water circulation is prone to cause preignition, yet many plugs run too cool, which prevents the burning of the inevitable carbon deposits and, in fact, very much favors the formation of carbon. One of the most important points in the design in a tractor motor is the location of the spark plug. The general considerations are as follows:

Summary of Spark Plug Requirements

1. The plug should be located as near as possible to the center of gravity of the mixture in the combustion chamber when the mixture is about to fire.
2. It should be so located as to be out of the exhaust gas stream.
3. It should be so located as to get the blast of this incoming rich mixture, or in such a place as will insure that the mixture surrounding the electrodes will be highly explosive and not deadened by residual charge.
4. The cooling water stream which has picked up a large volume of heat from the exhaust valve environments usually insures temperature enough to keep a good clean plug and cooling effect that will keep preignition out of the probabilities.
5. No cylinder head should be designed which will demand a long spark plug so as to reach the mixture.
6. A vertical spark plug is the only type which runs a long time without cleaning. In a valve-in-head motor the spark plugs must be placed at an angle in the head, and this is one of the inherent defects of this motor, as the oil cannot drain as well from a plug so located as from a vertical one.
7. The plug should not be placed so as to get the direct sweep of gases passing by the piston and rings on the suction stroke.

The above observations are particularly for the guidance of the engine designer, who must also bear in mind that the motor must work irrespective of where the farmer buys his plugs. Should the user desire advice as to the type of plug, it is only necessary to observe the following points:

*Paper read before Detroit Section Society of Automotive Engineers, April meeting. Condensed.

A. The insulator should be of the best grade of porcelain or stone now available.

B. The center electrode should be at least 3/32 in. in diameter, well smoothed off, rounded, and the distance from its tip to the outside air a minimum. Cooling ribs are very desirable. No sharp corners or points should be presented to the combustion chamber.

C. It is not so easy to give general specifications for a good mica plug, although there are many good ones. As a class they are to be avoided.

Aside from temperature problems, the greatest difficulties with spark plugs arise from the deposit of carbon. Excessive lubrication in the combustion chamber may result from heavy fuel and further favors the short-circuiting of the plug with oil and carbon.

Carbureter Problems

Whatever the shortcomings of carbureters under other conditions, there is no doubt that they must stand some real maltreatment for any and all trouble symptoms on the truck and tractor. The continual fussing with carbureters in and out of adjustment is responsible for the wide range of results obtained.

The gradual increase in the boiling temperature of the heaviest fraction in the fuel is imposing a difficult problem on the engineer and is also the cause of frequent and sometimes unnecessary adjustment of carbureters. Fuels differ widely, as will be shown in a later part of this paper, running from the light, easily vaporized fuel entirely within the range of modern gasoline carbureters and vaporizers to way beyond what can be handled. As a matter of fact, it is easily demonstrated that the average engine actually returns useful power from only 80 per cent of the fuel. Whatever may be the normal losses to the radiator, exhaust, friction horsepower, radiation, etc., in a modern engine burning a perfect mixture, one-fifth of our gasoline with an end point of 450 deg. cannot be burned in our present engines. We have demonstrated that it is commercially possible to increase mileage 50 per cent in many cases where mere vaporization is substituted for metering and fixing.

The name carbureter became a misnomer when the end point of gasoline exceeded 30 deg. Fahr. Present fuel specifications call for 50 per cent of fuel to come off under 302 deg. Fahr. All over 60 per cent presents a serious problem in vaporization.

Carbureters as commonly made to-day consist of four valves, using the term valve in the broadest sense as a means of controlling flow: 1—A needle float valve for maintaining a constant level of fuel; 2—A fuel valve or valve supplying the fuel in definite quantities; 3—An air valve or passage supplying air in response to the engine demand and in most systems regulating the fuel flow; 4—A heat valve, broadly speaking for the purpose of supplying a sufficient quantity of heat to vaporize that proportion of the fuel which lies beyond the 302 deg. Fahr. point and which is not properly vaporized by common carbureter and intake passages.

Modern carbureters are either devoid of the heat valve or have only rudimentary and inadequate means of thoroughly vaporizing the fuel. Herein lies the hope of our immediate future. No firm will be successful that cannot supply adequate heat control. By far the greatest number of our engine difficulties from fuel characteristics arise out of the simple necessity of a properly vaporized fuel.

Supplying Heat to Fuel Mixture

The heat may be supplied in many ways. The valve referred to may consist of a thin membrane to conduct heat of water or exhaust. It may consist of a thick-ribbed section. It may consist of ingenious heating of the air or fuel or both, or a combination of many heat devices; but whatever it is, fuel must be vaporized and the operator must have control of the flow of heat to the fuel.

Manograph charts of common designs indicate a vast change in mixture composition from one explosion to the other. One explosion varies from another as night and day. Preignition, rapidity of initial ignition stages, variable explosion lines, detonation, multiple combustion, incipient combustion, late temperatures and pressures all alternate with good combustion effects.

One investigator has shown in working out a temperature control that a change of 8 deg. Fahr. in the neighborhood of the correct temperature (which I am not at liberty to give to you) makes a difference of 20 per cent in economy. The Bureau of Standards, working with a highly ingenious device for measuring flame propagation in the cylinders of a Liberty engine, finds that flame propagation varies from one explosion to another in the ratio of 1 to 7. Beyond these citations many practical evidences point to the fact that the fundamental defect of our present practice is lack of vaporization, hence heat control.

The foregoing remarks refer to the indefinite fuel known as gasoline. The art of vaporizing kerosene is still in an undeveloped state, and we fail in handling kerosene for the same lack of a better understanding as to how to prepare the mixture.

No mention has been made of the limitation of fuels due to chemical compounds of such instability that they will not stand the destructive effect of the heat and pressure developed in the first stages of combustion.

The explanation of considerable deposits of carbon in the cylinder and of the gas knock known as "pink" preignition, etc., generally most noticeable at the bottom of a hill, upon the sudden use of the accelerator or at overload, so called, is fuel composition. This will be dealt with under the heading of fuel, but is mentioned here as one of the limitations of fuels which can be distinctly reduced by proper vaporization methods.

Bearings and Lubrication

Nothing can take the place of design and good workmanship in bearings, nor can lubricating oil be expected to cover the defects of a bad system of lubrication.

The common method of lubrication is splash, in which the level is established by overflow dams. Another form—and the most reliable—is the splash system in which the oil level in deep troughs is maintained correct irrespective of the inclination of the engine. The oil-pump capacity in pumping the oil into the troughs is just equal to the capacity of the scoops to throw the oil out. Inasmuch as the oil pump capacity varies as the speed of the engine and the rod scoop capacity varies, the level of the oil is always assured and constant.

Force feed through hollow crankshaft is a well-known and high-class system. It has not been widely adopted because of the difficulties with leakage of oil under pressure both past the piston and rings and at the crankshaft and because of the unusual workmanship required for the pressure maintenance. In both the above-mentioned systems old oil is pumped over and over, and this leads to bearing troubles with tractor engines.

Defects of Lubricating Oil

Lubricating oil is little understood even by the refiners. Most tractor oil is so loaded with the heavier portions that under high pressure and temperature under the piston heads and walls it breaks down into lighter oils, carbon and tars. Added to this, many engines suffer from dirt, dust and sand which enter either at the carbureter or breather. Taken together, the oil in the crankcase of an engine in use for a month with either the splash or common force-feed systems is usually a bad mixture and entirely unfit for lubrication uses.

With the force-feed system unusual care must be taken to strain and settle all grit or dirt out of the oil, or it will cause unusual damage to journals and bearings. No such care is necessary with the splash system, as it seems to develop the least difficulties with dirty oils. With clean oil well filtered in use and an oil of good body, the force-feed system works exceedingly well so long as the bearings are in good adjustment. A surplus capacity of oil must be available at all times, so one or more bearings in a loose condition will not starve other bearings. Unusually good piston and cylinder fit must prevent overrolling of cylinders when rod bearings are loose.

The ideal system, if expense and care are no object, is the

force feed of fresh oil to crankshaft bearings and cylinder in exact quantities. So far as results are concerned on the surfaces, bearings lubricated by this method are not only the most economical in oil consumed but also insure the longest life to both journals and bearing surfaces.

This brings us to the effect of heavy fuel on the bearings of tractor engines. Incomplete vaporization leaves heavy fuel unburned, incompletely burned and decomposed on the walls of the cylinder and combustion chamber. Under the action of high heat the fluid residue flows down the cylinder and past the rings through the oil drain holes so commonly used into the crankcase.

The products of complete and incomplete combustion found in crankcase oil range in hydrocarbons from formaldehyde to sugars. They include acetone, alcohols, serghums, formic acid and a list of disinfectants varying in constitution according to the circumstances of combustion. This mixture, taken together with the solid contents mentioned above, constitutes about the worst lubricant a cylinder and bearings could have. The lower crankcase is the catchbasin for the byproducts of the imperfect combustion process. It is the main sewer for decomposing body fillers of our poorly compounded lubricating oils. It is the settling basin for steel, iron and bearing particles which slough off into the lubricants, and the crankcase with its oilpan forms the dustpan of the self-appointed air cleaner which duty every engine takes upon itself. Taken from an unbiased standpoint, have not engineers in tractor engines of to-day finally arrived at about the worst lubricating conditions possible? Is there any device which would permit more fuel to get into the lubricant than our present design of oil scraper pistons? The man was a great philosopher who said, "Tractor engines work in spite of the designers and users."

Effects on Journals and Bearings

The heavy fuel and byproducts of combustion seem to have bad effects on steel journals and bearing materials. In England some practical men, and engineers as well, consider an engine "done for" if it is once thoroughly saturated with some of the fuel compositions.

Economic factors impose the splash system and its most thoroughly worked out form as being a good standby under all circumstances. Most men understand it best, or, to be frank, pay least attention to it. As an all-around system it takes care of itself better than any other. The ideal system of fresh oil to all points is perfect, theoretacilly, but the complication and details, together with thickening of oil in cold weather, make it hard to introduce. The force feed through the crank will become widely used when manufacturers and users know more about it.

Bearings suffer under heavy fuel conditions due to the high pressure of detonation and preignition. Preignition can be controlled by design, as will be noted under Cylinders, Pistons and Rings. Both preignition and detonation are limiting factors of our modern fuels.

It is not possible to state which of the two evils is the most detrimental to the bearings, the dirty condition of the engine crankcase or the detonation pressure.

In closing these remarks on bearings it is well to call attention to the increase in bearing troubles with decreasing fuel quality and the increasing fuel and waste product content of lubricating oil since using the pistons with lubrication drain holes.

Cylinders, Pistons and Rings

An ideal combustion chamber would be a sphere with a uniform wall thickness, of uniform temperature as high as possible without causing decomposition of the fuel in use. Practical considerations make such a combustion chamber not attainable at present.

Heavy gasoline and kerosene and fuel made by cracking processes ranging in boiling points from 302 to 575 deg. ignite at lower temperatures than better gasoline. Under stress of temperature and pressure they detonate after the initial explosion. The preignition is lost work and is damaging to the bearing. Preignition may be the one cause of detonation.

The ideal for which we have all been striving is the burning of all fuel down to heavy kerosene and even beyond by designing all the apparatus involved so as to prevent preignition, detonation and breaking down of the fuel; this to be accomplished without water, special fuels or admixtures, with a fuel consumption approaching that with the best gasoline and with a minimum loss of mean effective pressure.

To measure progress we have set up a yardstick of performance, using the ratio of fuel consumption per horsepower-hour to the brake mean effective pressure.

In burning heavy fuels the greater the heat application the better the economy figure. The greater the heat the less the brake mean effective pressure. All devices attempt to keep horsepower output to as near the gasoline output as possible by supplying a minimum of heat to the incoming mixture. You will note that great economy usually goes with low mean effective pressure.

By thoroughly vaporizing the kerosene in the manifold, it is possible at this time to get within 10 per cent of the present gasoline horsepower; to get equal fuel economy with gasoline. Using the same principles it is possible to improve gasoline economy by more than 20 per cent.

It has long been known in the art of coal-gas making that combustible hydrocarbons formed under the high temperature conditions of the gas retort have such stability under heat that considerable heat energy is necessary to break them down or to change their atomic structure. Such fuels act with clean combustion lines. Compression pressure reaching far beyond anything used in practice to-day results in no preignition detonations and in increased horsepower outputs. Such fuels have the benzol ring as their base and range down to naphthalene and anthracene. A mixture of these with ordinary gasoline or kerosene will eliminate the knock at good compression, even when the proportions of benzol and derivations are low. In motors of poor design where knocking is common a much better horsepower can be obtained with these stable fuels.

Whether it is possible to produce fuels stabilized by the ring compounds is an economic problem which is now receiving the attention of the best business brains of this industry.

Fuels are now being produced by cracking and other processes which bid fair to meet some of the demands for better and lighter fuel.

Hot spots in the cylinder cause the greatest trouble with modern fuels. Cylinder walls, pistons and rings suffer owing to the poor vaporization of fuel. The heavier constituents of the fuel mix with the lubricating oils which pass upward, thus reducing their viscosity and lubricating value. Dirt, dust and carbon on the cylinder wall all reduce the life of the piston, ring and wall surfaces. Aside from better vaporization there is room for great improvement in piston and ring design. Piston design offers about the only chance of keeping down the combustion-chamber temperature.

Valves and Springs

Poppet valves are always a problem. Heavy fuels cause trouble at this point because of their imperfect vaporization. Most valve troubles are due to carbon deposits, warping of cylinders and improper water circulation. It would be a great aid to the maintenance of good compression and valve seating if the valve could be positively revolved. Valves are damaged because of the unequal heating of the seats and stem. Revolving the valve slightly, each revolution distributes the heat load, and eventually the valve develops an absolutely correct seat. In this connection the device must not cause any more care, cost of maintenance or annoyance than the valve grinding. Valve springs suffer indirectly because of the fuel due to gumming of stems.

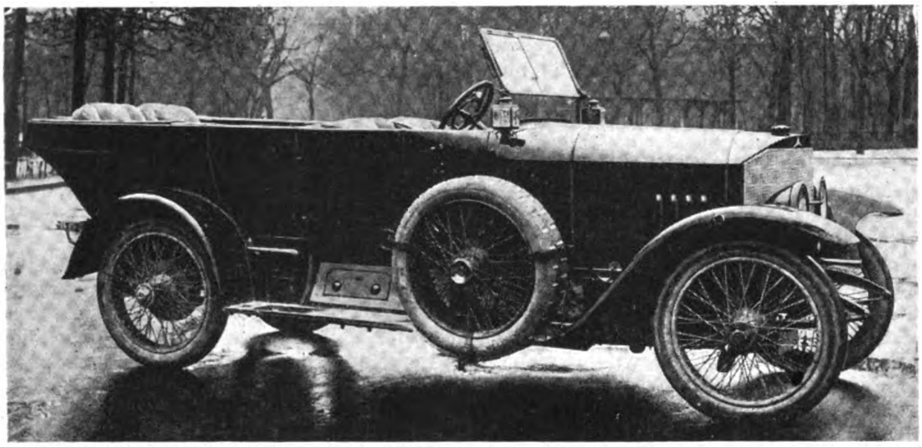
It is fortunate that the Bureau of Standards is taking up a program of investigation on lubricating oil which when complete will give us the data that will be the basis of future lubrication.

Generally speaking, the characteristics of most lubricating oil offered to-day by reliable refiners are dependent more upon the convenience of the refiner than upon the requirements of the user of the oil. Lubricating oil can be considered to consist of three parts: The light spindle oil, the medium weight, and the heavy cylinder stock.

(*Continued on page* 1043)

Ex-Kaiser's Latest Mercedes Car

Machine Captured by French in Strasbourg Has Knight-Type Engine, Full Electrical Equipment and a Body of Advanced Design

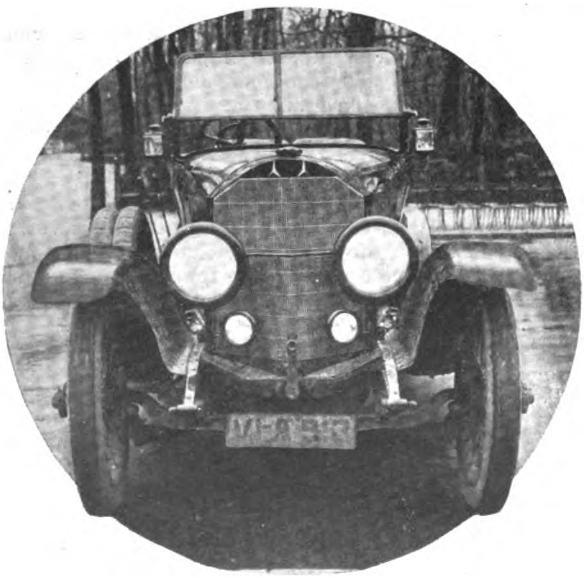


EX-KAISER WILHELM II's latest automobile appeared on the streets of Paris recently. During the summer of last year the German Emperor placed an order with the Daimler Motoren Gesellschaft at Unterturkheim for the latest type of Mercedes chassis. This was delivered to the Forrler Body Works at Strasbourg for a special touring body to be fitted, and the work was just about completed when the armistice and the flight of the Kaiser into Holland made delivery a rather difficult matter. When the Allied armies went into Strasbourg communication with the interior of Germany was cut off, and instead of being delivered at Berlin the Emperor's car was last month driven over French roads into Paris.

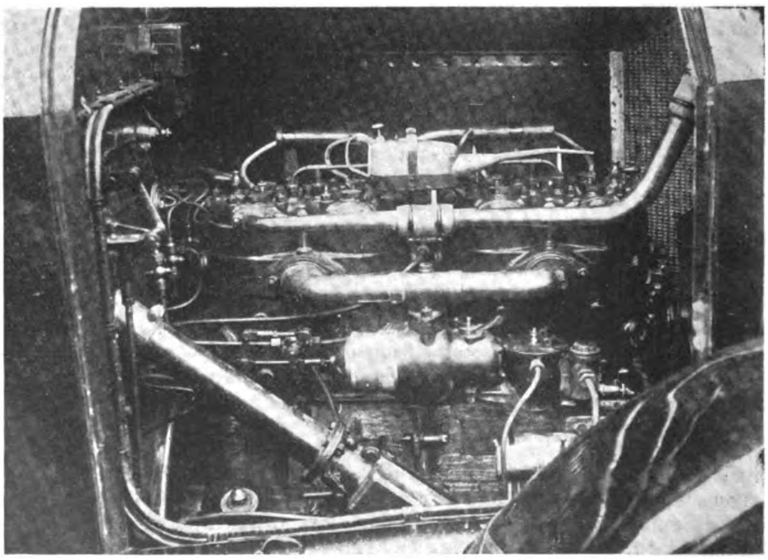
This latest type Daimler Mercedes is a four-cylinder car having a Knight sleeve-valve engine of 100 by 150 mm. (3.9 by 5.9 in.) bore and stroke. It is officially rated at 24-45 hp., but actually develops 70 hp. at 1800 revolutions. A Mercedes carbureter, with extra air control, is fitted, and the engine is provided with a supplementary lubricating system for the upper portion of the sleeve valves. Ignition is by high-tension Bosch magneto, placed on the left-hand or exhaust side of the engine, and driven from timing gears at the rear. The electric lighting set is also Bosch, the generator being on the right-hand forward end of the engine. The starting motor, however, is a Bijur.

The body work is a particularly fine example of up-to-date German lines. As will be seen from the illustration, the sides are narrower at the bottom than at the top, this giving an outward flare. About four inches from the top the sides become absolutely vertical, and the top rail of the body is in a straight line with the top of the hood. This, together with the straight line formed by the break from the inclined to the vertical sides, gives a very pronounced straight line effect to the body. The folding top disappears in the body, while the stern of the car is of the reversed clipper bow type, giving the greatest length near the top of the body. Seats are of the Pullman type, with two very comfortable folding seats facing forward. The windshield is divided vertically down the center, so that the driver's portion of the shield can be opened while the passenger obtains full protection. Glass is fitted in place of the usual board between the bottom of the windshield and the dash. Fenders are only moderately domed, those at the front being a single piece with the valences, and no bolts being visible. The car is fitted with detachable wire wheels, with two spares carried on the right-hand running board. The headlights are carried in the normal position in front of the radiator. The small lamps are rather peculiarly placed below the headlights but nearer the center of the pointed radiator than are these two latter. In addition to these there are two square carriage lamps carried on brackets attached to the windshield supports.

ACCORDING to an article in *Der Motorwagen*, an oil pump has been patented by a Munich inventor which consists essentially of two six-step rotating pistons and connections. The first piston acts as the oil suction, and the second as the pressure delivery.



The ex-Kaiser's Mercedes car brought to Paris



Intake side of latest Mercedes engine on ex-Kaiser's car

A Plan to Stabilize the Dollar in Purchasing Power*

The Effect of Our Present Monetary Standards on Prices—A Suggestion That We Vary the Value of the Dollar and Thus Fix Its Buying Ability

By Irving Fisher

OBVIOUSLY no explanation of a general rise of prices is sufficient which merely explains one price in terms of another price. To say that the cause of rising "prices" is rising "wages" is merely to say that the prices of commodities have risen because the price of labor has risen; and we might as well turn it about and say that the price of labor has risen because the price of food has risen and so driven workmen to strike for higher wages.

Scarcity will, in selected cases, go far toward explaining the rise of individual prices. But it will not go far toward explaining changes in the general level of prices—at least not before the beginning of the great war and only partly since that time.

All those who have offered explanations make one fatal mistake. They look at the wrong side of the market. They seek the causes wholly in the goods, the prices of which have changed, and not at all in the money, in terms of which those prices are expressed. It is hardly probable that commodities should rise in price en masse without some simple explanation in common. This corresponds with common sense.

Price Fluctuations Due to Money Conditions

Our conclusion is that until recently, at least, it was a fall in the value of gold, or money, that had taken place, rather than a simultaneous rise in the value of everything else.

That great price movements are chiefly monetary is evidenced by the fact that countries of like monetary standards have like price movements. Thus—to consider gold-standard countries—there is a remarkable family resemblance between the curves representing the index numbers of the United States and England. Again, the price movements in silver countries show a strong likeness, as in India and China from 1873 to 1893. On the other hand, we find also a great contrast between gold and silver countries. Speaking roughly, we may say that between 1873 and 1896 the price level in gold countries fell 25 per cent and in silver countries rose 30 per cent.

In the present war the data are so meager that it is impossible to express the relations in exact figures, but we may arrange the different countries in the approximate order in which their prices have risen. As a result we find that the order of the nations corresponds, in general, with the order in which the currency in those nations has been inflated by paper as well as with the order in which their monetary units have depreciated in the foreign exchange markets. This order—of ascending prices and of inflated currency—is: India, Australia, New Zealand, United States, Canada, Japan, Sweden, Switzerland, Denmark, Italy, Holland, England, Norway, France, Germany, Austria and Russia. Confirmatory evidence is found in the fact that the ups and downs of prices correspond with the ups and downs of the money supply. Throughout all history this has been so.

The present war furnishes important examples of this. In the United States the curve for the quantity of money in circulation and the curve for the index number of prices run continuously parallel, the price curve following the money curve after a lag of one to three months, as might be expected, money being the cause and price the effect. It was in August, 1915, that the quantity of money in the United States began its rapid increase. One month later prices began to shoot upward, keeping almost exact pace with the quantity of money. In February, 1916, money suddenly stopped increasing, and two and a half months later prices stopped likewise.

The conclusion toward which the foregoing and other arguments lead is that in the past the great outstanding disturber of the price level has always been money, and that at present the great outstanding cause of the high cost of living is money. It is curious that every time inflation of any kind has visited a country the public has had to be re-educated. The evils of colonial and continental paper money were forgotten by the generation of the Civil War, and the evils of the greenbacks are forgotten by most people to-day. At the present time we are confronted with still another kind of inflation, due not to specie, but to the use of checks. In so far as we subscribe to our war loans out of money borrowed at the bank—that is, out of an increase of deposit currency and not out of real savings—we are adding to inflation and to its evil effect on the cost of living.

Money is so much an accepted convenience in practice that it has become a great stumbling block in theory. Since we talk always in terms of money and live in a money atmosphere, as it were, we become as unconscious of it as we do of the air we breathe. Some people, even intelligent people, bolster up the illusion that the dollar is a stable standard of value by reference to the fact that "the price of gold" never changes. Only recently a former Government officer asserted that the value of gold is evidently constant because its price is fixed!

A dollar is 25.8 grains of standard gold—that is, of gold nine-tenths fine; and, since an ounce is 480 grains, the number of dollars in an ounce is $480 \div 25.8$, or 18.60. In other words, any 100-ounce lump of standard gold taken by a gold miner to the mint can be cut up and coined into 1860 dollars and handed back to him. Naturally he gets $18.60 an ounce, and this "price" can never vary so long as the weight of the dollar does not vary.

Gold Dollar Fixed in Weight but Not in Buying Power

Thus 100 ounces of gold will always be worth 1860 dollars of gold so long as 1860 dollars contain 100 ounces of gold; just as a quart of milk will always be worth two pints of milk so long as two pints make a quart. Gold is stable in terms of itself and in terms of itself only. Fixing the dollar at 25.8 grains of gold fixes the price of gold at $18.60 an ounce. But, of course, this fixity of dollar weight, or of gold price in terms of gold, does not fix its price or value in terms of other commodities. It does not release gold from the effects of supply and demand. The value of the dollar, as shown by its general purchasing power, is not stable but fluctuates with supply and demand as does the value (or purchasing power) of anything else.

If, instead of gold, we were to make milk the standard, or eggs—that is, if we used these to purchase all other things—they would acquire the same fixity of price—that is, price in terms of milk or eggs; and we would fall victims to the same illusion of inherent fixity.

An increase of money, then, always tends to raise prices. It was thus that prices rose in the mining camps of California a half dozen decades ago and in Colorado and the Klondike one or two decades ago. This local rise of prices soon communicated itself to other places; for the price level cannot

*Abstract of a paper read by Prof. Fisher before the Editorial Conference of the Business Publishers' Association.

in one locality greatly exceed that in a neighboring locality without causing an export of money to the locality of the lower level. Thus new money gradually finds its way into circulation throughout the world, raising prices as it flows from place to place, the process consisting, in all cases, of the effort on the part of somebody to get rid of an inconvenient surplus—a surplus which cannot be dissipated by transferring it from hand to hand, but only by a rise of prices. Of course, the price level is affected not only by the quantity of money. It is affected also by credit currency—that is, the so-called "money I have in the bank," which one pays out in checks. Moreover, the price level is affected by the rapidity of circulation both of money and of deposit currency and by the amount of commodities in trade. The price level may rise because of an increase of money or of deposit currency, or because of their rapidity of circulation, or because of a decrease in the volume of trade. And back of these causes (money, deposits, their velocities, and trade) lie innumerable other causes acting through one or more of them.

Dollar a Unit of Weight

Our dollar is now simply a fixed weight of gold—a unit of weight, masquerading as a unit of value. A twentieth of an ounce of gold is no more truly a unit of value or general purchasing power than a pound of sugar or a dozen eggs. It is almost as absurd to define a unit of value, or general purchasing power, in terms of weight as to define a unit of length in terms of weight. We would scarcely define a yardstick as any stick which weighs an ounce.

What good does it do us to be assured that our dollar *weighs* just as much as ever? Does this fact help us in the least to bear the high cost of living? We complain of the dollar, and justly, that it will not go as far as it used to. We want a dollar which will always buy the same aggregate quantity of bread, butter, beef, bacon, beans, sugar, clothing, fuel, and the other essential things that we spend it for. What is needed is to stabilize or standardize the dollar just as we have already standardized the yardstick, the pound weight, the bushel basket, the pint cup, the horsepower, the volt, and, indeed, all the units of commerce except the dollar.

Except the dollar, none of the old rough and ready units are any longer considered good enough for modern business. The dollar is the only survival of those primitive crudities. Imagine the modern American business man tolerating a yard defined as the girth of the President of the United States! Suppose contracts in yards of cloth to be now fulfilled which had been made in Mr. Taft's administration!

And yet the shrinkage in such a yardstick would be no greater than the shrinkage we have suffered in the far more important yardstick of commerce, the dollar; and this yardstick is used, not only in the few contracts in which the yardstick of length is named, but in all contracts of business! We tolerate our crazy dollar only because the havoc it plays is laid to other agencies.

Any Single Commodity Is Too Variable a Standard

A true standard of value, or general purchasing power over commodities, should not be dependent on one commodity merely, whether that commodity be gold or silver or wheat or what not.

Two commodities would be better than one, just as two tipsy men walk more steadily arm in arm than separately. Whenever they tend to lurch in opposite directions they neutralize each other. This is the argument which used to be urged for bimetallism, symmetallism, and other plans for uniting gold and silver. And the argument applies whenever gold and silver move in opposite directions, as from 1873 to 1896. A composite of gold, silver, copper, platinum, and all the other metals would be somewhat more stable than an amalgam of two. Money to-day has two great functions. It is a medium of exchange and it is a standard of value. Gold was chosen because it was a good medium, not because it was a good standard.

The argument that gold became money because it was thought to be a good standard of value is, so far as I can find out, an unfounded myth. Indeed, when it came into use as money, there were no index numbers and there was therefore no way of testing its stability or instability; and finally at that time there was not much need and not much thought of a standard of value, for the good and sufficient reason that there were few if any time contracts, such as promissory notes, mortgages or bonds. Almost all bargains were struck and settled on the spot. When a man was about to make a cash purchase it was immaterial to him what the monetary unit was.

But to-day if a man buys an article and promises to pay for it in three months the case is different. When the time for payment arrives it is very important for him to know whether the "dollar" is the same as was contemplated when the agreement was made. With our network of long-time contracts, running months, years, generations, or even centuries, including hundreds of billions of dollars in promises to pay money—promissory notes, mortgages, debentures, railway bonds, Government bonds, leases, etc.—the function of a standard of value—that is, a standard of deferred payments—has grown to be perhaps the more important of the two functions of money.

We now have a gold standard that is forever fluctuating. It is a gold standard with the "standard" left out! The proposal here made is really to put the standard into the gold standard—to standardize the dollar.

Vary the Weight of the Dollar

The method of rectifying the gold standard consists in suitably varying the weight of the gold dollar. The gold dollar is now fixed in weight and therefore variable in purchasing power. What we need is a gold dollar fixed in purchasing power and therefore variable in weight. I do not think that any sane man, whether or not he accepts the theory of money which I accept, will deny that the weight of gold in a dollar has a great deal to do with its purchasing power. More gold will buy more goods. Therefore more gold than 25.8 grains will buy more goods than 25.8 grains will buy. If to-day the dollar, instead of being 25.8 grains, or about one-twentieth of an ounce, of gold, were an ounce or a pound or a ton of gold, it would surely buy more than it does now, which is the same thing as saying that the price level would be lower than it is now.

But how, it will be asked, is it possible in practice, to change the weight of the gold dollar? The feat is certainly not impossible, for it has often been accomplished. We ourselves have changed the weight of our gold dollar twice—once in 1834, when the gold in the dollar was reduced 7 per cent, and again in 1837, when it was increased one-tenth of 1 per cent. If we can change it once or twice a century, we can change it once or twice a month!

Use Paper for Currency and Abolish Gold Coins

And if we use paper representatives of gold exclusively, instead of some paper and some gold coins, these monthly changes in the weight of the gold dollar can be made even more easily than the occasional changes were made which history records. In actual fact, gold now circulates almost entirely through "yellowbacks," or gold certificates. The gold itself, often not in the form of coins at all but of "bar gold," lies in the Government vaults.

If gold thus circulated only in the form of paper representatives it would evidently be possible to vary at will the weight of the gold dollar without any such annoyance or complication as would arise from the existence of coins. The Government would simply vary the quantity of gold bullion which it would exchange for a paper dollar—the quantity it would give or take at a given time. As readily as a grocer can vary the amount of sugar he will give for a dollar, the Government could vary the amount of gold it would give or take for a dollar. To-day the Government will give 25.8 grains of gold bullion to the jeweler or exporter for each dollar of certificates he pays in; next month it might give 26 grains or only 24 grains. These respective increases or decreases would of course be made for the purpose of compensating the decreases or increases in the purchasing power of the dollar.

But, it will now be asked, what criterion is to guide the Government in making these changes in the dollar's weight? Am I proposing that some Government official should be

(*Continued on page* 1043)

Dayton Starting and Lighting System

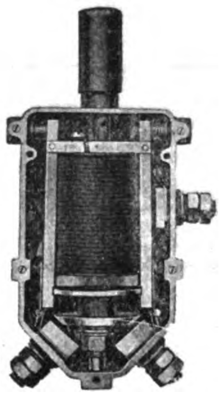
Specially Designed for Ford Cars—A Single Unit Connected Directly to the Crankshaft—Has a Special Form of Armature with Copper Bar, Form Winding Electrically Welded to the Commutator Bars

SEVERAL novel features are embodied in a starting and lighting system which is being manufactured by the Dayton Electrical Manufacturing Co., Dayton, Ohio, from designs of Vincent G. Apple. The outfit, which is of the single unit type, is specially designed for Ford cars, and it is possible to connect it directly to the crankshaft because of the new type of armature used. There is no cotton insulated wire used in its construction, the windings being made with flat copper strips cut to length and formed into hairpin loops which are inserted through a core of laminated iron discs. They are then bent into shape by a special machine to make them uniform, leaving the flat ends to weld to the commutator segments. This is done with an electric welder, which makes the commutator a part of the winding. The commutator, as will be seen from the illustration, is of the internal type. The idea of electrically welding the armature conductors to the commutator bars appeals, as it removes the weak link of the soldered joint, but it would seem to render more difficult the problem of "refilling" the commutator when worn out.

After the armature is assembled, it is impregnated with bakelite and baked, which makes it a solid, homogeneous mass impervious to oil and water. This armature, we are informed, can be shaped to fit the frame of any low-voltage dynamo.

The field frame of the dynamotor is made of semi-steel and has twelve field poles in which the armature rotates to generate the electric current. The armature winding is of the parallel type and there are twelve brushes bearing on the commutator. Two of these brushes are almost pure graphite, for lubricating the commutator, thereby eliminating any necessity of using oil on the commutator. The other ten brushes are made of metal-graphite composition.

The starting switch and automatic cut-out are combined, and this unit is claimed to contain fewer parts than any starting switch and cut-out on the market. It is mounted on the frame of the car under the heel board and is operated by pushing down on the starter button with the heel. This operation connects the battery in series, giving 12 volts for starting. When the starter button is released, it automatically comes back to the running position and the dynamotor then generates the electric current to recharge the 6-volt battery. This replaces the current which was used by the motor for cranking the engine and lighting the lamps. When the voltage of the dynamo drops below the charging rate, the cut-out in the switch automatically breaks the circuit between the dynamo and battery, so that the battery will not discharge when the car is running at too low a speed or when the engine is at rest.

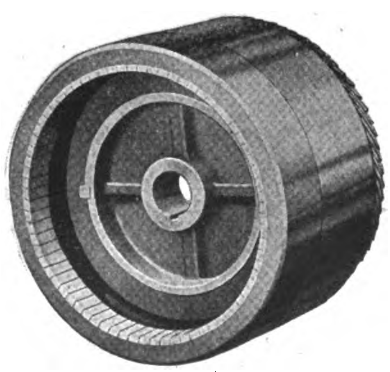


Interior view, combined starting switch and automatic cut-out

Hairpins inserted through armature laminations

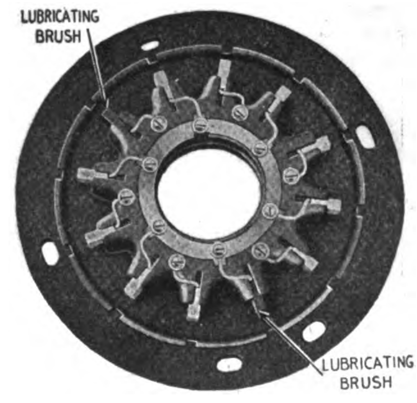
Antimony in Copper

THE opinion has gained ground of late that small percentages of antimony do not deteriorate copper, as used to be feared, but make it harder and leave it fit for rolling. Reviewing the recent researches on the problem in *Metall und Erz*, W. Stahl concludes that 0.3 per cent or 0.4 per cent of antimony is not at all objectionable, if present as metal or as copper antimoniate. A total impurity of the same amount of both nickel and antimony, i. e., about 0.15 per cent of each of these metals, is likewise to be welcomed rather than to be deprecated; such copper is also sound when hot. Combined with high nickel percentages, however, even a little antimony is bad; what is said for nickel also holds for manganese. When the copper contains bismuth, up to 0.05 per cent, enough antimony should be added to the fused copper at the commencement of the oxidation period to transform all the bismuth into antimoniate; the copper may then be rolled. As regards lead, similar restrictions apply.

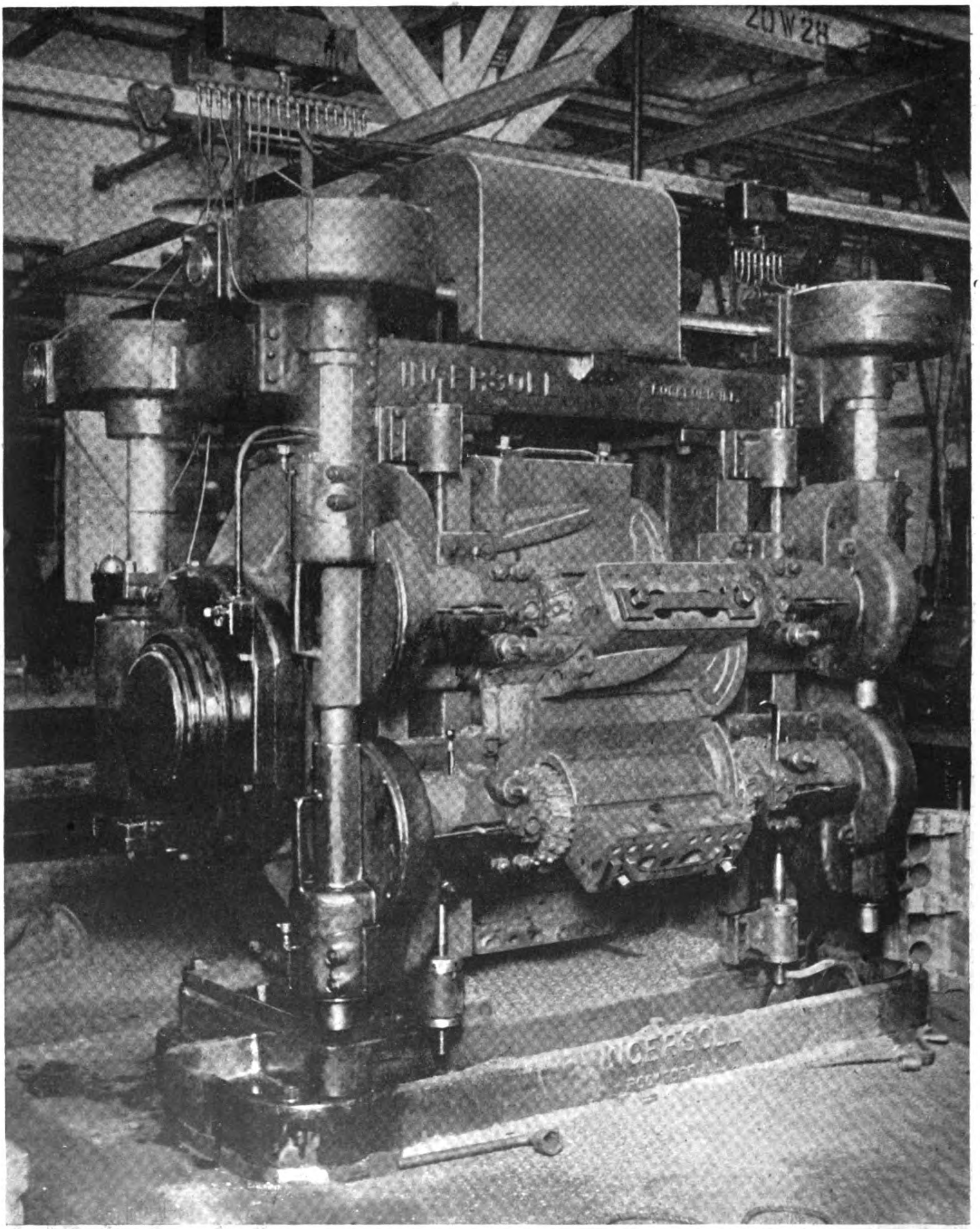


Completed armature

Hairpins shaped to weld on commutator



Commutator brush assembly



Milling Six Cylinder Blocks in One Operation

Rotary miller made by the Ingersoll Co. of Rockford, Ill., which handles six Fordson engine blocks at one time, milling the ends. This rotary miller takes both a roughing and a finishing cut, having four milling cutters, two on each end. It takes 3 min. to finish a cylinder block on this machine

Handling Parts in the Shop
and on the Assembly Floor

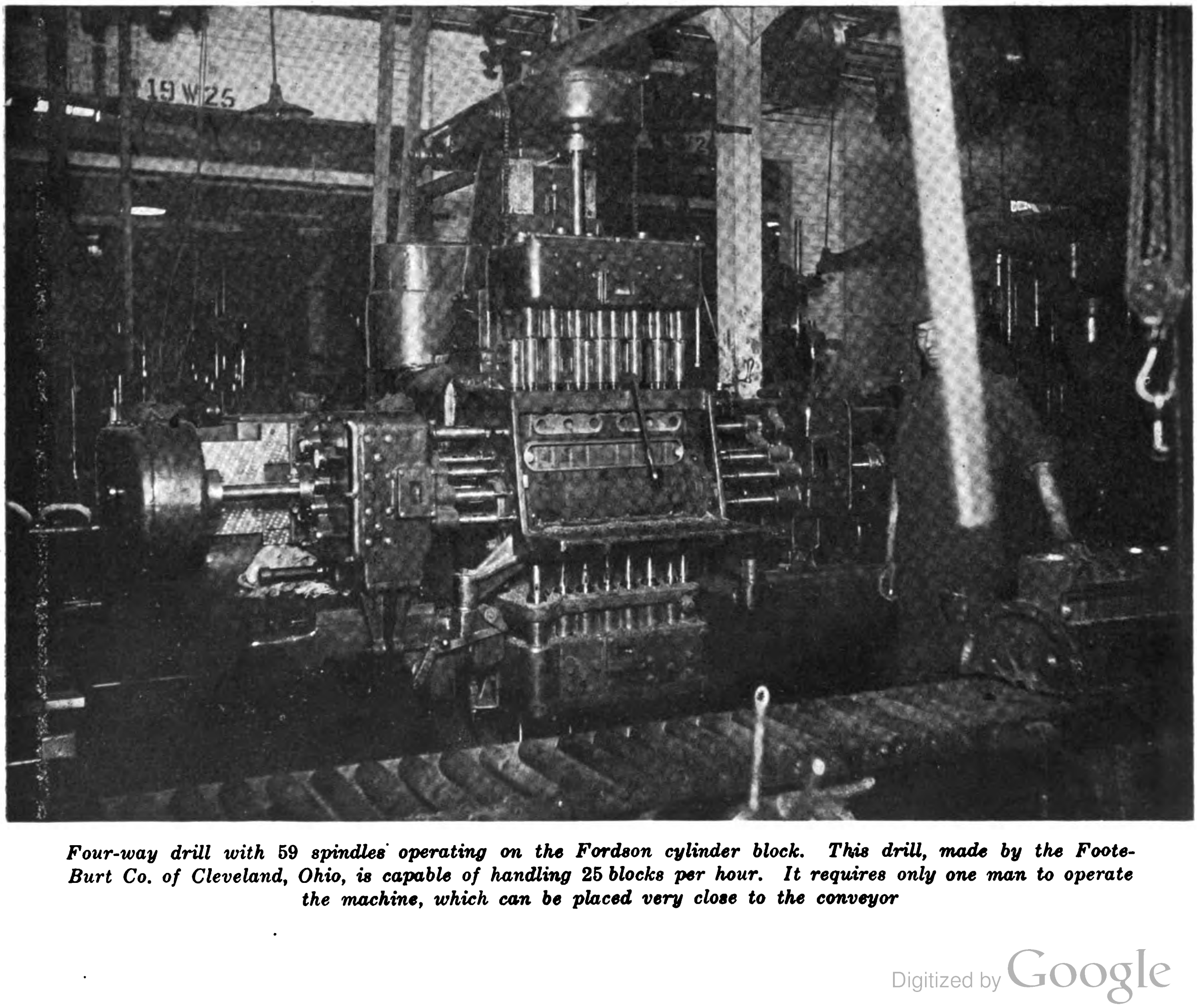
Description of Tools and Conveying Apparatus Installed in the Tractor Works of Henry Ford & Son to Eliminate all Unnecessary Handling and Motion of Parts

By J. Edward Schipper

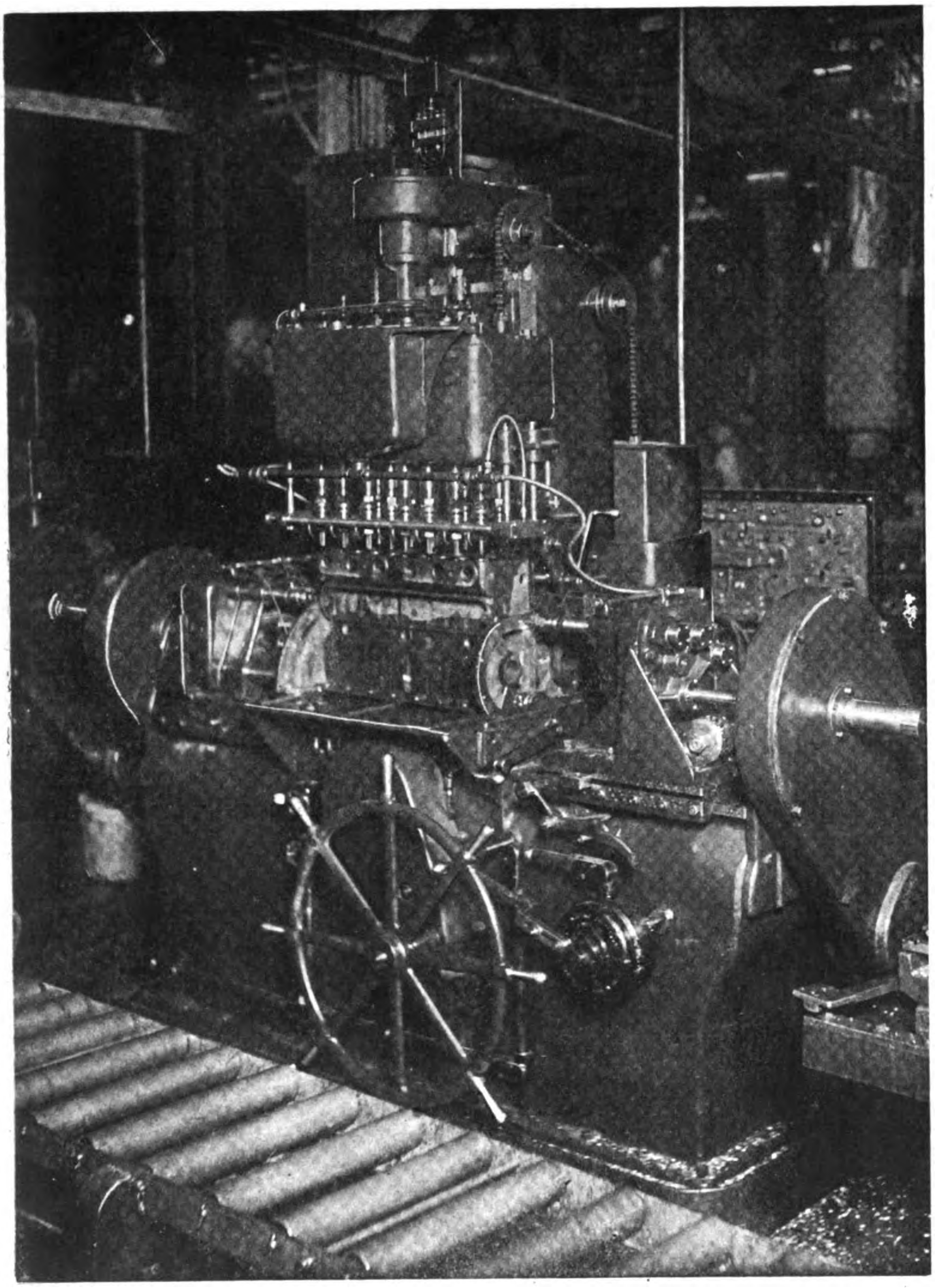
SMOOTHNESS of flow and regularity are prime essentials in manufacturing processes if the greatest efficiency is to be secured. Manufacture and assembly which proceed along the lines of regular geometric figures are generally highest in efficiency. The simplest form of progression is, of course, along a straight line, but manufacturing progression may be in a circle, an ellipse, or a rectangle, and frequently it is in the form of a straight line, with shorter feeding lines which enter this straight line at different points.

The ultimate object in the use of conveyor systems and special machinery is to secure this smoothness. Where a machine does the work of two, it reduces the amount of variation from straight lines or other regular geometric progression by a large percentage, because the very act of taking a piece off a conveyor, putting it on a machine and back on the conveyor again constitutes a deviation from the straight line of travel.

The illustrations are typical examples of the use of conveying apparatus and of special machinery at the plant of Henry Ford & Son, Dearborn, manufacturers of the Fordson tractor. The gravity conveyor system is



Four-way drill with 59 spindles operating on the Fordson cylinder block. This drill, made by the Foote-Burt Co. of Cleveland, Ohio, is capable of handling 25 blocks per hour. It requires only one man to operate the machine, which can be placed very close to the conveyor



A three-way tapper made by the Foote-Burt Co. of Cleveland, capable of handling 30 Fordson cylinder blocks per hour and tapping in three directions at the same time

used here to advantage, and there are a number of special machines of which those shown are very good examples.

The rotary milling machine shown is a product of the Ingersoll Co. of Rockford, Ill., and is capable of handling six blocks at one time, milling both ends of the block. In place of the reciprocating table, which is the cause of much loss of time in returning idly, this machine has a continuous rotary table which practically eliminates the loss of time due to setting up. Besides this, the machine takes both the roughing and finishing cuts. The two sets of milling cutters are apparent in the view of the machine. As will be noted, the machine itself is compact and can be set very close to the conveyor system, requiring little deviation from the conveyor line in order to place the block on the machine. The cylinder blocks shown are for the Fordson tractor engine, and it requires only 3 min. for a block to be completed on the machine. When once started, the machine is run continuously, there being a constant feed of blocks to the milling cutters.

The rotating table gives continuous motion because it is always proceeding in one direction and there is no necessity for the quick return movement common on reciprocating table machines.

Another special machine the use of which tends to keep the work close to the conveyor system is the four-way drill. The gravity conveyor used for passing the work along is shown in the foreground and the machine is directly behind it. The four-way drill has 59 spindles and is capable of handling 25 of the Fordson cylinder blocks per hour. The machine is a product of the Foote-Burt Co. of Cleveland, Ohio. It is handled by one man, and once set up is a simple machine to operate, because it is merely a matter of alignment with the jigs. Of course a machine of this kind must be so designed and laid out that the dangers of drill breakage are practically nil, because it would be very poor efficiency to have the entire 59 spindles held up due to the failure of one drill. This is a matter of speeds and drill quality, and the problem is readily solved by keeping the factor of safety just as high as possible on machines of this kind.

In using the gravity conveyor there are opportunities for placing inspectors at strategic points where they will be able to perform their work without interfering with the machines. One of these points is where the conveyor turns a corner, such as is illustrated. This particular illustration shows the inspector on the finished cylinder blocks, who can use his gages to advantage because he is located at a corner of the conveyor. This gives him free arm motion on both sides and allows him to work on either the end or the side of the blocks. The gaging operations performed at this point are checking the bearing diameter and the amount of metal on the face of the cylinder casting.

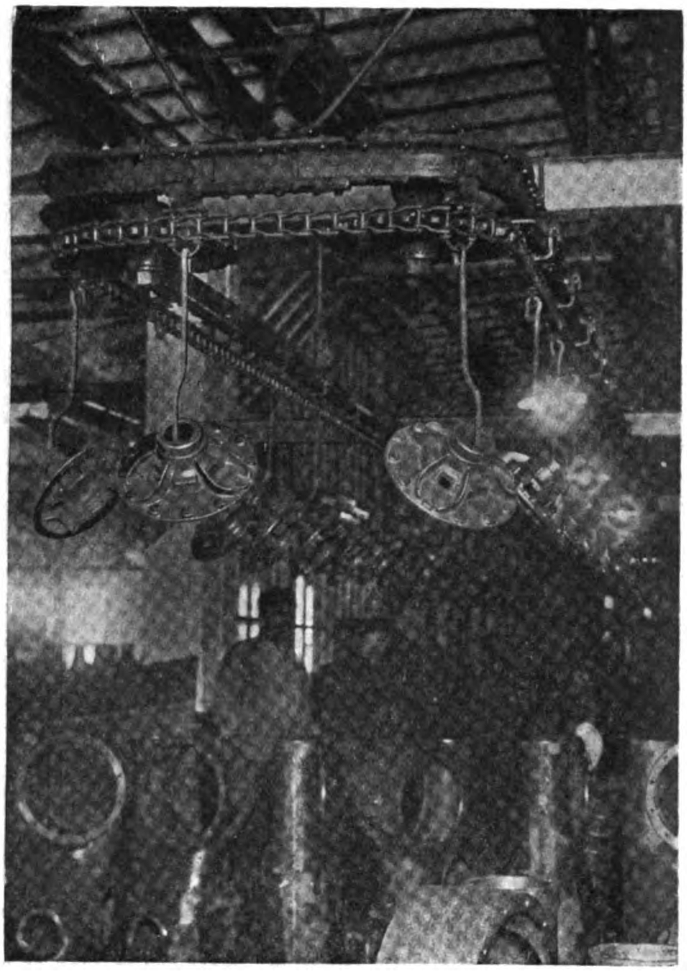
This particular inspection requires about six gages, which can be quickly used and the block pushed along at right angles to its previous course. This conveyor is the same as that shown in previous articles on Ford assembly methods, and illustrates the manner in which the cylinder blocks are brought directly to the assembly department without any intermediate storing operations in the finished parts stockroom.

Where the parts are not large enough to necessitate the use of a gravity conveyor and where other forms of chain conveyors fail, an overhead system such as illustrated can be used to advantage for bringing the work to the machines. The castings shown hang on hooks from an overhead chain carrier which passes around, bringing the work to the various machines. The operator on a machine simply reaches up and takes off a casting, performs his operation on it, and then hangs it back on the hook. When all the operations are complete, or at periodic intervals, the castings are removed from the hooks and placed on the conveyor, which travels down into the assembly department. In the foreground of the illustration showing these parts on the overhead chain can be seen finished transmission housings for the Fordson tractor, which are end to end on the gravity conveyor on the way to the assembly department. Thus it is apparent that with this overhead chain system it is possible to pass underneath with the regular gravity roller conveyor, and there is no trouble in the two lines crossing each other, as would be the case were they both on the same level.

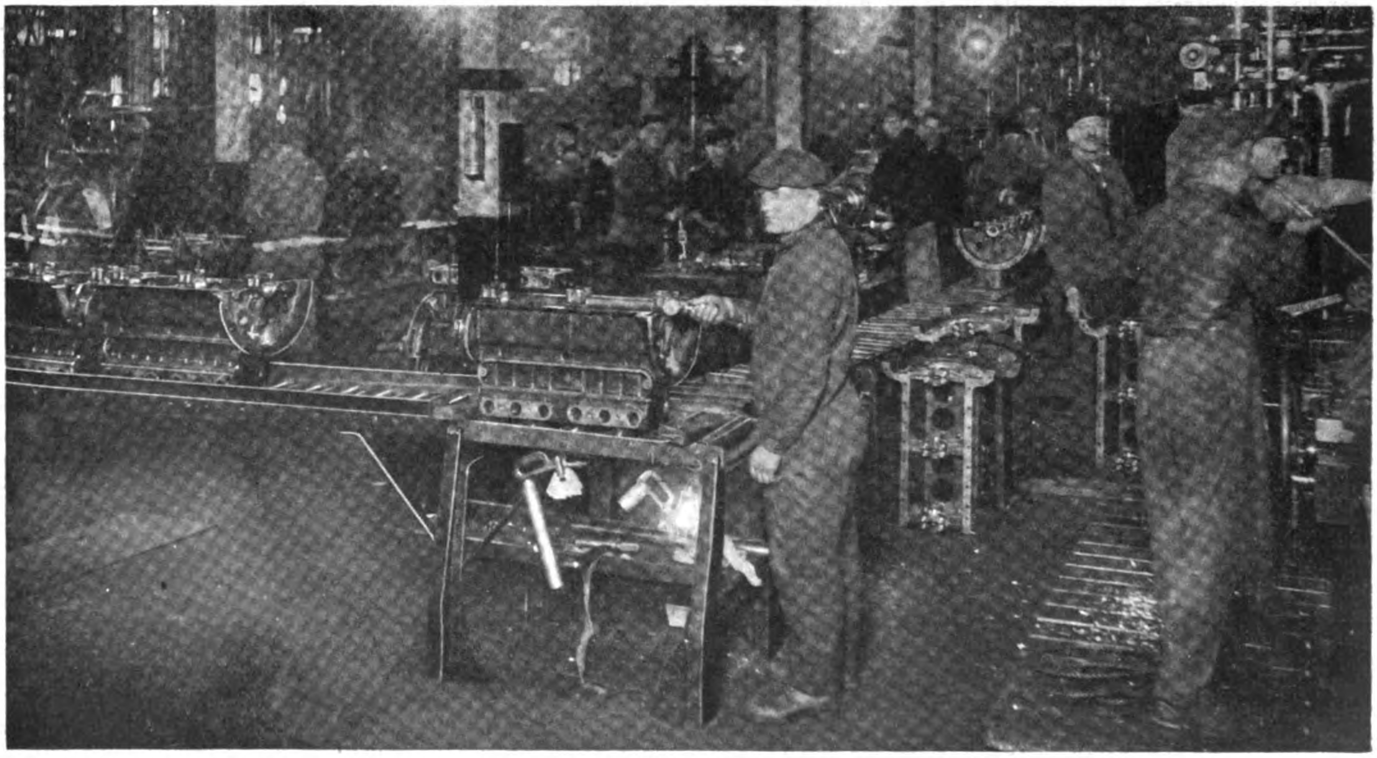
Sub-Assemblies Handled as Feeders

Feeding into assembly lines and manufacturing lines are always sub-operations which cannot be put in the continuous progressive system, because to do so would make the progressive line too long, or would complicate manufacturing problems. The solution for problems of this kind is to handle sub-assemblies or sub-manufacturing operations as feeders and allow them to come in as branches of the main line. The sub-assembly work shown on the worm wheel is a good example of this; the arbor pressing operations and electric drilling work can readily be handled to one side of the main assembly line, and the sub-assembled parts can then be sent along the gravity conveyor to the main line, reaching there at a point where the parts are required.

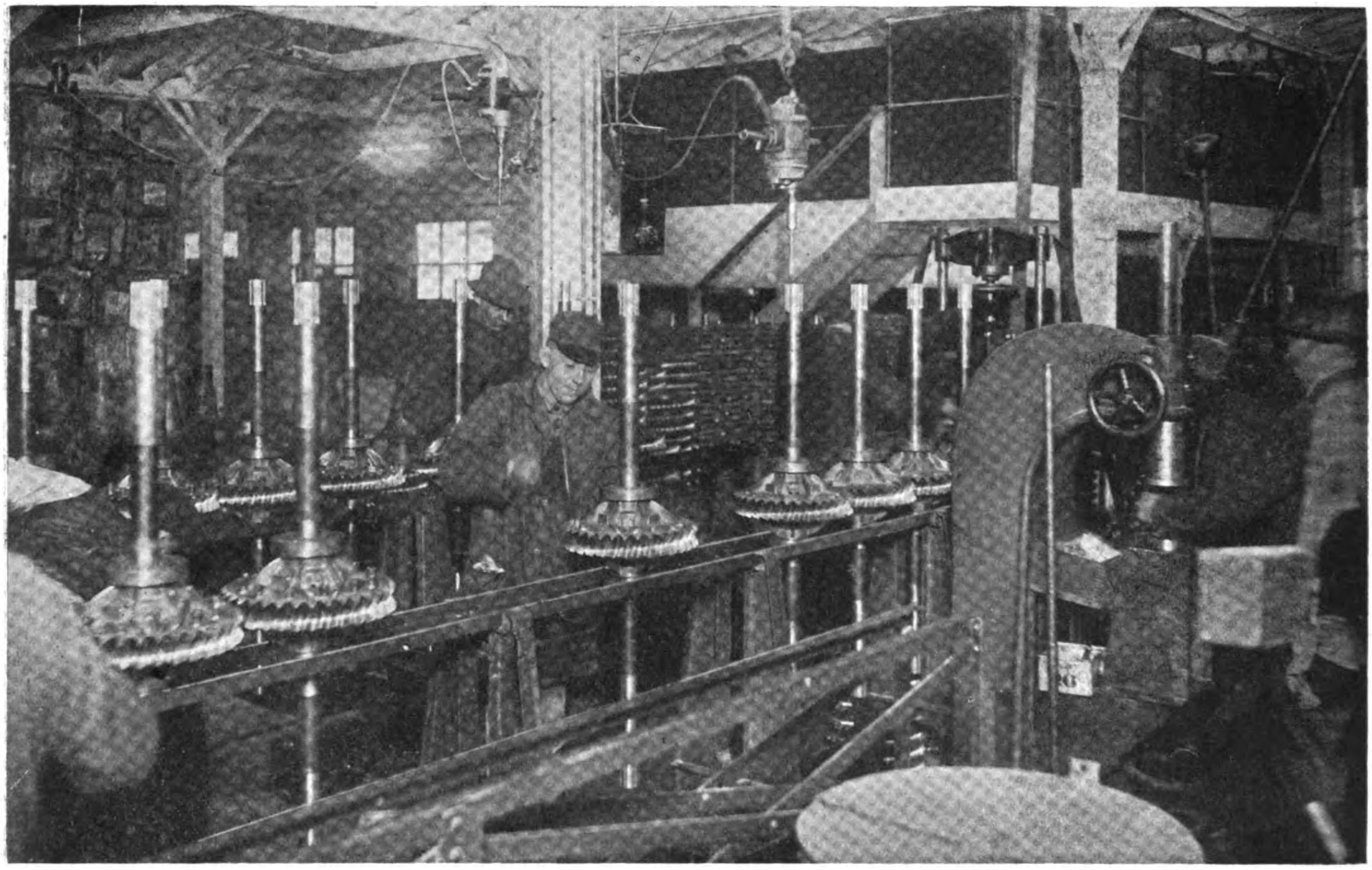
This method of handling the work is in common use at the Fordson factory and works out very well, indeed. The parts for the various sub-assembly jobs, such as



Overhead chain carrier used to bring the work to the machines and to eliminate storage on the floor. In the foreground are transmission housings on a gravity conveyor crossing the overhead line



Inspector stationed at a turn in the conveyor line. This insures freedom of motion in all directions



A sub-assembly feeding line by means of which the worm wheels and axle shafts on the Fordson tractor are sub-assembled and fed to the main assembly line. The arbor press operation is shown to the right of the illustration. Note the method of supporting the electric drills overhead

bolts, cap screws, etc., can be placed in pans beneath the gravity conveyors or racks, so that it is possible for the workman to always have a supply at hand. There is the objection of stooping for these parts; but whether or not that objection is serious depends on the number of pieces to be picked up and the possibility of putting a small supply at hand on a level with the job.

These random examples of methods in keeping the progressive line to a straight geometric figure are typical of the way the work is handled at the plant of Henry Ford & Son, Dearborn. The methods are those which should be adopted by any shop which is making a special study of motion efficiency, as both by the use of special machines and by the use of conveying apparatus which brings the work close to these machines and holds it to the preconceived line, the deviations are kept at a minimum and the total amount of travel of the work is kept as low as possible. After all, the efficiency of manufacture can be determined quite closely by the total distance traveled by the piece in its progression from a raw part to finished stock. The story can always be told by studying the distance traveled, and good conveying systems and wisely chosen special machinery will reduce this total travel to a minimum.

Exide Tractor Type Batteries

THE Electric Storage Battery Co. of Philadelphia, manufacturer of the well-known Exide batteries, has made a careful survey of the tractor field, and as a result has reached the conclusion that, while passenger automobile batteries are not adapted to this service, there are no conditions which cannot be met by a properly designed battery. It has therefore brought out a complete line of tractor type batteries.

These batteries have been subjected to the most severe shock and vibration tests, and have withstood these tests successfully, we are informed. The plates are very heavy and of rugged design. The separators are of the combination treated wood and perforated hard rubber type. This separator combines the good points of wood and hard rubber, and is employed where the conditions are very severe, as, for example, in mine locomotive service. Plate groups are supported on strong rubber bridges, an additional protection against shocks or vibration. Jars and covers are of Giant compound, and breakage is said to be practically eliminated. Covers are of the double-flange type, permitting effective sealing. With this construction, the cover supports the top of the jar from the outside as well as the inside, so that it cannot break away from the seal, and thus a permanently tight joint is rendered possible.

Elements are proportioned to fit the jars tightly, and extra heavy sealing nuts are used on the pillars to anchor them in place. Jars are set in compound in the carrying cases, and as an additional precaution the latter are equipped with through bolts so that the sides can be drawn together, holding the jars firmly in place.

Intercell connectors are of flexible copper, to prevent crystallization and consequent breakage under severe vibration, and are lead-plated to prevent corrosion. Terminal connectors are standard clamp lug type.

The initial cost of the Exide tractor type batteries is somewhat higher than that of the automobile type, but it is claimed that from the standpoint of service they will prove considerably cheaper, as the rugged construction employed will not only result in greater reliability and freedom from trouble but also in a much longer life.

Airplane Supply System of the American Army in France

(*Continued from page* 989)

and until the necessary machinery and organization have been brought into existence no amount of enthusiasm, no amount of punch, will produce tangible results.

France possessed the machinery and the organization as the result of three years' intensive effort under war conditions. America was just getting her machinery and organization together, and having to learn, as all those before her had learned, by her own mistakes. Until the American machinery could be put into motion, the best, indeed the only sensible plan, was to intensify the output of the French machinery to such a degree as to enable it to supply the American army's needs.

Consequently the moribund contract of Aug. 30, under which France was to supply America with 5000 airplanes, was wiped off the slate and a new contract was entered into between the French and the American Governments, by the terms of which France was to place at the disposal of all the large American units, such as army corps, divisions, etc., the same aviation material in quantity and quality as if corresponding French units were involved. This contract, which was put through in six weeks' time, went into effect on May 3, from which date the American Air Service got into its stride and went ahead at an increasing rate. As France was going to be the temporary furnisher of aviation material to the American army, and as 90 per cent of the French aviation industry was stationed in and around Paris, it was necessary that Paris, and not Tours, should be the headquarters of the Supply Section of the American Air Service.

In order to fully appreciate the difficulties under which the early work had to be carried out in France, it must be understood that it was not known by anybody how big an army America would have, whether the United States troops would operate as a separate army, or whether they would be attached as units to the various Allied armies. In other words, an Air Service had to be created to meet the requirements of an army of unknown size and nature. When, in the spring of 1918, Germany began to drive home her crushing and, as she hoped, final blow, and in consequence the Allies had to send an urgent appeal to America for immediate assistance in the field, the task was thrown on the Air Service of meeting big, urgent, deadly pressing calls.

Without in any way deprecating the importance of the preliminary work which had been carried on up to that time, it may be stated that the Supply Section of the Air Service took off its coat and rolled up its sleeves in the spring of 1918 and had no time to wipe away the perspiration until the unexpected armistice called for a halt on Nov. 11. It was during that period of nine or ten months that practically the whole of the 46 squadrons were formed, sent into the field and maintained there, and that the 6625 airplanes were obtained for the A. E. F.

All the airplanes built for the French army in the factories located in and around Paris were sent to the big depot at Le Bourget, on the eastern suburbs of the city, where they were completely equipped and despatched under their own power to the front. As France was to meet the needs of America until the home factories were in a position to produce, it was quite natural that space should be reserved for the American Army at Le Bourget. Germany was evidently fully aware of the great importance of the French air depot on the plains to the east of the city walls, for on several occasions she sought to destroy it by aerial raids, and during the month of March made a big concentrated night attack during which considerable damage was done. Among the machines destroyed were a number of Spad fighting planes for the American army.

Orly Field Established

As a result of this attack, the French decided on splitting up their own forces and gave orders for the American service to evacuate Le Bourget without delay. While the original cause of this removal was unfortunate, the outcome was most satisfactory, for faced with the necessity of securing its own quarters, the Supply Section of the American Air Service decided on the construction of Orly Field, the importance of which to the A. E. F. cannot be overestimated. On the main road from Paris to Fontainebleau, about 8 miles south of the former city, there lay a series of absolutely level fields, given over to farming, but devoid of hedges and ditches and con-

Nieuport airplanes used for training American pilots in France

A part of the American city built at Romorantin

sequently easily convertible into an air depot and flying ground. Within five days the American Air Service was authorized to take possession of this ground. This constituted a record, for usually these requisitions cannot be put through in less than six weeks. If any incentive to quick action was required, it was to be found in the threatening German activities on the Somme, accompanied by air raids and long distance bombardment of Paris, which began about that time.

On March 31 the Sixth Company of Motor Mechanics Regiment came up from Tours on 25 trucks, established themselves on the field, and began to lay the foundations of an air depot which six days later was able to receive the first airplanes from the French factories, and within three weeks to despatch the first planes from Orly to the front. When this ground was taken over it consisted of monotonously level fields without a building on them, with a fine granite paved road running through them, with convenient railroad lines, with the River Seine on the eastern edge, and just to the south the old Juvisy airdrome, where the first Frenchmen had learned to fly on Wright machines, and from which Count De Lambert had started on what was once a sensational flight around the Eiffel Tower. Seen from a height of 3000 ft. above Orly, the aviator had below him the city of Paris, the French airplane and engine factories and a regular series of French airdromes. The situation was [illegible]h that French civilian pilots, having planes to de-[illegible] from the factories to the American army could [illegible] to an altitude of 2000 or 3000 ft., shut off, and [illegible] Orly. It was a little economy in gas which the [illegible]rs were not above despising.

Imm[illegible] after the signing of what came to be known as [illegible] May 3 contract, a requisition was placed with the French for equipment to meet the needs of 94 squadrons, the supply of this of course to be spread over a rather long period. The French lived up to the spirit of this contract in a whole-hearted manner. Not only did they change all their production plans, but they altered all their arrangements at the front in order to meet the requirements of the American army.

Orly was designed with a capacity of 25 planes a day, but under the urgency of the calls from the front and in order to meet the rapidly increasing requirements of the army, it worked at all times beyond this capacity. By the middle of the summer it had established the record of 91 airplanes despatched on one day from this ground for the front, and from the end of March, when the agricultural fields were taken possession of, to the eleventh day of November there were sent out of Orly a total of 1800 planes. The ferry pilots who took these planes up to the front covered a total distance of 403,000 miles, equal to sixteen times around the world. This big mileage was obtained with a total loss of six lives, although owing to the extreme urgency of the calls it was often necessary to order deliveries to be made when weather conditions were unfavorable, and to give to pilots machines with which they had had little previous experience.

Although the French Government undertook to meet the immediate needs of the United States Government, this did not imply that the American Air Service had to sit by with folded arms and watch the planes come in. Under the contracts French makers delivered airplanes in about the same condition as automobiles were delivered ten years ago. The finished article consisted of a plane and an engine, which, while constituting a flying machine, was unfit for service at the front until it had been equipped with navigating instruments, supplied with a gun or guns, given wireless telegraphy sets, bomb carriers, and all other auxiliaries necessary for a fighting plane.

Equipment on Progressive Production Plan

Test groups composed of a pilot, a group inspector, an airplane mechanic, a motor mechanic and a clerk had to be formed to go to the various French airdromes around Paris and take delivery of machines for the American Government. These tests were severe, for out of 3394 planes presented by the French only 2126 were accepted immediately. Five hundred and ninety-seven planes were accepted after one rejection, 191 were accepted after two rejections, and a few were only admitted after six rejections. In all 1814 planes were rejected at various times, and of these 399 were never accepted. In carrying out this work the pilots made more than 5000 test flights.

Orly field, with its 78 hangars and scores of other buildings, its miles of cinder track and acres of perfect flying ground, was laid out on a progressive factory

system, with the sheds at one end for receiving new planes, and the other buildings in proper order according to the equipment to be added. In the first shed the plane would receive its navigating instruments; moving along, it would get its wireless equipment, if designed to receive this; next it would get its gun or guns, and would be taken up to the firing butts to be tested for accurate mounting of the gun and for synchronization. As it moved from shed to shed each machine was tested and reported on, until finally it went out for its final test flight fully equipped.

Having been pronounced perfect in every respect, the machine would take its place on the starting line marked across the field, from which point 25 to 90 machines were despatched to the front every twenty-four hours. On an average this work of receiving, equipping, testing and dispatching a plane to the front occupied two to three days. All the machines included in the initial equipment of a squadron went out complete with every requirement. Of the replacements sent out to make up losses due to wear and tear and enemy action, 50 per cent were completely equipped, and 50 per cent without equipment, for out of the crashes it was always possible to save some of the accessories.

At the time of the armistice Orly had a staff of 323 officers and 2283 enlisted men who were living on the field in sheds and buildings erected by the American army. This work of erecting buildings and fitting up machinery had to go on concurrently with production.

Every foreign airplane intended for the American Service had to pass through Orly. As the great majority of these machines came from French factories, they had to be flown but a short distance; but England and Italy also contributed, and their machines came under their own power to Orly. The Italian machines had to be flown over the Alps, and in order to meet these conditions the Italian Government constructed an emergency landing ground on top of Mont Cenis pass, 9000 ft. above sea level.

American Planes Fitted Out at Romorantin

While this big effort was being exerted in conjunction with the French, an equally big program was being developed for the reception of airplanes from America. At Romorantin, a little town situated on that all-American line from the Atlantic to the Vosges, there was established in early March what was officially known as Air Production Center No. 2. The French authorities turned over to the Air Service about 50 acres of thinly wooded or barren land, and on this there was erected within a period of 10 months a real live American city with 2,900,000 sq. ft. of constructions, 36,000 lin. ft. of made roads, 55,000 ft. of railroad, nearly 8 miles of water line and about 5 miles of drains, and adjoining it a flying field of 425 acres of prepared ground, the whole receiving a personnel of 12,000 officers and men.

Romorantin's duty in the scheme of supplying the flying forces was to receive American-built airplanes, to assemble them, to equip them, and dispatch them to the front. In addition to this it had to provide for all spares and replacements of planes, engines and airplane equipment. It had to receive all wrecked planes sent back from the front, repair them or salvage them, according to their condition.

The preparatory work, which consisted of clearing the ground and erecting buildings, began in early March, 1918. Lumber was scarce, machinery and equipment were not coming in from America and were hard to find on the French market. All that month of March the preparatory work went on and by the beginning of April work was sufficiently advanced for starting on preparations for the assembly of American-built planes then reported to be on the water.

It was on April 11, 1918, that the first American-built DH-4 airplane, designed to be flown with a Liberty engine, was unloaded from the American freight cars running over the American-built railroad line from Saint-Nazaire to Romorantin, and one week later this same plane—the first of a big and ever increasing series—was ready to make its trip over the lines into Germany.

From that time to the signing of the armistice Romorantin worked steadily, day and night, on the task of receiving, assembling and dispatching American-built airplanes to the armies in the field. Between May 11 and Nov. 11 there were sent out of these huge shops 1213 American planes, all equipped with the Liberty engine. Of these planes 1087 were in active service over the lines, and 67 were in hand for delivery when Germany threw up her hands.

Romorantin enjoyed an ideal geographical situation. Almost in the center of France, right on the main line of communication, it was yet sufficiently far from the fighting line to be undisturbed by enemy action. These 200 miles had to be covered by the planes under their own power, deliveries being made by ferry pilots, as in the case of the foreign planes sent out of Orly. Notwithstanding the distance, only 5½ per cent of the planes were crashed during delivery, and of these accidents 25 per cent were due to fog, rain or other climatic conditions beyond the control of the pilot.

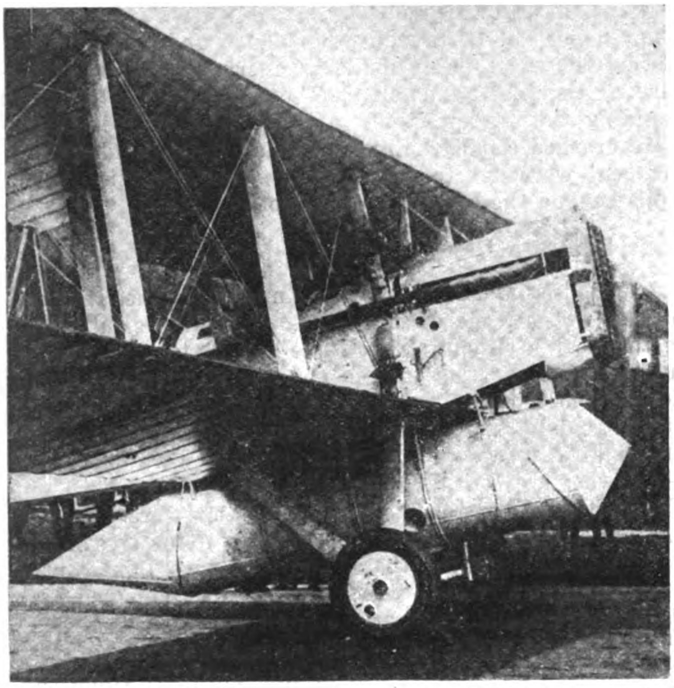
Sixty Planes a Day

Assembling and shipping new American planes was the biggest but not the most difficult, of the tasks intrusted to the staff at Romorantin. The size of the job can be judged from the fact that in one day 60 airplanes were flown from Romorantin to the armies. Up at the front, at Chateau-Thierry, in the Argonne, in Champagne, east of Dunkirk, wherever American aviators were operating —and they were to be found all along the line from the North Sea to the Swiss frontier—planes were smashed and were being sent back to Romorantin for treatment. During those eight months of heavy fighting Romorantin received 1184 airplanes which had been so damaged that the squadrons and parks at the front were unable to handle them. Of these planes 899 were American and 295 were of foreign origin. Out of this total 101 American planes and 207 foreign planes were salvaged, and 756 American planes and 40 foreign planes were repaired and delivered into service again, making a total of 796 airplanes returned to the army. In addition, when the armistice was signed there were 52 American and 48 repaired foreign planes on hand.

Under war conditions the life of an aviation engine is short. Each squadron in the field is equipped with limited repair facilities and is supposed to carry out work which can be executed without impairing the mobility of the organization. But in order to make possible any extensive amount of repairs it is necessary to provide each unit with a considerable stock of spare parts. But in France spares, whether for airplane engine, airplanes, or for automobiles, always have been exceedingly difficult to procure. French makers always preferred to build complete units rather than spares for the same, and from America there always seemed to be more difficulty in getting spare parts shipped to France than in securing whole engines. In consequence of this, Romorantin was made the great center at which aviation engine repairs should be carried out. When there was a defect which the squadron mechanics could not immediately remedy,

the engine was put aboard the railroad car and sent back to these centralized shops for treatment, its place being taken by a replacement which might be new or overhauled.

In considering this work it must not be imagined that the aviation material could be divided into American and foreign. While the United States practically limited itself to one type of engine and plane, the European material which had to be received and operated on comprised 41 different types of airplanes and 23 different types of engines. Before they landed in France not one man in a thousand had seen a foreign plane or even had the opportunity of reading a description of a modern airplane engine. Men had to be trained to fly these different types of planes; riggers had to learn to erect and adjust them. Mechanics had to study each different type of engine, to know how to repair them, assemble them and adjust them. Among the technical personnel were many first class automobile mechanics, but few if any of these had seen a foreign aviation engine before donning the uniform, and yet they had to handle such different types as the Renault, Rhone, Gnome, Fiat, R. A. F., Anzani, Beardmore, Hispano-Suiza, Salmson, Clerget, Lorraine-Dietrich and Peugeot.



To get deliveries of these foreign engines and planes necessitated negotiations with the Governments of France, England, and Italy, and even business connections with such neutral nations as Spain and Switzerland, This meant that hundreds of men who up to the outbreak of the war had never been outside the United States, had to make themselves acquainted with foreign business methods and handle one of the most highly specialized and technical subjects in a foreign language. Had any private business concern in America considered the possibility of a European business of this magnitude, it would doubtless have spent two years in laying plans and picking out a specialized personnel, before attempting to do any real work.

The call on the Supply Section of the Air Service fluctuated with the severity of the fighting. The course of the war might be followed merely by examining the diagrams of requisitions and deliveries. But from March to November, 1918, there was one continuous battle, and consequently one continuous call, with minor fluctuations, on the Supply Section. At Romorantin alone there were received in seven months 50,000 tons of material and distributed 17,000 tons, or a daily average of 322 tons. Among this material were 2600 propellers received and 1600 despatched; 1526 airplane wings received and 1039 sent out. The greatest strain came in the month of August, when the Supply Section sent out to the armies in the field a total of 950 airplanes.

The two big centers, Orly and Romorantin, were dependent on the base ports for their supply of material. From a military standpoint the whole of France and a small portion of England were divided up into zones, which comprised the various Base Sections, the District of Paris, the Intermediate Zone, and the Zone of Operation. At all the big base ports there were aviation officers and men whose duty it was to receive material and get it through as expeditiously as possible to its destination, which might be Paris or Romorantin or in extreme cases the Intermediate Zone.

(To be continued)

British Airplane Which Attempted Transatlantic Flight

THE Short Bros. biplane which fell into the Irish Sea on its attempt to fly across the ocean with Major Wood as pilot. The machine originally was built to carry a giant torpedo for attacking the German fleet. An aluminum gasoline tank with a capacity of 600 *gal. now takes the place of the torpedo. The wing span of the machine is* 34 *ft. and it is fitted with a Rolls-Royce engine of* 360 *hp.*

The International Labor Convention Analyzed

A Manifestation of a Common Purpose Among Labor Organizations of the World—The Nine Clauses and What They Indicate in the General Tendency of Labor Affairs

By Harry Tipper

LAST week there was printed in AUTOMOTIVE INDUSTRIES a summary of the Bill of Rights which was approved by the International Commission on labor legislation containing nine clauses that are proposed for insertion in the treaty of peace. The additional information which is available contains the text of the organization machinery by which the International Labor Conference is to function and through which its operations are to be made effective.

While this convention is not likely to become effective immediately and is not concerned in the present operations of a manufacturing plant, it is sufficiently important in its departure from precedent, in its indications of a common purpose among the labor organizations of the various countries and in the conditions of its recommendations, to make it worth while to examine the matter with some comment upon the developments.

Nine countries participated in this Commission: the United States, the British Empire, which, however, includes Canada, Australia, New Zealand and South Africa as self-governing colonies, France, Italy, Japan, Belgium, Cuba, Poland and the Czecho-Slovak Republic. This means that the most important manufacturing countries outside of the central countries of Europe, were interested in this International Labor Conference.

It is significant that while the main peace conference has been disturbed by the difference in national aims and the difficulty of their adjustment by the jockeying of political bodies, the International Labor Conference has gone ahead and with little trouble apparently has drawn up the nine clauses which constitute the Bill of Rights for incorporation in the treaty of peace.

We have had occasion to remark a number of times that labor knows how to co-operate in organizing for common purposes better than any other section of the population, and it is evident, from the conclusion of this conference, that the representatives of the different countries on this International Labor Commission have seen the necessity of establishing similar labor regulations upon certain broad lines if the international competition was not to interfere with the improvement of the condition of labor in the more populous and more advanced countries.

The actual Bill of Rights which has been presented for inclusion in the peace conference contains items which are of importance on account of their indication of the general tendency in labor affairs and their influence upon legislation in this country.

There is a specific clause dealing with this question admitting that employers and workers alike are allowed the right of association for all lawful purposes. Of course, this has been tacitly recognized by most manufacturing groups in this country, although this recognition has not taken the definite and effective form which it has taken in Great Britain. There are still a good many employers who question the right of the worker to organize and there are a great many groups of manufacturers who are still attempting to destroy the labor organizations with which they are concerned.

The recognition of the right of association and the recognition of its place in the relations between capital and labor must come definitely in the near future in any case, and, therefore, this clause in the treaty is merely a consolidation into the treaty of peace of the general opinions prevailing in the countries concerned.

Child Labor

Because of the control of labor regulations within its borders by each State in the Union, and the difference in public opinion in the different States, there has been no unanimity in the regulations concerned with the question of child labor in this country, and in this respect the United States is considerably behind the more important countries in Europe. Of all the matters pertaining to labor which can become the subject of State or national regulation, the conditions under which children may enter industry are the most important. The health, the education, and the outlook of the children directly affect the productive capacity, the political ideas and the social incentive of the mature.

In Great Britain the physical effects of the period in the middle of the nineteenth century, when factory work was done by thousands upon thousands of young children, is not yet eliminated. The physical deterioration, due to this industrial nearsightedness, is one of the difficulties which are affecting that country.

It should be considered, however, that the regulations in respect of the employment of child labor in Great Britain are to-day very strict, and the United States, as the most important industrial country in the world, has no definite policy in connection with this matter. It will become necessary for this country to decide, if this Bill of Rights is included in the treaty of peace, whether its ratification will include the three clauses which specifically regulate the employment of children in industry or commerce.

The Right to an Adequate Wage

Those clauses which deal with the right of labor to secure a wage adequate to maintain a reasonable standard of life are important more for the definition of this item than for any change which it would mean to industrial practice in this country, at any rate, in the metal trades and machinery industry, where the condition of the worker has been established on a basis which gives each worker this adequate wage on the basis stated.

The following clause, however, which deals with the pay to be given to women workers is of considerable importance to the machinery industries which have begun to employ large numbers of women workers, particularly since the war broke out.

This clause demands equal pay to women and to men for work of equal value in quantity and quality. Under the present system of handling labor pay, it has been customary in a good many plants to secure women workers for a reduction in the wage for given classes of work from that required by men working at the same job. The practice in this respect would be altered if the various States in this country decide to ratify this clause in the treaty.

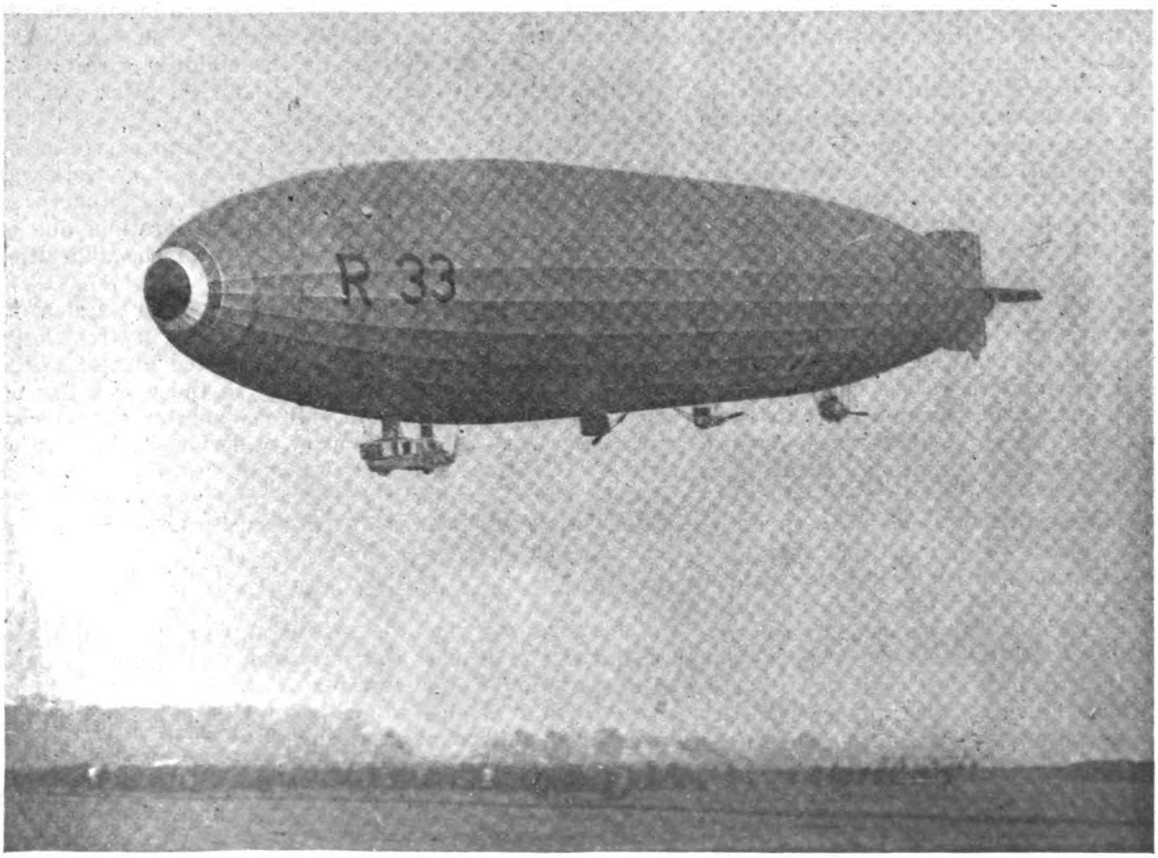
The only other item of importance in this array deals with the demand for a weekly rest for all workers and the limitation of hours to eight hours a day, or 48 a week.

The machinery of organization proposed in this International Labor Commission provides that the recommendations of such International Commission shall be treated in the case of a federal power as a recommendation only, where it is impossible for the Government to enter into a draft convention. This means that on labor questions, which are under the control of the various states in this country, most of the provisions contained in the Bill of Rights would have to be treated as recommendations only and recommended by the national government to the states for adoption. They are not of importance, therefore, as indicating any immediate or pending action on the part of the government in this country in its agreement with the Allies as to peace terms, but they are of importance in indicating the solidarity of the aims of labor in the various countries, the recognition of certain general regulations which must exist internationally if the labor position is to be safeguarded and the strength which can be used by the labor bodies in the various countries in the attainment of these provisions which they are convinced are internationally desirable.

This whole report should convince the manufacturer of the power which has been secured by the worker during the war and which has changed the conditions to which the industry must look forward and to which its operations must be adapted.

It is evident that the inclusion of this Bill of Rights in the treaty of peace would bring these nine clauses definitely into the political arena in this country and make them matters which must be decided either one way or the other by the political bodies. Such an event would also initiate the action of the various states upon regulations of a uniform character and have an additional political, civic significance in that way. Whether these clauses are actually adopted in the making of the final treaty and whether they become operative in this country in due course after that time or not, the attention which has been given to them by their recommendation to the peace conference from the International Labor Commission will bring them into prominence and undoubtedly reinforce the propaganda which has been established already for the passage of some such regulations.

Manufacturers in the automotive field will do well to watch the tendency now exhibited in various states in this country for the promotion of legislation of a regulatory character on labor matters, such as the bills which were brought before the New York State Legislature for a minimum wage and a definite working day, considering this increased tendency toward legislative enactments in their decisions as to their own policy toward their own workers and toward their own organization plans. It is desirable that as many of these questions be settled between the owners of the industrial organization and the workers within that organization and that as few of them be left to regulation as may be. The extent to which regulation is demanded will depend very largely upon the extent to which the manufacturer takes these things into consideration and considers his organization plans and his own policy in his own plan with due regard to the tendency of public opinion and the general attitude of the labor bodies as shown in their demands and agreements.



R-33

British rigid dirigible on trial trip

Direct Selling in South America*

A Careful Study of Markets and Trade Conditions Essential—Selling Through Branch Houses, Traveling Representatives and by Mail—The South American Merchant—Terms and Credit

SOUTH AMERICA is one of the world's greatest potential markets. Its resources are enormous. It is awakening to its great commercial opportunities, and its future development promises to be rapid. Our country should participate in that development to the extent of its ability. During the war, with European markets largely cut off, South American business was thrown at our feet, but this condition will not continue much longer. European manufacturers are alert to the possibilities of this market, and it promises to be one of the most hotly contested in the world. Our share of the business will depend almost entirely on the efforts which we make to retain our present customers and develop new ones. If American manufacturers will awaken to full appreciation of the importance and magnitude of the South American market, and make whole-hearted efforts to develop it, there is no reason why we should not retain and increase in this field the leadership which the war made possible.—P. S. STEENSTRUP.

MOST products marketable in the United States can be sold in South America, but the country is so large and trade conditions so varied that a very careful study of conditions should be made before a selling campaign is launched.

There are three different ways of direct marketing: First, through branch houses; second, through traveling salesmen; third, by mail, through the use of letters, catalogs and samples.

Branch houses are not desirable for the small manufacturer or the manufacturer with limited sales; neither are they profitable for the manufacturer who is interested in foreign markets only when he has a surplus of products and forgets all about overseas business when the domestic market is able to absorb all the merchandise he produced.

For the manufacturer with ample capital and a staple product for which a large and sustained demand can be created, the branch house is the best selling method to employ in developing South American markets. The establishment of a branch house makes your business a part of the country and community, and gives you a standing which cannot be obtained by other methods. The South American, like the European, is favorably impressed by the appearance of permanency and he likes to establish business relations on a more or less permanent basis.

Branch House Essentials

The location of branch houses should receive careful consideration. If inland, they should be on a good railway or near as many different transportation systems as possible. The locations should be selected only after careful consideration of the markets which the branches would serve, labor conditions, local taxes, etc. The initial expense incurred in establishing South American branches is much greater than the cost of similar ventures in the United States. Many different forms of taxes and gratuities must be paid, and traveling expenses are much higher than in this country.

The selection of a branch manager is very important. He should be familiar with the languages, customs and business methods of the countries in which he is located, should have a thorough knowledge of his product, and command the confidence of his house. Unlike the American branch manager, who is in almost daily contact with his home office, the manager of an overseas branch is almost entirely on his own resources. He must be competent and resourceful and be able to make decisions on important questions without the delays incident to communication with the home office.

If market possibilities or finances do not justify the expenses and risks incident to the establishment of branch houses, the next best way to market your product in South America is through traveling salesmen and exclusive representatives.

Traveling Representatives and Local Agents

Great care should be taken in selecting your traveling representatives. Although good men are scarce, traveling is so expensive that you cannot afford any other kind. An unsuitable traveler is a very costly investment. Men developed in your own office will probably be found most satisfactory. They should know your product thoroughly, should have a good conversational knowledge of Spanish and Portuguese, or Spanish and French, and be dependable and adaptable. Personality and breeding are important in the South American field. Friendship is a valuable factor in business, and the exchange of social courtesies is an essential preliminary to the opening of business relations. Do not expect your representatives to show immediate results. It takes time and patience to establish a profitable business in South America and manufacturers who are not prepared to spend the time and money necessary for development work should not attempt to enter the markets.

In the appointment of local representatives or distributers great care should be used in the apportionment of territory, and also in the selection of the business houses. Only as much territory should be allotted as a distributer is able to cover thoroughly. While old-established business houses often make the best representatives, a young, aggressive firm with less capital than its older competitors, but with much more initiative, will occasionally get the larger volume of business.

After a distributer is appointed he should receive all possible co-operation from the manufacturer. Literature in the language of the country without prices, or with prices quoted in the money with which his customers are familiar should be furnished. Periodical advertising campaigns should be provided and all possible assistance and encouragement given the distributer to promote the sale of your products through modern, aggressive sales promotion work.

Many American merchants and manufacturers whose salesmen have never been south of the Rio Grande have by mail built up substantial and profitable trade relations with South America. The larger mail order houses are doing a large volume of business in this territory, and many of the larger New York department stores are receiving orders from the wealthy South Americans. Our export publications are now carrying advertisements of practically all known commodities from pins to locomotives

*Abstract of a paper read before the Sixth Foreign Trade Convention by Mr. Steenstrup, who is general manager of the General Motors Export Co.

and many of the advertisers never have had traveling representatives in South America.

For the merchant or manufacturer who does not wish to incur the expense of sending out traveling representatives, the mails offer a comparatively inexpensive and frequently effective medium for developing South American trade. Advertisements in our export publications bring good results; and if desired, this form of advertising may be supplemented by circularizing lists of prospects, which may be obtained from daily commerce reports, foreign trade directories, business associations, banks with South American branches, United States consuls and the companies which furnish lists of various kinds. Advertising matter for use in a direct-by-mail campaign of this kind should be prepared with the greatest care. Catalogs and circulars should be well illustrated, printed in idiomatic Spanish, or in Portuguese if for distribution in Brazil, and when prices are quoted they should be in the money of the country in which the literature is distributed. All inquiries should receive prompt and careful attention, and replies should be in the language of the correspondent.

Before exclusive agencies are granted, a most thorough investigation of the prospects and possibilities of the territory which the agent proposes to cover should be made. Sometimes a merchant handling competitive lines manufactured in European countries places a small order with an American manufacturer for the sole purpose of obtaining an exclusive contract and excluding the product from the market during the life of the agreement.

The South American Merchant

Business establishments in South America are of two kinds, native and foreign, with business houses owned by foreigners greatly outnumbering those owned by the natives, especially in the large cities. Many of the native merchants are Mestizos, of mixed Spanish and Negro blood, and their establishments as a rule are not equal to those maintained by the foreign merchants.

The merchants of South America may be grouped in five classes: 1. The general importers who correspond to the wholesale jobbers in this country. 2. Large retailers who import for their own account. 3. Large land owners or development companies who import. 4. The small shops and retailers in the cities. 5. The general stores, usually found in the rural districts and mining camps and corresponding to the general stores in this country.

As a rule, the South American prefers a small turnover and a large profit. He conducts his business in what to us seems a very leisurely manner. The shops in the cities usually open at 8.30 or 9 o'clock, remain open until noon, and then close until three. The most popular shopping hours are from three to six, at which hour most of the city stores close.

The business men, as a rule, are conservative and shrewd, careful buyers. They are well educated, polite and hospitable, with a high regard for music, literature and the fine arts. The South American likes to become thoroughly acquainted with you before he talks business, and in the smaller cities it is advisable to visit your prospect two or three times before your business is even mentioned. Appointments are quite frequently neglected and you will find it desirable to give your prospect plenty of time to make up his mind, because, while he is at all times courteous and hospitable, he greatly resents being hurried or persuaded against his will.

Packing Instructions Must Be Followed

When you receive an order from South America in which definite instructions are given regarding packing, marking and shipping, follow them explicitly. Do not permit your shipping clerk to ignore these instructions on the assumption that what is good enough for us is good enough for any country in the world. It simply will not do! Much of the dissatisfaction with our merchants and products in the past has been caused by failure to follow packing and shipping instructions.

A great amount of the inland freight in South America is moved by animal transport; mules, oxen, llamas and burros are employed, and much of the travel is over rough mountain trails. The average load for these animals is: 100 lbs. for llamas, 150 lbs. for burros, and 200 lbs. for mules. When your customer specifies that his goods are to be packed in cases made of one-inch lumber and measuring not over 2x3 ft., there is a good reason for his not doing so.

On the West Coast of South America good ports are few and most ships are unloaded in the open roadsteads. The merchandise is discharged on lighters, which are flat-bottomed barges with vertical sides and a covering for rainy weather. Packages are lowered on to the lighters by the steamer crane, usually very carelessly. If the lighter is wallowing in a heavy ground swell, the load often strikes with a terrific impact. The necessity for secure packing in strong cases is therefore apparent.

Climatic Conditions Should Be Considered

The moisture, heavy rains and excessive heat should also be considered in preparing shipments, especially if the packages contain perishable articles. The best protection against moisture is a zinc or tin-lined case. Machinery and metal parts should be coated with oil to prevent rust. Pilfering is common in South America, and every effort should be made to make up the packages in such a way as to guard against this. When the packages are transported over numerous routes it is impossible to fix the responsibility for the theft, and there is slight possibility of recovery.

In making up shipments, the tariff classifications of the different countries should be considered. Do not pack in one case different classes of merchandise on which duty is assessed at different rates, as the duty is then assessed on the entire shipment at the highest rate.

Marks on cases should be simple, plain and legible; stencil marking is the best. Some South American countries prohibit receipt of shipments unless marked with stencils. The net, gross and tare weights should be plainly marked on each case, and when the shipment contains two or more cases they should be numbered consecutively.

Terms and Credit

Previous to the war South American merchants were granted liberal credit terms on all their purchases from European countries, and this was an important factor in the control of South American markets by European exporters. During the war American manufacturers have been demanding and getting cash in New York, but these terms must be liberalized if we are to get the maximum business from this country in the future.

The customary terms before the war were from three to twelve months' time. In fact, the German method was to ascertain what terms a merchant had been getting, and then offer him better ones. Credit liberality can easily be overdone, but there is no question but that the volume of our business with South America will depend somewhat on the terms we are prepared to offer.

The South American merchant requires credit for a number of good reasons. The resources of the country are, and will for some time remain, largely agricultural, and although the crops vary in the different countries, the merchants are called on to finance the native farmers; the same as our general merchants in the smaller towns. Bills are not paid until the crops are sold, and the merchant requires credit until he receives his money. Duty must be paid on practically all merchandise imported, and duty and ocean freight amounts to 25 to 75 per cent of the value of the goods. Stocks move slowly, and the merchants are required to carry large stocks on hand to take care of demand between shipments. Financing of some kind is essential, and as interest rates are high in South America the merchant usually prefers to buy where he can obtain credit terms at reasonable rates of interest rather than borrow money locally.

Your advertising copy should be conservative and descriptive of the merits and uses of your merchandise. Superlatives and bombastic or exaggerated statements should be avoided. The North American has a reputation as a "bluffer" in the Southern republics, and the class of advertising copy used by some of our merchants in South American publications has not done much to counteract this reputation.

The FORVM

Simplicity and Frankness in Industrial Relations

By Homer S. Trecartin

THE article by Harry Tipper in AUTOMOTIVE INDUSTRIES of April 10 is entirely too good to let pass without comment. It contains the germ of the truth which will have to be recognized and applied before a settlement of the whole controversy between employer and employee, between management and labor, will be arrived at. Mr. Tipper analyzes the question in a masterly way, but the subject should not be allowed to die or to remain dormant for a moment.

AUTOMOTIVE INDUSTRIES could do a great work by furthering in its pages a broad discussion of the subject which it has so ably taken up, that of industrial relationships. Mr. Tipper very clearly notes the tendency to a lack of simplicity in many of the plans which have been formulated by existing industrial organizations to bring about co-ordination of efforts and interest between workers and the management and employers and other concerns.

Nearly two years ago I assumed control of a manufacturing plant as the general manager. Certain profound beliefs and principles were firmly embedded in my mind as to the proper relationship between the employees in an organization and the management and owners of that organization. They were based largely upon the ideas that I had formed regarding the relationship that should exist between individuals in the very broadest form of association—that of the people and their government.

No Secrecy in Management

I applied these convictions and beliefs in my management of the company, and with very little compromise I was able to adhere consistently to them. What little compromise with the ideals was made was necessary, not from any inherent fault in the ideals, but because the ideals differed radically in some respects from prevailing custom. President Wilson had forcibly declared against secret treaties or secret diplomacy. I issued a plain decree in my small organization that there was to be no secrecy in it as far as the management end was concerned. It took eight or nine months to sell the individuals in the company this idea; the belief that secret conspiracies were an inevitable part of the management side of business were so deeply ingrained that it was necessary to talk it out of practically each man in the company individually.

Their belief in the efficacy of decisions kept confidential among the management was part of their training. As soon as a man was made a foreman he felt that he would no longer be able to take his fellow workers into his confidence about the details of his work. He felt that he was appointed partly because of his sympathy with the management and that there was implied the thought of confidential dealings with them. The superintendents had this idea; they felt that it was part of their job to conspire against the worker, that in business they were on different sides of the fight.

Not once but a dozen times did I call the whole organization together to enable me to tell them my beliefs and my principles that would actuate me in my management of the company, and in every talk, in almost every article I wrote for the magazine which we brought into being, in almost every notice which I had placed on the bulletin board, I had to dwell by direct statement or by suggestion upon this one big guiding principle—that there was to be no secrecy in the organization.

Complete transcripts of the proceedings of every foremen's meeting and of every conference of department heads, both of which occurred regularly once a week, were always typewritten and placed on the bulletin boards so that all could have a knowledge of everything that transpired in these meetings.

A stranger came to me once with the appearance and manners of a successful lawyer and laid on my desk a complete report of one of the meetings of the union, which was very strong in our company and which I never in any way opposed. It was a typewritten record of everything that had occurred at this meeting, in which some radical pleas were made for an immediate strike by two or three of the men in the shop. They were radically opposed to the management and were evidently trying to incite the rest to combative measures.

This man told me that the organization which he represented was nation-wide in its activities and he described to me their method of working. He said that they hired competent workers, paying them a salary of 50 per cent of their regular wages, and that they would then send them to industrial plants where the organization's services were contracted for to get employment. These men would ingratiate themselves with the workers in the plant and would proceed to spy upon them and furnish reports to their superior officers. In addition to their "observation" work other employees would do propaganda work for the management in ways that seemed most advisable, either by appealing to the better instincts of the workers, their sense of patriotism or loyalty, or by creating strife and jealousies among them.

I thanked the gentlemanly individual for his trouble in coming to see me, insisting that he take his report out with himself and his hat, and bade him adieu. I told the men of the occurrence and explained to them that I had not considered for a moment obtaining the services of the agency that had given me the report. I told them that I did not feel that it was any of my business what they wished to do or say in their meetings, that if they felt they had a grievance I would much rather they discuss it in any way they chose and take what steps they thought were necessary to correct the grievance. I told them, however, that I thought they could accomplish a good deal more for themselves by taking me into their confidence, but made them clearly understand that I felt I had no right in interfering with their methods of discussion.

The Simplest Idea Must Be Sold

As Mr. Tipper points out in his article, it is not sufficient to formulate an ideal proposition and then to advance it to the people who will benefit by it.

The very best selling point that a proposition coming from the management to the workers can have is that of simplicity. Mr. Tipper speaks truly when he says that the company lawyers are prone to use the characteristic methods of legal departments and the language of the lawyer. He also says truly that the lawyer's method of approach to the question does not lead to that simplicity and clarity which is absolutely necessary in a case of this kind, if the value of the method is not to be befogged by the verbiage that surrounds its constitution.

I found the application of the simple laws of government that were brought forth by the necessity of the time wholly successful from every point of view. It satisfied the owners, the management and the workers of the little organization of three hundred souls where it was applied, and I believe that without this factor of simplicity little results will be achieved in bigger organizations and it will no doubt be demonstrated that those lacking simplicity will have no results that will benefit or appeal to the masses.

The editor of AUTOMOTIVE INDUSTRIES can do no better work than by furthering in the pages of his publication the creed of, first, correct principles to actuate the owners, managers and workers, and, second, simple methods of expounding these principles and beliefs and simple methods of putting them into practice.

Business Needs Leadership and Government Co-operation

(*Continued from page* 992)

was the first national legal step. Massachusetts has recently enacted a law permitting employees in corporate industries to elect directors of the corporations to provide them with a part in the management. There are cases where through co-operation manufacturers have voluntarily reduced prices. More frequently there is the spirit of co-operation developing by which concerns actually competitive are combining to deal with common problems of their industry."

There is something radically wrong with this country, stated Governor Edge of New Jersey, who claimed that we are lacking business leadership and governmental initiative.

"Our government," he stated, "is stopping, looking and listening, watching and waiting when it ought to be leading. The government should set the example by digging canals, building roads, increasing railway facilities, developing water power and otherwise demonstrating that Uncle Sam is not afraid to buy and hire at prevailing prices. Private business is bound to follow. Capital will be released. Labor will be employed. And our so-called post-war reconstruction prices will evaporate. We must remove the paralyzing hand of over-regulation, governmental prejudice and political management of business."

Governmental regulation that oversteps the requirements of healthy competition has degenerated to governmental persecution. The government has no justification for attempting to run the business of others until it can run its own business successfully.

The government must curtail the present war taxes on industry, said A. L. Shapleigh, decrying the effect of these taxes which take cash from industry, whereas the profits are usually represented only by increased inventory and accounts receivable.

"If the government," he said, "continues to demand so large a share of profits, the ability to increase working capital by addition of earnings to surplus, thus enabling expansion and greater employment of labor, is minimized."

Private Ownership of Merchant Marine Approved

Unanimous approval greeted the demand of Edward B. Burling for the sale of the merchant marine to private American owners. The American marine should include at least all of the ships now controlled by our government of more than 6000 tons dead weight. They should be sold to private companies or individuals and their cost prices should be regarded as war costs just as were the costs of the airplanes, motor trucks, and so forth, and the costs should be written off sufficiently to allow the sale of the ships to Americans on a basis which will allow them to compete abroad.

In a concrete plan for the sale of the marine, Mr. Burling outlined the following:

1—The government should sell all of the merchant marine ships.

2—Purchasers of ships should be free from government direction or regulation of routes or rates except as are now embodied in the law.

3—Re-sale to any foreign countries should be restricted for a period of years.

4—The ships should be sold as a whole fleet, but terms of sale must be liberal, and all of the steel ships over 6000 tons should be sold to Americans only. In order to insure the widest distribution and stimulate financial interest throughout the country the government should invite the formation of shipping associations to represent the different maritime sections of the country, such associations comprising only American citizens or concerns of good financial standing and representing New England, New York City, Philadelphia, Baltimore, the South Atlantic ports, New Orleans, Pacific Coast, and San Francisco, and at the Puget Sound and the Great Lakes.

The budget committee of the chamber recommended the establishment of a national budget to be compiled by the Secretary of the Treasury for presentation to the President, to include the expenditures of the year, the condition of the national treasury, and the recommendations for appropriations for the following year, together with suggestions for raising the revenue needed. The committee also recommended that Congress should establish but two committees to have jurisdiction over all revenue and expenditure proposals, one for the House and one for the Senate.

A demand was made for cessation of price fixing by the Government by A. W. Douglas, who recommended a return to free operation of the law of supply and demand, stating that in his opinion this would bring about a decline in prices. Prolonged applause greeted his statement: "We have had enough of Government control of transportation with its incompetence and extravagance."

There is a lack of systematic business organization of retail distribution and a need for analysis of retail business and especially the introduction of systems of cost keeping, stated by Dr. W. F. Gephart of the Washington University School of Commerce. Another weakness is the failure of distributers to organize their business and classify their patrons.

The Government, he said, frowns upon associations and co-operation among business men and only because of the small minority of inefficient or dishonest men in the groups.

The middleman is the specialized distributer of commodities, he declared, between the producer and the consumer and, while there may be too many of them and too many inefficient ones, yet his function is a product of normal and natural industrial development and there is no need to fear that the individual proprietor in business will disappear.

The present tendency of manufacturers and retailers to continue the large per cent of profit of the past few years was decried by Harry A. Wheeler, president of the Chamber of Commerce, who stated that we must be content to share those profits with the Government if we do maintain them or to so shade our prices as to fall back to the profit level of pre-war years, on the principle of a fair return upon capital actually invested.

"Insofar as public ownership and operation by federal authority is concerned," stated Mr. Wheeler, "the country is farther away from the adoption of that principle to-day than it was a decade ago. But there is a strong tendency to increase public regulation, and it is important that this be recognized because co-operation with public authority will produce intelligent, constructive regulation, while disregard of the tendency will bring increasingly drastic control.

That we cannot look to the Allies for export trade for the next 4 or 5 years, and that we must make large investments in public and private enterprises in those countries, were points emphasized by Maurice Casenave of the French Industrial Mission, Joy Joyce Broderick of the British Embassy and Lieutenant Constanti of the Italian Mission. France,

SO far as public ownership and operation by Federal authority is concerned, the country is farther away from the adoption of that principle to-day than it was a decade ago. —HARRY A. WHEELER, *President United States Chamber of Commerce.*

stated Casenave, is suffering severely from the results of the war, which for four years cost her 25 per cent of her normal tax revenue, the use of 80 per cent of her blast furnaces, 67 per cent of her coal, 90 per cent of her pig iron and 90 per cent of her textiles, because all of these were in the region invaded by the Germans. France, he stated, must first establish her domestic business and her own export business and inculcate a strong policy of thrift in her people before she can consider the import of commodities from foreign countries. The French Government owes the United States almost four billion dollars, and it cannot afford to increase that indebtedness by permitting exports from this country in unrestricted quantities. Similar declarations were made by Broderick and Lieutenant Constanti with regard to Italy and England.

"It is impossible," said Broderick, "to say how long the British restrictions will last, but my latest information is that they will be revised on the first of September. I presume it is quite clearly understood that the restrictions do not seek in any way to discriminate against the United States but apply equally to the manufacturers of all foreign countries."

There must be taxes and bond issues to meet the financial requirements of this country, stated Paul M. Warburg, pointing out that countries starting on the "all-tax theory" have been taught by experience that it was impossible for them to raise the funds required without recourse to huge loan operations, and conversely the "all-loan champions" found that it was foolhardy to try to raise great sums without increased taxation. We must look to those possessed of smaller incomes and subject to only moderate taxation to produce the funds for bond investments, he stated, if owing to drastic taxation the larger incomes cannot now be relied upon to furnish the bulk of the investment funds. The fundamental remedy for the national economic ills, he emphasized, lies in thrift, which spells increased production and decreased consumption and resultant saving. This will bring about a healthy deflation and prices will then find their proper levels and our problems of equitable and reasonable taxation will solve themselves.

A plea for a centralized department to co-ordinate the work of the fifteen different government bureaus actively engaged in export matters was made by Stanley J. Quinn, secretary of the American Association of Exporters, who pointed out that there are bureaus in the departments of Commerce, State, Agriculture, Interior, and Treasury, the Federal Trade Commission, the War Trade Board and the Tariff Commission all interested in matters of concern to exporters, and which have no single place where they can co-ordinate the results of their efforts. England, he pointed out, with her vast experience in export trade, found it necessary to create a separate Department of Overseas Trade to co-ordinate the functions of the various government bureaus, and he pleaded we should do likewise.

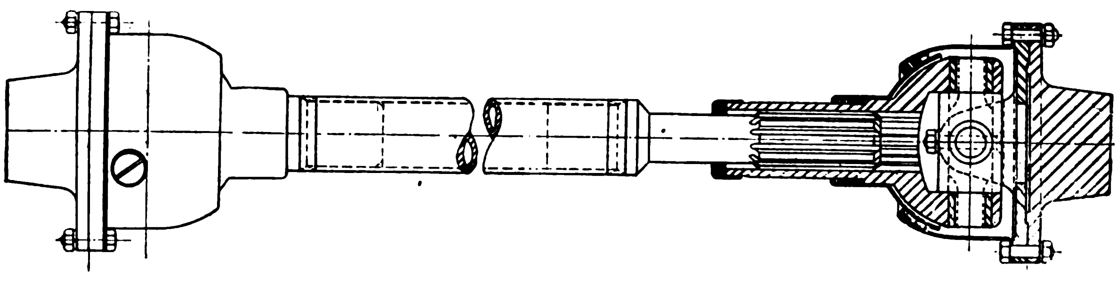
IF our foreign trade position is to be maintained and an outlet found for excess production we must be prepared to sell on credit, or in other words, invest the money due us in foreign securities or in foreign enterprise.—* R. F. LORRE, *Vice-President, Guaranty Trust Co., New York.

New M. & E. Universal Joints

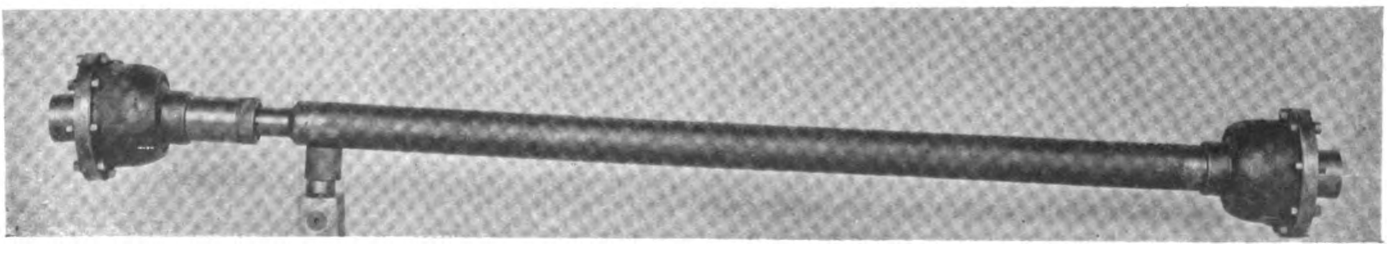
THE Merchant & Evans Co., Philadelphia, Pa., has brought out a new line of universal joints in four sizes, rated at 25, 30, 40 and 60 hp. respectively, at 1000 r.p.m. The joint is of the yoke and block type, comprising one yoke and one disc with two lugs, which are connected by the block. The working parts consist of two hardened pins, accurately ground, the ends of which are inserted in four hardened and ground bushings, which are driven into the yoke and the lugs on the disc, both of which parts are steel drop forgings. The block is inserted between the yokes for the purpose of centering and supporting the pins.

The most interesting feature of the joint is the housing. This consists of two steel pressings with spherical surfaces. The outer part of the housing is secured to the disc of the universal by the same bolts which hold this disc to the machine part to which the universal is connected. The inner part of the housing is provided with a sleeve or hub, surrounding a coiled spring on the hub of the yoke member of the universal and having its outer edge flanged inward. This part of the housing is pressed against the outer part by means of the coiled spring. Between the inner and outer portions of the housing there is a gasket insuring a dust- and grease-proof joint.

The Merchant & Evans Co. makes up complete universal sets, comprising two propeller shafts, two universal joints and a slip joint.



Section of M. & E. universal showing yoke and block construction



The M. & E. universals are made in four sizes from 30 to 60 hp. capacity

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL. Thursday, May 8, 1919 No. 19

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address - - - Autoland, New York
Long Distance Telephone - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - One Year, $3.00
Canada - - - One Year, 5.00
Foreign Countries - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Designing for Manufacture

ARE we going too far in the matter of designing for production?

This is something to guard against, as we cannot afford, for the sake of saving in manufacturing costs, to have performance ability decrease. Yet if it is possible to get equal performance and to really design for manufacture so as materially to reduce the number of operations per car, or to reduce the number of tools required and the number of jigs, by making parts do the work which formerly required two or three different kinds of parts, then we have really accomplished something.

Some of the cars not yet in production, but which will probably be shown at the next national show, have been designed very largely from a manufacturing standpoint. The result is that sizes of parts and sizes of tapped holes will be far out of line from a requirement standpoint, as far as stresses, etc., are concerned; yet these sizes are employed simply because they largely cut down the number of tools and the amount of equipment required in the factory. Probably they also cut down the number of operations required, and therefore effect a gain from a manufacturing standpoint. It will be interesting to note the performance of such cars and see if it has been notably sacrificed.

A certain car which will make its appearance about the time of the next national shows is said to have no lefts and rights. Every part which will fit on the left-hand side will also fit on the right-hand side, even to the runningboards. The number of reamer sizes in the tool equipment for manufacturing this car is said to have been cut down by 50 per cent, and the number of other tools has been reduced correspondingly. This means a reduction in labor cost per car, and the money thus saved can be put into materials or it can be taken off the selling price.

Big savings in the cost of labor or in the finished product will result in a lower price and better product to the consumer. With fewer operations, the operations can be more carefully checked, and probably better workmanship will result. This is an important phase in manufacturing and should be closely watched.

The Disappearing Top

PASSENGER car bodies with a compartment containing the top when down are no novelty, though previous to the war this construction was not very general in Europe. This practice in body design now seems to have "caught on," and several of the most recent foreign cars of which details have reached this country embody this feature. We have in mind particularly the Austin 20, recently described, and a Mercedes with body by Forrler of Strasbourg.

It is rather difficult to believe that this construction will ever come into general use here. What need is there for stowing the top away in this manner, anyhow? To some people the folded top with its cover extending to the rear of the car may appear obtrusive, but we do not believe that the average person sees anything objectionable in it. It may be possible to design an attractive-looking body with a top compartment, but those that we have seen so far certainly do not possess this attribute. Not only are the bodies with top compartment less attractive than conventional up-to-date designs, but the tops designed to go into these compartments are very ungainly when up.

Possibly the inclosed top is an outgrowth of the plan to streamline the whole body. If so, it seems this idea has been carried to excess.

Preservation of the top from wear can hardly be an object. When covered with a boot or case of waterproof material and held from rattling by a suitable holder the top is well protected.

Our manufacturers in their search for novelty have often been inclined to adopt European practices without convincing themselves of the merits of these practices. In the case of the top compartment it will be well to observe great caution.

Direct Selling in Foreign Lands

THE consensus of opinion among more than 500 American business men who participated in the sessions of the foreign trade convention was that direct selling in foreign lands is the only course to permanent foreign trade.

By direct selling they meant selling through branches in foreign countries, or directly through foreign jobbers, or dealers, or exclusive foreign agents.

In any or all of these three methods of direct selling there is the one underlying fundamental, namely, that you are doing business direct with the man who is meeting the consumer in the foreign country. This is the essential, the one necessary, it might be said the imperative part, of the transactions between manufacturer and consumer in successful foreign trade.

The branch-house method was conceded to be the best one although very expensive at first. The branch manager should be an American citizen, and preferably one who has been with the home company for many years, who is a living embodiment of the spirit of the company and who knows intimately the organization in every detail. Such a manager, with a staff picked in the foreign country in which he is doing business, will be qualified to handle foreign trade as it must be handled to make it permanent.

Where the exclusive agent is used as a representative abroad he must be an agent who is a recognized factor in the line he represents. The exclusive agent of an American tire company in London must be a recognized tire man in Great Britain. That is the first requirement. After this, it is imperative that the American maker give much assistance in getting the agent started in business with his line. This is best done by one or perhaps two representatives of the manufacturing company going to London and remaining several months until the business is well launched.

These representatives see that the exclusive agent gets started right—that he knows the fundamentals of the manufacturer's business policy; that he knows every detail of the merchandise; that he knows the spirit and rule of the company's service system; that he knows the future plans of the company. Such a selling connection, established in this way, is next best to a branch.

In direct selling the personal as well as business characteristics of the several countries must be studied individually. A blanket policy of studying European characteristics will not assure good foreign trade in a single European country. The business fabric of each country must be intimately understood. So must the social structure. This is specially true in the older world and also in Spanish speaking countries where a well-established acquaintanceship is a prerequisite for business.

In some countries a certain portion of business can be designated as clean business and another portion as tainted business. The manufacturer must understand this. By direct selling methods there is a possibility of some control over the taking of tainted business, whereas with what might be known as indirect selling there is not a possibility of the manufacturer protecting himself by any form of control in taking any of this kind of business.

By direct selling some control of the advertising of a product in foreign countries can be had. In fact the manufacturer should co-operate with the foreign seller of his product in this particular, and must realize that just as he gives his home distributers and retailers assistance by his national advertising campaigns so he must give his like assistance to his exclusive agents or jobbers in foreign trade.

This advertising must be intelligently done and not blindly dictated from the home office. There are too many cases where the home advertising company insisted on writing the copy for foreign consumer sales, which proved a dismal failure because the local conditions of the foreign country were not understood. The home advertising organization can give assistance. It can furnish copy that breathes the spirit of the home merchandising policy, but there should be no arbitrary instructions merely to translate the copy and use it. The only instructions should be to use the spirit of the copy and express it so that it will be understood in the local field.

No advertising man can write selling copy for a people living 3000 or 6000 miles away, whose country he has never visited, whose social customs he has not studied at first hand, whose business methods he has only read of and whose language he has never spoken.

Service requirements constitute one of the strongest reasons for direct selling connections. Good service is impossible where the manufacturer is not known to the consumer, as too often happens with indirect selling methods. Service in the foreign field is immeasurably more important than in the domestic market.

The carrying of an adequate stock of spares in foreign countries is a most important factor in continuing and developing foreign trade. The branch house provides the best opportunity to do so, but with the foreign jobber and the exclusive agent good representation in this particular is possible, but with a greater degree of effort. The branch house managed by a factory representative is as closely in touch with the foreign consumer as the home factory. The stock of spares in the foreign branch can be handled as methodically as the factory maintenance department. When free service has to be given the factory man is there to look into the merits of the case. And this also applies to the replacement of defective parts.

In direct selling the error must not be made of placing the business in one country under a jobber or agent in some other country. Some form of direct representation should be established in every country where it is expected to do business.

Latest News of the

Foreign Propaganda for N.A.C.C.

Chamber to Send Investigators Abroad and Advertise American Cars—Propose National Truck Shows

DETROIT, May 6—Active steps in spreading trade propaganda of the American motor car in foreign countries, and a move toward the holding of national truck shows in New York and Chicago, were taken at the meeting of the directors and truck committee of the National Automobile Chamber of Commerce here to-day.

The N. A. C. C. plans to send special investigators abroad immediately for the purpose of investigating the foreign markets, and an extensive world-wide advertising campaign will be carried on to exploit the merits of the American-made car and truck.

The automobile industry in 1916 exported products in excess of $120,000,000 and the N. A. C. C. is not only anxious to maintain this business but to enlarge it. Growth is sure to come through the recognition of the value of automotive transportation due to the extended use of the American motor truck and passenger car during the war.

It is expected by this means to increase materially the export ratio to the total business. At the present time it is about 10 per cent. Details on these matters will be threshed out in New York on June 6 at a meeting of the export managers, when C. C. Hanch of the N. A. C. C. will have returned from Europe.

The truck division has taken under advisement the holding of truck and tractor shows the same weeks as the national automobile shows. Plans for the national truck shows to be held in New York and Chicago in January were outlined by the Show Committee.

The special committee on truck standardization headed by D. C. Fenner, and working in co-operation with the Society of Automotive Engineers, made substantial advances in its plans for new standard load ratings and various other matters concerning truck construction, to the advantage of users by reducing manufacturing costs and lowering selling price and at the same time adding to the efficiency and carrying capacity of the vehicle itself.

While truck business was slow in January and February, reports read at the meeting show that March and April business was reaching normal with excellent future prospects. Indications point to a great increase in truck sales in 1919.

Reports on legislation throughout the country show a marked degree of fairness on the part of state legislation for trucks. State bodies are becoming convinced of the necessity of hard-surfaced roads for their use and for motor travel in general. This is evinced in the fair attitude by lawmakers as to registration fees and weights permitted on the road. The general impression is to favor 25 cents per horsepower and 25 cents per 100 lb. as proper legislation, with 28,000 lb. as a maximum and not more than 800 lb. of weight permitted for each inch width of tire.

In attendance at Tuesday's meeting were J. Walter Drake (Hupmobile), chairman; W. D. Sullivan (G. M. C.); C. W. Williams (Hudson); J. J. Rathbun (White); H. M. Robins (Dodge); J. D. Dort (Dort), and number of export managers from Detroit plants.

Will Not Lift French Embargo

WASHINGTON, May 6—There is no truth in the reports that French import restrictions are to be completely lifted on June 1. A cablegram received by the Department of Commerce is to the effect that there may be some slight relaxation at that time, but there is no contemplated rescinding in a body of existing restrictions. Rumors were to the effect that the demand for textiles and automobiles in France would force the government to remove the import embargo.

International Harvester Buys P. & O. Plow

CHICAGO, May 7—The International Harvester Co. has purchased the Parlin & Orendorff Co., Canton, Ill., maker of P. & O. plows. The International company takes over the Parlin & Orendorff Co., with its ten branches, on July 1.

According to the financial report of the International Harvester Co. for the year ended Dec. 31, 1918, which includes operations of the International Harvester Co. of New Jersey and the International Harvester Corp., from Jan. 1, 1918, to Sept. 19, 1918, when the two companies were merged into the present organization, the combined surplus in 1917 amounted to $12,659,000. The 1918 surplus of $14,985,325 is $2,326,000 in advance.

In 1918 the company charged off $10,478,000 as depreciation of its assets in Russia. With the $13,727,000 charged off in 1917, the deduction for the 2 years amounts to $24,205,000. The gross income, after providing for taxes, is $31,648,850 and the surplus account, which was $61,051,337 in 1917, was increased at the end of 1918 to $68,036,662.

Vacuum Tank Patents Not Infringed

Previous Decision Freeing Weinberg of Stewart-Warner Infringement Claim Upheld

CHICAGO, April 7—The patent situation on vacuum tank methods of fuel feed made another step toward final solution when the Court of Appeals, April 30, upheld the previous decision of the United States District Court that the Thermo-Vacuum system based on Fred Weinberg's patents does not infringe the Webb-Jay patent on which the Stewart-Warner tank is built.

While directly affecting only the situation as between Stewart-Warner and the Thermo system, it also indirectly may influence the final decision on the appeal of Stewart-Warner from the decision of Judge Westenhaver last winter, which held that the Sparton tank, manufactured by the Sparks-Withington Co., infringes the Stewart-Warner patents only on two points of a series claimed.

After Judge Sanborn handed down his decision, April 20, 1918, in the United States District Court, holding that the Thermo-Vacuum system brought out by Fred Weinberg of Detroit was not an infringement on the Webb-Jay patents under which Stewart-Warner is licensed to manufacture the Stewart-Warner vacuum tank, Stewart-Warner appealed the case in the district Court of Appeals, and April 30, 1919, in this court, Judge Baker affirmed the decision of Judge Sanborn.

This court held that pumping a liquid, either gasoline or water, was an old process, and that while the Stewart-Warner patents were valid, the Weinberg tank was not an infringement, as in both devices the whole apparatus combined with the engine was broadly a pump.

On Dec. 10, 1918, the Webb-Jay patents on the Stewart-Warner vacuum tank were held infringed by the Sparton vacuum system, made by the Sparks-Withington Co. In a decision handed down by Judge Westenhaver, in the United States District Court, also in Chicago, again the Stewart-Warner patents were held valid. Two of the 14 or 15 claims of Stewart-Warner were held infringed. The other claims for which an infringement decision was asked were upheld in a decision that the Sparton tank did not infringe.

This has been carried to the Court of Appeals by Stewart-Warner, and should this court be influenced by the recent decision of Judge Baker in affirming Judge Sanborn's decision on the Weinberg patents, and rule that the Sparton tank was

Automotive Industries

not an infringement on the Jay patents, then Stewart-Warner may carry both cases to the Supreme Court. If the decision of Judge Westenhaver is affirmed, then Stewart-Warner will probably not carry the Weinberg case to the Supreme Court, as they feel the Thermo-Vacuum system is not a real competitor.

Air Service Establishes Landing Fields

WASHINGTON, May 6—The Air Service of the U. S. Army has inaugurated a plan to establish landing fields in all parts of the United States in co-operation with municipalities, according to announcement by Maj. Gen. C. T. Menoher, and has issued specifications which are in accord with the army regulations. Together with this announcement, the Air Service states that it has already designated 32 cities and towns from the Atlantic to the Pacific where it hopes to secure the aid of the municipalities to establish and organize a national system of air lanes. Landing fields will be of four classes.

The Air Service will select landing fields in co-operation with municipal representatives. Neither the Air Service nor the Post Office Department will deal with any private associations in this matter.

At present the government will cooperate only in the establishment of municipal flying fields at the cities where the Post Office Department establishes aerial mail stations, or where the Air Service cross country routes require intermediate stations. The following cities have already been designated and flying fields will be built at each:

Boston, Mass.	Columbus, Ohio
New York City, N. Y.	Tucson, Ariz.
Richmond, Va.	Phoenix, Ariz.
Raleigh, N. C.	Yuma, Ariz.
Columbia, S. C.	Bakersfield, Cal.
Augusta, Ga.	Fresno, Cal.
Macon, Ga.	Buffalo, N. Y.
Atlanta, Ga.	Syracuse, N. Y.
Kissimmee, Fla.	Albany, N. Y.
Mobile, Ala.	Columbus, N. M.
New Orleans, La.	Kansas City, Mo.
Baton Rouge, La.	Oklahoma City, Okla.
Beaumont, Texas	Uniontown, Pa.
Flatonia, Texas	Daytona, Fla.
El Paso, Texas	Cleveland, Ohio
Texarkana, Texas	Chicago, Ill.

Although the government is confining itself to the establishment of these municipal landing fields, there is no restriction on other landing fields at cities and towns where local conditions or local initiative warrant it. The government will furnish an expeditionary steel hangar to be erected at the expense of the municipality.

It is understood also that the landing fields will be prepared at the expense of the municipality, which will also bear the expense incurred in the procurement of personnel and the maintenance of the field and equipment exclusive of airplanes.

Treasury Department Issues Rulings on Excise Taxes

Official Interpretations of the Law as It Applies to Automotive Products—Regulations Covering the Manner of Calculating the Amount of Tax and How It Is to Be Collected—What Is and Is Not Taxable

HIGH LIGHTS IN THE TAX REGULATIONS

TAX became effective Feb. 25, 1919.

The tax is on the actual sale.

If the tax is included in the sale price, the tax must be computed on the increased price.

Discounts for cash made subsequent to the sale cannot be deducted. When a rebate is made in return for a quantity purchase that extends over a period of time a deduction of the rebate is allowed to be made for the month when the final price is determined.

Commissions to agents or other expenses of sale are not deductible.

A maker of a body pays a tax. A maker of a chassis pays a tax. The assembler of both pays a tax, but can credit himself with the amount of the tax imposed on the body and chassis makers.

Where makers have agencies in which they have financial interest the agency pays the tax.

Tractors are not taxable even if sold in combination with trailers.

Trailers are not taxable unless they are of the type that forms the rear part of a car or truck.

When parts are sold by a maker to a jobber and in turn to a producer of cars, the manufacturer of the parts pays the tax.

Where a maker of parts or accessories sells them to a maker of cars, trucks or motorcycles, the manufacturer of the completed article pays the only tax.

If a manufacturer is engaged in both wholesale and retail business he bases the tax on the wholesale prices when sold at wholesale and on the average wholesale price of the articles sold at retail.

There is no tax for cars, trucks or motorcycles sold for export, provided they are exported within six months of the date of sale.

WASHINGTON, May 6—Regulations and interpretations of the income taxes as they apply to automotive products have been completed by the Treasury Department.

The rulings are not sufficiently complete to allow definite understanding of all of the problems that have come up in relation to the tax on automotive products.

In some instances they are exceedingly vague, as, for example, in the statement that if any doubt exists as to whether an accessory should be taxed, it will be determined by the fact that it is sold to an automobile accessories dealer by the manufacturer, which ruling is completely reversed by a following statement to the effect that a monkey wrench sold for general purposes is not subject to a tax.

On all such matters it will be necessary to secure definite special rulings from the Treasury Department. This, judging from the length of time taken to compile the present regulations, will occupy some few months, and in the meantime it will be necessary for the manufacturers to pay the tax and depend on a later ruling for securing credit where credit is due from the government.

That a tax can be imposed more than once on the same commodity is shown in the case of the assembler of automobiles who buys chassis from one maker and bodies from another. Each of the three producers has to pay a tax although certain credits are allowed the assembler as specified below.

Where an automobile maker has an agency in which he has a financial interest he does not pay a tax on the cars delivered to that agency for sale until the agency makes the sale. The agency then pays the tax. This is apparently done because of the difficulties that would arise if a manufacturer shipped a number of passenger cars to one of his branch retail establishments and had to pay a tax on them, whereas they have

(*Continued on page* 1031)

Rapid Increase in Car Production

7084 Cars a Day Turned Out in Michigan and Ohio During April—Demand Well Ahead of Output

Daily car production figures for April are as follows:

Car	Jan.	Feb.	March	April
Buick	100	400	450	500
Briscoe	30	50	50	75
Barley	...	4	10	12
Cadillac	55	60	80	100
Chalmers	30	65	70	80
Chandler	...	50	90	60
Chevrolet	...	300	350	700
Columbia	8	10	15	18
Dodge	300	375	400	500
Dort	40	65	70	100
Ford	1,300	2,000	2,400	3,000
Harroun	4	4	10	15
Hudson	30	50	50	100
Hupp	38	55	65	75
King	...	4	10	10
Liberty	15	15	25	30
Maxwell	150	150	220	250
Oakland	160	160	200	...
Olympian	4	5	10	12
Oldsmobile	...	110	140	140
Overland	320	400	422	600
Packard	...	...	1	25
Paige	50	50	55	70
Paterson	10	10	10	15
Jordan	...	...	...	12
Reo	100	100	125	125
Saxon	10	50	65	50
Scripps-Booth	20	40	45	45
Studebaker	150	150	175	200
Essex	30	50	50	100
Grant	25	35	50	50
Total	2,984	4,822	5,741	7,084

DETROIT, May 3—Production figures for Michigan and Ohio show that approximately 7084 automobiles were made daily during April. This is an increase of 1353 cars over the daily March production of 5741 cars and nearly 2½ times greater than the production of January, when 2984 machines were turned out daily.

From the unprecedented sales orders in the hands of manufacturers it is evident that if every factory could double its production every car would have an immediate sale. The demand for cars is greater to-day than at any other time in the history of the automotive industry. The demand exceeds the production of practically every company from 33⅓ to 70 per cent.

If the majority of the plants increase production during May, as many are now endeavoring, daily production for the present month will average approximately 10,000 cars and the month of June will see it reach a high mark under present manufacturing conditions. So great is the demand that many plants are rushing work on new building units. This is noticeably true of the Jordan Motor Car Co., Cleveland, which proposes to build a new plant greater than its present establishment. The Hudson Motor Car Co. is pushing work to the limit on new units to handle Essex production. Scripps-Booth will have a new factory this fall. General Motors expansion plans call for greatly increasing the manufacturing facilities of Buick, Oakland, Oldsmobile, Cadillac, Chevrolet and its other passenger car units.

Production during April was boosted despite the handicap of a tight material market and labor difficulties. All parts makers are experiencing an equally great rush of business and are unable to keep up with orders. As a result the companies depending upon them for parts are obliged to limit production to their parts supply. The parts makers have not switched from a war to a peace basis with the same rapidity of the motor car companies, and as a result are just beginning to reach capacity production. They have been harder hit by the hold-up of funds on government contracts, but this disadvantage has lately been overcome by the willingness of the government to advance 70 per cent of the money they claim is due them, leaving the remaining 30 per cent to be paid when the contract claim is finally approved at Washington.

The Detroit car manufacturers have encountered considerable difficulty in obtaining a steady flow of castings from the foundries, due to labor trouble. During April, 13 Detroit foundries were tied up by strikes. Seven are still affected, but six of the strikes have been settled. The companies all have had trouble in various departments, but in almost every instance the workers returned to work in the course of a few hours. However, suspension of operations for but a brief period had a marked effect on production, causing the April output of a number of concerns to fall short of schedule.

Packard Running Up Production

DETROIT, May 2—The Packard Motor Car Co. is running up its production rapidly, producing 200 passenger cars and 750 trucks in April. In May 350 passenger cars will be turned out, while June and July production calls for 500 cars monthly.

Paterson Turning Out 15 Machines a Day

FLINT, May 2—The Paterson Motor Car Co. is running 15 machines daily and is preparing to increase this production. The company has encountered some difficulty in securing material, but this situation has been greatly relieved within the last three weeks.

Harroun Picking Up on Production

DETROIT, May 2—The Harroun Motors Corp. of Wayne, Mich., is now running 15 cars daily. Within the next 30 days the company hopes to produce 25 cars per day.

The assembly department of this plant is still choked with government machinery, which has not yet been removed. Until this machinery is taken out production will be greatly curtailed.

Chandler to Make 3000 in June

CLEVELAND, May 2—The Chandler Motor Car Co. hopes to produce 2500 machines this month and 3000 in June. At present it is running approximately 16 cars daily.

Detroit Now Faces Labor Shortage

50,000 Skilled and Unskilled Workers Needed—Active Efforts to Enlist Men in Other Centers

DETROIT, May 2—There is a shortage of 50,000 skilled and unskilled workers in Detroit and an advertising campaign is being conducted in 69 cities where a surplus is reported. The larger companies are going even further, and are sending field representatives into these localities to head the unemployed toward Detroit. An example is the Packard Motor Car Co., which could use 500 more men immediately. This company has sent men to Camp Custer and to Great Lakes Naval station offering immediate employment to all service men the minute they are released from service.

Every company has more business than it can handle and the cry for men is becoming greater daily. As a result wages are beginning to go up, and it is predicted that within a month the scale will be greatly increased everywhere. The great obstacle which the companies must solve is the housing situation. This is daily becoming more critical. Rents are soaring and homes are at a premium. The companies are meeting this situation manfully and are not only contemplating house construction for employees but are aiding in the financing of a $5,000,000 corporation which proposes to start work at once on several thousand homes.

Within three months Detroit's labor problem has swung from one extreme to the other. In February between 30,000 and 50,000 men were without jobs, and the word was sent out to stop the flow of labor to Detroit. This warning had a noticeable effect, with the result that Detroit has a huge shortage.

The first of May saw labor demonstrations of a minor nature in Detroit. There are many strikes on and a universal cry for more wages. The big automotive concerns are not greatly affected, however. Some of them have suffered small walk-outs, but the trouble is usually settled in a few hours and the men are back on the job. While wages have advanced generally in the last three months, the advance is not keeping pace with the increasing cost of living, which still continues to soar. The increase in the wholesale cost of all commodities between August 1, 1914, and April 1, 1919, is 72 per cent.

Apperson Adopts 25 Per Cent Profit Sharing

KOKOMO, IND., May 6—Twenty-five per cent of the profits of the Apperson Brothers Automobile Co. for 1919 will be distributed among its employees who have been with the company throughout the year, proportionate to the amounts paid to each during the year. Announcement of the plan was made this week by the company to all employees.

The distribution of the employees' share in the profits will be made at the same time that dividends are determined for the stockholders, and the amount will be one-quarter of the net profits, after deducting the 8 per cent allowed by the Federal Income Tax law on invested capital. Every employee of the company, in whatever capacity, will share in the distribution provided he has been with the company throughout the year, and still in its employ at the time of the profit distribution.

—

Shop Committee to Represent Overland Employees

TOLEDO, May 5—Details of a plan whereby Toledo employees of the Willys-Overland Co. will elect a shop committee to represent them in all negotiations with the company will be announced soon. In a preliminary statement the company explains that a committeeman will be elected by secret ballot from the various departments, and that these committeemen will form a joint committee with representatives of the managament.

When the plan is in operation the workers will have a direct voice in determining working conditions, questions of safety, health, discipline and unfair treatment, and in settling any differences that may come up between them and the company. A general board of adjustment also will be organized, composed of both representatives of the employees and the company, to which cases may be appealed. Every employee, male or female, in service 3 months may vote for his choice of representative.

—

Wilson Foundry Makes Bonus Awards

PONTIAC, May 3—The Wilson Foundry & Machine Co. has announced a plan of continuous service awards for working men. The amount of these bonus distributions aggregates $250,000 a year. The plan is based on efficiency and continuity of service.

Every employee working 6 months without absence except for recognized reasons will be entitled to participate in the payments made quarterly. The first checks were distributed to-day in addition to the quarterly payments, and the annual one will be made rewarding long continued service and efficiency.

—

White Capital Raised to $20,000,000

CLEVELAND, May 5—An increase in the capital of the White Motor Co. from $16,000,000 to $20,000,000 was voted at the annual meeting of the company's stockholders. Its regular quarterly dividend of $1 per share was declared, payable June 30 to stockholders of record June 14. All directors and officers were re-elected.

—

Maxwell Sales Ahead of Production

DETROIT, May 5 — The Maxwell Motor Car Corp. is running between 200 and 250 cars daily. Sales are exceeding production of this company by 33 1/3 per cent.

Detroit Labor Trouble Continues

26 Unions Filed Demands on May 1—Several Strikes Indirectly Attack Ford Company

DETROIT, May 5—Labor trouble in Detroit continues to grow in scope. On May 1, as predicted last week by AUTOMOTIVE INDUSTRIES, 26 unions filed demands for more wages and shorter hours.

The outlaw United Automobile, Aircraft & Vehicle Workers of America called strikes in several plants. Altogether, approximately 12,000 workers of different unions went on strike at the plants of Wilson Body Co., Liberty Starter Co., Detroit Brass Works, Murphy Iron Works, L. A. Young Industries Co., Bowen Products Corp., Aluminum Castings Co., Commonwealth Brass Co., Solvay Process Co. The men returned to work when general wage demands were met by the respective companies. Strikes in 7 out of 13 foundries still continue. No settlement has yet been reached in the Wadsworth Mfg. Co. strike.

A number of strikes were averted by compromise agreements. The Electrical Workers, who threatened a general walkout, postponed action until May 17 at the request of the strike committee, who said a settlement would probably be reached by that time. The Typographical Union settled with the employers on a $36 weekly scale with 48 working hours a week. This union asked for $42 salary and 42 hrs. a week.

While the United Automobile, Aircraft & Vehicle Workers of America are strongly organized in Detroit, attempts of this organization to form a local branch in Flint, home of Buick, Chevrolet, Dort and Paterson automobile companies and scores of other automotive concerns, last week met with a rebuff. The Flint Federation of Labor has gone on record as bitterly opposed to this new organization, branding it as a "pirate organization not affiliated with the American Federation of Labor, radically socialistic in its demands and a sister of the I. W. W." The Flint unions are preparing to wage a bitter fight against the entry of the outlaw organization in that city.

In Detroit it is apparent that labor's indirect attack is at the Ford Motor Co. The walkout in the Liberty Starter Co.'s plant, practically halting all work, has all but cut the Ford company out of starting devices for its sedans and coupés. The Liberty company is devoted exclusively to the manufacture of starters for Ford cars. The Wadsworth Mfg. Co. is working entirely upon Ford sedan and coupé bodies. Its production has dwindled from 250 bodies daily to less than that number in three weeks. The Wilson Body Co. is also making Ford bodies in large numbers and its production has been badly hampered.

At the Liberty Starter plant the machinists have gone out. The union asks the reinstatement of certain employees discharged for labor activities, the elimination of the check system of wage payment, the elimination of "gum-shoe" men, service men to be restricted to exits, adjustment of conditions in some departments by officials meeting with the department committee, a minimum wage of $6 per 8-hr. day for men and women alike, a 42-hr. working week, time and one-half for overtime up to four hours, double time for a longer period; double time for holidays and Sundays, 80 cents per hour for tool specialists, 90 cents per hour for tool makers.

At the present time strikes have not affected the automobile companies directly, being confined entirely to parts and body makers. Some of the automobile plants have had a little trouble in some departments, but it was only temporary and production was not materially affected.

—

Wages Increase 32.5 Per Cent in February

WASHINGTON, May 5—Wages in 47 automobile factories increased 32.5 per cent for the month of February, 1919, as compared with February, 1918, while the number employed increased only 0.8 per cent. Forty-seven manufacturers reporting stated that they employed 109,583 workers in February, 1918, for $2,445,176, as compared with 110,472 in February, 1919, for $3,240,057. The increase of February as against January, 1919, although not so high, is marked. Forty-six manufacturers reporting for February stated an employment of 108,546 against 107,741 in 1919, an increase of 0.7 per cent, while the pay roll for February, 1919, totaled $3,197,307 as against $2,963,982 for January, 1919, an increase of 7.9 per cent.

—

Company Formed to Meet Akron Housing Scarcity

AKRON, May 5—Akron has launched a campaign to raise two and one-half million dollars for the purpose of building homes for the working men. The housing problem has been very serious here since early spring, when the factories expanded their activities and greatly increased their working forces. This project is being fathered by the housing committee of the Chamber of Commerce and has been endorsed by the heads of all of the city's industrial plants.

The company to be formed will work along three lines; it will let money on first and second mortgages at reasonable interest to men who want to build, supplementing the home financing done by banks and savings and loan companies in this respect.

The company will build houses to rent. It will encourage renters, however, to buy. Rentals charged will be high enough only to carry the investment and overhead expense. The effect of a lot of such houses for rent will, it is thought, bring down the exorbitant rents now charged in many sections.

While the company will be legally a corporation for profit, it does not expect to make more than 6 per cent, and the stockholders may have to content themselves with 5 or 4 per cent.

The company, which is as yet unnamed, will have an authorized capitalization of $5,000,000, but only half of this amount will be issued at this time. The Goodyear, Goodrich and Firestone Tire companies have already subscribed for half a million apiece, so there will be just a million dollars' worth of stock to be floated in the city generally. A campaign will be put on to raise this money.

—

General Motors to Become Billion Dollar Corporation

NEW YORK, May 5—General Motors will likely become a billion dollar corporation. At the meeting of the board of directors in Wilmington last week, President W. C. Durant stated that the board of directors had recommended an increase in the debenture stock to $500,000,000 and in the common stock to $500,000. The increase will be passed upon at a special meeting to be held on June 12.

W. P. Chrysler is elected first vice-president and H. H. Bassett was added to the Board of Directors and appointed general manager of the Buick division. Both Bassett and F. W. Hohensee, general manager of production of the Chevrolet division, were elected vice-presidents. The complete list of officers and directors follows: President, W. C. Durant; first vice-president, W. P. Chrysler; vice-presidents, H. H. Bassett, A. G. Bishop, R. H. Collins, W. L. Day, J. A. Haskell, A. W. Higgins, F. W. Hohensee, R. S. McLoughlin, C. S. Mott, J. J. Raskob, A. P. Sloan, Jr., Edward VerLinden, F. W. Warner; secretary, T. S. Merrill; treasurer, H. H. Rice; comptroller, M. L. Prensky.

—

Oakland Adopts 48-Hour Week

PONTIAC, MICH., May 5—The Oakland Motor Car Co., beginning May 8, will put its entire plant on a 48-hr. a week basis. The plan calls for beginning at 7 a. m., a 50 minute noon hour, and closing at 4.30 p. m. The usual half-holiday Saturday is allowed. To keep wages near the old standard certain increases in piece rates and hourly rates have been allowed.

—

Jordan Capital Jumps Over Million

CLEVELAND, May 6—The capital stock of the Jordan Motor Car Co. is to be increased to $1,200,000, 7 per cent preferred, and 12,000 shares of common with no par value, authorization for the increase having been voted at a special meeting yesterday. The company will erect several new buildings and will make a conservative increase in production.

Last year Jordan business totalled $8,000,000 on a capital of $300,000. The new stock issue will be in the form of a 50 per cent stock dividend. Edward S. Jordan retains control of the company.

6000 Machinists Quit at Overland

Demand 44-Hr. Week, Wage Increases and Elimination of All Piece Work

TOLEDO, May 6—The International Machinists Union called a strike at the Willys-Overland Co. plant at 3.30 Monday afternoon. Approximately 6000 machinists quit at that hour, refusing to work until 4.06 o'clock, the closing hour decided upon by the company. There are 6665 men at work in the plant to-day. The strikers have picketed the factory, and have declared they will resist to the utmost the effort to put a 48-hour working week into effect. There has been no rioting. Automobile production has been considerably curtailed. Production in some departments is at a standstill. Just how much the daily output has been hit will not be known for several days.

C. A. Earl, vice-president and general manager of the Willys-Overland Co., said to-day:

We are going to stand by the interests of the great mass of our employees. We are not going to let the radicals run this business. We have been trying for 6 weeks to reach an agreement with the Union. Every attempt has failed. This matter had to come to a head sooner or later and it is probably just as well that it be settled now as later. We are going ahead at any cost.

The Willys-Overland company to-day stands with absolutely clean hands and a clear conscience in its dealings with its employees. In its desire to promote harmonious relations with its workers, it has established a 50-50 profit sharing plan through which the first payment of the company distributed $415,000. The company has made a wage adjustment by which thousands of its employees received increases. The company has provided for an employees' representation plan by which every employee can present any grievance as to hours, wages or working conditions, with absolute certainty that a fair adjustment will be made. This company has asked its employees to work 48 hours a week, to co-operate with it in competing with others in the automobile industry, where hours range from 48 to 55 a week. The Willys-Overland presents this open record of its policy to demonstrate conclusively that fairness and justice have been the paramount considerations in all its dealing with its employees.

On March 27, the Willys-Overland Co. was presented with written demands by a committee of employees claiming to represent all the employees, when as a matter of fact many departments were not included. These demands, among other things, called for increases in pay of from 15 to 50 per cent for a 44-hr. week of 5 days of 8 hr. each and 4 hr. on Saturday; elimination of all piece work; double time for all overtime, with other restrictions referring thereto; a closed shop with a shop committee elected from certain sections of their employees without regard to the interests of other workers, and this committee to be elected outside of the company's plant, and such a committee to be recognized by the company for the adjustment of all grievances.

Their demands further provide that all physical examinations should be discontinued, notwithstanding that this practice has proven to be in the interests of the employee and has had the unqualified indorsement of governmental boards and national labor leaders. Other restrictions were imposed as to apprentices. With these demands there was not submitted, nor has there been since at the several conferences held between the company and this committee, one line of supporting evidence substantiating the fairness of the demands made or the practice of them in the automobile industry.

Meetings have been held from time to time whenever desired by the committee. The company has offered to lay before the committee its reasons in writing in support of the position that it has taken on the several questions at issue. The committee's answer in effect has invariably been: "It's not what the war and labor boards have done, it's not what constitutes an 8-hr. day. It's not what the other competing automobile companies are paying as wages nor the hours worked nor their piece work systems, but it's what we want or, in other words—COME ACROSS."

No weight nor attention was paid to the facts or given any consideration whatsoever that supported the position of the company. From the very outset the company officials made plain to this committee their attitude on the question of hours of work and the other conditions in question. Monday the committee refused to avail themselves of the representation plan or give it a single trial, even when they were told that the first work of this employees adjustment board could be a division of the 48-hr. week into six 8-hr. periods or the basic 8-hr. day.

It became very evident from the first that it was not the 8-hr. day that the committee desired, but a 44-hr. week. It has been made plain by the officials of the company, both through the shop paper and the public press, that the new classification of wage scale which has resulted in increases to thousands of Willys-Overland workmen, that any inequality in classifications or rates could be taken up and adjusted. They absolutely have refused to have anything to do with it.

The fact that for years in the arsenals and Navy Yards a system of grading and classification of employees has been in force with all the advantages that accrue to the workmen in a wage system of this kind received no consideration at their hands. The fact that time and a half overtime to be paid each day beyond the standard working hours did not interest them, notwithstanding many recent decisions of governmental boards recognized the practice of paying overtime only beyond the 48-hr. week. Nor did the representation plan, in which the employees are to elect half the members of the adjustment board, serve to interest them, nor to offer any indication to their minds of the company's fairness.

The company is manufacturing automobiles in a competitive field. The proposed 48-hr. week is as short as, or shorter than their competitors. Its wages are equal to or higher. The working conditions are equal to or better. The company has paid to its employees within the last few days the sum of $415,000 from the profits on the 50-50 plan for the first quarter of 1919.

The company has made a most careful survey and investigation of rates of wages paid in this industry, has installed these rates which range from a minimum of 40 cents to $1.10 per hr. for male employees. It has classified the workmen in an equitable and fair way and provided means of remedying, through the proposed employees' committees, any errors that might have occurred in this enormous task.

Last, but not least, they have provided a representation plan of taking up and correcting grievances and complaints, providing for a voice of their employees in all matters of wages, hours and working conditions.

With many concerns actually reducing wages and lengthening working hours, this company, in order to meet and maintain the fairest conditions in its plant, increased wages and announced a 48-hr. week for a period of at least 8 months.

The company is charged with the conduct of its business through its officials, who are responsible to the stockholders of the corporation, and to those loyal employees who appreciate what the company has done in this way of a profit-sharing distribution, representation plan and a wage increase.

The company proposes to stand to the end by those employees who desire to be fair and work squarely with them in partnership. It does not propose, nor can it permit, persons who are not its employees and who have no responsibility in the conduct of its business, to dictate its business methods or policy. The company appreciates the loyalty of its many thousand employees who refuse to believe the untruthful and misleading statements of outside agitators, and who are standing manfully by this company, and who have assured their foremen and department heads that they would not cease work as some did because of the threats and attacks made upon them.

The company wishes to emphasize the fact that there has been no lockout. Those who left work did so voluntarily and in defiance of the rules of the company.

Mr. Willys very much regrets that his profit-sharing plan, in the interest of his employees, should not be appreciated by some of them at the Toledo Plant, who have voluntarily forfeited additional profits that would have come to them in the next two distributions.—C. A. Earl, First Vice-President.

(*Continued on page 1034*)

Treasury Department Issues Rulings on Excise Taxes

(*Continued from page* 1027)

not been actually sold since the manufacturer owns the retail establishment. The tax on the cars sold through the retail establishment of a manufacturer is based on the wholesale and not the retail price.

The interpretation to the effect that trailers are not taxable except when they form a composite part of a truck is apparently meant to apply to those units which are attached to a chassis to form the truck. Likewise the interpretation allowing for credit of taxes where rebates are made on quantity sales stretched over a period of time is probably intended for such manufacturers as Ford, which rebates its dealers after they have purchased a certain quantity of cars. The regulations regarding tractors do not specify farm tractors and apparently no tractor is taxable whether it is intended for farm or other use.

Taxes are effective on all articles sold or leased by manufacturers, producers and importers beginning February 25, 1919, regardless of the date of manufacture.

In the tax law the use of the word "manufacturer" means also "producer" or "importer"; the word "sale" or "sold" includes "lease" or "leased." The term "purchaser" includes the "lessee" and the word "person" includes "partnerships," "corporations" and "associations" as well as individuals.

The tax is imposed on the sale by the manufacturer and is measured by the price for which the automobile or article is sold.

The tax is on the actual selling price, not on the list price.

If the price of a taxable article is increased to cover the tax the tax applies on the increased price.

Discounts for cash made subsequent to the sale cannot be deducted when assuming the tax, but if the articles are sold over a period of time with an agreement for a quantity rebate this fact may be taken into consideration in calculating the tax when the rebate is made.

Commissions to salesmen or agents and other expenses of sale are not deductible from the price.

If an article is sold at the factory and the buyer pays the delivery charges from the factory f.o.b. freight cars, or if it is sold delivered at a price less delivery charges, to be paid by the purchaser, the charges need not be included in the price of the goods.

If the manufacturer sells f.o.b. consumer and himself pays the delivery charges he cannot make deductions.

If articles sold are returned and the sale entirely rescinded no tax is payable, and if paid it may be credited in a subsequent monthly return. If part of the articles sold at one time are returned and credit is allowed, the proportion of the tax to be credited will be only that proportion of the total tax paid which the amount allowed as a credit or rebate bears to the total sales price of all of the articles.

A manufacturer is a person who prepares a taxable article in marketable form.

Under this interpretation if there are several manufacturers, as, for example, if a manufacturer produces a body and another a chassis and these two are assembled by a third, each must pay a tax. However, the assembler can credit himself with an amount equal a tax he has already paid to the manufacturer of the body and of the chassis. It is necessary, however, for the assembler to keep records to clearly establish his right to this exemption.

When a manufacturer sells passenger cars or motor trucks to the government, the tax applies unless the government has supplied the manufacturer with all but a small portion of the parts used in the assembling.

There is no tax on motor driven vehicles used in intra-factory work at railroad stations, etc., where they are used to pull other vehicles. Motor trucks equipped as hook and ladder trucks are taxable.

Automobiles sold by a manufacturer and once taxable are not taxed when sold again unless the manufacturer accepts the return of the automobile and resells it after taking credit for the tax on the first sale.

Tractors are exempt even if sold in combination with trailers.

Accessories, tires, etc., sold to a dealer for the rebuilding of a used car are taxable.

Manufacturers of accessories when selling them to assemblers or manufacturers of automobiles must secure written certificates that the accessories and parts will be used in the manufacture of new cars or for free replacement under contract or guarantee.

Failure to possess such certificates will be considered sufficient to warrant demand of payment of tax by the government.

A "part" for a motor truck, motor wagon, other automobile or motorcycle is any article designed or manufactured for the special purpose of being used as or to replace a component part of the vehicle and which by reason of some peculiar characteristic is not such a commercial commodity as would ordinarily be sold for general use and which is not primarily adapted for use as a component part of the automobile or motor truck or motorcycle; consequntly bolts, nuts, screws, etc., are not taxable. Articles which would ordinarily be classed as commercial commodities become taxable when the design or construction adapts them for use as component parts of vehicles, as, for example, plates, jars and separators for automobile storage batteries are taxable when sold separately. A chassis is a part of an automobile, as is also a body, and is taxable at 5 per cent when sold separately regardless of whether it is a chassis for a passenger car or motor truck.

An accessory is any article designed primarily for use on a motor vehicle to add to its utility and is taxable whether or not it is essential to its operation.

Robes, goggles and lunch kits are not taxable.

Automobile trailers are not parts or accessories for automobiles, but rear portions of automobile trucks that are not properly called trailers are taxable as a part of the truck.

Where a manufacturer sells automobile accessories or parts to a jobber who in turn sells them to a manufacturer of completed cars the tax is paid by the manufacturer who sells these parts or accessories to the jobber. Where a manufacturer sells raw materials to an accessories maker who in turn sells the accessories to a manufacturer of completed passenger cars, the producer of the completed vehicles pays a tax on his sales and no tax is due on the previous sales.

When a manufacturer sells a passenger car, for example, both at wholesale and retail, he pays a tax on the passenger car sold at retail computed on the same price for which he sells them at wholesale.

Taxes are returnable and payable monthly and every return must be made under oath and in duplicate if it exceeds $10. A tax does not apply to the sale of a motor vehicle which is shipped directly to a foreign country by the manufacturer himself or sold by him for export and in proper time exported by the purchaser. If, however, an article sold for export is not exported within six months it becomes taxable. It is necessary for a manufacturer to secure a written certificate to the effect that a car or motorcycle sold is to be exported. Proof of exportation comprises an affidavit containing the name and address of the manufacturer and of the exporter, the dates of the sale and shipment and export of the car or motorcycle, the price paid and a statement that the commodity has not been subjected to further manufacture following its purchase, the name of port of export, the name of carrier issuing the export bill of lading and a copy of the export bill of lading.

Following are the complete regulations as they apply to the automotive industry:

EXCISE TAXES ON SALE BY THE MANUFACTURER

Article 1. **Effective date**—The tax is imposed on all articles sold or leased by the manufacturer, producer, or importer on or after Feb. 25, 1919, even though manufactured, produced, or imported before that date.

Art. 2. **Use of terms**—In these regulations, for convenience, unless obviously inapplicable, the term "manufacturer" is used to include also "producer" and "importer;" the term "sale" or "sold" to include "lease" or "leased;" the term "purchaser" to include "lessee," and the term "vendor" to include "lessor." The term "person" is used to include partnerships, corporations, and associations, as well as individuals.

Art. 3. **Basis of tax**—The tax is on the sale by the manufacturer of the taxable article. It is measured by the price for which the article is sold. It is on the actual sales price of the goods sold, and not on the list price, where that differs from the sales price. If the price of a taxable article is increased to cover the tax, the tax is on such increased price. Where, however, the tax is billed as a separate item such amount need not be included in the price of the article in computing the tax. The tax is payable in respect to a sale made, whether or not the

purchase price is actually collected. (See further Art. 6.)

Art. 4. **Discounts and expenses**—A discount for cash or other discount made subsequently to the sale cannot be deducted in computing the price for the purpose of the tax. Where, however, articles are sold over a period of time under an agreement for a quantity rebate, the tax, if originally computed on the gross price, may be adjusted in the return for the month in which the price is finally determined. Commissions to agents and other expenses of sale are not deductible from the price. If articles are sold at the factory or f. o. b. cars at the place of manufacture, and the delivery charges from such place to the point of delivery are paid by the purchaser as a specific item, or if they are sold delivered at a sum less delivery charges to be paid by the purchaser, such charges need not be included as a part of the price of the goods, but if the manufacturer sells goods at a delivered price and he himself pays the delivery charges, he is not entitled to make any deduction on account of the inclusion in the price of such charges.

Art. 5. **Exchanges**—If articles sold are returned and the sale entirely rescinded, no tax is payable, and if paid it may be credited against the tax included in a subsequent monthly return. See Article 41. If a part only of the articles sold at one time is returned, and credit or rebate allowed by the vendor therefor, the portion of the tax to be credited will be only the proportion of the total tax paid which the amount allowed as a credit or rebate bears to the total sales price of all the articles. If an article is sold under a guarantee as to its quality or service and is thereafter returned and a rebate made pursuant to the guarantee, the vendor may claim as a credit against the tax included in a subsequent return such portion of the tax originally paid in respect of the article as is proportionate to the amount of the price refunded. If an article is sold and thereafter, before use, exchanged for another article of a higher price, the purchaser paying the difference, the vendor should pay the tax on the second sale, but may take as a credit against such tax such part of the tax paid on the returned article, which the amount allowed as a credit for the return of such article on the second sale bears to the amount of the purchase price in the case of the first sale.

Art. 6. **Credit for taxes already paid**—A manufacturer may take as a credit against the tax imposed on him in respect to the sale of any article taxable under Section 900 an amount equal to any tax imposed under Section 900 which he has reimbursed to the vendor from whom he purchased any article forming a component part (whether or not changed in form by process of manufacture) of the article sold by him and in respect to which tax is paid by him. No credit is allowable, however, for any tax so reimbursed by a manufacturer to the vendor in respect to any article, unless such article forms a component part of an article sold by such manufacturer and in respect to which a tax is payable by him. This credit will be allowed only if the taxpayer keeps such records and evidence as will clearly establish his right to the exemption. In cases of doubt, in order to avoid penalty for default if the claim is not established, the tax should be paid in full and application made for refund.

Art. 7. **Who is a manufacturer?**—(a) A manufacturer is a person who prepares a taxable article in marketable form. There are several cases, however, in which under Section 900 there may be several manufacturers, each of whom must pay a tax, as, for example, the tax upon "articles made of fur." In such case the tax may attach on successive sales, if there are several stages of manufacture. See, however, Article 6 as to credits in such cases.

(c) A person who is employed to make an article and receives for it the cost of materials and labor, plus a specified profit, shall be considered a manufacturing agent, and the person who procures the preparation of the article for purposes of resale will be considered the manufacturer.

Art. 8. **Tax payable by the manufacturer**—The tax is to be paid by the manufacturer on all sales made directly by him or through an agent. If the manufacturer has a sales agent or sales agency to whom he only nominally sells an article, but retains an interest in the profits from the resale of the article, the taxable sale is that made by the sales agent or sales agency. On articles manufactured for a jobber by a foreign manufacturer, the jobber must pay the tax as the importer. A receiver or trustee in bankruptcy of a manufacturer conducting a business under court order is liable to the tax upon articles sold by him. Where a manufacturer consigns articles to a retailer, retaining ownership in them until they are disposed of by the retailer, the manufacturer must pay the tax based upon the price for which sold by the retailer. See Article 34.

Art. 9. **When tax attaches**—The tax attaches when the article is sold; that is to say, when the title to it passes from the vendor to the purchaser pursuant to a previous contract of sale or upon a sale without previous contract. When title passes is a question of fact dependent upon the intention of the parties as gathered from the contract of sale and the attendant circumstances. Where goods are segregated from other goods owned by the vendor and it is the intention of both the vendor and the purchaser at the time the goods are segregated that they shall then belong to the purchaser, the title will be presumed to pass at such time. In the absence of an intention to the contrary the title is presumed to pass upon delivery of the article to the purchaser or to a carrier for the purchaser. In the case of a conditional sale, where the title is reserved in the vendor until payment of the purchase price in full, the tax attaches (a) upon such payment, or (b) when title passes if before completion of the payments, or (c) when, before completion of the payments the dealer disposes of the sale by charging off, by any method of accounting he may adopt, the unpaid portion of the contract price.

Art. 10. **Sales to the Government or a State**—The tax applies to articles enumerated in Section 900 when sold to the Government. Where, however, the Government supplies a manufacturer with all materials and parts except a small portion furnished by the manufacturer, under a contract stipulating that the manufacturer shall be guaranteed a certain profit, no tax is payable, because the manufacturer does not sell the articles. Articles manufactured in plants taken over and operated by the Government are not subject to the tax. Articles sold to a State or a political subdivision thereof by the manufacturer for use in carrying on its governmental operations are not subject to the tax. Articles sold by the manufacturer to a State, county, or municipal institution are also exempt from tax when paid for entirely out of public money.

Art. 11. **Automobiles: Scope of tax**—An automobile (as well as an automobile truck or automobile wagon) is a self-propelling vehicle designed primarily for the transportation in or upon it of persons or property. Motor-driven machines for pulling a vehicle around factories and railway stations and motor-driven machine gun carriages are not taxable. An automobile hearse and a pallbearers' coach are taxable under subdivision 2. A self-propelled fire engine, at least if designed to carry only such persons as are necessary to drive it, is not taxable. If, however, it is especially designed to carry firemen not employed in or about the driving of the machine, it is taxable as an automobile. Automobile trucks equipped as hook and ladder trucks, and hose carts for the use of firemen, are likewise taxable. A usable substantially completed automobile or automobile truck produced by assembling new parts of trucks or cars is subject to tax, but a rebuilt car is not subject to tax as such, although the new parts thereof are subject to tax when sold by the manufacturer, even though assembled into a car. Automobiles which have been sold by the manufacturer are not taxable when sold again. Where, however, a manufacturer sells again an automobile which he has once sold and which has been returned to him and the first sale rescinded, the tax attaches on the second sale. A tractor is not taxable.

Art. 12. **Automobile trucks and automobile wagons**—The tax is 3 per cent of the price for which automobile trucks and automobile wagons are sold by the manufacturer. An automobile truck or automobile wagon is a self-propelling vehicle primarily designed or adapted for the transportation of property. The act specifically exempts tractors; even if sold in combination with a trailer. Any tires, inner tubes, parts or accessories for automobile trucks and automobile wagons sold on or in connection therewith or with the sale thereof are taxable at 3 per cent. Such tires, inner tubes, parts and accessories, however, as (although sold on or in connection with an automobile truck or automobile wagon or with the sale thereof) are in excess of the quantities usually sold in the ordinary course of trade to a single customer at the time of the purchase of an automobile truck or wagon, will not be taxable at 3 per cent, but will be taxable under subdivision (3) of section 900 at the rate of 5 per cent.

Art. 13. **Other automobiles and motorcycles**—The tax is 5 per cent of the price for which such articles are sold by the manufacturer. It applies to all automobiles primarily designed for carrying persons, including passenger cars, taxicabs, auto-buses, sight-seeing cars and also to all motorcycles, including side cars. Where an automobile chassis, although of such construction as is ordinarily used in automobile trucks, is fitted with a body designed for the carriage of persons, or for the carriage of persons and property, the completed whole is taxable at 5 per cent of the price for which sold by the manufacturer, and not under subdivision (1) at 3 per cent. Tires, tubes, parts and accessories for motorcycles or automobiles other than automobile trucks or automobile wagons sold on or in connection therewith or with the sale thereof are taxable at 5 per cent.

Art. 14. **Tires, inner tubes, parts and accessories sold to manufacturer**—Subdivision (3) of section 900 of the act provides that tires, inner tubes, parts or accessories shall be exempt from the tax if sold to a manufacturer or producer of automobile trucks, automobile wagons, other automobiles or motorcycles. To come within this exemption the sale must be to such a manufacturer for use by him in the manufacture or production of new cars or for free replacement under contract or guaranty. If sold to such a manufacturer for any other purpose, such as resale to a dealer or for the rebuilding of used cars, the sale is taxable. In order for the sale to come within the exemption of the statute, the manufacturer must at the time the goods are shipped or sold (whichever is prior) have in his possession an order or contract of sale, with certificate of the purchaser in writing printed thereon or permanently attached thereto, showing that the tires, inner tubes, parts, or accessories so purchased are to be used in the manufacture or production of new cars or for free replacement under contract or guaranty. If in any case such an order and certificate cannot be produced on demand of any authorized agent of the department the tax in respect to the sale will be considered in default.

Art. 15. **Definition of parts**—A "part" for an automobile truck, automobile wagon, other automobile, or motorcycle is any article designed or manufactured for the special purpose of being used as or to replace a component part of any such vehicle, and which by reason of some peculiar characteristic is not such a commercial commodity as would ordinarily be sold for general use, and which is primarily adaptable only for use as a component part of such vehicle. Mere stock or commercial commodities such as bolts, nuts, washers, screws, though used as components for such vehicles, are not "parts" within the meaning of subsection (3) of Section 900. Articles, however, which ordinarily would be classed as commercial commodities become parts when, because of their design or construction, they are primarily adaptable for use as component parts of such vehicles. Component parts of articles taxable under this definition are taxable when sold separately, if they have reached such stage of manufacture that they are primarily adaptable for use as such a component part. Thus plates, jars, and separators for automobile storage batteries are taxable when sold separately. A chassis is a part of an automobile and taxable at the rate of 5 per cent when sold separately regardless of whether it is a chassis for an automobile truck or wagon, or for any other kind of automobile. An automobile body is also a part of an automobile.

Art. 16. **Definition of accessories**—An "accessory" for an automobile truck, automobile wagon, other automobile, or motorcycle is any article designed to be attached to or used in connection with such vehicle to add to its utility, and which is primarily adaptable for use in connection with such vehicle, whether or not essential to its operation. The term "accessories" includes, for example, horns, speedometers, self-starters, spot-lights, shock absorbers, tire pumps, pressure gauges, and hydrometers. All such articles primarily adapted for use in connection with an automobile are subject to the tax even though they may sometimes be used otherwise, as for example, with motor boats. If any doubt, reasonable and bona fide, exists as to the special adaptability of an article the fact of its sale by the manufacturer to be used with an automobile or to an automobile accessories dealer will determine its taxability. A wrench or other tool of a kind sold in hardware stores for general purposes is not subject to the tax, but a wrench or other tool of special design or construction primarily adapted to be used in connection with automobiles will be subject to the tax. Robes, goggles, and lunch kits are not subject to the tax. Automobile trailers, regardless of the number of wheels

which they may have, are not parts of or accessories for automobiles; but rear portions of automobile trucks, automobile wagons, or other automobiles, not properly called trailers, are taxable as a part of the automobile. Where a manufacturer sells automobile accessories or parts to a jobber who in turn sells them to a manufacturer of completed cars the tax upon the accessories or parts is payable by the manufacturer who sells them to the jobber. Where a manufacturer sells material to an accessories manufacturer who in turn sells the accessories constructed from them to a manufacturer of completed automobile trucks, automobile wagons, other automobiles, or motorcycles, except tractors, the manufacturer of the completed vehicle is liable for the tax upon his sales and no tax is due upon such previous sales.

Art. 34. **Manufacturer also retailer**—By "customarily sells" is meant a bona fide practice of selling the same article at both wholesale and retail, in substantial quantities, and not mere occasional sales at wholesale, with the bulk of the business done at retail. Only a manufacturer who does both a wholesale and retail business and holds himself out as a wholesaler as well as a retailer with respect to the goods sold will be entitled to compute the tax upon goods sold at retail on the price for which like articles are sold by him at wholesale. As to articles sold at *wholesale*, the tax paid must be based on the actual selling price of each article sold. As to sales at *retail*, the tax on each such sale made during any calendar month must be based on the average wholesale price of all sales of like articles made at wholesale during the previous calendar month. This average wholesale price is to be obtained by dividing the sum of the actual selling prices of all such articles sold at wholesale during such previous calendar month by the total number of such articles so sold.

Art. 35. **Repeal of former taxes**—The present taxes supersede the excise taxes imposed by the Revenue Act of 1917 upon the sale of automobiles, musical instruments, sporting goods, chewing gum, cameras, toilet soaps and similar articles. The Revenue Act of 1917 remains in force for the assessment and collection of all taxes which have accrued thereunder, and for the imposition and collection of all penalties or forfeitures which have accrued and may accrue in relation to any such taxes. In the case of any tax imposed by the Revenue Act of 1917, if there is a tax imposed by the present statute in lieu thereof, the provision imposing such tax remains in force until the corresponding tax under the present statute takes effect. See Section 1400 of the statute.

Art. 36 **Colorable sales**—If a manufacturer, through the device of a selling branch or in any other manner, contrives to sell under the market price, with the result of benefiting his business or with the intent to cause such benefit, the tax shall be based on the fair market value of the articles and not on their nominal selling price. See Article 8.

Art. 37. **Return and payment of tax**—Each manufacturer of any of the articles hereinabove enumerated must make monthly returns under oath in duplicate and pay the taxes imposed on such articles to the collector of internal revenue for the district in which his principal place of business is located. Any return may, if the amount of the tax covered thereby is not in excess of $10, be signed or acknowledged before two witnesses instead of under oath. The returns shall be made on form 728 (revised). Instructions for preparing will be found on the back of the form. The returns are to be rendered and the tax paid on or before the last day of each month covering all the transactions of the preceding month, the first return to cover all transactions after Feb. 24, 1919, and before April 1, 1919. Branch houses should in general make reports to the parent house, which is liable to make monthly returns of the sales of the branch house. An itinerant manufacturer should make return and pay the tax to the collector of the district where the sales were made. The books of every person liable to the tax shall be open at all times for inspection by examining internal revenue officers. As to penalties, see Article 40.

Art. 38. **Trade with possessions of United States**—A sale which results in the shipment of articles into the United States from the Virgin Islands is taxable to the same extent as a sale of articles within the United States. Articles going into the Virgin Islands from the United States are free from tax in the United States. The same rules apply to trade with Porto Rico and the Philippine Islands. See Section 1000 of the Revenue Act of 1917 and Section 5 of the Act of Aug. 4, 1909, as amended by Section 4, subdivision C, of the Act of Oct. 3, 1913. The tax attaches, however, to articles shipped to other possessions of the United States, including the Canal Zone.

Art. 39. **Aids to collection of tax**—In collecting the excise taxes the Commissioner has the benefit of all existing internal revenue laws. In aid of the enforcement of the statute the Commissioner may require any person to keep specified records, to render returns and statements as directed to submit himself and his books to examination, and to comply with such regulations as may be prescribed.

Art. 40. **Penalties**—Any person, including an officer or employee of a corporation and a member or employee of a partnership in the course of his duty, who fails to pay or collect a tax or to make a return, is liable to a penalty of $1,000. If his failure is willful, or he otherwise tries to evade the tax, he is guilty of a misdemeanor and liable to a fine of $10,000 and imprisonment for a year. If his failure is willful, he is also liable to the addition to the tax of a 25 per cent penalty for failure to make a return and a 50 per cent penalty for a fraudulent return.

Art. 41. **Credits and refunds**—If a manufacturer overpays the tax due with one monthly return, he may take credit for the overpayment against the tax due with a succeeding return. If under Section 1312 of the statute or otherwise he similarly overcollects the tax, he shall refund the overcollection to the purchaser from him. If in a case under Section 1312 he sells on credit, other than on conditional sale, he shall return the tax at the time of the sale, but may defer collection of it from the purchaser. See Articles 44-46. For the procedure with reference to claims for refund see Sections 3220 and 3225 of the Revised Statutes, as amended by Section 1316 of the Revenue Act of 1918 and Regulations No. 14 (revised).

Art. 42. **Exemption of export sale**—The tax does not attach to the sale of an article which is either (1) shipped direct to a foreign destination by the manufacturer himself, or (2) both (a) sold by him for export and (b) in due course so exported by the purchaser. Where a manufacturer at the time an article is sold or shipped (whichever is prior) has in his possession an order or contract of sale showing in writing (1) that the manufacturer is to export the article, or (2) that the purchaser is buying the article in order to export it prior to its being used or subjected to further manufacture, there is a presumption that the sale of the article is exempt from tax, as an export sale, and the manufacturer may, for a period of six months from the date of sale or shipment (whichever is prior), rely on such presumption. This temporary presumption becomes a permanent presumption upon the manufacturer's receiving, and attaching to such order or contract, before the termination of such period of six months, due "proof of exportation" (see Article 43) of such article. On the other hand, if, within such period of six months, the manufacturer has not received, and attached to such order or contract, such "proof of exportation," then the temporary presumption that such sale is an export sale disappears, and the manufacturer shall include a tax on the sale of such article in his return for the month in which such period of six months expires. The order or contract of sale and the "proof of exportation" must be preserved by the manufacturer in such a way as to be readily accessible for inspection by internal revenue officers. No sale shall be considered to be exempt from tax under Section 1310 (c) of the act, unless its character as an export sale has been established in accordance with the above provisions.

Art. 43. **Proof of exportation**—By the term "proof of exportation" is meant: (1) An affidavit containing the following information: The name and address of the manufacturer, the name and address of the exporter (who, if not the manufacturer, must be a person who has purchased direct from the manufacturer), the respective dates of the sale or shipment (whichever is prior), and exportation of the article, the price for which purchased, the fact that the article has been exported by the manufacturer or original purchaser without having been used or subjected to further manufacture, the name of the port of foreign destination, the name and address of the carrier issuing the export bill of lading, and any further information necessary to identify the article sold with the article exported; and (2) attached to such affidavit a copy of the export bill of lading, or a certificate by the agent or representative of the export carrier showing the exportation of the article, or, if exported by parcels post, a copy of the certificate of mailing.

Art. 44. **Contract of sale before May 9, 1917**—If before May 9, 1917, A, a manufacturer, made with B, a wholesaler, a contract of sale which does not permit the addition of the tax to the amount payable under the contract, then the liability for the tax is on B, with the duty on A only to collect and pay it to the collector as provided in Article 47. If B also made before May 9, 1917, a contract of the character described with C, a retailer, the liability for the tax thus imposed on B is transferred from B to C, B being obliged only to collect the tax from C and to pay it over to A for payment to the collector. If, however, any person before May 9, 1917, made a contract of the character described with any person other than a dealer as defined in Article 48, no tax is payable in respect of the sale by him, since on May 9, 1917, no tax was in force on the sale of any of the articles described in these regulations.

Art. 45. **Contract of sale before Sept. 3, 1918, of article not then taxable**—If before Sept. 3, 1918, A, a manufacturer of candy or other article not taxable under the Revenue Act of 1917, made with B, a wholesaler, a contract which does not permit the addition of the tax to the amount payable under the contract, then the liability for the tax is on B, with the duty on A only to collect and pay it to the collector as provided in Article 47. If B also made before Sept. 3, 1918, a contract of the character described with C, a retailer, the liability for the tax thus imposed on B is transferred from B to C, B being obliged only to collect the tax from C and to pay it over to A for payment to the collector. If, however, any person before Sept. 3, 1918, made a contract of the character described for the sale of candy with any person other than a dealer as defined in Article 48, no tax is payable in respect of such sale by him.

Art. 46. **Contract of sale before Sept. 3, 1918, of article then taxable**—If before Sept. 3, 1918, A, a manufacturer of chewing gum or other article taxable under the Revenue Act of 1917, made with B, a wholesaler, a contract which does not permit the addition to the amount payable under the contract of the difference between the present tax and the corresponding tax imposed by the Revenue Act of 1917, then B is liable for such difference. A must collect and pay to the collector as provided in Article 47 the portion of the tax for which B is so liable, and he must also include in his return and pay the portion of the tax for which B is not so liable. If B also made before Sept. 3, 1918, a contract of the character described with C, a retailer, the liability for the tax thus imposed on B is transferred from B to C, who is liable for the difference between the tax imposed by the present statute and the tax imposed by the Revenue Act of 1917. B must collect and pay over to A for payment to the collector the portion of the tax for which C is so liable. For example, if any person made before Sept. 3, 1918, a contract of the character described for the sale of chewing gum with any person other than a dealer as defined in Article 48, the tax to be collected under the present statute will be the tax in force on Sept. 3, 1918; that is, the tax under the Revenue Act of 1917.

Art. 47. **Return of tax**—Each person receiving any payments referred to in Section 1312 of the statute shall collect the amount of the tax, if any, imposed by such section from the person making such payments, and shall make monthly returns under oath in duplicate and pay the taxes so collected to the collector of the district in which his principal office or place of business is located. Any person making a refund of any payment upon which the tax is so collected may repay therewith the amount of the tax collected on such payment; and the amount so repaid may be credited against amounts included in any subsequent monthly return. The return shall be made on Form 728 (revised) on or before the last day of the month following the month in which the sale is made, as provided in Article 37. The tax shall without assessment by the Commissioner or notice from the collector be due and payable to the collector at the time fixed for filing the return. If the tax is not paid when due, there shall be added as a part of the tax a penalty of 5 per cent, together with interest at the rate of 1 per cent for each full month from the time when the tax became due.

Art. 48. **Meaning of "dealer"**—The term "dealer" includes not only dealers in the ordinary sense—that is, persons engaged in the business of selling articles—but also a person who purchases an article with the intention of using it in the manufacture or production of any article intended for sale. The term does not include a person buying an article for his personal consumption or use. The United States, a State, Territory, or a political subdivision thereof, or a foreign government, purchasing an article for its own use is not a dealer.

Art. 50. **Payment of tax by uncertified check**—Collectors may accept uncertified checks in payment of excise taxes, provided such checks are collectible at par; that is, for their full amount, without any deduction for exchange or other charges. The collector will stamp on the face of each check before deposit the words "This check is in payment of an obligation to the United States and must be paid at par. No protest," with his name and title. The day on which the collector receives the check will be considered the date of payment so far as the taxpayer is concerned, unless the check is returned dishonored. If one check is remitted to cover two or more persons' taxes, the remittance must be accompanied by a letter of transmittal stating (a) the name of the drawer of the check; (b) the amount of the check; (c) the amount of any cash, money order, or other instrument included in the same remittance; (d) the name of each person whose tax is to be paid by the remittance; (e) the amount of the payment on account of each person; and (f) the kind of tax paid.

Art. 51. **Procedure with respect to dishonored checks**—If the bank on which any such check is drawn should refuse to pay it at par, the check should be returned through the depositary bank and be treated in the same manner as a bad check. All expenses incident to the attempt to collect such a check and the return of it through the depositary bank must be paid by the drawer of the check to the bank on which it is drawn, since no deduction can be made from amounts received in payment of taxes. See Section 3210 of the Revised Statutes. If any taxpayer whose check has been returned uncollected by the depositary bank should fail at once to make the check good, the collector should proceed to collect the tax as though no check had been given. A taxpayer who tenders a certified check in payment for taxes is also not released from his obligation until the check has been paid. See Chapter 191 of the Act of March 2, 1911.

Art. 52. **Misrepresentation of tax**—If a manufacturer or other vendor misrepresents the tax, he is guilty of a misdemeanor and is liable to a fine of $1,000 and to imprisonment for a year. This provision is designed, among other things, to prevent a vendor adding more than the amount of the tax to the price of an article and representing that the increase is due to the tax.

—

(*Continued from page* 1030)

The company learned that on Saturday night the union instructed its members to quit at 3.30 o'clock Monday. On Sunday the company posted notices on all bulletin boards in the plant outlining the situation, and stating that men who left at the end of 8 hours did so against the rules of the company and were no longer in the company's employ. When the men quit, their cards were immediately pulled, and steps taken to replace them with other men.

"It may take a few days and it may take two or three weeks to settle this affair, but we are going to settle it to the perfect satisfaction of all concerned," said Mr. Earl.

—

Rolls Royce to Manufacture in America

NEW YORK, May 7—Rolls Royce, Ltd., London, England, is preparing to manufacture in America. No definite location has yet been named, but it is understood that the plant will be somewhere in the eastern part of the United States, where Rolls Royce cars will be manufactured complete.

—

Johns-Manville Denver Office in New Quarters

NEW YORK, May 6—The Denver office of the H. W. Johns-Manville Co. moved from the Denver Gas & Electric Bldg. to the Iron Bldg., 1021 17th Street. Louis H. Inglee remains as manager of this branch.

20,000 Army Trucks For Roads

Part of Surplus Stock of 31,000—None Left for Sale to Makers or Public

WASHINGTON, May 8—Twenty thousand motor trucks are being turned over to the Bureau of Public Roads, Department of Agriculture, by the War Department to be distributed to the various states for use on road construction. These trucks are part of the 31,000 which were recently declared surplus by the War Department, and this disposition of them actually insures that there will be no trucks available for sale to the public or for resale to the manufacturers. The Post Office Department has requisitioned 7000, and it is expected that other Government bureaus will absorb the remaining 4000.

The trucks turned over to the Department of Agriculture are valued at $45,000,000, and include 11,000 new and 9000 used vehicles ranging from 2- to 5-ton capacity, all in serviceable condition.

The trucks are turned over under provisions of the Post Office Appropriation Bill, which authorizes requisition of surplus trucks from the army by the different Government departments. They must be used by the states on road construction under the Federal Road Aid Act. The only charges which the states will pay will be for loading and freight. The trucks will be apportioned to states only upon request of the State Highway Department on the basis of the requests received and in proportion to the financial apportionment under the Federal Road Act.

—

Will Retain Standard Vehicles

WASHINGTON, May 7—The standard types of trucks and passenger cars purchased for the army during the war will be used to replace all of the non-standard vehicles at the various army camps and posts in this country and the non-standard vehicles will be disposed of. They will be turned over to various Government bureaus, and if not entirely absorbed by them the manufacturers will be given the opportunity to buy them back from the Government. Arrangements for these plans are being completed. The standard vehicles include the B 3-ton. A 1½-ton and AA ¾ to 1-ton trucks, the four wheel drive and the passenger car standards are the Cadillac, Dodge and Ford.

—

Willys Export Corp. Formed

NEW YORK, May 6—The John N. Willys Export Corp. has been formed to absorb the export department of Willys-Overland. Inc. It has opened offices in the City Investing Building, 165 Broadway, and will direct export sales for a number of Overland interests, chiefly the Willys-Knight and Overland cars. Associated with Mr. Willys are E. C. Morse as vice-president and general manager, and John Macfadyean, vice-president in charge of sales.

Mr. Morse at the present time is in Europe, where he has been since the beginning of February studying the foreign markets. He is expected to return the end of this month.

Mr. Morse's first connection with the automobile industry was as commercial manager of the E. R. Thomas Co., Buffalo, which marketed the output of the E. R. Thomas-Detroit Co. Upon the organization of the Hudson Motor Co. he was made sales manager. In 1916 he resigned to become vice-president of the Chalmers Motor Co., of which he was also general manager. Nearly two years ago he joined the Willys-Overland interests and represented the company in Washington during the war.

Mr. Macfadyean was with the Goodyear Tire & Rubber Co. from 1909. He was first branch manager, then district manager and finally manager of the export department. He was also vice-president of the Goodyear Tire & Rubber Co. of South America.

—

New Industries in Saginaw Complicate Housing Question

SAGINAW, May 6—The housing situation in Saginaw is acute, and the business interests of the city, through the Chamber of Commerce, are exerting every influence to get people to build. The banks are aiding in this campaign. The housing situation here is attributed solely to the surprising number of new industries that have come to the city in the last two years, calling in thousands of people. Hundreds of homes are now in the course of construction.

—

Smith Leaves Buda for Midwest

INDIANAPOLIS, May 7—Lon R. Smith has resigned as sales manager of the Buda Co., Harvey, Ill., effective June 1, to become general sales and advertising manager of the Midwest Engine Co., Indianapolis. The Midwest Engine Co. was formed last year to take over the Lyons-Atlas Co. and the Hill Pump Co. It is capitalized at $3,500,000 and will produce oil engines and centrifugal and reciprocating pumps.

—

Mechanical Engineers to Meet at Detroit

NEW YORK, May 7—The spring meeting of the American Society of Mechanical Engineers will be held at the Hotel Statler, Detroit, June 16 to 19. On the opening day there will be a business meeting in the afternoon, followed by a general meeting at which the society's committee on aims and organization will make a preliminary report.

Papers on industrial research will be read at the morning session on June 17, which will be under the auspices of the research committee. This is to be made a leading topic of the meeting, because of the great impetus which has been given to industrial research through war conditions. The afternoon session on the 17th will be devoted to the subject of industrial relations, and there will be a

symposium by leading organizers on the factors dominant in the labor situation. On June 18 there will be a gas power session with papers on oil engines, and the closing session on June 19 will deal with powdered fuel and oil fuel.

—

Receiver for Campbell Appointed

NEW YORK, May 7—The Campbell Motor Car Co., which emerged as the result of the reorganization of the Emerson Motors Co., Kingston, N. Y., in September, 1917, has been placed in the hands of a receiver. It is stated that the action is a friendly one, brought about largely through a shortage of ready cash, and that there is a strong probability that the company will be reorganized. In the meantime the receiver is to continue the business. The action to have receivers appointed was brought by Abel L. Smith, who holds 166 1/3 shares of the company's stock. The receivers are Marcus Helfand and E. V. Wilson.

Not long after the Emerson company was reorganized into the Campbell company certain contracts were entered into with the United States Government, the Y. M. C. A. and the Overseas Corp. for the delivery of ambulances. All of these contracts were cancelled, however, before the company got into production on them. It is stated that the company is at present solvent, though President J. A. Campbell admits that debts amounting to some $60,000 are pressing.

—

Uncompleted Ordnance Contracts

WASHINGTON, May 5—Tank and tractor contracts totaling $57,469,700 have been cancelled, and all cancellation negotiations have been completed regarding them. Contracts totaled at $136,067,300 have been suspended with the suspension accepted by the contractor. Orders totaling $27,357,300 have been ordered suspended. Nine per cent of the orders outstanding for tanks and tractors valued at $72,328,000 remain to be completed.

—

Motor Contracts Outstanding

WASHINGTON, May 5—Of $419,184,000 worth of orders for motor trucks and other motor vehicles outstanding on Nov. 11, 1918, there were $18,023,000 left on order on April 1. Of the total, 67 per cent were canceled, 29 per cent delivered, leaving a balance of 4 per cent due.

—

No Motor Driven Fire Fighting Equipment Sold

WASHINGTON, May 5—Motor driven fire fighting equipment that has been purchased by the Army is not for sale, and will not be sold, according to a statement made to-day by the Director of Sales.

—

Sell Castor Oil and Castor Beans

WASHINGTON, May 5—The Bureau of Aircraft Production sold castor oil and castor beans, forming a surplus above the needs of the Air Service, valued at $332,927.89.

Industry Waiting for Steel to Drop

Expect Lower Price Through Railroad Administration—Buy Only for Immediate Needs

DETROIT, May 5—The steel situation in Detroit has not changed in the last two weeks. An open market prevails, with most companies purchasing only enough to cover immediate needs and very few contracting for the season's output. Some of the large automobile companies are covering themselves by contracts, but the majority are not. The trade is uncertain. Some purchasing agents are looking for a further drop in price below that recently fixed by the government. They argue that the Railroad Administration, which refuses to pay the price fixed by the government and the steel interests, will ultimately win out and bring the market further down.

Others declare the steel price is at rock bottom now, but are withholding their orders due to the uncertain conditions abroad. They are waiting until conditions clarify, which they hope will occur in the next few weeks. They predict that there will be no buying to speak of until the peace conference is over, a definite government reconstruction policy announced, Congress again in session, and the Railroad Administration and the steel interests settled upon a standard price.

One purchasing agent for an automobile company which will build 40,000 cars this year sums up the situation as follows:

"We are buying steel only as we need it. We are not contracting for any fixed amount. We are having no trouble in getting steel, but we expect the price will drop materially, and we are waiting for that drop before buying heavily.

"There is no question in my mind but what the price is going down. I say that because of the difference between the basic price of steel before the war and the price to-day. Prices dropped somewhat after the signing of the armistice, but there is still an increase of over 100 per cent over the price in 1914. I do not know what the increased cost of steel manufacture amounts to, but I do not think it is sufficient to merit upholding the present price.

When the government Railroad Administration and the steel interests agree upon a price of steel for the railroads, the automotive industry is going to benefit by the same reduction, regardless of the present price which has been regulated by the government. The automotive industry is nearly as great a steel consumer as the railroads. The big automobile companies have been buying in fair quantity, while the railroads, building industries and other consumers have been holding back. It is a broad statement, but I believe that the automotive industry has saved the steel companies from a stagnant market, and there is no reason why we should not benefit greatly if the Railroad Administration should succeed in getting a further price cut."

—

British Steel Manufacturers Disturbed by American Prices

LONDON, April 19—The recent cut in American prices of $4.25 for pig iron and $12 for finished steel brings the American price so far below British prices that many of England's manufacturers feel her domestic and foreign markets are both threatened. At the revised prices, 4-inch billets bring $38.50 per gross ton in America, while the British figure is $61.25. The American price for galvanized sheets is about $105 per ton, and the British $140. When the British government removes its subsidy from pig iron, the price is expected to advance at least $5. Sellers cannot quote prices for future business, and as a result business is slowing up. As Great Britain doubled her steel market capacity during the war, manufacturers would feel the loss of her market keenly. As a result import restrictions are being urged by some manufacturers to protect their market.

—

Germany May Buy Copper Soon

WASHINGTON, May 6—It is expected that Germany will be in the market for copper within the next few months. At present there is a surplus of about 2,000,000 lb. of copper. Copper producers are operating at about 50 or 60 per cent capacity, but the demand is said to be increasing and it is also expected that countries which have been cut off from supplies during the war will help reduce the surplus. The embargoes against copper still hold in France and Italy, but, it is believed, will not continue much longer. England has already removed all copper import restrictions.

—

N. Y. Amends Law to Permit Air Insurance

ALBANY, N. Y., May 6—Three bills amending the state insurance laws to permit marine, fire and casualty insurance companies to insure against loss or damage to airplanes, seaplanes, dirigibles and other aircraft have been signed by the Governor. The Governor also signed the Booth bill requiring motor trucks operating on state highways to be equipped with mirrors or some reflecting device giving drivers a view of the road in the rear.

—

Maxim Drops Maxim Silencer

MILWAUKEE, May 2—The Geuder, Paeschke & Frey Co. is now manufacturing the Maxim silencer formerly manufactured by the Maxim Munitions Corp.

—

Dort Producing 100 Daily

FLINT, May 1—The Dort Motor Car Co. is running more cars daily than ever before since it was organized. Daily production is hitting the hundred car mark. The entire production for the

months of May and June is already contracted for.

Hereafter the Earl C. Anthony Co., Inc., will handle Dort distribution on the Pacific coast. This company succeeds the Frawly Motor Car Co. of San Francisco as coast distributers, and the Leach Motor Car Co. of Fresno as distributers. The Anthony company's headquarters are in Los Angeles, but the firm maintains seven branches throughout the state, being represented in San Francisco, San Diego, Fresno, Stockton, Sacramento, Oakland and San Jose.

Briscoe Carbureters to be Made in Pontiac

PONTIAC, MICH., May 3—The Briscoe Carbureter Co. of Jackson is about to move to this city. Frank Briscoe, former automobile manufacturer, is at the head of this company which is now producing carbureters on a small scale. Ground has been broken here for the new plant. It will be a 1-story concrete structure, 60 x 200 ft. The plant is to be completed and the company in production within the next 70 days. About 40 men and women will be employed at first. The Briscoe carbureter is designed principally for use on Ford cars.

Mitchell Plans for 100 a Day

RACINE, May 2—The Mitchell Motors Co. completed its government four-wheel drive truck contract last week, and is now returning to commercial production as quickly as possible. It is expected that the plant will reach a production of 100 cars a day within the next month.

Capacity for 500 Studebakers a Day

SOUTH BEND, May 2—The Studebaker Corp. will have capacity for 500 cars per day when the extensive additions now building here are completed. These will include a group of buildings to occupy 61 acres and give from 3,000,000 to 4,000,000 sq. ft. of floor space: 12,000 persons will be employed. This is all in addition to the present Studebaker plant.

Wallis Tractor Production Doubled

RACINE, May 2—Production of the Wallis tractor is to be more than doubled within the next month. The factory has been partly closed for the installation of new equipment and a progressive assembly system. It is estimated that the plant will be in complete production by June 1, increasing from its present rate of 10 to 24 tractors per day.

Melling Resuming Operations

LANSING, MICH., May 2—The Melling Forging Co., recently destroyed by fire, will shortly resume operations with two shifts. Previous to the fire the plant was in operation with three 8-hr. shifts. Repairs to the building are nearly complete.

Hudson Super-Six Reduced $225

New Models Incorporate Many Body Refinements—Color Schemes Different

DETROIT, May 5—A price reduction of $225 has been made in the 7-passenger Hudson Super-Six and the other models have been reduced on a corresponding scale. In connection with this announcement there is also the announcement of a number of refinements in detail. The springs have been modified and longer shackles used to give a flatter suspension and better riding qualities. The frame has been increasesd to 7 in. in depth and a new square cross-member has been added in front of the gasoline tank at the rear of the chassis for greater rigidity. The rear axle has also been strengthened. There is a stronger ring and pinion gear and an improved adjustment of the ring gear. The wheels have solid rims and the tire equipment is now 34 x 4½ in. on all models. The front and rear wheels have 12 spokes.

The brakes have also been enlarged, the former size of 14 x 2 in. having been increased to 15⅛ x 2½ in. There have also been a few detailed changes, such as a larger horn, the license and lamp brackets attached to the cross-tube instead of the fender and an improved ignition switch, choke control and pilot lamp.

In the body works and control units the levers have been made longer, bringing them within easier reach of the driver. Gypsy curtains have been provided on both the 4 and 7-passenger phaetons.

In the 7-passenger phaeton the comfort, appearance and strength of the auxiliary seats have been notably improved. These seats are now upholstered in long grain leather pleated over Marshall springs. The steel braces supporting the backs of these seats have been leather covered. Scuff plates now cover the entire door opening and the door locks have larger bolts. Solid brass robe rails have also been provided. The robe rail now runs the width of the back of the front seat to provide a hand rest for passengers entering the tonneau, and all of the fixtures are nickel-plated.

New painting styles are also used on the Model O Super-Six. The body and wheels of the 7-passenger phaeton are finished in Valentine blue with black fenders. The body is striped in white and the hood louvres and wheels are also painted in the same manner to bring out the lines of the car. The body of the 4-passenger phaeton is finished in the same shade of blue as the 7-passenger, but the wheels are vermilion and the striping on the body bevel and louvres sets off the 4-passenger lines.

The cabriolet and sedan are also finished in Valentine blue throughout and matched with the cloth upholstery. The coupé and touring limousine are finished in light Brewster green, deep maroon and Valentine blue, and are upholstered in harmonizing fabrics. Following are the new and old prices:

	New Price	Old Price
Seven-passenger phaeton	$1,975	$2,200
Four-passenger phaeton	2,075	2,300
Cabriolet	2,450	2,750
Sedan	2,775	3,000
Coupe	2,950	3,100
Touring limousine	3,300	3,400
Limousine	3,650	3,650

Hayes Wheel to Occupy Old Buick Plant

JACKSON, MICH., May 3—The Hayes Wheel Co. has leased the old Buick plant, which was occupied during the war by the Jackson Munition Corp. The Hayes company will use the plant for the manufacture of tractor wheels. The plant was used by the Imperial and Mutual Motors for car manufacture after it was abandoned by the Buick. The last car made there was the Marion-Handley.

Ignition Plug Co. Locates in Louisville

LOUISVILLE, May 5—The Ignition Plug Co., Dayton, has established a plant at 14th Street and Broadway and is preparing to manufacture spark plugs. The company is capitalized for $50,000, with the following officers: President, E. R. Stucky; vice-presidents, H. C. Smith and C. D. Rodman; secretary and treasurer, W. T. O'Neal; assistant secretary, A. C. Reager.

Van Dorn & Dutton Open Branches

CLEVELAND, May 5—The Van Dorn & Dutton Co. has opened branches in New York and Chicago. Harry F. Keegan will manage the Chicago office at 1241 First National Bank Bldg. His brother, John, will manage the New York office at 30 Church Street.

Huffman Bros. to Make Trucks

ELKHART, IND., May 2—Huffman Bros. Motor Co., formed recently, has secured a plant in which will be manufactured two types of medium priced trucks. One with internal final drive is listed at $1,495, and the other, with worm-gear final drive, is listed at $1,695. W. L. Huffman is president of the company, and other officers are: Vice-president, F. C. Huffman; treasurer, Leroy Huffman; secretary, Verne C. Cawley; general manager, R. S. Wiltrout; sales manager, N. L. Kuhnen.

Arrow Grip to Have New Plant

GLENS FALLS, May 3—Ground will be broken at once for the new plant of the Arrow Grip Mfg. Co., to be erected on a 4-acre plot on Dix Avenue. The company has been reorganized and new directors added. The following officers were elected at its annual meeting: President, George Tait; vice-president, William H. Denning; secretary and sales manager, E. G. Mertens; treasurer, William H. Gelshenen; assistant treasurer and general manager, T. M. Avery. The officers and George F. Underwood, C. F. Burns, and G. F. Bayle, Sr., form the

board of directors. The Arrow Grip Mfg. Co. is incorporated for $500,000, of which $300,000 capital stock has been paid in.

—

Indianapolis Entries Total 43

NEW YORK, May 5—On May 1, the closing of the entries for the Indianapolis 5-Mile Victory Sweepstakes race for May 31, 43 entries appear on the lists. There are still four drivers to be named, for a Hudson special, a Detroit special and two Premiers. Omar Toft will drive his old Miller special under the new name of Darco special. Tom Alley has entered with a Bender special, a car built by him for C. J. Bender, president of the Ahlberg Bearing Co. The car has a 4-cylinder engine, with 3⅝ in. bore and 7 in. stroke, giving a displacement of 289 cu. in.

Only 33 out of the 43 entered for the race on May 31 will be permitted to start, as a rule of the American Automobile Association limits the number of cars in any speedway race to one for every 400 ft. of track. Beginning May 27, time trials will be held on the Indianapolis speedway to eliminate ten cars. Each contestant will be permitted three trials for speed in a single circuit of the 2½-mile track, the best record standing. No entrant who cannot show a greater speed than 80 m.p.h. will be permitted to enter. Starting positions for the contest will be awarded in the order of the speed shown in the time trials.

The complete list of drivers and cars follow:

Clifford Durant	Chevrolet special
Dario Resta	Sunbeam
Jean Chassagne	Sunbeam
H. C. Simmons	Hudson special
J. M. Reynolds	Hudson special
Eddie Pullen	Hudson special
W. W. Brown	Richards special
Eddie O'Donnell	Duesenberg special
Wilbur D'Alene	Duesenberg special
Tommy Milton	Duesenberg special
Kurt Hitke	Roamer-Duesenberg
Jules Goux	Peugeot special
Ray Howard	Peugeot special
Arthur Klein	Peugeot special
Louis LeCocq	Roamer special
Ralph DePalma	Packard special
Earl Cooper	Stutz special
Ralph Mulford	Frontenac special
Louis Chevrolet	Frontenac special
Denny Hickey	Stickel special
Arthur Thurman	Thurman special
Elmer P. Shannon	Mesaba special
Eddie Hearne	Durant special
Roscoe Sarles	Oldfield special
Dave Lewis	Duesenberg special
Omar Toft	Darco special
J. J. McCoy	McCoy special
A. E. Cotey	Ogren special
Ira Vail	Hudson special
Joseph Boyer	Frontenac special
P. W. Monahan	Johnson special
Andre Boillot	Peugeot special
....	Detroit special
Gaston Chevrolet	Frontenac special
Tom Alley	Bender special
....	Hudson special
....	Premier
....	Premier
Howard Wilcox	
....	Premier

—

Foreign Drivers Arrive for Races

NEW YORK, May 6—Several of the foreign drivers scheduled to take part in the 500-Mile Victory Sweepstakes speedway race at Indianapolis on May 31 are already on their way here. René Thomas and Albert Guyot, two of the Ballot team, arrived in this city yesterday on board the Savoy. Paul Bablot and Louis Wagner, the remaining members of the Ballot four, sailed from Havre on May 4 on the Espagne, which is due on May 13. Andre Boillot, who will drive a Peugeot, is also a passenger on the Espagne.

British Army Used 46,700 Motor Vehicles in France

PARIS, April 15—The British army in France made use of 46,700 motor vehicles, of which 30,000 were trucks. Despite this big mechanical fleet, the number of animals was constantly on the increase, and attained 400,000 horses and mules before the armistice was signed.

The British forces were responsible for the upkeep of 4500 miles of roadway. The traffic was of such a heavy nature that for one mile of ordinary road it was necessary to provide 100 tons of road material per fortnight for maintenance. During the month of October 85,000 tons of road material were carried weekly by motor truck, this involving a gasoline mileage of 14,000,000 weekly. The total amount of stone used for road maintenance from the beginning of 1918 to the date of the armistice was about 3,500,000 tons.

In his last official report, Sir Douglas Haig points out that mechanical appliances have not reduced the importance, in any degree, of infantry and artillery. As an instance of the interdependence of tanks and artillery it is stated that in the actions fought east of Amiens on Aug. 8, 1918, vast numbers of tanks were employed and carried out their tasks in the most brilliant manner. Yet the return of artillery munitions shows that in no action of similar dimensions had the expenditure of ammunition been so great.

While the war has given no new principles, the different mechanical appliances, particularly the rapid improvement and multiplicity of airplanes, the use of immense numbers of machine guns, the employment of vast quantities of barbed wire, the enormous expansion of artillery, and the provision of great masses of motor transport, have introduced new problems of considerable complexity concerning the effective co-operation of the different arms of the services.

—

American Police Aid French in Paris

PARIS, April 16—American military police now control automobile traffic on all the main avenues and boulevards of this city. The Americans are paired with French policemen and have authority not only over American drivers, but over French, English, Italian and other military cars, as well as over French civilians.

This scheme had to be adopted because of the international character of the automobile traffic in Paris and the growing recklessness of drivers. The Peace Conference has brought into the city more army drivers and more varied nationalities than during any period of the war. The United States is represented by the Army, the Navy, the Y. M. C. A., the Red Cross, the K. of C., Salvation Army, as well as the military cars attached to the Peace Conference. The British have big military, naval, and air services in Paris. The Italians are almost equally important, while in addition there are Belgian, Polish, Greek, Roumanian, Portuguese, Jugo-Slav and other missions, all of which have important automobile services.

—

Discontinue Flying Fields

WASHINGTON, May 5—Ten flying fields will be abandoned by the War Department as soon as the equipment in storage at these fields can be disposed of. Other departments, including Interior, Commerce, Navy, Treasury and Agriculture, have been informed that these fields will be discontinued so that they can make use of them or the equipment if they desire. Following are the ten fields to be discontinued:

Barron Field	Fort Worth, Texas
Call Field	Wichita Falls, Texas
Carruthers Field	Fort Worth, Texas
Eberts Field	Lonoke, Ark.
Love Field	Dallas, Texas
Payne Field	West Point, Texas
Rice Field	Waco, Texas
Taliaferro Field	Fort Worth, Texas
Taylor Field	Montgomery, Ala.
Gerstner Field	Lake Charles, La.

—

Uniontown Entry List Lengthens

NEW YORK, May 5—The complete list of entries for the 112-mile Uniontown race for May 17 as received so far by the Contest Board of the American Automobile Association includes:

Louis LeCocq	Roamer special
Kurt Hitke	Roamer special
Eddie Pullen	Hudson special
Cliff Durant	Chevrolet special
Harold Simmons	Hudson special
Wilbur D'Alene	Duesenberg special
Dennie Hickey	Stickel special
Ray Howard	Peugeot special
P. W. Monahan	Johnson special
Joseph Boyer	Frontenac special
Louis Chevrolet	Frontenac special
Gaston Chevrolet	Frontenac special
Eddie Hearne	Durant special

—

British Import Restrictions Lifted

WASHINGTON, May 2—The restrictions on the importation of certain commodities, including Edison cells (and component parts) for electrically propelled vehicles, machine tools and parts, tools, appliances and parts, including abrasive wheels, drills, drill presses, drill sleeves and sockets, emery wheel dressers, hand and breast drills, lathe carriers and lathe dogs, have been removed by Great Britain, and according to a statement of the War Trade Board may be imported freely under general license.

The War Trade Board under special license will permit the importation of solid drawn weldless tubing in very special circumstances, as well as ball bearings, roller bearings, ball retainers, ball-bearing bolts and steel balls.

—

Webster Electric Gets Addition

RACINE, WIS., May 5—The Webster Electric Co. is preparing to build a two-story addition, to be used for an extension to the power plant as well as the factory. The enlargement is due mainly to the growth of the company's tractor ignition business.

Ungar Becomes Vice-President of SKF Ball Bearings

NEW YORK, May 2—G. A. Ungar, who has been engineer and technical director of the SKF Ball Bearing Co. for several years, has resigned to become vice-president of the company, of which he has been a director since its organization.

Seward in Charge of Walden-Worcester Office

WORCESTER, MASS., May 2—Walden-Worcester, Inc., has opened a New York sales office at 295 Broadway. Howard H. Seward is in charge.

Nonnes Gets Foreign Stock of Norma Ball Bearing

NEW YORK, May 5—Walter M. Nonnes, who has been president and general manager of the Norma Ball Bearing Co. since its formation in 1911, on Saturday purchased all of the foreign controlled stock of the company at a sale of the Alien Property Custodian. A total of 1950 shares, valued at $500,000, thus becomes the property of Mr. Nonnes and his present business associates. The business will be enlarged and expanded as conditions warrant. Executive control of the business has been vested in Nonnes since the formation of the company, and there will be no changes in the administration.

Earl A. Stone, formerly manager of the Detroit branch of the Wheeler-Schebler Carburetor Co., Indianapolis, has been appointed sales manager of the company to succeed George T. Briggs, who resigned.

Fred W. Thomas has opened an office in Cleveland, Ohio, as consulting engineer. He was formerly chief engineer of the Olympian Motors Co., Pontiac, Mich.

Capt. Wakeman Hackett, recently released after 20 months in service, has become associated with the Oshkosh Motor Truck Mfg. Co., Oshkosh, Wis., as factory representative covering the Middle West.

H. H. Lotz, for many years with Lowe Bros. Co., has joined the sales force of the Hilo Varnish Corp. He will cover southern Ohio with headquarters at Dayton.

J. H. Weller, formerly assistant production manager of the Packard Motor Car Co., has been appointed assistant to B. W. Burtsell, president of the Herschell-Spillman Motor Co., North Tonawanda, N. Y., and will be in charge of production.

W. R. Mason, Albany, N. Y., has been appointed sales representative of the O. Armleder Co., Cincinnati, to cover the state of New York.

Men of the Industry

Changes in Personnel and Position

Guthrie Re-opens Engineering Office

CLEVELAND, May 2—Major James Guthrie, honorably discharged from the U. S. army, has re-opened his consulting engineering office at 420 Hickox Building, here. He served in the Ordnance Engineering Department at Washington for a year, and eight months as engineering manager of the Michigan Ordnance District.

Ferguson President of Chamber of Commerce

WASHINGTON, May 5—Homer Ferguson, president of the Newport News Shipbuilding Co., has been selected as president of the U. S. Chamber of Commerce for the coming year.

R. P. Leigh has been appointed factory manager of the Hackett Motor Car Co., Grand Rapids, whose plant has just been completed. It expects to be in production by July 1.

C. W. Jacoby has been appointed manager of the Philadelphia office and warehouse of Peter A. Frasse & Co., Inc., succeeding W. F. Moore who resigned.

May S. A. E. Meeting to Discuss Aviation

CHICAGO, May 6—The May meeting of the mid-west section of the Society of Automotive Engineers will be held at 1735 Monadnock Block, Friday, May 9, at 8 p.m. W. B. Stout, sales and aircraft manager of the United Aircraft Engineering Co., will tell of the lure of aviation, in which he will discuss present airplanes and their influence on car design, also future airplanes and engines. The second paper will be by O. E. Szekely, chief engineer and production manager of the Velie Motors Corp., on the development of kerosene burning fuel.

The meeting will be preceded by an informal dinner at 6.30 p.m. at the Chicago Engineers Club. Tickets are $1.50. Friends of members and interested engineers are invited. Reservations for the dinner can be made through Francis W. Parker, 1410 Marquette Building.

E. B. Hayes Doubling Plant

OSHKOSH, Wis., May 5—The E. B. Hayes Machinery Corp., manufacturer of worm-drive axles for trucks, has under consideration plans for new buildings which will more than double the size of the plant and provide facilities for greatly increased production. Work probably will be undertaken during May so increased production may begin late in the summer.

Howard Spohn Again with Class Journal

NEW YORK, May 5—After something over two years as commercial manager of the U. S. Ball Bearing Mfg. Co., in Chicago, Howard L. Spohn has returned to the Class Journal Co. Spohn was connected with the Class Journal Co. for the 7 years previous to his going West, and upon his return to this city he is taking up the same general duties he was performing prior to his venture in the manufacturing world.

De Kam & Petit Open Engineering Office

William H. Petit, former chief engineer of the Olympian Motors Co., Pontiac, and Major C. T. De Kam, formerly of the Canadian forces, have united under the firm name of De Kam & Petit, with offices in Detroit, and will carry on general engineering work.

George Smith Heads Dixon Crucible

JERSEY CITY, May 5—George T. Smith was elected president of the Joseph Dixon Crucible Co. at the annual meeting recently; other officers elected being, vice-presidents, George E. Long and J. H. Schermerhorn; secretary, Harry Dailey; treasurer, William Koester; assistant secretary-treasurer, Albert Norris. The Philadelphia branch has been moved from 1020 Arch Street to the Finance Building. W. G. Stringer, Philadelphia district sales representative since 1912, continues in charge.

Willys Chairman of N. A. C. C. Show Committee

NEW YORK, May 6—The National Automobile Chamber of Commerce has appointed John N. Willys chairman of its show committee for the 1920 passenger car show. Other members of the committee are H. J. Root, Westcott, and H. M. Jewett, Paige. M. L. Pulcher, Federal, heads the committee on motor truck show, his associates being A. J. Whipple, Diamond-T, and David S. Ludlum, Autocar.

Willys-Overland Stockholders to Meet

TOLEDO, May 5—The regular annual meeting of the stockholders of the Willys-Overland Co. will be held at the factory offices of the company here May 13 at 2 o'clock. Directors for the ensuing year will be elected.

National Wire Wheel President Dies

GENEVA, N. Y., May 5—Wallace W. Page, president of the National Wire Wheel Works and secretary of the Geneva Cutlery Corp., died last week of pneumonia.

William Hyslop, president of Hyslop Brothers, Toronto, Can., died at his Toronto home on April 26. The concern of which he was head is one of the largest jobbers of automotive equipment in Canada and Cadillac distributer for eastern Canada.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Ford Assembly to Be Done at Plant

DETROIT, May 3—The Ford Motor Co. will hereafter assemble its cars for Michigan at the plant instead of at the factory branch, which was sold last week to a local real-estate company for approximately $1,500,000. Plant assmbly will not take place until after Nov. 1, on which date the company turns over its 10-story branch building to new owners.

The Ford company will this fall build an assembly plant at the factory. Just across Woodward Avenue from the Ford plant, a sales and service station will also be built to handle the commercial work now being cared for at the factory branch. The company decided to discontinue assembly work at the branch when it was apparent that the cost of transporting parts from the factory to the branch by truck was becoming excessive. This work can be handled at the factory at a greatly reduced cost.

The Ford company is now running 3,000 cars daily. Approximately 300 cars a day are assembled at the factory branch for the Michigan trade. On April 8, the company completed Model T engine No. 3,000,000. The first Model T engine was cast in 1908 and has been changed but little since that time. There are now approximately 3,150,000 Ford engines in operation.

Standard Aircraft Liquidating

ELIZABETH, N. J., May 2—The Standard Aircraft Corp. is winding up its affairs preparatory to going out of business. It does not feel that commercial aircraft is getting sufficient support at this time to warrant its continuation. The parent organization commenced work in 1914 and the present company was organized in 1915 to manufacture aircraft exclusively, and was active all through the war.

Badger Aluminum Ready for Production

SHEBOYGAN, WIS., May 2—The Badger Aluminum Co., incorporated early in April with an authorized capital of $50,000, decided to double this amount, making it $100,000, at the stockholders' meeting for permanent organization. Equipment and machinery is now being installed in the new plant and the company hopes to be ready to start regular production of castings and stampings by June 15. Officers were elected as follows: President, William A. Erdmann; vice-president, Noah Saemann; secretary, William F. Toepel; treasurer, Charles Voigt; director, William Markwardt.

Marlin-Rockwell Motor Radiators Back to New Haven

NEW HAVEN, May 3—The Motor Radiator Division, formerly the Mayo Radiator Division of the Marlin-Rockwell Corp., which was located temporarily in New York for war work, will shortly be moved back to the plant here. During the war this division manufactured airplane radiators for the Government.

First Antigo Tractor for Demonstration

ANTIGO, WIS., May 2—The first demonstrating model of the new four-wheel drive tractor which the Antigo Tractor Syndicate is preparing to manufacture in quantities was completed at the shops of the Dauber-Kratsch Machine Co., Oshkosh, Wis. The design is by D. S. Stewart. Mr. Stewart assisted in the founding of the Topp-Stewart Tractor Co., Clintonville, Wis., from which he retired two and a half years ago.

His latest design weighs 3500 lb. It uses a 32 hp. Doman engine and Hayes front and rear axles. The tractor, although 136 in. long overall, turns within a 16-ft. circle.

Klumb Engine Now Liberty Tractor

SHEBOYGAN, WIS., May 3—The Klumb Engine & Machine Co., an old-established gas engine and farm machinery manufacturing concern, has been reorganized under the laws of Iowa as the Liberty Tractor Co., and is now moving its equipment and offices to Dubuque. Paul Klumb, president and manager of the Sheboygan company, will continue to be associated with the company. At Dubuque a new plant is being erected. The first structure, a machine shop, 80 x 180, is ready for occupancy. An assembling floor and gas engine shop, 60 x 300 and 100 x 250 respectively, will be built during the summer. Practically the entire output until Jan. 1 has been contracted for.

Aircraft Factory Converted for Car Manufacture

WASHINGTON, May 2—Straker & Squire, Ltd., British car manufacturers, have purchased from the Government the national aircraft engine factory at Edmonton, proposing to transfer all its manufacturing industries there, according to a report from Commercial Attaché Kennedy at London. The purchasers intend to concentrate on two standard models—a 6-cylinder passenger car and a 4-cylinder commercial chassis suitable for transport services and omnibuses.

The cars will be British-built throughout and fitted with British magnetos. The entire factory will be organized on the lines of quantity production from standard jigs, and it is anticipated that 5000 workers will be employed continuously. It is planned to produce 2000 complete vehicles in the converted factory in the first year. The price paid the Government for the factory was $681,300. The Disposal Board has 14 other national factories available for private enterprise.

Ricardo Tank Engine Developments

LONDON, April 15—Developments of the cross-head type of engine invented by Harry R. Ricardo, whose engine was used in the British tanks, is continuing along broader lines. The present development includes a 4-cylinder engine for heavy trucks, with cylinder 4¾ x 6, and a crankshaft speed of 1500 r.p.m. This engine has been developing 72 b.-hp. in tests and is a development of the tank engines in that the valve gear is entirely enclosed. Another development is a heavy duty kerosene engine for tractors intended to develop 30 b.-hp. at 800 to 900 r.p.m. Mr. Ricardo has been accomplishing results with the use of kerosene in the cross-head piston engine. He uses cooled exhaust gas in his patented carbureter and is getting a higher horsepower than with gasoline.

American Motors Corp. Increases Capital $500,000

NEW YORK, May 2—In order to increase the output of its plant at Plainfield, N. J., the American Motors Corp. has made a stock issue of $500,000. The output for May is scheduled at 150 cars, June 200, and July and thereafter, 250 per month. At the directors' meeting, P. W. Hansl was elected vice-president and supervisor of sales. He has been secretary and treasurer of the company for years. George G. Gates succeeds him as secretary. G. A. Brower, president of the Penn-American Motor Car Co., Philadelphia, was elected a director. George W. Craven continues as a director, and Laurence P. Rife, for many years production manager of the Hudson Motor Car Co., who has been factory manager since March 1, is also a director of the corporation. Robert Bursner remains president and Louis Chevrolet first vice-president.

Steel Spring Piston Ring Organized

NEW YORK, May 3—The Steel Spring Piston Ring Co. has been formed by A. J. H. Kuhsiek, formerly factory superintendent of Edward V. Hartford, Inc., and A. Meyer, formerly production manager of the same concern, to make the Bull Dog ring, a three piece ring having several novel sales points.

Derf Factory Moved

NEW YORK, May 2—The Derf Mfg. Co. has moved to new factory quarters at 9-13 Walker Street, where both equipment and number of employees have been increased. The company's office remains at 90 West Broadway.

New Chicago Office for Van Dorn Tool

CLEVELAND, May 2—The new Chicago office of the Van Dorn Electric Tool Co. has been opened at 527 South Dearborn Street and extends to 528 Plymouth. William Cottrell remains as sales manager of the Chicago branch.

New York Exports Drop During March

Cars Increase in Number, but Value Is Lower—Trucks Show Big Fall—Parts Also Show Loss

NEW YORK, May 3—Although our exports of automotive products through this port show a falling off when compared with those of February, they are well in front of January's totals. Taking the values of cars, trucks and parts for the three months, the following results are arrived at:

January	$4,274,827
February	6,870,057
March	4,677,369

It is not always a fair method of comparison to take any one month against another. This method does not necessarily indicate either a gain or a falling off in the sense that the actual shipments are limited by the tonnage available for the various ports. For this reason it should not be assumed that because our exports during March are below those of February, our foreign trade is falling off.

The shipping shortage is still severe and there are many thousands of dollars worth of automotive products awaiting overseas transportation.

Automobile, Truck and Parts Exports from New York for February

	Cars		Trucks		Parts
	No.	Value	No.	Value	Value
Argentina	206	$233,005	7	$9,675	$209,868
Australia	179	197,929	85	89,040	63,064
Barbadoes	..	......	3	2,856	2,305
Belgium	5	4,060	..	......	22,852
Bolivia	..	......	..	......	2,365
Brazil	93	90,692	17	9,370	58,819
British East Africa	1	2,091	..	......	1,898
British East Indies	..	......	..	......	108
British Guiana	2	2,500	2	1,901	5,089
British India	39	42,329	..	......	20,875
British South Africa	93	109,683	3	6,142	74,989
British West Africa	29	27,718	6	7,692	21,482
British West Indies	2	1,040	6	3,600	2,113
Canary Islands	..	......	..	......	20
Chile	112	100,005	32	25,634	69,979
China	36	43,078	50	86,647	15,386
Colombia	26	19,235	2	1,000	4,267
Costa Rica	..	......	..	......	16
Cuba	77	60,542	40	66,524	80,630
Danish West Indies	4	1,940	..	......	309
Denmark	15	30,184	26	25,475	7,332
Dutch East Indies	92	192,206	39	73,891	64,941
Dutch Guiana	..	......	..	......	1,249
Dutch West Indies	..	......	..	......	726
Ecuador	..	......	..	......	612
England	35	48,835	11	21,347	281,650
France	71	169,693	180	568,125	131,309
French Africa	10	4,392	7	6,710	2,199
French East Indies	6	5,734	..	......	......
French West Indies	12	9,051	6	6,016	3,408
French Guiana	..	......	..	......	18
Greece	10	12,798	1	972	4,737
Guatemala	..	......	..	......	594
Haiti	..	......	..	......	1,809
Honduras	..	......	..	......	134
Hongkong	9	11,385	..	......	3,398
Iceland	2	1,271	..	......	988
Italy	..	......	..	......	10,798
Jamaica	7	6,311	3	1,650	6,838
Japan	181	112,450	18	30,434	15,970
Japanese China	..	......	3	5,000	682
Mexico	42	38,393	3	10,735	10,881
Morocco	2	3,100	..	......	......
Netherlands	..	......	..	......	7,435
Newfoundland	2	2,500	..	......	589
New Zealand	65	84,550	2	8,577	4,469
Nicaragua	8	4,689	3	1,511	1,672
Norway	21	50,388	25	63,326	37,398
Panama	16	10,765	..	......	1,191
Peru	8	14,850	..	......	3,536
Philippine Islands	..	......	5	18,200	285
Russia in Asia	3	1,900	..	......	98
Salvador	2	2,984	..	......	75
Santo Domingo	19	15,631	6	3,300	6,973
Scotland	..	......	..	......	1,002
Serbia	..	......	1	3,000	......
Siam	9	9,390	3	1,613	547
Spain	60	92,453	10	13,520	21,528
Sweden	80	63,380	..	......	1,849
Straits Settlements	60	73,197	6	9,000	15,890
Trinidad	1	875	..	......	2,043
Turkey in Asia	..	......	..	......	2,489
Turkey in Europe	1	4,000	..	......	......
Uruguay	139	149,495	12	12,000	55,502
Venezuela	22	15,263	7	4,000	3,578
	1,864	$2,164,675	530	$1,143,488	$1,369,206

Enemy Trading Lists Withdrawn

WASHINGTON, May 6—All enemy trading lists issued by the War Trade Board have been withdrawn by it with the authority of the Associated Governments, at the same time all restrictions attached to trading or communication with persons in such lists have been removed. Subject to other rules of the War Trade Board, limitations of trade and communication with persons outside the United States, with whom trade was prohibited by the Trading with the Enemy Act, have also been withdrawn. This action does not, however, affect any of the restrictions against trade with Germany or Hungary, nor does it authorize trade with any person or company taken over by the Alien Property Custodian. The Associated Governments have reserved the right to re-issue the Enemy Trading List if found necessary.

Want Two-thirds Canadian Products Permitted to Enter England

WINDSOR, ONT., May 3—Automobile manufacturers of the border cities, comprising Ford, Walkerville, Sandwich, Windsor and Ojibway, favor a compromise in British tariff regulations that will permit Canadian products, provided they are 66⅔ per cent of Canadian manufacture, to enter the British Isles.

A number of Canadian car factories are subsidiaries of United States concerns, and are utilized largely for assembling purposes, although recent activities indicate that in future more actual manufacturing will be done in the Dominion.

Under present regulations United States cars and parts are not allowed in the British Isles, and well-founded rumors reaching the Border Chamber of Commerce are to the effect that British manufacturers are opposed to admitting even cars from Canada, provided less than 80 per cent construction work is done in this country.

Fords May Be Made in Tokio

DETROIT, May 3—Henry Ford may establish a car and tractor plant in Tokio, Japan, according to Baron Shimpel Goto, one of Japan's most influential men, who is here conferring with Mr. Ford. Mr. Ford is now contemplating a trip to the Far East, the Baron said. The Japanese nobleman is making a study of American manufacturing methods.

Continental Motors Dividend

Continental Motors Corp., Detroit, 1½ per cent dividend payable May 15 to stockholders of record May 10.

$6,000,000 Canadian Plant for General Motors Started

WALKERVILLE, ONT., May 5—Ground has been broken for the $6,000,000 plant of the General Motors Corp. here. Plans call for the erection of two structures, 300 x 200 ft. Within 2 weeks more than 300 men will be employed in construction work, it was stated, preference being given to returned Canadian soldiers.

Goodyear Opens Office in Spain

AKRON, May 5—The Goodyear Tire & Rubber Co. has established a branch at Madrid, Spain, with Edward M. Sonntag in charge.

Scripps-Booth Up to 45 Cars Daily

DETROIT, May 2—The Scripps-Booth Corp. will be housed in its new $1,500,000 factory this fall. While the plant is in construction production of the present plant will not be affected. The company is turning out 45 cars daily, while the demand calls for 50 per cent more than can be produced. It is exporting 150 cars monthly.

Government Disposes of 605,235 Tons Iron and Steel

WASHINGTON, May 5—The government is about to dispose of a total of 605,235 tons of iron and steel, including 47,908 net tons of raw materials, 514,460 net tons of finished steel and semi-finished products, 2,150 net tons of cast iron and steel, and 31,317 tons of scrap. The material will be disposed of on sealed bids to be accompanied by a certified check for 20 per cent of the amount of the bid, deliveries to be made f.o.b. cars.

Completing Government Aviation Engines

WASHINGTON, May 5—All orders for aviation engines for the army have been completed except those on Hispano-Suizas, and for the week ended April 17 only 1058 of these remained to be delivered. Of these 809 are the 180-hp. type and 249 are the 300-hp. type. The original order was for 6000 of the former and 500 of the latter. Deliveries of DeHaviland 4 planes are 99.9 per cent complete, 4,842 of 4,846 having been turned over.

War Department Sells Lead

WASHINGTON, May 3—Surplus stocks of lead owned by the War Department are being sold at current local market prices in the community in which the surplus is held. It is scattered throughout the country and there is no large quantity in any one place. The department has 7000 tons of lead on hand, a small percentage of the year's production, and not sufficient to affect the market.

American Welding Bureau Officers Elected

NEW YORK, May 5—At a meeting of the American Bureau of Welding at the Engineering Societies Building, by-laws were adopted and the following officers elected: Director, C. A. Adams; vice-directors, H. M. Hobart and A. S. Kinsey; treasurer, W. E. Symons; secretary, H. C. Forbes. At a directors' meeting J. H. Deppeler of the Metal & Thermit Corp., Jersey City, was elected a director of the society.

Regular meetings of the Bureau are to be held the third Friday of each month. It was also voted that a Research Committee be established to carry out the plan of co-operation in conducting investigations.

Hackett Car Plant Nearing Completion

GRAND RAPIDS, MICH., May 5—Work is nearing completion on the new plant of the Hackett Motor Car Co. This company recently moved here from Jackson.

Purchasing Agents Want Standard Invoice Forms

DETROIT, May 3—The Standardization Committee of the National Assn. of Purchasing Agents is making a thorough effort to standardize the forms used for bill heads or invoices. The members complain very strongly about the lack of standardization. They desire to have the date, invoice number and other information in some predetermined spot on the page and want the sheets of a uniform size for convenience in filing and handling.

The committee has outlined the following points, which should be borne in mind when considering this subject:

1. In order to have a standard form enthusiastically adopted by the selling organizations it should appeal to them as reasonable.
2. No attempt should be made to force anything through which will serve as a restraint upon business and therefore we should aim to make our form fit the requirements of the selling as well as the buying end of business.
3. Large selling organizations are now using accounting machinery, such as electrical tabulating equipment for statistical purposes, and any form must be large enough to permit ready use of these accounting machines without interfering with the accuracy of the work.
4. To accommodate these accounting machines it is necessary to have definite columns provided in which to show description, size, quantity, dimensions, weight, price each, total price, and a separate column for the net total of the invoice. To this must be added some other columns in many cases to suit certain lines of business, such as number of bundles, number of feet, length, etc.
5. From the standpoint of the purchasing agent particularly, and the sales department secondly, it is desirable to have the date, order number, invoice number, car number, and similar data placed in some definite spot on each and every invoice so that there is always one place to look for this information.
6. Some of the information in No. 5 should be so located on the sheet that it will be convenient when looking through a file for a definite invoice.
7. It may be necessary to provide more than one length of invoice form, but if it is possible to do so that should be avoided. One standard size would be far preferable from the standpoint of filing. This also has some advantages in the use of accounting machinery.

The subject is to be discussed at meetings of the various branch associations throughout the country. The National Assn. of Purchasing Agents has made great strides toward the standardization of catalogs, and hopes to meet with similar co-operation in eliminating the confusion which now surrounds the matter of invoices. The members of its Standardization Committee are:

W. V. C. Bulkeley, Liberty Steel Products Co., New York City.
H. H. Meehan, A. B. Dick Co., Chicago.
A. Lockwood, Lumen Bearing Co., Buffalo.
K. L. Kulow, Willard Storage Battery Co., Cleveland.
W. L. Chandler, Dodge Sales & Engineering Co., Mishawaka, Ind.

Standard Parts Dividend

Standard Parts Co., Cleveland, 1½ per cent, common, payable May 15 to stockholders of record May 6.

Exports of Automotive Equipment for March and Eight Previous Months

	1918		1919		1918		1919	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	....	....	....	....	18	$192,620	43	$577,600
Airplane parts	....	$1,219,743	....	$639,858	....	5,959,990	....	10,133,099
Commercial cars	626	1,537,949	1,223	3,124,484	9,855	26,505,174	8,934	24,407,841
Motorcycles	1,105	256,997	7,198	327,609	7,928	1,739,567	6,737	1,636,242
Passenger cars	4,249	3,981,016	3,443	4,168,184	41,879	35,653,258	22,966	26,502,156
Parts, not including engines and tires	....	2,683,902	....	2,527,620	....	23,982,557	....	24,978,768
Totals	5,980	$9,679,607	5,864	$10,787,755	59,680	$94,033,166	38,680	$88,235,711

	1918		1919		1918		1919	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas	3,219	$394,496	1,445	$244,044	28,515	$3,280,221	17,200	$2,717,070
Marine, gas	520	263,958	1,119	552,055	5,751	1,904,216	4,889	2,652,941
Stationary, gas	2,873	331,157	1,623	257,579	19,241	2,216,176	16,777	2,470,616
Tractor, gas	3,900	3,651,020	943	994,737	15,751	15,808,038	15,511	17,164,673
Totals	10,512	$4,640,631	5,130	$2,048,415	69,258	$23,208,651	54,377	$25,005,300

Exports by Countries for March, 1919—Eight Months Ending March, 1919

	Cars		Trucks		Cars		Trucks	
	No.	Value	No.	Value	No.	Value	No.	Value
Denmark	15	$30,184	....	....	158	$262,728	....	....
France	73	170,893	166	$764,125	678	911,787	3,105	$13,035,669
Norway	21	50,383	....	....	234	477,523	....	....
Russia in Europe	....	....	....	....	6	6,605	....	....
Spain	62	94,053	....	....	566	760,538	....	....
United Kingdom	35	43,835	11	21,347	131	186,568	869	2,531,039
Canada	405	430,102	401	1,352,690	2,889	2,267,137	1,488	2,776,611
Mexico	199	178,922	....	....	1,335	1,340,006	....	....
Cuba	151	171,431	61	103,121	1,326	1,955,579	456	888,636
Argentine	206	228,005	7	9,675	1,210	1,503,439	49	96,363
Chile	116	109,289	....	....	926	1,411,236	....	....
Uruguay	139	149,495	....	....	626	603,495	....	....
British India	39	42,329	....	....	111	144,498	....	....
Dutch East Indies	158	282,380	....	....	1,387	1,831,734	....	....
Russia in Asia	3	1,900	....	....	6	13,634	15	18,200
Australia	212	242,047	....	....	2,595	2,464,407	....	....
New Zealand	65	84,550	....	....	998	996,952	....	....
Philippine Islands	156	223,288	....	....	1,046	1,176,815	....	....
British So. Africa	93	109,683	....	....	903	944,731	....	....
Other countries	1,295	1,530,415	577	873,526	6,335	7,242,744	2,952	5,061,328
Totals	3,443	$4,168,1[illegible]4	1,223	$3,124,484	22,966	$26,502,156	8,934	$24,407,846

Oil Exports for March and 9 Months Ended March, 1919

	March, 1919		March, 1918		9 months ended March, 1919		9 months ended March, 1918	
	Gallons	Value	Gallons	Value	Gallons	Value	Gallons	Value
Crude mineral oil	9,172,572	$549,812	8,787,165	$576,639	33,978,978	$8,398,658	127,840.914	$6,144,883
Illuminating oil	54,280,902	6,537 000	49,048,642	4,943,369	425,515,688	46,661,851	411,424,127	36,120,277
Lubricating oil	21,244.331	6.154,923	25,755,958	7.324.550	201,554,178	64,370,953	203,881,418	48,319,537
Gasoline, naphtha, etc.	22,402,072	5,577,230	46,885,000	12,152,117	382,835,156	95,052,217	319,309,081	77,241,263
Residuum, fuel oil, etc.	36,940,670	2,031,946	80,473,120	4,103,169	755,229,304	42,778,694	922.806,472	45,207,427

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb. .02 - .03
- Phosphoric (85%) lb. .35 - .39
- Sulphuric (60%), lb. .008

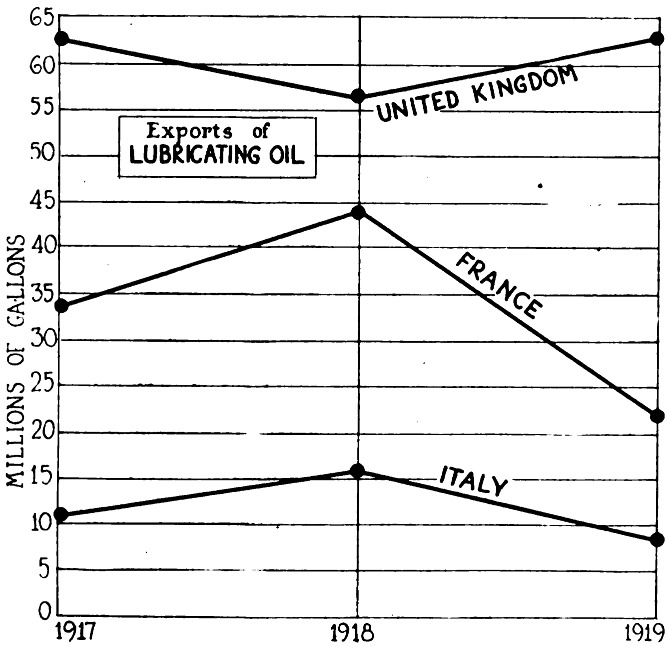
Aluminum:
- Ingot, lb. .29 - .31
- Sheets (18 gage or more), lb. .42

Antimony, lb. .07 - .07⅛

Burlap:
- 8 oz., yd. .08½ - .08¾
- 10½ oz., yd. .10½

Copper:
- Elec., lb. .15¼ - .15½
- Lake, lb. .15¾ - .15⅞

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.4[illegible]
- Egypt, combed, sq. yd. 1.25
- Egypt, carded, sq. yd. 1.20
- Peelers, combed, sq. yd. 1.08
- Peelers, carded, sq. yd. .85



Exports of fuel oil to the United Kingdom, France and Italy for the seven months ended January 31, 1919. The figures indicate the enormous quantity needed for the operation of oil-burners in the British fleet

Fibre (⅛ in. sheet base), lb. .50

Graphite:
- Ceylon, lb. .09 - .22
- Madagascar, lb. .10 - .15
- Mexico, lb. .03¾

Lead, lb. .04¾ - .05

Leather:
- Hides, lb. .24 - .42½

Nickel, lb. .40

Oil:
- Petroleum (crude):
  - Kansas, bbl. 2.25
  - Pennsy., bbl. 4.00
- Gasoline:
  - Auto, gal. .24½
  - 68 to 70 gal. .30½
- Lard:
  - Prime City, gal. 2.60 - 2.65
- Ex. No. 1, gal. 1.00 - 1.20
- Linseed, gal. 1.53 - 1.56
- Menhaden (dark), gal. .85 - .90

Rubber:
- Plantation:
  - First latex pale crepe, lb. .46½
  - Brown crepe, thin, clear, lb. .44½
  - Smoked, ribbed sheets, lb. .46

Para:
- Up River, fine, lb. .56
- Up River, coarse, lb. .34
- Island, fine, lb. .47½ - .48

Shellac (orange), lb. .56 - .57

Spelter, lb. .06 - .06¼

Steel:
- Angle beams and channels, lb. .03
- Automobile sheet (see sp. table).
- Cold rolled, lb. .0625
- Hot rolled, lb. .039

Tin .72½

Tungsten, lb. 1.00

Waste (cotton), lb. .12¾ - .17

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when Seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lbs.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lbs.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lbs.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lbs.

Blank Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.

Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close of May 3

	Bid	Asked	Net Ch'ge
Auto Body Company	9	10	..
Briscoe Motor Car com.	14	..	..
Briscoe Motor Car pfd.	50	65	..
*Chandler Motor Car	144	146	+2
Chevrolet Motor Car	209	211	..
Cole Motor Car Co.	93	105	..
Continental Motors com.	9¼	9½	+½
Continental Motors pfd.	96	99	..
Edmunds & Jones com.	19	22	+4
Edmunds & Jones pfd.	72	78	—3
Electric Storage Bat.	75	77	..
Federal Motor Truck*	34	37	..
Fisher Body Co. com.	57½	58½	—1½
Fisher Body Co. pfd.	92	94	..
Ford Motor of Canada	320	330	..
General Motors com.	181¾	182¾	+1½
General Motors pfd.	89½	91½	—1½
Hupp Motor Car com.	9¼	9⅝	+⅞
Hupp Motor Car pfd.	98	101	+2
Kelsey Wheel Co. com.	35	37	..
Kelsey Wheel Co. pfd.	93	95	.
Manhattan Electric S. com.	..	48	..
Maxwell Motor com.	40¾	41¾	+1¼
Maxwell Motor 1st pfd.	68½	69½	—½
Maxwell Motor 2nd pfd.	31¼	32¼	—¼
McCord Mfg. com.	34	37	..
McCord Mfg. pfd.	97	100	+2
Mitchell Motor Co.	38	41	+5
Motor Products Corp.	..	35	..
Nash Motors Co. com.	230	..	..
Nash Motors Co. pfd.	95	100	..
National Motor Co.	16	20	..
Packard Motor Car com.	146	149	..
Packard Motor Car pfd.	99	102	..
Paige-Detroit Motor com.	34½	35½	..
Paige-Detroit Motor pfd.	9	9¾	..
Peerless Motor Truck	26	28	—1
*Pierce-Arrow M. Car com.	51⅜	52⅜	+⅝
Pierce-Arrow M. Car pfd.	102	104	..
Premier Motor Corp. com.	5	..	..
Premier Motor Corp. pfd.	..	75	..
Prudden Wheel Company	21	22	..
Reo Motor Car Co.	26¾	27½	+¼
*Republic M. Truck com.	43	45	—½
Republic M. Truck pfd.	91	95	..
Saxon Motor Car com.	6⅝	8⅝	—⅜
Scripps-Booth Corp.	21	25	..
Stewart Warner S. Corp.	91⅛	93⅛	—1⅝
Stromberg Carburetor Co.	38	40	..
Studebaker Corp. com.	76⅞	77⅞	+1⅜
Studebaker Corp. pfd.	94	97	..
Stutz Motor Car Co.	57½	58½	+1½
United Motors Corp.	47	49	..
White Motor Co.	62½	63½	+4¾
Willys-Overland com.	34	35	+2
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	92½	94½	+2½
Firestone T. & R. com.	142	145	+2
Firestone T. & R. pfd.	100	101	..
Fisk Rubber Co. com.	135	140	..
Fisk Rubber 1st pfd.	100	105	..
Fisk Rubber 2nd pfd.	138	142	..
Fisk Rubber 1st, pfd. conv.	105	110	..
Goodrich, B. F. com.	73¼	74¼	+2⅛
Goodrich, B. F. pfd.	107	109	..
Goodyear T. & R. com.	284	288	+4
Goodyear T. & R. 1st pfd.	105½	107½	..
*Goodyear T. & R. 2nd pfd.	106	107½	..
*Kelly Springfield com.	126½	127½	+3⅝
Kelly Springfield 1st pfd.	95	97	..
Lee Tire & Rubber Co.	36⅜	37⅜	+4⅝
Marathon Tire & Rubber	55	75	..
Miller Rubber Co. com.	172	175	+2
Miller Rubber Co. pfd.	104	..	+2
Rubber Products Co.	127	130	+2
Portage Rubber Co. com.	155	159	—3
Swinehart T. & R. Co.	78	81	+1
U. S. Rubber Co. com.	98¼	99¼	+11⅛
*U. S. Rubber Co. pfd.	112	113	+⅝

*Ex dividend.

A Plan to Stabilize the Dollar

(*Continued from page* 1006)

authorized to mark the dollar up or down according to his own caprice? Most certainly not. A definite and simple criterion for the required adjustments is at hand—the now familiar "index number" of prices. The Bureau of Labor Statistics, which now publishes an index number, the Bureau of Standards, or other suitable Government office would be required to publish this number at certain stated intervals, say monthly. That is, each month the bureau would calculate from current market* prices how much would have to be paid for our composite basket of goods. This figure it would publish and proclaim; and this figure would then afford the needed official sanction to the Secretary of the Treasury to change the rating of the gold dollar—that is, to change the amount of gold which the mint would give or take for a gold certificate, and thus increase or diminish the purchasing power of that certificate. The certificate would always be equal to the gold dollar; and the gold dollar would be kept equal to the goods-dollar, which is the ultimate standard. If, for instance, the index number representing the current price of our composite basket of goods is found to be 1 per cent above the ideal par—that is, above the one dollar price it had at first—this fact will indicate that the purchasing power of the dollar has gone down; and this fact will be the signal and authorization for an increase of 1 per cent in the weight of the gold dollar. For what is added to the weight of the gold dollar will be automatically registered in the purchasing power of its circulating certificate.

Summary of Plan

The plan, then, as above set forth, is, in brief:

(1) To abolish gold coins and to convert our present gold certificates into "gold-dollar certificates" entitling the holder to dollars of gold bullion of such weight as may be officially declared from time to time.

(2) To retain the virtual "free coinage"—that is, deposit—of gold and the free redemption of gold-dollar certificates.

(3) To designate an ideal composite goods-dollar consisting of a representative assortment of commodities, worth a dollar at the outset, and to establish an index number for recording, at stated intervals, the market price of this composite dollar in terms of the gold dollar.

(4) To adjust the weight of the gold-bullion dollar at stated intervals, each adjustment to be proportioned to the recorded deviation of the index number from par.

(5) To impose a small "brassage" fee not to exceed any one change in the gold dollar's weight.

The crux of the plan lies in the steering rule by which the index number regulates the dollar's weight. Its significance is that to keep the gold dollar from shrinking in value we make it grow in weight, thus recognizing that a depreciated dollar is a short-weight dollar; and reversely, to keep the dollar from growing in value we make it shrink in weight, thus recognizing that an appreciated dollar is an overweight dollar.

Or again, since a heavier or lighter dollar simply means a lower or raised price of gold, we may say that to keep the level of prices of other things from rising or falling we make the price of gold itself fall or rise.

Italian Market for Automobiles

WASHINGTON, May 3—There is a great demand for a lightweight low-priced car in Italy, according to Trade Commissioner M. J. Chisea at Rome. The demand is greatest in the rural districts throughout the provinces, where the people increased their resources during the war. For instance, in Macerata with a population of 20,000, there are 500 cars in use. The car most suitable is one for general use, simple in construction, lightweight and selling at $600 to $1000 delivered.

American manufacturers of the lower priced cars would do well to survey this field and prepare for future possibilities. The market is almost a virgin one, and no particular make of car predominates. Most of the Italian cars now available are too high priced, and the majority of the people are postponing purchases until prices are lower. There is a lack at this time of standardization in the industry, which is also handicapped by the shortage of raw materials and the increasing labor costs.

As the restrictions placed by the Italian government prevent the importation of automobiles into Italy, manufacturers will necessarily have to limit their activities to organization. Publicity at this time would be advantageous, with actual demonstration a little later on. American manufacturers should be ready for this trade when importation restrictions have been lifted.

Missouri's Compensation Law

ST. LOUIS, May 3—Missouri now has a workmen's compensation law, of which some of the provisions are:

Basis of compensation—Two-thirds of the average wage; not to exceed $15, nor less than $6 a week.

Effective Nov. 1, although commissioners are to be appointed at once and immediately organize.

Employers are permitted to carry their insurance in private companies.

Employers and employees presume to be operating under the act, but they may elect whether ta come under its provisions.

Commission to be bi-partisan, and one member will represent the employers and another the employees.

Medical aid first 8 weeks will not exceed $200, employer choosing the physician, but the employee has the privilege to choose a physician at his own expense.

Temporary total disability will not exceed 400 weeks, and temporary partial disability, two thirds of the wage loss, not exceeding 200 weeks.

Pension of permanent total disability is two-thirds wages for 240 weeks and thereafter 40 per cent of wages for life.

Death burial benefit of $100 in every case: total dependents to receive two-thirds of wages for 300 weeks.

Exempts agricultural and domestic pursuits of less than five employees.

Fuel Limitations of Tractor Engines

(*Continued from page* 1003)

In nearly all so-called good oils there is a portion in the medium content which constitutes the very essence of good lubricating qualities. This constitutes about 15 per cent of lubrication oils, and it would be impossible to supply the demands if this were the only oil accepted by the user. Oil companies virtually have to fill in with lighter oils to give a flow and heavy oils to give body and viscosity at the higher temperatures.

Light oils and even medium body oils evaporate at low temperatures and are thus the cause of excessive oil consumption. Heavy oils having complex molecules break down under high temperatures. Light oils have no body or viscosity at high heat. In rough terms, therefore, the oil which comes off at medium temperatures will not evaporate excessively at high temperatures, nor disintegrate. In aviation oil, a maximum of the good medium is used. In compounding a tractor oil a little of the lighter and heavier is used with the good, and so on through the truck oils down to the oils for small passenger-car engines, where, because of the low temperatures, a maximum of the light fair quantity of the good and a minimum of the heavy can be used.

Vaporizing and atomizing defects of our present systems are our design faults affecting starting. The high boiling point of the first drop of fuel coming off at distillation tests in our gasolines is the characteristic in the modern fuels affecting starting. Because so little of the fuel can be vaporized at the intake manifold temperatures, large volumes of fuel beyond what would be necessary in an easily vaporized fuel are taken in. Motors start with difficulty at that, and all this amounts to inconvenience and bad blood between the user and modern engines.

Whatever inconvenience arises is nothing compared to the damage done to the combustion chamber with heavy fuel and the lubricating oil by dilution when the engine is cold in starting. Perhaps 70 per cent of these troubles comes from this source at the time of starting. Means for catching the heavy oil and preventing it from entering the combustion chamber must be provided.

Massachusetts Fighting Motor Legislation

BOSTON, May 3—Massachusetts motorists and dealers are up in arms over three bills that are now being threshed out by the legislature. One bill calls for tripling the fees on motor vehicles, put in by Mayor Peters of Boston. A second bill would require every motorist to be bonded before being allowed on the roads. A similar measure was killed last year and the year before. A third bill seeks to have dealers make a record every day of the cars they take in trade, and send the report to the State House to the Highway Commission and also to the local police. The used car dealers would have to hold their cars four days; the new car dealers could sell theirs by getting a permit.

Calendar

SHOWS

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and Accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

May 15-June 1—Venezuela. National Exhibit of Venezuela.

June 2-6—Hot Springs, Va. Convention Automotive Equipment Assn., Homestead Hotel.

*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-15—London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December — Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

May 6-12—Sacramento, Cal. — Sectional Tractor Demonstrations, Demonstration Field.

May 30—College Park, Md. — Power cultivator Demonstration, Maryland State Dept. of Agriculture.

June 8-14—Denver, Col. Sectional Tractor Demonstrations, Denver Tractor Club.

July 14—Wichita, Kan. Automotive Committee of National Implement Assn.

Aug. 18-22—Aberdeen, S. D. Sectional Tractor Demonstrations.

October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

CONTESTS

†May 17—Uniontown, Pa., probably 112½ miles.

May 30—Atlantic City, N. J.—Airplane races—Aeronautic Convention.

May 30-31—Richmond Va.—2-Day Dirt Track Meet. Virginia State Fair Grounds Track.

May 30-31—Los Angeles, Cal.—Los Angeles-Yosemite 3rd annual gasoline economy run.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*June 14—Sheepshead Bay, L. I. Speedway race.

July 4—Atlantic City, N. J.—Airplane races—Aeronautic Convention.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15 — Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

†Sanctioned.
*Tentative dates.

CONVENTIONS

May 1-June 1—Atlantic City, N. J. — Pan-American Aeronautic Convention and Exhibition—Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

May 21-24—Washington — Conference on Weights and Measures—Bureau of Standards.

May—Washington, Pan-American Commercial Conference, Pan-American Union Building.

June 2—Chicago, Ill.—Natl. Gas Engine Assn. Hotel Sherman.

June 23-28—Ottawa Beach, Mich.—S. A. E. Mid-summer Meeting.

Sept. 22-24 — Philadelphia. Annual Convention, National Association of Purchasing Agents, Bellevue-Stratford.

Foreign Trade Opportunities

WASHINGTON, May 3—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has inquiries for the agencies of automobiles and accessories, airplanes and airplane parts, farm tractors and trucks. Full information regarding each of the following can be had by addressing the Bureau of Foreign and Domestic Commerce at Washigton, D. C., and referring to the Foreign Trade Opportunity number.

Tunisia—Tractors of crawler type, in three sizes, 12 to 20 hp., 35 to 45 hp., and 50 to 70 hp., using gasoline or kerosene, preferably kerosene. Correspondence may be in English. No. 29235.

Colombia—Car for 20 passengers; for use in a tropical country. Plans and specifications to purchasing agent here. Name and address bureau or its district offices. No. 29237.

Brazil—An American citizen desires to purchase farm tractors. Payment, cash against documents in New York or at destination. No. 29230.

Norway—Automobiles and supplies. Terms cash against documents in New York or at destination. No. 29168.

Norway—Cars, motorcycles, tires, engines and accessories. Terms, cash against documents. No. 29185.

France—For the sale in France and Morocco of oil, low-priced cars and motorcycles. No. 29188.

Switzerland—Rubber tires and tubes, cheap cars, two and four passenger, and accessories. Purchases in large quantities. No.29190.

Egypt—Engines, motor plows, motors, lorries and agricultural machinery. No. 29034.

Spain—Gasoline or petroleum tractors from 10 to 30 hp. Four immediately. If satisfactory, ten or twelve later. Correspondence may be in English. No. 29039.

Sweden — Automobile tires. Quotations should be given f.o.b. New York. Terms cash against documents. No. 29059.

American Firm with Connection in Denmark—Trucks, cars, motorcycles, parts and accessories, marine engines, tractors, airplanes, pneumatic and solid tires and tubes, brake lining, tools and machinery for automobile shops and garages. No. 29068.

Spain—Truck tires. Quotations should be f.o.b. New York. Payment cash against documents. Correspondence in Spanish. No. 29079.

France—Low-priced cars. Correspondence in French. No. 29084.

Belgium—All kinds of electrical machinery, fittings and apparatus, internal-combustion engines, motor cars, trucks and lorries. No. 29090.

Ireland—Moderately priced light car, truck, tractor and accessories. No. 29091.

American Buying Agents for Far East—American tractors not too heavy, and fairly low, that may pass under trees on plantations, turn about in their own length, and pull from 1- to 6-disk ploy, plowing 8 in. deep. Information wanted as to the number of acres covered per 8-hr. day, gas consumption per day, etc. One light, one medium tractor, and one lightweight and one medium wheel-driven tractor. No. 29093.

Australia—Automobile accessories. Reference supplied. No. 29107.

Algeria—Lathes, drills, tools, etc., for repair work, cars, trucks and tires. Correspondence should be in French. Reference supplied. No. 29136.

Norway — Second-hand motorcycles, cars and tools. Payment through bank in New York. Reference supplied. No. 29145.

China—Rebuilt cars, motorcycles and engines. No. 20155.

Orders Placed by War Department

WASHINGTON, May 2—The War Department has approved the following orders:

McCord Mfg. Co., Detroit, radiators, $30,-739.46.

Reo Motor Co., Lansing, spare parts, $30,-867.64.

Kelly-Springfield Motor Truck Co., Springfield, O., rear parts, $34,971.20.

Standard Steel Casings Co., steel wheels, $72,688.02.

Briscoe Motor Corp, 1 set tools, 5000 differentials, $1,279.91.

Richmond Forging Co., axles, $167,538.86.

Lexington Motor Co., 1,000 10-ton trailers, $74,882.57.

Dort Motor Car Co., crating chassis, $1,738.17.

Columbia Wagon Co., escort wagons and wheels, $52,342.94.

Winona Wagon Co., escort wagons and parts, $63,146.81.

Garford Motor Truck Co., spare parts, $46,017.62.

Westfield Mfg. Co., Westfield, Mass., spare parts, $9,431.62.

Locomobile Co., Bridgeport, spare parts, $417,431.76.

Packard Motor Car Co., Detroit, spare parts, $379,888.36.

Peerless Motor Car Co., Cleveland, spare parts, $120,683.48.

Pierce-Arrow Motor Car Co., Buffalo, spare parts, $298,520.28.

The White Co., Cleveland, spare parts, $73,204.62.

Buick Motor Co., Flint, Mich., spare parts, $49,317.32; repair parts, $24,656.86.

Four Wheel Drive Auto Co., Clintonville, Wis., spare parts, $168,863.51.

General Motors Truck Co., Pontiac, spare parts, $32,193.23.

Willard Storage Battery Co., spare parts, $264,780.33.

Harley-Davidson Motor Co., Milwaukee, spare parts, $9,270.72.

Continental Motor Corp, Muskegon, Mich., repair parts, $7,358.96.

Goodyear Tire & Rubber Co., Akron, casings, $190,871.14; tubes, $6,824.30; solid pressed-on tires, $29,919.22; demountable solid tires, $10,851.50.

Firestone Tire & Rubber Co., Akron, casings, $268,017; tubes, $85,492.39.

B. F. Goodrich Rubber Co., Akron, casings, $127,647; tubes, $9,220.45.

Fisk Tire & Rubber Co., Chicopee Falls, Mass., casings, $56,991.

For Standard Tractor Ratings

CHICAGO, May 6—It is likely that a standard method of rating farm tractors may be developed by the United States Department of Agriculture, working in conjunction with the Tractor Division of the National Implement & Vehicle Association. The latter body has appointed a committee to take up the matter of standardization with Department of Agriculture authorities. The committee which consists of four members is headed by E. J. Gittens, vice-president of the J. I. Case T. M. Co., other members being J. B. Bartholomew, president of the Avery Co.; Finley P. Mount, president Advance-Rumely Thresher Co.; G. J. Alexander, vice-president and treasurer Aultman-Taylor Machinery Co. The committee has not met as yet nor has it formulated any plan of procedure. However the matter has been placed before the Department of Agriculture, which had its representatives at a meeting of the Tractor Division of the N. I. V. A. two weeks ago.

AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Vol. XL
Number 20

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MAY 15, 1919

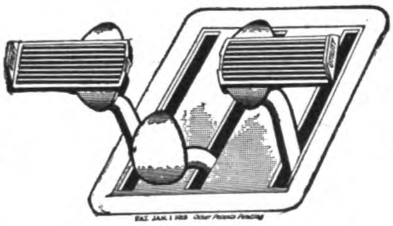
Fifteen cents a copy
Three dollars a year

UTILITY
Automotive Products

The UTILITY Pedal

Utility Pumps
for All Cars
$12.00
For Fords $7.50

For Fords



Price $1.25

Utility Rim Wrench for All Cars $1.75

Is An Absolute Necessity Say Users—And They Know

Ford owners practically drive their cars with their feet.

On the proper operation of the clutch pedal and the brake pedal, the safety of the passengers in the car depends.

UTILITY Pedals for Ford Cars make the clutch and brake pedals safe—keep the driver's feet from slipping. They are the width of the Pedals regularly furnished with higher priced cars.

The flange at the sides and the rubber covering make for absolute safety in operating Ford cars.

Ford owners who use them state in letters that they are *an absolute necessity.*

Ford owners who have never before used them at once recognize their worth, and buy them.

Ford Owners—ask your dealers for UTILITY Pedals today.

DEALERS: Order from your jobber.

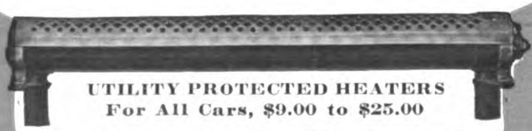
JOBBERS: Get in touch with us.

Utility
Disappearing
Truck Body
For Fords.
Price $38.50

Utility Universal Wrench for All Cars $3.50

HILL PUMP VALVE COMPANY
Mfrs. of UTILITY Products
Archer Ave. & Canal St.
Chicago, Ill.

Sales Department:
THE ZINKE COMPANY
1323 S. Michigan Ave., Chicago, Ill.



UTILITY PROTECTED HEATERS
For All Cars, $9.00 to $25.00

HILL PUMP VALVE Co. UTILITY CHICAGO U.S.A.
LOOK FOR THIS TRADE MARK

HILL PUMP VALVE Co. UTILITY CHICAGO U.S.A.
LOOK FOR THIS TRADE MARK

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL — NEW YORK—THURSDAY, MAY 15, 1919—CHICAGO — No. 20

FRENCH TRACTOR DESIGN
Shows Lack of Uniformity

Spring Agricultural Exhibition at Saint-Germain Brings Out Varied Array of Machines of Four-Wheel, Track-Laying and Cable Type—Tractor Industry Getting Into Hands of Automobile Makers

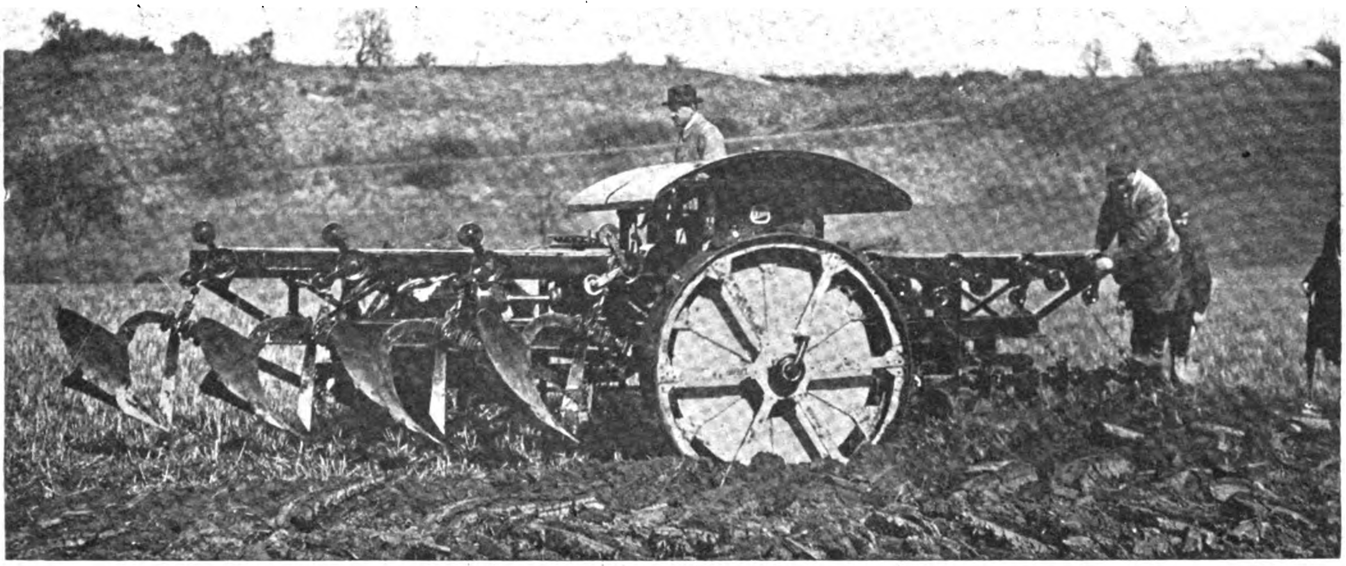
By W. F. Bradley

PARIS, April 12—France held her big spring agricultural tractor exhibition last week on a farm at Saint-Germain, 12 miles west of Paris. Unlike tractor demonstrations in America, it was not a competitive event, the machines merely demonstrating individually what they could do. Because of this the results were not entirely satisfactory. Not enough information of practical value to tractor users was developed.

Several things of interest to those familiar with tractor conditions in America, as showing in contrast tractor conditions in France, were emphasized by the meeting. Among them was the fact that the French automobile industry is actively taking hold of the tractor and appears likely to retain control of its manufacture in that country and that French machines are much more expensive than those made in America, ranging in price from $2,500 to $7,000 each. Another point of interest to which attention was again called by this meeting is the fact that few tractors are sold to individual farmers in France but rather to groups or co-operations of not less than seven men. Any such group can obtain from the French Ministry of Agriculture a subsidy varying from 30 to 50 per cent of the cost price of the machine. Purchasers under this system have to give a guarantee that the machine will be kept in repair and that a determined amount of land will be cultivated.

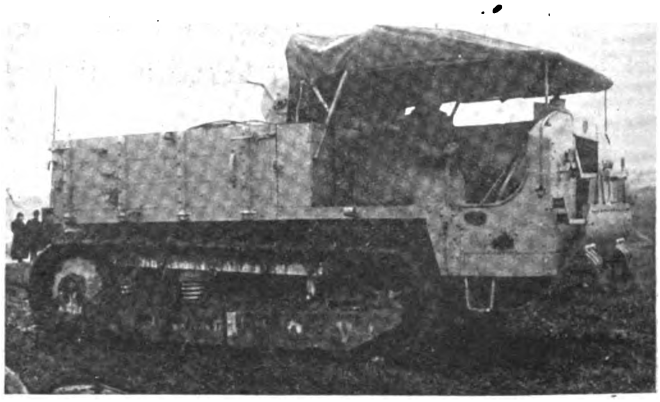
There were 34 firms present at the exhibition, some of them with two or three models of the same type. Seventeen of these firms were French, one English and sixteen

A demonstration of the Renault tractor at Saint-Germain



The new Delahaye is a three-wheel, self-contained plowing machine driven by a four-cylinder engine. Two of the driving wheels are in tandem on the side not shown

The English Austin is a frank copy of the Fordson



The Schneider tractor is a development from the French tank

American. The American tractors were difficult to recognize from their catalog descriptions, for in most cases the French importers have re-christened them since taking them over. Frequently what at first sight would appear to be a French production turned out on closer examination to be a well-known American tractor. The leading American makes represented were Fordson, Bull, Cleveland, Heider, Case, Gray, Neverslip, Happy Farmer, Moline, Titan, Avery, Parrett.

Before the demonstration had been brought to a close it was realized that it should have been of a competitive nature in order to provide definite and practical information to possible purchasers. Information on price and delivery dates was obtainable, but on all other points connected with the machines, vague, contradictory and frequently foolish answers were given. Many of the makers could not answer elementary questions on gas consumption, drawbar pull, speed of operation on various land and under varied conditions, depreciation, possible cost of repairs, etc. A practical test would have given some sound basis on which to make comparisons and would have been of great value to those who are contemplating purchase.

This demonstration revealed that automobile manufacturers are interesting themselves in agricultural tractors, for all the new machines came from firms which before the war built trucks and touring cars only. The three most important new arrivals were Renault, Delahaye and Gnome & Rhone. Other big firms were De Dion Bouton, Latil, Schneider, Peugeot and the Paris General Omnibus Company. The Gnome & Rhone Company is the well-known aviation engine firm, which possesses in the suburbs of Paris a couple of the most modern factories to be found in Europe.

There is no uniformity in the minds of European manufacturers regarding the best type of agricultural tractor. They are all using four-cylinder vertical truck type engines, and they are all putting as good work in their tractors as in the best trucks, but beyond this the greatest diversity exists.

Fiat, who is representative of Italy, and Austin, who is representative of England, have adopted the four-wheel frameless type of tractor. Renault, the biggest automobile manufacturer in France, has adopted the self-track-laying type. Delahaye, one of the biggest truck makers in France, has built a self-contained plowing machine, with plows placed in front and in rear. Latil, the most important four-wheel-drive tractor maker, has

a self-contained machine with plow in the rear. De Dion-Bouton has adopted the cable system of plowing with fixed tractors. The big Schneider company has both an endless track type and a rotary plow. The Paris General Omnibus Company has adopted the English Saunderson type of direct towing tractor. Filtz has a special type of cable machine, the ends of the cable being fixed, and the machine hauling itself along by means of winding drums.

The Cable Type

In the cable class alone there are three distinct methods, and both gasoline and electricity are employed as the motive power. In the first class is the De Dion-Bouton type, where the two machines take up a position at the extremities of the field and haul the plow across the land by means of a cable and winding drums. In the Doisy system the tractor runs across the field, unwinding its cable as it goes, then anchors itself and hauls the plow by means of its winding drum. Finally the Filtz type has the ends of the cable fixed at each extremity of the ground and hauls itself along by means of winding drums, with the plow in direct tow.

All the leading European makers, Fiat, Renault, Delahaye, De Dion-Bouton, Latil, Schneider, use their truck engines with enclosed valves on one side, high-tension ignition, forced feed lubrication and automatic carbureters for gasoline or benzol. Air cleaners are not used by anybody, for the climate of France and England is so damp that a tractor aspires less dust than a truck on the road. Nobody has made any provision for night plowing, for this does not appear to have entered into the habits of the French farmer.

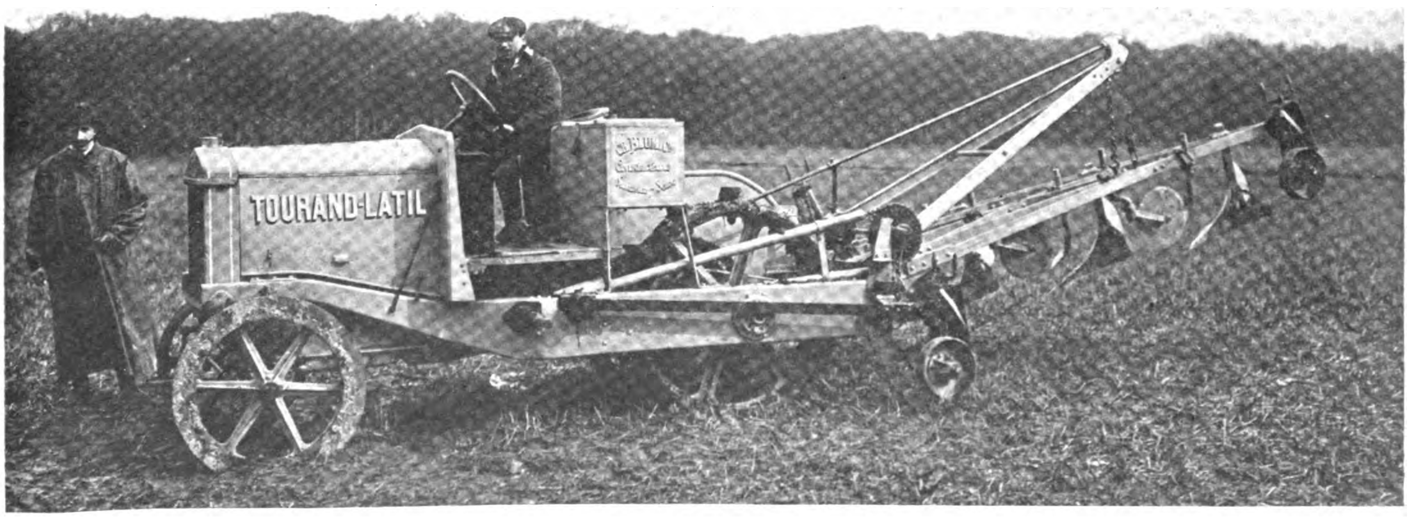
European machines are costly. The Delahaye is listed at $7,000, calculating at the nominal rate of 5 francs to the dollar. This price, of course, includes the plows, as the machine is self-contained. The Renault creeper type of tractor is sold for $5,700; the Fiat runs about this price and the Latil is a little higher. Some of the cheapest direct tractors are selling at $2,400 to $2,500.

The Renault, a Converted Tank

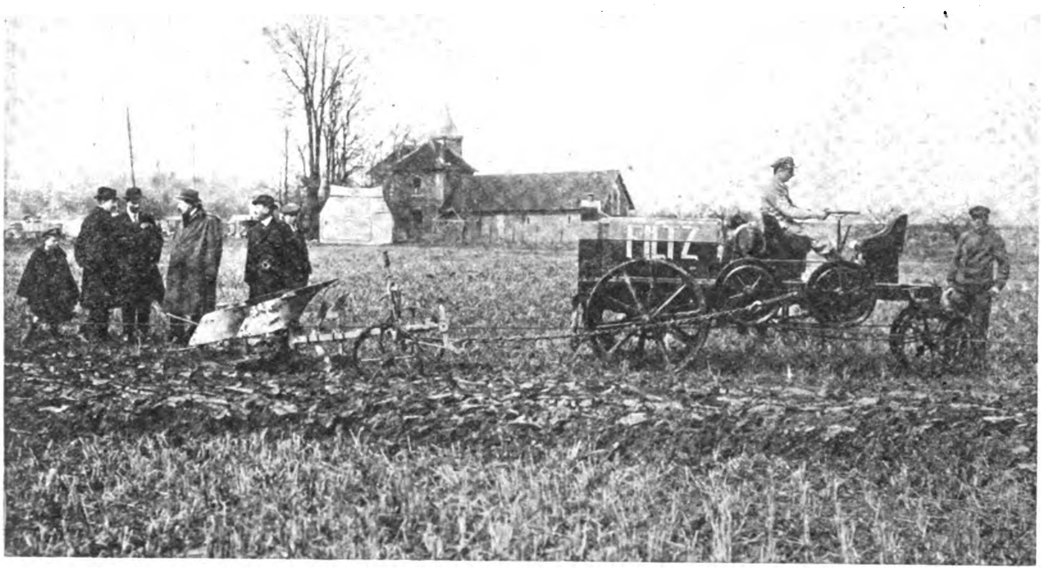
Since Nov. 11 Renault has transformed his army tank shops into a tractor producing plant, and at the present moment is turning out 100 agricultural tractors a month. The assembly of these tractors is carried out in a very modern method on a moving rail. The Renault tractor is the direct outcome of the two-man tank built in large quantities during the war. The engine is exactly the same, being a four-cylinder block type of 95 by 160 mm.

An American representative—the Moline—at Saint-Germain

The new Renault incorporates the general features of the small tank



The Tourand-Latil tractor approaches the automobile type in general design, but the plows are permanently attached



The Filtz tractor is a variation of the cable type. The cable is anchored at each end and the tractor pulls itself along by means of it

bore and stroke. The gasoline feed adopted on the tank to assure a flow of gas to the carbureter whatever the inclination of the machine has given place to direct flow by gravity. The special lubricating system, however, with dry base chamber, has been retained.

Engine Mounted at Front

Instead of the engine being at the rear, as on the tank, it is mounted at the front, under a hood, with the radiator behind it, inclined at an angle of about 45 deg. This radiator is of the gilled tube type, with a ribbed aluminum header tank, and has a draft of air drawn through it by means of the flywheel fan. In this way no air is drawn in over the engine.

From the engine the power is transmitted through an inverted leather faced cone clutch to a four-speed gearbox, then by a couple of Ferodo lined lateral clutches and a train of reducing gears to the two driving sprockets, one on each side, which transmit the movement to the endless bands. As in the case of the tank, the tension of the endless band is maintained automatically. Indeed, the whole of the track-laying mechanism is the same in general design as on the tank. Naturally, the parts are smaller and lighter, the bands, for instance, having a face width of 7 in. as compared with 13½ in. for the tank.

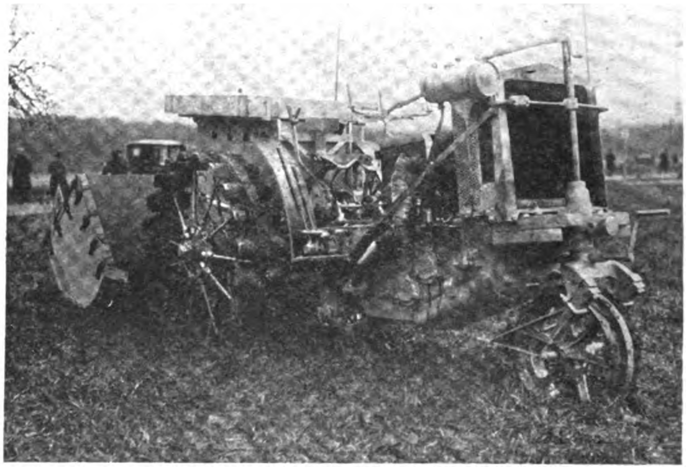
Steering is by means of a couple of levers mounted on a vertical column. By pulling the right-hand lever the lateral clutch on that side is withdrawn and the entire tractor made to turn to the right. The power plant is mounted in a channel section frame which is attached at the rear to the endless track mechanism and secured at the front by an inverted semi-elliptic spring.

Renault Tractor Dimensions

Overall dimensions of the Renault tractor are 135 by 69 in. The endless tracks have a length of 64 in. in contact with the ground; total weight of the machine is 6000 lb., and drawbar pull 5500 lb. The catalog price of the tractor is 28,000 francs, or $5,600 at nominal rate of exchange.

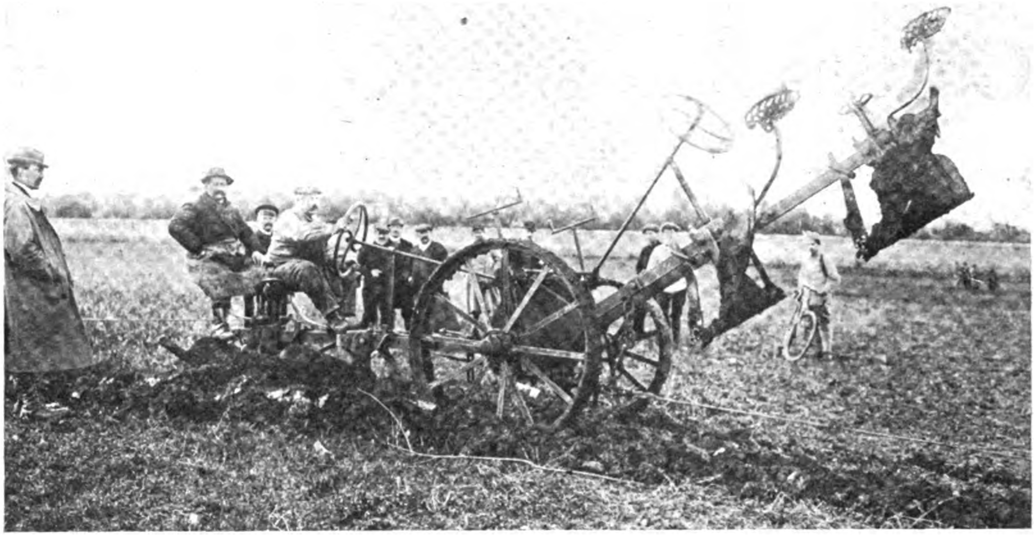
The new Delahaye is a complicated, well-built, three-wheel, self-contained plowing machine. The four-cylinder engine is the 4-ton truck type of 100 by 160 mm. (3.9 by 6.29 in.) bore and stroke, placed across the machine. Two of the driving wheels are in tandem on the outside, and the third wheel, which is also a driver, is centered between the two others. Mounted transversely in the frame, with the radiator placed just back of the single wheel, is the four-cylinder engine, clutch and gearset, this latter providing two speeds ahead or reverse. The drive is taken to the wheels in tandem by means of a couple of horizontal shafts, one running ahead and the other astern, to worm gearing, and finally by enclosed internal spur gears. The single wheel receives its drive more direct by means of a transverse shaft parallel with the crankshaft and enclosed internal gear.

The two wheels in tandem are steerers as well as drivers, but the turning angle is very small, and does not



A three-wheel machine with rotary plow built by the Schneider company

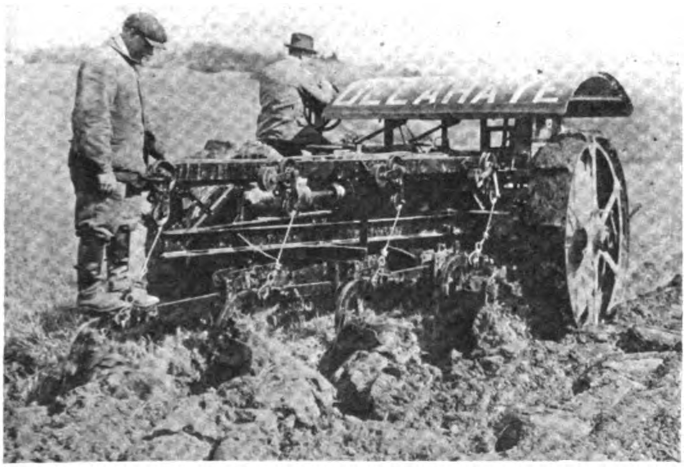
One of the 16 American makes represented—the Case



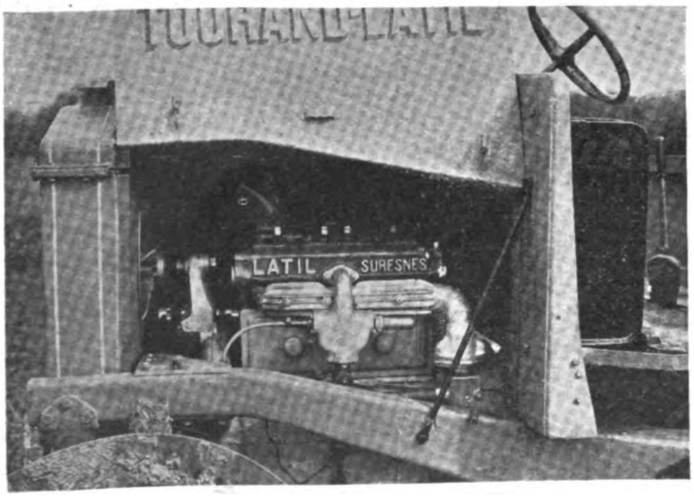
The only electrically pulled cable plow exhibited at Saint-Germain. Electric winches at either end of the plot to be plowed pull the plow first one way and then the other

appear to give anything more than is necessary to change position for a fresh furrow when the end of the ground is reached. The operator sits on the outside of the machine, in the position farthest removed from the furrow, and has a couple of steering wheels mounted on the top of a vertical column. The steering is naturally duplicated, there being two main steering arms and two fore and aft connecting rods. As the steering pivots are on the inside of the wheels and the fore and aft rods are on the outside, connection is made by carrying the connection through the wheel hub. On the opposite side a similar method is adopted when the starting crank is carried through the hub of the single driving wheel.

A four-bottom plow is mounted at each end of the machine, and each one can be raised mechanically by means of a winch. The single driving wheel has a diameter of 60 in. and a face width of 11.8 in. The two wheels in tandem have a width of 51 in. Total weight of the machine with plows is 8800 lb.



The Delahaye is a four-furrow machine with plows on each end



Valve and manifold side of the four-cylinder engine fitted to the Tourand-Latil tractor

De Dion-Bouton produces two types of cable plowing machines. One of these is rated at 50 hp. and has a four-cylinder engine of 4.8 by 5.9 in. bore and stroke; the smaller one, rated at 30 hp., has a four-cylinder engine of 3.9 by 5.5 in. bore and stroke. The method of operating is to place a tractor-winch at each end of the machine and to haul a double plow across the land. Each tractor has its engine in front, winding drum in the center, and a small platform at the rear. The big tractor takes the drive to the rear wheels by means of transverse shafts and internal gears, exactly the same as on De Dion-Bouton trucks, but the number of gears is reduced to two and reverse.

A 15-mm. steel cable is used, having a length of 550 yd., with a breaking strain at 26,000 lb. The drawbar pull is 7000 lb. average, this allowing plowing to be carried out, in moderate ground, with a six-blade plow to a depth of 9.8 in., giving a width of 70 in., at a speed of 2.3 to 2.8 miles an hour. With three blades, and plowing to a depth of 11.4 in., the width of land operated on is 47 in. Gasoline consumption is said to be 3 to 3¾ gal. per acre with a drawbar pull of 7000 lb., using a six-blade plow and plowing to a depth of 7 to 9½ in. Under these conditions two of the big machines working together will cover 12 acres per day of 10 hours.

The smaller De Dion-Bouton machine differs from the larger by reason of the adoption of chain drive, with only a single gear ahead and one reverse. The winding drum is provided with 440 yd. of 13-mm. steel cable, having a rupture point at 20,000 lb. The drawbar pull is 4400 lb., and the plowing speed 2.3 to 2.7 miles an hour.

The Gnome and Rhone

The new tractor for which the Gnome & Rhone Company is responsible, or rather will be responsible, for the exhibition model appears to be an experimental type built outside, is a four-wheel driver type. At the trials a machine was shown with a twin cylinder vertical engine, but it was explained that this will be replaced by a four-cylinder vertical slow-speed engine of 16-20 hp., water cooled, with forced feed lubrication. The tractor, which is of comparatively light weight, namely 2800 lb.,

(*Continued on page* 1085)

Curtiss K-6 and K-12 Aircraft Engines

Of Aluminum Construction with Steel Cylinder Liners—Outstanding Features Include Counterbalanced Crankshaft, Double Valves in Heads; Overhead Camshafts and Bevel Gear Camshaft Drives—Herringbone Gear Reduction on the K-12

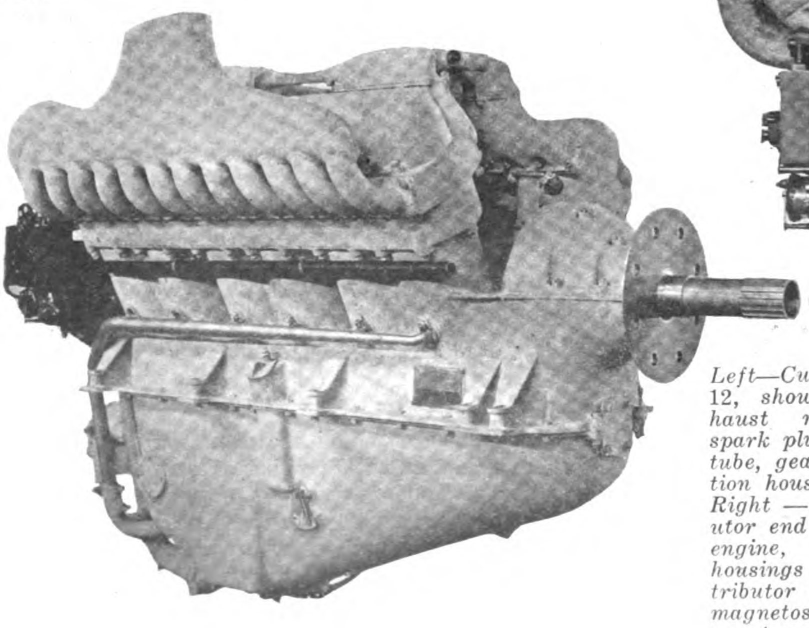
DURING the latter part of the war the Curtiss Aeroplane & Motor Corp., Garden City, L. I., and Buffalo, N. Y., developed two high-powered airplane engines of which it has been possible to obtain complete technical details only quite recently. One is a 6-cylinder and the other is 12-cylinder type, as indicated by the designations K-6 and K-12. Both have cylinders of the same dimensions and are identical in design except for the greater cylinder number and output of the twelve and for the fact that the latter is a V-type engine while the K-6 is a vertical type. The general construction may be briefly described as follows: Cylinder blocks and top half of crankcase are in one casting of aluminum. The cylinder heads form a separate aluminum casting which is bolted to the cylinder block. Steel cylinders or liners are used, six of them being screwed into each cylinder head. The cylinder heads are then placed over the cylinder blocks, and watertight joints between the steel liners and the aluminum blocks secured by means of packing.

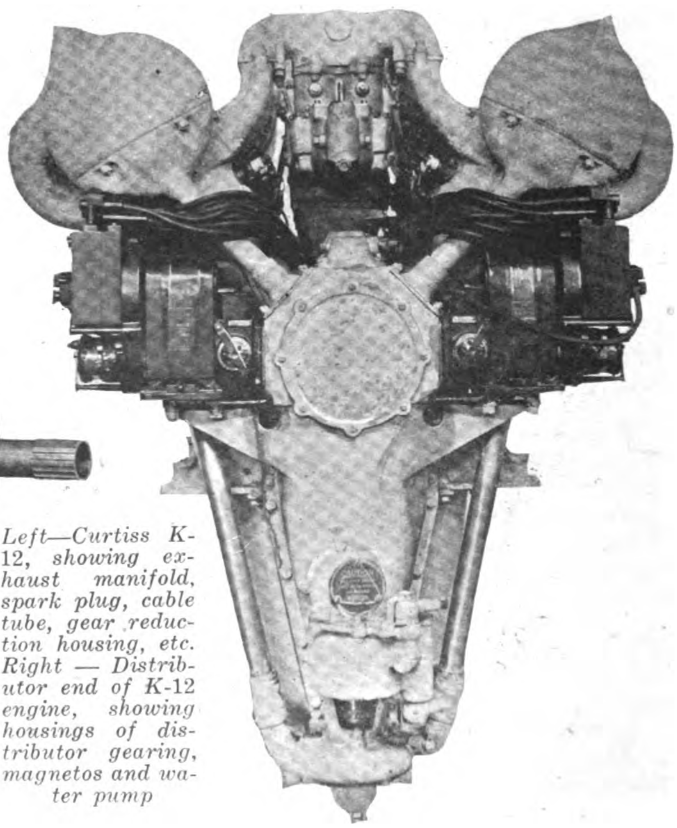
In the K-6 the cylinders are, of course, set all in line, while in the K-12 they are set at an angle of 60 deg. This is the natural angle for a 12-cylinder engine, as it gives uniformly spaced explosions, though the practice often has been departed from in aircraft engine design in order to decrease the head-on air resistance. The bore is 4½ in. and the stroke 6 in., which gives a piston displacement of 572.4 cu. in. for the K-6 and 1144.8 cu. in. for the K-12. A power curve of the K-12 has been published which shows an output of 420 hp. at 1600 r.p.m.

The K-6, which is a direct driving engine, weighs 420 lb. dry, with all equipment except the exhaust manifold (14 lb.). This is 0.735 lb. per cu. in. displacement, and slightly over 2 lb. per hp. The K-12, which is a geared engine, weighs 720 lb. dry, with all equipment except the two exhaust manifolds (28 lb.). This is 0.63 lb. per cu. in. displacement and well below 2 lb. per hp.

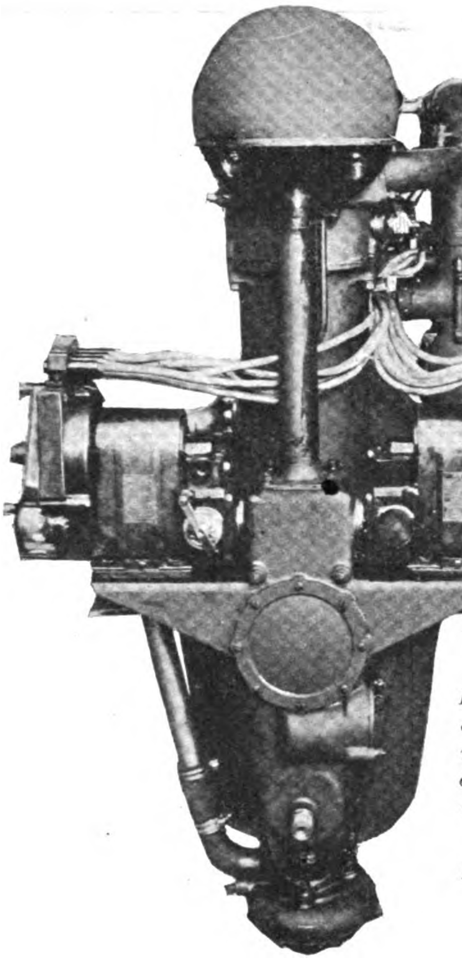
The cylinder liners are made of hydraulic forgings of high-carbon steel, which are first rough bored and rough turned, and then subjected to heat treatment. The liner is then reamed out to within a few thousandths in. of its finished size, and the outside is finish-turned to a wall thickness of 5/64 in., leaving stiffening flanges every 1 in. of length, as well as a packing retaining flange at the bottom and a central stud at the top. The upper end of the liner, forming the combustion chamber, is slightly enlarged and is turned with a screw thread on its outside by means of which it is screwed into the cylinder head. The liners are of thimble form, having a closed head, in which there are four openings for the four valves respectively.

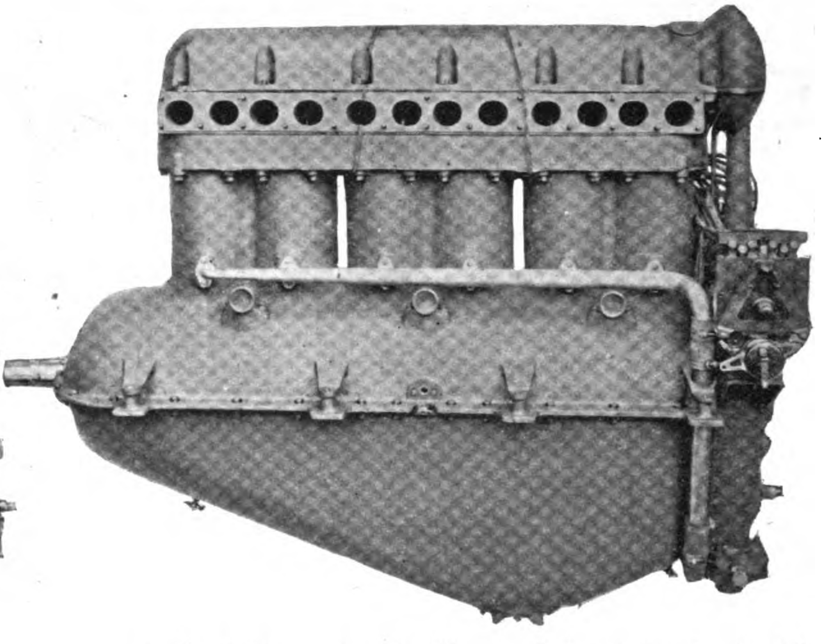
The cylinder head is an aluminum casting, in which are formed the inlet and exhaust valve passages, the combustion chamber recess and the necessary water spaces.





Left—Curtiss K-12, showing exhaust manifold, spark plug, cable tube, gear reduction housing, etc. Right — Distributor end of K-12 engine, showing housings of distributor gearing, magnetos and water pump





Left—Distributor end of K-6, showing magnetos driven by cross-shaft, arrangement of camshaft and pump drive

Right—Side view of the K-6

The combustion chamber recesses are internally threaded and the six cylinder liners are screwed into the cylinder head, the head casting and the six liners together forming a complete unit. The head casting extends somewhat beyond the section of the cylinders, matching up with a flange cast on the upper end of the cylinder block, and is held in place on the cylinder by means of studs, screwed into the cylinder head, passing through the flange on the cylinder block, and having nuts on their lower end.

In order to insure intimate contact of the head portion of the steel liner and the head casting, the liner is formed with a threaded stud at the center of its head which passes through the combustion chamber wall in the cylinder head casting, and is drawn up by a nut. The threaded portion of the liners is made a tight fit in the threaded portion of the cylinder head, and this is depended on to give good heat conduction.

Liners Assembled with Cylinder Head

When the six liners have been assembled with the head, the assemblies are finished on all surfaces which have to be very accurate. The upper and lower faces are machined to absolute parallelism, the cylinder liner bores are ground to size, the valve ports bored and seated, and the spark plug bushings inserted. These bushings, which are of bronze, are cut with a tapered thread on the outside, and with an 18 mm. standard spark plug thread on the inside. When these bushings are screwed tightly into the cylinder heads, there is said to be no danger of their coming loose while unscrewing the spark plug.

The same size of crankshaft is used in both engines, although the K-12 develops about 100 per cent greater power. The crankshafts are made of 35-45 point carbon, chrome nickel steel, by the drop forging process. The forgings are first rough-machined, then heat-treated and lastly finish-machined. The crank is of the standard 6-cylinder type with the two center throws in one plane. Crankpin bearings are 2½ in. in diameter by 2⅛ in. in length. There are five main bearings, one front, two intermediate and two rear bearings, one of the latter on each side of the reduction gear in the 12-cylinder model and of a deep-groove radial ball bearing serving as thrust bearing in the 6-cylinder model. The dimensions of the main bearings are as follows (front to rear): 2½ x 2 in., 2½ x 2 in., 2½ x 2 in., 2½ x 2¾ in., 2½ x 1⅝ in. All crankpins and all main bearings are bored out to a diameter of 1⅞ in.

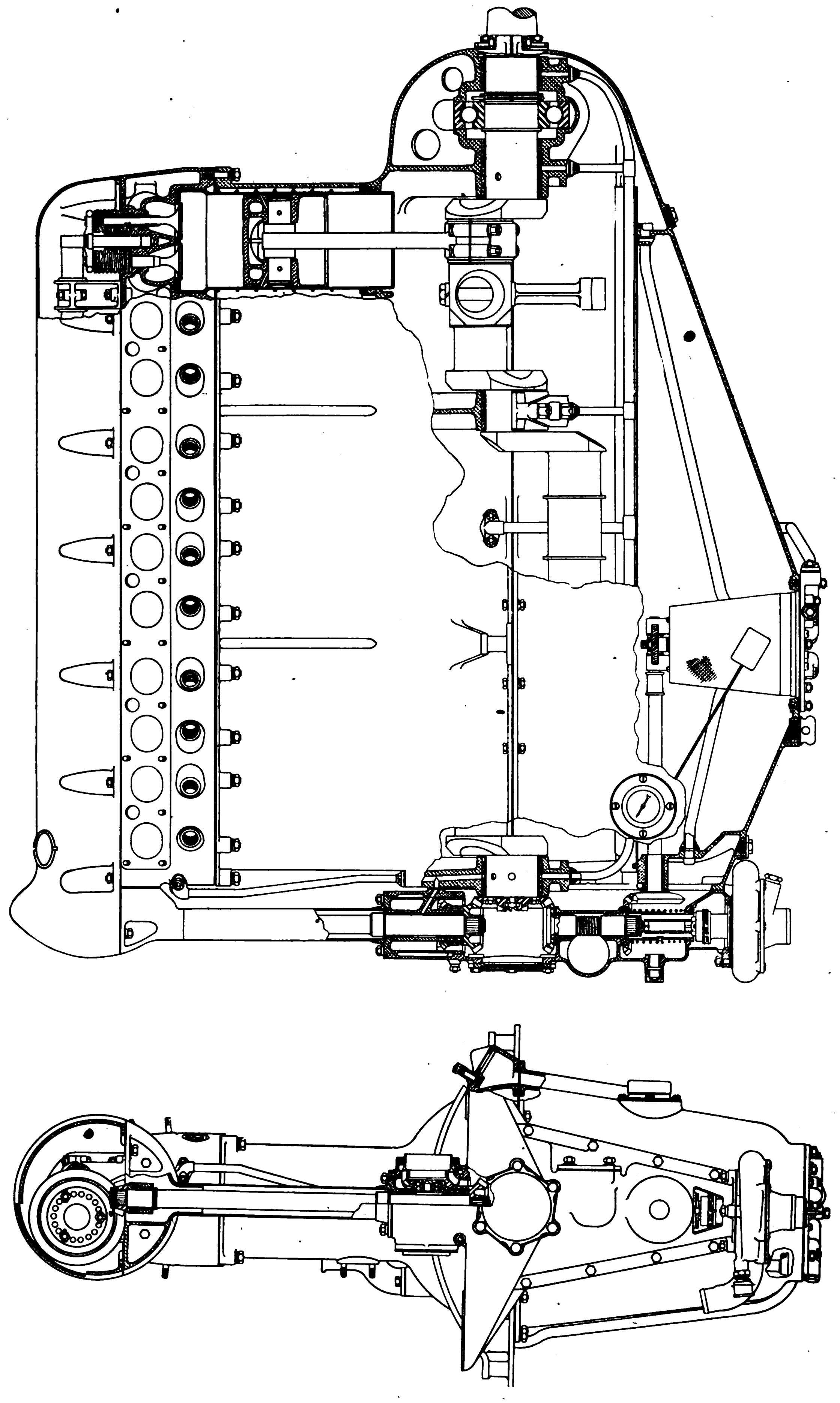
Crankshaft Carries Balance Weights

The problem of crankshaft balance has been thoroughly considered, and on the two long arms of the crank there are balance weights to insure perfect running balance. These two long crankarms naturally produce an unbalanced moment around the crank axis, which in the conventional 6-cylinder crankshaft is balanced by a spool between the two center crankpins. However, this balancing weight between the two center pins is a source of weakness, owing to the bending moment produced by the centrifugal force on it at high speed. Another disadvantage of this method of balancing a 6-cylinder crankshaft is that, whereas the unbalanced moments are produced between the first and second and between the fifth and sixth crank throws respectively, it is attempted to neutralize them by a moment created by a balance weight between the third and fourth crank throws. Hence the opposing moments are in different planes, separated by one of the main bearings of the crankshaft, and this naturally imposes additional load on the bearings. By applying balance weights directly to the sides of the long crank arms their unbalanced moments are eliminated, and the double center throw of the crankshaft can be made without the balancing spool, whereby the centrifugal force on it is reduced.

To obtain the greatest possible balancing effect with the least weight, aluminum spacers are inserted between the steel balance weights and the crankshaft, the balance weights being held to the crankshaft by steel bolts.

At the forward end of the crankshaft an internal flange is machined to which the combined camshaft driving bevel gear and starting ratchet is secured by means of 6 bolts. At the rear end of the 6-cylinder crankshaft a deep groove radial type ball bearing is mounted between

Curtiss K-6 Airplane Engine



This view shows details of the camshaft and accessory drive, the crankshaft, the cylinder liners, pistons, valves and oiling system. The cylinder dimensions are 4½ x 6 in.

a flange and a nut, to take up the end thrust of the propeller. The rear end of the 12-cylinder crankshaft is turned with an integral flange, to which is bolted the driving member of the herringbone reduction gear, by means of nine 7/16-in. alloy steel bolts. The driving gear is cut with 5-7 pitch stub teeth, the teeth of the two sections of the gear being staggered.

Crankcase Cast Integral with Cylinder Block

In both models the upper half of the crankcase is cast integral with the cylinder block, and naturally it is different in design for the two, but the lower halves are the same in both engines. The cylinder portion of the casting forms only the jacket wall, the cylinder wall proper being formed by the steel liners. At the bottom of the cylinder there is an internal flange, between which and an external flange at the bottom of the steel liner is inserted a cork packing ring to insure a water-tight joint. Between the top of the cylinder casting and the cylinder head there is a copper-asbestos gasket. There is direct communication between the water space of the cylinders and that of the cylinder heads through drilled holes. It is claimed for this construction that, with the bolted joints between the cylinder block and the crankcase eliminated, a very rigid structure is obtained, besides which the cooling water comes in direct contact with the steel cylinder liner, which insures very effective cooling.

All main bearings are supported by the upper half of the crankcase, on partition walls of same. The caps of the bearings are of very substantial design, having an I section, and are held in place by 4 studs, fitted with casttellated nuts and cotter pins. The studs of the rear bearings on the K-12 extend entirely through the gear housing and crankcasing, having nuts applied to them at both ends. In this way the aluminum housing is relieved of the strain due to the tooth pressure of the reduction gear. In order to prevent disalignment of bearing caps, they are formed with large keys. The cap of the reduction gear housing is designed with recesses for the nuts on the retaining bolts, and all ribs are on the inside, so that a very smooth exterior is obtained. In addition to the "through" bolts holding the rear bearings in place, several other studs are used for retaining the reduction gear housing cap.

All bearings are of the bronze-back, babbitt-lined type, tin babbitt being used, and are held from turning in the bearings by means of brass screws with countersunk heads. No shims are used between the halves of the bearing, the two half bushings being in direct contact with each other. All journals of the crankshaft are ground accurately to size, and as the bushings are reamed in a precision fixture, there should be the same clearance on all journals of the shaft.

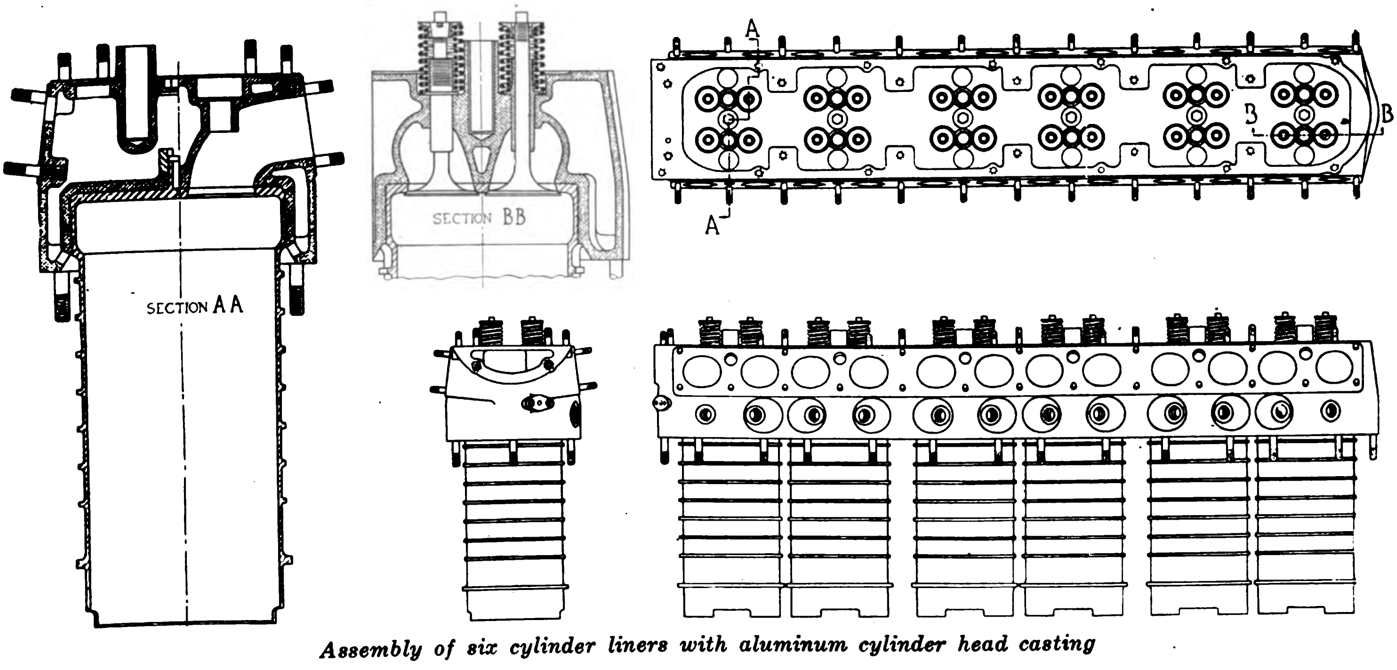
Pistons of aluminum alloy are used. With a view to quickly carrying off the heat absorbed by the cylinder head, the pistons are heavily ribbed, there being one circular rib concentric with the skirt, and, in addition, a number of radial ribs which extend the whole length of the skirt and help to transmit heat from the head to the skirt.

There are three piston rings on the piston above the pin. Of these the upper two are 1/8 in. wide each, while the lower one is 3/32 in. wide. Directly below the lower ring there is an oil groove from which inclined holes are drilled to the bearing surfaces of the piston pin in the piston bosses. The piston pin floats in both the piston and the connecting rod and is held against endwise motion by a snap ring in each piston boss.

Connecting Rods I Section

The connecting rods are I-section drop forgings of alloy steel. They are heat treated and machined all over. In the 12-cylinder model, where the pistons of oppositely located cylinders work upon the same crankpin, there is one master rod, which is provided with a lug at its big end to which the other rod of the pair is pivoted. A wristpin for the small connecting rod is secured in this lug by means of a clamp screw, and the small rod straddles the lug. Bronze bushings are used in the wristpin bearings and also in the upper ends of all connecting rods.

As already mentioned, there are two inlet and two exhaust valves in each cylinder, and the two sets are interchangeable. These valves have a clear diameter of 1⅝ in., and the seat is 1/16 in. wide. Cast iron bushings are inserted into the valve stem guides in the cylinder head, these bushings being fitted to a slight taper. Each valve has two concentric springs of alloy spring steel. The inner spring rests against a flange on the valve guide bushing, while the outer spring rests in a recess in the head casting. The spring washers on the ends of the valve stem are backed up by nuts secured by straight



Assembly of six cylinder liners with aluminum cylinder head casting

pins, so that the pressure of the springs can be adjusted.

There are two camshafts extending across the top of the cylinder heads, the whole length of the engine. The cams do not act directly upon the valve stems, but through the intermediary of cam followers in the form of yokes, each of which embraces the tops of two valves of the same kind. These cam followers are provided with stems sliding in a bushed guide between the valves. There are adjusting screws in each arm of the cam follower yoke, by means of which the valve clearance can be adjusted. When the adjustment is made the adjusting screw is locked by means of a clamp screw.

In the 6-cylinder model, the camshaft is driven from a bevel pinion on the forward end of the crankshaft through a vertical shaft extending up the forward end of the engine. As this vertical shaft is located in the center plane of the cylinders, whereas both of the camshafts are outside this center plane, a pair of skew bevel gears has to be used at the upper end for driving one of the camshafts from this vertical shaft. The other camshaft is driven from the first one through a pair of helical gears. In the 12-cylinder model the arrangement is naturally somewhat different. Here an intermediary vertical shaft is used, which receives its motion from the crankshaft through a pair of bevel gears. This shaft extends up from the crankshaft, and near its upper end carries two bevel pinions, the lower of which meshes with two magneto driving gears and the upper with gears on the two camshaft driving shafts. This intermediate shaft is mounted in a long plain bearing at its lower end and in a ball bearing at its upper end.

Camshaft Driving Shafts Inclined 45 Deg.

What gives the Curtiss K-12 a somewhat unusual appearance is the fact that the camshaft driving shafts at the forward end of the engine do not run parallel with the axes of the cylinders, but are inclined 45 deg. to the vertical. These camshaft driving shafts are mounted in ball bearings at both ends. In the K-12 the axis of the camshaft driving shaft intersects the axis of the driven camshaft, and, therefore, straight bevel gears are used at the upper end. The gear at the lower end of the camshaft drive shaft is integral with the shaft, while that at the upper end is fitted to it by means of muliple splines.

One camshaft is located directly in line with the exhaust valves, and the other in line with the inlet valves. The two shafts are geared together by means of helical gears. These gears are indexed to the cams, and, as the thrusts on the two shafts are in opposite directions, the timing and longitudinal positions of the shafts are accurately maintained. The bevel gear through which the camshafts are driven is bolted to a flange on the forward end of the exhaust camshaft, and timing is effected by means of a set of vernier holes. The thrust is taken on the back of the flange. The camshafts are supported in bearings mounted in aluminum brackets, one set of bearings between each pair of cylinders. The shafts are drop forged from low carbon steel, carbonized and hardened. They have the cams, the two helical gears and the necessary flanges forged integral with them. The cams are of the constant acceleration type, and give a lift of 0.406 in. On the intake camshaft there is an eccentric which may be used for driving a pressure air pump.

Directly in line with the intermediary shaft for driving the magnetos and camshaft driving shaft, but below the axis of the crankshaft, there is another vertical shaft which is used for driving the water pump, oil pumps and the tachometer. This shaft is driven from the same bevel pinion on the forward end of the crankshaft that drives the intermediary shaft. The water pump is located at the bottom of the accessory driving shaft and is driven from it through a coupling joint. The gear housing is formed with pads over which the water pump, the tachometer drive housing, the magneto drive housings and the camshaft drive housings may be bolted. Magneto brackets are cast integral with the driving gear housing.

Zenith Carbureters

The K-6 is equipped with one and the K-12 with two 52-mm. Zenith duplex aero carbureters. Each carbureter furnishes mixture to three cylinders through a water-jacketed manifold. Ignition is by high-tension magnetos, of which two are used on both the 6-cylinder and 12-cylinder models. The magnetos are of the two-spark type, and each cylinder is provided with two spark plug bushings. The spark plugs are connected to the magneto distributers by cables enclosed in rectangular micarta tubes.

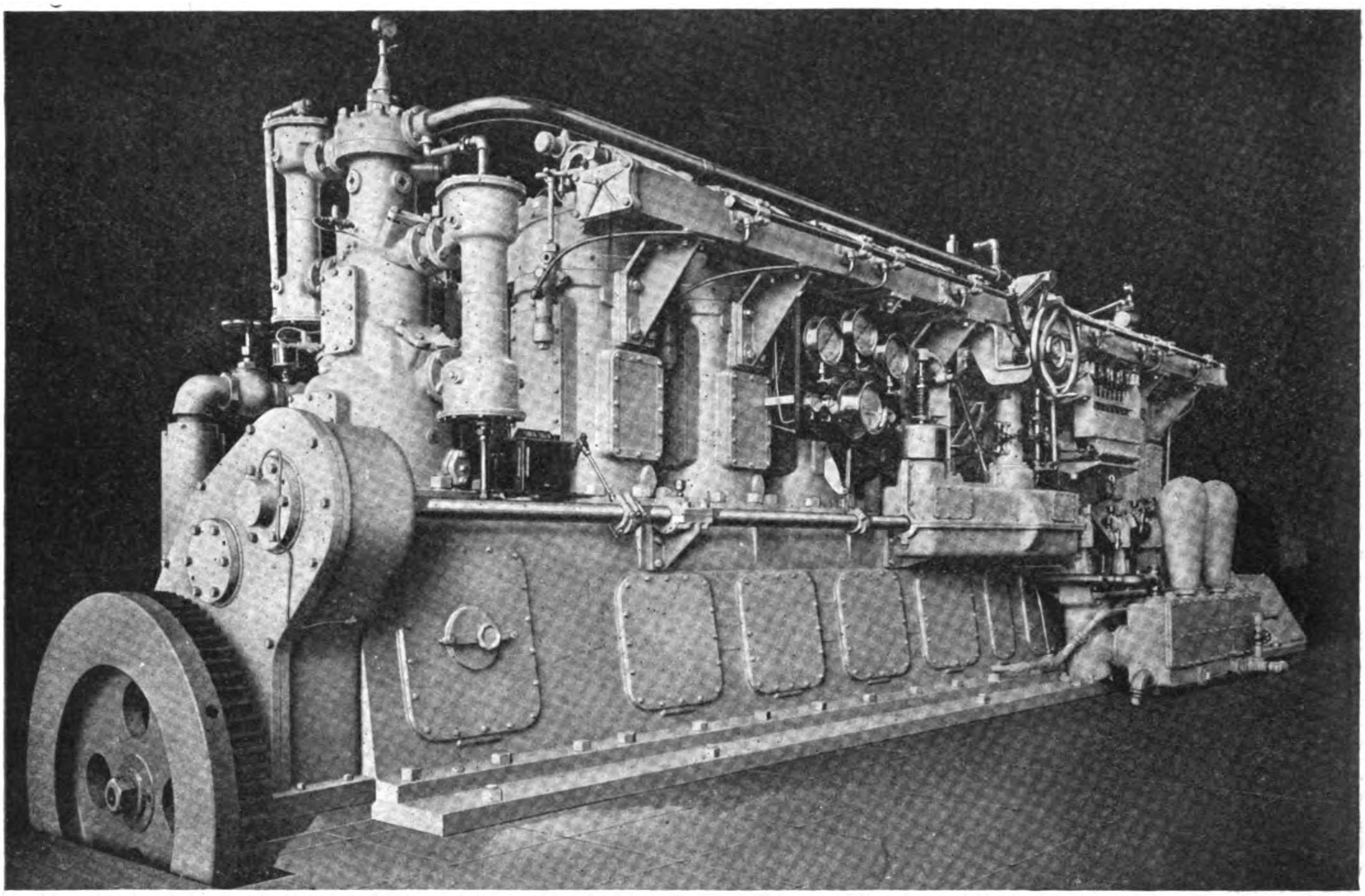
Lubrication is entirely by force feed, and, in addition to the pumps forcing oil to the bearings, there are auxiliary pumps which remove oil from the crankcase above the oil pan deck. The pumps are located in the lower part of the crankcase and are driven from the accessory driveshaft through a horizontal shaft. All of the gears are arranged in a single unit, which comprises two pumps for forcing oil to the various bearings, and a triple pump for emptying the oil out of the crankcase. Combined with the pump unit are the gear shafts and spiral gears for driving the pump, and the whole casting is surrounded by a fine mesh wire screen through which all of the oil is filtered. This screen is properly reinforced so that it cannot be damaged by excessive suction in case it should become clogged. Within the cover of the pump are the by-passes and spring-retained conical relief valves, which regulate the pressure under which oil is forced to the bearings.

The pressure pump draws oil from the sump through the screen and delivers it into the oil feed line. This line has a flange connection to the upper half of the crankcase, and at this point the oil enters the main distributer, which delivers oil to all main bearings. All of the journals of the crankshaft are hollow, and the main journals are provided with end caps. From these journals the oil is carried to the connecting rod bearings through small oil tubes built into the crankshaft. In the case of the K-12, the bearing at the lower end of the small connecting rod is fed from a bleeder hole in the connecting rod bushing. In the case of the K-12 also, the propeller shaft is oiled by a portion of the oil being by-passed around the bushings of the two rear crankshaft bearings through copper tubes to the propeller shaft bearings. A bleeder tube from the front propeller shaft bearing lubricates the upper reduction gears.

At the front end of the engine, oil from the front bearing bushing is carried through drilled holes and outside tubes to the cylinder heads. There the tubes have a sliding point with the revolving camshafts, which are drilled out, and the oil is fed to the camshaft bearings through the hollow camshafts and radial holes drilled through the camshaft walls. Provision is also made for lubricating the camshaft bevel gears and the valve stems, cam followers, etc. Any excess oil in the cylinder head runs down the camshaft drive housing and lubricates the bevel gears on the vertical shaft, and some of it is caught in two oil cups on the vertical shaft bearing and lubricates this bearing. The rest runs down into the front end of the engine. The sumps form a sediment chamber which may be emptied through a hole fitted with a screw plug.

An important feature of the lubricating system is an

(*Continued on page* 1094)



The new Winton Diesel engine which incorporates many automotive features in its design. Note the geared starting wheel, timing gear case and enclosed crankcase

Winton Diesel Engines

Marine-Type Six and Eight-Cylinder Engines Built in 200, 300 and 500-Hp. Sizes —Twin Valves, Enclosed Base, Pressure Lubrication and Other Features Indicative of Automobile Influence

AUTOMOBILE practice has been applied to a notable extent in the development of the new Diesel engines by the Winton Co., Cleveland. The result has been a marked similarity of appearance, and in many cases of design, with what has come to be recognized as standard characteristics.

There are three sizes of Winton Diesel engines. The smallest develops 200 hp. at 250 r.p.m., and has 11 x 14 in. cylinders. The intermediate size is of 300 hp. and, the same as the small type, has six cylinders, the cylinders in this case being 13 x 18 in. The same cylinders are used in the largest type, which is an eight-cylinder, rated at 500 hp.

Enclosed crankcases, trunk-type pistons, and crankshaft bearings solidly mounted in the upper half of the crankcase with bolted-on caps are the chief characteristics of the Winton Diesel engine as distinguished from other types.

The engine operates under 550-lb. compression, which is sufficient to cause preignition, thereby dispensing with electrical ignition. The fuel pump is a plunger type, with one plunger for each cylinder. It delivers the fuel to the fuel injection valve under a pressure of from 1000 to 1200 lb., depending on the pressure of the fuel injection air. The stroke of the fuel pump is constant, the amount of fuel delivered being controlled by the early or late closing of the pump inlet valve by the governor. On the Winton Diesel engines an adequate supply of fuel is always assured by the fact that the fuel oil is lifted to the fuel pump from the tank by 10 to 15 lb. air pressure, which is sufficient to secure plenty of fuel at the pump inlet valve.

Since these engines work on the true Diesel cycle, the fuel is forced into the cylinder against a compression of 550 lb. by the use of air at about 1000 lb. pressure. This not only carries the fuel into the cylinder but breaks it up into very fine particles so that combustion is complete. The high-pressure air for this purpose is obtained from a three-stage air pump mounted at the front end of the engine.

This pump is of interesting design, the piston being of the trunk type, operated by a connecting rod which is a duplicate of the connecting rods in the power cylinders, and a single-throw counterweighted crankshaft, which is bolted to the front end of the main crankshaft. The throw of this single crank is somewhat greater than that of the power shaft.

The capacity of the air compressor, being considerably in excess of that required for the injection of the fuel, provides for the initial charging and maintenance of pressure in the storage tanks, or air bottles, which are used for starting the engine. There are two sets of these air bottles, one carrying the air at about 600 lb. pressure per square inch, which is admitted to the cylinders in turn, to force the

pistons down, starting the engine rotating. The second set of air bottles carries air at 1000 to 1200 lb. per square inch. This is used to inject the fuel into the cylinders, thus starting the engine running under its own power. As soon as the fuel is injected the compression pressure raises the temperature to such an extent that it at once starts to burn.

It will be noted from the following description that a great many of the structural points are very similar to those found in motor truck and motor car practice. The crankcase is of gray iron and cast in one piece, of skeleton construction, the sides having large openings opposite each throw of the crankshaft, these openings being provided with cover plates, affording easy access to all parts of the interior. A main bearing for the crankshaft is provided on each side of each throw, each bearing being supported by heavy ribs so as to give the desired rigidity. The lower part of the crankcase forms an oil pan, which, as in motor-car practice, extends from the timing gear in the front to the rear of the thrust bearing at the back end of the engine. This gives a fully enclosed oiling system.

The cylinders are cast individually, with integral water-jackets. There are large cover plates provided on the water-jackets so as to permit them to be cleaned readily if necessary. The cylinders are bored and ground.

The cylinder heads are secured to the cylinders by studs and nuts, so arranged that the pressure is uniformly distributed. Each cylinder head carries five valves—two for the incoming air, two for the exhaust and one for the injection of the fuel. The head also carries the rocker mechanism by means of which these valves are operated.

The pistons are about 75 per cent greater in length than in diameter. The piston-pin bosses are located about one-third of the diameter up from the bottom of the piston, which brings them about the center of the effective bearing surface. The length of the bosses is such that the bronze bushings can be inserted from the inside. As each bushing is flanged it is thus locked against endwise motion when the connecting rod is in place. The piston tops are dished, giving the necessary compression space, and there are heavy ribs from the top of the piston to the side walls and the bosses. The piston is also strengthened by a rib around its inside just above the bosses.

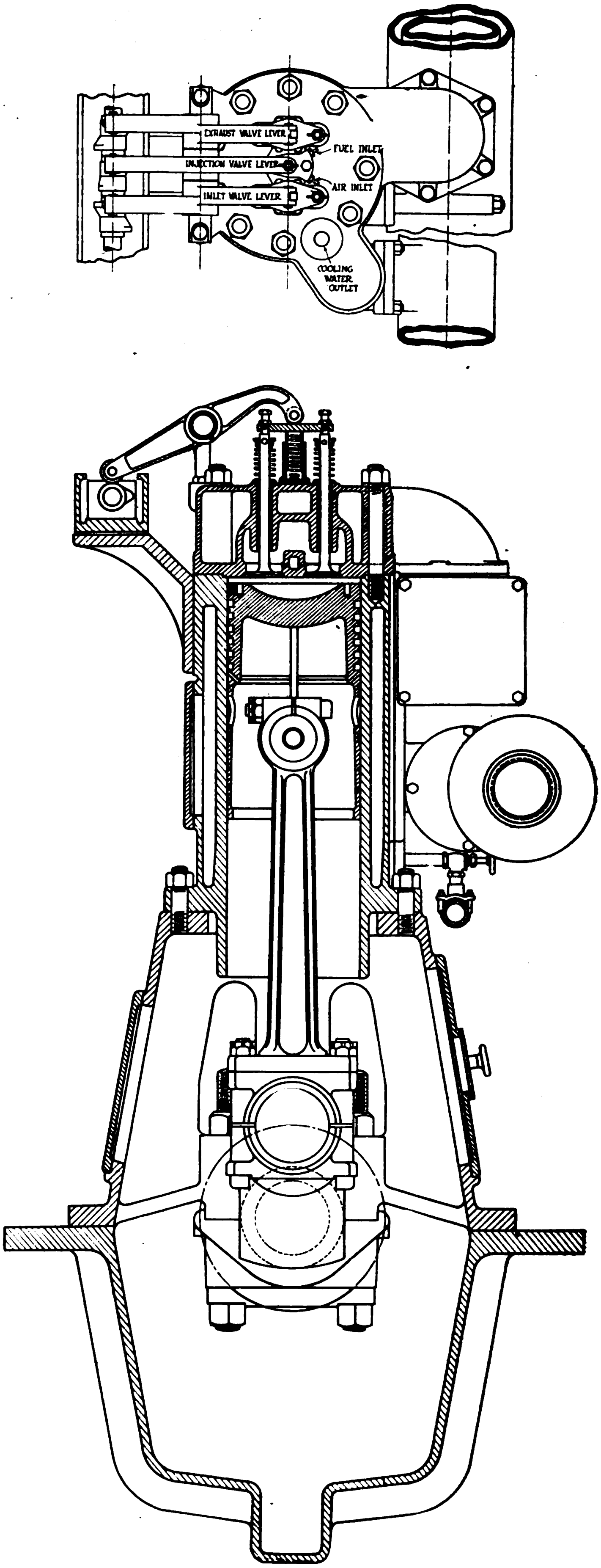
To prevent oil working up above the piston rings a groove is turned immediately below the lowest ring, and from this groove a number of holes lead back into the inside of the piston. To prevent oil splashing up under the lower side of the head, where it would be burned and blackened, the hole through the rib around the inside of the piston is enclosed by a sheet-metal plate.

Each piston has a hole through each side, midway between the pin bosses and slightly above them, through which it is possible to handle the bolt which clamps the upper end of the connecting rod around the piston pin.

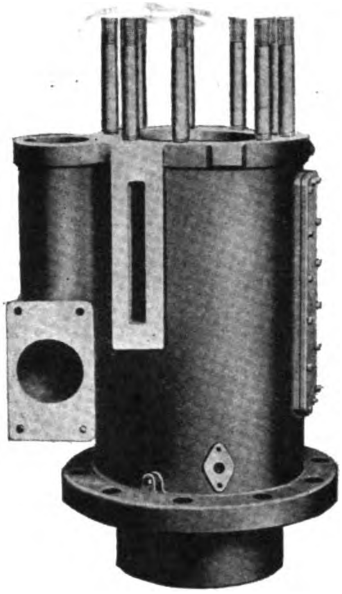
The connecting rods are I-section forgings, split at the upper end and clamped around the piston pins, and formed into a T-head at the lower end, to which two half-boxes and a supporting cap are bolted. Each rod has an oil tube connecting with the groove in the upper half-box and leading upward to the piston pin. The piston pin itself is hollow, with its ends plugged, and is drilled near each end so that oil is fed directly to the bushings in the piston. The tube and piston pin are thus filled with oil under pressure from the pump, and adequate lubrication of the piston pin is insured. The piston pin is case-hardened and ground and bears on bronze bushings pressed into the bosses in the piston.

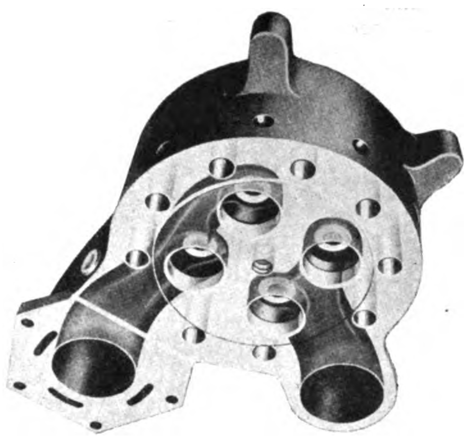
The crankshaft is made in three pieces, two sections having each three or four throws for the power cylinders, and the third section having a single throw for the air compressor. These sections are flanged and bolted solidly together before being assembled into the crankcase.

From each main bearing of the shaft a hole is drilled through the adjacent web to the crankpin. These holes register with grooves in the main and connecting rod bearings so that the connecting rod lower bearings are also lubricated under pressure directly from the pump. Each bearing has an individual oil lead to a header running the full length of the crankcase. This header is connected to a two-cylinder reciprocating oil pump which maintains con-



Transverse section and plan view of Winton oil engine, model W 24 A, 12 15/16 in. bore by 18 in. stroke





Left—One of the cylinders from the Winton Diesel engine
Above—The cylinder head, showing the five valves, two for incoming air, two for exhaust and one for fuel injection

stant oil pressure on the bearings. Further details of this pump will be given later.

The camshaft is supported in a long box-shaped casting open at the top, which in turn is supported on brackets from the cylinders. This trough is partly filled with oil, insuring ample lubrication to the cams and camshaft bearings. The driving gears are fed directly with oil under pressure from the pump.

The camshaft is driven by bevel gears from a vertical shaft near the center of the engine, which in turn is driven from a lay shaft and a train of spur gears at the front end.

The camshaft is provided with two complete sets of cams, for forward and reverse motion respectively. Shifting the shaft endways by means of a handwheel and suitable mechanism brings either set of cams into operation. The shift from full speed ahead to full speed astern is guaranteed in 6 sec., and is frequently accomplished in 5 sec. Considering the weight of the parts which must be brought to rest and started in motion in the opposite direction, this is a wonderful performance.

Reversing the Engine

The procedure required to reverse the engine is as follows:

1—Close fuel-oil supply valve.
2—Shift camshaft.
3—Open fuel-oil supply valve.
4—Open valves controlling starting air.
5—Close starting air valve.

Each pair of inlet and exhaust valves is operated from the camshaft by a single rocker arm, the valves being connected by a T-head slide on which the end of the rocker rests. The slide is carried in contact with the rocker at all times by a coil spring in the center of its hollow stem. Each end of the slide carries an adjusting screw and locknut by which the clearance between the ends of the valve stem and slide can be adjusted. This clearance is 0.015 in. for both main inlet and exhaust valves. These pairs of valves are used instead of single large valves, as the small valves are much less apt to warp under the high temperatures to which they are exposed. This agrees with practice in high-powered aviation and motor-car engines.

The fuel-injection valve is located in the center of the head and is also operated by a rocker from the camshaft. The adjusting screw for this valve is set to leave 0.025 in. clearance when the valve is closed. All these clearances are those for a cold engine, and will be somewhat less as the engine warms up.

The valve timing, as regards the air inlet and the exhaust valves, is very close to an average four-cycle gasoline-engine valve timing, the figures being as follows:

Air intake opens 5 deg. before upper center.
Air intake closes 25 deg. to 30 deg. after lower center.
Exhaust opens 40 deg. before lower center.
Exhaust closes on top center.

The timing of the fuel injection valve is as follows:

Valve opens 7 deg. before upper center.
Valve closes 25 deg. after upper center.

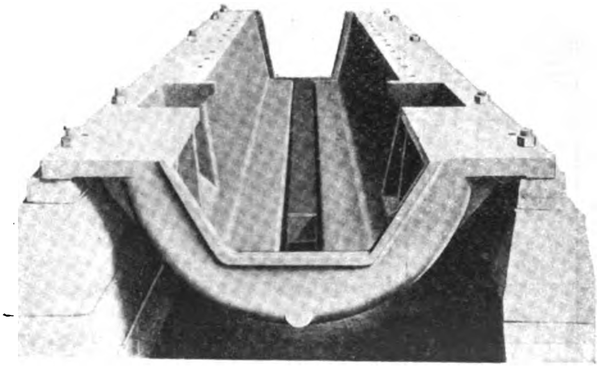
High-pressure-injection air flows all the time the injection valve is open. Fuel is injected, however, during part or all of this period, depending on the amount of power required from the engine. The amount of fuel is controlled by a centrifugal governor which limits the duration of the fuel pump suction as may be required to maintain the engine speed.

Cooling water is circulated through the jackets of the engine cylinders and air compressor by a four-cylinder plunger pump operating from the same small crankshaft which handles the oil circulating pump. This shaft is about the same size as would be used in large six-cylinder automobile engines, but looks extremely small by comparison with the rest of the powerplant.

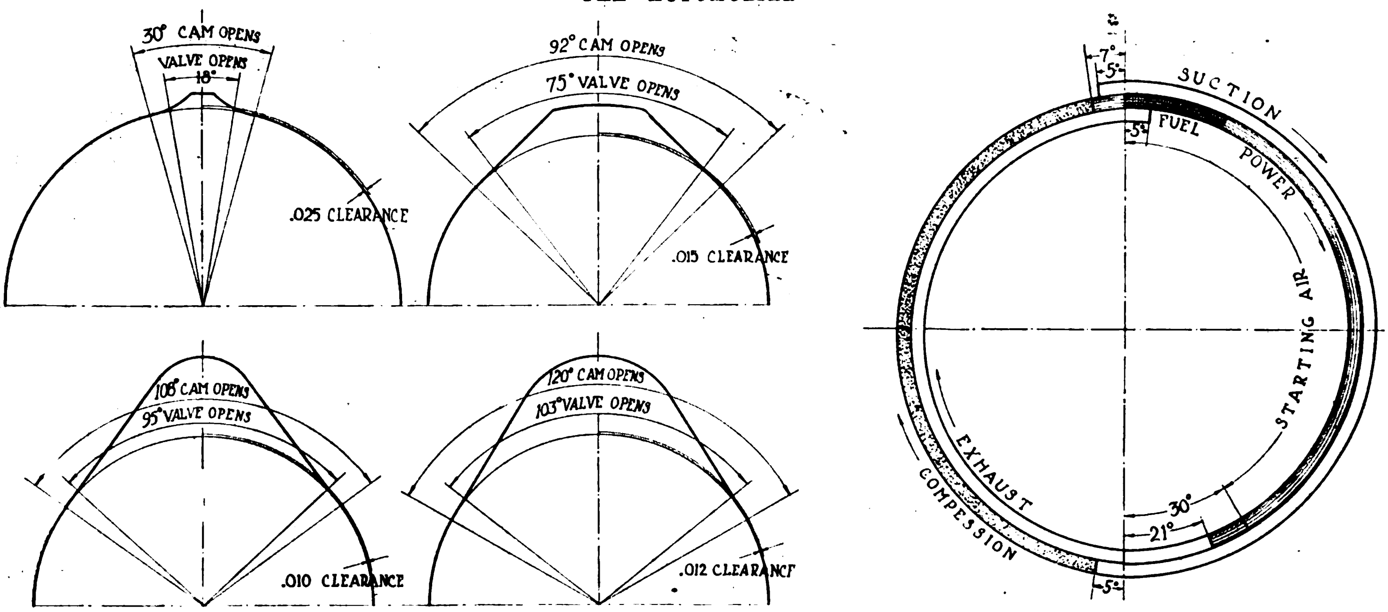
The oil circulating pump which provides lubrication for all the main bearings of the engine really consists of two single-cylinder pumps. The one driven from the end throw of the crankshaft operating the circulating water and lubricating oil pumps draws the oil from the sump in the lower half of the crankcase and forces it through a cooler and a strainer to a storage tank. The other single-cylinder pump draws the oil from this storage tank and forces it into the header, from which it is piped to the bearings, as described above. The discharge side of this pump is provided with an air chamber to insure constant pressure being carried on these bearings. The circulating water pump is of the four-cylinder type, and also has an air chamber on the discharge side to insure steady circulation of the water. The cylinders, pistons and stuffing-box glands are made of bronze to prevent injury by the water.

The supply of air for starting the engine is carried in steel air bottles, which are from 12 to 18 in. in diameter and 10 to 20 ft. long. These are stored wherever convenient on the ship and are connected by heavy brass tubing to a header running the full length of the engine. At the point where the pipe from the air bottles join this header is located a valve, which can be opened by pulling on a long handle. This admits the air to the header.

Each cylinder is connected to the header by means of a pipe in which is located a valve operated regularly by the camshaft. The end of this pipe connected to the cylinder is fitted with a special casting containing three valves. The first is a check valve to prevent the compression or power-stroke pressure from escaping from the cylinder. The second is an overload valve or safety valve, which is set to open if the pressure in the cylinder exceeds normal power-stroke pressure. A valve of this type is necessary to prevent damage to the cylinder or piston in case water or oil should accidentally collect in the cylinders. If this happened and the engine was started, the top of the piston would probably be broken out, as water or oil is practically non-compressible. The third valve in this casting is operated by a small handwheel and is opened only when it is desired to attach an



Oil pan of the Winton Diesel engine



Cams and cam setting on the Winton Diesel engine

indicator to determine the work being done by the cylinder.

Contrary to automotive practice, the exhaust is not fitted with a muffler close to the engine, but the air inlets for both air compressor and the main cylinders are carefully muffled. The air inlets to the main cylinders are connected to a large header, into which air is taken through a muffler at each end. This arrangement of drawing the air for the engine directly from the engine room has the decided advantage of constantly drawing fresh air into this room, thus insuring ventilation.

The thrust block at the rear of the engine has a unique feature, in that the thrust surfaces are lubricated under pressure from the engine oil pump. The thrust block consists of a short, heavy shaft flanged at both ends, one flange being bolted to the rear flange on the crankshaft. Turned integral with this shaft are a number of large collars between which the horseshoe-shaped thrust segments are mounted. Each of these segments is faced with babbitt on both sides and has a connection at the top to an oil lead from the pump. The babbitt facings are grooved so that the oil is distributed under pressure over the entire thrust surface. The segments are held in the proper position by nuts on heavy threaded shafts along each side of the thrust block. They are consequently readily adjustable for wear. They also are reversible, so that if the babbitt should wear or burn off one side a new bearing surface could be brought into operation by a few minutes' work.

Pressure Delivered by Air Compressor

(Test data)

High-pressure cylinder..	1050	1200	1175	1150	1225
Intermediate cylinder...	200	295	280	280	325
Low-pressure cylinder..	60	60	60	60	60

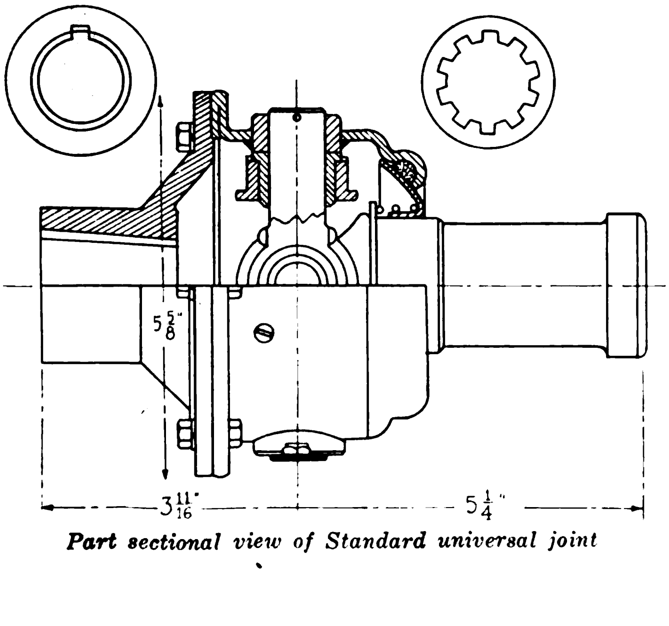
Camshaft runs half engine speed.

Oil and water pumps run two-sevenths engine speed.

New Standard Universal Joint

THE Universal Machine Co., Bowling Green, Ohio, has brought out a "4000 series" of its standard universal joint. This joint is only 5⅝ in. in diameter, and is said to be suitable for the largest 7-passenger car. It is of light design, weighing with flange only 9 lb.

The shell or casing is a stamping of ⅛-in. steel and has two hubs for the joint pins welded to it by the acetylene torch. Being made of such heavy material, there is no danger of the shell being dented by flying stones or through other causes. The yoke and hubs are made of drop forgings, and the pins and bushings are of carbonized steel hardened and ground. The joint is completely enclosed, use being made of an oil retainer in the form of a spherical segment, and of packing between it and the shell. Thus the oil is kept in and the dirt out. Suitable oil grooves are provided for all bearings. The joint itself is furnished completely assembled, and all the customer has to do upon its receipt is to secure the flange on the shaft and then bolt on the joint.



Part sectional view of Standard universal joint

This type of universal joint is furnished as a single joint, and also in double joints, assembled with either solid or tubular shafts, and equipped with a hardened, splined slip connection. This connection is provided with a grease-retaining felt and steel washer, and adjustable clamps.

ACCORDING to a recent address by Captain Guilliet, France in 1913 consumed 70,000 magnetos, of which 94 per cent were of German manufacture. Upon the outbreak of the war the magneto question became simply alarming. Both the aircraft and automobile industries developed rapidly and demanded a constantly growing number of magnetos. It was necessary to greatly increase the manufacture of these devices, by enlarging existing plants and establishing new ones, and the effort made was such that toward the end of the war France became the principal source of magnetos for the Allies.

Present Status of German Motor Industry

War Strain Has Worn Out Shop Equipment and Made Inroads on Supply of Skilled Labor—Country Stripped of Automobiles, But Materials Are Scarce

AS in other European countries involved in the world war, in Germany the automobile industry has greatly expanded during the past four years, but it has been engaged largely on products other than those which it turned out previously. During the war we had occasional brief notices regarding the activities of individual concerns and the prosperity of the industry as a whole. From this the conclusion might have been drawn that the German automobile industry was in a strong position and likely to become a formidable competitor in the world's markets, but a rather different view of the situation is taken in a lengthy report from United States Vice-Consul Robert L. Gray, Jr., of Lucerne, Switzerland, which has just been made public by the Bureau of Commerce.

According to this report, before the outbreak of the war Germany was equipped and able entirely to supply its own market for passenger cars. The number of automobile factories established in Germany was 38, all German owned and controlled. These factories were located in East Prussia, West Prussia, Rhineland, Bavaria, Baden, Wuertemberg, Saxony, and Hessen.

Present Scarcity of Trucks

The 43 automobile factories now existing in Germany—the war produced five new factories—have concentrated all their efforts to produce trucks for the army during the war. In 1917 and 1918 between 10,000 and 12,000 trucks—3-ton trucks of standard type—were produced. This represented the maximum output of production for one year. In all about 40,000 trucks have been manufactured during the period of the war. Four and more ton trucks have not been constructed to any great extent, because this type of truck was not used by the German Army. It was predicted and anticipated that in the event that peace came by the end of 1918 about 39,000 to 40,000 trucks would be returned by the army and placed at the disposition of the German people. Owing, however, to the terms of the armistice and to the rapid retreat of the German armies across the Rhine, hardly more than 9000 trucks were brought back, and these were all in very bad condition, almost unfit for further use. Again, it is worthy of note that the German construction of trucks is far behind what it should be. This is due to the lack of modern machinery, skilled workmen, and the hasty construction demanded by the military authorities. Also the lack of copper, tin, zinc, and especially of nickel and chrome, necessary for the production of the high-grade steel needed in truck construction, has greatly hindered the production of modern and durable cars.

Principal Truck Manufacturers in Germany

The following listed factories represent the principal automobile manufacturers in Germany who during the war manufactured only trucks. The figures quoted show roughly the maximum capacity of truck production for one month, reached during the period of the war:

	Trucks Per Month
Wuertemberg:	
Daimler, Stuttgart	100
Baden:	
Benz Gaggenau	100
Union, Mannheim	15
Bavaria:	
Saurer, Nuremberg	45
Faun, Ansbach	30
Prussia:	
N. A. G., Berlin	120
Bergmann, Berlin	40
Loeb, Berlin	40
Protos, Berlin	50
Hansa Lloyd, Bremen	100
Komnick, Elbing	60
Pomerania:	
Stoewer, Stettin	60
Westphalia:	
Duerrkopp (Bielefeld)	40
Rhine Province:	
Mannesmann } Daag }	90
Saxony:	
Vomag, Plauen	70
Horch	60
Hesse:	
Opel, Russelsheim	70
Adler, Frankfort	60
Total maximum production for one month	1,150

The remaining 24 factories are small concerns, engaged principally in the manufacture of motorcycles, motor side cars, munitions, and other war material.

Before the war the total production of trucks amounted to about 100 per month, Daimler, Benz-Gaggenau, and Hansa Lloyd being the principal manufacturers. During the war all the factories have been so enlarged that, together, they have been able to produce on an average of from 1000 to 1200 trucks per month. This includes the five new factories established and a number of the smaller concerns, not mentioned above, which produced from 2 to 10 trucks, respectively, per month.

Prices Nearly Doubled

During the war tractors were not made in Germany to any great extent. The Hansa Lloyd factory in Bremen manufactured tractors on a small scale, producing about 12 tractors per month. Though German manufacturers were engaged in developing a standard type of tractor they did not progress beyond the experimental stage.

It is hardly possible to give an exact idea of the prices the German manufacturer will be obliged to charge for passenger cars after peace has been signed. It is estimated that an increase of from 50 to 75 per cent is the least that can be expected. Prices of trucks advanced during the war about 75 to 100 per cent. Before the war the 3-ton truck, 45 to 55 horsepower (N. A. C. C. rating), sold at from 14,000 to 15,000 marks, without tires. The German Army at the beginning of 1918 paid 28,000 marks for a 3-ton truck, including steel tires.

From the commencement of the war all rubber tires, of whatever description, were confiscated by the German military authorities, and it was not long before the available supply was completely exhausted. In fact, the lack of tires in Germany became so serious that the German general staff was forced to limit the use of passenger cars needed for military purposes at the front. A large number of mechanical inventions calculated to replace the no longer obtainable pneumatic and solid rubber tire, especially those for use on trucks, were placed upon the market and tried out. However, no matter how good was the substitute produced, it never approached the point where it could be compared in

any way with the much-needed rubber tire, and in the end was cast aside as worthless. After the failure of the many invented substitutes to relieve the situation, all trucks were put on steel tires. This necessitated the reinforcement of the bearing parts of the trucks, at a considerable increase in the cost of construction. Even then the life of the truck was shortened, and it was not very long before the car was practically jolted to pieces or in a very dilapidated condition, making continual repairing necessary.

Synthetic Rubber Inadequate

From the first days of the war hope was placed in the ability of the German chemist to solve the problem of producing synthetic rubber and thus supply the urgent need of rubber required for all purposes in Germany. Especially was it hoped and confidently expected that it would not be long before synthetic rubber would be produced in quantities sufficient to enable the wholesale production of the greatly needed rubber tire. This dream was never realized. Although the German chemist did succeed in producing synthetic rubber, the product could not replace the natural rubber. This was due to the lack of elasticity, durability, and the high cost of production of the synthetic rubber. A large amount of this rubber was manufactured and mostly used for insulating purposes, in the construction of submarines, torpedo boats, electrical engines, etc., where it offered a good substitute for the natural rubber required. However, the synthetic rubber did not relieve or in any way affect the tire situation.

Large amounts of natural rubber belonging to German manufacturers are stored in neutal countries. With the signing of peace it is expected that this rubber will be released and the manufacture of solid rubber tires started immediately. Owing to the lack of cotton in Germany, it will be impossible for some time to come to manufacture pneumatic tires. In any event, the demand for rubber tires will be enormous, and Germany is not able to supply it.

Proposed Plans for Protection

On Nov. 18, 1918, the president of one of the largest automobile factories in Germany, and one of the most prominent men in the German automobile industry, addressed a meeting of about 75 representatives of all the automobile manufacturers in Germany. The meeting was private and no mention of the proceedings was made in the newspapers. In his speech he called special attention to the fact that the future standing and existence of the German automobile industry will depend entirely upon the ability to meet and cope with foreign competition. He proposed a consolidation of all the manufacturers, stating that every one must stand together and work for the common good of all, and that only by such united effort would they be able to succeed in meeting foreign competition. He also proposed to send carefully selected engineers, mechanics and automobile business men to the United States for the purpose of studying American methods of manufacture and organization, and to engage American engineers to come to Germany for the purpose of introducing American methods of manufacture and to modernize the German automobile industry. At the request of the assembled manufacturers, printed copies of this speech were sent to all members of the "Verein Deutscher Motor Fahrzeug Industrieller" (Society of German Automobile Manufacturers), Berlin, with the purpose of bringing before them the danger to be feared from foreign competition. What effect this speech will have is, as yet, unknown, but the fear is well founded and apparent, because Germany is not now, and will not for some time be, in a position to put this industry back upon the footing it occupied before the war.

Field for American Cars and Parts

In spite of the fact that Germany has lost the war, and in view of the facts above stated, there is no question that Germany will offer a good field for the introduction of American automobiles, trucks, tires, etc. In spite of the German Government's action in placing a luxury tax of 10 per cent upon all passenger cars, the number of prospective buyers is very large and continually increasing. The "Verein Deutscher Motor Fahrzeug Industrieller" is fighting against the 10 per cent luxury tax imposed by the Government, on the ground that it considers the automobile to be a necessity rather than a luxury. Likewise, all the leading business men and commercial newspapers are opposing the tax upon the same ground.

The war has also shown to Germany that the automobile is a valuable, quick and effective means of transportation, and its use in a strictly commercial sense is understood and fully appreciated by the German business man. In the larger cities in Germany, since the armistice, large companies with several millions of marks of capital have been formed for hauling and delivery purposes and for renting trucks.

Disposition of Army Trucks—Establishment of Truck Lines

Most of the 9000 to 10,000 trucks returned from the front have been purchased by the organizations above mentioned. Some of these companies are private, others have been subsidized by the State, and in the near future it may be expected that a great number will be established and controlled by the Government. In Bavaria an official declaration of the Minister of the Interior, department for traffic, has been issued, proposing to control the road traffic on trucks in the same manner as the railroads are controlled. In other words, truck lines will be established and run in connection with the railroads which are Government owned. This official monopoly, however, can only be ratified by the National Assembly. Before the war Bavaria was the leading German state operating and maintaining an autobus line, which replaced direct railroad connection between cities in the mountainous parts of Bavaria. It is now the intention to supplement this with a truck line for the freight traffic. This measure is viewed with great favor by all large commercial enterprises and individuals throughout Germany, who see in it a great advantage for the development and re-establishment of interstate commerce and trade after the war. Since the signing of the armistice large sums of public moneys have been appropriated by many provincial officials for the immediate reconstruction and improvement of the public highways. This work will give employment to thousands of discharged soldiers, and at the same time tend greatly to develop and improve the interstate commercial relations in many respects.

Condition of the German Railways

When consideration is given to the fact that the condition of the railroads in Germany is very bad, roadbeds in a neglected, run-down and extremely worn-out condition, rolling stock greatly depleted and in an almost ruinous state of repair, owing to the lack of proper lubricants and to the enormous demands made upon it during the four and a half years of war, it can readily be seen that the railroads must be supplemented by the automobile and trucks, especially with respect to freight traffic. The horse has almost disappeared from Germany.

There is no doubt that a great demand for motor cars of all kinds will arise throughout Germany. As conditions are now, it will be very hard, and in fact impossible, for Germany to manufacture an automobile or a motor truck at a price low enough to compete with American prices. Conditions have never been so favorable as now, in many respects, for the introduction of American automobiles and trucks.

Improper Selling Methods

Of all the foreign producers the American automobile manufacturer and exporter has been in the most disadvantageous position. Before the war several American firms exported motor cars to Germany, but no great success attended their efforts. This was due to a number of reasons, chief among which the following are worthy of notice: (1) The unskillful selection of the importer by the American producer. For instance, cars were sold to German importers who knew very little about the automobile business or who selected agents who were not capable to represent the car. (2) Lack of interest shown by importer in car after sale. When a car was sold the importer or his agents lost all interest in the buyer, and nothing was done, in many instances, to keep in touch with him or to look after the welfare of the car. This tended to create dissatisfaction among the buyers of American cars. (3) Lack of knowledge in many cases by

the importer and agents of the importer of market conditions. (4) Wrong methods employed to introduce American cars. This applied to advertising methods, lack of a well established and equipped repair shop, and choice of location and establishment of agencies.

The policy of many of the large automobile manufacturers in the United States of granting an agency or sole agency for a foreign country to a foreign importer upon the conditions that the importer should buy the car or a certain number of cars outright, f.o.b. New York, etc., and should have an established sales organization, be financially able to buy the cars outright, and guarantee to sell a certain number of cars per year, is not the proper method of procedure and will not result in the establishment of a permanent market or in the successful introduction of American cars to foreign markets. The moment the car is received by the importer it is alone in a strange country, duplicate parts are not readily to be had, the car is in the hands of mechanics who do not thoroughly understand its mechanism and construction, and are, therefore, not able to effect good repairs, and, in general, the foreign importers are not interested in the welfare of the car or in the satisfaction of the buyer after the sale.

Proper Methods for Establishment and Location of Agencies

It would be advisable and of great advantage to the American producer desiring to create a lasting market to establish his own agency in the prospective foreign territory. In the event that he desires to do this great care should be given to its establishment and organization and to the selection and location of the principal office and subagencies. This part, especially with respect to the selling end, should be placed in the hands of a man who is thoroughly familiar with the country, people, language, methods of procedure, and organization employed in this instance by the German automobile industry, and who has large and influential connections in the country and good experience in the automobile business. This is especially necessary for the selection of sales agents.

With respect to location, Berlin and Munich are the two principal cities to be considered. Munich more so than Berlin, because the latter city and Prussia, in general, have undoubtedly lost during the war a great deal of former influence and prestige. In the event that German Austria, with Vienna as the principal city, decides to throw in its lot with Germany, Munich would be the best choice for the head office.

In connection with an established agency, it is of great importance to have a well-equipped repair shop, including a large stock of duplicate parts. There is no doubt that a prospective customer would be largely influenced by the possibility of having his car repaired by the original firm and of being able to secure duplicate parts at once. The establishment and maintenance of a well-equipped repair shop will support the sale of the car by at least 50 per cent.

It is advisable to say a few words regarding the methods of advertising as carried out in Germany with respect to the automobile. The German method of advertising cannot be taken as an example of the right method, because it does not bring before the public a proper and strong conception of the idea involved. In any event, the German does not attach the importance to advertising the American producer does. While the American methods of advertising, as carried out in Germany, have been excellent in many respects, they have not been in such form and style as to attract especially or appeal to the German conception of things. Also mistakes have been made in the manner of placing the advertisements before the public and in the selection of the proper papers to carry them.

German Sales Methods

Until shortly before the war all German automobile manufacturers were selling their cars on a commission basis. A certain specified territory was allotted to a commission agent for a number of years as stipulated by contract. The agent was required to sell a certain number of cars per year or else forfeit his contract, or placed in a position which eventually necessitated him to relinquish his agency in the event he could not dispose of the number of cars he was under contract to sell. Every car was sold at a fixed price set by the manufacturer. In case the agent sold this car at a lower or higher price he forfeited his contract. The agent's commission was included in this fixed price. When, toward the end of the year, an agent saw that he had not sold his required number of cars and would not be able to do so before the end of the year, he immediately set to work to sell the car at a price much lower than the set factory price. This reduction sometimes involved the sacrifice of his entire commission on the sale of the car at the normal price, and in some instances, where the situation was desperate, the agent sold the car at a price which not only involved his entire commission but required him to make up the price at which the car was sold to him by the factory. Of course, the buyer of the car paid the set and fixed factory price to the agent, however, with the understanding, made beforehand, that the agent would make him a present, before or after the purchase, of 1000 marks, or of a horse, gold cigarette case, diamond ring, etc., according to the terms of the discount offered by the agent in order to effect the sale of the car. Again, inasmuch as the agent was naturally controlling the market in his allotted territory for the sale of the car represented, it was not long before he was demanding higher commissions and a better contract with the producer. If the agent's demands were not granted he, in many cases, simply took another representation at the expiration of his contract with the manufacturer and did everything possible to influence the market against the car formerly represented by him, and in this he generally succeeded. In fact, conditions were such that the agents were, to a great extent, controlling the producers. In order to protect their interests the producers formed a combination to bring pressure to bear against the agents and their methods, and to prevent what threatened shortly to be the complete control of the producer by the agents. This organization of the producers was known as the "Verein Deutscher Motor Fahrzeug Industrieller" (Society of German Automobile Manufacturers).

This resulted in the agents combining and forming an organization known as the "Deutscher Automobil Haendler Verband" (Union of German Automobile Agents), to counteract the combination formed by the producers. This resulted in the producers, starting with the larger manufacturers, installing their own agencies in all of the large cities in Germany and elsewhere, as soon as the contracts with their former agents had terminated. The smaller companies, in a great many cases, soon followed suit. In all the large cities in Germany there will now be found branches of the principal manufacturers with offices and exhibitions. As this system was introduced only shortly before the outbreak of the war, it is impossible to give statistics of comparison of a reliable nature. However, the results obtained so far have been extremely satisfactory.

INDUSTRIAL GOODWILL

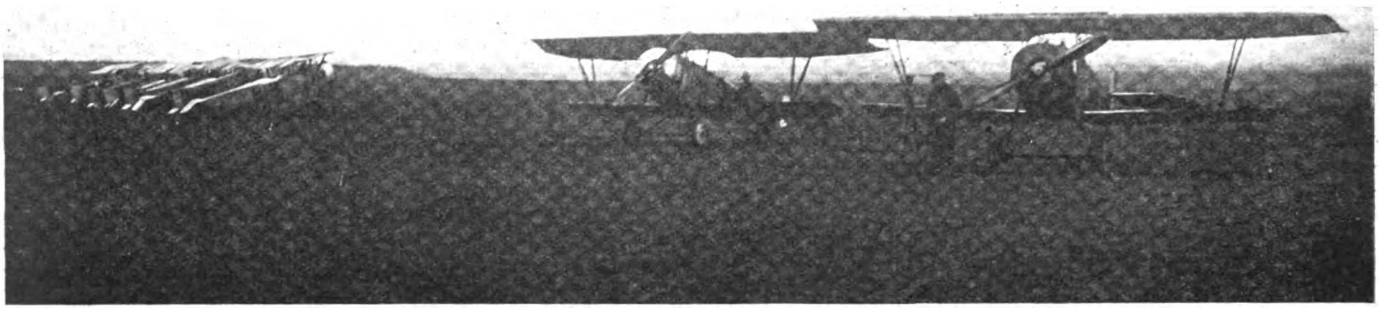
INDUSTRIAL GOODWILL. By John R. Commons, University of Wisconsin. New York: McGraw-Hill Book Co., Inc. Price, $2.

This book deals with the labor question from the industrial standpoint. It deals with the commodity theory of labor, with the machinery theory of labor, with the position of goodwill as a labor matter, the concern of the public, the question of democracy, the solidarity of labor, education, health, insurance and other similar matters.

The book presents cases for the various subjects and the conclusions in a very simple, practical form, and it contains a great deal of information which it would be well for all men connected with the handling of labor to have available and to understand.

It does not attempt to deal with the organization question as such, nor does it bring in the political and social side to any great extent.

As it stands, it cannot be considered as a complete exposition of the relations between employer and employee or of the deficiencies of the present methods of organization and outlook. It attempts to cover only certain specific branches of the subject and in respect to those branches the information is accurate and valuable, the material is well presented and readable and should prove of interest to those who have either control or supervision of labor.—HARRY TIPPER.



Nieuport airplanes supplied by the French to the American army

The Airplane Supply System of the American Army in France—II

The Advance Depots—Handling 18 Tons of Materials a Day for Seven Months at One of Them—The Balloon Supply Service—How Automobile Equipment Was Provided

By W. F. Bradley

IN any system of supply, whether it be civil or military, it is rarely sound policy to ship direct from the producer to the consumer. Under war conditions such a policy would be suicidal. The men who are doing the actual fighting must be relieved of all responsibility connected with the furnishing of supplies. The infantryman, whether he is hard in pursuit of the enemy or whether falling back in a stubborn fight, expects to be provided at all times and under all conditions with the two essentials, food and ammunition. The men who fight in the air need the same essentials, but in addition they call for a host of detail and highly specialized articles, the loss of any one of which might spell disaster.

An aviation squadron is the most mobile unit under the sun. Almost at a moment's notice the machines can be prepared for flight, and after an hour in the air they can be at some new location 100 miles from their original base. By reason of automobile transportation their squadron equipment can be brought to them at such a new center within 24 hours. Such changes may come two or three times in one week, or they may not have to be made more than once in several months. In war it is necessary to be prepared for all emergencies.

Because of these constantly varying circumstances, it is necessary for the big supply centers in the rear to furnish material to advance depots, which in turn distribute to the squadrons in the field. The Air Service of the American Expeditionary Force established its most important advanced depot at Colombey-les-Belles, 11 miles south of Toul, at which point there were 90 officers and 2000 enlisted men receiving airplane motors, propellers, spares, hardware, instruments, clothing, etc., and distributing them, as requisitioned, to the squadrons in the field. In other words, this was a retail store, but a retail establishment which did business on a big scale, for during the month of September alone this depot handled 2595 requisitions, each requisition comprising from 40 to 50 articles. The regular clients of the depot in the month of October, 1918, were 23 headquarters groups, 16 observation squadrons, 4 bombardment squadrons, 20 pursuit squadrons, 12 park squadrons, 8 photographic sections, and 22 balloon companies.

What Was Done at Colombey

The standard requirements of an air force in the field are infinitely varied. Some of the big lines are gasoline and lubricating oil. Thus, while it was in active operation, from April 1 to Nov. 11, the depot at Colombey-les-Belles sent out 206,000 gal. of transportation gasoline, 280,000 gal. of aviation gasoline, 167 gal. of special fighting gas, more than 47,000 gal. of castor oil, and about the same quantity of Mobiloil BB. At the other end of the line were the small articles: altimeters, speed indicators, engine parts, special aviators' clothing, which do not look big in statistics, but which are absolutely essential to successful operation.

In addition to furnishing these regular consumable stores, Colombey was the receiving center for foreign airplanes despatched from Orly and American airplanes sent out of Romorantin. In nearly all cases the ferry

pilots landed the machines at this point, from which they were taken in a single short flight to the squadrons located in the immediate vicinity of the line. These new machines sent out to make up losses, or to form new squadrons, were replaced by wrecked or partly wrecked planes in an almost equal number. Colombey received these crashes in all sorts of conditions. Some were subjects for the junk pile, in which case whatever accessories could be saved were taken off and put into storage. Others were capable of rebuilding and of going into service again. In the month of August, when the battle was at its height, the airplane repair depot at Colombey received 175 crashed planes. Of this number it was possible to repair 52 and return them to active service. Up to the signing of the armistice a total of 237 crashed planes had been repaired and sent back into the fight.

Advance Depot No. 1

Ninety miles from Colombey was another depot, known as Advanced Depot No. 1, at Is-sur-Tille, where, with a storage space of 70,000 sq. ft., clothing and airplane parts, machinery and tools were handled and sent out to 40 different units of the A. E. F. This was a quick-action center, for of the requisitions received 90 per cent were executed and the goods delivered within 24 hours. For seven months this depot handled 18 tons of material a day. At Vinets, in the Zone of Advance, sufficiently far up for a short single flight to the front, was another spare parts depot and ferry station. Further back, at Chatenay, on the mail railroad line from Paris to Chaumont, still another depot got into its full stride only a short time before the armistice came.

Special Section of Balloon Companies

While a part of the Air Service, the balloon companies form a specialized section with altogether special material. Working usually in conjunction with the heavy artillery, their captive balloons have to be in the air whenever weather conditions are favorable for observation, and they have to be capable of following every movement of the guns. Their entire equipment is automobile transported, and consists of special four-wheel drive trucks, on the platform of which there is fitted an auxiliary gasoline engine and winch for controlling the height and movements of the balloon.

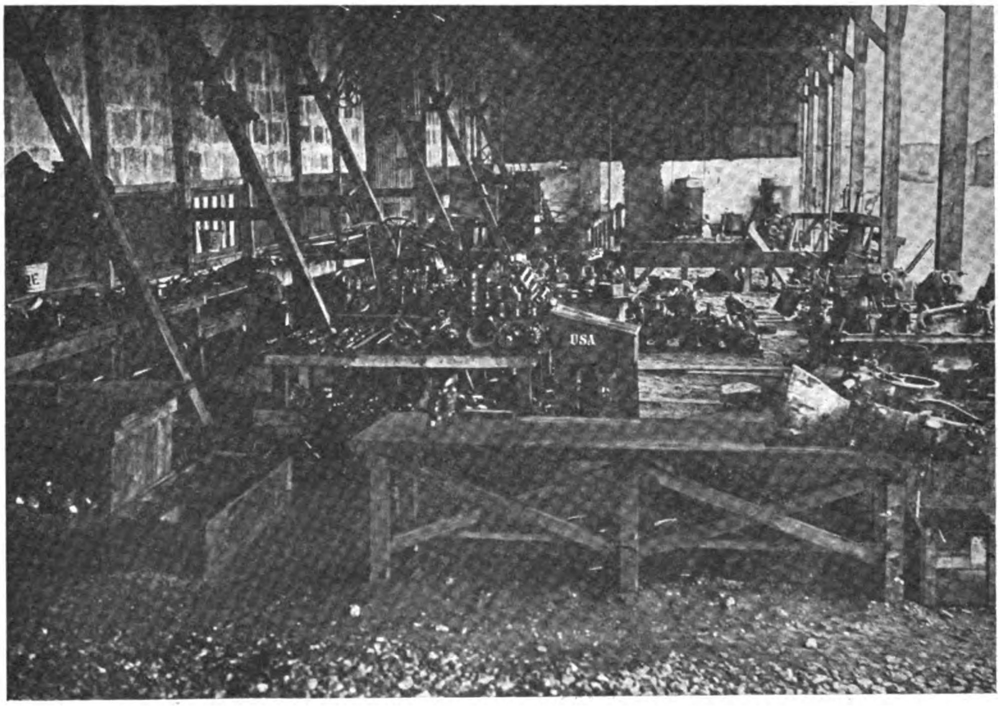
These trucks, with power transmitted to all four wheels, are capable of traveling over any kind of country and taking up any position that the artillery may designate as necessary for carrying out effective observations. In addition to these, there are special balloon tenders, also capable of traveling over any kind of country, and made use of specifically for carrying supplies to the winch-trucks and the balloons. Next in line are more standard types of trucks for carrying the stores and baggage.

At the time of the armistice there had been got together equipment to furnish 50 balloon companies and keep them in operation for four months. About 75 per cent of this material had been supplied by the French and 25 per cent came from America. Because of shipping difficulties the French had been appealed to for winch-trucks and had furnished 50 special Latil trucks, fitted with the Cachot power winch, as used by the French army. In addition to these a large number of special 4-ton trucks had been turned over by the French to the balloon companies at a time when shipment of similar material could not be obtained from America.

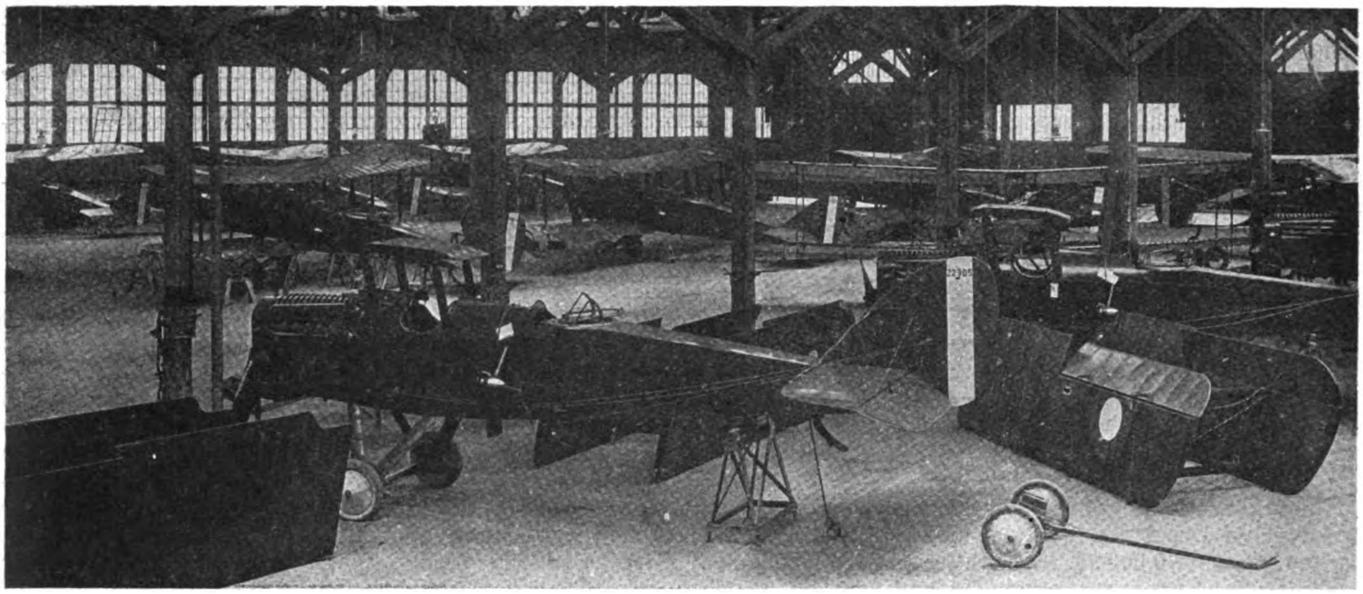
Balloon Companies Had Separate Supply Depot

Because of the special nature of its requirements, the balloon companies had their own main supply depot, independently of the airplane service. It was one of the accidents of war that this depot should have been erected by Germans and used as a factory by the Continental Tire Company, of Hanover, until August, 1914. The German personnel escaped before the storm broke, the French took possession of the factory, enlarged it, and on America coming into the fight turned it over to the Air Service as a balloon depot. Before the fighting stopped this one-time German factory had become the biggest hydrogen gas producing center in the world, with an output of 500,000 cu. ft. per day. During the active period this depot sent out 1650 tons of special balloon material.

It is one of the features of the Air Service that while regular work is going forward, something new is always in preparation. The biggest scheme that the American Air Service was working on as a surprise for the Boche was the organization of night bombardment groups. Had the war continued a few weeks longer these machines would have been in commission and making nightly trips over the German lines with deadly effect. The planes were of the Handley-Page type, built in America, but sent to the Handley-Page factory in England for equipment. On Nov. 11 most of the parts were in hand for about a dozen planes, and the remainder were following up at a rapid rate. These planes, formed into squadrons of 10, would have been flown from England to the field at Orly,



Air service automobile repair and salvage shops at Romorantin



DH-4 airplanes in the assembly shops at Romorantin on the day of the armistice

where they would have received their equipment and picked up their automobile transportation sent out from Romorantin. Supplied with this, the squadrons would have flown to the depot at Vinets, and then proceeded to the special airdromes already prepared for them at various points along the front.

Providing Automobile Equipment

No air force can operate for a single day without automobile transportation. Even in the preliminary stage, which consists of securing supplies, clearing the ground and erecting buildings, the first request made is for trucks and passenger cars. When the preliminary mission came over to map out the ground, in the early summer of 1917, its first requisition, if there had been anybody to receive a requisition, would have been for automobiles. But the French supplied the need in both machines and drivers until the service had grown so much that it was intimated other arrangements should be made. There were plenty of automobiles in America, but the trouble then, as for a long time afterward, was in getting them through the ports and across the Atlantic. Automobiles being required too urgently to admit of delay, and Italy being in a position to make immediate deliveries, an officer was sent to that country with instructions to bring machines back with him by road, which order was carried out in less than a week.

The Air Service had the foresight to see that in the scramble for shipping space the delivery of automobiles from America would be unsatisfactory for a long time, and that some of the special types of vehicles which had never been produced in the United States would be unavailable for many months. In consequence the wise decision was taken to secure available European material, most of it supplied by Italy, at the beginning of the movement. It followed, as a result of this policy, that when the really active period began in the spring of 1918 the Air Service was the only section of the American Army adequately provided with automobile transportation. This material had been selected on the experience of the French and British armies in France, and consisted in addition to the ordinary touring cars and motorcycles, common to the entire army, of special light and heavy aviation trucks, trailers, machine shop trucks, etc.

When the work was at the height of its prosperity, a general order was issued calling for the pooling of all automobile transportation. Under this order the Air Service had to be sacrificed for the benefit of the American Expeditionary Forces as a whole. Those in authority, also, seemed to be of the opinion that the Air Service should not be mobile and that it did not require more than a fraction of the material provided for in the tables of organization. The Air Service consequently turned over about 2000 new and unused vehicles, and from that time on became dependent on the Motor Transport Corps for its transportation.

In this great task of supplying the American Air Service in France there were employed 3000 officers and 20,000 enlisted men. In the Paris district alone, including Orly, there were 7000 officers and men. There was never a single moment when the job was easy, and there were times when it was so difficult and complicated as to discourage all but the stoutest. In the Supply Section they had a motto, "It can't be done, but here it is," and probably nothing could better describe the general attitude and conditions of the organization.

The Men Who Did It

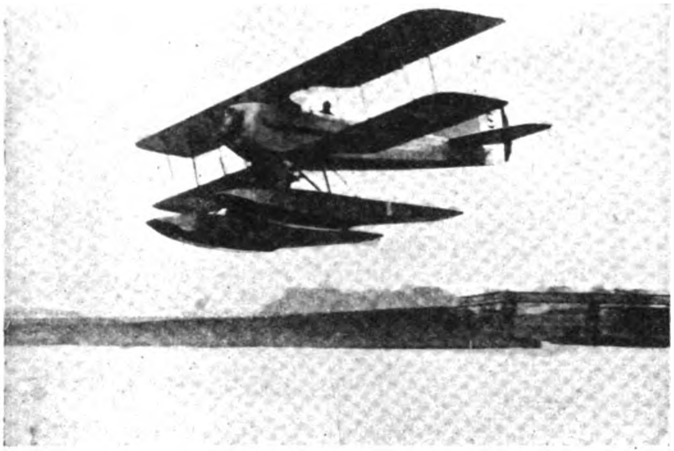
The men who did effective work on this big job are many. Right at the beginning Colonel Bolling came out with a few experts to pave the way. Active results did not immediately follow. The death of the Colonel early in 1918 was one of the many tragedies of the war. While on a visit to the British Front, Colonel Bolling was surprised by the advancing Germans and his automobile put out of commission by machine gun fire. Taking refuge in a shell hole, in company with his chauffeur, he determined to make a stand, although the only weapon the two men possessed was a service revolver. The end of this unequal fight was that Colonel Bolling was left dead on the field and his chauffeur led captive into Germany.

From near the end of 1917 to early 1918 General Foulois, one of the most experienced aviators in the Service, was Chief of Air Service in France, until he took charge of Air Service operations at the Front, when he was afterward succeeded by Brigadier General William Mitchell. In the spring of 1918, with Germany seriously threatening and the Allies calling on America to make a mighty effort, it became apparent that the American Air Service could only meet the call by close co-operation with the French.

Major-General Patrick, who conducted operations as Chief of Air Service in France until the close of opera-

tions, was made Chief of Air Service upon the relief of General Foulois in early 1918. Colonel Halsey Dunwoody was assigned to duty in April, 1918, by General Foulois, then Chief of Air Service, to organize the Air Service Supply and to negotiate with the foreign governments in order to obtain material to create the Air Service and maintain it until the necessary material should have come from America.

Colonel Dunwoody assumed this duty before the Air Service Supply Section began its operations and held the position from that time until the termination of the war. He was responsible to General Foulois and later to General Patrick, not only for negotiations and supply proper, but also for production, maintenance, transportation, salvage and the operations of all depots, also the big centers of Romorantin, Orly and the ports organizations.



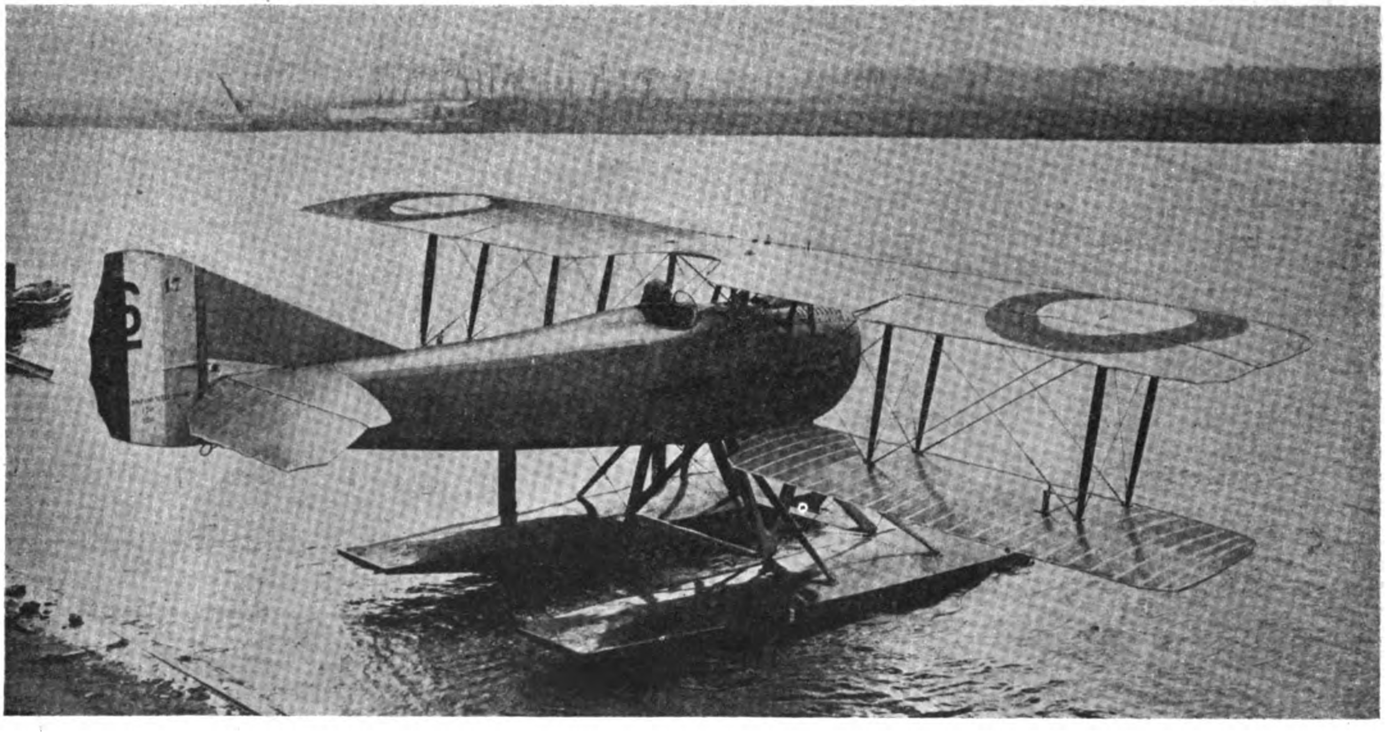
Spad hydroairplane in flight

It is difficult to give adequate appreciation of the magnitude of this work. It must be borne in mind that the conception, the building and the maintenance had to go hand in hand throughout the period of the great effort against Germany. It was only by resolutely attacking and overcoming all obstacles that this giant business enterprise was perfected until it was in a position to meet the material program of the Air Service needs in France.

New Flying Speed Indicator

THE anemotachometer is a new important instrument for aircraft, for measuring the actual or relative speed of the flying machine. It is made in the form of a cross, each arm of which carries a cup-shaped impeller which the wind drives. The rotation of the wind-driven impeller on its central spindle actuates a pendulum movement, the strokes of which are transmitted to the indicating dial. One of the greatest advantages of this instrument is that its action is always positive and is not affected by the density of the air through which the aeroplane is passing and, further, that the anemotachometer comes into action immediately the machine starts.

As this instrument has to be near the driver's seat, in large flying machines the same four-cup cruciform anemotachometer is used, but in this case the control is electrical and the flying speed is given by the voltmeter above the pilot's seat. This instrument has a second valuable use in that from it the pilot can judge the curvature of his course. Owing to the number of motors which are now included in the design of one airplane, steering has become very difficult, and it is often impossible for the pilot to know in foggy weather whether he is steering in a curve or straight forward. If two anemotachometers electrically connected to a central voltmeter are placed toward the extremity of each wing of the airplane, then the indications of both instruments will be the same if the machine is flying straight, but if flying in a curve the instrument on the inner or shorter radius of the curve will register a slower speed than the one on the outer radius. From the difference between these indicated speeds, the curvature can be seen from a properly prepared chart on the indicator dial.

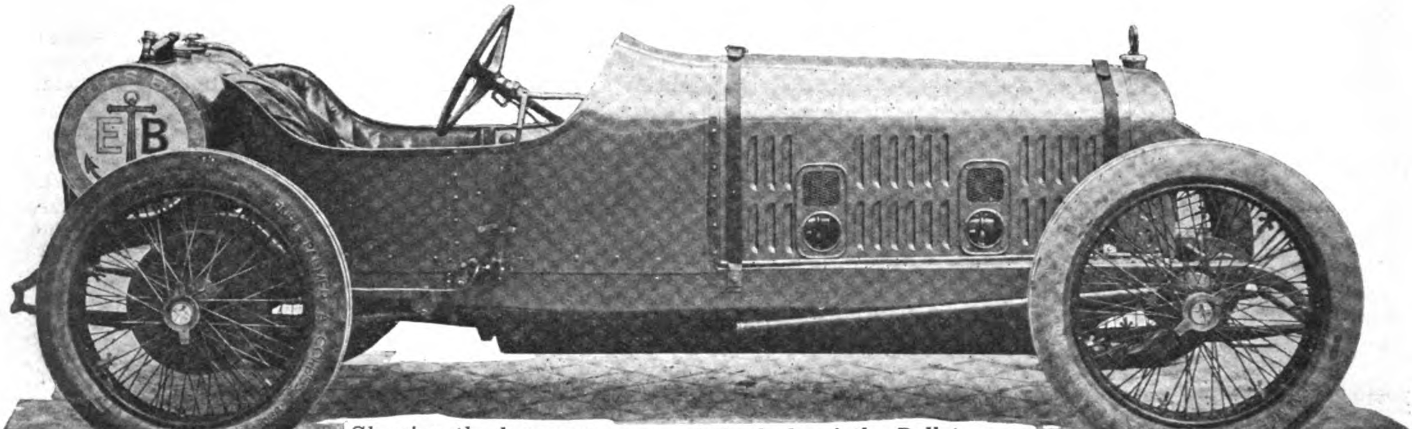


Spad hydroairplane constructed in France. It is interesting in that it is virtually one of the famous Spad fighting planes mounted on pontoons. Note the short span, the absence of wing tip floats and the large aileron surfaces in upper wing only. The control rods for the aileron are carried inside the lower wing and operate the surfaces through a bell crank and rod at the back of the outer rear strut. The engine is a 200-hp. Hispano-Suiza

Ballot Racing Cars
Built for Indianapolis Track Conditions

Designed and Produced in 102 Days—Eight-Cylinder Vertical Engine with Built-Up Ball-Bearing Crankshaft—Large Wheels and Low Body

By W. F. Bradley



Showing the low appearance of the body of the Ballot racer, which is mounted on underslung springs

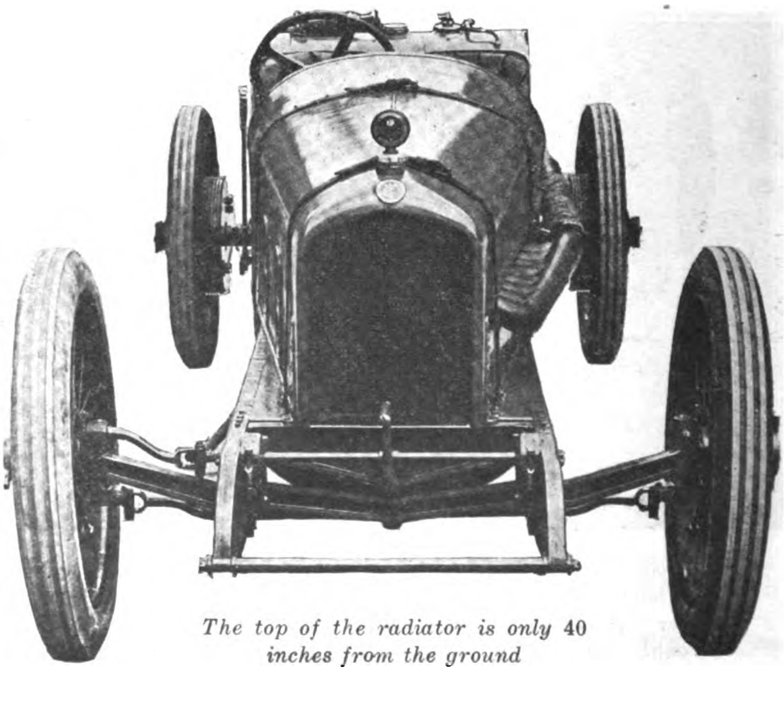
PARIS, April 24—The four special Ballot cars entered for the Indianapolis race are absolutely new productions, built in Paris entirely at the Ballot establishment with Indianapolis track conditions especially in view. They were constructed in record-breaking time, being designed and produced in 102 days.

They have eight vertical cylinders in line, consisting of two castings of four. The bore and stroke is 74 x 140 mm. (2.9 by 5.5 in.). There are four valves per cylinder mounted in the head and operated by means of two camshafts driven by a train of gears contained within an aluminum housing at the front of the engine. The crankshaft is built up in four parts and is carried in ball bearings. I-section connecting rods and aluminum pistons are employed. The engines have a single plug per cylinder and only one magneto. There are two Claudel carbureters per engine.

The engine, clutch and gearbox are mounted on a subframe which is attached to the main frame by three-point suspension, so that there is no possible misalignment no matter how much the main frame members are twisted. There are four speeds and reverse. Drive is taken through the springs, which are of the semi-elliptic underslung type. The front springs are also underslung. The rear axle is full floating type, composed of two forged axle tubes and a central aluminum housing. The center of gravity of these cars is exceptionally low. With 880 x 120 mm. wheels and tires (practically 34 in.) the top of the radiator is only 40 in. from the ground. No special attempt has been made at streamlining and the cars will be run without a tail.

While exact figures regarding speed are not available for publication, it may be stated that these cars are the fastest 300 cu. in. mounts ever produced in France. They will be particularly dangerous in track work by reason of their rapid acceleration. All previous French cars sent to Indianapolis have been road racing machines built for the long straightaway stretches of French roads.

When the Ballot Company undertook the construction



The top of the radiator is only 40 inches from the ground

of these machines it was guided by the experience of René Thomas, who decided that Indianapolis called for a very low center of gravity, good balance and suspension to reduce tire wear, and exceptionally rapid pick-up. The wheel diameters are the biggest ever used on the Indianapolis track, and the cars are the lowest ever seen in America. The final gear ratio has been laid out with the nature of the track in view. There appears to be no doubt that these cars will be able to tackle the four turns per lap at a much higher speed than any of the others, and it is believed that their powerful pick-up on coming out of the turns will give them an exceptionally high speed on the two straight stretches.

Details of BALLOT RACING CARS

No. of cylinders	Eight
Arr'g't of cylinders	In line
Bore and stroke	2.9 x 5.5 in.
Crankshaft	Four-piece, ball bearing
Valves	Four per cyl.
Camshafts	Two overhead
Ignition	Single, magneto
Carbureters	Two Claudel
Gearbox	4-speed and reverse
Springs	Underslung semi-elliptic
Wheels	880 x 120 mm.

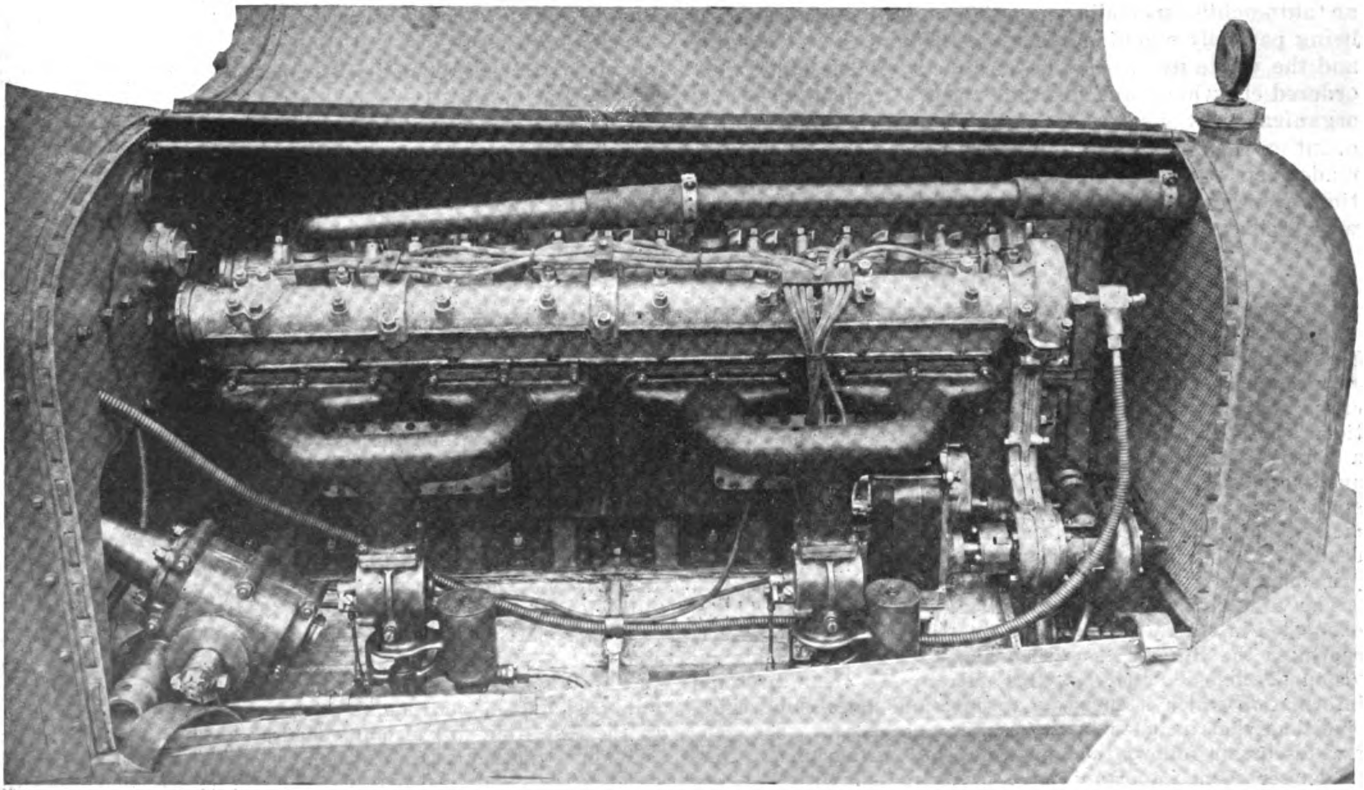
Designed and Produced in 102 Days

The building of these four cars constitutes a record in the history of the automobile industry of France, if not of the world. Immediately after the armistice was signed, the writer approached the leading European automobile manufacturers with a view to securing their participation in the Indianapolis race. Some of these firms had decided to race after the war; two of them had cars built; one had an engine partly completed, and one had drawings well in hand. After due consideration, all these firms decided that in view of the very unsettled state of the industry it was a material impossibility to build racing cars between Nov. 11, 1918, and the end of April, 1919, the date on which shipment would have to be made for Indianapolis. In fact, the French makers signed an agreement among themselves not to participate in racing during 1919.

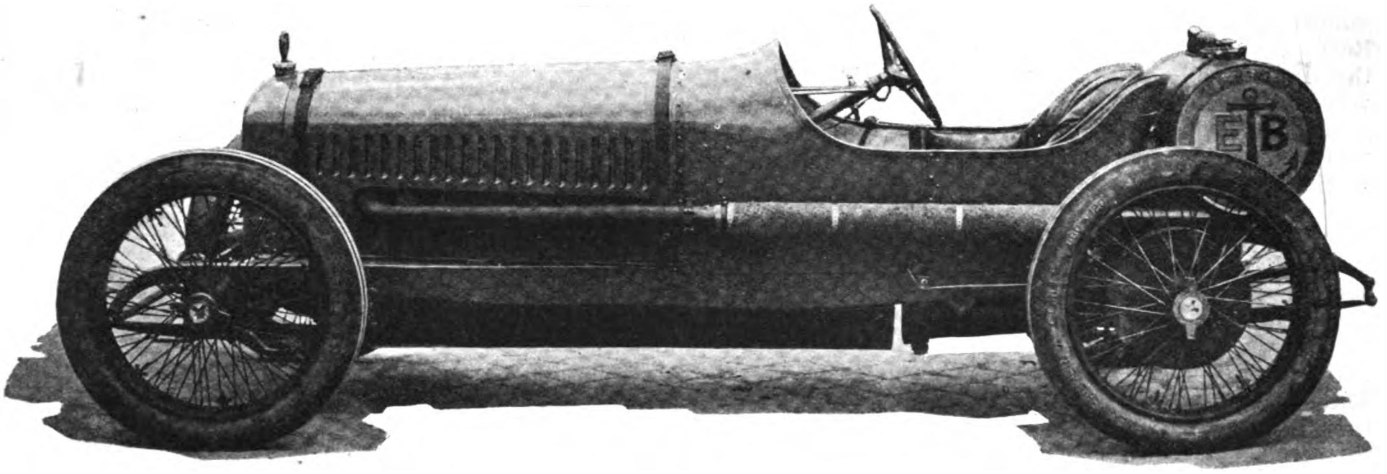
After the attempt to get special cars out of the European factories had failed, the subject was brought before the Ballot Company, one of the largest firms in France specializing in automobile engines. On the morning of Dec. 24 Mr. Ballot announced that he would build a set of cars for Indianapolis, and on the evening of the same day a contract had been signed between Ballot and René Thomas whereby the latter entered the company as head of the racing team.

In order to reach Indianapolis on time it was necessary to ship the cars from Paris not later than April 26. This meant that there were 120 clear days, including Sundays and holidays, in which to design, build, assemble, test and pack a set of special racing cars. No set of racing cars had ever previously been built in France in less than twelve months, and even this time was considered short. It must be remembered that although the fighting was over, a state of war existed in France, labor was scarce, material hard to procure, and transportation in an impossible condition.

To secure secrecy, it was decided that the drawing office should be far removed from the Ballot factory. Dec. 25 and 26 were spent in looking for an establishment. It was discovered 12 miles from the Ballot factory in a house



The engine used on the Ballot racing car has its eight cylinders arranged in line in two blocks of four. It is equipped with two Claudel carbureters and a single magneto. Two overhead camshafts operate the valves



One of the four Ballot racers entered for Indianapolis

and courtyard which had been abandoned by a German firm on the outbreak of the war.

On Dec. 26 Mr. Ballot called in one of his best engineers and three of his most skilled draftsmen and informed them that he wished them to disappear immediately from both home and factory and to remain absent for two months. The same day these men loaded drawing office equipment, a stove, bedding, coal, and gasoline aboard a closed truck and went off to an unknown destination. On Dec. 27 the first work was done in the secret drawing office of the Ballot racing establishment. Before making this change the men had been working full time; during the first month each draftsman nearly tripled his working hours. No man left the building except to take meals.

The first real difficulties were experienced when crankshafts were ordered. The first five, forged by one of the best firms in France, could only be delivered by sending an automobile specially on a 300-mile journey. After being partially machined they were found to be defective and the whole five had to be scrapped. Three more were ordered elsewhere, and also had to be scrapped. The disorganization was so great in the French factories, consequent on the change from a war to peace basis, that parts made from bar steel supposed to have the same specifications were found to vary 100 per cent. At this time the work fell behind the close schedule which had been laid out and the advisability of abandoning the scheme was considered.

Finally it was decided that the Ballot Company should forge and heat-treat its own shafts, and in view of the difficulties which had been met, a test piece was taken from every individual bar, and every bolt and nut which went into the car was subjected to the Brinell test.

On April 7 the first Ballot racing car was run in the yard, after the workmen had left. It had been designed and produced in 102 days, including Sundays. Although everything had been built in the Ballot shops, with the exception of carbureters, magnetos and wheels, the secret had been so well guarded that nobody outside the racing department knew what was going on. On April 11 the first car was approved by the French Government inspector, and on the following day René Thomas went on the road for five days' test.

Shipping space was secured aboard the French liner Savoie, sailing from Havre on April 26, but the railroad service between Paris and the port was so unreliable that on April 24 the boxed cars were loaded on automobile trucks and sent to Havre by road. To provide against any possibility of a breakdown at the last moment, a reserve truck followed behind with a couple of skilled mechanics in attendance. Arrangements were made whereby, on reaching New York, the cars should be unloaded from the steamer and carried to Indianapolis as personal baggage.

Testing Motor Gasoline

IN May, 1917, the Bureau of Mines, Department of the Interior, issued Technical Paper 166, "Motor Gasoline Properties, Laboratory Methods of Testing, Practical Specifications," by E. W. Dean. This paper was prepared because of a general desire for information relative to the properties and methods of analyzing gasoline. The Bureau of Mines studied the problem and prepared a paper discussing the methods of production and essential properties of gasoline, describing laboratory methods of analysis and outlining the principles upon which gasoline specifications should be based.

The first edition of this technical paper (No. 166) was exhausted in the fall of 1918, and instead of merely having it reprinted the Bureau has issued a revised edition. This revision (Technical Paper No. 214), also by Mr. Dean, presents information which is more up to date and more comprehensive than that included in the earlier publication. The general discussion follows the same lines, but certain phases that no longer seem important have been treated with less detail, and considerable additional information obtained during the last two years has been added. The recommendations made in the earlier publication regarding analytical methods and systems of specifications have been changed only in a few minor details, but the method of presentation has been changed in order to make the information more usable.

Technical Paper No. 214 includes a general description of the properties, methods of production and methods of testing gasoline. The practical interpretation of results of tests is discussed in some detail. The problem of writing specifications for gasoline is treated and specific recommendations are made regarding the limitations which are believed to be important. Figures specifying any particular grade of gasoline have not, however, been included, as it is believed by the Bureau that no single general specification is desirable.

The properties and methods used for the analysis of gasoline are described in detail. Chief emphasis is laid upon the tests of greatest importance, such as the distillation analysis, but in addition a description is included of most of the tests that are recommended or used either by the Bureau or by other organizations. Convenient forms for recording the results of analysis of gasoline are shown and the table is included for transforming Centigrade temperatures into Fahrenheit equivalents.

Copies of this publication may be obtained by addressing the Director of the Bureau of Mines, Washington, D. C.

Tractor Hitch Problem Fundamentally Mathematical

Simple Laws of Dynamics Apply—Most Hitch Problems Can Be Worked Out Graphically

THE tractor hitch problem is readily capable of mathematical analysis. Many of the matters which have been debated from all sorts of angles are clearly open to geometric proof or can readily be solved by graphic statics. While, in general, it is always best to get away from the purely mathematical and to bring home in other ways the advantages and disadvantages of certain types of design, the matter of relation of the tractor to its load through the medium of the drawbar connection cannot logically be discussed in any other way.

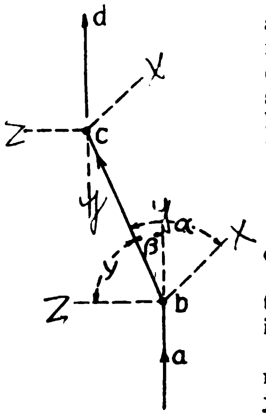


Fig 1

The propelling force of the tractor, the weight of the tractor, the character and form of the load or trailer, whether it be plow, road drag, or any other form of load, and the other fundamental factors are all measurable quantities which determine the effect that the hitch has upon the tractor and the implement.

This being the case, a purely mathematical analysis of the matter is well worth while. E. A. White of the University of Illinois has gone into the matter from this standpoint and the following is a digest and re-arrangement of the facts presented by him in a recent paper.

It is a well-known principle of mechanics that one force or one force and a couple may be found which will produce the same effect as a number of forces. In addition to this due consideration must be given to Newton's Third Law, viz., "Action and reaction are equal and opposite." A proper application of these universally accepted laws together with other well-known principles of statics furnishes the keys to a thorough understanding of equalizers and hitches and will clarify many problems which, on the surface, appear to be complicated and perplexing.

As the first general case, take the conditions which are represented in Fig. 1. The load moves in the direction a b and the prime-mover in the direction c d. The hitch is attached to the load at the point b and to the prime-mover at the point c, in such a manner that the drawbar takes the direction b c. The line a b is parallel to the line c d, both of which are parallel to the z-axis. Let the tension in the drawbar b c be represented by F, and designate the angles which this drawbar makes with the x- y- and z-axis respectively as α, β and γ. The force from the load acts upon the motor in the direction c b, and can be resolved as follows:

$$F_x = F \cos \alpha$$
$$F_y = F \cos \beta$$
$$F_z = F \cos \gamma$$

If a tractor is used force F_x will tend to pull the rear end of the prime-mover to the right and swing the front end to the left. Force F_y will produce a downward pull upon the tractor. The exact manner in which this affects the operation of the tractor will depend upon where the point of attachment c is placed with reference to the wheels. The force F_z is the effective force acting opposite to the direction of motion.

The effects produced upon the load are equal in magnitude and opposite in direction to those produced upon the prime-mover. F_z is the only force which is effective in the direction of motion and is therefore the only force which should be taken into consideration when computing the drawbar horsepower required to move the load. Suppose that this unit moves at the rate of n feet per minute, then

$$\text{Hp.} = \frac{F \cos \gamma . n}{33{,}000}$$

Very few hitches, however, are as simple as the general case just considered.

In general (eliminating a few patent hitches seldom used) tractor-plow hitches are of two classes, differing essentially in the range of adjustments permitted at the plow.

In Fig. 2 a hitch is represented which allows a very wide range of horizontal adjustment in addition to a vertical adjustment. The hitch illustrated in Fig. 3 has a very desirable vertical adjustment, but the range of the horizontal adjustment is more limited than in the case of the hitch illustrated in Fig. 2.

These hitches both contain the same fundamental elements—three bars making a rigid triangle with a single point of attachment for the clevis which makes the connection between the hitch and the tractor.

In order to illustrate the method of analyzing these hitches for the purpose of comparison a few typical cases will be considered.

Unfortunately, it is not known whether the forces which resist the motion of a plow can be resolved into a single force and a couple. In either case, however, it is evident that there must be some line in which the resultant of the forces which move the plow should act, in order to give a minimum draft and to produce conditions most favorable from the standpoint of operating the plow.

In this paper the resultant of the forces resisting the movement of the plow will be represented by a single force. Any error which may be involved in this assumption can easily be

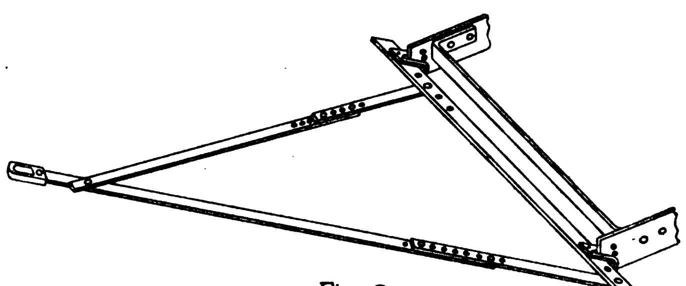


Fig 2

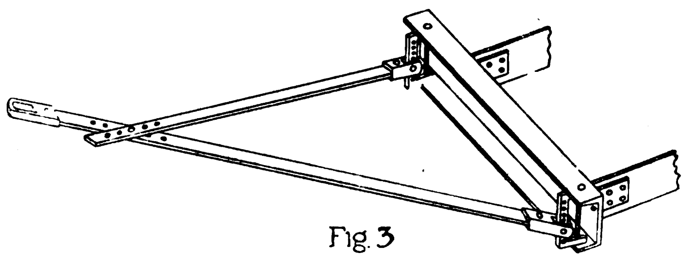
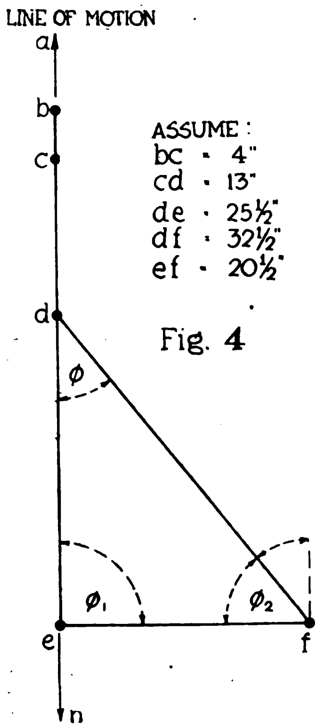
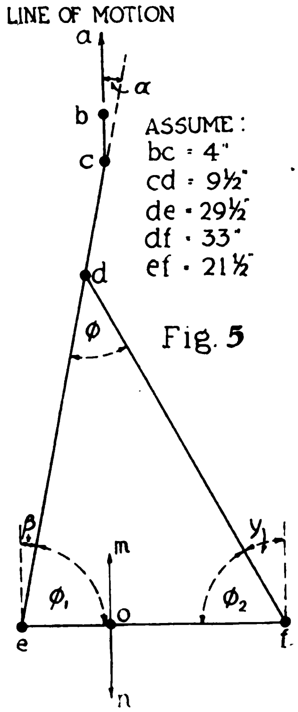
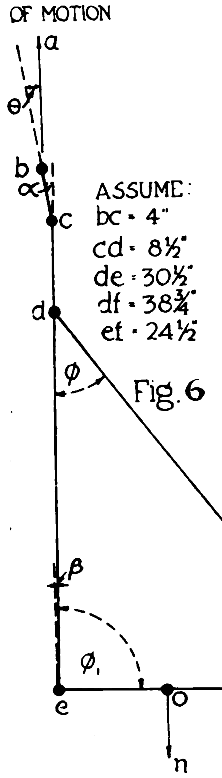
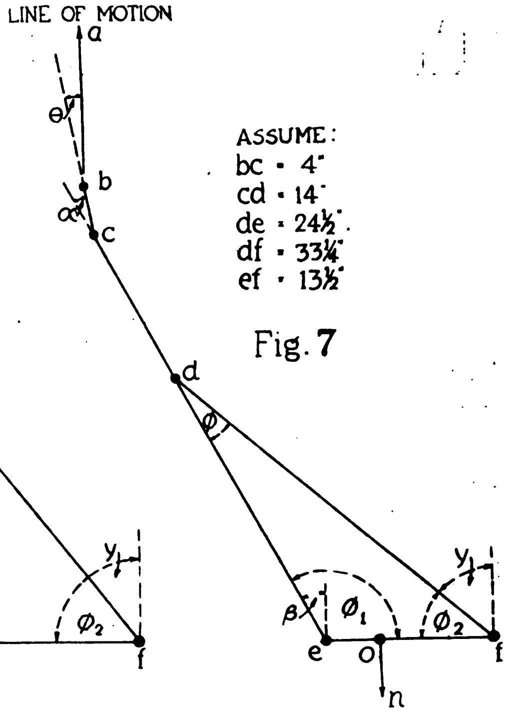


Fig 3









taken account of if later investigations prove it to be incorrect. Further, the effects of the vertical angle of hitch are omitted from the discussion.

In Fig. 4 the adjustments are such that the clevis, *c b*, connecting the hitch and tractor falls in the line of motion of the center of resistances of the plow, *e n*. In this case there is no side-draft on the plow. If the line of motion of the resultant of the forces tending to move the tractor falls in the line *e d* extended, there will be no side-draft on the tractor.

If, however, this resultant from the forces of the tractor does not fall in the line *b c* extended there will be a tendency to rotate the tractor equal to the moment of the couple produced. In the hitch the entire load is carried on the member *c e*. The member *d f* is neither in compression nor tension. It is useful on the turns or when the plow strikes an obstruction which tends to force it out of the line of motion.

In Fig. 5 the member *b c* is parallel to the line of motion, and falls in the same line *o n* as that produced by the motion of the center of resistances of the plow. In this case there is no side-draft on the plow. The only problem then is to analyze the strains produced in the members of the hitch. The method here presented is general and therefore will be given in detail.

Let the tension in the clevis *c b* be *F* pounds. The tension along *c e* is

$$F_3 = F \cos \alpha$$

Acting perpendicular to *c e* is a force.

$$F_4 = F \sin \alpha$$

This force F_4 acts upon *c d e* as lever and produces tension in *d f*, which will be designated as F_5. From the law of levers

$$F_4 \, (39) = F_5 \, (29.5) \sin \phi$$

$$F_5 = F_4 \frac{39}{29.5} \times \frac{1}{\sin \phi}$$

From this lever there will be a reaction at point *e* (F_6) Taking moments about *d*:

$$F_4 \, (9.5) = F_6 \, (29.5)$$

$$F_6 = F_4 \times \frac{9.5}{29.5}$$

F_6 can be resolved into two forces, F_7 acting perpendicular to the line of motion and F_8 acting parallel to the line of motion, but in the opposite direction

$$F_7 = F_6 \cos \beta$$
$$F_8 = F_6 \sin \beta$$

At point *e* F_5 can be resolved into two forces, F_9 which acts parallel to the direction of motion, and F_{10} which acts perpendicular to the line of motion.

Similarly at point *a* the force F_5 can be resolved into two forces, F_{11} and F_{12}, which are respectively parallel and perpendicular to the line of motion.

Then it follows that:

$$F_8 + F_9 + F_{11} = F_3$$
$$F_7 + F_{10} + F_{12} = 0$$

If the point of attaching the clevis to the hitch does not fall in the line of motion of the center of resistance of the plow then the conditions illustrated in Fig. 6 may arise when the hitch shown in Fig. 2 is used. Under these conditions the clevis *b c* will make an angle *α* with the line of motion.

Let the tension in the clevis be *F* pounds. At *B*, the point of attachment to the tractor, this force *F* can be resolved into two forces, viz., $F_1 = F \cos \alpha$ which opposes motion of the tractor and $F_2 = \sin \alpha$ which acts perpendicular to the line of motion and tends to rotate the tractor.

In cases of this kind the point of attaching the clevis to the tractor is usually to the right of the line of motion of resultant of the forces which move the tractor.

The moment produced by the force F_2 will act in the opposite direction to the couple tending to rotate the tractor. As a special case these two moments would balance each other. The stresses in the members of the hitch can be analyzed in the same manner as given above for the illustration in Fig. 5.

As the point *c* does not fall on line *n o* extended there will be side draft on the plow. The force F_1, acting at point *c* in the direction of motion, is opposed by an equal force applied at *o* acting in the direction *o n*, which is parallel to the line of motion.

The moment of this couple is F_1 multiplied by the perpendicular distance from the line *n o* to the point *c*, and it will tend to rotate the front end of the plow to the right. Opposed to the action of this couple is the moment of a force F_2 applied at *c* acting over a lever arm of unknown length. The increase in draft due to this hitch will be directly proportional to the difference between these two moments.

The conditions represented in Fig. 7 may occur when the hitch represented in Fig. 3 is used. In the ultimate analysis the tendency to produce side draft on the plow and tractor will be the same, but the stresses in the hitch have a very different distribution than in the hitch in Fig. 6.

Counteracting the Propaganda of the Irreconcilables

How Racial Conditions in Our Large Industrial Centers Have Accentuated the Problem—The Effect of an Inadequate Educational System

By Harry Tipper

THE strike which has occurred at the Willys-Overland Company in Toledo brings up again with particular force the division in the labor union ranks and the fight which exists between the labor unions and the radical elements who are taking advantage of the present situation to organize workers in a number of industries and to induce strikes on the basis of their more extravagant promises and more definite position. These radical movements are backed by the irreconcilables in the labor ranks who can see no good in the compromises which have marked the progress of the older and parent unions and who do not want to see any value in such compromises. These irreconcilables are committed to a policy of warfare with the object of direct control. Their position in respect of both the older and more stabilized unions and the manufacturer are sufficiently indicated by three paragraphs herewith taken from the printed propaganda of the Metal and Machinery Workers' Industrial Union, which is a branch of the I. W. W.

We have noted in these articles from time to time the tendency which exists within the ranks of the labor union for the radicals to gain control under various local conditions which favor that control because of the broad character of the promises and the plausible character of their propaganda.

The unions which are affiliated with the American Federation of Labor find themselves unable to meet or even countenance all the demands which come from dif-

THIS KIND OF PROPAGANDA MUST BE COUNTERACTED

"THE old craft unions can do nothing for us. In the first place, th are controlled by a gang of reactionary politicians whose main object is to hold on to their comfortable, well-paid positions and continue to deliver the workers to the employers like a herd of slaves. They invariably defeat any radical movement among the members. They are able to do this because the A. F. of L. unions are controlled by the officers, not by the members at large."

"WE must have one big union of the workers in each industry, and these unions must be bound together into one mighty organization, which shall reach out to our fellow workers in other countries and unite the workers of the world in one universal brotherhood, with one common aim, the abolition of the capitalist system and all its evils, low wages, long hours, unemployment, industrial slavery and commercial wars. While capitalism lasts, no worker's life is safe."

"FELLOW-WORKERS, the day of the inevitable industrial revolution is near. Signs of the approaching overturn are on every hand. No one can tell when the final break-up will come, but no one will deny that it is coming rapidly. We must not be caught unprepared. The workers must make ready to take over the industries, or our civilization will go down in ruin.

"One enemy, one union, must be our watchword."

□ □ □ □

AND THESE WILL COUNTERACT IT

AMERICANIZATION of the mixture of races which provides fertile ground for the promulgation of theories which can be so plausibly presented.

Education which will carry with it enlightenment on economic facts and will offset traditions arising from political backgrounds which facilitate the spreading of such propaganda by those who are familiar with the ideals, the racial instincts and the political history of these races.

Intelligent co-operation with the conservative body of workers who have no desire to see this sort of program succeed and with the more powerful members of the affiliated unions who are as little in sympathy with this program as are the manufacturers.

Time and patience expended by the manufacturer in understanding the worker's position, the worker's point of view and the things which he really desires.

ferent sections of the local bodies and from the different trades. The long experience which they have had in organization work, their continued contact with manufacturers in the settlement of disputes, their knowledge of the responsibility which attaches to the action of the unions have brought some measure of understanding in social obligations so that they are in comparison conservative in their attitude, and their constitutions do not contemplate much more than what they may consider a fair day's work for a fair day's pay. The consequence is that the leaders of these unions have been obliged to discountenance many of the demands of the radical elements in the local unions and in the national bodies. They have been obliged to urge conservatism in the actions of the unions and they have been obliged to recognize the social responsibility which goes with organization power.

These interests have failed to meet the desires and wishes of the radicals and they furnish the groundwork upon which the irreconcilable socialists in the ranks of labor have formulated their propaganda in favor of organizations like the Industrial Workers of the World and in favor of a regrouping of local unions for a larger and broader program of labor demand. The propaganda issued by these irreconcilables is very frank, may be termed brutally frank without overstating the case. It is directed equally against the American Federation affiliations and against the so-called capitalist. It is not only strong propaganda, but it is intelligently written in such a way as to inspire the greatest resentment, to magnify the irritation which may exist in the mind of the worker who is not satisfied with union action and to keep the industrial unrest constantly seething.

Radical Element Took Advantage of War Conditions

Attention is called to it at this time because the detailed reports of occurrences in many industrial cities would indicate that this propaganda is affecting a larger section of the working population than it did before the war and that the indefatigable workers who are behind it are taking advantage of the conditions which have existed during the war and during the armistice period, when the American Federation of Labor has frowned upon excessive demands and strikes, to push this propaganda to the uttermost. The importance of this problem is accentuated by the racial conditions in many of our large industrial centers where the mixture of races provides fertile ground for the promulgation of theories which can be so plausibly presented. Their fundamentally destructive character is not understood by the workman, who is allured by their promises and incited by their denunciations. The Americanization of these races has not yet progressed to the point where they are familiar with the ideals, the machinery and the inherent value of representative organizations. They know little or nothing about economic facts, their traditions arise out of political backgrounds which form excellent soil for such propaganda, and they are worked upon, in almost all cases, by members of their race who are thoroughly familiar with their ideals, their racial instincts and their political history.

The men who are committed to this sort of propaganda, who are committed to control industry and not merely to democratize it, who can see no value in industrial peace under present organizations or modifications of them, but who are engaged in keeping alive the unrest and stimulating it on the theory that warfare must inevitably lead to the control of industry by the workers, these men cannot be reached by any decent organization means. They will not countenance any orderly method of improvement and they are not concerned with organization developments looking to industrial peace and the preservation of the best elements of the present system, which has lasted a good many years and which has so much of important value. Wherever the local unions or the local workers get into the hands of these irreconcilables and are induced by them to organize for the purpose of their deliberately excessive demands, there is no hope of arriving at a solution until the power of the organizers over the local body of workers is broken. No attempts at adjustment will stave off the trouble where this occurs, and strikes and probable trouble in connection with the strikes must be expected.

Counteracting the Irreconcilables

The conservative body of workers who have no desire to see this sort of program succeed and the more powerful members of the affiliated unions who are as little in sympathy with this program as are the manufacturers, are of importance in combating this propaganda, and careful, co-operative and educational methods will aid very greatly in stabilizing the situation. The large body of the workers who are temporarily misled by the specific promises of such agitators and who are allured by their indefinite pictures of the future, can be reached by the manufacturer if time and patience is expended in understanding the workers' position, the workers' point of view and the things which he really desires.

At no time in the history of developments in the United States has the old Scotch business philosopher's statement been of such importance as it is to-day. The statement that it was vitally necessary for the executive to understand those who were under him while there was no corresponding probability of the converse. It is this necessity in the labor situation which demands a degree of patient consideration and a degree of faithful promotion, by the manufacturer, of all plans prepared for the improvement of the worker's condition and and a constant education of all supervisors, so that a confidence may be established which will itself be the most effective means of combating the minority propaganda with its persistent attempts to maintain the industrial unrest.

The other day a manufacturer made the statement that the workers' demands were unreasonable, that they did not seem to appreciate the fact that if their demands were acceded to the business could not continue, and they did not seem to understand or care about the fundamental economic facts. There is no doubt that in a good many of the local strikes which have occurred in the last few months the demands of the local bodies of labor have been excessive and the statements of the leaders of many of these bodies have borne a remarkable resemblance to the propaganda of the I. W. W. and similar irreconcilable radical bodies.

The Influence of Inadequate Education

An examination of the educational work which is done in the schools, a little understanding of the atmosphere by which these men are surrounded, a careful study of the reading which forms a large part of their means of acquiring information indicate that it would be very remarkable if they showed any understanding of the fact that their demands are excessive or any appreciation of the economic fundamentals.

In the public education in the various states of the Union and in the high school education, very little attention has been paid to the proper teaching of the reasons for industrial organization. As it is, in very few cases have manufacturers concerned themselves with the character of the education or the surroundings of their workers, and even where educational processes have been

(*Continued on page* 1094)

The Webb Law in Operation

Two Views of the Act Permitting Combinations for Export Trade—The Legal and the Business Viewpoints—How Combinations May Be Affected

By Allen Sinsheimer

AS a result of study by legal and business authorities, two distinct views of the Webb-Pomerene law, authorizing combinations of American manufacturers for export trade, have been developed.

One conception foresees legal pitfalls for all combines organized under its authority and predicts that business will find itself mired in a quicksand of trouble, with consequent penalties. This is the view of the lawyers, who naturally note chiefly the legal disasters that may arise from the phraseology.

The other view is optimistic. It foresees the Government co-operating, for the first time, with business, rather than acting the part of the overseeing policeman. This view prophesies that through the Webb law business may promptly develop export trade and compete equally with foreign manufacturers. It pronounces the bill to be the most important step taken to advance and maintain American foreign trade. This is the view of business men who have studied the act and some few lawyers whose perspectives reach beyond the merely legal aspect.

Both views were discussed at the recent Foreign Trade Convention at Chicago, where all the manufacturers present voiced a unanimous approval of the act. More than eighty combines have already been organized, it was stated, and are functioning without difficulty.

As it stands, the Webb-Pomerene act authorizes American manufacturers to organize combinations to engage in foreign business which will not be called illegal under the Sherman act.

The pitfalls pointed out by various lawyers are found in Section 2, which is to the effect that any combination organized under the Webb law will be found guilty of illegal practices if it restrains trade in the United States or restrains the export trade of a domestic competitor or artificially or intentionally increases or decreases the prices of its commodities sold either in foreign or domestic markets.

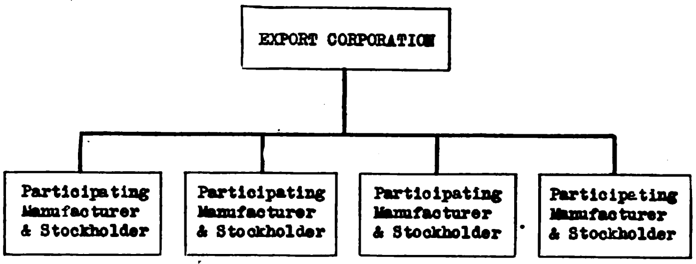
Three Questions Which the Lawyers Ask

Under these legal limitations lawyers find three questions arising:

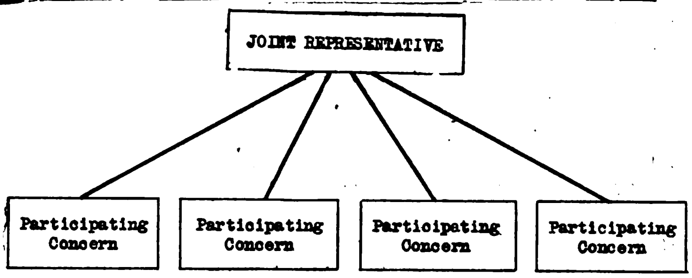
1. If a combination of American manufacturers exports such quantities of merchandise as to diminish the domestic supply and thus force an increase of domestic prices, will it be enhancing prices in the United States in conflict with the provisions of Section 2?

2. If a combination of American manufacturers undersells another combination of American exporters abroad to the extent that the competitor's business is ruined both abroad and at home, will it be acting in restraint of trade?

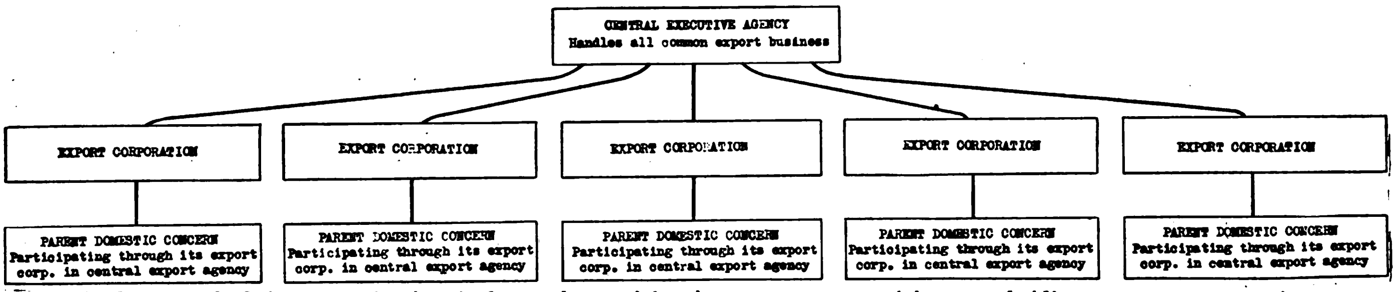
Three Methods of Organizing Export Combinations Under the Webb Law



The most commonly used method is the organization of a corporation by a group of manufacturers with the participating concerns as stockholders. The export corporation operates as an independent concern



Another, and very simple, form of organization is that where the participating concerns form an association by joint agreement through a joint representative who assumes charge of the foreign business



A third method for organization is by each participating concern organizing a subsidiary export corporation with each of these entering into an agreement for handling all export business through a central agency

Practically all of the manufacturers and some of the legal advisers, including John Walsh, former chief counsel of the Federal Trade Commission, were inclined to regard these questions as being more or less superficial. They believe that the act, which in itself for the first time in legislative history does not provide a penalty for the first violation, but merely a recommendation by the Federal Trade Commission to violators, was intended by Congress to be purely an aid to American business and not an obstacle. The possible pitfalls caused by the legal limitations will be accepted, it is thought, by the Federal Trade Commission in a broad light, and no attempt will be made to prosecute concerns unless they practice dishonest or positively unfair methods. In other words, it will be the policy of the Government, according to the manufacturers' viewpoint, to co-operate with American business throughout, and manufacturers may combine under the provisions of the act and plan to engage in foreign business without fear of any Government interference, provided they engage in honest business.

May Undersell Competitors

Question No. 1 was disposed of by the general acceptance of the belief that manufacturers who would meet and pledge certain quantities of their supplies for export once each year prior to the beginning of the year's campaign could in this way display their honest intentions and be able to overcome any legal questions that might arise even if the domestic supply were thus diminished and domestic prices increased as a result.

American combinations organized under the act may undersell their American competitors abroad regardless of the provisions of Section 2 if they can prove that their methods of production and operation of business warrant their sales at lesser prices. In other words, in answer to Question No. 2, they may undersell if they do it by fair and honest methods.

Question No. 3 was answered by statements that American manufacturers might sell a commodity abroad for less than the domestic prices without enhancing domestic prices if the foreign prices were reduced to meet foreign competition. If, however, prices are reduced only in certain localities abroad merely to meet American competition or without justification, this, it was thought, would be regarded as an enhancement of domestic prices.

It is unfortunate that the provision in Section 2 was drawn in its present manner, for it creates a situation whereby the Sherman law is suspended in behalf of American exporters yet at the same time is held over the exporter as a club in the event of violation. It can be assumed, however, that the Government will not undertake to penalize an export association for openly practising methods it regards as proper under the law, but it will probably be well for the protection of associations to constantly keep the Commission informed of the practices planned and engaged in.

Act to Be Broadly Interpreted

That a broad view of the act may be expected of the Commission is displayed in its statement that: "It is not reasonable to suppose that Congress meant to obstruct the development of foreign commerce by forbidding the use in export trade of methods of organization which do not operate to the prejudice of the American public, are lawful in the countries where the trade is to be carried on and are necessary if Americans are to meet competitors there on more nearly equal terms."

That the act will allow combinations to engage in many practices not directly export trade but indirectly connected with it was the opinion of Mr. Walsh, who stated: "Although the act strictly defines 'export trade' and exempts from the penalties and restrictions of the Sherman act only 'an association entered into for the sole purpose of engaging in export trade and actually engaged solely in such export trade,' still it must be assumed that the Congress had in mind the fact that under the corporation statutes of the various states and the District of Columbia every corporation is vested automatically with certain incidental powers and that it would be a practical impossibility to form a corporation with no powers other than that of being engaged solely in export trade.

"It is a general rule of law that a corporation possesses not only the powers specifically conferred upon it by its charter but also such as may be fairly implied from those powers, including all that are essential to the declared object of its existence. Therefore, it may be fairly assumed that an export association may among other things establish and maintain agencies and act as agent in foreign trade, acquire, equip and operate wharves, warehouses, elevators, ships, and acquire, dispose of, pledge, mortgage or lease property, real or personal, subject to legal restrictions, and to do many other acts incidental to the business of export trade."

Phraseology of Doubtful Meaning

Other sections of the act also include phraseology and provisions that should have the attention of exporters. Section 1 indicates, for example, by the words "exported from the United States to any foreign nation" that export products must actually be sent to a foreign nation. Again, by the use of the phrase "or selling for consumption or for resale" within the United States, Congress has left opportunity for misunderstanding. It is clear that an export association must not sell for domestic consumption, but it is not clear whether such an association may manufacture for consumption or resale in the United States.

Section 3 allows a corporation to hold or acquire or own any part of the stock of an export corporation which is organized actually to engage in export trade unless the holding or owning of such stock will restrain trade or lessen competition within the United States. This will allow associations to take over the export department of some established manufacturer if they so desire.

Section 4 provides that any exporters who are engaged in unfair practices which interfere with or obstruct free competition, such for example as selling below cost, will be found guilty of illegal methods. This section is a powerful one and can be used to prevent all trickery and fraud.

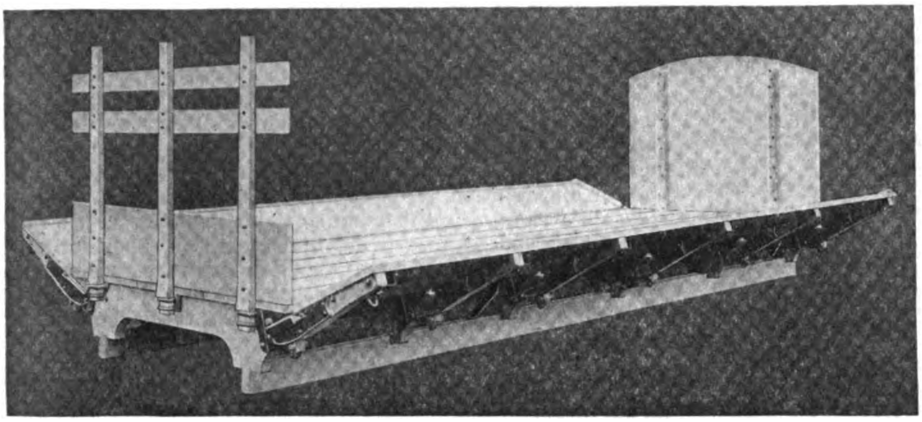
Export Associations Must File Statement of Ownership

Section 5 provides that every association formed to engage solely in export trade must file a statement with the Federal Trade Commission within thirty days after its creation, giving the names of its officers and stockholders, its by-laws, if any, and make like statements each year. The second paragraph of Section 5, which provides that the Federal Trade Commission when it discovers any violations of the act may summon the officers of an association and make recommendations for readjustments, is designed to enable the Government to guide export associations definitely and to avoid the confusion which has resulted in business circles since the passage of the Sherman law.

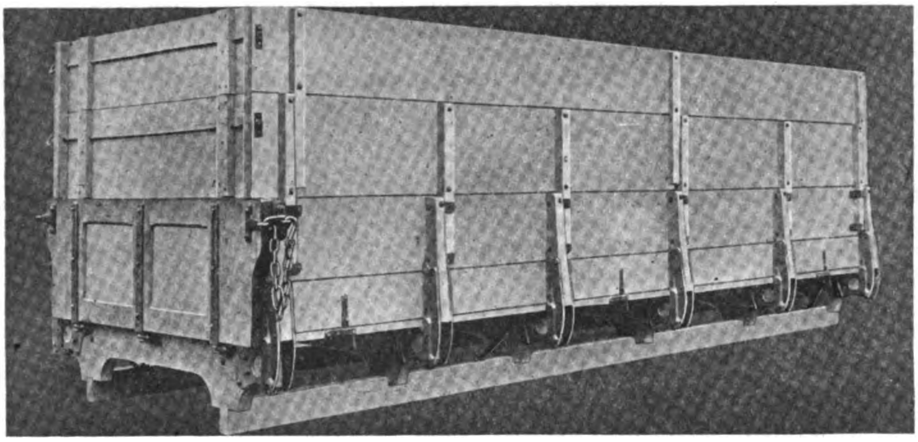
The use of the term "foreign nations" is taken to mean any land except the Hawaiian Islands, Porto Rico, Alaska and the United States proper. The term "commerce" is taken to imply navigation, and consequently grants permission to operate ships for both export and import.

Republic All-Purpose Farm Truck Body

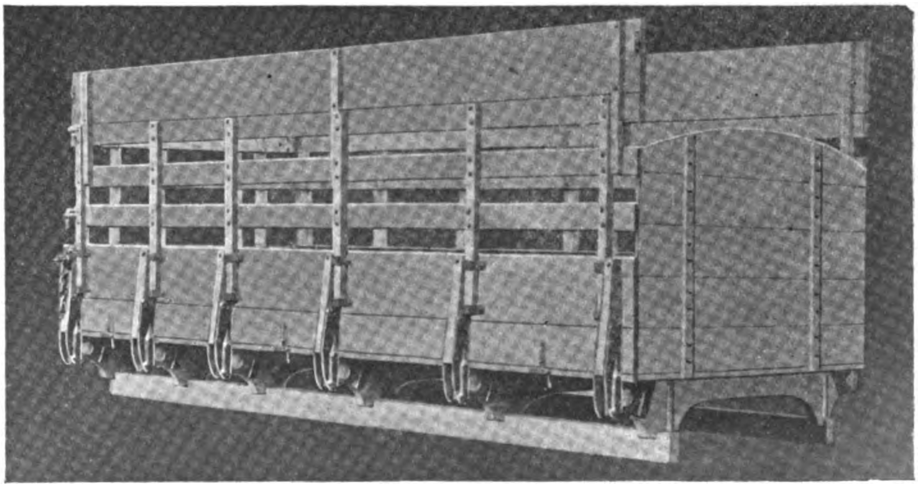
Can Be Quickly Converted for Different Uses Covering the Whole Range of Farm Haulage



Platform hayrack useful in hauling hay, wheat, oats, cornstalks, etc. By using a different set of supporting stakes we obtain a platform with level extension side boards, head board and end gate, suitable for hay, grain in bags, cement in bags, fertilizer in bags, fruit produce in crates, poultry in crates, farm machinery, dressed meats, fence posts, etc. Entirely removing the extension boards makes a platform type truck with head board and end gate adapted to stone hauling and other heavy duties



Three-section tight removable side box for barnyard fertilizer, cabbage and bulky produce. Removing top side boards makes a combination grain, apple and potato box with two-section tight removable sides. Removing the remaining side boards gives a regulation wagon box with removable sides and end gate arranged for hauling loose materials such as coal, dirt, gravel, grain, etc.



Cattle rack type adapted for hauling cattle and also transporting cotton and similar materials requiring a rack enclosed body. Removing the side boards converts this into a combination stock and basket rack box suitable for hauling hogs and sheep and crated goods

AN all-purpose farm body has been brought out by the Republic Motor Truck Co., Inc., of Alma, Mich., for use with Republic trucks. The body is designed to give the farmer a wider range of use for his truck. Eight types of bodies are combined in one, and so designed that one man can adjust it to any desired type in a few seconds.

The body is made of kiln-dried hardwood lumber and well ironed so as to prevent rattles. It is made in two sizes, known as Nos. 1 and 2. The No. 1 body is 9½ ft. long and is a combination platform and wagon box, as illustrated. The bare body sells for $115.

No. 2 body is 11½ ft. long and is a combination platform and wagon box, as illustrated, selling for $135.

The extra side racks to convert the body into grain, fruit and cattle type are $33 on the No. 1 size and $36 on No. 2. The weight of the No. 1 body, combination platform and wagon box only is 500 lb., and of No. 2 600 lb. All the paint work on these jobs is standard green with light green stripes.

Some of the different types of bodies are illustrated and the purposes for which they are intended are outlined.

This is apparently one of the first attempts to solve the truck-body problem from the standpoint of the use of motor trucks on the farm. Loads of such wide variety have to be transported in this service that convertible bodies are really essential.

The FORVM

Liquid Fuel Injector

By Henry B. Higgins, Jr.

THE primary object of the device shown in the drawings is to simplify the "direct-injection" type of oil engine so that its use becomes practicable in the relatively small, high-speed units employed in trucks, tractors and similar service where operating conditions are often severe and good care is seldom available.

The most efficient means yet devised to insure the perfect combustion of fuel oils consists in spraying them direct into the combustion chamber by means of a jet of compressed air as the piston begins its working stroke. This charge may be ignited as it enters the chamber by means of an electric spark, hot surface, or the heat of the suddenly compressed injection air, or by the Diesel method.

The advantages of this type of engine over those operating on the Otto cycle, employing atmospheric carbureters, mixers, etc., together with various heating arrangements, are well recognized. Following are some of them:

They start readily on their regular fuel without priming, preheating or other preliminaries (except where hot surface ignition is used).

They are flexible in operation and not particularly sensitive to atmospheric variations.

Thorough combustion of the fuel is secured, practically eliminating smoky exhaust, fouled cylinders and valves, and the serious troubles incident to dilution of the lubricant by unburned fuel.

As no fuel is present in the working cylinders until used, preignition is impossible, eliminating the need of water injection.

Combustion is not explosive; hence high compression may be used without excessive pressures ensuing, making for good fuel economy without excessively heavy construction.

It follows that they are longer lived and more economical, both of fuel and lubricating oil, generally using from 0.4 to 0.7 lb. of fuel per brake-horsepower hour.

In addition to economical operation, higher volumetric efficiency is possible, due to the induction of cold air and the absence of throttling or wire-drawing action of the atmospheric carbureter (necessary to provide sufficient air velocity to break up the fuel) upon the incoming air.

The principal factor which has confined these advantages to comparatively large engines has been the expensive, complex and rather bulky apparatus necessary for the supply of injection air. This usually consists of a two- or three-stage compressor, air cooler, receiver and high-pressure piping and connections, besides the admission valve to the atomizer.

Attempts have been made to avoid these by the use of the "solid-injection" system, wherein no air is used, fuel being sprayed into the cylinder by a high-pressure pump and atomizer under a pressure of 2500-3000 lb. per square inch; but so far they have not been entirely successful, partly owing to troubles with the high pressure fuel pump and connections and partly to the inferior quality of the spray entailing higher fuel consumption and dirty operation.

The device shown avoids the complications of the usual compressed-air system, while retaining its desirable features, to which it adds another—that regardless of whether the engine is being cranked over or running at full speed the quantity and pressure of the injection blast are absolutely uniform and a good spray can be depended upon, without undue wastage of high-pressure air, under all conditions.

It is applicable to either two- or four-cycle engines, and overcomes the usual objections to the two-cycle—backfiring in the base and loss of fuel through the exhaust ports while charging, thus increasing the usefulness of this simple and durable engine.

In effect, the system under discussion is a two-stage compressor, the compression in the working cylinder not only supplanting the first stage but also acting upon a small differential piston to further compress a small portion of itself for fuel injection. Except for a cam and rocker arm, or their equivalent, to time this operation by giving the small piston a slight initial lift off its seat, a check valve and the piston itself, which is practically frictionless except for the packing rings requiring little or no lubrication or attention, the device has no moving parts, and this slight added complication is more than offset by the elimination of the troublesome carbureter and ignition system.

While a small plunger pump for each cylinder is the most reliable method of measuring and supplying fuel for each atomizer, some form of gravity or low-pressure feed may be utilized, as it does not have to encounter any pressure. Any form of "open-type" atomizer may be used, those shown being among the simplest.

Figs. 1 and 2 show the injector applied to a two-cycle engine igniting by high compression and will serve to illustrate its operation.

In Fig. 1 it is ready to operate. Working piston *A* is nearing the top of its stroke and cam *K* is on the point of depressing the end of rocker arm *J*. The space above compressor piston *C* is filling with air at cylinder pressure, through valve *N*.

It should here be noted that the bottom face of compressor piston *C* is divided into two parts by the seat *D*. One portion, *E*, communicates with atmosphere through vent *H*. The other, *F*, is open to cylinder pressure. However, the area of the top face, *G*, of piston *C* is a little greater than that of *F*, therefore piston *C* is held tighter upon its seat as the pressure increases.

In Fig. 2 working piston *A* reached its firing point and cam *K* slightly lifted compressor piston *C*. The instant that this took place, vent *H* was cut off and the entire bottom face of piston *C* exposed to cylinder pressure, which caused this piston to move rapidly up and forcibly eject the air above it through atomizer *M*, spraying the oil contained therein into working cylinder *B*. A small space is left between passage *L* and the end of compressor cylinder *I*, in order to provide an air cushion for piston *C*.

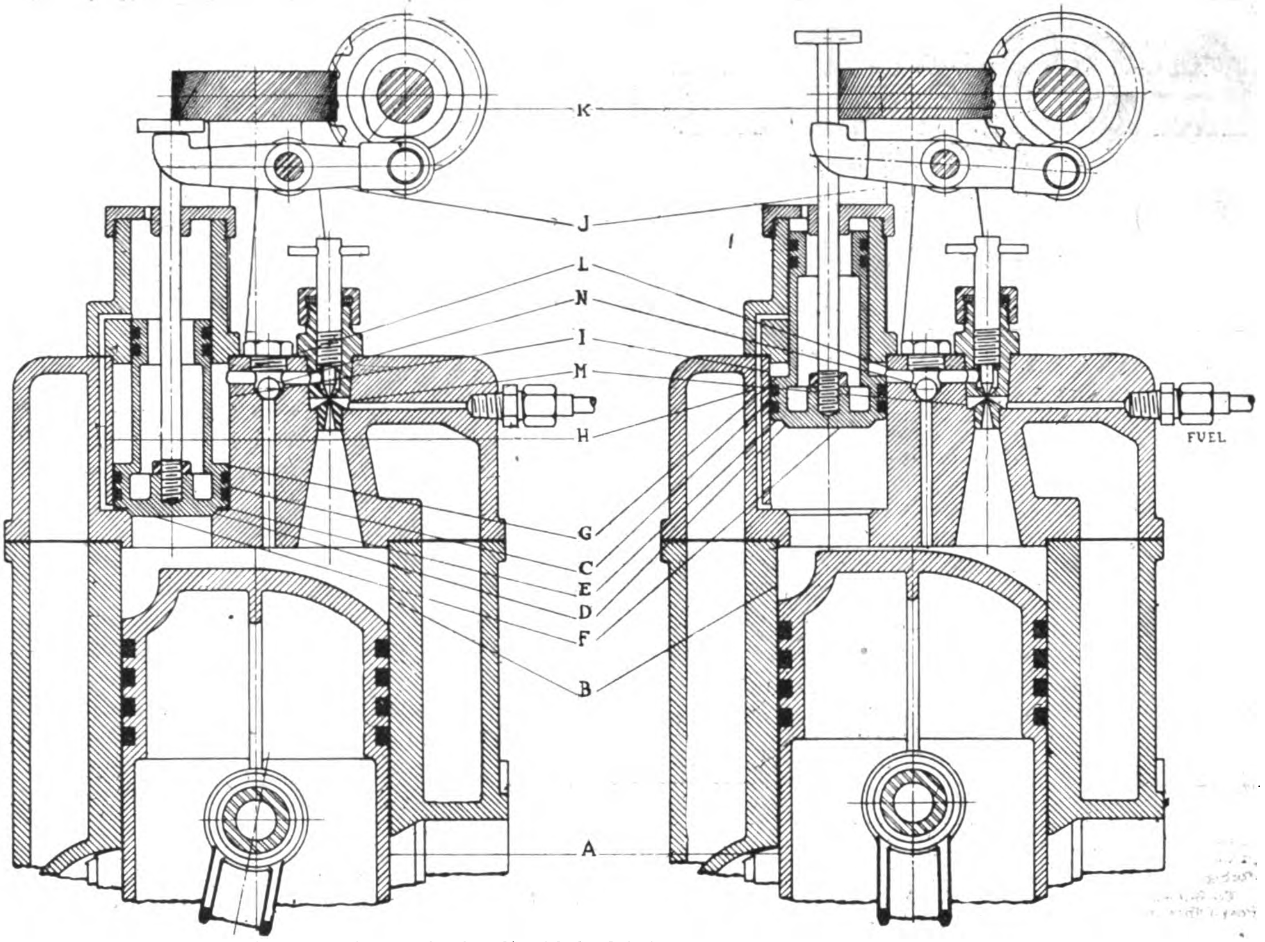
If the device is designed to compress to 350 lb. per square inch or more, the heat of the suddenly compressed air will be sufficient to ignite ordinary fuel oil before it leaves the atomizer, blowing it into the combustion chamber in the form of a flame. If it is desired to use lower compression, ignition may be effected by a spark plug or hot surface placed in its path.

The slight partial vacuum in the working cylinder during the charging period of the cycle (either two- or four-stroke) should be sufficient to return compressor piston 3 to its seat, or a light spring may be used if faster action is desired.

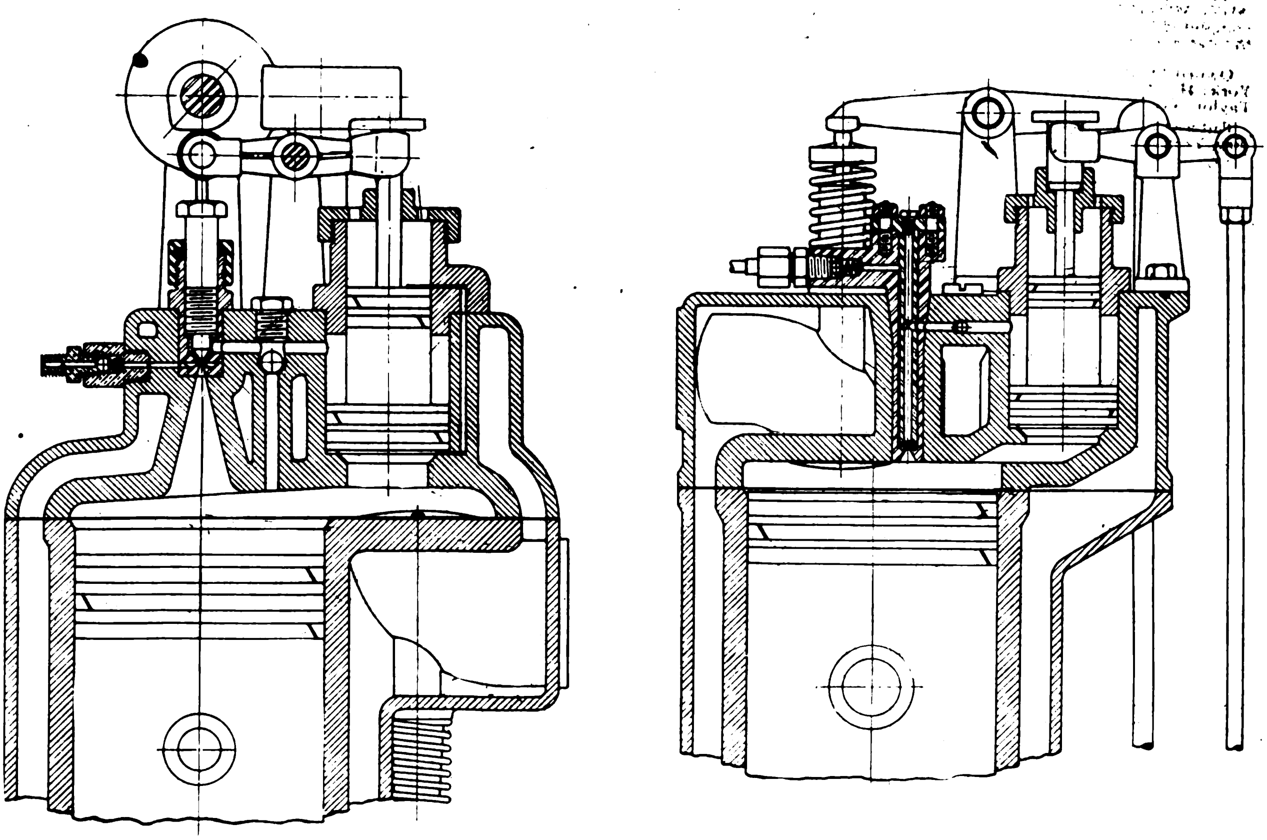
Fig. 3 shows a possible application of the injector to a four-cycle L-head motor, and Fig. 4 shows it in connection with a valve-in-head type.

A minor improvement is also shown in Fig. 4. A portion of the lift rod for compressor piston *C*, just below its head, is enlarged, this enlarged portion fitting into a counterbore in the upper head of compressor cylinder *H*, as the piston nears the bottom of its return stroke. The compression of air in the pocket thus formed serves to cushion the piston and prevent its unduly pounding upon seat *D*.

In conclusion, the drawings only show the principle of the device. Its various details may be arranged to conform to almost any type or size of engine. It is cheap to manufacture, and for most engines would involve no great changes in design. It involves no new and untried theories, but is merely an adaptation of the already successful large stationary and marine oil engines to the smaller units of the automotive field.



Figs. 1 *and* 2—*Higgins liquid fuel injector applied to two-stroke engine*



Figs. 3 *and* 4—*Application of Higgins liquid fuel injector to four-stroke L-head and valve-in-head engines*

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL. Thursday, May 15, 1919 No. 20

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address - - - - Autoland, New York
Long Distance Telephone - - - - 8760 Bryant, New York

SUBSCRIPTION RATES

United States and Mexico - - - - One Year, $3.00
Canada - - - - One Year, 5.00
Foreign Countries - - - - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS

Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Webb Act Will Aid Export Business

LESS legal advice and more sound business judgment should be the guide to exporters who consider forming combinations under the Webb Act.

The engineer believes that all the success of the automobile business lies in design. The production manager thinks it is all in manufacture. The sales manager will tell you it is entirely a matter of sales policy. And similarly the lawyer sees only the legal technicalities in the Webb Act.

He notes only how you may entangle yourself with the law and not how the law may help you to untangle export trade. He finds only the pitfalls in which combines may be caught and overlooks the sound government support by which industry can escape the pitfalls in foreign business.

The Webb Act is stated in its title to be specifically an act for the promotion of foreign trade. It was definitely intended as such by Congress and any attempt to use it for the entanglement of business would be a perversion.

That the legal authorities are wrong seems evident in the verdict of the Federal Trade Commission, which also finds it a law for the benefit of industry and not intended as a club over it.

It is a safe and sound opinion that American manufacturers may combine under the authority of the Act and develop a vast export trade regardless of the legal possibilities of the law so long as they conduct a fair and honest business.

The Aerial Convention

IT is obvious that the aircraft industry needs effective propaganda at the present time. Under Government nursing it has grown to large size in a few years, and now that Government support has been practically withdrawn, the industry has to stand on its own legs, as it were, which will be a difficult experiment at first.

All other branches of the automotive industry were successfully promoted by competitions and exhibitions in their earlier years, and there is no reason to doubt that the same method should be successful when applied to the airplane industry. The aircraft convention, exposition and contest being held this month at Atlantic City is a parallel to the "Nice weeks" of former years. Nice occupies much the same position as a shore resort in Europe that Atlantic City does in America. At Nice the automobile, the motor boat and the airplane have successively had their innings, and efforts were made there specially to promote the sale of the more expensive and luxurious cars, boats, etc.

Atlantic City has not figured very prominently in motor sports so far. There can be no question, however, that it is a suitable place for spreading the gospel of aerial transport. During the month there will probably be several hundred thousand visitors at the resort from all parts of the country, as well as some from foreign countries. These will largely represent the wealth and the business interests of the country, and if a favorable impression can be made with these classes, a very good beginning will have been made toward popularizing the airplane.

The program which is being carried through consists mainly of illustrated talks on different phases of aircraft work. Among the possible applications of aircraft covered in these talks are forest patrol, police service, mail service, overland and overseas transport and exploration. There will be talks on the medical, legal and insurance phases of aerial travel. Numerous are the contests for which prizes are offered, and with the exception of the prize for the transatlantic flight from Atlantic City, all are likely to be won during the month, as the conditions attached to them do not appear at all difficult in view of the progress made in airplane construction.

There is also scheduled for the end of the convention a series of engineering sessions. It is very likely, however, that the lectures and discussions (if any) will be of a popular character, though dealing with the engineering phases of the airplane.

Legislative Meddling with the Fuel Problem

CALIFORNIA legislators recently took it upon themselves to solve the motor fuel problem by law and in about a week's time introduced no less than three bills embodying proposed standard specifications for gasoline, in the State Legislature. Happily this legislation was smothered, but inasmuch as it is very likely that other states will venture similar legislative action in the future, it may not be amiss to show the futility of the thing.

It is true enough that purchasers of motor fuel are experiencing certain difficulties with the product sold them. Gasoline is not what it was ten or fifteen years back. But we have long become reconciled to the changing quality of gasoline and have endeavored to adapt our engines to it. It is not a matter of human perversity but of immutable natural laws. The amount of petroleum which can be pumped from the earth is limited; in fact, according to figures given out by representatives of the Fuel Administration, the whole unmined supply will last only for about a score of years. The demand for gasoline is increasing faster than that for any other petroleum products, and to meet it the oil companies have found it necessary to increase this supply by every known means, such as including heavier fractions and rendering the fuel usable in engines by blending with casing-head gasoline, converting kerosene or gas oil into gasoline by the cracking process, etc.

The Law of Supply and Demand

How the law of supply and demand is asserting itself in this connection was well brought out in a recent lecture by a representative of the Bureau of Mines, who said that the cost of processing was substantially the same for kerosene and gasoline; that the only reason gasoline sold at about twice the price of kerosene was that the demand for gasoline was relatively much stronger.

This inexorable law of supply and demand will continue to assert itself, and if we wish to have all the fuel we will need for the rapidly growing number of gasoline engines we will be obliged to use heavier and heavier fuels in spite of whatever legislation we may pass. If we stipulate that gasoline must not show lower than 60 deg. Baumé at 60 deg. Fahr., then most of us will soon have to burn something called by a different name—and the change in name will not help us in our carburetion difficulties.

The problem of standard specifications was taken up some years ago and we thought that the subject had been definitely laid aside, the conclusion having been reached that such a standard would have to be continually modified and therefore would be of no practical value. If a specification should be adopted that called for a really high-grade gasoline the result would be that, owing to scarcity of the available supply, the price of such a fuel would soon rise beyond all reason, and every garage would be compelled to sell another grade of fuel, at a price within the reach of the average consumer. It is self-evident that, with the more volatile fractions removed, this motor fuel would be less volatile and less burnable than what we now burn as gasoline. If we have understood the Bureau of Mines correctly, it has maintained the standpoint that the solution of the fuel problem lies in using straight-run fuel; that is, a blend of all the fractions of crude petroleum which can be successfuly burned in modern engines. If legislation like that proposed in California should be adopted widely throughout the country the effect would be just the opposite. The class of automobile owners to whom money is no object, who as a rule own the latest models that are best adapted to burn the heavier or poorer grades of fuel, would buy the high-grade fluid, and leave the man in moderate circumstances, with his superannuated machine with weak fuel-digestive organs, to get along as best he may with the poor stuff. Instead of remedying that fuel situation such legislation would really aggravate it.

Another reason why legislation of the character referred to is objectionable is that when it is taken up by different states and handled in different ways it will lead to confusion. What a burden it would be to the petroleum refiners if they had to produce and store gasoline of different grade for each State! Also, the engine manufacturer could hardly be expected to turn out different classes of engines to suit the "legal fuels" in different states. The lot of the engine manufacturer and the engine user would certainly be the easiest if one uniform grade of fuel were sold throughout the country—the best that the proportion of demand to supply would allow. And sectional legislation of the character proposed in California, instead of furthering this end, would defeat it.

America's Lead in the Motor Industry

EUROPEAN automobile manufacturers are not unmindful of the fact that from the beginning of the war, when all passenger car manufacture for private account stopped with them, for a period of four years the American industry continued to improve its designs, and as a result has achieved a substantial lead in motor car construction. Some have sent representatives to this country to study our latest practice, while in one or two instances American designing talent has been engaged abroad to introduce our methods.

Previous to the war European and especially Continental manufacturers looked upon the American chassis with scorn. It was said, for instance, that it would never satisfy the artistic taste of the French purchaser. Possibly at the present time in France the exigencies of commercial life are a stronger factor than the artistic instinct. At any rate, American achievement in the automobile line is no longer deprecated and literature on our methods of design and production is in demand abroad.

Latest News of the

Saxon Reorganization Plan for Formation of New Company Perfected

New Corporation Will Be Financed by New York and Chicago Bankers —Digest of Plan—Creditors to Receive Stock for Value of Claims Against Present Company

DETROIT, May 13—The Saxon Motor Car Corp. refinancing plan continues to make steady progress. Matters directly connected with the securing of additional capital necessary to put the company on its feet have not been completed by the creditors' advisory committee as yet, but will follow when all details connected with the proposed reorganization are effected. All of the bankers and the majority of the merchandising creditors have approved of the plan which calls for the formation of a new company to be capitalized for $6,450,000, the liquidation of all present stock, and the assuming of all liabilities by the new organization. The creditors are to receive stock for the value of their claims against the present company. The present stockholders are to be given stock in the new company according to the present plan.

Since June, 1917, the affairs of the Saxon corporation have been conducted by an advisory committee of creditors, consisting of: Chairman, William J. Gray, vice-president of the First & Old Detroit National Bank, Detroit; Ralph Van Vechten, vice-president, Continental & Commercial National Bank, Chicago; C. R. Talbot, vice-president, National Bank of Commerce, Detroit; C. W. Dickerson, treasurer, Timken-Detroit Axle Co., Detroit; W. R. Angell, secretary, Continental Motors Corp., Detroit; W. S. Thomas, vice-president and treasurer, Wagner Electric Co., St. Louis.

Has Paid Off 30 Per Cent

This committee has kept the company solvent through the application of a general liquidation policy and the extension of outstanding notes. Every 6 months the books are balanced, 10 per cent payment on obligations made, and the paper renewed. The company is now on its fourth 6-month period and has paid off 30 per cent of the original indebtedness with 6 per cent interest. The company's standing indebtedness to date is now approximately $2,450,000.

The new company is to be refinanced by New York and Chicago brokers, who have tentatively agreed to underwrite the stock. This matter, however, has not been formally settled inasmuch as the committee in control has had its hands full since the first of the year in, first, obtaining a 6-months time extension on outstanding obligations, and, second, in securing the consent of each individual creditor to the proposed reorganization plan. With the exception of a few minor creditors the indorsement of all has been approved, and the next step will be the taking up of the financing project with the brokerage firms.

A digest of the reorganization plan of the Saxon Motor Car Corp. is as follows:

The advisory committee of creditors who have been in charge of Saxon Motor Car Corp. affairs since June, 1917, will cause a new company to be organized to be called The Saxon Corp., and to acquire the title to the assets of the present company through application of claims of the depositing creditors. It is contemplated to organize with the following capitalization:

$2,000,000 in principal amount, 6 per cent gold bonds;

$1,250,000 issue of 8 per cent cumulative preferred stock;

$3,200,000 common stock, $100 par value, each.

War Conditions Affected Reorganization

The committee states that under war conditions previously existing it was impossible to interest capital in the enterprise, and that it is now apparent that a complete reorganization must take place. Efforts to induce the stockholders to work out some plan of reorganizing have failed. The enforced policy of gradual liquidation has reached its limit, and unless new capital is immediately secured to carry on the business, manufacturing activities must cease.

The present indebtedness of the corporation is approximately $2,400,000. The assets at book value exceed this indebtedness by $250,000, but in event of enforced liquidation the assets would bring but a fraction of the book value.

Creditors Will Take Stock

Under the plan, the present creditors will take stock equivalent to the value of their claim. Responsible bankers are ready to furnish capital by the purchase of bonds and preferred stock if the creditors take stock in payment of claims. The underwriters propose to manage the reorganized company for a period of from 3 to 5 years. If it is found impossible to transfer the assets of the present company to a new corporation, then the advisory committee, in the opinion of the creditors, should take steps to sell the assets of the company.

Common stock in the reorganized company will be deposited with trustees for a period of 3 years. This stock will be evidenced by the trust certificates, to be issued by the trustees, to be delivered to creditors as stockholders in the new company, but a continuing option will be given the banker to purchase within 3 years shares of the par value figures of $2,400,000, plus annual interest at 6 per cent.

Willys-Overland Strike Now a Matter of Principle

TOLEDO, May 14 (*Special Telegram*) —Watchful waiting is the policy adopted by both Willys-Overland Co. and their idle employees. The situation remains unchanged. Both sides refuse to give in an inch, but nevertheless an air of expectancy prevails. Toledo is full of rumors that an agreement is near. Since Saturday morning daily conferences between the workers and the company have been held, but an agreement seems far away.

Though the strike was called as a result of a controversy over hours, it has gradually taken the aspect as to whether or not Toledo will remain an open or closed shop town. The Merchants and Manufacturers Association has indorsed the Willys-Overland stand and brought down upon its head the wrath of unionized labor. The whole affair has developed into a matter of principle, not of hours, and the radical element predicts a general walk-out unless the cause of the strikers is victorious.

On the other hand, it is said the manufacturers are prepared to suspend all operations if serious difficulties develop. Both sides are leaving no stones unturned in their efforts to prolong the struggle.

Willys-Overland stockholders held their annual meeting Tuesday, and endorsed the stand of the company in handling the strike. A general assessment of 50 cents a day has been levied on all union men in Toledo. The boilermakers and iron shipbuilders have voted to stand by the Willys-Overland strikers, and other unions will take the same action, it is said.

In a statement to-day the Electric Auto Light Co. says it is prepared to operate its plant 48 hours a week if the majority of the workers approve such a schedule. This company is a subsidiary company of the Willys-Overland.

Automotive Industries

At the annual stockholders' meeting the Willys-Overland Co. elected the following directors: John N. Willys, C. A. Earl, James E. Kepperly, Edwin B. Jackson, C. O. Miniger, Royal Scott, F. K. Dolbeer, Edw. F. Swift and Rathbun Fuller.

Spacke to Produce Low Priced Car

INDIANAPOLIS, May 13—The Spacke Machine & Tool Co. will begin producing within the next four weeks a car which will be sold for $295. It will be known as the Spacke and its builders claim that it will go between 40 and 50 miles on a gallon of gasoline. The company expects to be able to turn out 30 of these cars a day, and if present plans are carried out over 10,000 will be produced during the coming year.

The car is a roadster, seating two persons, and is equipped with the Spacke 9-13 De Luxe twin cylinder air cooled engine. Fully equipped, the car will weigh about 700 pounds. It will have a wheelbase of 90 in. It will use tires 28x3 in., and will have demountable wire wheels. The seats will be of the bucket type, the body of pressed steel. Atwater-Kent ignition will be used with hand control on the dash.

The car is equipped with two speeds forward and one reverse in a planetary system. Camshaft drive with helical gears is fitted on the machine and the lubrication is of the eccentric pump and splash type. The gasoline feed of the car is gravity with a foot accelerator. The body will be painted a battleship gray.

The manufacture of the car will be confined to the present factory and a new assembly plant, while Factory No. 2 will continue to produce car axles.

General Motors Issues $50,000,000 Stock

PONTIAC, May 14—General Motors Corp. has issued $50,000,000 additional cumulative 6 per cent debenture stock to provide increased working capital. This brings the total outstanding up to $85,315,000. The amount authorized is $150,000,000.

Capt. Lepere President of the Franco American Engineering Co.

DETROIT, May 15—Capt. Georges Lepere, who came to this country in 1917 as chief engineer of the French aviation mission to America, is remaining as president of the Franco-American Engineering Co. here. Capt. Lepere is the designer of the Lepere fighting plane. The company is doing consulting engineering work on cars and engines as well as airplanes.

8-Hour Day Voted by French Parliament for All Industries

Involves No Wage Reduction but Increased Production—Agreement Already in Effect in Some Factories—General Satisfaction with Scheme

PARIS, April 26—The 8-hr. day voted by the French Parliament will affect the entire automobile industry of France. The engineering trades of France, however, had not waited for the Government decree before reducing the number of working hours to 8 per day.

Early in March the men's unions approached the French Union of Metal Industries and Mines with a view to the adoption of the 8-hr. day. The manufacturers declared their willingness to meet the representative of the workers, and although considerable difficulties had to be overcome a satisfactory agreement was arrived at for the entire metal industries of France, including mechanical construction, naval engineering, and electrical work. The men's delegates signed the agreement on behalf of 200,000 workers. Even among the socialistic element it is recognized that the manufacturers displayed a broad and generous spirit throughout the negotiations.

Production to Be Speeded Up

In the agreement between masters and men, it is recognized that there shall be a general speeding up by the adoption of more modern methods of shop practice, so that the output shall be the same under the 8-hr. day as under the old system. At the same time it is clearly understood that the reduction in the number of working hours shall not be accompanied by any reduction in wages. When men are paid by the hour there will be an increase in the rate, so that the same weekly salary can be earned.

The agreement went into effect 2 or 3 weeks before the law was passed. But even before this agreement, some of the automobile factories had adopted the 8-hr. day. One of the first to make this change was M. Laurent Seguin, head of the Rhone & Gnome Aviation & Automobile Co. Mr. Seguin was convinced that the 10-hr. day, 60-hr.-per-week system, in general use in France, was not economical. The men began work at 7 a. m. and left at 7 p. m. after having spent 2 hours over a heavy lunch. In winter work had to be done by artificial light at each end of the day, whilst 2 of the brightest hours of the day were spent in eating, or in going to and from the factory and home.

There was inefficiency at the beginning of the day, for the hour immediately following lunch, and during the last hour of the day. It was proposed that the men should work for 8 consecutive hours, with the exception of a break of one-half hour to take a light meal on the premises. This half hour is paid. The men now start work at 7.30 and quit at 3.30. Since this scheme was adopted by Rhone & Gnome it has been taken up by the Rolland-Pilain Automobile Co., at Tours.

This experiment is being watched with considerable interest. Officially it will not go into effect before June 1, 1919, but in many cases the 8-hr. day will be adopted immediately. In blast furnaces and other establishments where fires have to be kept going continuously, it will be necessary to modify the plant, and on this account the new régime will not be applied until 6 months after the signing of peace preliminaries.

In the agreement between masters and men, as well as in the Government law, provision is made for either 6 days at 8 hours each, or for what is known as the English week, under which the factory is closed on Saturday afternoons, the total working hours for the week not exceeding 48.

International Signals for Aircraft in Distress

LONDON, April 19—In a "Notice to Mariners," the Admiralty announces a provisionally agreed upon international code of distress signals for airplanes. The Board of Trade has also notified owners and masters of shipping. The announcement of the Air Ministry is as follows:

"In order to eliminate unnecessary risks of fatal accidents to aircraft and pilots, signals for aircraft in distress have provisionally been agreed upon by the International Aerial Sub-Committee of the Peace Conference in Paris and will be used in the future.

"The signals, which may be displayed by the aircraft, either together or separately, are as follows:

1. The International Signal "S.O.S." by means of visual or wireless telegraphy.
2. The International Code Signal of Distress indicated by N.C.
3. The Distance Signal, consisting of a square flag having above or below it a ball or anything resembling a ball.
4. The continuous sounding with any sound apparatus.
5. A Signal consisting of a succession of white Very Lights fired at short intervals.

"These signals are subject to such modifications as may be published from time to time."

Tire Prices Going Down

Reduction, Averaging About 15 Per Cent, Attributed to Plentiful Supply of Rubber

NEW YORK, May 12—Tire prices have been quite generally reduced, the average reduction amounting to approximately 15 per cent. Although it was expected that prices would eventually come down, it was not thought that the reduction would be made so soon, and the action has caused some surprise, particularly in view of the fact that late last week tire manufacturers stated that no reduction was looked for until June 1 or later. In fact some went so far as to offer reasons why the revision should be upward instead of downward.

Goodyear started the downward move, and was followed almost immediately by United States, Firestone, Goodrich and practically all of the other large makers. At this time there are very few makers who have not made public new lists with reductions ranging from 10 to 15 per cent, the average being approximately the larger figure.

The present reduction is laid largely to the plentiful supply of rubber, as well as to its low price. Last month a total of 24,000 tons came in as compared with a total of about 7000 tons the same month last year. Shipping is easing up to a noticeable degree and still better conditions are looked for in the immediate future.

The fabric situation is not in an altogether satisfactory condition. Since England placed an embargo on all Egyptian stocks, prices have soared and there is little, if any, available.

It is expected that some Egyptian stocks may be released soon, and this probably will cause a drop in fabric prices. The general tendency at present is toward a slight reduction. Factories are not buying in any quantities for future deliveries, most of them ordering only what they need and re-ordering as this is used up.

Chemicals, too, have been declining slightly, but against the reduction in costs of chemicals and fabric, there is the present high cost of labor. It is not expected that this will be reduced for some time to come.

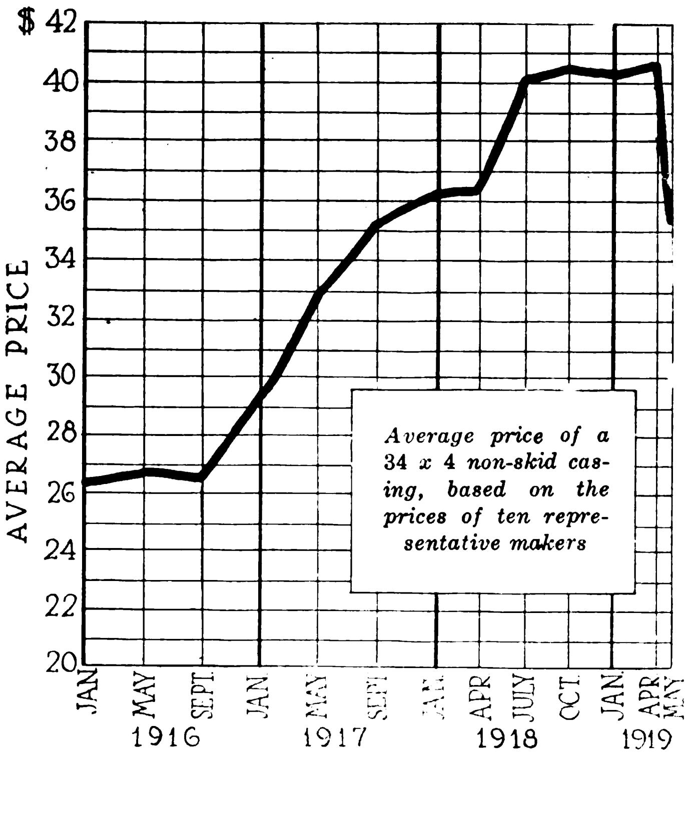
Tire prices have remained practically steady for nearly a year. The last general movement was an increase, this being made about April, 1918, when most makers added something like 10 per cent to their lists.

Prior to the present drop, prices had reached what is probably their record height. The average price of a 34 x 4 non-skid casing, considering the products of 10 of the leading manufacturers in all price-class fields, stood at $40.47.

Assuming that all manufacturers reduce their prices in accordance with the reductions made by the leaders, this average at the present time figures out at $35.43, which is very close to the average for September, 1917, as shown by the accompanying chart.

Tire prices first started on their upward trend in January, 1916, when most makers added approximately 10 per cent to their lists. A year prior to that, in February, 1915, makers had reduced prices by 10 to 15 per cent. The next rise came in December, 1916, when 15 per cent was tacked on; in April, 1917, another 15 per cent was added; in September, 1917, prices were raised from 5 to 15 per cent, this being the third increase in the year; and in April, 1918, another 10 per cent was added.

Just how long the present prices will hold it is difficult to predict. It is pointed out that crude has reached its lowest point for a number of years.



Average price of a 34 x 4 non-skid casing, based on the prices of ten representative makers

New Corporation to Take Over Red Head Spark Plugs

NEW YORK, May 10—The Red Head Spark Plug Corp. has been formed with principal sales offices at 261 Broadway, and has taken over the Red Head Spark Plug business formerly operated by the Emil Grossman Corp., Brooklyn, N. Y. The new company has no connection with the old one. It will continue and enlarge the business. An insulating plant has been opened at Newtown, Pa.

27,948 Tons of Rubber Imported in April

Figures Are 14,523 Tons Ahead of Same Month in 1918—Returning to Normal

NEW YORK, May 13—The removal of all government restrictions on the importation of crude rubber into the United States and the improved shipping facilities have combined to bring rubber imports back to normal. Figures for April show importation of 27,948 tons. The slight decrease from the 28,223 tons for March is undoubtedly explained by the irregularity of the shipping schedule at the present time. Figures compiled by the Rubber Association of America showing the importation figures for crude rubber for the past four years follow:

	1916 Tons	1917 Tons	1918 Tons	1919 Tons
January	9,162	12,788	16,084	7,235
February	1,597	10,162	13,108	14,079
March	10,070	18,624	17,161	28,223
April	10,014	13,000	13,425	27,948

Bulletin on Gasoline Issued by Bureau of Mines

WASHINGTON, May 13—Methods of analyzing and securing information of gasoline properties have been described in detail in a technical paper, Motor Gasoline Properties, Laboratory Methods of Testing, and Practical Specifications, by E. W. Dean, and issued by the Bureau of Mines, Department of the Interior, this week. The paper is an elaboration of an earlier paper on similar subjects.

The revision brings information up to date and includes methods of production, laboratory methods of analysis and outlines the principles upon which gasoline specifications should be based. The problem of writing specifications for gasoline is treated and specific recommendations are made regarding the limitations which are believed to be important. Figures specifying any particular grade of gasoline have not, however, been included, as it is believed by the Bureau that no single general specifications for motor fuel are either practical or desirable.

The properties and methods used for the analysis of gasoline are described in detail. Chief emphasis is laid upon the tests of greatest importance, such as distillation analysis, but in addition a description is included of most of the tests that are recommended or used either by the Bureau or by other organizations. Convenient forms for recording the results of analysis of gasoline are shown and the table is included for transforming Centigrade temperatures into Fahrenheit equivalents.

Wisconsin Axles to Have New Maker

OSHKOSH, May 12—The E. B. Hayes Machinery Corp., maker of Wisconsin axles, has been sold to the Wisconsin Parts Co., a new corporation capitalized

at $500,000. W. F. Rockwell, formerly vice-president in charge of engineering and production of the Torbensen Axle Co., Cleveland, is president and general manager of the new concern, and Louis Schriber, vice-president of the Old National Bank of Oshkosh, is treasurer. The Wisconsin Parts Co. will continue the manufacture of Wisconsin worm drive axles for trucks from 1- to 5-ton capacity. A tractor axle has also been designed and is in process of manufacture. The present capacity of the factory is 500 axles a month, and additions now being made will soon double the capacity.

—

Patterson Truck to Come from Los Angeles

DETROIT, May 12—J. Neil Patterson, Los Angeles, Cal., is in Detroit completing plans for the organization of a new company to manufacture trucks and trailers at Los Angeles. He was former president and is now vice-president of the Los Angeles Trailer Co.

The new company will bring out a truck to be known as the Patterson. It will be made of standard parts. It will have many new features to meet western conditions. Eastern as well as western capital is interested. Robert Fry of Detroit, until recently with the engineering department of the Motor Transport Division of the Army, is associated with Mr. Patterson as chief engineer.

—

Fellows Gear Shaper Extending Plant

SPRINGFIELD, VT., May 11—The Fellows Gear Shaper Co. will make further extensions to its plant, which was enlarged during 1918. A 2-story shop, 144 x 147, of brick and steel, will give an increased manufacturing capacity of 60 per cent. When the additional plant is in full operation, the 450 men now employed will be increased to 750. An office 42 x 102 will also be built. The top floor of the new office building will be occupied by the engineering and drafting departments, and the general offices will be on the second floor. It is estimated that the extension will cost about $200,000, not including equipment.

Overland Strike Is Still On

Manufacturers Siding with Overland Rousing Organized Labor —Workers Want 44-Hr. Week

TOLEDO, May 13—Rioting late Wednesday and Thursday afternoons at the plant of the Willys-Overland Co. caused Clarence A. Earl, vice-president and general manager, to order the plant closed indefinitely, making approximately 16,000 men idle. In issuing the order, Mr. Earl stated that he was closing the plant as the only way of averting bloodshed.

The Electric Auto-Lite Co. and the Ford Plate Glass Co. are also closed. Although the Willys-Overland Co. and a committee of Overland employees have been holding daily conferences since Saturday, no perceptible progress in adjusting the trouble has been made.

A new and grave crisis is developing which may involve the entire industrial section of Toledo. In a signed statement, published in all the Toledo papers, nearly 100 Toledo manufacturers endorsed the stand of the Willys-Overland Co. This statement has aroused organized labor to a high pitch and talk of a general strike is heard everywhere.

Mayor Schreiber is acting as the point of contact between the strikers and the company. His request that he be permitted to assist in bringing about a settlement was accepted by both parties. More than 7000 workers, at a mass meeting Friday, agreed to appoint a subcommittee to accompany the mayor to the Overland plant.

From the tone of the newspaper articles it is apparent that Toledo is badly split in its opinion as to justifiability of the strike. A big element is endorsing the stand of the company. The only point in question is the matter of hours. The workers are willing to stay on the job 8 hr. and 36 min. daily if they receive overtime for the extra 36 min. The company is steadfast in its determination to operate on a regular schedule of 48 hours a week without the overtime. It is on this point that the whole strike is based.

Governor Cox of Ohio has ordered George F. Miles, chief investigator of the Industrial Commission, to Toledo, to aid in bringing about a settlement. The police department has taken steps to deputize 3000 special officers to keep order in and about the plant.

—

National Organization for Liberty Highway

SPRINGFIELD, ILL., May 13—At its first annual convention held recently a national organization of the Liberty Highway Association was effected. Stephen Lawless, Liberty, Ill., was elected president and Truman T. Pierson, Quincy, Ill., treasurer and national organizer. Vice-presidents are: R. J. Holmes, Decatur, Ill.; C. A. Hetrick, Asbury Park, N. J.; Joseph T. Daniels, Columbus, O.; George A. Binkert, Quincy, Ill., and W. H. Conkling, Springfield, Ill. The organization has been formed for the purpose of having a hard surfaced highway built across the continent from ocean to ocean.

—

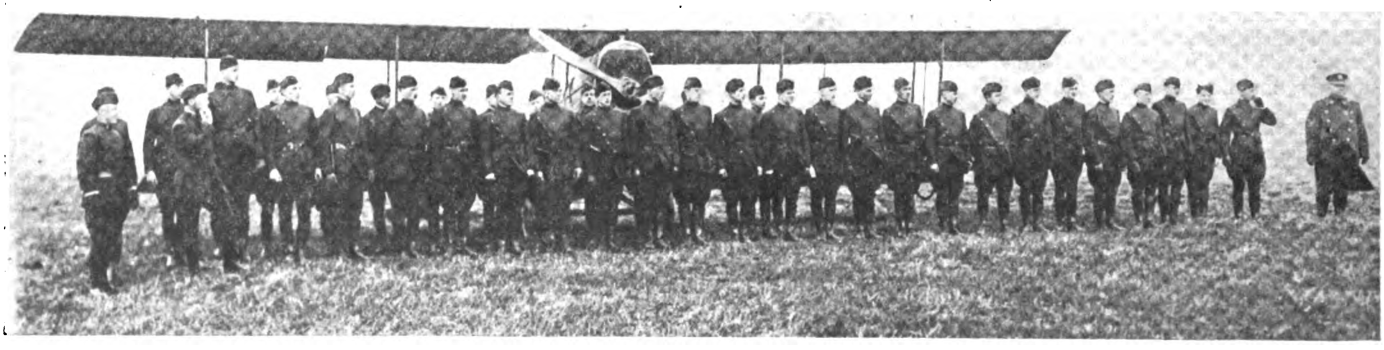
Dependable Truck to Move to Peoria

GALESBURG, ILL., May 11—The Dependable Truck and Tractor Co. is considering the removal of its plant and headquarters to Peoria. Plans have been completed for a building with 50,000 sq. ft. of floor space. C. W. Morse, who is at the head of the company, was formerly with the Locomobile Co. of America and later with the Pan-American Corp., Decatur, Ill.

—

Eisemann on Overtime Basis

BROOKLYN, May 14—The steady drift toward normal conditions in the motor industry, following the change of conditions due to the termination of the war, still finds the Eisemann Magneto Co. working full blast, with part overtime. The indications are that in order to maintain its record for prompt deliveries on its large bulk of commercial orders the entire Eisemann plant will be working to its capacity for some time to come.



Inauguration ceremony of Pioneer Wing of Police Reserve Air Service, making New York the first municipality with aerial police force. Two Curtiss JN-4D biplanes with 110-hp. engines were used at inauguration ceremonies. First flight was made to Philadelphia

Cheap Roads Increase Transportation Cost

National Highway Traffic Assn. Hears Practical Problems Discussed at First Annual Meeting

NEW YORK CITY, May 14—Upward of 75 attended the first annual meeting of the National Highway Traffic Association, an organization formed last November for the purpose of working for traffic betterment throughout the country. This organization had its inception several years ago as a local traffic organization for greater New York City. It was soon expanded into a traffic organization for the state of New York. The demands for solution of traffic problems from adjoining states suggested the desirability of making it a national organization and this was successfully carried out. The membership is now over 300.

Development of Rural Express

The subjects considered at yesterday's meeting had to do with the development of rural motor express. F. W. Fenn of the National Automobile Chamber of Commerce gave a complete summary of what has been accomplished throughout the country. J. H. Collins, Highway Transport Committee, Washington, outlined the necessary plans for making surveys for rural motor express routes, and James E. Boyle, professor of rural economy at Cornell University, analyzed the situation in New York state. He showed the fluctuating costs of farm products in different seasons due to lack of flexibility in highway transportation.

H. G. Shirley, secretary of the Federal Highway Council, Washington, referring to the work of the council, reported that it has 400 members and its work has been endorsed by 800 commercial organizations. The national character of the Federal Highway Council's activity is indicated by the fact that 43 state highway departments are now co-operating with the council and 68 different highway officials are represented in the council.

Road Cost

Geo. H. Pride, president of the Heavy Haulage Co., New York, an organization engaged exclusively in motor transportation between cities and in practically any field, declared that heavier loads must be permitted on the highways if cheaper transportation is to be obtained. He says it is possible to make money on inter-city haulage between New York and Boston if you are permitted to carry 7½-ton loads, but is not possible with 3 or 5-ton loads. His views on the problem of road cost are very practical. If expensive highways that will withstand heavy traffic are built the cost of transportation is lowered; but if cheaper highways are built that will not carry heavy traffic, the cost of transportation is increased. It is a case of six of one and half a dozen of the other. If you do not pay the bill in road-building you pay it in higher cost of transportation, and vice versa. In either case it is the general public that pays the bill.

First Aeronautical Exposition for Holland

WASHINGTON, May 14—During July and August an International Aeronautical Exposition will be held at Amsterdam, Holland, under the auspices of the Chambers of Commerce of Amsterdam and Rotterdam, the secretaries of the Interior, War, Agriculture, Commerce and Water Works, the governor of the province of North Holland and the chairman of the Royal Dutch Association of Aircraft. Foreign airplane industries will also take part.

The exposition will include aircraft and all aids to air transportation, but aircraft designed primarily for military use will be excluded. The motor industry will be represented as will parts and accessories. Demonstrations and air contests will also form part of the program.

Exhibits will be accepted commencing June 15. Further information can be procured from the commercial attaché of the Royal Netherland Legation, Washington, D. C.

U. S. Rubber Offers Common Stock to Employees at $70

NEW YORK, May 15—Employees of the United States Rubber Co. have been offered the chance to purchase common stock of the company at $70 a share. It is now selling on the market for $95. Employees will be given 5 years in which to pay for subscriptions.

Square Turn Tractor Elects Officers

NORFOLK, NEBR., May 12—New officers elected by the Square Turn Tractor Co. are: President and general manager, R. Florian; vice-president, G. S. Albaugh; vice-president, C. E. Burnham; treasurer and secretary, William G. Eppley; production manager, F. E. Wilson; sales manager, F. H. Squires; chief engineer, A. J. Colwell.

Claudel Carbureter in American Production

NEW YORK, May 15—The Claudel carbureter, patented in France in 1902, will be produced in America by E. J. Conill and Israel Ludlow. Offices here are in the Aeolian Building. The Detroit branch will be in the Garfield Building in charge of Frank R. Jackson, for many years with the Zenith Carbureter Co.

A. H. Doolittle, sales manager of the Zenith Carbureter Co. for several years, and lately general manager of the Sunderman Carbureter Corp., will be general manager.

Internat'l Harvester Makes $14,985,325

Statement for Year Combines Two Merged Companies—Effects of War

CHICAGO, May 14—The International Harvester Co., which is the company formed by the merging of the International Harvester Co. of New Jersey and the International Harvester Corp., shows an increase of $2,326,000 in its profits for 1918 over the combined profits of the two companies in 1917. A considerable part of the earnings came from the company's steel business, sales of motor trucks and government contracts.

Following is the complete balance sheet of the International Harvester Co. of New Jersey and the International Harvester Corp. combined for 1917, and the balance sheet of the merged companies into the present International Harvester Co. for the year ended Dec. 31, 1918:

ASSETS

	1918	1917
Property account, plant, mines and timber land, etc.	$65,694,250	$62,510,405
Inventories	114,516,302	78,682,825
Notes and accounts receivable	35,800,926	40,860,374
Fire insurance fund	1,258,950	1,258,950
Pension fund	1,000,000	....
Cash	28,040,060	35,258,327
Deferred charges	335,934	149,481
Investments	11,737,597	15,191,670
Funds withheld in Europe by war conditions	24,834,972	35,312,972
Total	$283,218,991	$269,225,004

LIABILITIES

	1918	1917
Preferred stock	$60,000,000	$60,000,000
Common stock	80,000,000	80,000,000
Bills payable	10,370,000	12,784,300
Accounts payable	35,882,912	29,052,928
Reserves	26,679,417	24,786,438
Preferred dividend payable	1,050,000	1,050,000
Common dividend payable	1,200,000	500,000
Surplus	68,036,662	61,051,338
Total	$283,218,991	$269,225,004
Profit	$14,985,325	$12,560,315

The 8-hr. day was made effective by the International Harvester Co. in all Amercan plants during the year and the wage increases have brought the present hourly wages 100 per cent above those of 1914. The French factory near Lille is being re-equipped after being stripped of all machinery and material by the Germans. The factory at Neuss, Germany, is under the jurisdiction of the allied army of occupation. The Russian factory near Moscow was running at last reports, but all American employees were forced to leave by the end of 1918. A few of the Russian branch houses are still in operation, but most have been

closed. To meet the depreciation of the Russian investment, $24,205,000 was charged off in the past two years. The Harvester industrial council adopted in March is now in operation in 19 of its 20 plants in the United States and Canada.

—

Government to Buy Airplanes

WASHINGTON, May 14—Plans of the Army Air Service are for the purchase of about 500 airplanes of the approved army types. Contracts have been prepared and sent to Secretary Baker for his consideration. The primary purpose is to keep the industry in sufficiently active condition to insure rapid expansion in case of emergency.

The seven types of planes approved by the Air Service, and which will probably be purchased, include the Le Pere observation, the Hoening monoplane, the Thomas Morse scout, the US-D 9-A day bomber, the Voight training plane, the Martin day bomber and the ordnance engineer pursuit plane. With the exception of the Voight, all of these types were developed in the United States during the war.

The Air Service also plans to further encourage the airplane industry by recommending that the War Department and other government agencies lend domestic manufacturers their assistance to develop markets for airplanes in South and Central America.

—

New Road Work Records Made in April

WASHINGTON, May 15—During April, 1919, the Secretary of Agriculture approved project statements for 120 Federal aid projects, involving the improvement of 923.53 miles of road at a total estimated cost of $16,261,326.51, and on which Federal aid in the amount of $7,528,550.68 was requested. This represents the largest number of project statements approved, the largest total estimated cost, and the greatest amount of Federal aid requested during any month since the passage of the Federal Aid Road Act in March, 1919, which surpassed all records in these items up to that month.

During April 55 road projects were approved and executed involving the improvement of 521.51 miles of road at a total estimated cost of $4,626,415.48, and on which $2,039,614.99 Federal aid was requested and set aside in the Treasury. In addition, agreements to cover 72 other projects were placed in process of execution during the month.

Up to and including April 30, 1919, statements for a total of 1057 projects had been approved, after deducting all approved projects cancelled or withdrawn by state highway departments. The 1057 projects involved 10,580.17 miles of road, a total estimated cost of $92,933,-121.81, and a total of $36,576,857.48 Federal aid. On the same date a total of 535 project agreements had been executed, involving 4,624.83 miles of road, a total estimated cost of $39,059,327.44, and a total of $15,614,929.61 Federal aid.

Reservations Coming Fast for S. A. E. Summer Meeting

NEW YORK CITY, May 15—Reservations for the summer meeting of the Society of Automotive Engineers to be held at Ottawa Beach, Lake Michigan, June 23-27, are coming in at the rate of 40 to 50 per day. Reservations with checks have been received from 250, and promises are that the hotel capacity will be sold out by June 1 or soon after.

It would be almost impossible to find a summer hotel better suited for such a convention. The exclusive use of the hotel for the period of the convention will enable the members to get better acquainted, and to talk over matters relating to engineering that they have not had an opportunity to do since the war. The professional program is being so arranged that approximately 50 per cent of the time will be free for discussion of papers and addresses. Instead of having two sessions per day, one in the forenoon and one in the afternoon, there will be an extra long morning session and no sessions in the afternoon.

A new feature of the meeting will be hour lectures each evening after dinner and before the dancing starts at 9 o'clock. These lectures are to be on popular subjects, some related to engineering and others not.

Arrangements are being made for the entertainment of the women. Forenoon lectures by important women outside of the society are being arranged. There will be various amusements, sport tournaments, and other diversions.

—

Curtiss Seeks Injunction for Commercial Sale of Government Planes

BUFFALO, May 14—The Curtiss Aeroplane & Motor Corp. has begun suit in the United States Court to restrain the United Aircraft Engineering Corp. from selling airplanes purchased from the British government in Canada to buyers in the United States. The Curtiss company alleges that the sale of these planes would be an infringement on 13 patents which it owns, some of them controlling and others covering certain structural features of the planes. The bill states that the planes were manufactured by the British government in Canada under rights granted by the Curtiss company on condition that they were to be used only for war purposes, that is, for training in Canada only.

—

Building Back to Commercial Work

BOSTON, May 14—The Ford Motor Co. building in Cambridge, which was turned over to the Quartermaster Department early in the war, was returned this week to its owner. Since the beginning of the war the Ford building has been the chief quartermaster store for the Boston district and a vast quantity of army supplies have been shipped from there. Considerable readjusting will be necessary before the building is ready for the assembly of cars. The offices on Brookline Avenue have been moved back to Cambridge.

—

All Air Pilots Must Be Licensed

WASHINGTON, May 10—All civilians who pilot aircraft, including seaplanes, airplanes and balloons, must obtain licenses from the joint Army and Navy Board of Aeronautic Cognizance. A heavy fine is attached to operation without license. Application can be made to Lieut. A. J. Clayton, Building D, Sixth and B streets, Washington, D. C.

—

May Buy More Hispanos

NEW YORK, May 15—It is reported that the Government shortly may place orders with the Wright-Martin Co. for a quantity of Hispano-Suiza engines. It is stated that the order may amount to $5,000,000.

—

Lauraine Magneto for Long Island City

LONG ISLAND CITY, May 14—The Lauraine Magneto Co. is building a factory here and will move its machinery from its Menominee, Wis., plant to the new building shortly. The new structure is 150 x 100 ft., giving a floor space of 15,000 sq. ft., and having a capacity for 50,000 magnetos in 1919. Plans call for doubling production facilities next year, giving an output of 100,000.

—

Stevens Named Rex Vice-President

PONTIAC, May 14—Guy N. Stevens, assistant secretary of the Olympian Motors Co., has just resigned, to become vice-president and treasurer of the Rex Tool & Machine Co. He is also assistant secretary of the Power Truck & Tractor Co., Detroit.

—

French Tractor Design

(*Continued from page* 1049)

is a very compact machine with engine forward, engine base and gearbox in one casting, and drive taken to all four wheels. The machine has four speeds, two of which are calculated for use in the field, and two when the tractor is employed on the road.

The Gnome & Rhone machine is marketed under the title of the Aurore. It is being sold at $2,400, which is a very low price compared with other and similar machines shown at the demonstrations. One of its features is the use of a detachable strake of a very simple and practical nature. This is in three sections for the entire circumference of the wheel, and is attached to the latter by means of lugs in the inner face which pass through holes on the wheel rim and are then secured by a bolt. The entire set can be fitted in five minutes and taken off in less tha ntwo minutes.

—

Erie Tire Ready for Production

SANDUSKY, OHIO, May 9—The Erie Tire & Rubber Co. will begin manufacture about Aug. 1. The company will specialize in cord tires and tubes. It is organized under the laws of Ohio with

an authorized capital stock of $1,000,000, half of which is 7 per cent cumulative stock and half common stock. The officers are: President, C. H. Berlekamp; vice-president, H. H. Forest; treasurer and general manager, P. F. Wills; secretary, C. H. Roth.

—

Advance in Steel Plates

NEW YORK, May 14—The Lukens Iron & Steel Co. is the first to raise the price of steel since a free market was created by the abandonment of the stabilization plan by the government and the industry. It has raised the price of steel plate $2 a ton. Although this is the first move toward an increase in steel there is a general feeling in the industry that it is a forerunner of a general rise in prices.

—

Appleton Engine Works in New Building

APPLETON, WIS., May 10—The Appleton Engine Works has purchased a vacant building at 1019 College Avenue and after remodeling and enlarging the structure will transfer its entire operations to the new location. The capacity will be increased threefold when the improvements are completed June 15.

—

Young Industries Buys Factory in Jackson

DETROIT, May 10—L. A. Young Industries, Inc., has purchased the factory of the Borden Mills Co., Jackson, Mich., with 150,000 sq. ft. of floor space, and will announce shortly the purchase of another plant in the state. Both of these factories will be operated as part of the wire division of the company, and men and machinery will be removed from Detroit to operate them.

Ford Planning Foreign Production

Factories for Italy, France, Russia and Germany—Assembly Plants for Smaller Countries

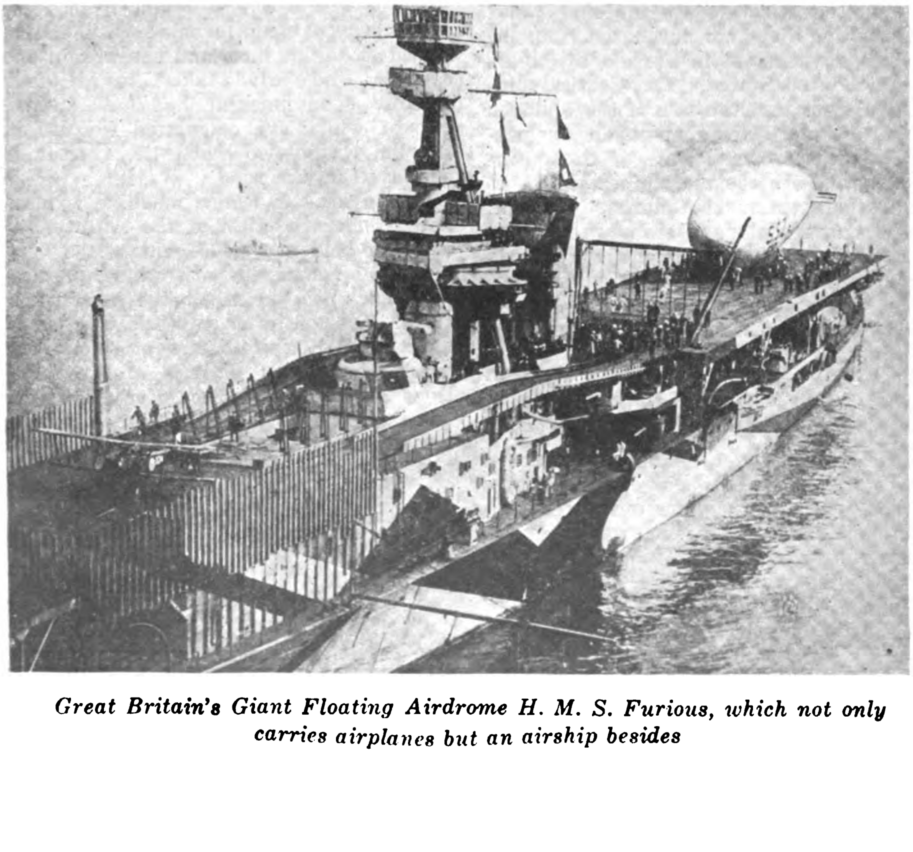
DETROIT, May 12—Ford Motor Co. officials state that as soon as the peace treaty is signed, immediate steps will be taken for building several assembly plants in European countries, besides factories in many of the foreign nations such as Italy, France, Germany and Russia. In the smaller countries such as Denmark, Spain and Portugal, assembly plants will be erected with an average capacity of 100 cars per day. These latter plants will be the first constructed and will become the clearing houses for the parts supplied to them from the Detroit and Manchester, England, factories. Cadiz and Copenhagen have already been decided upon as cities where assembly plants will be erected, each to cost approximately $350,000.

By this system the Ford interests expect to be able to place on the European market at least half a million cars annually. It is but a question of weeks when the Paris and Bordeaux offices of the company will be re-opened.

Ford officials will not deny that the present sites decided upon for tractor plants are Troy, N. Y., and Pennsgrove, N. J., and that the Troy plant will also manufacture the standard Ford car.

At the Ford plant, figures obtained show that from April 28 to May 6 inclusive, 21,761 cars were manufactured, being a daily average of 2720. The most productive day during this 8-day period was April 29, which shows a total output of 3312, and May 1 the smallest output, 2651. For the month of April, which contained 26 working days, the plant's output totaled 69,947, a daily average of 2689. The actual number of unfilled orders April 20 was 80,283, which was increased to 88,528 on May 8.

Ford officials are confident that, beginning June 1, the daily average output will be 4000, and that the number for the present year will exceed 1,000,000. This enormous output of cars requires the services of approximately 40,000 men. The number now on the Ford payroll, which includes the car, shipbuilding, blast furnace and carbureter plants, is 53,650.



Great Britain's Giant Floating Airdrome H. M. S. Furious, which not only carries airplanes but an airship besides

Fordson Production After Inventory

DETROIT, May 12—The Fordson Tractor plant at Dearborn is starting production again after a 15-day suspension of operations for inventory. While it may be two or three weeks before the company gets into full production, operations started this week with a fairly large force. The company found that it was overstocked with certain materials and to bring conditions to a balance again, operations are being pushed in the over-stocked departments and curtailed in those where conditions are normal.

—

General Motors Discloses Further Plans

DETROIT, May 9—Plans for the development of the General Motors property on both sides of Holbrook Avenue have been disclosed with the application of the General Motors Corp. to the city council for permission to run two sidetracks across Holbrook Avenue. This tract will contain an engine plant, differential gear plant, a die shop, heat-treating plant, forge shop of the Central Forge Co., and an axle plant. Later a large truck assembly plant will be erected. The land comprises nearly 60 acres. The new plant of the Cadillac Motor Car Co., Detroit, has been planned for the old American Car & Foundry site on Scotten Avenue and will be one of the largest of the General Motors projects.

—

War Contracts Reduced from $5,600,000,000 to $500,000,000

WASHINGTON, May 12—More than 90 per cent of the war contracts placed and outstanding on Nov. 9, 1918, have been completed either by termination or delivery, being reduced from $5,600,000,000 to $500,000,000. Cancellations and suspensions reported for the two weeks ended April 12 totalled $70,000,000, and delivered $50,000,000. Following is the status of cancellations on April 12 of the air and motor contracts:

	Bureau of Aircraft Production	Motors and Vehicles
Contracts outstanding Nov. 9, 1918a	$672,849	$441,691
Reductions since Nov. 9, 1918, by termination	498,039	294,288
By deliveries	160,000b	126,827
Remaining outstanding	14,810b	20,626

(a) Some items include subsequent commitments.
(b) Estimated; subject to revision.

Petroleum Products for February

Production Decreased Slightly But Stocks Are Satisfactory and Position Is Good

PRODUCTION

	February, 1919	January, 1919
Crude oil (bbl.)	25,232,876	26,967,332
Gasoline (gal.)	283,518,194	303,710,556

STOCKS ON HAND

	Feb. 28, 1919	Jan. 31, 1919
Crude oil (bbl.)	14,820,601	15,380,185
Oils purchased to be re-run (bbl.)	1,176,483	1,088,264
Gasoline (gal.)	458,449 187	383,212,692
Kerosene (gal.)	303,062,436	332,393,181
Gas and fuel (gal.)	692,816,000	646,411,414
Lubricating (gal.)	152,297,163	158,370,431
Wax (lb.)	209,908,707	189,064,329
Coke (ton)	33,716	28,732
Asphaltum (ton)	102,547	93 027
Miscellaneous (gal.)	500,413,825	483,942,833

WASHINGTON, May 14—Although production of both crude oil and gasoline shows a slight decrease over January figures, stocks of gasoline and fuel oil on hand show an increase, marking the tendency to catch up with production to some extent. At the present time the stock of gasoline on hand is 75,236,495 gal. more than it was in January and there are 46,404,586 gal. more fuel oil on hand.

Almost all through 1918 the consumption of petroleum products exceeded the production. It was almost the end of December before the production was in excess of consumption. In January, 1919, both production and consumption dropped to some extent. However, consumption dropped to a greater extent than production, thus improving the general situation.

During February the position continued to improve, and a curve showing the situation would indicate that production for the month was decidedly above consumption. Obviously consumption, so far as use by passenger cars is concerned, was at a low point in February, as in other winter months, but road transport by truck has been on the increase and was maintained throughout the winter on a larger scale than heretofore.

N. A. C. C. Will Fight Chassis Tax

WASHINGTON, May 13—The National Automobile Chamber of Commerce has filed a protest with the Treasury Department against the rulings on the tax for chassis. Under the present ruling, if a manufacturer sells a chassis directly to a consumer there is one tax of 5 per cent paid. If a manufacturer sells a chassis to a dealer there is no tax paid by the manufacturer if the dealer knows for what purpose it will be used, and fills out certain necessary papers. If, however, the dealer is unable to definitely specify how the chassis will be used, by whom, etc., the manufacturer pays a tax of 5 per cent.

If the manufacturer sells the chassis to a distributer and he in turn sells to a dealer both pay a tax. If a dealer sells a chassis he pays no tax unless he attaches a body to it, when it is regarded as a manufactured vehicle and again becomes subject to taxation, 3 per cent for a truck and 5 per cent for a passenger car. It is expected that there will be some time required before the tax department will give a new ruling on this.

P. T. Tractor Wheel Acquired by Wm. Wharton

EASTON, PA., May 14—The Wm. Wharton Jr. Co., associated with the Trylor-Wharton Iron & Steel Co., has acquired the patent rights and will manufacture the P. T. wheel for tractors and trucks. The P. T. wheel, originally an Italian invention, was formerly made in the United States by the P. & T. Wheel Corp., Dayton, Ohio. A complete description of it appeared in a former issue of AUTOMOTIVE INDUSTRIES.

Building Factory for Transport Truck

MT. PLEASANT, MICH., May 10—Work on the new plant of the Transport Truck Co. has commenced. The buildings will cost $150,000 and will be ready for operation before the end of the year. The officers of the company are: President, M. A. Holmes; vice-president, H. E. Chatterton; secretary, W. D. Hood, and treasurer, A. E. Gorham. The capital stock of $1,000,000 is half paid in. At the company's present quarters two models are being built, a 1½-ton and a 2-ton truck. When the company gets into its new factory two more models will be built.

50% Detroit's Contract Claims Approved

92 Per Cent Filed—70 Per Cent Aircraft Claims Recorded—Problems of Settlement

DETROIT, May 12—Greater progress has been made in this district by the Government Claim Adjustment Board during the past 30 days than at any other time since the organizations were established to aid the war contractors in getting settlements of war contracts. Approximately 92 per cent of a total of 236 claims have been filed with the Ordnance Claim Board. The total value of these contracts now up for settlement or already settled at Washington is approximately $25,000,000. The percentage of claims approved at Washington is about 50 per cent.

40 Per Cent of Aircraft Claims Approved

During the last two weeks things have not moved as fast with the Aircraft Board as with the Ordnance organization. All of the big aircraft claims are still out and may not be filed for some time. Approximately 40 per cent of the total of aircraft claims in this district have been approved at Washington. Thirty per cent are now before the board and 30 per cent remain to be filed. Officials of both boards, however, predict that settlement matters will move rapidly from now on. Many points which have been holding back claims have been cleared up at Washington and new regulations are greatly simplifying the work of the board.

Claims officials declare they have received no information from Washington relative to the suspension of work May 15. They look upon the publicity sent out by the Secretary of War's office calling attention of contractors to the necessity of filing their claims before May 15 or seeking redress elsewhere as a rather crude method of stirring the contractors into action. There is no question, however, but what this publicity has had a marked effect, as more claims have been filed within the last two months than during any other period. All boards will continue to function as in the past until

Output of Refineries of the United States by Months

1918	Crude (bbl.)	Other Oils (bbl.)	Gasoline (gallons)	Kerosene (gallons)	Gas and Fuel (gallons)	Lubricating (gallons)	Wax (pounds)	Coke (tons)	Asphaltum (tons)	Miscellaneous (gallons)	Losses (bbl.)
January	23,842,587	2,300,334	242,632,044	119 358,184	547,866,248	56,623,425	39,2'8 858	41,216	54,854	70,995,829	1,078 181
February	23,386,676	2,298,333	234,324,618	121,218,320	510,165,397	58,300 914	35,087,337	42,371	42,033	75,134,088	983 992
March	26,239,662	3 696,872	269,627,968	151,228,007	587,985,804	69,308,351	43,597,019	44,248	56,901	94,865,148	1,097,489
April	26,201,544	3,956,244	293,396,162	153,703,682	578,255,341	71,022 204	40,173,524	45,674	51,242	89,242,012	1,182,020
May	28,510,698	4,112,023	319,391,202	160 590,760	631,586,209	79,589,735	42,544,633	48,864	60,449	88,627,491	1,269,281
June	28,140,479	3,483,270	315,023,445	151,840,252	628 842,033	74,420,996	41,317,794	46,605	50,321	81,110,922	1,282,177
July	29,170,718	5 951,537	332,022,095	156,828,826	658,439,682	79,303,107	41,691,551	48,914	58,433	159,374,139	1,338,304
August	28,534,275	6,376,353	330,335,046	149,678,850	671,113,871	72,892,879	41 829,516	51,759	59,715	163,345,034	1,337,327
September	28,390,431	5,485,747	314,595,959	164 963,798	653,085,050	70,593,079	42,704,894	48,052	49,157	138,201,963	1,236,834
October	29,237,767	5,571,847	314,251,318	164,928,640	661 780,441	72,244,633	43,470,132	48,870	51,878	166,109,867	1,161,545
November	27,411,636	3 857,754	312,968,640	169,278,105	604,403,494	72,178,602	49,642,007	51,393	35,387	75,430,160	1,236,818
December	26,958,157	3,474,890	291,744,465	161,742,713	587,873,987	64,987,842	43 847,092	41,747	37,596	84,273,730	1,352,657
Total	326,024,630	50,565,204	3,570,312,963	1,825,360,137	7,321,397 557	841,465,767	505,144,357	559,663	607,968	1,286,710,383	14,556,625
1919											
January	26,967,332	3,919,492	303,710,556	158 501,260	589,630,056	68,304,613	44,987,603	59,003	54,074	92,324,236	1,183,767
February	25,232,876	3,997,025	283,518,194	164,181,787	553 853,753	62,503,072	42,702,886	57,200	41,348	88,515,735	1,115,040
Total	52,200,208	7,916,517	587,228,760	322,683,047	1,143,483,809	130,807,685	87,690,489	116,203	95,422	180,839,971	2,298,807

orders bringing work to a stop are issued at Washington.

While contract settlement delays caused many local concerns financial embarrassment, no real hardships resulted except in a few isolated cases. Four firms agreed to a 75 per cent settlement in order to get immediate cash, leaving the remaining 25 per cent to be settled later when the government completes checking up invoices and claims.

It was not until March 2 that Congress passed the law permitting settlement of informal contracts by validating them. Until the Dent bill became a law, the adjustment boards were limited to action on formal contract claims only. Inasmuch as more than two-thirds of all war claims in this district were of an informal nature, the majority of the work of both boards was held up, awaiting congressional action.

The greatest problem of settlement resulted from the action of the government in shifting all contracts from a fixed price basis to a cost plus 10 per cent basis. This caused all companies affected to make radical changes in their manufacturing plans. There are companies who will be heavy losers as a result. For instance, a certain automobile company contracting for the manufacture of shells at a fixed price carries a large portion of its employees on its regular automobile payroll contemplating a big profit on shell manufacture by cutting overhead to a minimum. It filed with the government a cost estimate on the price of shell manufacture according to that plan. When the government automatically switched contracts to a cost plus 10 per cent basis, the company having already gone upon record regarding shell production costs, was obliged to start up its munition work as separate departments, hiring additional men and conducting the work at excessive expense if not actual loss. There are others in the same fix, it is said.

All contract adjustment boards say it will be along in July before the last claims have been filed and settled.

Pan American Convention

WASHINGTON, May 12—The Pan American Convention, which will be attended by delegates from various industries of the United States and representatives from the Pan American countries, will be held in Washington, June 3-6, at the Pan American Building.

Detroit Will Hold Prosperity Dinner

DETROIT, May 10—The May meeting of the Detroit Section of the Society of Automotive Engineers will be preceded by a prosperity dinner to be held at the Hotel Pontchartrain. The meeting will take place on May 23 and the dinner is scheduled for 6 p. m.

At the meeting held immediately after the dinner, Prof. W. T. Fishleigh of the University of Michigan will talk on "An Automotive Nation Victorious, and Its Prime Demands Upon Manufacturers, Engineers and Educators." The banquet speaker will be announced later.

Stagnation in British Car Industry

Production Small and Prices High—Used Car Prices Soaring—Buyers Offer Premiums

LONDON, ENGLAND, May 1—Uncertain conditions in the automobile industry, and a stronger spirit of procrastination than has been seen since the first of the year, continues.

In Coventry, which is one of the big centers, there is a dominating spirit of comparative stagnation in the industry. No one as yet seems to have gotten under way. Some makers are blaming labor. There are intimations that the salvation of the British motor industry rests in the influx of new blood into many of the older organizations. There are three or four firms coming into the industry from other branches of engineering and these have the necessary capital and apparently the proper spirit of progress.

There is a big amalgamation coming through in the automobile industry which points to the fusion of the Armstrong-Whitworth Co. and the Siddeley-Deasy Co. The latter firm is one that has made great progress during the war. In 1914 it had 3 acres of factory and now has 25. Siddeley-Deasy is one of the first to plan a low-priced car.

There still seems to be too much of the "getting it while the getting is good" spirit among car manufacturers, and prices are exceptionally high, as indicated by a 12 hp. car listing at $3500. There is no tendency to reduce prices, and naturally with comparative stagnation through the industry there is a shortage of cars. The private owner is faced with the fact that a car which sold for $1500 two years ago is now selling at $2500.

Production which was promised by the factories a month or so ago is not coming through. There are many deposits up on these cars and the buyers are awakening to the fact that when their deposit was taken the manufacturer must have been conscious of the fact that he could not make deliveries for many months. It seemed as if the manufacturer did not understand the situation well enough, and was not willing to go ahead with the production until he had orders and deposits placed with him. This points to the program followed by so many manufacturers in pre-war Olympia shows.

Production on a few of the lighter type cars is coming through. With high priced cars the production is so small as not to have any modifying effect on the market. Fine weather has spurred the buyer and the pernicious practice of offering premiums is making itself known. In one case a premium of $500 over the new price was offered on delivery on a 10-hp. car if the owner could have it by Easter.

As a result of holding back in the production of new cars the price of used cars is still increasing. Recently a 1913 French car was purchased for $650 and was sold a week later for $1750. This is not an exception and almost every day sees the value of used cars mounting in this way. There are 1914 Rolls-Royce touring cars selling at $10,000. Four years ago these cars were selling at $5,000 each. In 1915 a 15 hp. Renault limousine listed at $1560, but is now priced at $7500. Wolseley cars which 4 years ago listed at $2250 are now offered at $4500. These examples are typical of the increased prices of used cars.

British Import Restrictions Not Satisfactory to Importers

LONDON, ENGLAND, May 1—British importers are still of the opinion that the permitting of imports of American automobiles under the recent ruling of the Board of Trade is scarcely satisfactory to a minority of the importers, and that after September 1, when the matter is revised by the Board of Trade, some more satisfactory arrangement will be worked out.

The present ruling which permits of importing approximately 1200 automobiles in that period is a mere ration of the requirements, as there are some importers who have capacity for disposing of 6000 cars per year.

There has not as yet been an official interpretation of the 50 per cent ruling on imports, but one is to be issued shortly. There is a feeling that the concession for 50 per cent importation granted by the Board of Trade is open to a more favorable interpretation than that given. The action of the Board of Trade is awaited in clarifying this interpretation.

There have been some recent removals of import restrictions made by the Board of Trade as follows:

A—Prohibition of magnetos is to be maintained and licenses to import magnetos are to be granted only in very exceptional cases. This points to a certainty of the British magneto industry, which is a product of the war, being protected during the restriction period.

B—Forgings and castings for motor vehicles are to be prohibited and importation only under licenses.

C—The importation of clocks, clock parts, and clock movements is to be restricted to 50 per cent of the 1913 imports from all sources, importers obtaining their quotas from any country with which trading is permitted.

Lifts Ban on Passports for Business

WASHINGTON, May 12—The State Department will issue passports to all applicants who are going abroad on bona fide business, and American business men will be given every aid to carry on and develop foreign trade.

Import Certificate Number No Longer Necessary

WASHINGTON, May 10—It is no longer necessary for exporters to submit with their applications for licenses to export to Luxemburg and that part of the Rhine provinces occupied by the American and allied armies the number of the import certificate issued by the

Inter-Allied Economic Committee at Luxemburg. The War Trade Board has announced this amendment to the rulings made by it March 6, 1919. Applications for export licenses should be filed with the War Trade Board on Form X-A.

Manufacturers and Government Will Meet to Discuss Exports

WASHINGTON, May 12—A meeting to discuss existing embargoes and foreign trade restrictions, and their effects on the motor industry, will be held here soon. Automobile manufacturers and the Departments of State and Commerce will attend. The meeting was planned for this week, but was postponed. It will probably be held the first week in June owing to the inability of some of the manufacturers to get to Washington sooner.

Freight Rates for Trucks to Be Studied

WASHINGTON, May 10—A study of existing railroad freight rates and motor freight rates will be made by Capt. A. J. Stevens, assigned from the Department of Purchase, Traffic and Storage, War Department, to the Highways Transport Committee, National Council of Defense, for the purpose of fixing equitable and profitable rates by which motor trucks can haul commodities over rural routes. Existing rates, it is said, are neither equitable nor profitable, and many motor truck fleet owners are losing money in some instances and overcharging in others. It is to overcome these problems and to establish motor truck rural express on a sound basis that the work is being undertaken.

Steel Disk Wheels Wanted for Light Trucks

WASHINGTON, May 12—Orders will be placed for 550 steel disk wheels to take 38 x 7 pneumatic tires with straight sides. The wheels are to fit on the hubs of the rear wheels of the light aviation army trucks which have been taken over by the Post Office Department from the War Department. They are to be interchangeable with the wheels now on the trucks. A hub cap, locking flange, necessary clamping nuts and cap screws are to be furnished with each wheel. Prices are to be f.o.b. factory, and bids must include time of delivery. All bids should be sent to the Purchasing Agent, Post Office Department, Washington, D. C.

Tractor Demonstrations for Pennsylvania

HARRISBURG, May 10—The state of Pennsylvania is to hold four 2-day tractor demonstrations during the coming season. These will be held in different sections of the State. Representatives of various tractor companies have agreed on this schedule. There is a little uncertainty regarding the rules covering these demonstrations. Some of the tractor makers want to furnish their own rules and the State Department feels that it should have a voice in framing them.

Present Planes Lack Quantity Idea

Must Come Around to Ingersoll Type, Says Stout at S. A. E. Meeting—Other Subjects Discusssed

CHICAGO, May 9—Before we can call the airplane commercially successful we must go from the Swiss watch type of construction to an Ingersoll watch type. That is, we must make our future planes of more rigid construction on a quantity basis, and correspondingly cheaper. This was the capital idea in the talk presented to the Midwest Section of the Society of Automotive Engineers this evening by William B. Stout of the United Aircraft Corp., New York City.

In his talk on aviation, Mr. Stout said that aviation is a new lure, and those men who have been up in the air, who have been flying, and who for the moment are satiated with air work, are coming back with a craving for space. In judging the airplane of to-day we must hark back to the corresponding days of the motor car, when the latter was undeveloped and as expensive a proposition as the airplane is to-day.

While we have built planes in quantity, we have not designed in quantities. At the time of the war we had to take what we had and develop it. We had no knowledge of other than amateurish materials. But with the war we have developed materials, constructions and the production end of aircraft. Good engines have been developed, possibly not the right size, but good enough for this stage of development. Now we are coming to the point where we must have greater safety than with the war machines, a place to land on small fields and at slower speeds.

Mr. Stout told further of the wonderful achievements of the wireless telephone as regards aviation, particularly in policing aerial routes and keeping the pilot informed of his location and weather conditions ahead. The speaker in taking up the subjects of parasite resistance and lift-drift ratios supplemented his talk with blackboard illustrations. He said the lift-drift ratio of the best machine is about 8.4; that is, 8.4 lb. can be carried for every pound of propeller pull. This means a limitation of loads to be carried, and fuel in proportion to horsepower. If a machine can be developed with a low enough parasite resistance, so that the lift-drift ratio is about 10 or more, then if we are lucky and have a calm day we might be able to fly from Halifax to Ireland. As yet we have not produced any such machine.

The use of steam in handling kerosene as engine fuel was the chief topic of the paper on Developments in Burning Kerosene as Motor Fuel, presented by Otto E. Szekely, chief engineer and production manager of the Velie Motors Co., Moline, Ill. The author dwelt particularly on the experiments and research work done by this concern in using kerosene with its tractor engine. Increased volumetric efficiency, Mr. Szekely said, has been obtained by means of a fairly successful method consisting in vaporizing the kerosene and drying the mixture in connection with the superheated steam and fuel washing. This paper will be discussed at the next meeting.

Following are the new officers of the Midwest Section elected at this meeting: Chairman, Dent Parrett of the Parrett Tractor Co.; treasurer, Francis W. Parker, Jr., of the firm of Parker & Carter, patent attorneys, and secretary, C. S. Rieman of the Elgin Motor Car Co.

Industrial Board Disbanded

WASHINGTON, May 12—All attempts to fix prices of basic commodities by the government were ended when the Industrial Board, which is headed by George Peek, disbanded this last week following the refusal of the Railroad Administration to accept the steel prices as set by the Industrial Board. It is also stated that one reason for the termination of the Board was that the Attorney General found all such price fixing illegal. All of the industries which submitted figures to the Board and agreed upon prices, including steel, sand, gravel, crushed stone, glass and lumber industries, were released from the fixed and proposed prices with the termination of the Board.

Uniontown Entries Complete

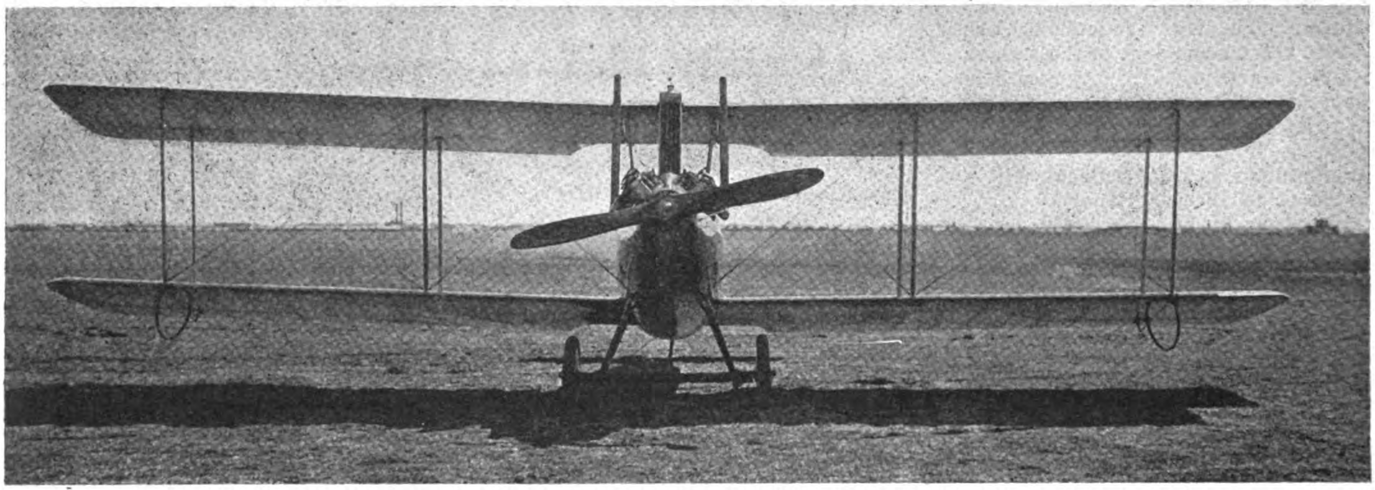
NEW YORK, May 12—The opening racing event for the year on American speedways will be the 112-mile race on the Uniontown speedway on Saturday. A good many of the racers will go from there to Indianapolis to take part in the 500-mile race on May 31. Gaston Chevrolet is entered for both Uniontown and Indianapolis if he is reinstated by the American Automobile Association by that time. If not some other driver will have to be chosen for his Frontenac special. The 16 following names are entered for the race at Uniontown:

Driver	Car
Louis LeCocq	Roamer special
Kurt Hitke	Roamer special
Eddie Pullen	Hudson special
Cliff Durant	Chevrolet special
Harold Simmons	Hudson special
Wilbur D'Alene	Duesenberg special
Denny Hickey	Stickel special
Ray Howard	Peugeot special
P. W. Monahan	Johnson special
Joseph Boyer	Frontenac special
Louis Crevrolet	Frontenac special
Gaston Chevrolet	Frontenac special
Ralph Mulford	Frontenac special
Tommy Milton	Duesenberg special
Fred McCarthy	Hudson special
Eddie Hearne	Durant special

Washington-New York Air Mail Service Completes Year

WASHINGTON, May 12—The Air Mail Service between Washington and New York has completed its first year, during which time it represents 128,037 miles of air travel and 7,720,840 letters carried. The revenue from airplane mail stamps totaled $159,700 and the cost of the service, $137,900.06.

The record of the entire service for the year shows 92 per cent of performance. Out of 1261 possible trips, 1206 were un-



Front view of the Curtiss Oriole, which carries two passengers in addition to the pilot

dertaken and 55 were defaulted on account of weather conditions. During rain, fog, snow and electrical storms, 435 trips were successfully made. The year's travel of 128,037 miles represents the total out of a possible 138,092 miles. Fifty-one forced landings resulted on account of weather and 37 on account of engine trouble.

One of the lessons learned from the operation of the service is that the element of danger existing in military and exhibition flying is almost entirely absent from commercial flying. The year's operation including flights at altitudes as low as 50 ft. during periods of invisibility. During the year no airplane carrying mail has fallen, and no aviators have lost their lives.

The year's flying has established the fact that 200 ft. of visibility from the ground is the limit of practical flying, although a number of flights were made at lower altitudes. This was discovered by means of a device built by the Bureau of Standards in the form of a radio directional compass. The objection to flying above the ground fog, rain, snow or heavy clouds with single engine planes lies in the possibility of the engine's stopping over a village or other bad landing place with a limited radius of visibility. Flights were made in gales from 40 to 60 miles an hour.

The same 6 planes that were in operation at the inauguration of the service are in operation to-day, and the two planes that made the initial flights on May 15, 1918, will make the initial flights on May 15, this year, to mark their first anniversary.

Salisbury to Make Axles Only

JAMESTOWN, N. Y., May 14—The Salisbury Wheel & Axle Co. has changed its name to the Salisbury Axle Co., Inc., and has discontinued the manufacture of wheels for cars

Blakely in New Factory

DETROIT, May 12—The Blakely Mfg. Co. has moved into its new factory at the corner of Wabash and Stanley Avenues.

The Oriole—New Curtiss Commercial Plane

BUFFALO, May 12—The Curtiss Aeroplane & Motor Corp. has put out its first purely commercial airplane—the 3-passenger Oriole, which was designed by W. L. Gilmore, airplane engineer for the company. The plane embodies a new idea in body construction, special ply wood being used. Longitudinal stringers, running fore and aft, add to the rigidity. The body is made in two parts and connected on the center line. It is elliptical in section and contains no real diaphragms.

The passengers' comfort has been well looked after in the design. There are no controls in the front cockpit, which seats two passengers abreast. The upholstering is of leather and a curved windshield protects the occupants and gives them a clear vision while flying.

The machine is equipped with a self-starter. It is colored to represent the oriole, the body being orange and the wings yellow and black. The engine is a Curtiss OX-5, which was used in the JN-4D training planes. The machine is 25 ft. long, 36 ft. from tip to tip and is 9 ft. 5 in. high. Its total weight, loaded, is 2188 lb. and it carries a useful load of 767 lb. It has a maximum flying speed of 85 miles per hour.

On its initial flight, the Oriole captured two prizes offered by the Pan-American Aeronautical Congress for the first airplane to fly to and from Atlantic City on the opening day. The machine was piloted by Roland Rohlfs, Curtiss test pilot, who, on the return trip, made the distance of 109 miles in 1 hr. 11 min. On the way to Atlantic City, the Oriole carried as a passenger Victor Hugo Barrance, Cuban consul-general.

Proposed Air Service Between Australian Capitals

WASHINGTON, May 12—A company has been organized, according to reports, called Aircraft, Ltd., to establish interstate air service in Australia, to begin within the next year. It is expected that aerial service will be operated between the capitals of all of the states of the Australian continent. Planes will be used to carry 20 passengers each. They will be used for both passenger and express service.

Flying Fatalities Increase

WASHINGTON, May 9—Flying fatalities at United States flying fields have increased since the armistice was signed. From June 1, 1918, to the armistice the average hours flown per fatality were 3149, while from the armistice to date the average is 1852 hours, an increase of 41 per cent.

The following table shows the pre-armistice rate compared with the monthly rate since the armistice:

Period	Fatalities	Hours flown	Hours flown per fatality
June 1 to Nov. 11, 1918..	156	491,283	3,149
Nov. 11 to Jan., 1919...	42	78,831	1,877
January	6	16,498	2,750
February	17	15,688	922
March	14	28 072	2,005
April	6	14,650	2,441

American Cars May Not Be Exhibited at Olympia

LONDON, ENGLAND, May 1—No decision has been made as yet as to whether importers of American cars will be permitted to exhibit at the coming Olympia show in November. Importers are not at all satisfied with the present ruling restricting automobile importations, and it would be a serious blow to them if they were not permitted to exhibit their cars at the Olympia show on a par with other makers.

Industrial Clinic for Labor

WASHINGTON, May 10—Plans for the establishment of industrial clinics by organized workers in their respective localities to be under government supervision have been laid before the 800 central labor bodies in this country by the Department of Labor. Under the plan expert medical examination, advice and treatment under government supervision will be available to the workers upon payment of fees ranging from 10 cents to $1. Supervision of the clinics by the government will be undertaken by Dr. A. J. Lanza, Chief of the Division of

Industrial Hygiene and Medicine, Department of Labor.

If these plans are adopted by organized labor, the immediate effect will be to abolish the existing industrial health systems which are being operated by many of the large manufacturers at the expense of the various corporations. Some corporations have followed a plan of this kind for several years, examining workers upon their application for employment, including dental, eye and ear examinations, and maintaining a corps of doctors and nurses to look after the health of the employees and visit those who are ill. There has been some objection to this plan voiced by organized labor on the ground that there is likely to be discrimination against union workers. The new plan, it is thought, will be more favorably regarded because it eliminates this possibility.

Citroen Workers on Strike

PARIS, April 23—All the men in the Citroen automobile factory came out on strike this week. The men asked for the abolition of night work and overtime, the immediate adoption of the 8-hour day without a reduction in wages, and an increase of 5 cents an hour on all salaries. The Citroen company decided on a lockout, and this was followed by a general strike of the 6000 workpeople employed by the firm. It is maintained by the workers that wages are lower in the Citroen factory than in other similar establishments.

Italian Factories Closed Through Labor Disputes

PARIS, April 23—Information is received from Turin, Italy, to the effect that practically all the automobile factories are closed owing to labor troubles. The disputes affect Fiat, Lancia, Scat, Isotta-Fraschini and others.

AC Speedometers in Production

FLINT, MICH., May 10—Manufacture of AC speedometers has been started by the Champion Ignition Co., maker of AC spark plugs. At the time of the armistice 40,000 AC aviation spark plugs were turned out daily for the government.

The plant built for government work will be used for the production of spark plugs and speedometers. Jo Berge will be in charge of the speedometer development and manufacturing departments.

Dodge Bros. Open Export Office in New York

NEW YORK, May 9—Dodge Brothers, Detroit, have opened an export office here at 43 Exchange Place. John C. Mathews, who for a number of years has represented the Dodge foreign sales department in this city, will be in charge of the new office.

Dividends Declared

Studebaker Corp. of America, South Bend; quarterly dividend, 1 per cent common, 1¾ per cent preferred, payable June 1 to stockholders of record May 20.

Michigan Housing Situation Critical

LANSING, May 10—The housing situation here is becoming critical. With all of the city's industries reaching capacity production and many planning to greatly increase their output, Lansing faces a shortage of labor as well as homes to house the workers. The General Motors Corp. expansion plan calls for the erection of hundreds of houses for Oldsmobile workers and other G. M. C. concerns. Inasmuch as the industrial boom is general, the new G. M. C. homes will not begin to care for the existing shortage and the influx of new families. The Chamber of Commerce and many individual companies are working on plans to solve the housing problem.

MUSKEGON, MICH., May 10—Muskegon will build between 750 and 1000 new homes this summer, which number is sufficient to relieve the present shortage of homes, which is not serious here. The Muskegon Building & Loan Association, by the formation of a mortgage loan company with a liberal loaning policy has increased its capital and activities. Local manufacturers are not building homes for their workingmen. This plan was tried some years ago but the workingman did not readily respond to the idea of buying his home from his employer.

PONTIAC, MICH., May 10—The Beudette Body Co. is backing two hotel projects for housing its workingmen. The company has also provided temporary working quarters for a limited number of men in one of its buildings.

The General Motors Truck Co. has leased the Wellington Hotel and will provide rooms there for 100 men. The Oakland Motor Co. is rushing work on an apartment for men, and the Wilson foundry rooming house is nearing completion. Several hundred single men will be accommodated in these buildings. The result is expected to bring about a sharp decline in rental of houses and rooms in Pontiac.

GRAND RAPIDS, MICH., May 10—The housing situation in Grand Rapids is quite satisfactory. There is only a slight shortage of homes at the present time. This city ranks second in the United States as to the percentage of home ownership, being surpassed only by Spokane, Wash. Five building and loan associations have over 4,000 borrowing members.

A number of contractors are building homes for 10 per cent down and 1 per cent a month. It is estimated that 500 new homes would adequately relieve the situation, but the possibilities are that before fall the city will need more than this.

Canadian Maxwell and Chalmers Orders Ahead of Production

WINDSOR, ONT., May 9—The Canadian plants of Maxwell and Chalmers are far behind in filling orders. February shipments were only 65 per cent of February orders. The March record is about the same in spite of the fact that the plant is working on its midsummer schedule. Production is difficult, it was explained, because material continues to be as hard to get as it was a year ago.

Detroit Seamless Tube Plant Started

DETROIT, May 12—The Detroit Seamless Steel Tubes Co. has begun construction of a $3,000,000 plant on a 60 acre tract on Warren Avenue. The first section, costing $1,000,000, will be completed by Jan. 1. The company's present location has been sold to the Pennsylvania Railroad.

The structure will be steel and glass with brick and concrete facing. The roof will be of tile. The plant proper will occupy a space of 350 x 550 ft. It will consist of three buildings for manufacturing, a separate heating plant and a 2-story administration building. The three manufacturing units will each be 90 x 550 and 45 ft. high.

About 150 homes for workmen of the company will be built in the vicinity of the plant. The total capacity of the first unit will be 2,500 tons of seamless steel tubing a month, the range of sizes being from ½ in. to 6 in. in diameter.

Cletrac New Name for Cleveland Tractor

CLEVELAND, May 9—The Cleveland Tractor Co. has adopted the name Cletrac as the registered name of its tractor. Tank-type-tractor is used in connection with the name, as it is of crawler construction.

Acason Truck Sales to Be Handled from Factory

DETROIT, May 9—Sales and service of the Acason motor trucks will be handled direct by the factory, according to an announcement by Vice-President and Director of Sales Harry Conlon of the Acason Motor Truck Co. The sale of Acason trucks at retail in Detroit and wholesale for Michigan will be handled by a special department of the factory, which will be in charge of H. P. Mills. Arthur C. Acason will assist Mr. Mills.

L. V. Estes Moves

CHICAGO, May 9—L. V. Estes, Inc., industrial engineer and accountant, has moved its offices from the McCormick Building to the fifteenth floor of the Century Building, 202 S. State Street.

U. S. Light & Heating Building

NIAGARA FALLS, N. Y., May 9—The U. S. Light & Heat Corp. is adding several new brick and concrete buildings to its present plant, which consists of 22 units, to give the company increased manufacturing facilities. Work is already under way. Several acres of adjoining property have been acquired for further expansion.

Ford's Mammoth War Work

DETROIT, May 12—Government war contracts held by the Ford Motor Co. exceeded $560,000,000 and represented work for the Army, Navy and Air Service. The following items will give some idea of the work done by the Ford interests during the war:

More than 2,000,000 steel helmets.

Order for 5000 12-cylinder Liberty engines. Over 1500 had been delivered when the armistice was signed, and the company was just striking production capacity.

10,000 caissons, mainly for 155 mm. guns. Something over 8000 delivered.

Order for 112 "Eagle" boats, 200 ft. long, 25 ft. beam. Something like 25 delivered when the order was reduced to 62. The balance will be finished by Aug. 1.

More than 8000 trucks.

More than 25,000 regular Ford cars.

More than 6000 ambulances.

400,000 cylinders for Liberty engines. The government placed the order with the Ford Motor Co. to make all the cylinders for all the Liberty engines made in America. The original order was practically completed when the armistice was signed, and a new order for $300 000 had just been entered.

700,000 bearings for the Liberty engine. The government placed the order with the Ford company for all the bearings for all the Liberty engines made in the United States. On this order over 400,000 bearings had been delivered.

700,000 cylinder forgings for Liberty engines. The government placed orders with the company for all the cylinder forgings for all the Liberty engines made in America. Over 400,000 had been delivered.

A large volume of experimental work was done in building 3-ton military tanks, and the government had just placed order for 15,000 of the small, two-man, military tanks, and 3000 of the 6-ton military tanks. Cancellation came before more than a dozen or so had been delivered. But the foundations had been laid and the superstructure almost completed for an enormous building in which tanks alone were intended to be built.

Motion picture reels in behalf of Liberty loans, Red Cross and Patriotic fund work were made by the company and supplied to the government in sufficient quantities to serve the entire United States in motion pictures. Motion picture reels in volume sufficient to serve the armies of the States in France, Italy and Palestine were furnished by the Motion Picture Department of the Ford Motor Co.

The company also did more than $1,000,000 of work in the production of special devices in the naval department of the British government.

It also furnished the government with 275 skilled mechanics for work in France.

The Ford company, through its chemical laboratory, co-operated with the manufacturers of gas masks for the United States army.

An average of 34,000 men and women were employed by the main factory at Highland Park; 8800 men at the shipbuilding plant on the River Rouge, 4000 men employed at the new blast furnace, in course of construction on the River Rouge, 250 men employed at the carbureter plant, or an average of 45,000 employees, practically all on 100 per cent government work, under a standard 8 hr. day and a minimum wage of $5 a day.

New Tractor Company

EVANSVILLE, IND., May 12—A new company, capitalized at $1,000,000, has been formed for the manufacture of farm tractors. Robert C. C. and J. B. Graham, of Graham Bros., Inc., glass manufacturers, and Benjamin Bosse, president of the Bosse-World Furniture Co., are interested in the new concern. Besides a local plant it is planned to have a branch at Loogootee.

Eugene McGuckin in New Offices

PHILADELPHIA, May 10—The Eugene McGuckin Co. has moved its offices from 105 North 13th Street to 1211 Chestnut Street.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Climber Cars in Production

LITTLE ROCK, ARK., May 12—The Climber Motor Corp. has just completed its new plant here. Machinery is being installed and operations will start immediately. It is a 1-story building of concrete, steel and glass, 100 x 300 ft. Other units will be built later. The Climber Co. will manufacture a passenger car, truck and tractor. The truck and tractor departments will not be established until passenger car production is well under way.

George Schoeneck is chief engineer. He has been in charge of a small shop in Detroit where the first Climber experimental cars were made. H. F. Buhler is sales manager of the company. The plant will start work with a force of 100 men. It is proposed to produce 10 cars daily during the first year.

New Vim Tractor Co.

SCHLEISINGERVILLE, WIS., May 10—The Vim Tractor Co. has been organized to take over the plant and equipment of the Standard Machinery Co., manufacturer of gas and kerosene engines, which recently has developed a tractor design to be placed in quantity production by the new corporation. The Standard works are being re-tooled and will be ready to begin manufacturing tractors at once. Officers of the Vim company are: President, Charles D. Storck; vice-president, John F. Mayer; secretary, Dr. Philip M. Kauth; treasurer, Peter Schuck; works manager, Otto E. Zahn.

Samson Tractor Buildings Under Way

JANESVILLE, WIS., May 10—Contracts were awarded Thursday by the Samson Tractor Co., subsidiary of General Motors Corp., for the construction of the second unit of the new tractor plant here, where a total investment of $4,500,000 is contemplated. The first unit, 200 x 500 ft., was finished late in March. The second building will be an exact duplicate of the original unit. When it is completed, the assembling of Samson tractors will be done by the "endless chain" method. A third unit will probably be erected in August or September.

Oldberg Adds to Manufacturing Facilities

DETROIT, May 8—The Oldberg Mfg. Co., makers of automobile and marine mufflers, will greatly increase its manufacturing facilities through the purchase of a 3-story brick factory building on East Grand Boulevard, formerly occupied by the O'Neill Mfg. Co.

Boring Tractors on Market Soon

ROCKFORD, ILL., May 10—The Boring tractor is getting into production and will be on the market by June 1. The Boring Tractor Corp. has built a new fireproof factory at Blackhawk Park Avenue and Kishwaukee Street, which will be occupied during the present week. It is a stone building, 70 x 200 ft., monitor construction, and will have a capacity of about 300 tractors a year.

The Boring tractor is a 2-wheel tractor of 2-plow capacity. It has a new and simple power lift for the plows and enclosed chain drive.

K-W Wins Switch Litigation

NEW YORK, May 13—The K-W Ignition Co., Cleveland, has won its suit against the Goodrich-Lenhart Co. for infringement of certain patents on ignition locks. The United States District Court for the Eastern District of Pennsylvania has held that patents Nos. 841,844 (Burnet), 1,015,300 (Cox) and 1,253,470 (Cox), under which the K-W Ignition lock switches are made are valid and infringed by lock switches made by the Goodrich-Lenhart Co. The latter company has paid certain damages to the K-W company and is allowed to dispose of a comparatively small quantity of lock switches which it now has on hand.

National Engineering Company Enlarging Force

SAGINAW, May 12—The National Engineering Co., acquired some time ago by the General Motors Corp., is employing about 200 men, but it is said the force will be doubled in a short time. The company makes the engine crankshaft for the Oakland Motor Car Co.

Allith-Prouty Adds Hubs to Line

DANVILLE, ILL., May 13—The Allith-Prouty Co., engaged in the manufacture of steel and iron products, has installed new machinery and will turn out hubs and other parts for motor vehicles. Thirty additional machinists will be required to take care of the new line. The new machinery will have a capacity of 50,000 automobile hubs per month to start. The war contracts have all been filled and the plant will hereafter handle the regular line of business.

Perfex Creditors Meet

RACINE, WIS., May 14—At the first meeting of creditors of the Perfex Radiator Co., Julius J. Goetz of Milwaukee, previously appointed receiver, was elected trustee under bond of $50,000. A court order was filed authorizing the trustee to continue and operate the business for 30 days. The Perfex plant has been in operation since bankruptcy proceedings were filed March 28. It is believed that creditors will succeed in effecting a reorganization and that they will realize practically 100 per cent on their claims. The next meeting of creditors will be held Monday, June 2, in the federal court at Milwaukee.

Flanders Retiring from Management of Maxwell

DETROIT, May 12—Walter E. Flanders, chairman of the board of directors of the Maxwell Motor Co., Inc., has advised the Maxwell company that he will not again contract with them July 31, but will retire from the management of their affairs. He will probably retain an interest in the Maxwell company, but will cease active work. Mr. Flanders will not state just what his future plans are. It is understood, however, that shortly after finishing his duties at the Maxwell plant he will board his new yacht for a long cruise down the Atlantic coast through the Panama Canal for California.

Mr. Flanders, it is said, has disposed of a large part of his property holdings in Michigan and Ohio. It has been said that he contemplates locating in California, where he will establish a factory to make a new automobile. That he will go into the automobile manufacturing business in California, Mr. Flanders denies.

E. W. Templin, formerly assistant engineer of the Selden Motor Truck Co., and more recently production manager of the Bessemer Motor Truck Co., has joined the staff of the Goodyear Tire & Rubber Co. as motor truck engineer attached to the development department.

Raymond F. Brown has been appointed purchasing agent of the Bantam Ball Bearing Co., Bantam, Conn., to succeed C. D. Stoddard, who resigned.

Ernest P. Johnson, who has been with the Frankl'n Automobile Co. since 1915, succeeds Walter C. Biddle as assistant sales manager. Mr. Biddle resigned to handle Franklin distribution in Toledo.

Sherman W. Dorman who for the past three years has handled the buying of accessories for the Biddle Purchasing Co. for domestic and foreign trade, is now connected with the Overseas Motor Service Corp. as manager. The corp. will handle a number of accessories in foreign fields exclusively, those controlled by the United Motors Co. being prominent.

Lynn V. Blankman has been appointed manager of the central west territory for the United Aircraft Engineering Corp., New York. His headquarters are at 514 Westminster Building, Monroe and Dearborn streets, Chicago.

Connecticut Telephone & Electric Adds to Engineering Staff

MERIDEN, CONN., May 9—F. J. Croton, Jr., and John A. Terrell, both recently released from government service, have been added to the engineering staff of the Connecticut Telephone & Electric Co., Croton as mechanical engineer and Terrell as assistant to the chief radio research engineer. Mr. Croton, before enlisting in the Chemical Warfare branch of the army, was in charge of a die house of the J. A. Barbour Co.

Men of the Industry

Changes in Personnel and Position

Squires Engineering Co. Formed

DETROIT, May 9—John Squires, formerly chief engineer of the Signal Motor Truck Co., has organized the Squires Engineering Co. and has opened a laboratory here. Mr. Squires is working on a steam power plant for distillate fuel. He hopes to have it in operation in an experimental car by early fall.

Fred I. Tone, former vice-president and chief engineer of the American Motors Co., Indianapolis, and later chief engineer of the United States Ball Bearing Co., is now with C. Harold Wills, former chief of the Ford Motor Co., who is making ready to enter the car manufacturing field in Detroit.

P. C. Gunion is now assistant manager of the new Industrial Division of the General Motors Corp.

Peter T. Hill has joined the sales department of the Torbensen Axle Co.

Guy Wright, formerly assistant sales manager of the Buda Motor Co., Harvey, Ill., has been made sales manager, succeeding Lon Smith, who resigned to become sales manager of the Midwest Engineering Co., Indianapolis.

H. A. Flogaus has been appointed to the engineering staff of the Maibohm Motors Co., Sandusky, Ohio. Previously he was with the Willys-Overland Co., Toledo, and later with the Curtiss Aeroplane & Motor Corp., Buffalo. Last year he was stationed at Washington as assistant chief draftsman of the Motor Transport Corps, in charge of the chassis design of Class B trucks. Since leaving government service he has been chief tool engineer with the Matthews Engineering Co., Sandusky.

Trailer Manufacturers Assn. Office

NEW YORK, May 12—The Trailer Manufacturers Association of America, recently organized to deal with questions of importance to the trailer industry, has opened offices at 110 West 40th Street. Legislation affecting trucks and trailers is one of the most important matters that will be handled by the association. The question of exemption of trailers from taxation under the Revenue Act of 1918 has also been taken up. A publicity campaign to familiarize the public with the advantages of haulage with the use of trailers and the development of transportation by highway will be part of the association program.

White Resigns as Cadillac Vice-President

DETROIT, May 12—D. McCall White, vice-president and assistant general manager of the Cadillac Motor Car Co., whose resignation is to take effect at once, will not discuss his future plans further than to say that he will remain in the automotive business and that his operations will be very extensive.

Mr. White upon coming to America, from England, became a member of the engineering department of the Cadillac company, later being appointed chief engineer. He started with that company in a secret office in the heart of Detroit in March, 1914, and commenced the design of the 8-cylinder Cadillac engine, which he completed in less than 2 months. He then went East, changed his name, calling himself David Wilson, and had the parts for 3 cars completely machined all ready for assembly, returning to Detroit on June 4, exactly 117 days after the first pencil lines were drawn on the designing board. The car proved successful on test and the tooling up was immediately commenced, with the result that the Cadillac Motor Car Co. announced to the public on September 25, 1914, that it would build an 8-cylinder car, delivering the first 40 cars by the middle of October. After getting into full production, the company completed 13,000 by the middle of June, 1915.

Shortly after the United States entered the war, Mr. White was appointed a member of the committee which was charged with the placing of the Liberty engine on a production basis.

Walter T. Roose, formerly in the purchasing department of the Studebaker Corp., has become sales representative for the Motor Materials Co., Detroit.

Russell Munro has returned from France and has resumed his duties as assistant advertising manager of the Ford Motor Co., Detroit.

James G. Roe has resigned as advertising manager of the J. C. Wilson Truck Co., Detroit, and has joined the Green-Fulton-Cunningham Co., advertising agents.

A. E. Crysler has joined the Commerce Motor Car Co., Detroit, as assistant to the director of sales and advertising, G. D. Wilcox.

New Directors for Allis-Chalmers

WILMINGTON, DEL., May 10—The Allis-Chalmers Co. at its annual stockholders' meeting elected the following directors for the ensuing year: J. H. McClement, chairman; Otto H. Folk, Oliver C. Fuller, J. D. Mortimer, Fred Vogel, Jr., Charles F. Pfister, Knox Pim, F. O. Wetmore, Arthur W. Butler, Arthur Coppell, Charles W. Cox, Oscar L. Cubelman, I. C. Hutchins, Jr., William T. Abbott, James P. Winchester, Dr. C. E. Albright and Charles Hayden.

Counteracting the Propaganda of the Irreconcilables

(*Continued from page* 1072)

undertaken within the factory for the benefit of the worker, they have been confined, almost without exception, to training in the conditions of work and not in the necessities of business as such or in any other way that would broaden their outlook upon the character of industrial organization. Under such circumstances the propaganda from which we quoted in the beginning of this article is particularly plausible and not without its allurement to the worker who gets his information about capital from the more sensational newspapers and from the similarly informed workers with whom he spends his social hours.

Under such circumstances the most carefully developed plans for co-operation with the workers, the most efficient means for allowing them a voice in the government of their working conditions and the keenest suggestions and development for their comfort and safety are of little value unless they are promoted with such care and developed with such patience that the discouragements which must be faced are none of them sufficient to alter the determined policy.

It is obvious that the workers have learned the strike method of enforcing demands very thoroughly; so thoroughly that they are apt to give it an importance and a power which it does not possess in fact; that they are suspicious of everything which is proposed by the manufacturer; that they have learned to regard capital and the present capitalist system, so called, as a direct bar to their enjoyment of greater benefits, and that the only means of education which ordinarily come into their life are newspapers with their inevitable inaccuracy and partisanship and who are generally emphasizing and confirming this opinion. In addition to all this they are subject to the ceaseless propaganda of the radical elements in the labor bodies who are committed to the destruction of the present system and who are constantly pushing their point of view, not without intelligence and not without a keen political understanding of the people upon whom they are working.

All these things must be taken into account by the manufacturer, and particularly should they be studied with an eye to their importance in their relations to the educational processes, to the character and understanding of the supervisors and to the promotion which must be undertaken if any understanding of industrial organization and its necessities is to permeate the minds of the workers in any reasonable time.

The matter is proving to be a sufficiently difficult one in Great Britain, where the foreign element is small and all the people have grown up with the same political traditions and the same racial background. It is much more complicated in this country, where it is not unusual to have from six to twenty separate races among the workers in a single manufacturing plant; with political histories ranging from feudal autocracy to trivial communism, with little or no knowledge of the political and racial conceptions which govern this country and with less understanding of the significance of their surroundings.

It is inevitable that plans which appear to the manufacturer to be of great benefit to the workers should be accepted by the workers without enthusiasm or rejected by them or should fail to bring industrial peace within the organization because of the inherent difficulty in securing a common idea and developing a common purpose where the ideas are already so far apart. Nevertheless the old Scotchman's statement is still correct, that it is up to the manufacturer to find out what his workmen think and to understand them a great deal better than they can be expected to understand him.

Chicago-Cleveland Air Mail

WASHINGTON, May 13—The air mail service will inaugurate a route between Chicago and Cleveland beginning May 15. The service will advance delivery of letters at Cleveland and Boston by 16 hours, and at Albany, New York City and Springfield, Mass., by 6 hours.

Mail from San Francisco and the entire Pacific Coast states put on Burlington train No. 8; mail from South Dakota and Northern Illinois put on Illinois Central No. 12; mail from Northern Minnesota and Northern Wisconsin put on Northwestern train No. 514; mail from Minnesota, North Dakota and Montana put on C. M. & St. P. train No. 18, and mail from Kansas City and the entire Southwest put on Santa Fe train No. 10 will reach Chicago in time to make connection with the air mail east bound. The mail from these trains will be taken direct to the air mail field. At Cleveland the air mail will catch the New York Central train at 4 p. m. for the East.

Under this arrangement the air mail will be delivered in Cleveland and Boston on afternoon deliveries instead of the following morning. At Albany, New York City and Springfield, Mass., this mail will catch the morning delivery.

Letters mailed in New York City in time for New York Central train No. 19, leaving at 5.31 p. m., will reach Chicago in time for 3 o'clock afternoon delivery by carrier instead of the following morning carrier delivery as would be the case if sent by train.

Airplane stamps or ordinary postage at the rate of 6 cents per ounce must be used on mail, and the letters conspicuously marked "AIR MAIL." A special delivery stamp in addition to the air mail postage will insure still greater expedition of letters at points of delivery.

Haynes Enlarging Plant

KOKOMO, IND., May 14—A $450,000 addition to the Haynes automobile plant to be built here will include an assembling plant and forge shops, and will be the beginning of $1,500,000 worth of construction which the Haynes company will put up.

Curtiss K-6 and K-12 Aircraft Engine

(*Continued from page* 1054)

oil temperature regulator. This consists of a coil, having a cored water passage and two cored oil passages. Water of the cooling system circulates through this temperature regulator while on its way from the radiator to the pump. This temperature regulator is not merely an oil cooler, but also serves to heat up the lubricating oil quickly when first starting the engine from cold. In first starting an engine, the jackets heat up much quicker than the lubricating oil, as the latter circulates only very slowly. By passing the cooling water through the duct of the oil temperature regulator, the oil can be brought up to normal working temperature much quicker than would otherwise be possible.

In regular operation, the oil tends to assume a much higher temperature than that of the cooling water, and then the temperature regulator acts as an oil cooler. It keeps the temperature of the oil down and maintains its lubricating properties. After passing through the ducts in the regulator, the oil passes through the triple return pump and then to the oil chamber, whence it is recirculated. There is an oil gage on the oil pan, which is calibrated to show the amount of oil in the sump in gallons. There is an oil filler on the top of the crankcase. The oil pressure relief valve is adjustable, so that the pressure under which oil is fed to the bearings can be varied to suit condition of work.

Cooling water is circulated by a centrifugal pump mounted on a vertical shaft at the forward end of the engine. The pump used on the K-12 is of the double type, having two outlets on opposite sides, one connecting to each cylinder block. The water, as it comes from the radiator, passes first through the oil temperature regulator, and then enters the pump through the pump cover casting. From the pump the water is delivered into the cylinder jackets at the lowest part of it. From the cylinder jackets the water passes into the head jacket through a series of drilled holes. There the water circulates around the valve passages and then leaves the head casting at a point between the valves on each cylinder. Next it passes through the inlet manifold jacket, and thence it returns to the radiator.

The reduction gears, which are of the herringbone type, with 5-7 pitch, give a reduction in the ratio of 5 to 3. The gears are bolted to flanges with alloy steel bolts. Each half of the herringbone gears has a width of face of 1 in. The gears are first roughed out and then heat-treated, after which the centers and faces are ground, and the gears are then recut.

Sewell Cushion Wheel Dividend

Sewell Cushion Wheel Co., Detroit, 7 per cent dividend declared on preferred and common, for stockholders of record June 1. Within 60 days factory branches will be opened in Portland, Ore., Los Angeles and San Francisco.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
- Muriatic, lb ..... .02 - .03
- Phosphoric (85%) lb .... .35 - .39
- Sulphuric (60%), lb. .... .008

Aluminum:
- Ingot, lb. .... .33
- Sheets (18 gage or more), lb. ...... .42

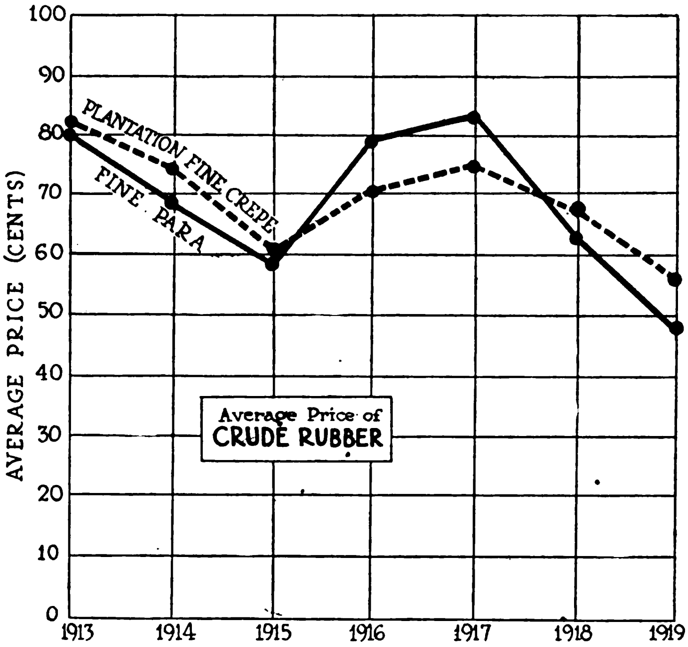
Antimony, lb ...... .07 - .07½

Burlap:
- 8 oz., yd. ...... .08¾ - .09
- 10½ oz., yd. ...... .10¾ - .11

Copper:
- Elec., lb. .... .15⅝ - .15½
- Lake, lb. .... .15¾ - .15⅞

Fabric, Tire (17¼ oz.):
- Sea Is., combed, sq. yd. 1.40
- Egypt, combed, sq. yd. 1.25
- Egypt, carded, sq. yd. 1.20
- Peelers, combed, sq. yd. 1.08
- Peelers, carded, sq. yd. .85

Fibre (⅛ in. sheet base), lb. .... .50



Prices of crude rubber, both plantation and wild, were affected during war time both by Government restrictions and lack of available shipping. The chart shows average price on May 1 in each year

Graphite:
- Ceylon, lb. .... .09 - .22
- Madagascar, lb. .. .10 - .15
- Mexico, lb. .... .03¾

Lead, lb. .... .04½ - .05

Leather:
- Hides, lb. .... .24 - .45

Nickel, lb. .... .40

Oil:
- Petroleum (crude):
  - Kansas, bbl. ...2.25
  - Pennsy., bbl. ...4.00
- Gasoline:
  - Auto, gal. ..... .24½
  - 68 to 70 gal..... .30½
- Lard:
  - Prime City, gal.2.60 -2.65
  - Ex. No. 1, gal....1.00 -1.20
- Linseed, gal. 1.56
- Menhaden (dark), gal. .... .75 - .80

Rubber:
- Plantation:
  - First latex pale crêpe, lb...... .48
  - Brown crepe, thin, clear, lb....... .41½ - .42
  - Smoked, ribbed sheets, lb..... .47

Para:
- Up River, fine, lb. .56¼
- Up River, coarse, lb. .... .34½ - .34¾
- Island, fine, lb.... .47 - .47½

Shellac (orange), lb. .62 - .68

Spelter, lb. .... .06 - .06¾

Steel:
- Angle beams and channels, lb..... .02½ - .03
- Automobile sheet (see sp. table).
- Cold rolled, lb.... .04¼ -. 04½
- Hot rolled, lb..... .03½ - .03¾

Tin .... .72½

Waste (cotton), lb. .. .12¾ - .17

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when Seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock................	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock...............	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping.........	6.55	6.45
Crown fender cowl and radiator casing, deep stamping................	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lbs.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lbs.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lbs.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lbs.

Blank Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.
- Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.
- Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close May 10

	Bid	Asked	Net Ch'ge
Auto Body Company......	9	10	..
Briscoe Motor Car com...	14	..	..
Briscoe Motor Car pfd...	50	65	..
*Chandler Motor Car.....	149	151	+5
Chevrolet Motor Car.....	209	211	..
Cole Motor Car Co........	120	125	+27
*Continental Motors com.	9	9½	+¼
Continental Motors pfd...	96	99	..
Edmunds & Jones com..	.29	31	+10
Edmunds & Jones pfd....	75	80	+3
Electric Storage Bat.....	76	78	+1
Federal Motor Truck.....	42	44	+8
Fisher Body Co. com.....	57	59	—½
Fisher Body Co. pfd......	92	94	..
Ford Motor of Canada...	320	330	..
General Motors com......	188½	189½	+6¾
General Motors pfd.......	91¾	93¾	+2¼
Hupp Motor Car com.....	8¾	9¼	+½
Hupp Motor Car pfd......	98	101	..
Kelsey Wheel Co. com....	35	37	..
Kelsey Wheel Co. pfd.....	93	95	..
Manhattan Electric S com.	..	48	..
Maxwell Motor com......	41½	42½	+¾
Maxwell Motor 1st pfd....	68½.	69½	..
Maxwell Motor 2nd pfd...	32½	33½	+1¼
McCord Mfg. com........	40½	42	+6½
McCord Mfg. pfd..........	100	102	+3
Mitchell Motor Co........	45	47	+7

	Bid	Asked	Net Ch'ge
Motor Products Corp.....	45	50	+10
Nash Motors Co. com.....	230	..	..
Nash Motors Co. pfd.....	95	100	..
National Motor Co.......	16	20	..
Packard Motor Car com..	170	177	+24
Packard Motor Car pfd...	100	102	+1
Paige-Detroit Motor com.	38½	39¼	+4
Paige-Detroit Motor pfd..	9	9¾	..
Peerless Motor Truck.....	29	31	+3
*Pierce-Arrow M. Car com.	49⅜	50⅜	—2
Pierce-Arrow M. Car pfd.	102	104	..
Premier Motor Corp. com.	5	..	..
Premier Motor Corp. pfd..	..	75	..
Prudden Wheel Company.	21	22	..
Reo Motor Car Co.......	31	32	+4¼
*Republic M. Truck com..	48	50	+5
Republic M. Truck pfd...	91	95	..
Saxon Motor Car com....	6⅞	8⅞	+¼
Scripps-Booth Corp.......	25	30	+4
Stewart Warner S. Corp.	90½	92½	—⅝
Stromberg Carburetor Co..	38	40	..
Studebaker Corp. com...	77¾	78¾	+⅞
Studebaker Corp. pfd......	94	97	..
Stutz Motor Car Co......	57¾	58¾	+¼
United Motors Corp......	47	49	..
White Motor Co..........	57½	58½	—5
Willys-Overland com.....	33¼	34¼	—¾
Willys-Overland pfd......	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co..........	88	90	—4½
Firestone T. & R. com...	153	156	+11
Firestone T. & R. pfd....	100	101	..
Fisk Rubber Co. com.....	149	152	+14
Fisk Rubber 1st pfd......	100	105	..
Fisk Rubber 2nd pfd......	149	152	+11
Fisk Rubber 1st pfd conv.	105	110	..
*Goodrich, B. F com.....	70	71	—3¼
Goodrich, B. F. pfd.......	107	109	..
Goodyear T. & R. com...	323	330	+39
Goodyear T. & R. 1st pfd.	106	108	+½
*Goodyear T. & R. 2d pfd.	107	108	+1
*Kelly-Springfield com....	124⅛	125⅛	—2⅜
Kelly-Springfield 1 pfd....	95	97	..
Lee Tire & Rubber Co...	33⅛	34⅛	—3¼
Marathon Tire & Rubber	55	75	..
Miller Rubber Co. com....	185	..	+13
Miller Rubber Co. pfd.....	105	107	+1
Rubber Products Co......	129	132	+2
Portage Rubber Co. com..	155	159	..
Swinehart T. & R. Co...	78	81	..
U. S. Rubber Co. com...	94¾	95¾	—3½
*U. S. Rubber Co. pfd...	112½	113½	+½

*Ex. Dividend.

Calendar

SHOWS

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and Accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

May 15-June 1—Venezuela. National Exhibit of Venezuela.

June 2-6—Hot Springs, Va. Convention Automotive Equipment Assn., Homestead Hotel.

*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-15—London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December — Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

May 30—College Park, Md. — Power cultivator Demonstration, Maryland State Dept. of Agriculture.

June 8-14—Denver, Col. Sectional Tractor Demonstrations, Denver Tractor Club.

July 14—Wichita, Kan. Automotive Committee of National Implement Assn.

Aug. 18-22—Aberdeen, S. D. Sectional Tractor Demonstrations.

October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

CONTESTS

†May 17—Uniontown, Pa., probably 112½ miles.

May 30—Atlantic City, N. J.—Airplane races—Aeronautic Convention.

May 30-31—Richmond Va.—2-Day Dirt Track Meet Virginia State Fair Grounds Track.

†May 30-31—Los Angeles, Cal.—Los Angeles-Yosemite 3rd annual gasoline economy run.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*June 14—Sheepshead Bay, L. I. Speedway race.

July 4—Atlantic City, N. J.—Airplane races—Aeronautic Convention.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15 — Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

†Sanctioned.
*Tentative dates.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

CONVENTIONS

May 1-June 1—Atlantic City, N. J. — Pan-American Aeronautic Convention and Exhibition—Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

May 21-24—Washington — Conference on Weights and Measures—Bureau of Standards.

June 2—Chicago, Ill.—Natl. Gas Engine Assn. Hotel Sherman.

June 3-6 — Washington, Pan-American Commercial Conference, Pan-American Building.

June 23-28—Ottawa Beach, Mich.—S. A. E. Mid-summer Meeting.

Sept. 22-24 — Philadelphia. Annual Convention National Association of Purchasing Agents, Bellevue-Stratford.

Swiss Market for Motor Cars

WASHINGTON, May 11—Consul Lewis W. Haskell reports that Switzerland will have to look to the United States for motor cars and trucks, lubricants and gasoline. Previous to the war $125,000,000 worth of goods annually were bought from Germany, and American manufacturers will undoubtedly have a future market in Switzerland if terms, prices, etc., are made attractive to the Swiss buyer.

Tractors in British Guiana

WASHINGTON, May 12—There are 50 tractors in use in British Guiana, according to a consular report, chiefly in the rice and sugar industries. It is expected that the number will be increased within the next few years. The soft soil during the wet season makes the crawler type of tractor popular.

Cars in Venezuela

WASHINGTON, May 12—There are 300 automobiles in the Puerto Cabello district of Venezuela, chiefly 5-passenger cars of American manufacture, retailing at 52 to 100 per cent higher than in the United States, according to a consular report. The scarcity of skilled mechanics, high price of gasoline, poor roads and the cheap cost and care of pack animals restrict the sale of automobiles.

Market for Tractors in Guadeloupe

WASHINGTON, May 11—Despite the fact that practically all of the 75,000 acres devoted to sugar cane in Guadeloupe could be plowed and cultivated by tractors, there are at present not more than 7 tractors in use there, according to report of Consul Henry T. Wilcox. All of the tractors were brought from the United States. Satisfactory results are apparently obtained from both light and heavy tractors.

Grande Terre and Marie Galante, the islands on which most of the cane is grown, are almost level, and the portions now under cultivation are divided into about 1100 estates, which vary greatly in size. The soil is heavy and in many places marshy. The greatest drawback to the use of tractors in Guadeloupe is the lack of experienced operators. The ordinary laborers cannot drive such machines. Other obstacles are the numerous ditches which are found in the fields, the high cost of fuel, and the lack of initiative on the part of the planters.

The duties charged on tractors when imported from countries other than France are $1.31 per 100 lb. net, plus 3 per cent ad valorem. Such machines of French manufacture pay only the local duty of 3 per cent.

Truck Market in Scandinavia

WASHINGTON, May 12—There is a great demand throughout Scandinavia for American motor truck chasis, 3- to 5-ton, for immediate delivery, to cost about $3,000, according to the Department of Commerce, which recommends that American dealers make a personal canvass with demonstrations.

War Dept. Places Orders for Parts

WASHINGTON, May 12—Orders for motor vehicles and parts are still being placed by the War Department. The Locomobile Co., Bridgeport, Conn., received an order totaling $232,465.19 for spare parts for the Class B truck; Hendee Mfg. Co., Springfield, Mass., spare parts for motorcycles, $181,258.38; Harley-Davidson Motor Co., Milwaukee, spare parts for motorcycles, $132,301.25; Continental Motors Corp., spare parts for AA ambulances, $29,138.42.

Mexican Firm Issues Shipping Instructions

WASHINGTON, May 12—In order to facilitate imports into Mexico of automobiles from the United States, a concern in Mexico City has furnished complete shipping instructions to its American connections. Following are the complete directions:

1. *Packing.*—Pack goods securely for water transportation. Iron strapping is cheaper and more effective than heavy boxing.

2. *Marks and Numbers.*—Mark packages with brush or stencil, also with gross and legal weight on each. Show these marks and numbers on every document relating to the shipment. Number packages consecutively. Do not place any other marks or numbers whatever on the packages.

3. *Invoices and Packing Lists.*—Make five invoices and four packing lists. Send original and two copies of invoice and original and one copy of packing list to us. Send two copies of each to —— (name of forwarding agent in New York). Show contents of each package and itemized prices on each invoice. Show gross and legal weight of each package on packing lists; also the marks and numbers as they actually appear on the packages. If a package contains more than one class of goods give legal and net weights of each kind.

4. *Weights.*—Gross weight is the weight of the package and contents. Legal weight is the weight of the goods, together with the interior packing or containers, such as cardboard or tin boxes or bottles, but does not include the weight of the outside box.

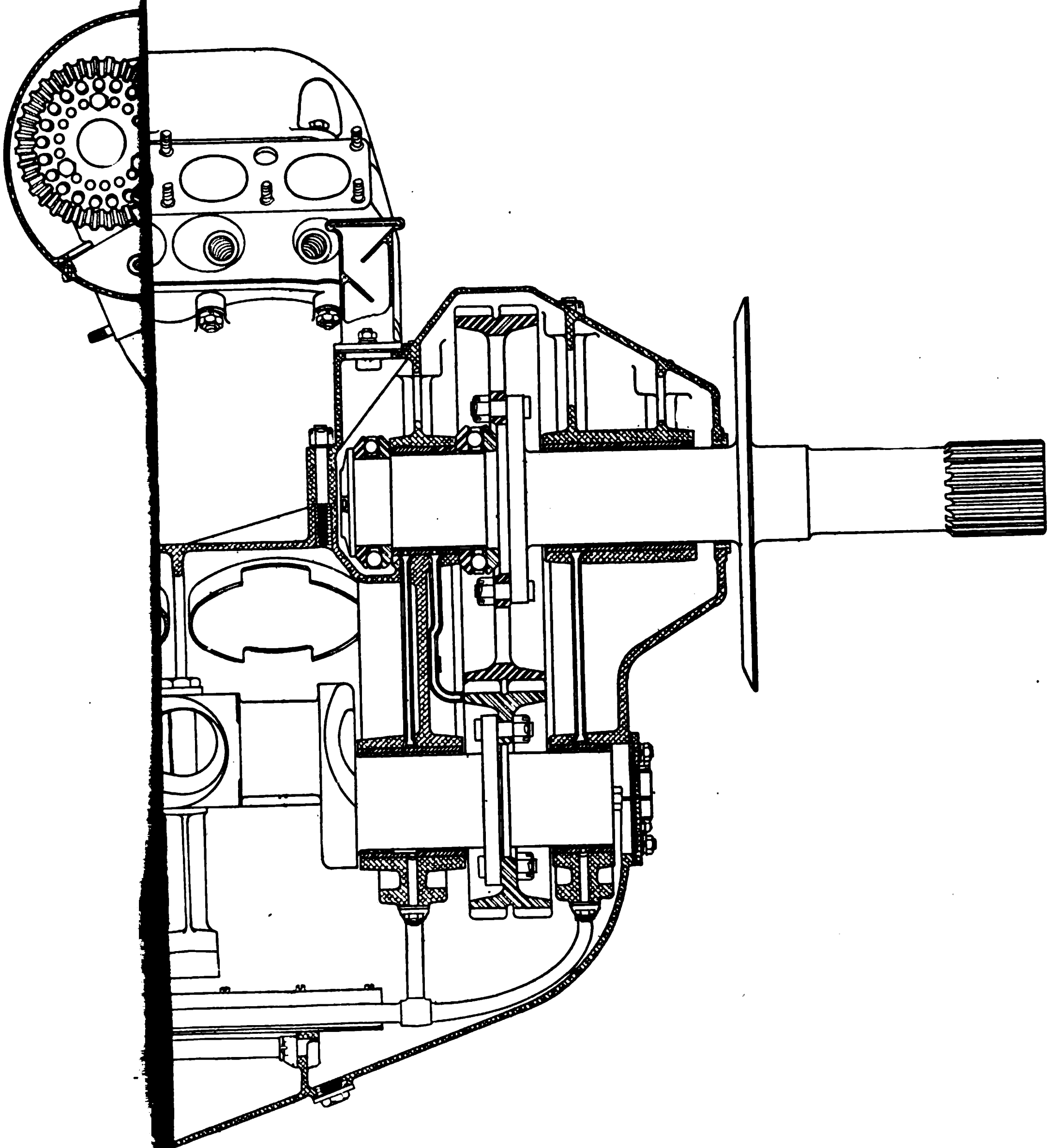
5. *Cubic Measurements.*—Show on invoices and packing lists the measurement of each package.

6. *Local Truck Deliveries.*—New York shippers will send two copies of invoices and two copies of packing lists to —— (New York forwarding agents), who will give instructions for delivery to steamer.

7. *Inland Shipments.*—Shippers outside of New York will ship on local bill of lading to —— (New York forwarding agent), mark bills of lading "For export," and send same to —— (New York forwarding agent) with two copies of invoices and two copies of packing lists immediately shipment is made.

8. *Express shipments.*—When shipment is requested to be forwarded by express shippers will send express receipts to New York forwarding agents with two copies of invoices and two copies of packing lists immediately shipment is made.

9. *Insurance, Consular Invoice, and Ocean Bill of Lading.*—These will be attended to by our forwarders on receipt from you of the above-mentioned documents.



Curtiss

K-12 Aircraft Engine

erature
geared
the cut

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

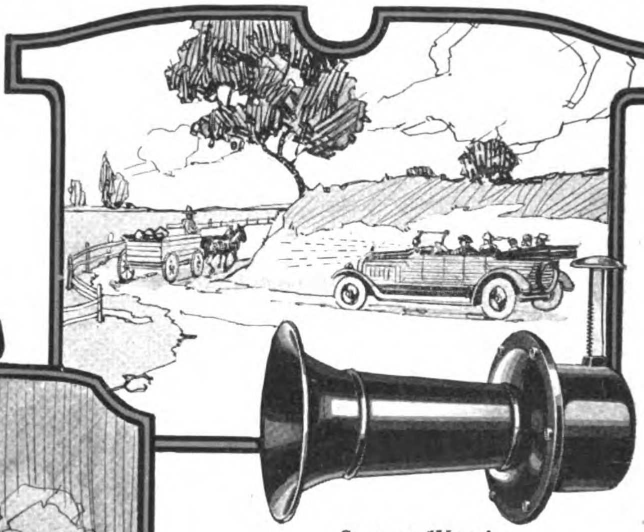
Vol. XL
Number 21

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MAY 22, 1919

Fifteen cents a copy
Three dollars a year

Stewart Stewart Stewart Stewart Stewart Stewart Stewart Stewart

3 of the famous Stewart BIG 10



Stewart Warning Signal (Hand-Operated), **$4.50**

Stewart V-Ray Searchlight $6.00

Stewart Vacuum System, $12.50

Line-Up With the Leaders

"A man is known by the company he keeps." An accessory dealer is known by the company he represents. Why not "hitch your wagon to a star?"

Your success depends on selling the kind of accessories your trade demands. Get the reputation of being a purveyor of "just as good" and you might just as well close up shop.

Stewart Custombilt Necessities are the most popular everywhere. The name Stewart guarantees a superior article and the most value for the money. You cannot make a more progressive step this year than to become known as a headquarters for Stewart Custombilt Necessities. Carry the entire line. Establish a Stewart "Big Ten" section in your store. It's a sure bet that your cash register will begin to work overtime.

The Stewart-Warner Speedometer Cor'n
Chicago, U. S. A.

Stewart CUSTOM BILT NECESSITIES

"They're More Than Accessories"

Stewart Stewart Stewart Stewart Stewart Stewart Stewart Stewart

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, MAY 22, 1919—CHICAGO NO. 21

Transatlantic Flight Achieved

American Naval Airplane Reaches Azores; British Machine and Crew Are Lost

NC-4 Reaches Ponta Delgada, 1350 Miles from Trepassey Bay, After 17:02 Hours in Air—Hope Abandoned of Finding Hawker, the Sopwith Pilot, Who Left St. John's Sunday Night

THE Atlantic Ocean has been crossed in the air, and it was an American flying boat, manned by members of the United States Navy, that accomplished the historical feat. Lieut.-Commander Albert C. Read, piloting the Navy flying boat NC-4, reached Ponta Delgada at 1.50 p. m. (New York time) on May 19. After having completed the major part of the task of crossing the Atlantic, the plane is awaiting favorable wind to complete the journey to actual European soil, Lisbon being the selected landing place. From Trepassey Bay to Ponta Delgada the NC-4 was in the air 17:02 hours, traveling 1350 miles at an average speed of 79 miles an hour. The leg of the flight remaining is only 800 miles.

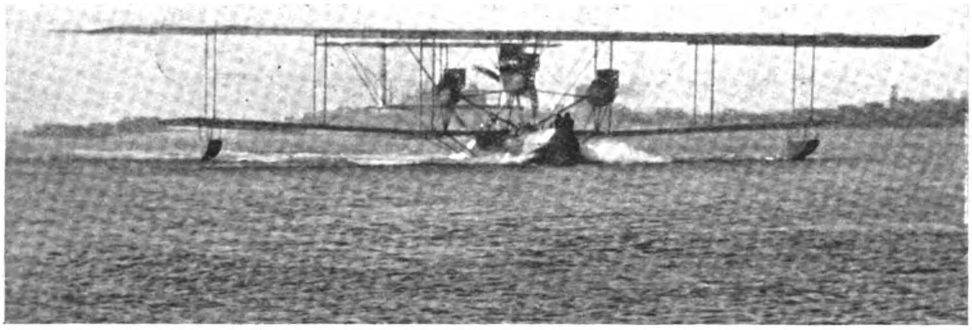
It was 100 years ago this month that the Savannah, an American built steamship, made the first trip across the Atlantic under man-made power.

Ever since Bleriot crossed the English Channel in an airplane in 1909 people interested in aircraft have looked forward to the date when the first transatlantic flight would be made in a heavier-than-air machine. It is an immense step from the twenty-odd miles of the cross-channel flight to the more than 2000-mile trip of NC-4 from Newfoundland to Portugal, and the difference in the two performances is a measure of the progress made in aircraft design and construction in the short span of ten years. The feat of Lieut.-Commander Read and his gallant crew will live in history both as a daring exploit crowned with success and as a milestone in the annals of mechanical flight.

Only one of the three NC boats which left Rockaway, N. Y., on May 8, succeeded in reaching the opposite side of the Atlantic. The NC-1, in charge of Lieut.-Commander Bellinger, was forced to alight on the ocean off the Azores in bad weather and was severely damaged. The crew were saved by a passing ship, but the plane was lost. Commander Towers' "flagship," the NC-3, got off its course when nearing the Azores, ran short of fuel, and had to alight on the ocean in foggy weather with heavy seas. It reached Ponta Delgada, Azores, under her own power, but was so seriously damaged by the buffeting she received that it was decided to disassemble her and ship her back to New York on one of the Navy vessels.

Lieut. Read's craft, the NC-4, which was pursued by ill luck during the first stage of the flight from Rockaway, N. Y., to Halifax, N. F., made the flight from Trepassey to Horta, Azores, without incident. She obtained a lead of about 30 minutes on the other planes and in consequence escaped the fog and heavy weather near the Azores that proved to be their undoing. On May 20 the NC-4 flew from Horta to Ponta Delgada, a distance of 150 miles, in 1 hr. 44 min., making its average speed for this distance 86 m.p.h. It was from Ponta Delgada that the last stage of the long air voyage was started.

The real start of the transatlantic flight was made



The NC-4 starting on her transatlantic flight. Leaving Trepassey, N. F., on the evening of May 16, the boat, after 17:02 hr. of continuous flight, reached Ponta Delgada May 19

Lieut.-Commander Albert C. Read, Commander and Navigator of the NC-4

from Trepassey, N. F., on the evening of May 16. The NC-4, which was belated in its arrival at Trepassey owing to a number of mishaps on the first leg of the long journey, had replaced one of her engines during the night. Mechanics worked on the machine all day. Her wings were given a thorough inspection, and the engines were warmed up and given their finishing touches during the afternoon. First to get away was the NC-3, which started at 4.36 p. m., Washington time. NC-1 followed at 4.56 p. m., and NC-4 at 5.13. The boats did not make directly for the Azores but practised around the harbor to warm up their engines.

Most extensive preparations had been made by the Navy to insure the safety of the crews in case there should be any accidents. No less than 22 cruisers and destroyers were stationed on the way between Trepassey and the Azores. With a total distance of about 1200 miles, this makes only a little over 50 miles between stations.

The following is condensed from an official log on the flight, compiled by the Navy Department from reports sent in by the station ships:

NC-4 First to Be Heard From

The NC-4 took off the water at 5:36 p. m., Washington time. After having circled Trepassey harbor it alighted at 5:53 p. m. It took off the water again at 6:07 p. m., and immediately started for the Azores. The NC-3 left the water for the Azores at 6:06 p. m., and the NC-1 at 6:09 p. m. All three machines passed from sight at 6:20 p. m.

The first of the three boats to be reported from the Azores was the NC-4 piloted by Commander Read. A dispatch from Horta, Island of Fayal, under date of May 17, conveyed the information that in view of thousands of persons the NC-4 arrived at Horta Bay, having been on the way from Trepassey 15 hr. and 18 min. Both crew and machine were in first-class condition. Most of the distance was covered at an altitude of 3,000 ft., but when about 200 miles from the island of Corvo, the first island of the Azores to be sighted, Commander Read had dropped to an altitude of 1,000 ft., owing to a heavy fog. Three ships were passed on the way. The crew subsisted on sandwiches, and had no sleep during the whole trip.

The other two machines lost their bearings in a heavy fog. The NC-1 was forced to alight off Corvo Island, and the NC-3 alighted off the island of Fayal. Both of them established wireless communication with American destroyers and a search for them was begun at once.

Commander Read of the NC-4 deemed it wise to alight at Horta, rather than go on to Ponta Delgada, owing to the unfavorable weather conditions. The trip of the NC-4 from Trepassey Bay to Horta, 1,200 miles, constitutes the longest overseas flight on record. So far as representatives of the U. S. Navy at Ponta Delgada were concerned, the NC-1 and NC-3 were practically lost for 10 hrs. Then their positions were located by means of directional wireless.

After the start from Trepassey, the three machines remained close together for a considerable time, but finally the NC-4 drew ahead. The progress of the different machines, as reported from the station ships, was as follows (New York time):

NC-1 passed ship No. 2 at 7:35 p. m., No. 3 at 8:03 p. m., No. 6 at 10:05 p. m., No. 13 at 3:13 a. m., No. 16 at 6:07 a m., No. 18 at 6:14 a. m.; No. 20 at 8:10 a. m.

The NC-3, which started from Trepassey at 6:03, passed station ship No. 2 at 7:35 p. m., No. 6 at 10:05 p. m., No. 7 at 10:58 p. m., No. 9 at 12:10 a. m., No. 13 at 2:23 a. m. and No. 17 at 5:15 a. m.

The NC-4, which started from Trepassey at 6:07, passed station ship No. 2 at 7:35 p. m., No. 6 at 10:05 p. m., No. 8 at 11:29 p. m., No. 11 at 1:50 a. m., No. 14 at 3:06 a. m., No. 16 at 4:30 a. m., No. 18 at 5:45 a. m., sighted land at 7:35 a. m., passed No. 22 at 8:10 a. m., and arrived at Horta at 9:25 a. m.

No mishap or incident of any kind occurred to the NC-4 during the entire voyage and the machine was found to be in perfect condition upon its arrival at Horta.

Full moon-light favored the flight during the early part of the trip. The average speed made by the NC-4 was more than 75 miles per hour. At Horta a section of the harbor had been specially prepared for the plane. Two American destroyers were at hand, ready to assist the planes if they should alight outside of the breakwater and need assistance. Most of the American naval officers at the port remained up all night to follow the progress of the planes by means of the wireless reports. The wireless worked perfectly throughout the night, merchant ships and radio stations heeding the request of the Navy to refrain from interfering with messages regarding the flight.

At 11:40 a. m., New York time, a report was received at Horta from the NC-1 that she had been blown off her course, and had been forced to alight in the open sea, 200 miles northwest of Fayal. Four destroyers were immedi-

ately sent to her assistance. From the NC-3 a report was received at 5:15 a. m., New York time, that she was off her course between stations 17 (Destroyer Stockton) and 18 (Destroyer Craven).

The weather was fair during the first part of the trip, but heavy fogs were encountered by the NC-1 and NC-2 after passing station 17, the NC-1 being forced to descend to the surface of the ocean. The crew of the NC-1 was rescued by the Steamship Ionia, east of Flores and Corvo of the Azores group, about 110 miles west of Fayal. When a wireless was received at Horta from the NC-1 to the effect that she was lost in the fog about position 20, the destroyers Phillip, Waters, Harding and Dent were sent in search of the missing plane.

After a search lasting until well into the afternoon, the Harding got into communication with the NC-1 and reported her position. The Harding at once started off in the direction from which the signals came, at a speed of 22 knots. She reported that the wireless calls of the plane became more distinct as she approached. At the time, the Harding cannot have been so very far away from the plane, as the latter when on the surface of the water can use only her weaker radio set, the more powerful set being available only when the propellers are working and the craft is in the air.

The NC-3 had not been heard from since 5:14 a. m., at which time she was approximately 265 miles off the port of Horta.

News of the arrival of the NC-4 at Horta reached the Navy Department at 10:59 a. m. on May 17.

The first official news of the difficulty experienced by the NC-3 arrived at Washington at 11:06 in a cable dispatch from Admiral Jackson on the Melville, in which he reported that the NC-1 had passed station 19, and NC-4, station 22. In this dispatch Admiral Jackson said that the NC-3 was between station No. 16 and station No. 18 at 5:15 a.m. (Washington time) but off its course. In the same message the weather was reported to be foggy.

A report of the experiences of the crew of the NC-3 was made by Commander Towers to the Navy Department, and was given out officially on May 20. This shows that the plane was forced to alight on the ocean at 9:30 a. m. (New York time) on May 17. Commander Towers had then only 2 hours' fuel supply left, and from the time he came down until he reached Ponta Delgada his machine was buffeted by heavy seas, and was in a precarious situation for something like 52 hr.

When the NC-3 alighted on the ocean, she was about 85 miles south of the straight course between Newfoundland and the Azores. In alighting the center forward engine strut was seriously damaged, and during the trip to Ponta Delgada the machine lost both wing pontoons, the first about 4 hr. before she reached port, the second, just before she entered the harbor. Ponta Delgada was reached at 1:50 p. m. (New York time) on May 19.

In his report Commander Towers says that he was compelled to go above the clouds at station No. 8, on account of the failure of the light on the pilot instrument board, and the necessity of having the heavenly bodies for reference. The last destroyer sighted was No. 13. The plane came through the clouds at daybreak, but destroyer No. 14 was missed. Commander Towers believes that he was thrown off his course by the high velocity of the winds at the higher altitudes, but says he followed a parallel course. Heavy rain squalls were encountered at 3:45 a. m. on May 17, which continued until 9:30 a. m., when the weather cleared. At that time, after considering the fuel supply, it was decided to land and make observations.

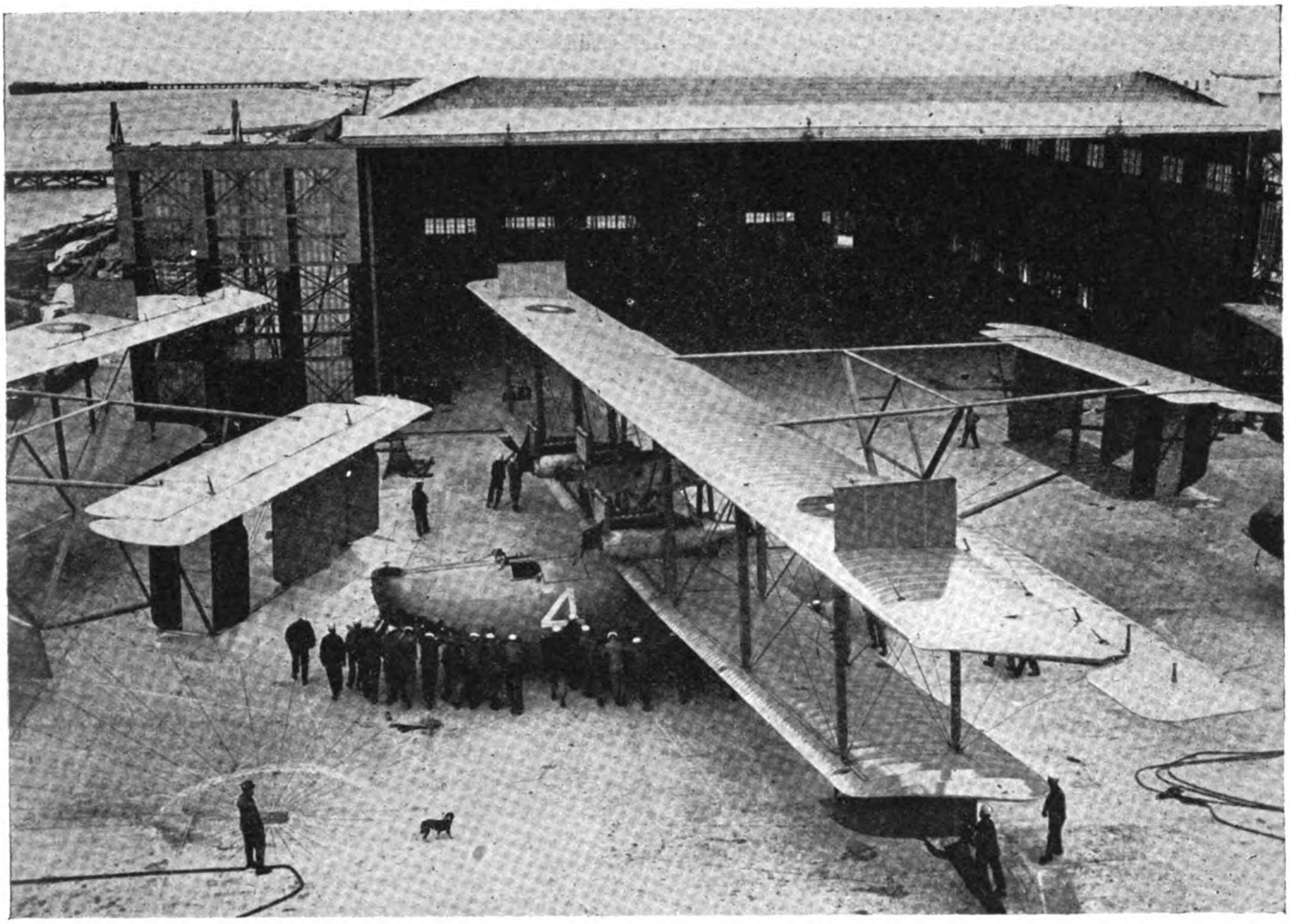
A heavy sea was running at the time, but this was discovered too late to remain in the air. In alighting, slight damage was done to the hull, but the center forward engine strut was badly damaged, and this made it impossible to leave the water again. A gale arose on the evening of the 17th, which was ridden out successfully until 5 a. m., New York time, May 19, when the port wing pontoon was lost. From the latitude and longitude given in Commander Towers' report, it is figured that he alighted on the water 90 nautical miles due south of station 22 (Destroyer Harding). This is about 95 miles from Horta and 200 miles from Ponta Delgada. The NC-3 sailed the entire 205 miles from her landing place to Ponta Delgada under her own power.

When the crew of the NC-1 was picked up by the steamer Ionia on Saturday afternoon, May 17, after they had been tossed about in the water for over 5 hr. they were greatly fatigued and suffering from sea-sickness. The plane was severely damaged by the heavy seas, and was almost a total wreck. A statement was made by Commander P. N. L. Bellinger of the NC-1 on May 19, from which we extract the following:

> The NC-1 was the last plane to take the air at Trepassey, at 6:10 p. m. (New York time). She proceeded on her course, being guided by the smoke and searchlights from the destroyers, and the star shells sent up by them. No trouble was encountered until the machine ran into a fog at

Dimensions and Characteristics of the NC Type of Flying Boats

Engines	4 Liberty
Power	1600
Span	126 ft. upper, 94 ft. lower
Length	68 ft. 3½ in.
Height	24 ft. 5⅛ in.
Chord	12 ft.
Gap	13 ft. 6 in. to 12 ft.
Wing curve	R. A. F. 6
Wings to hull	3 deg.
Engines to hull	0 deg.
Stabilizer to hull	2 deg.
Dihedral	0 deg. upper, 3 deg. lower
Wing area	2380 sq. ft. (incl. ailerons)
Aileron area	265 sq. ft.
Stabilizer	268 sq. ft.
Rudder	69 sq. ft.
Elevator	240 sq. ft.
Fin	79 sq. ft.
Weight empty	15,874 lbs.
Weight loaded	28,000 lbs.
Useful load	12,126 lbs.
Gravity tank	91 gals. capacity
Fuel tanks	1800 gals. capacity
Oil tanks	160 gals. capacity
Maximum speed	74 knots for 28,000 lbs.
Minimum speed	58 knots for 28,000 lbs.
Maximum speed	84 knots for 24,000 lbs.
Minimum speed	55 knots for 24,000 lbs.
Center of gravity	35 to 45% of wing chord
Factor of safety	3 for 28,000 lbs.



The NC-4 at its hangar

7:10 a. m. (New York time) on May 17, near station 18.

After being in the fog for some time, Commander Bellinger alighted on the water at 9:10 a. m. on May 17. The machine kept to its course until it struck the fog, when the pilot lost his bearings. It was deemed advisable to head into the wind, toward land, to take bearings before proceeding. Up to that point, the machine had been flying at an altitude of 3,000 ft., and now she dropped to 50 ft. in order to get sight of the water.

It was then found that the wind was in a different direction at the low altitude. It was also found that the fog was denser at the lower altitude. A good landing was made on the sea, which was rough and choppy, with heavy swells. The strong wind continued until the crew was picked up by the Ionia.

The mast of the Ionia was sighted at 2 p. m. (New York time), the ship being on its way to Fayal and Gibraltar. It was impossible for the crew of the NC-1 to see the hull of the Ionia, and as the vessel did not have wireless, it was impossible to communicate with her. The NC-1 therefore taxied toward the vessel, and soon they were sighted and a boat was lowered, which picked up the crew at 2:20 p. m. The position of the NC-1 when picked up was 30 deg. 15 min. longitude, 39 deg. 58 min. north latitude. An attempt was made to salvage the plane, but the tow line of the Ionia broke and the attempt was given up.

Considerable difficulty was encountered in rescuing the crew of the NC-1, as the small boat of the Ionia was tossed about like a cork. All of the crew was seasick, but otherwise they were not suffering. S O S calls were sent out by the NC-1 after alighting on the water, but the sending radius of the radio was then only 50 miles. While the crew was waiting for the rescue, they intercepted messages sent from one destroyer to another. The last radio picked up from the NC-3 was at 9:15 o'clock on Saturday morning.

Commander Bellinger stated that if the fog had not been so thick, they could have continued to Ponta Delgada. Their engines worked splendidly throughout, and the plane proceeded at an altitude varying from 500 to 3,500 ft.

Leaving Rockaway

The three NC planes of the U. S. Navy made their getaway from the Rockaway Air Station at 10 o'clock on Thursday morning, May 8. The NC-3, flagship of Commander Towers, which was piloted by Commander H. C. Richardson and Lieut. C. H. McCullough, was the first machine to start. Forty-nine seconds later the NC-1 went into the air, followed after another minute by the NC-4. The NC-1 and the NC-3 arrived at Halifax at 7 o'clock, p. m., and a report of their arrival was sent to the Navy Department at Washington by the U. S. S. Baltimore, the station-ship at Halifax. The planes made the trip of 540 nautical miles in a little less than 9 hr.

A third plane, the NC-4, commanded by Lieut.-Commander A. C. Read, had not reported at Halifax up to 8.30 p. m. Early in the afternoon, the NC-4 reported

that one of her engines was out of commission and that she was running with three engines. Later it was reported that the trouble had been corrected. Between 2 and 3 o'clock during the afternoon, the NC-4 was reported as having passed the first of the destroyers, stationed on the long lap starting at Chatham lighthouse. The machine had to make a landing at Chatham, Mass., where she was detained for several days while two of her engines were being replaced. She joined her two sister planes at Trepassey before the final "hop off."

The F-5 Navy blimp escorted the three seaplanes beyond Fire Island, and then returned to its base at Rockaway Beach shortly after 11 o'clock, a.m., on Thursday, May 8.

The second stage of the journey, from Halifax to Trepassey, was made by the NC-1 and NC-3 on Saturday, May 10. The NC-1 arrived at Trepassey at 4.14 p. m. in perfect condition after a 460-mile flight. The navigator of the NC-1 followed the precise course laid down in advance, but owing to low visibility was able to see only a few of the destroyers lining the course. The NC-3 met with a mishap on the way and had to return to Halifax, but made a second start later in the day and arrived safely late in the evening.

Hawker Not Heard From After Start

HARRY G. HAWKER and Lieut.-Commander McKenzie Grieve, the crew of the Sopwith biplane which had been waiting at St. John's, N. F., for over a month for favorable weather to cross the Atlantic, finally made off on May 19 at 1.51 p. m., New York time. No doubt the start of the NC flyers from Trepassey Bay and the successful arrival of the NC-4 at the Azores were factors in urging the British aviators to get started.

About an hour later, Frederick T. Raynham and his navigator, Capt. C. W. F. Morgan, another crew, also made an attempt to get into the air, but in trying to do so they broke the axle of their landing gear, and their machine was completely wrecked, both aviators being painfully injured. The machine which Capts. Raynham and Morgan were to pilot across the ocean was a Martinsyde.

Only about 100 persons were present when the Sopwith of Hawker went into the air. The machine ascended in spirals up to an altitude of about 2000 ft., and then Hawker flew directly east over the city, which lies 5 miles from the Mt. Pearl Airdrome, from which the start was made. Favorable weather conditions attended the start, the sky being cloudless, and only a moderate breeze blowing.

A few minutes after his start, Hawker passed Quidi Vidi Lake, alongside of which the Martinsyde Airdrome is located. As Hawker passed the Martinsyde Airdrome he cast off his landing gear, which was held on by a special tripping device to make this possible. This reduced the weight of the Sopwith by about 400 lb., and it was estimated that it would increase its speed by about 8 miles per hour. This was at once a notice to Raynham and Morgan that Hawker was off for good.

From Signal Hill, an eminence overlooking the St. John's harbor, the machine could be seen for about 10 min. longer. At the time it passed from view it was heading directly for the Irish Coast at a speed probably exceeding 100 m.p.h., as it was favored by a strong breeze.

While the weather conditions at St. John's were very favorable to the flight, those reported about the same time from Ireland were most unfavorable, there being a marked depression in that area, with rain and fog.

As Hawker and Grieve were contending for the *Daily Mail* $50,000 prize, their start had to be officially confirmed. Major Partridge, who acted as official starter, arrived at the Airdrome at 3 p. m., at which time the Sopwith had already been brought out in the open, its engine started, and everything made ready for the "hop off."

Hawker and Grieve wore heavy woolen clothing, and over that inflatable rubber suits which, it was figured, would keep them afloat for 48 hr. in case they should be thrown into the sea. They carried with them a non-sinkable boat, which was built into the fuselage of the plane, to which they intended to take in case it was necessary for them to alight on the surface of the water.

The Sopwith, with which Hawker and Grieve started from St. John's, and the Martinsyde, with which Raynham and Morgan were to make the trip, are craft of an entirely different type from the NC boats with which the U. S. Navy is making the flight. The British machines are very much smaller, and have only a single engine each. Hawker's Sopwith has a wing span of 46 ft. and an overall length of 31 ft., while Raynham's Martinsyde has a wing span of only 41 ft. and length of 26 ft. The Sopwith is equipped with a 350-hp. Rolls-Royce engine, while the Martinsyde engine only rates at 275 hp.

But while the British craft are smaller, they are speedier than the American machines. The Sopwith is rated at 100 m.p.h., and with the landing gear off she is expected to attain a speed of 106 m.p.h. Raynham's Martinsyde was a much faster machine, and was expected to make at least 124 m.p.h. with a normal load and 110 m.p.h. with the excess fuel cargo required for the long ocean flight.

Both of the British competitors intended to compete for the $50,000 prize of the London *Daily Mail*, which is for the first transatlantic flight completed in one stage, in 72 hr. It was the intention of both of the contestants to alight at the Brooklands Airdrome, near London. Commander Grieve, Hawker's navigator, expected to fly due east about 600 miles, and then turn into the transatlantic shipping lane. Capt. Morgan, of the Martinsyde, on the other hand, intended to take the direct course for Ireland, thus shortening the flight by several hundred miles.

Both navigators of the British machines relied upon their sextants and compasses for their bearings, and expected to make use of special tables in making their calculations.

At the time of this writing, Wednesday morning, no word has yet been received from Hawker and Grieve, and fears are developing that they have been lost at sea. At first there were various rumors that the Sopwith had been observed within a 100 miles of the Irish coast and another rumor was to the effect that a Sopwith machine had been observed floating on the ocean 40 miles west of the mouth of the River Shannon, but all these rumors proved without foundation. It is the belief of the British Admiralty that Hawker suffered an accident shortly after his departure, for absolutely no wireless messages were received from him, not even a farewell message.

Crowds of people waited all day Monday at the Brooklands Airdrome, where Hawker intended to land, although aircraft experts had expressed doubt that he would be able to fly the entire distance with his fuel supply. The weather off the Irish coast on Monday was boisterous, with rain and a gale.

Air Mail Service Profitable in First Year of Operation

COSTS AND REVENUES

Revenue from airplane postage		$159,700
Saving in railway transportation		2,264
Total revenue and saving		161,964
Cost of operation	$137,900	
Loss, Standard Plane No. 3, less salvage of useful parts	4,961	
Total cost of operations		142,861
Surplus		$19,103

The consolidated cost sheet for the year shows the total cost of operations of the route to be $137,900.06, apportioned as follows: Cost per mile of overhead $0.2829; cost per mile of flying, $0.2029; cost per mile of maintenance, $0.4081.

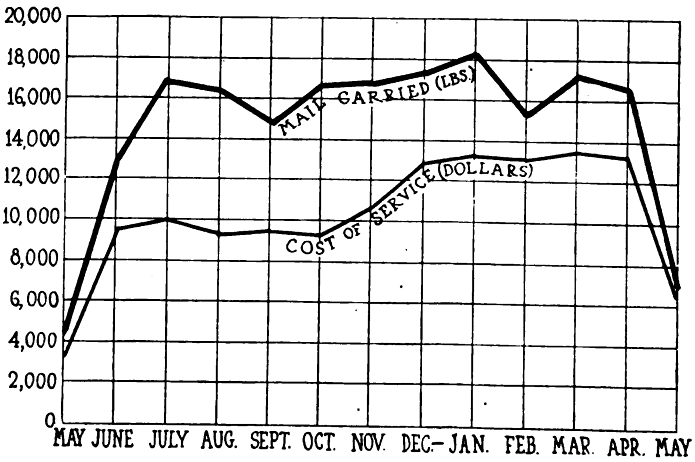
By Allen Sinsheimer

WASHINGTON, May 17—The first year of operation of the Air Mail Service between Washington and New York has particular significance because, as the first commercial aeronautical venture in this country, it indicates the possibilities of future commercial aviation, and the record of the first 12 months reveals definitely that commercial aviation is already an established fact, profitable, successful and without physical hazards.

There were no deaths resulting to the pilots carrying the mails and no instances of airplanes falling. A total of 128,256 miles was flown out of a possible 138,310 miles, 92.73 per cent of the total possible mileage. An aggregate of 193,021 lb. of mail was carried with a revenue of $159,700 and a service cost of $137,900.06. Letters carried total 7,720,840 for the year. Twenty-seven airplanes were used in the service at an average cost of $0.899 per mile each, which includes gas, grease and oil, office organization, the use of motorcycles and trucks, rent, light, fuel, power, telephone and water, miscellaneous, pilots' wages, mechanics and helpers, repairs and accessories, interest on investment, and departmental overhead. The interest on investment is a charge against the total cost of all expense incurred not including department overhead, which is considered separately. It includes a total of the cost of the planes, the landing fields, emergency fields, hangars and complete equipment.

The accompanying chart shows clearly that the commercial flying can be maintained successfully both winter and summer and that the planes can combat gales and winter conditions regardless of their severity. Starting in May, 1918, the planes traveled 78 per cent of the possible mileage, 94 per cent in June, reaching 100 per cent in September. The record fell in November and December, corresponding with the increase of severe weather, reaching a low point of 77 per cent of possible mileage performance in the latter month. The efficiency then increased gradually, despite gales of 70 m.p.h. in March, until it reached 98 per cent of the total possible mileage in May, 1919.

That the fogs, rain, snow and other climatic conditions are responsible for increased gasoline consumption and reduction of the number of miles traveled is clearly indicated by the chart, in which the curve showing the trips in clear weather, the miles traveled and the per cent of performance rise and fall together, while the trips in fogs, etc., the miles per gallon gasoline consumed, the cost of service and the forced landings rise and fall in direct contrast to the curve of the per cent of performance. Fifty-three of the trips made in January were through fog, rain and snow, at which time the mileage



Relation between mail carried and cost of service since May, 1918

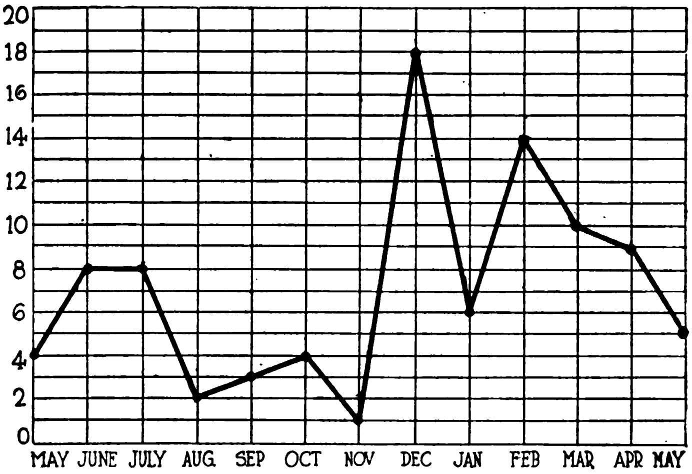
performance fell to 82 per cent, while the cost of operation climbed to $13,300.

That the engine trouble was probably the result of climatic conditions to an important extent is indicated by the fact that it occurred chiefly at the same time with the forced landings caused by the weather.

Three types of airplanes have been used in the service, including the Standard, JNRI, the Curtiss and the De Haviland 4 army airplane, which was reconstructed and adapted to mail carrying. Each of the first two was equipped with engines of 150 hp. and the De Haviland with the 400 hp. Liberty engine. The reports indicate that the power of the Liberty engine was found necessary to combat the heavy gales. The 150 hp. engines were unable to achieve a speed over 37 m.p.h. in the face of the high winds.

Of 1261 possible trips, 1206 were undertaken and fifty-five were defaulted because of weather conditions. Four hundred and thirty-five trips were made successfully during rain, fog, snow, gales and electrical storms. Fifty-one forced landings resulted on account of the weather and thirty-seven because of engine trouble. The Department believes that these forced landings have demonstrated that the airplanes, as designed for the army, lacked the strength necessary for daily cross-country work.

It was necessary early in the operation of the service to determine if visibility is essential to commercial flying. The first step was the refinement of the existing radio direction finders to eliminate the liability of 3 to 5 per cent of air. This was worked out by the Navy Department on an air mail testing plane. The second problem was that of guiding the mail plane to the center of the plot for landing. This problem has been solved by the Bureau of Standards in experiments with the radio directional compass, which is now effective to an altitude of 1500 ft. and by further refinements will be made efficient for 2500 ft. The year's flying in the mail service has established the fact that 200 ft. visibility from the ground is the limit of practical flying, although in emergencies flights have been made at altitudes as low as 50 ft.



Number of forced landings due to weather and engine trouble

The distance between Washington and New York by air is 218 miles and has been covered in 1 hr. 58 min., while the distance between New York and Philadelphia, which is 90 miles, has been covered in 48 min. Speed averages have reached as high as 110 m.p.h., while against the severe gales of last March they were held down as low as 51 m.p.h.

Several of the planes, of the Curtiss and Standard makes, have records of 200 flying hours and 14,000 miles of flying each. Records of flight include 191 legs of the New York-Washington route by Dana De Hart, who covered 21,360 miles and made 179 of the legs and 20,324 miles without a forced landing. Max Miller flew 82 legs covering 9,242 miles without forced landing or an uncompleted flight. The service was under the control of army aviators during the first three months of operation, and was then taken over by the Post Office Department and was operated by a civilian organization.

Following is the complete report of Second Assistant Postmaster General Otto H. Praeger, who is in charge of the Air Mail Service, containing complete tables of the cost and the performance for the year:

Forced Landings Due to Mechanical Troubles, May 15, 1918, to May 15, 1919.

Date	Distributer	Magneto	Generator	Radiator or Water Trouble	Bad Valves	Gas Pressure Leak	Oil Pressure Leak	Carburetor	Plugs Fouling
May 16									1
May 20		1							
June 3	1								
Jnne 8				1					
June 11				1					
June 24		1							
July 5									1
Juiy 8									1
July 16							1		
July 23						1			
Avg. 27								1	
Sept. 21					1				
Sept. 24				1					
Oct. 26							1		
Oct. 30				1					
Nov., none									
Dec. 11		1		1					
Dec. 18*									
Dec. 19									1
Dec. 23							1		1
Dec. 24									1
Jan. 16							1		
Feb. 8				1					
Feb. 12							1		
Feb. 15			1				1		
Feb. 25							1		
Feb. 27					1				
Mar. 15				1					
Mar 21								1	
Mar. 25		1							
Mar. 27									2
Apr. 1				1					
Apr. 12						1			
May 2		1							
Totals									

*Thrust rod broke crank case; killed motor.

Report on AIRPLANE MAIL SERVICE

Washington-Philadelphia-New York Route, for Year of May 1, 1918, to May 1, 1919

POST OFFICE DEPARTMENT,
Office of Second Assistant Postmaster General,
Washington, D. C., May 15, 1919.

The Postmaster General:

One year ago to-day the Aerial Mail Service was inaugurated by your direction, with instructions that once installed it must remain a permanent and practical feature of mail transportation. The first year's operation of this service has vindicated the judgment of the Department in entering upon this work.

At the request of the Chief Signal Officer of the Army, the operations of the Aerial Mail Service were originally conducted by the Army in connection with its work of training aviators for the war. This service continued under military direction until August 10, when, by agreement with the Secretary of War, it was taken over by the Post Office Department and operated by an entirely civilian organization.

A single route from Washington to New York was established, though much incidental work was done with reference to the extension of the service to other parts of the country as soon as sufficient equipment became available. This

Consolidated Statement of First Year's Operations of Air Mail Service

Month	Trips Possible	Trips Attempted	Trips Defaulted	Weather Encountered		Mileage Possible	Miles Traveled	Per Cent of Performance	Mails Carried (Pounds)	Cost of Service	Forced Landings Due to	
				Trips in Fog, Etc.	Trips Clear						Motor	Weather
1918												
May (15 days)	60	53	7	31	29	6,750	5,324	78.87	4,750	$3,682.11	2	2
June	100	96	4	35	65	11,250	10,685	94.97	13,081	9,922.71	4	4
July	108	106	2	41	67	12,150	11,855	97.57	16,967	10,001.46	4	4
August	109	109	0	17	92	11,988	11,984	99.96	16,588	9,555.67	1	1
September	100	100	0	36	64	10,900	10,900	100.00	15,200	9,638.74	2	1
October	108	108	0	24	84	11,772	11,617	98.68	16,788	9,841.76	2	0
November	104	102	2	24	80	11,336	11,118	98.07	16,854	10,673.68	0	1
December	104	91	13	50	54	10,896	8,415	77.23	17,778	13,300.46	7	11
1919												
January	108	92	16	53	55	11,772	9,653	82.00	18,105	13,741.58	1	5
February	97	92	5	42	55	10,554	9,307	88.18	15,489	13,645.16	6	8
March	106	102	4	34	70	11,554	10,699	92.59	17,531	13,880.29	5	5
April	107	105	2	32	75	11,682	11,105	95.06	16,677	13,516.44	2	7
May (15 days)	52	52	0	16	36	5,706	5,593	98.01	7,213	6,500.00	1	4
Total	1263	1208	55	435	826	138,310	128,255	92.73	193,021	$137,900.06	37	53

preparatory work related to the establishing of a second route from New York to Chicago, an air-line distance of 720 miles across the Allegheny Mountains and the southernmost points of Lakes Erie and Michigan

Trial flights were made to establish the practicability for commercial work of the De Haviland 4 airplane, which became available upon the signing of the armistice, but it was found that this plane, designed wholly for war purposes, lacked the strength necessary for daily cross-country work, with its incidental forced landings. It was then decided to modify these war planes, and, after some delay, aeronautical engineers have developed a strong and powerful plane which can still retain all the excellent flying qualities of the De Haviland machine.

The principal work of the Aerial Mail Service, however, concerned the operation of a daily air-mail service between Washington and New York, a distance of 218 miles air line. A great divergence of opinion existed among aeronautical experts as to the possibility of the Post Office Department keeping up anything approaching a daily service, regardless of weather conditions. The opinion was held that the service would have to be given up during the winter months. However, the postal authorities and the aeronautical experts retained by the Post Office Department believed that practically all of the weather conditions could be overcome, and that possibly 90 per cent of the trips scheduled could be entered upon. How well this judgment has been borne out is shown by the fact that out of a possible 1263 trips, only 55 were not undertaken and utterly failed on account of weather or other conditions requiring the sending of the mail by train. This is a record of only 4.4 per cent of trips not attempted. Out of a total 138,310 miles possible there were flown 128,255 miles, which is a performance of 92.73 per cent. Such performance for a single motor training plane was not believed possible when our service began, and has never been equalled in the history of aviation. It should be explained that the airplane journey from Washington to New York and return, daily, is made in four trips, as follows: Washington to Philadelphia; Philadelphia to New York; New York to Philadelphia, and Philadelphia to Washington, mail and—when necessary—pilots and planes being exchanged at Philadelphia.

In the year's operation an aggregate of 128,255 miles was flown, and an aggregate of 193,021 lb. of mail was carried, the cost of operation of this route being $137,900.06. It may be well to state here that the same six airplanes that entered upon this service a year ago to-day, with the same engines that operated them, are on the flying fields on this date, rendering a continuous service, and the mail to-day from Washington to New York and New York to Washington will be carried in the same airplanes that made the initial flight from Potomac Park on May 15, 1918, and that brought the mail from New York on that day. This operation has cast a new light on the question of the life of an airplane, and demonstrates that the mechanical requirements and results in commercial flying are much safer, much more economical, and in many instances more practical than in exhibition or military flying.

During the year there have been 37 forced landings, due to mechanical troubles during flight, which is another record not heretofore approached in aviation, and speaks well for American-built airplanes and the mechanics who were engaged to keep them in flying condition. Especially is this record a strong tribute to the American-built Liberty and Hispano-Suiza motors.

In field work, in testing out of planes by aviators, there has been one serious injury, when an aviator smashed a plane, resulting in the gas tank catching fire on the ground. In this accident the pilot was severely burned, but was able to report for duty at the end of four weeks.

The New York-Washington Air-Mail Service, while undertaken as a permanent transportation improvement in the carrying of mail, was, during its first year, largely an experimental proposition. Inaugurated before the close of the war, it was possible to obtain only small training planes with a limited capacity for carrying mail. It had to be established first that a daily, fairly dependable schedule could be maintained. Exploration and experiments had to be made to properly equip the planes to fly regardless of weather conditions and of visibility. The route was but 218 miles in length, and the cost of operations of this route had to bear the entire cost of adapting the war machines and training machines to commercial work as well as the cost of the experimental flying and the experimentation with devices that would enable flying in all kinds of weather. Under the circumstances, the cost of the service would naturally be higher than it should be the subsequent years of operation, with the expense problems connected with experimental flying solved. Likewise, the cost per pound of mail carried in the larger planes which are now available will be much less than the cost of carrying the mail in planes of but 200 lb. mail capacity.

Costs and Revenues

Revenue from airplane postage		$159,700
Saving in railway transportation		2,264
Total revenue and saving		161,964
Cost of operations	$137,900	
Loss, Standard Plane No. 3, less salvage of useful parts	4,961	
Total cost of operations		142,861
Surplus		$19,103

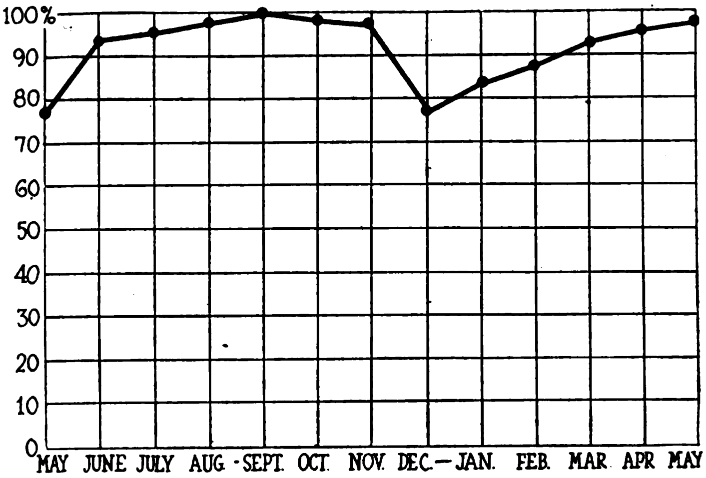
The consolidated cost sheet for the year shows the total cost of operations of the route to be $137,900.06, apportioned as follows: Cost per mile of overhead, $0.2829; cost per mile of flying, $0.2029; cost per mile of maintenance, $0.4081.

The revenue on the sale of airplane stamps was $159,700. In addition to the airplane mail there were carried several million ordinary letters taken from railroad connections,

which were advanced in delivery by airplane over train from twelve to eighteen hours. This improved service involved millions of letters delivered by reason of airplane service in New York in the afternoon, instead of on the following morning had they gone by train, which alone justifies from a postal standpoint the operations of the service.

The postal value of an airplane service depends upon the distance covered and upon railroad schedules. There is not sufficient business between New York and Washington of such an urgent nature as to pay out through airplane postage alone the cost of operations. The distance is too short and the train service too efficient to warrant the use on a large scale by commercial interests of airplane service in lieu of the train service. The transportation by airplane is ordinarily twice as fast as by train, and on distances of 600 miles or more, no matter how frequent or excellent the train service, the airplane mail at the higher rate of postage should equal the cost of its operation. Wherever the train service is not as frequent or as fast as it is between Washington and New York the airplane operations should show an immense profit on all distances from 500 miles up.

Again, with large airplanes and over greater distances, substantial reduction in the sums paid to railroads for mail transportation would be made, besides cutting down the time of transit by one-half.



Per cent of possible monthly mileage flown since May, 1918

New York-Chicago Route Most Promising

The most promising of such routes is the run from New York to Chicago. An airplane leaving New York at 5 a. m., traveling at the rate of 80 m.p.h., with 15-min. stops for mail and exchange of planes at Bellefonte, Cleveland, and Bryan, will reach Chicago before 2 p. m., Chicago time, thereby insuring connection with the afternoon regular carrier delivery. Such an airplane dispatch, by reason of the great service rendered, would give a handsome profit on operations.

The first leg of the New York-Chicago route will be opened with our rebuilt De Haviland airplanes to-day from Cleveland to Chicago, and the remainder of the route from New York to Cleveland will be opened as soon as the necessary Curtiss R-4 mail ships are delivered to us by the factory, which should be within the next thirty or forty days.

One positive lesson learned from the operation of the aerial mail during the year is that the element of danger that existed in training aviators in military flying and exhibition flying is almost entirely absent from commercial flying.

The record of the Aerial Mail Service, which includes flying at altitudes of as low as 50 ft. in periods of marked invisibility, throws an interesting light on the dangers of aviation. In a period of one year, covering a travel of 128,255 miles, there has never been an airplane carrying the mail fallen out of the sky; there has not been a single death of an aviator in carrying the mails. The casualty record for the year comprises two deaths. One of these was in the case of an aviator who undertook to give a demonstration of his flying ability before being given a plane to carry the mail. He went up in a De Haviland 4 and showed by his management of the plane that he was not qualified for the work. He put the plane in a vertical stall at a low altitude and crashed to the ground, killing himself. The second casualty was that of a mechanic who slipped and fell into a whirling propeller of a machine that was on the ground.

There have been six injuries to aviators of a minor character and two serious enough to send the aviators to the hospital for a period of several weeks each. All of these accidents occurred, not in the air, but while on the ground. Of the minor injuries, the aviators were in a position to report for duty on their next run. These injuries consisted mainly of bruises or contusions sustained by a plane turning over after it had landed on the ground. Of the three types of planes operating regularly in the mail service, one type was more given than the others to turning over on rough ground, and it was principally on those planes that the pilots were shaken up or bruised by the plane turning turtle.

The first serious accident, which resulted in a hospital case

Consolidated Cost Sheet of First Year's Operations and Maintenance of the Air Mail Service

Airplane Number	Gas	Grease and Oil	Office Force	Motor Cycles, Trucks	Rent, Light, Fuel, Power, Telephone, and Water	Miscellaneous	Pilots	Mechanics and Helpers	Repairs and Accessories
1	$539.36	$105.71	$159.31	$178.55	$157.60	$335.70	$961.86	$782.36	$2,747.48
2	698.09	187.17	353.70	427.52	308.47	1,052.85	1,358.80	1,622.64	608.95
3	449.16	153.40	281.01	396.20	280.93	828.13	903.76	1,377.66	293.22
4	631.71	175.16	340.95	427.52	258.92	821.23	1,061.77	1,664.10	697.74
5	317.58	78.24	131.22	178.53	157.61	335.71	613.80	827.47	516.08
6	283.52	81.62	109.00	115.49	124.12	215.96	540.40	728.03	433.85
7	164.45	54.91	167.16	169.01	107.29	442.55	212.60	687.39	125.94
8	119.13	18.43	121.18	169.00	107.28	330.55	253.24	471.05	104.45
30	124.97	11.15	43.37	107.33	39.96	133.79	36.71	243.78	67.00
14872	129.93	20.43	49.30	91.41	66.93	217.06	91.51	389.31	18.35
24213	54.59	11.13	40.20	63.05	33.51	119.77	67.31	85.85	16.20
24224	30.15	6.24	22.32	107.33	27.95	122.25	17.66	31.72	12.00
37944	15.75	2.71	11.73	12.40	22.06	2.66	48.41	129.99	9.77
(10) 38262	704.21	207.80	376.88	618.20	319.57	954.62	1,230.57	1,891.86	2,360.18
(12) 38274	896.90	242.85	364.10	618.20	306.36	915.23	1,265.83	2,200.88	1,796.60
(17) 38275	698.47	202.49	394.69	618.20	363.12	1,113.22	1,076.10	2,075.00	2,269.61
38276	191.01	60.70	46.13	190.68	54.66	62.38	321.57	587.69	270.44
(11) 38278	1,063.82	328.49	407.98	618.20	376.16	1,031.78	1,832.37	2,748.31	713.73
(14) 38279	272.96	91.73	195.02	248.99	162.87	466.69	745.85	868.30	457.46
(15) 38280	283.70	57.22	167.16	169.00	106.68	448.56	544.13	715.53	275.37
(39) 39362	570.99	114.93	330.63	574.48	313.52	800.86	545.90	1,689.93	1,803.17
(38) 39363	710.47	117.06	265.34	574.49	248.26	808.83	740.02	1,500.87	341.43
39364	221.66	47.80	181.83	412.94	225.56	905.11	339.76	910.94	339.18
39365	581.83	72.29	257.94	593.91	315.76	930.66	566.50	1,422.15	288.27
39366	503.12	69.62	124.93	285.06	127.74	243.43	511.81	822.50	667.25
(43) 39367	534.45	49.14	179.17	416.88	200.11	502.51	579.25	1,160.72	968.85
Totals	$10,791.98	$2,568.42	$5,122.25	$8,382.57	$4,813.00	$14,142.09	$16,467.49	$27,636.03	$18,202.57

Cost per mile overhead, $0.2829; cost per mile flying, $0.20[illegible]9; cost per mile maintenance, $0.4081.

NOTE.—The numbers in column 1 in parentheses indicate new numbers of planes.

Consolidated Cost Sheet of First Year's Operations and Maintenance of the Air Mail Service

Airplane Number	Interest on Investment	Departmental Overhead Charge	Total	Service and Unit Cost						
				Gallons of Gas	Total Time Run		Total Miles Run	Miles Run per Gallon of Gas	Cost per Hour	Cost per Mile
					Hours	Minutes				
1	$401.77	$422.48	$6,792.18	1,826	127	29	10,253	5.61	$53.40	$0.6624
2	685.51	746.68	8,050.38	2,282	151	06	11,547	5.06	53.40	.6971
3	583.54	633.19	6,180.20	1,507	85	40	6,413	4.25	72.00	.9636
4	685.51	746.68	7,511.29	2,063	137	54	9,993	4.84	54.60	.7516
5	401.79	422.47	3,980.50	1,082	78	46	4,389	4.05	50.40	.9069
6	331.67	337.16	3,300.82	935	61	49	4,944	5.28	53.40	.6676
7	186.39	184.05	2,501.74	540	21	08	1,643	3.04	70.80	1.5226
8	186.39	184.05	2,064.75	391	18	14	968	2.47	113.40	2.1330
30	131.35	118.97	1,058.38	414	3	07	180	.43	339.60	5.8798
14872	144.90	168.53	1,387.66	412	10	39	962	2.33	130.20	1.4424
24213	70.11	85.31	647.03	174	7	51	476	2.73	82.20	1.3593
24224	108.46	118.97	605.05	100	1	50	180	1.80	330.00	3.3613
37944	27.56	16.66	299.70	62	7	19	550	8.87	40.80	.5449
(10) 38262	828.14	850.44	10,342.47	2,291	157	06	10,273	4.48	66.00	1.0066
(12) 38274	828.14	850.44	10,285.53	2,939	219	......	14,393	4.89	46.80	.7146
(17) 38275	828.15	850.42	10,489.47	2,287	150	53	9,840½	4.30	69.60	1.0659
38276	163.92	103.78	2,052.96	632	51	34	3,401	5.38	39.60	.6036
(11) 38278	828.16	850.44	10,799.44	4,151	252	49	17,953	4.32	42.60	.6015
(14) 38279	262.47	324.21	4,096.55	877	61	10	4,380	4.99	67.20	.9352
(15) 38280	165.14	184.04	3,116.53	921	52	36	3,951	4.28	59.40	.7887
(39) 39362	725.29	720.28	8,189.98	1,826	49	33	3,988	2.18	165.00	2.0536
(38) 39363	725.27	720.29	6,752.33	2,219	73	08	6,161	2.77	92.40	1.0959
39364	583.74	579.69	4,748.21	774½	25	28	1,907	2.46	186.00	2.4898
39365	774.69	788.94	6,592.94	1,749	61	31	5,132	2.93	107.40	1.2846
39366	336.01	302.57	3,994.04	1,672½	90	35	8,098	4.84	43.80	.4932
(43) 39367	520.29	448.56	5,559.93	1,803	61	51	5.006	2.77	90.00	1.1106
Totals	$11,514.36	$11,759.30	$131,400.06	35,930	2020	06	146,981½	4.09	$64.80	$0.8939
	Add May 1 to 15, 1919		6,500.00	......	76	14	5.593	......	......	......
	GRAND TOTALS		$137,900.06	......	2096	20	152,574½	......	......	......

of several weeks, occurred to a pilot driving a De Haviland 4, the axle of which crumpled after the pilot had touched the ground and had run some distance along the surface.

The other accident was in the case of an aviator who started up to try a motor that had gone through the block test, and at 150 ft. elevation it began to miss. Not desiring to take the chance of landing on rough ground, he undertook, what nobody has ever been able to accomplish with a De Haviland, that is, to turn around and land in the center of his field. The turn naturally killed his speed and he slipped to the ground in a side slip. The plane struck partially on a wing and partially on the radiator nose, driving the engine into the air-pressure tank, which squirted a spray of gasoline that caught from the exhaust and sent the machine in flames while the plane was on the ground. The aviator jumped through that flame and his clothing caught fire and he was burned about the face and hands.

One Death for Every 64,108 Miles Flown

Of one type of machine in the mail service, which has performed almost half of the amount of work of the other two types, there has never been a case, by reason of the construction of the machine, of turning turtle. This record means, taking into account all of the accidents, whether on the ground, testing machines, testing aviators, flying the mail, or other cross-country work, that there has been but one death for each 64,018 miles flown—one serious accident in each 64,018 miles, and one minor hurt for each 21,340 miles. This is a record which will compare favorably with any mode of mechanical transportation in its early days. Even this favorable record is susceptible to improvement by reason of the steady development of the airplane itself.

The following is a chronological list of accidents and deaths in the Aerial Mail Service for the year just past:

Sept. 10, 1918—Ed. C. Radel, mechanic, plane No. 39367; turned over and completely wrecked on return experimental trip from Chicago to New York; Radel pinned under plane; motor fell on him, injuring arm somewhat, and burning back with gasoline; 10 miles from Belmont; taken to hospital for treatment, but out next day. Edw. Gardner, pilot (Chicago-New York reconnoissance); nose had been broken a short time before; this fall shook it loose again and gave him a black eye.

Oct. 18, 1918—M. A. Newton, pilot, plane No. 39366, Philadelphia to Belmont; four miles from Belmont engine went dead, gas pressure failed, and dropped plane in deep hole which was so covered with dust and weed-filled that it looked to be solid ground; thrust pilot forward, breaking his nose; flew next day.

Dec. 16, 1918—Carl B. Smith, pilot, making demonstration flight to show ability to fly; plane No. 39464, DH-4; machine in perfect condition according to test-out before; Elizabeth, N. J.; plane fell directly to earth, killing pilot instantly; observation made that if pilot's seat had been in the rear cockpit where the mail compartment was he might have been saved, as that part of the plane was undamaged; pilot crushed almost beyond recognition.

Dec. 28, 1918—Lyman W. Doty, pilot, injured in accident at Belmont Park; plane No. 24238, DH-4, demolished; faulty axle; machine of too soft wood; crumpled like an eggshell when the axle of the plane gave way; this pilot would not have been injured if pilot's seat had been located in the rear where the mail chute is placed instead of directly between the engine and gas tank.

Jan. 7, 1919—Auguste Thiele, mechanic, while starting propeller of plane No. 4, slipped and fell in front of blade, fracturing skull, at Belmont Park; accident occurred at 3.20 p. m.; Thiele in hospital at 4.40 p. m.; died at 6.14 p. m.

March 19, 1919—L. D. Smith, pilot, plane No. 8, Tottenville, Staten Island, N. Y.; Smith's nose broken; heavy wind brought him down; nothing wrong with motor; broke landing gear, propeller, and wing.

April 26, 1919—Paul Ferron, plane No. 68, DH-4, Belmont; pilot started up to try a motor which had gone through the block test, but it missed at 150 ft. Not desiring to land on rough ground, he turned around to land in the center of the field, killing his speed and slipping to the ground in a side slip; plane struck partly on wing and partly on radiator nose, driving engine into air-pressure tank, which squirted a spray of gasoline that caught fire from the exhaust and sent the machine in flames; pilot jumped through flames clothing catching fire, and receiving burns about face and hands; in hospital several weeks.

In the course of the year a number of severe gales were encountered and a few trips failed through experimenting with different types of planes to meet the gale conditions. Out of the experience this lesson was learned: It is useless to send

(Continued on page 1147)

Design of Tractor Wheels

Variety in Design Emphasized by Sketches Shown—Spokes Made of Round and Flat Bar Stock and of Pressed Steel—Plain, Flanged and Corrugated Rims

By P. M. Heldt

TRACTION engine wheels have been in use for many decades, and it might be supposed that their design had been fairly well settled. This, however, is far from correct. It must be remembered that previous to the advent of the gas tractor the number of traction engines manufactured was limited and there was not that competition among parts makers to improve their product, and thus secure for themselves a bigger share of the market, which we are witnessing to-day. All improvement in wheels tends toward decrease in weight without loss of strength and toward a lessening of the cost of manufacture.

Tractor wheels must, of necessity, have comparatively large diameter, and this seems to almost preclude the all-cast wheel. The rims are rolled of either flat or angle steel, the hubs are cast and the spokes, which are of either flat or round section, are riveted to the rim and either cast into the hub or riveted to flanges thereon. All wheels have two rows of spokes, and in order to secure lateral rigidity these spokes must slant considerably. The driving and braking torque is not transmitted through the spokes, and the latter therefore may be arranged radially.

The sketches illustrating this article were drawn by an AUTOMOTIVE INDUSTRIES artist at the Kansas City tractor show and represent practically all the different designs of wheels at present in use. One of the sketches shows the Fordson front wheel. The rim of this wheel is rolled up out of two steel angles, and the flat spokes are riveted between the two outwardly extending flanges of the angles which form the skid ring. The outer ends of all spokes are thus in the same plane, and this gives considerable inclination to the spokes, insuring great lateral rigidity without an unduly long hub. The inner ends of the spokes are cast into the hub.

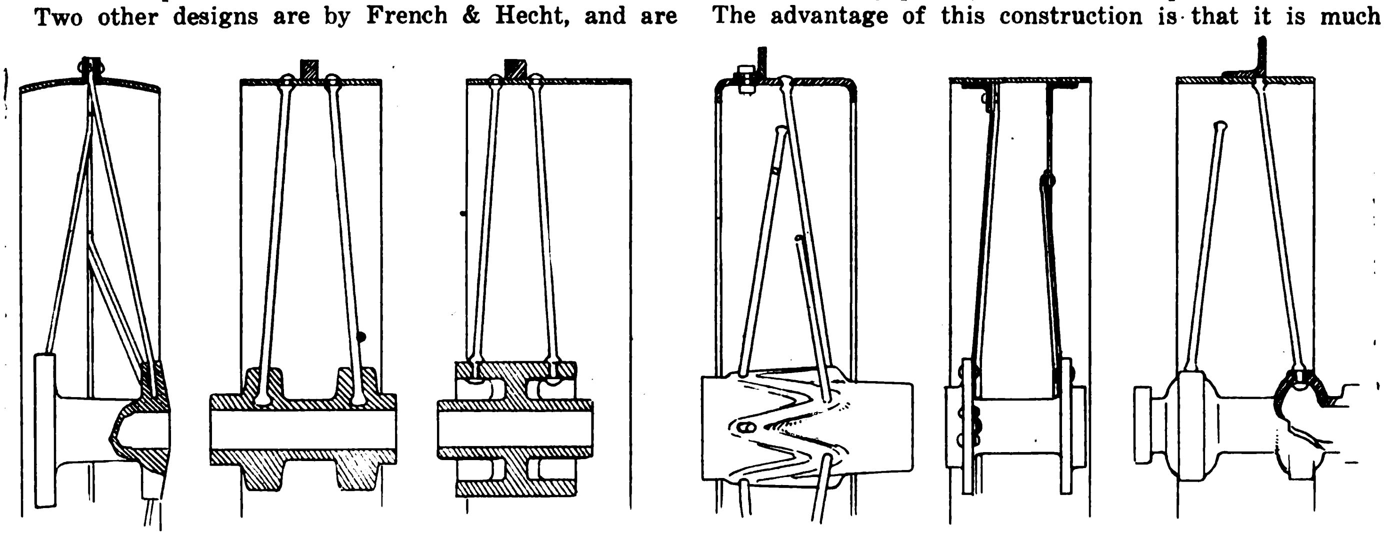
Two other designs are by French & Hecht, and are standard traction engine wheels. Both have plain rims, and the round spokes are cast into the hub, being anchored in circumferential flanges in one instance and in a sort of rim in the other. It does not appear that there is much difference between these two designs of hubs as regards weight of metal. Plain skid rings of square cross-section are shrunk on to these wheels.

Another sketch shows the Hart-Parr design of front wheel. This has an inwardly flanged rim, a construction which gives light weight without unduly reducing the structural strength. The sketch bears witness to the effort of the designer to reduce weight to a minimum. In order to gain plenty of lateral strength, the spokes are all brought to the same central line on the rim, and are given a considerable slant. To secure a firm anchorage of the spokes in the hub, the latter is cast with a zigzag flange, the spokes entering the hub at the turning points of the flange. In this wheel an angle-iron skid ring is used, which is bolted to the rim.

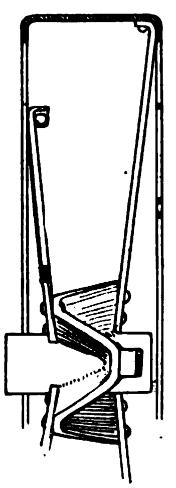
The J. I. Case T. M. Co. wheel has a plain rim with two angle-iron rings riveted to the inside, to which the spokes are riveted. The spokes are made of pressed steel, with a corrugation running down the middle, and appear to be very light. This is the first sketch to be shown in which the spokes are riveted both to the rim and to the hub. There are flanges of ample depth on the hub, which facilitate the riveting.

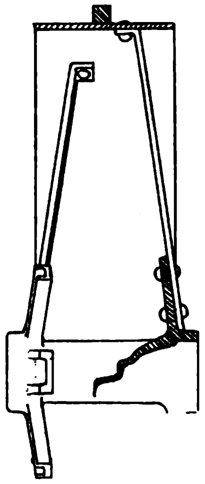
The Russel front wheel has round spokes cast into the hub and riveted into the plain rim. An angle-iron band serves as a skid ring. The hub is somewhat unusual, in that it is chambered out where the flanges for the spokes come.

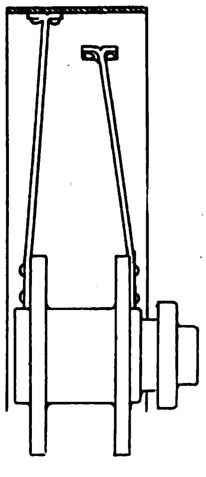
The wheel of the new Twin City tractor has the hub formed with a moderately deep zigzag flange, with flats at the turning points, to which the spokes are riveted. The advantage of this construction is that it is much

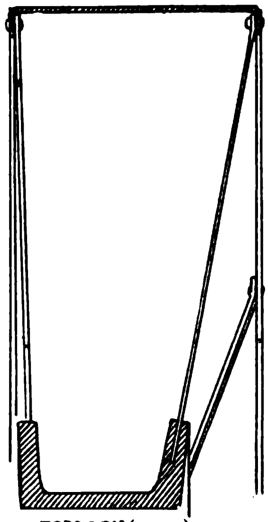


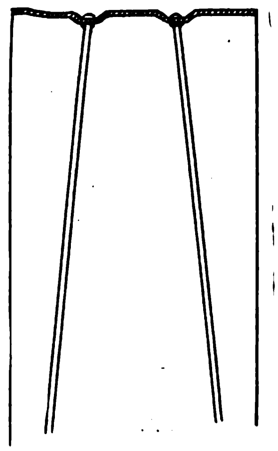
FORDSON (Front) WISCONSIN SANDUSKY HART-PARR CASE RUSSELL


TWIN CITY


AVERY


LIBERTY


FORDSON (Rear)


VELIE

easier to hold the heads of the rivets in riveting the spokes in place than where there are two flanges. As the two rows of spokes are comparatively close together at the hub, they are arranged to spread outwardly toward the rim, and they are riveted to the rim just inside the inwardly turned flange. The Avery front wheel has a cast hub with spurs to which the flat spokes are riveted. The spurs are quite long, and are formed with a depression, in which the flat spokes fit, and there are two rivets in each spur.

The wheel of the Liberty tractor has flat spokes with Tee heads riveted to the rim, and a cast hub with deep flanges to which the spokes are riveted on the outside. There are two rivets through the inner end of each spoke.

The Fordson rear wheel is similar to the Fordson front wheel, except that the two rows of spokes, instead of approaching, recede from each other in passing from the hub to the rim, and the outer ends are riveted to the inturned flange of the wheel rim.

The rear wheels on the new Velie tractor have corrugated rims. The wheels are of French & Hecht make, and the idea of the corrugation is to strengthen the rim.

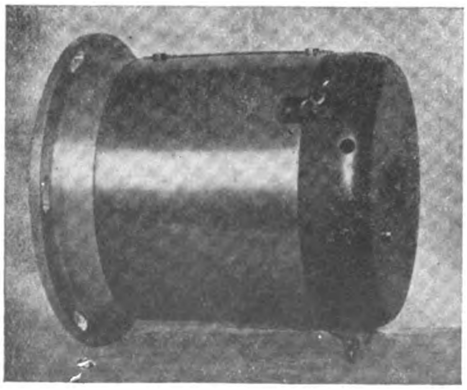
The Liberty Ignition Magneto

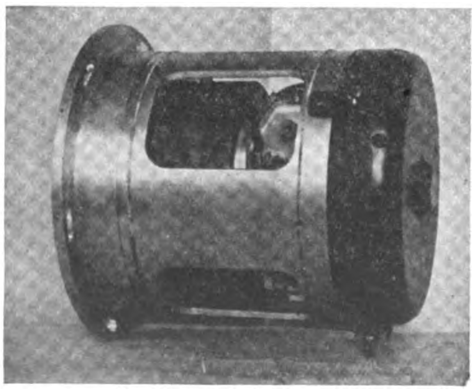
ENGINEERS of the Berkshire Magneto Co., Pittsfield, Mass., have developed a high tension, inductor type magneto which is mechanically interchangeable with the distributor heads forming part of the battery ignition system used on the Liberty aircraft engine. This magneto will be marketed as the Liberty.

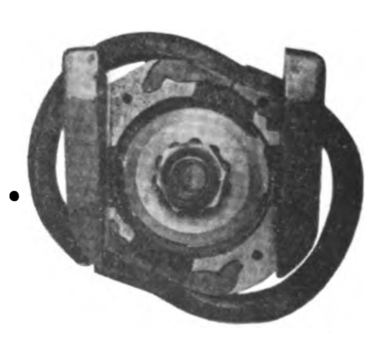
In appearance the magneto closely resembles a small electric motor, as it is cylindrical in form, measuring 6½ in. in diameter by 7¾ in. in length. The weight is less than 17 lb. Briefly described, the magneto consists of a cylindrical aluminum frame within which is mounted an aluminum field casting with four sets of laminated steel inserts for pole pieces. The four poles of the field are not symmetrically arranged, as in standard practice, but are located so that the distances between the centers of adjacent poles are alternately 67½ and 112½ deg. apart, these angular spacings corresponding to the intervals between successive explosions in the engines. This arrangement insures that all sparks occur at corresponding points of the voltage wave, thus insuring substantially equal intensity of all sparks.

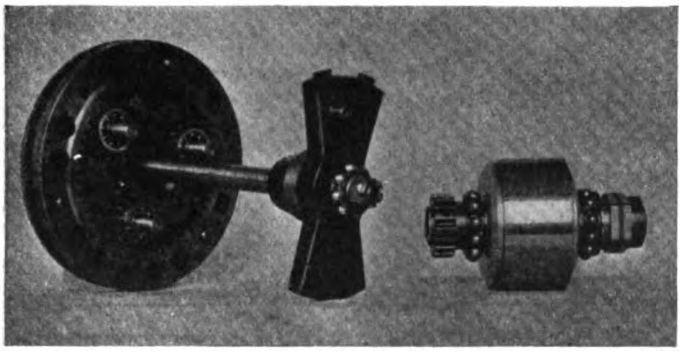
Secured to opposite sides of the field casting are two nearly semicircular magnets of tungsten steel, the ends of which abut each other in the center of one pair of pole shoes. The primary and secondary coils of enamel-insulated wire are wound on a laminated core. After final assembly the entire unit is thoroughly impregnated with a special compound in a vacuum.

A two pole rotor, arranged for four sparks per revolution, built up of steel punchings and assembled on a one-piece, hollow steel shaft, is carried on two substantial ball bearings,

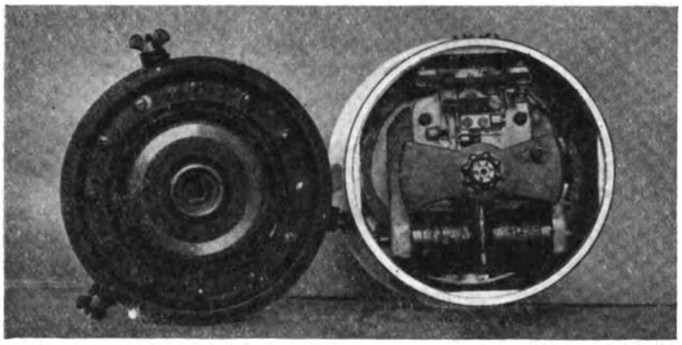

Complete Liberty magneto


Magneto with sheet metal housing removed


Arrangement of field structure



Distributor and distributor gearing



End view of Liberty magneto showing interrupter and cam

one of which is rigidly mounted in a flange on the inside of the main frame, while the other is pressed into an aluminum plate, secured to the outer end of the field casting, which also serves to carry the interrupter and condenser.

The interrupter, which is of exceptionally light design, is operated by a self-lubricating cam, so designed as to provide for the irregular spacing of explosions.

The distributer is of the gap type, made of a molded compound, with metal inserts and socket type, radial receptacles for the leads from the spark plugs, the terminal binding screws being on the inside. This distributor also serves as the end cover of the magneto, and when removed exposes the interrupter, condenser, coil and other vital parts, which are thus easily accessible for inspection or repair.

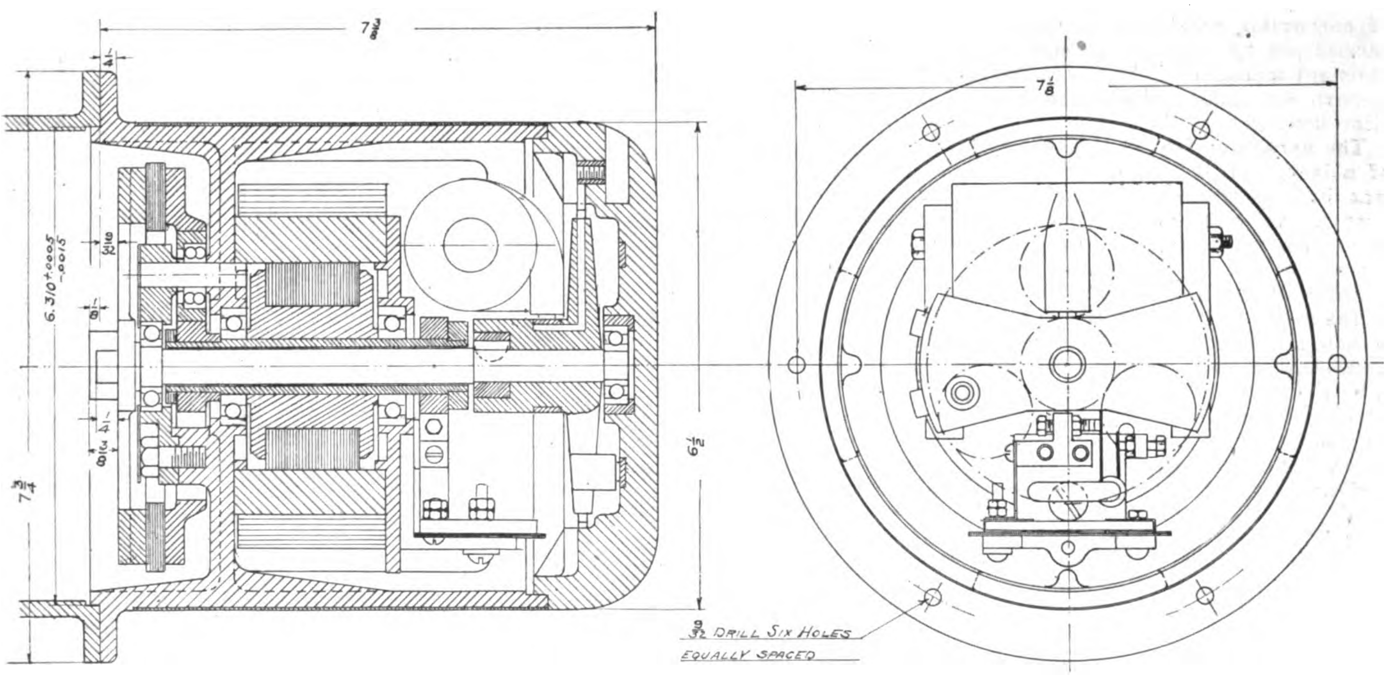
Power is transmitted from the camshaft of the engine to the rotor through a flexibly mounted train of gears, comprising a large bronze annular gear and three steel pinions, which latter engage with a hardened steel pinion on the rotor shaft, causing it to turn at three times camshaft speed. A sheet metal cover incloses the side of the frame and together with the distributor on the end forms a water and dust proof protection for the working parts of the magneto.

Newest Type of Zeppelin Cruiser

ALL the latest improvements that the Germans had achieved were embodied in a Zeppelin which made a forced landing in France in October, 1917. Since that time no change has taken place in any essential feature. In length the airship is about 656 ft., the total height 79 ft., and its volume 2,000,000 cu. ft. In form the central portion is cylindrical, and the two ends taper to a cone. Of the four gondolas one is placed well forward. This is divided into two compartments, in one of which there is the commander's cabin and the wireless telegraphic apparatus, while in the other the motor is fixed. Approximately amidships, side by side, are two other gondolas, each of which is also furnished with a motor. The fourth gondola, situated close to the tail, contains two engines, one of which is held in reserve for emergencies.

A triangular passage is built into the lower part of the envelope and is completely covered in. A ladder connects the gondolas directly to this passage. A wooden construction in the center of this passage contains the fuel, the water ballast, the bombs, and several hammocks. A cylindrical chimney, constructed of a series of metal rings, connects this passage to a platform on the top side of the airship, where machine-guns and other light weapons are stationed. The four gondolas are well streamlined. The most forward of these is 32.8 ft. long, 20 ft. of which is taken up by the cabin of the commander. In height this chamber is 8.2 ft. and in breadth 7.4 ft. The motors develop approximately 1200 hp., while the diameter of the four propellers is 16 ft. The fuel tanks are of aluminum, and hold 80 gal.

The water ballast tanks have a capacity of 265 gal. The normal speed of this airship amounts to 62 m. p. h., while journeys of 30 hours' duration were undertaken without any difficulty. With a good climbing capacity the airship can attain heights of 18,000 to 20,000 ft.



Sectional and end views of Liberty magneto

Flowmeters and the Calibration of Carbureter Nozzles*

Experimental Work on Carbureter Nozzles in Respect to Gasoline-Flow Calibration—Development of a Standard System of Carbureter Nozzle Calibration by Gasoline Flow

By Capt. G. Smith Clarke

PREVIOUS to July, 1915, as far as the author is aware, it was the universal practice of carbureter manufacturers to define the size of their carbureter nozzles as the size, in inches or millimeters, of the drill used to produce the orifice. This system, however, did not give that interchangeability of the nozzles, from a carburetion standpoint, which it was undoubtedly intended to do. For instance, let us suppose that an engine fitted with a duplex carbureter was giving satisfactory results when two nozzles marked 1.70 mm. were fitted. There was then absolutely no guarantee that another engine and carbureter, similar in every respect as far as is possible, would give anything like similar results when fitted with two other nozzles also marked 1.70 mm.; or, further, let us again suppose that such an engine when fitted with nozzles marked 1.70 mm. showed obvious signs of weak mixture, then again there was no guarantee that nozzles marked 1.80 mm. would pass more gasoline; in fact, as will be shown later, it was frequently found that nozzles marked 1.60 mm. passed more gasoline than those marked 1.80 mm. when tested under similar pressures. This condition of affairs created the impression that there was some mysterious "individuality" among gasoline engines, even when they were practically identical in capacity, design and workmanship. Subsequent developments have proved that much time, labor and materials were needlessly expended in trying to cope with this supposed "individuality," which in the majority of cases was really due to the "individuality" of the carbureter nozzles.

It is believed that the first investigations into the behavior of carbureter nozzles as commercially manufactured were carried out by Lieut. B. Humphrey, who, about 1905, when assistant manager of the Great Western Railway Motor Car Department, instituted a system of nozzle calibration by gasoline flow.

The apparatus first used is shown in Fig. 1, and consisted of a length of ½-in. gage glass tube, to one end of which was fitted an adapter to take the carbureter nozzle to be calibrated. At two points, as shown on the diagram, datum lines were made on the tube, 10 in. apart, and the number given to the nozzle was the number of seconds required to pass the quantity of gasoline between these points.

The method of using this instrument was for the operator to hold the tube vertically, nozzle downward, and, closing the nozzle orifice with his finger, to fill the glass tube with gasoline; the nozzle orifice was then uncovered, and as the top of the gasoline column passed the first datum point a watch was started, being stopped as the column passed the bottom datum point. Such a method was obviously crude and liable to serious error, but the results obtained were such as to fully justify the development of the system, and it may be stated that from the date of these early experiments until the present day the size of all nozzles used by the Great Western Railway Motor Car Department has always been designated by a figure representing discharge under fixed conditions. In 1909-10 it was decided to standardize a system whereby all nozzles were calibrated under a constant head of 100 cm., the number stamped upon the nozzles representing the quantity of gasoline in cubic centimeters passed in unit time, which was fixed at one minute.

The instrument used for this system of calibration consisted of a 1-in. brass tube a little over 100 cm. in length, fitted at the lower end with an adapter to take the nozzles to be calibrated, and provided with a valve to control the flow of gasoline. At the upper end a float feed mechanism was fitted, which maintained a constant level of gasoline in the tube 100 cm. above the nozzle orifice. This, it is confidently believed, was the father of all constant-head nozzle calibrating machines, and upon this system has been based the system now standardized by the Aeronautical Inspection Department and the Royal Air Force.

Concurrently with the nozzle calibration experimental work described, efforts were made to produce a simple gasoline flowmeter for the determination of the gasoline being consumed during engine testing. The usual method of measuring consumption by timing a given volume of gasoline is liable to serious error, its accuracy depending entirely upon the personal element, while to run one hour or even half hour consumption tests is wasteful and expensive. After much experimental work and many failures, a satisfactory instrument was evolved. This will be fully described later.

In July, 1915, when the author first became interested in

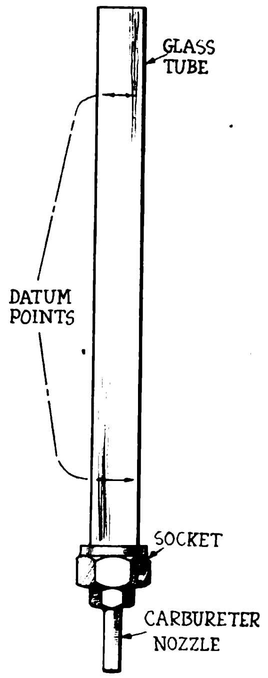


Fig. 1—Early device for determining flow characteristics of carbureter nozzles

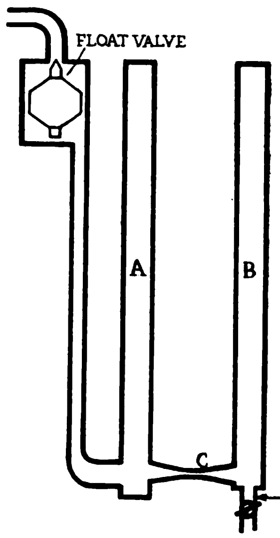


Fig. 3—Diagram of flowmeter type of instrument

*Paper presented to the Institution of Automobile Engineers, condensed.

the inspection and running tests of aero engines, the 80-hp. Gnome and the 90-hp. R. A. F. were the engines built, both being air-cooled and therefore very sensitive to variations in the strength of the explosive mixture. The Gnome engine was fitted with a floatless carbureter having a multi-orifice nozzle, the actual gasoline flow being controlled by a simple stopcock between the nozzle and the fuel supply. As may be supposed, very careful adjustment of the stopcock was needed to get the engines through their tests, on the fuel consumption demanded, without damage to the steel cylinders through overheating, and it was quite the usual thing for an engine to do several official test runs before the tester hit upon the correct adjustment.

The 90-hp. R. A. F. engine was fitted with a duplex carbureter having two diffuser nozzles, and it was a very difficult job to get these engines through the official test, one engine often taking several days. The troubles experienced were overheating, failure to obtain the required fuel consumption, erratic running and bad distribution. These troubles were usually attributed by the manufacturer's staff to insufficient cooling, and to "dud" magnetos, but it was always the opinion of the author that the great majority of them were due to bad carburetion. Reaming of nozzles was officially prohibited, since it was obvious that the nozzles must be interchangeable in the field by makers' numbers; after changing nozzles it was necessary to run the engine for at least half an hour before the result could be seen, and if, as frequently happened, the engine during the run had been getting a weak mixture, overheating had dried up the pistons and damaged the piston rings, which would not be detected until several tests had been run, the engine getting steadily worse and finally refusing to give the required power. It would then be taken off the test bed and overhauled, after which the whole process would be repeated, until by a lucky shot a pair of nozzles were found which gave the required results, and the engine was passed off test amid general rejoicings.

Irregularities in Operation Traced to Nozzle Sizes

Finally the conclusion was reached that carburetion was really the root of the trouble, and investigations were made into the characteristics of the carbureter nozzles as supplied by the manufacturers. Tests carried out with a small tank, a glass measure and a stopwatch showed that it was quite impossible to take the maker's number as an indication of the quantity of gasoline which the nozzle would pass under given conditions. As the result of these investigations, an instrument was made for the calibration of nozzles under a constant head. The instrument previously described was copied, except in the matter of the actual head used. This, in view of the fact that the nozzles used in the aero engines were very much larger than those used in car engines, and also that the instrument might be reduced in size, was fixed at 50 cm. The timing mechanism was incorporated as an integral part of the instrument and inter-connected with the control valve.

A large number of jets of various makers' sizes were then taken from the stock of an engine contractor, and these were very carefully calibrated; the new number, which represented quantity of gasoline in cubic centimeters per minute passed under a constant head of 50 cm. was tabulated against the original maker's number, the results of these experiments being shown in Tables I and II.

These figures confirmed the previous conclusion that the maker's number had practically no connection with the actual nozzle size, and it was decided that all nozzles in stock at the works of various engine contractors must be recalibrated, but as the engine testers and the R. F. C. personnel were accustomed to think of nozzles in maker's numbers, it was at this juncture decided that such numbers must be retained, a flow of value being fixed for each nominal size.

Time instruments were installed at the works of the carbureter makers, and nozzles began to come through which could be depended upon to some extent. The result of this was that conditions in the engine-testing shops showed great improvement, and engines were got through acceptance tests with very much less trouble. A little later, upon the introduction of other makes of carbureters, it was finally decided to drop drill sizes entirely and to adopt the gasoline flow figure as the nozzle size. This was known as A. I. D. Standard Jet Calibration System, Mark 1, the sizes indicating the flow of gasoline through the nozzle in cubic centimeters per minute, under a constant head of 50 cm., using gasoline of S. G. 0.700 to 0.750, at a temperature of 50 deg. F.

Nozzle Calibration Eliminates Carbureter Tuning

With every type of engine using non-adjustable nozzles, it has been possible to fix the nozzle sizes for use on test and in flight, and with very few exceptions all the engines of any one type have been tested upon nozzles of the fixed size without any carbureter tuning whatever, while in the very few exceptional cases the necessary change has not exceeded plus or minus 15 per cent, the extreme variation only being found in the case of nozzles of the diffuser type.

All engines have been dispatched from maker's works fitted with the standard size flight nozzle for its particular type, and in this case again, with very few exceptions, the machines have passed the flight test, and have been put into service without alteration of nozzle size.

In the comparatively few cases where it has been necessary to change the flight size nozzles this has usually been eventually traced to variations in the design or position of the air intake pipes fitted after the engine has been installed in the aeroplane.

In the case of rotary engines having carbureters fitted with adjustable nozzles, a very interesting instance of the value of "gasoline flow" calibration has been experienced. On what is believed to be the most powerful rotary engine which has been built in quantities, a carbureter was fitted in which the nozzle size was controlled by a taper needle connected to the throttle slide; this had been adapted from a smaller edition of a similar type of carbureter, and the needle valve was very far from satisfactory. Once a carbureter was corrected to suit the engine all other carbureters were

TABLE I

Maker's Number	Flow in c.cs. per min.	Maker's Number	Flow in c.cs. per min.	Maker's Number	Flow in c.cs. per min.
1.60	255	1.65	250	1.70	280
1.60	215	1.65	270	1.70	277
1.60	195	1.65	240	1.70	257
1.60	197	1.65	260	1.70	257
1.60	252	1.65	230	1.70	290
1.60	275	1.65	267	1.70	290
1.60	240	1.65	255	1.70	240
1.60	257	1.65	260	1.70	245
1.60	257	1.65	265	1.70	255
1.60	232	1.65	260	1.70	280
1.60	240	1.65	*100	1.70	287
1.60	210	1.65	265	1.70	277

*Obstructed by solder inside nozzle tube.

TABLE II

Maker's Number	Flow in c.cs. per min.	Maker's Number	Flow in c.cs. per min.	Maker's Number	Flow in c.cs. per min.
1.75	285	1.80	280	1.85	280
1.75	260	1.80	282	1.85	292
1.75	257	1.80	270	1.85	267
1.75	257	1.80	262	1.85	272
1.75	245	1.80	272	1.85	290
1.75	277	1.80	292	1.85	297
1.75	170	1.80	267	1.85	280
1.75	287	1.80	287	1.85	245
1.75	265	1.80	282	1.85	292
1.75	272	1.80	282	1.85	282
1.75	270	1.80	277	1.85	280
1.75	280	1.80	300	1.85	272

made uniform and interchangeable with it, by calibrating each one on a specially adapted flowmeter, at several positions of throttle opening. So satisfactory was this method that when shortage of carbureters rendered this necessary engines were despatched without carbureters, to be followed when supplies permitted by carbureters which had been calibrated, but which had not been tested upon engines, and in every case these functioned correctly when fitted to the engine, without any further adjustment whatever.

Standard System of Nozzle Calibration

With the adoption of the principle of gasoline flow calibration, and the decision that all nozzles must be calibrated on the "time instrument," new troubles were at first experienced, it being frequently found that nozzles calibrated in London failed to check up correctly when tested at Coventry or Birmingham. Many theories were put forward to account for these discrepancies, the most usual ones being that temperature and barometric pressure were affecting the accuracy. The author, while recognizing that temperature was possibly having some small effect, could not believe that this factor alone was responsible for the amazing differences sometimes found between a nozzle calibrated at the maker's works and the same nozzle when tested upon his master instrument at Coventry.

Causes for Test Differences

Investigations were made by taking nozzles which had been very carefully calibrated at Coventry and trying them in the instruments in use in London, and, strangely enough, the London figures were identical in every case with those obtained at Coventry. This was very puzzling, but finally the trouble was located, and found to be caused by three things, among which the factors of temperature or barometric pressure were *not* evident.

The first and most important cause of the differences was that the calibrating instruments used by makers did not have interconnected stopwatches, an ordinary 30-minute recorder, constantly working, being hung between two instruments, and doing duty for both. It was found that in order to save time the operators did not always start gasoline flow when the hand passed zero on the watch dial, but at the point which the hand happened to be passing when the nozzle was in position ready for calibrating, and as the operators naturally talked with each other while waiting for the minute to pass, it was very likely that in many cases calibration commenced at, say, 10 seconds past zero, and continued for perhaps 50 seconds, or perhaps 70 seconds, the operator, in the meantime, having forgotten just where she began.

The second cause of difference was that the particular nozzles in question, being of the diffuser type, had a cap screw, which, during the calibrating process, was left loose in order to facilitate its removal by the fingers when it was necessary to ream the orifice to size. When this cap was finally screwed hard home it then occupied a different position, and was closer to the nozzle orifice than it had been during calibrating, and this was found to vary the flow when again tested in the instrument by some 8 to 10 per cent.

The third cause of difference was that the cap screw mentioned was, after final assembly, locked by soldering, and it would seem that either the soldering fluid used or the heat had some considerable influence on the nozzle orifice, this being proved by the fact that nozzles calibrated immediately before and after soldering showed marked differences in discharge.

Three Master Instruments Provided

To settle disputes as to the accuracy of calibration figures, three master instruments were provided, which it was claimed were absolutely accurate and foolproof. These were designed by a London automobile engineer, the principle being that the opening and closing of the gasoline valve was automatically accomplished at an interval of exactly one minute. The energy was provided by a falling weight, and the time controlled by a quarter-seconds pendulum. Unfortunately, although the design was undoubtedly very ingenious, it did not work properly, and after much heartbreaking work it was finally decided to discard the automatic gear and to substitute an interconnected valve and stopwatch.

Shortly after the completion of these instruments, in consequence of the enormous increase in the number of nozzles being manufactured, it was considered necessary that an instrument should be produced in which the time element could be eliminated, and to this end a number of gasoline flowmeters were placed on order. After much labor and experimental work an instrument was produced which proved thoroughly satisfactory in every respect, and with the exception of certain alterations in details of design which have been rendered necessary by the ever increasing sizes of jets required, has remained unaltered in principle until the present day.

Toward the end of 1916 a serious fault was discovered in the standards which had been used for the calibration of the Mark I flowmeters, it being found that the effective head in the master time instrument was varying considerably with the size of nozzle being calibrated; this was due to the control valve being of insufficient size, which caused considerable restriction in the gasoline flow during calibration of the master nozzles. This defect had but very little effect when the maximum size required was in the order of 350 c.c. per minute, but with the advent of nozzles passing 700 to 800 c.c. per minute, required for the more powerful engines then coming into use, it became necessary to alter the master instrument, and to supersede Mark I calibration by Mark II.

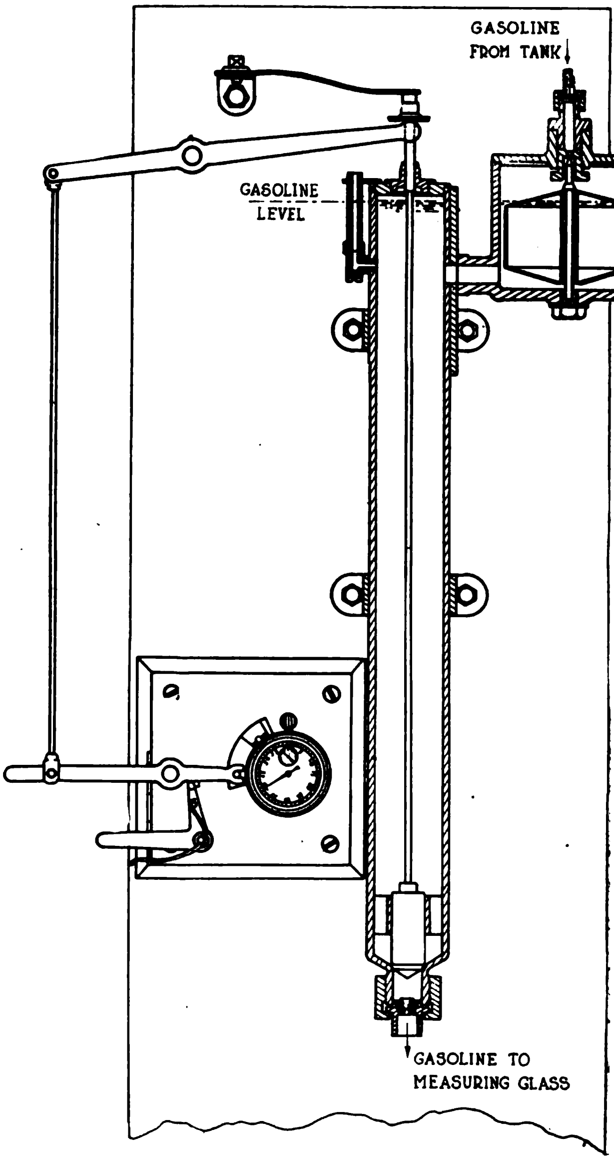


Fig. 2—Sectional view of master time flowmeter

Having arrived at the finally perfected and standardized Mark II instruments, a brief description of their construction and method of working will be given and, since the root principle has never changed, this will cover the whole range of instruments previously described.

Fig. 2 is a sectional arrangement of the master time instrument. It consists of a vertical tube A, fitted at the lower end with a control valve B, and with an adapter to receive the master nozzles shown in position at C; a constant level of gasoline 50 centimeters above the nozzle orifice is maintained by the float feed mechanism D.

The valve B is normally closed by the spring E, and is opened when required by the lever F, which is interconnected with the stopwatch lever G. The stopwatch lever when placed in the "on" position is retained "on" by the trigger H.

Gasoline is supplied to the float chamber from a tank above the instrument, and after passing through the nozzle is collected in the bottom tank, being returned to the upper tank for further use by means of an air pump.

Calibration of Master Nozzles

The method of calibration of the "master" nozzles is as follows:

Accurately made nozzles having all edges carefully rounded and with a length of "stricture" not less than three or more than five diameters of the actual orifice, are inserted in the adapter. The lever is pressed into the "on" position and gasoline is allowed to run for a minute or so to get rid of any air which may be present below the valve.

The trigger H is then released, thus closing the valve. The stopwatch is now set to zero and a graduated measure being placed under the nozzle, the control lever is again pressed into the "on" position, and gasoline is allowed to flow through the nozzle into the measure for one, two, three or five minutes, according to the size of the nozzle to be calibrated. It will be seen that the actual time during which gasoline is flowing is recorded by the stopwatch, and that should the operater fail to close the valve exactly on the minute intervals it is a simple matter to divide the actual time registered into the quantity of gasoline in the measure, and so obtain the exact quantity passed per minute. Fig. 3 shows a purely diagrammatic arrangement of the "flowmeter" type of instrument; this will be dealt with in the last section of this paper.

The principle upon which this instrument works may best be described as follows: A and B are vertical tubes connected at their lower ends by the venturi passage C. Tube A is coupled to a float feed mechanism which maintains within it a practically constant level of gasoline whatever may be the quantity passing away through the venturi C. Tube B is provided with an outlet at D controlled by a stopcock. It will be evident that when the stopcock is closed gasoline in tube B will reach the same level as in tube A, but if the stopcock is opened, the level in tube A will remain constant or practically so, but the level in tube B will fall to some point at which it will remain stationary, the amount of the fall depending upon the quantity of gasoline flowing from the stopcock, providing of course that this quantity is within the range of any particular instrument.

The range of difference in the height of the gasoline in the tubes is controlled by the discharge, under the constant head, through the venturi orifice, which in the instrument takes the form of an accurately made and carefully calibrated nozzle.

Formula for Scale of Flowmeter

The formula for calculating the scale graduations when the instrument is used as a measuring flowmeter is

$$Qa = C\sqrt{2\,gh}$$

or

$$h = \frac{Qa^2}{C^2\,2\,g}$$

Where Qa = Actual cubical discharge from the delivery side of the instrument.

h = The difference in height between the constant head on the supply side of the instrument and the reduced head on the discharge side.

C = The coefficient of discharge of the venturi orifice, which varies with the area of the orifice *and with variations of the detail design of each type of instrument*; therefore it is, of course, essential that the value of "C" be carefully determined experimentally in every case.

The Mark II nozzle calibrating flowmeter has two progressive scales which are calibrated, not in unit volume passed by the nozzle being tested, but to correspond with the amount passed by the corresponding master nozzle when this is tested in the master time instrument under a constant head of 50 cm.

How Instrument Is Used

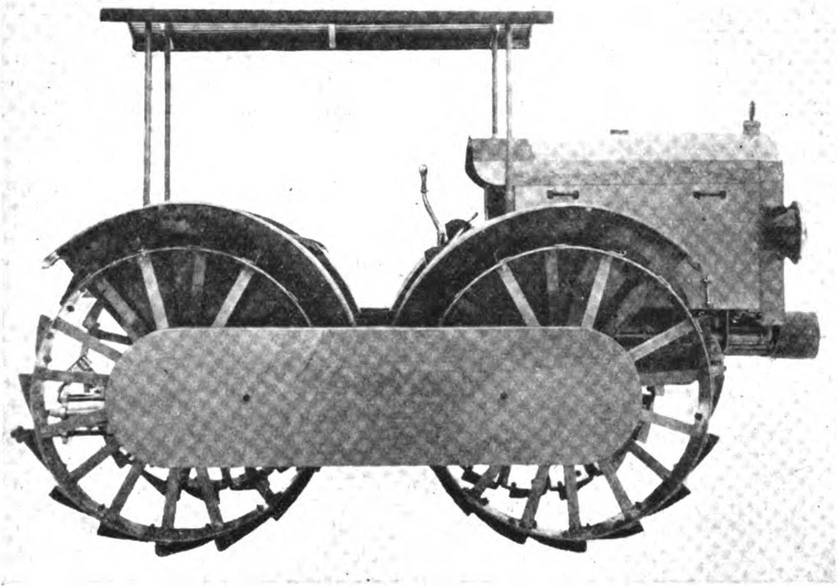
When using the instrument, the nozzle to be calibrated is inserted in a special adapter, under the scale upon which its desired size is found. The gasoline cock at the base of the gage tube is opened, and after the air trapped in the adapter has been released by means of the valve provided for this purpose, the level of the gasoline in the gage tube will drop and remain stationary at a figure upon the scale which denotes the size of the nozzle which is being tested, and it will be evident that this provides a method of nozzle calibration into which the personal equation of the operator cannot enter, since there is no measurement of time or of quantity required. It is desired to emphasize particularly the fact that the numbers given upon the scales indicate the quantity of gasoline which the corresponding master nozzles would pass under the constant head of 50 cm., but as the head actually acting upon the nozzle in this instrument varies with the size of the nozzle being tested, the actual quantity of gasoline passing through the nozzle will not be the quantity which is indicated upon the scale.

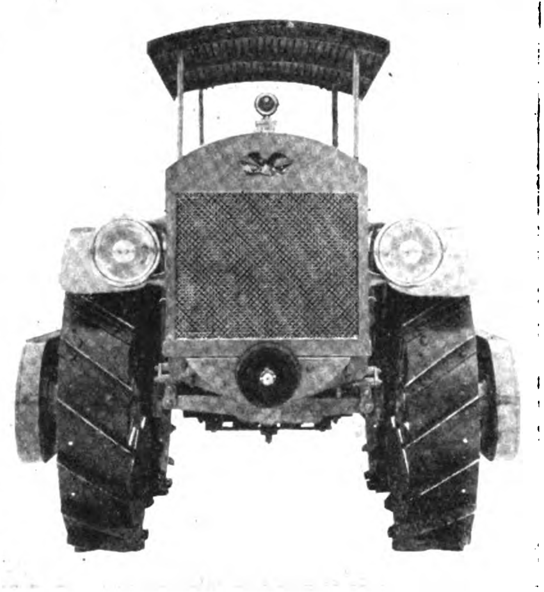
Types of Gasoline Flowmeters

When official acceptance tests of aero engines were first instituted, and in fact until some appreciable production had been reached, the usual method of obtaining the fuel consumption was to commence the test with a measured quantity of gasoline in the tank, and, having run the engine for the period required by the testing schedule, to empty out and measure the amount of fuel remaining in the tank. This had very grave disadvantages, in that serious inaccuracies were possible owing to carelessness upon the part of the workman in filling and emptying the tank; the author has, in fact, at the conclusion of a test frequently seen a measure being so held that gasoline was running directly on to the floor, the holder in the meantime being busily engaged in discussing some point of great interest with a fellow worker! There was also a very grave risk of fire, but the most serious disadvantage was that during the actual running time there was no indication of any fluctuation of changes which might be taking place in the carbureter action. Also, it was not possible to see the result of any change or adjustment made in the carbureter without running the engine for some considerable period. Upon the successful conclusion of their work in connection with the Mark II nozzle calibrating flowmeter, Messrs. Brown & Barlow were requested to submit a flowmeter to meet the following conditions:

(1) Accuracy within plus or minus 2 per cent.
(2) Steady indication at any rate of flow within its range.
(3) Maximum possible range of scale to be obtained.
(4) Length of connections between the instrument and the engine not to affect accuracy.

This instrument was produced and was tested, being connected in series with the ordinary tank containing a measured quantity of gasoline. Readings were taken at intervals of fifteen minutes, and these were averaged at the conclusion of the test and compared with the reading obtained by actual measurement. The results of a considerable number of tests carried out in this manner showed the flowmeter to be accurate within less than $\pm$ 1 per cent; the only condition which was not quite fulfilled was that of steady indication under all conditions. This trouble was completely eliminated and a steady indication was obtained. A large number of the instruments were placed on order, being classified as engine test bench flowmeter Mark III.





Heinze Tractor Has Novel Drive

Equipped with Ball-Bearing, Kerosene-Burning Engine of New Design—Drives Through Enclosed Side Chains to All Four Wheels and Steers Like Creeper Tractor

THE four-wheel drive idea has had adherents in the automotive field from the early days of the passenger car and truck. In the passenger car field it never got beyond the experimental stage, because the advantages which it affords over the two-wheel drive do not warrant its complication and extra weight. In truck practice the four-wheel drive has conquered quite a field in recent years, mainly in connection with ordnance transport. It would seem that if this drive had any justification at all, it would have it in tractor work, because a tractor must develop driving effort sufficient not only to propel its own weight over loose soil but to haul a plow or other implement as well. Driving lugs of suitable design no doubt serve greatly to increase the limiting traction, but these add to the weight to be moved, and they also consume power. It is obvious that even with four-wheel drive it would not be possible to use smooth steel rim driving wheels, but the lugs could be made much smaller. That four-wheel-driven tractors have not reached the production stage before this is probably due to the fact that the complication and heavy manufacturing costs ordinarily associated with four-wheel drives has deterred manufacturers from adopting it. The chain tractor is in a way equivalent to a four-wheel-drive machine, as it makes the whole weight of the tractor available for traction purposes.

A four-wheel-drive tractor of unusually simple construction, known as the Heinze, has been placed on the market by the Traction Engine Co., Boyne City, Mich. The complication of the ordinary four-wheel drive is owing to the fact that the front axle has to be arranged for both driving and steering. That is, assuming the Ackerman steering is to be used, the front-wheel spindles have to be pivoted on the axle, and universal joints have to be used for transmitting the power from the axle to the wheels. Mr. Heinze has avoided this difficulty by steering on the same principle as a creeper-type tractor is steered; that is, applying brakes to the two inner wheels, so that driving power will be applied to the two outer wheels only. All the wheels, therefore, remain at all times parallel with each other, and there is no difficulty in driving the two wheels on each side through a single chain. Some people might question the effectiveness of this method of steering, but the manufacturers claim that the machine turns at right angles and in a radius less than its length.

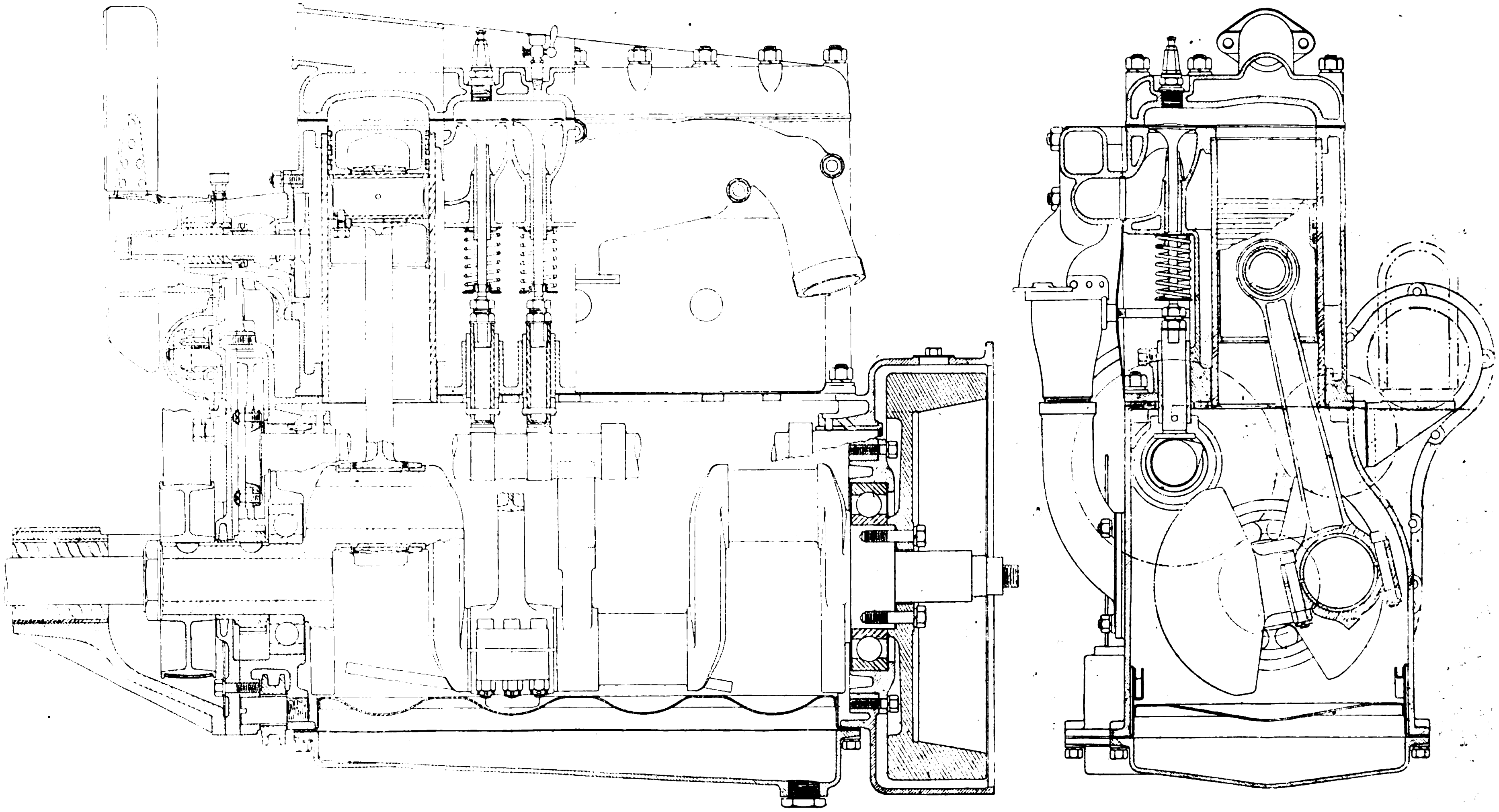
We will first describe the engine, which is of Mr. Heinze's own design, and manufactured by the Traction Engine Co. In this connection it is worth noting that John A. Heinze was formerly general manager of the Northway Motor Mfg. Co., of Detroit, and consequently has had extensive experience in the design and manufacture of gasoline engines. His new engine is of the four-cylinder block type, with detachable heads. Among its most notable features are the use of case-hardened steel liners for the cylinders and two ball bearings on the crankshaft, together with balance weights on it. The engine is of 4¼-in. bore by 6-in. stroke, and is of low compression, in view of the possible use of kerosene as fuel. The cylinders are of the L-head type, all of the valves being located on the left-hand side. The valves have a clear diameter of 2 in. and a lift of ⅜ in. It is notable that there is a large filler between the valve head and valve stems. Mushroom-type cam followers are used, and the camshaft is forged integral with its cams, in the usual way. This camshaft is supported in two bearings only, and consequently is of unusually large diameter, 2 in.

Crankshaft of Unusually Heavy Dimensions

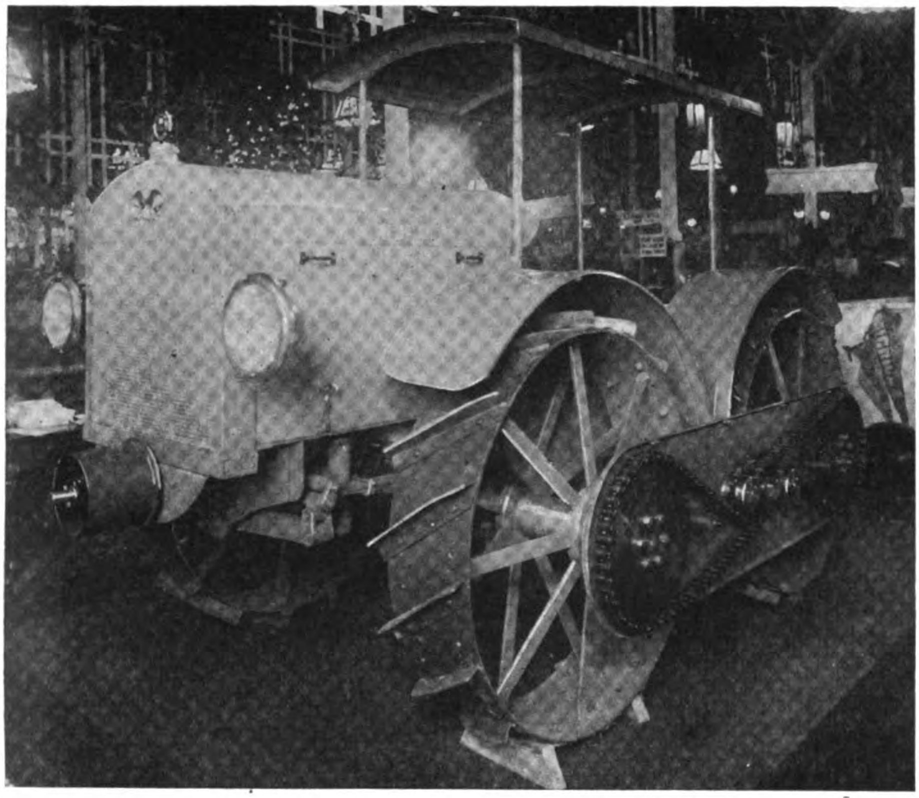
The crankshaft is a drop forging of unusually heavy dimensions. It has crankpin bearings measuring 3 x 3¾ in. The crankshaft is carried in two annular ball bearings, a No. 315 medium series at the front end, having a rated load capacity of 4400 lb., and a No. 222 light series at the rear end, having a rated load capacity of 5000 lb. Balance weights are forged integral with the two short arms of the crankshaft, and there is also a heavy balance weight between the central double crank pins. In order to reduce the weight of the crankshaft, both the crankpins and the main bearings are bored out. The crankcase is cast in a single piece, open at the bottom.

The pistons, which are of cast iron, are provided with three sets of two rings at the upper end. The hollow piston pin, which is of unusually large diameter, is fastened in the piston bosses, and the bronze-bushed connecting rod rocks upon it. Cast integral with the crankcase is a bell housing for the flywheel. The piston-pin bearings measure 1⅞ in. in diameter by 2⅜ in. in length, and the connecting rod has a length

Heinze 30-40 Hp. Engine for Farm Tractors



Among the noteworthy features of this engine are the very rugged crankshaft and camshaft, the crankshaft ball bearings, hardened steel cylinder liners, crankshaft counterweights, pump and fan on same shaft and high-speed centrifugal governor



A view of the Heinze at the Tractor Show, with chain cover removed

of 13 in. There is also plenty of bearing surface on the pistons, which are 6 in. in length. The timing gears are made of steel and cast iron, for the pinion and gear respectively, and have helical teeth.

Ordinarily the tractor is fitted for operation on kerosene, and a kerosene capacity of 20 gal. and a gasoline capacity of 2 gal. are provided. A combination inlet and exhaust manifold is used, so that some of the heat of the exhaust can be utilized in vaporizing the kerosene. Ignition is by a high-tension magneto. Lubrication is by splash, the oil being circulated by pumps. There is an oil capacity of 3 gal. in the crankcase.

The cooling water is circulated by means of a centrifugal pump, which comprises only an impeller, the ordinary pump housing being dispensed with and the impeller located directly within the engine jacket. Both the pump and the fan are mounted on the same shaft and are driven by a 2-in. flat belt. The fan has 3 blades, and is 20 in. in diameter. A centrifugal governor is mounted on the foreward end of the magneto driving shaft.

Transmission

A large Raybestos-faced cone clutch is located within the flywheel. The transmission is of the sliding-gear selective type, and gives three forward speeds in addition to the reverse. All transmission shafts run on large annular ball bearings and operate in oil. From the main shaft of the transmission the power is transmitted to the differential shaft through a worm and worm wheel. This differential shaft, which is located transversely on the frame, midway between the front and rear axles, extends all the way across the tractor, and carries a sprocket pinion on each end. From these sprocket pinions the transmission is by two chains to the four driving wheels, an idler sprocket being used on each chain for taking up the slack.

The roller chain is enclosed in a steel housing and operates in oil. The small driving sprockets and the chain idler sprockets are carbonized, heat treated and ground; the large sprockets are made of steel, and have machine-cut teeth. Every bearing of the drive is provided with a pressure grease cup.

The belt pulley, which is located at the forward end of the tractor, is of 8 in. diameter by 8 in. face and is crowned. It operates at a speed of 1200 r.p.m., and sets directly upon a forward extension of the engine shaft. A substantial bracket bolted to the forward end of the engine crankcase supports this shaft extension on a Hyatt roller bearing.

As will be observed from the longitudinal sectional view of the engine, the latter is arranged for three-point support upon the main frame. At the forward end the frame is supported on the axle by means of half-elliptic side springs, and in order to insure greater flexibility the forward ends of these springs are not shackled directly to the frame but to a cross-bar, which is swiveled to a cross-member of the frame in front. All four driving wheels are of the same diameter, 42 in., and also have the same width, 10 in. With lugs attached, the width is 12 in. The overall length of the tractor is 125 in. and the overall width 72 in. Without canopy the height is 62 in., and with canopy, 86 in.

A laterally adjustable drawbar is provided. The road clearance is 14 in. The tractor is equipped with fenders, and it also has front and rear lights for night plowing.

The engine rating is 30-40 hp. at 1200 r.p.m., and the tractor weight is 4000 lb. At a speed of 1 mile per hour on hard, soddy soil, the tractor will deliver a pull of 6000 lb., while at a speed of 3 miles per hour on loose sandy soil it will develop from 3000 to 3600 lb. drawbar pull. It is sold as a 3-4 plain tractor.

Use of Coal Gas as Motor Fuel in France

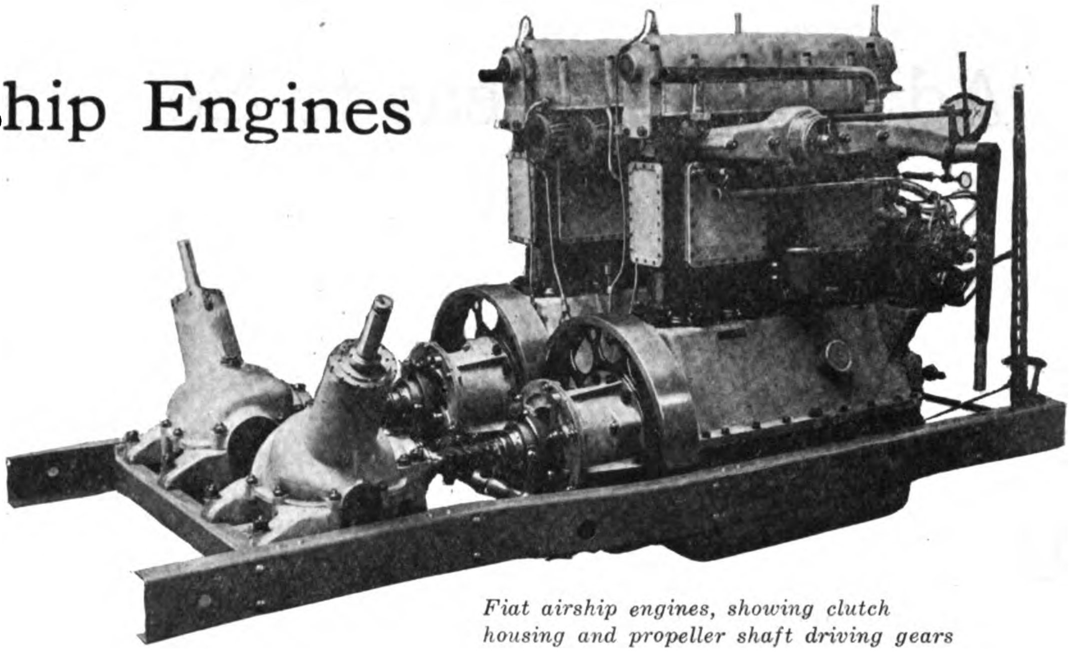
BEFORE the war the scarcity and expense of volatile liquid combustibles was causing anxiety in France, Italy and Germany, and the war has greatly increased it. One of the means of obviating the difficulty is to employ illuminating gas, of which 1.650 cu. m. at 4700 calories is equivalent to 1 litre of gasoline of a specific gravity of 0.730. The annual consumption of gasoline and of benzol produced from coal before the war had attained 350,000 tons, of which 130,000 tons was benzol. Now the consumption is about double. In the gas-works of France about 30,000 tons of benzol are being produced yearly, and when the coking plants in the Nord area are reinstated the output should reach 50,000 tons. French benzol only represents some 7 per cent of the total requirements of France. The consumption of internal combustion engines varies from 2500 to 3000 calories per hour, and assuming an average of 2750 calories this is represented by 0.25 kg. of benzol.

Gas from which the benzol has been extracted has a thermal value of about 4700 calories per cubic metre at atmospheric pressure and about 0.3 kg. by weight. The present price of benzol is more than 1 franc per litre outside Paris, and gas 0.3 franc per cubic metre not compressed, so that the cost of benzol per mile may be taken as double that of gas.

In a recent article in *Le Genie Civil*, the author, after quoting the practical results obtained in England, describes what has been done in France. L. Neu in 1913 took out a patent for an installation which permitted the use of either gasoline or gas upon a given automobile. Experiments have recently been made with a Renault of 8 to 9-hp. car, a Renault limousine of 12-14 hp., and a Renault 3-ton truck. Each was fitted up with an arrangement by which gasoline or gas or a mixture of both could be used, and the tests proved that about 1.7 cu. m. of gas of a thermal value of 4700 calories was equal to 1 litre of gasoline. They also showed that gas could be satisfactorily employed in all three types of vehicles without any serious structural alteration.

Fiat Airship Engines

Mounted in Pairs in a Channel Section Frame—Starting Gear Mounted on Camshaft Drive Shaft

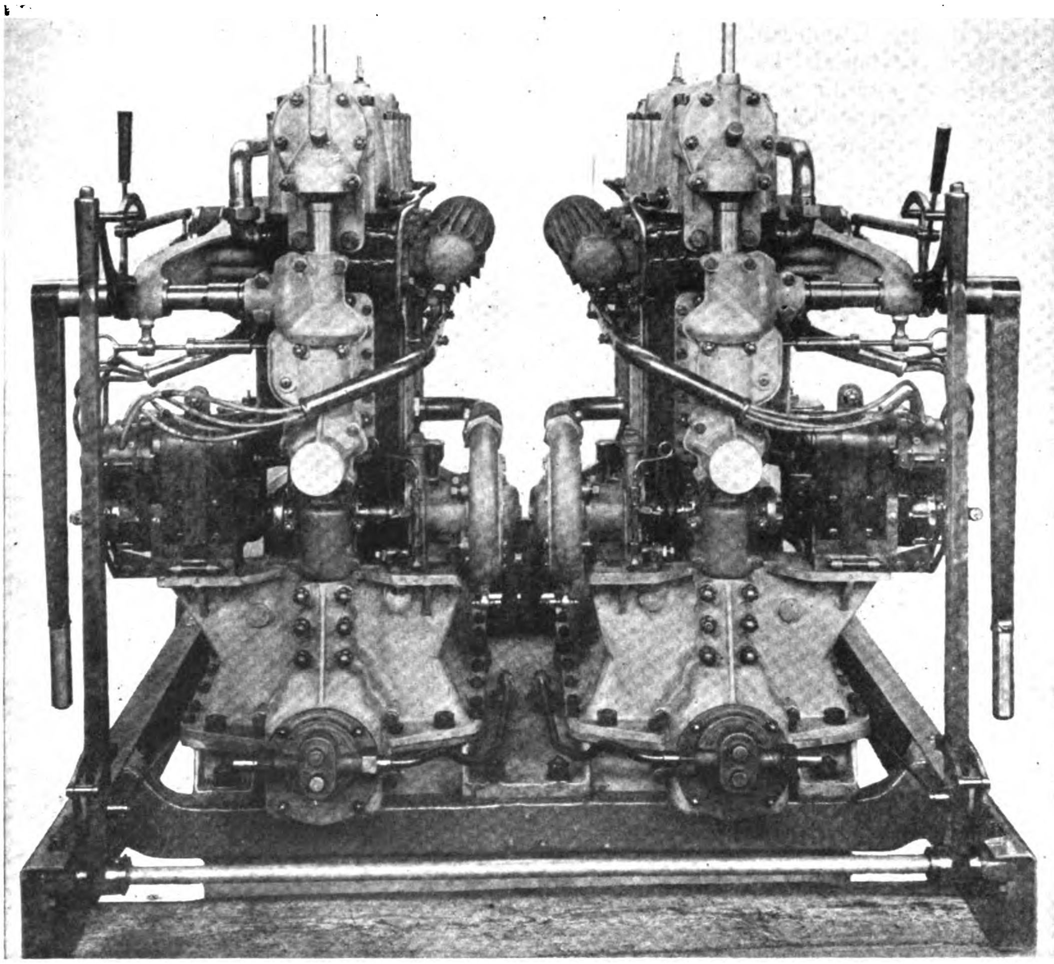


Fiat airship engines, showing clutch housing and propeller shaft driving gears

DURING the war Italy made a very extended use of airships for coastal patrol work and for the detection of submarines in the Adriatic and the Mediterranean. The great majority of these airships were equipped with Fiat engines. The size and type of engine varied with the airship, but a very popular installation was a twin group composed of two four-cylinder engines placed side by side, and as close together as possible, in a channel section frame. These engines have a bore and stroke of 110 by 190 mm., the cylinders being a block casting, with enclosed valves in the head and large aluminum water jacket plates on the sides and the ends. The overhead camshaft is operated by means of an enclosed vertical shaft and bevel gearing, and advantage is taken of this shaft to mount the starting gear by means of a lever and bevel gearing. The carbureter is placed on the outside of each engine, while the exhaust is on the inside.

At the base of the vertical shaft the water pump and the high-tension magneto are driven by means of bevel gearing. These two organs are opposed, so that the magneto distributors and contact breakers are on the outside in each case. Each engine is fitted with a light flywheel and a coil clutch, the control of which is by means of a lever at the forward end of the engine. From the clutch shaft the propeller shaft is driven by means of bevel gearing, this shaft having an inclination of about 45 deg. from the vertical.

It will be seen from an inspection of the photographs that the two engines are not exact duplicates, but are right and left respectively, the design evidently making for accessibility.



Front view of Fiat airship engine set

Advertising Ideas to Sell American Goods Abroad

Successful Men Agree There Is No Single Rule, but That a Distinctive Plan, Made to Fit the Article and the People to Be Reached, Must Be Worked Out for Each Country

By Allen Sinsheimer

DOES advertising for export trade pay? What mediums and forms of advertisement are most profitable? These questions were asked at the group session on advertising at the recent Foreign Trade Convention and were answered by advertising authorities and business men with practical foreign experience.

Nearly every method of advertising used successfully for the development of domestic business, it was said, has been found appropriate and profitable in various foreign countries, but no blanket form of advertising can be applied to all foreign countries. Each country must be studied as to its customs, social, industrial and financial conditions, and the advertising must be as carefully adapted to each country as domestic advertising is adapted to the various articles of trade.

It was generally agreed that newspapers, American export magazines, local weekly and monthly publications, billboards, street car, railroad station, poster and handbill advertising are each successful in certain foreign countries. The application of any of these media, however, must follow a thorough practical and psychological analysis.

It is not possible, for example, to write an advertisement in the English language and translate it into Spanish with profitable results. No advertisement, the speakers asserted, can be written in English and translated into a foreign tongue without losing its selling force and appeal. Expressive American phrases are unknown abroad and the translation becomes meaningless. The advertisements should be written in the language of the country for which they are intended, by a native of that country or a writer familiar with both the country and its language.

Foreign Advertising Must Be Done By Manufacturers

Foreign advertising must be done directly by the manufacturers, and not through local dealers, who are likely to use the wrong media or carelessly expend the appropriations in wasted efforts. Expenditure of advertising funds directly by the manufacturer insures a consistent nation-wide campaign in place of spasmodic local efforts.

No two countries can be sold on the same publicity plan and this even applies to nations as closely situated as Brazil and Argentina. Many manufacturers have plunged into their foreign advertising campaigns without first making a careful survey of the fields and inquiring into the mental characteristics and material conditions of the people, their customs, peculiarities and systems. A proper survey of each nation includes:

The population.
The buying power per capita.
Literacy and illiteracy.
Importance of women and the family.
Native industries.
Superstitions.
Average wages paid.
Agricultural conditions.
Highway, general topographical and climatic conditions.
Local and national taxes.
Native customs and peculiarities.
Retail distribution.

Investigation of Local Conditions Essential

Stories are told of American manufacturers who have wasted huge sums by not first investigating these factors; of the implement maker who advertised lawn mowers in China where they have no lawns; of the syrup advertised for pancakes in Peru where they know nothing about pancakes; of the chewing gum advertised as a cure for smoking in Argentina, where the Argentinian would give up his all for a life-long supply of cigarettes. Similarly it is futile for an automotive manufacturer to advertise automobiles in a country where the highways are too narrow to allow their use.

The buying capacity per capita is an important consideration in apportioning the foreign advertising appropriations. Such appropriations will be most successful in those countries, other conditions being equal, where the buying power per capita is the greatest as a result of a more universal prosperity.

Literacy and illiteracy are fundamentals in the preparation of foreign advertising copy. In the Latin American countries particularly, where 50 per cent of the people are unable to read or write, advertising should consist chiefly of illustrations and simple phrases, with the prices conspicuous and plain. In Cuba, for example, the people are of an easy-going, pleasure-loving nature, not over fond of thinking and are attracted more by what they see than by what they read. The appeal to sight by means of large billboards or electrical displays, calling attention to the gorgeous upholstery and brilliant finish of the automobile, is most successful, and the best Cuban advertisements in magazines are those in which the illustrations have local color, drawn by either a native artist or some one who knows the country and the people, with the trade-mark or brand name well played up. Price is important. The text should be brief and to the point.

The importance of the women in the home is a consideration that should influence passenger car advertisements. Woman's situation varies in different countries and while in some she can be an important influence in the sale of a car, she may have little or no influence in

others. Latin American women have but little influence on the purchases for the families and are chiefly proud of their domestic qualities. They are likely to be more proud of a washing machine than of an automobile.

Superstitions, also, are important and particularly so in the preparation of advertising copy which contains illustrations of the commodity and its trade-mark. The Chinese, for example, have numerous superstitions, consider certain symbols unlucky and cannot be persuaded to accept commodities bearing what they consider ill-omens even as a gift. Similarly, there are many subjects which they consider lucky and they also exhibit a marked weakness for certain colors, buying those commodities regarded as lucky or which have the favorite colors even though not needing them. Certain countries give birds, animals or symbols high heraldic station and the selection of the trade-mark should be made with consideration of this if the mark is for that country only.

Retail distribution enters into advertising when it is of a local nature because of the customs of various countries. In the Far East it is customary to use the "compradore," a sort of go-between who acts between your representative in the field and the native. In China the compradore acts as the Chinese manager and credit man, usually furnishing cash guarantees and meeting obligations which have not been paid by the customer. As a rule the compradore is an influential, well acquainted individual and local advertisements referring to him are the most profitable.

MANUFACTURERS who have successfully built a foreign trade in American merchandise agree:

Reputable American export journals are indispensable as advertising mediums in building up a dealer clientele. These journals are regarded by dealers as catalogues of what is new in the industry represented.

The mediums for reaching the consumer are as numerous abroad as in this country, but usually they need not all be used in one country. Billboards, posters and handbills, if well illustrated, reach the Chinese. Newspapers and posters are profitable mediums in Argentina. Colored pictures appeal best to the Cubans. Newspapers, if well selected, are useful in Brazil, Peru, Australia and other countries.

Advertising media demand as much analysis as the preparation of the copy itself in each country. The use of cut-outs, calendars, post cards, souvenirs and attractive illustrated trade literature for distribution by local dealers has been found an excellent plan in some countries, magazines, daily newspapers, posters and handbills in others, while still others respond more readily to billboards and railroad station and street car displays. Particular stress was laid by all the speakers on the value of American export trade publications, which, it was said, are looked upon, especially in South America, as monthly or weekly catalogues of the American products of the industry represented, and in the case of reputable papers are highly regarded.

The use of local newspapers in Argentina, Brazil, Peru, Australia, South Africa and the Far East has been found profitable, according to Howard G. Winne of the Johnson Overseas Co. Billboards, posters and handbills are successful in China. Posters have been profitable in Argentina. The railroads of Uruguay and Argentina are owned by British companies who have followed the British system of display advertisements in the railroad stations, and the natives have come to understand them and respond favorably to them. The street cars of Brazil are owned by American capitalists who inaugurated the American system of advertising in the cars and Brazilians have become accustomed to this form of advertising.

The newspapers of each country must be studied separately to determine the selection. This applies also to the local and national weekly and monthly publications. Many of the publications reach only certain class trade, as, for example, there are more than 500 newspapers published in Buenos Aires, 100 of which reach specific foreign colonies only. Sunday papers in foreign countries, unlike the American Sunday papers, are worthless and useless. The various large advertising agencies of this country with foreign trade departments have made a study of most of the papers and are in position to advise the manufacturers. Although there are many newspapers and magazines, the good ones are so obvious by contrast that the selection of media is relatively an easy matter. In many countries the newspapers fill the place of both magazine and paper and are read both in the home and at business.

Manufacturers will find, it was stated by all the speakers, that those American advertising agencies which have established foreign advertising departments have anticipated the development of export trade and have made research in many countries and have complete data for analysis of the different markets. They have on hand information showing the appropriations necessary to conduct a successful campaign, the kind and style of copy that is most effective and the most effective media for placing it before the public. The American Association of Advertising Agencies is compiling a report of sources of available information on foreign advertising and foreign business which manufacturers planning a foreign campaign will find beneficial.

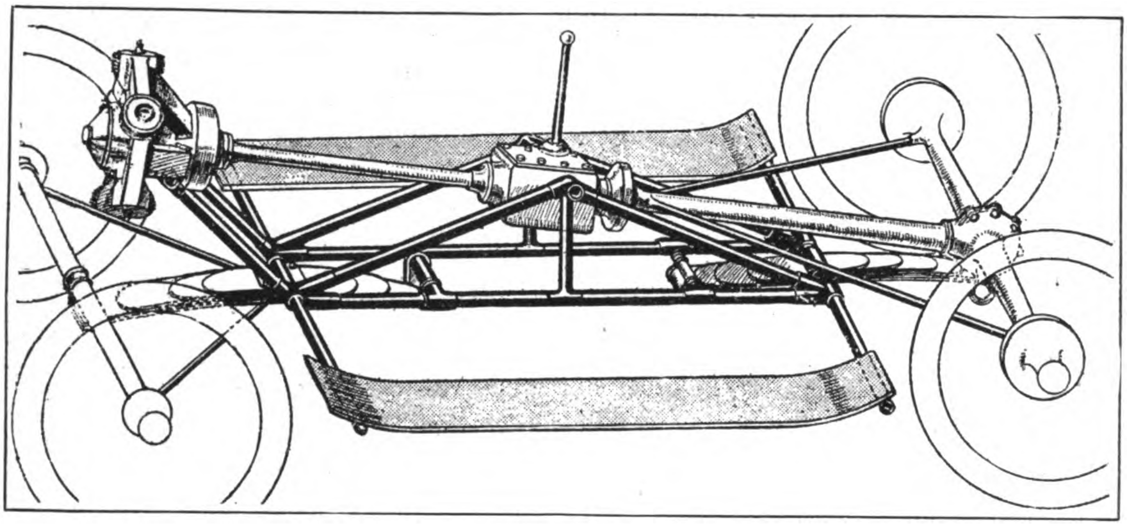
That advertising abroad is successful was shown by examples of selling, ranging from 25 cent cans of talcum powder to highly priced machinery, which have been sold through export publications, foreign and local newspapers, weeklies and other media described above.

If a manufacturer or his advertising manager, after ascertaining that there is a market for his product, will secure a thorough knowledge of this market, applying the same conservative, well considered and developed selling and advertising methods that he applies to the cultivation of his home trade, he can undoubtedly secure even more profitable results abroad for a given expenditure than he can at home. W. G. Hildebrant, of the Gotham Advertising Agency, cited a number of firms, some of which appropriated less than $5,000 for the first year, that are successfully selling manufacturing tools, soaps, toilet lotions and various other commodities at a wide range of prices, as a result of judicious advertising.

But it must be remembered, agreed all the speakers, that there is no cut and dried plan, no rule of thumb method which can be successfully applied to all products or to all markets. Each market must be analyzed.

Radial Engine Revived in England

Cycle-Car Type of Machine with Five-Cylinder, Air-Cooled 10-Hp. Engine to Be Marketed by Enfield-Allday Co.—Cloverleaf, Three-Passenger Body Fitted



Sketch of the general assembly of the radial engined car, showing the peculiar springing arrangement, also the tubular frame and engine bearers. This sketch is purely diagrammatic

TWO models of cars are provided for in the post-war program of the Enfield-Allday Co. of Birmingham. One is a six-cylinder four-pasenger touring car, while the other is a small 10-hp. radial engined car. The engine of the latter consists of five air-cooled cylinders bolted to a stationary crankcase in which is a single-throw, built-up crankshaft.

The crankcase is bolted to the frame. The crankshaft carries, at its rear end, a small flywheel, which is in reality a Sirocco fan, and is used to draw a current of air over the cooling flanges of the cylinders. The cubic capacity is 1208 c.c. (74 cu. in.), while the bore and stroke are 62 x 80 mm. (2.44 x 3.15 in.). The maximum horsepower is 20.5 at 2500 r.p.m.

The engine itself is placed in the orthodox position in front of the car under a hood of circular shape.

In place of the radiator there is a perforated screen which is hinged at the top, and can be lifted up for inspection purposes. By a rather clever arrangement it is possible to disconnect the engine and swivel it, so that any desired cylinder can be brought round to the top. (Care should be taken not to confuse the radial with the rotary engine, the latter being the type mostly used in airplanes and having a set of cylinders revolving round a stationary crankshaft. The radial is another type.)

Each cylinder forms a separate casting, with a series of circular radiating fins extending from near the base up to the combustion chamber. Arranged centrally at the top of the cylinder proper, but of less diameter, is the combustion chamber with two series of valve ports round it. The valves, which are operated from overhead, consist of two concentric sleeves, the exhaust resting on a bevel seat in the cylinder extension, similar to a poppet valve seat, while the inlet has a seat formed on the inner circumference of the exhaust valve and normally covers a series of ports cut in the latter, through which, when the inlet is raised, the exhaust gases pass.

The valve mechanism imparts to the valve sleeves (as they may be termed) a slight reciprocating movement lifting them from and returning them to their seats, as is the case with poppet valves.

As regards their operation, no camshaft is used, but the large wheel of the two-to-one gear is provided with a side flange, on which the cams are formed, and a simple actuating mechanism is connected up by rods—mere wires under tension—with the overhead levers. The latter are acted upon by the valve springs, which are situated externally, and not affected by the temperature of the cylinder walls.

Advantages Claimed

The following points are claimed for this system of cylinder and valve construction: Absolute uniformity of cooling; an extremely large valve opening area in proportion to cylinder capacity, with a very small valve lift; the explosion terminal pressure does not resist the opening of the exhaust valve, thus enabling the valve-operating gear to be of very light construction; both valves can be removed with the cylinder head by taking off four easily accessible nuts; and, lastly, no leakage of oil can occur from the valve mechanism.

The pistons are of the slipper type, made of aluminum alloy, with four rings. The crankshaft carries a master connecting rod running on a plain bearing on the crank and supporting on its big end four articulated connecting rods for the remaining four cylinders. The big end has no bolts, being formed in one piece, and threaded onto the crank pin when the built-up shaft is assembled.

Lubrication is by the dry-sump method. A double pump is used, one section of which forces oil through the hollow crankshaft, while the other sucks up all the surplus oil from the base of the crank chamber and returns it to the oil reservoir at the side of the machine. An advantage claimed for this system is that the lubricant is kept cool and clean.

The magneto and carbureter are of orthodox design, although the latter embodies an extra air inlet which is controlled by hand.

The transmission is by means of a single-plate clutch connected by a long hollow shaft to the three-speed gearbox, having the lever mounted centrally upon it. From here the drive is taken through an enclosed propeller shaft to helical bevel gearing in the back axle.

Central Cantilever Springs Used

The system of springing is quite novel, and departs entirely from the usual design. The springs themselves are but two in number, both cantilevers, and are arranged *centrally* in the frame, one at the front and one at the rear. Outriggers project from the frame at each side to support the body, while at the front end of the propeller shaft casing is a flexible connection with the body to prevent undue side sway, which would otherwise occur in the absence of a spring or other support at each corner. Triangulated rods are provided, both in back and front, to keep the axles at right angles with the center line of the car.

The makers state that the object of this novel form of spring construction is to reduce vertical oscillation of the frame to a minimum. In addition it is claimed that the car will hold the road better and that an appreciable reduction of weight is secured.

The standard body supplied with the radial engined car is a three-seater of "cloverleaf" pattern. The top, which encloses all three seats, folds back into a special compartment out of sight. The body itself is built on aero construction lines. It closely approximates streamline form, with inswept sides and a bulbous back. To render accessible the gearbox and other details beneath the body the latter is pivoted or hinged at the rear end, so that it can be raised up several feet at the front end. The wheels are of the pressed-steel disk type, and are of unusually large diameter for a car of this size, being 810 x 90 mm.

The wheelbase is 8 ft. and the track is 4 ft.

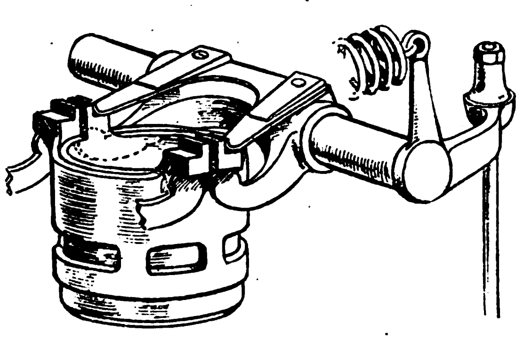
It may be pointed out that the aim has been to design a light attractive type of sporting car, providing exceptional speed with the comfort of running of much more costly vehicles. Reduction of weight should insure not only marked improvement in acceleration and hill-climbing, but also a reduction in running costs as regards both tires and fuel. As regards the latter, economy should be apparent, owing to the practical increase in cylinder temperatures obtained by the adoption of air cooling, and a design enabling these higher temperatures to be attained without distortion of the cylinders and valves.

The Six-Cylinder Model

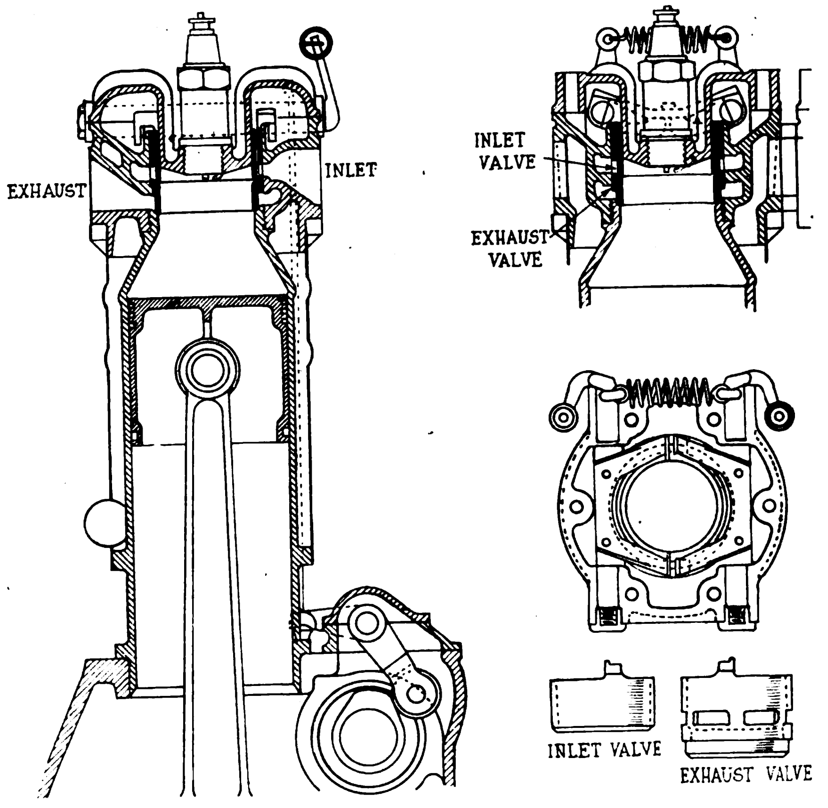
The second type being built, already referred to, has an engine with six cylinders of more normal arrangement; that is to say, they are water-cooled, and are vertical and in line on the top of an aluminum crankcase. The same valve system is used as the one already described. Each cylinder is a plain tube, reduced in diameter around the valve and combustion chamber. To secure uniform thickness, and consequently that uniformity of cooling which prevents distortion, each cylinder is machined inside and out and has a narrow water space enclosed by a steel jacket through which the water is circulated by a special force pump. Provision is made for relative movement, due to unequal expansion, between the cylinder barrel and the jacket.

The bore and stroke are 70 x 110 mm. (2.75 x 4.33 in.), giving a piston displacement of 2500 c.c. (153 cu. in.) and delivering 21 hp. at 1250 r.p.m.

The remaining details are much the same as those of the radial engined car. Both cars are sold complete with electric lighting and starting sets—the 10-hp. car for $1.275 and the larger for $2,495.



Above—Sketch showing the method of operating the sleeve valves. The complete fork shown takes effect on the inner, or inlet valve, while the outer valve, the exhaust, is operated by a similar fork mounted the same way on a transverse spindle



Right—Three partly sectional views, showing the Enfield-Allday valve system

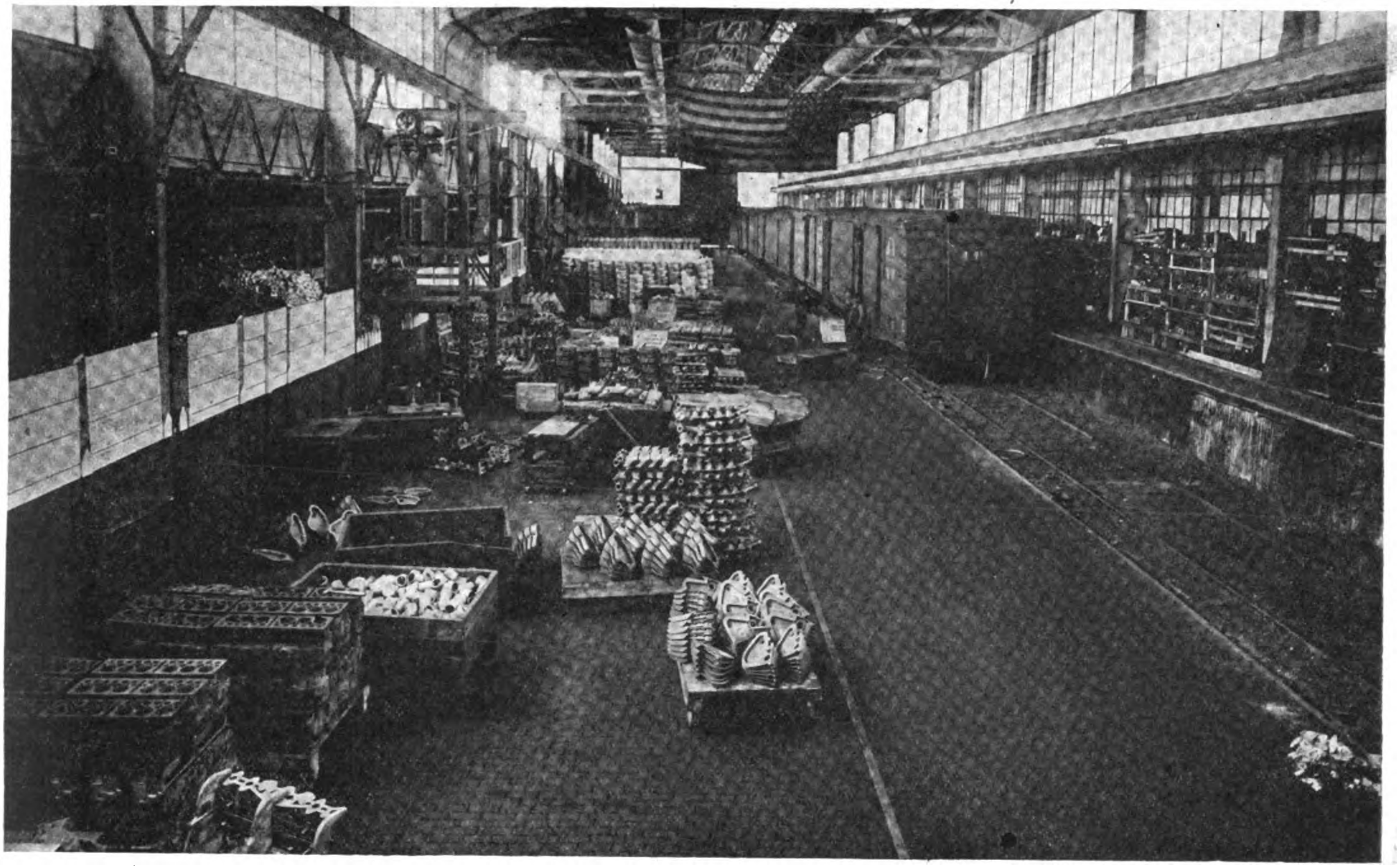


Fig. 1—Continental receiving and shipping department, showing the loading platform on the extreme right, and the checking-in floor of the receiving department on the left

Continental Plant Layout Facilitates Production

Engine Shipments Go Out on Same Tracks on Which Raw Parts Enter—True Progressive System Used

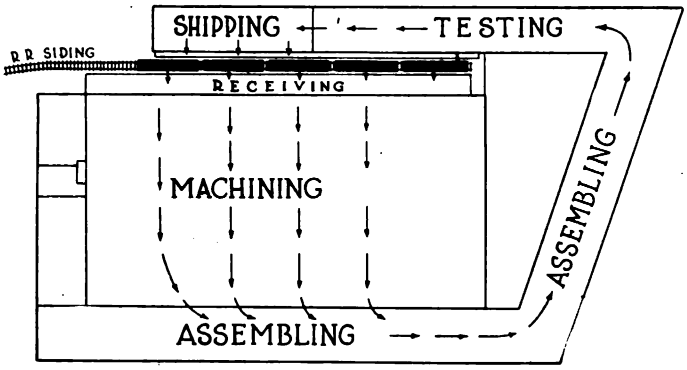
MATERIAL production at the Detroit factory of the Continental Motors Corp. moves around the four sides of a square. By this arrangement manufacture and assembly are carried out along strictly progressive lines without the necessity for the long, narrow buildings generally required for this purpose. In fact, the finished engines leave the shipping room, just across the freight siding, alongside of which is the receiving room from which the raw parts were originally started, and the same cars which came in with the raw material go out with finished engines. A very ingenious plant layout has permitted this result to be achieved.

If the operations in the manufacture and assembly of the 250 to 300 engines now daily passing through the plant were strung out in a line the building required would be extremely long and narrow and would necessitate long walks on the part of officials in reaching various parts of the plant. As it is, the plant dimensions are 560 by 760 ft., or 425,600 sq. ft. Through this plant there pass more than 100 tons of raw material per day, of which about 90 tons are transformed into finished engines. There are about 2,100 productive men employed in the manufacturing departments, these men working on 8-, 9- and 10-hr. shifts. Six different models are being manufactured, but there are about 75 sub-types.

The layout and arrangement of the plant can be understood from the map herewith, which makes plain how it is possible to take this practically square plant and yet have true progressive manufacturing and assembling methods. As will be seen from the map, the freight siding enters the rectangle and runs practically across it near one end. This divides the plant roughly into a process department and the testing and shipping work department.

Leaving the freight tracks on one side, the materials enter the receiving department, then the stock bins, pass across one side of the rectangle through the manufacturing departments until they strike the assembly department on one end; whereupon they pass around the other three sides of the rectangle, finally terminating at the shipping platform, where the finished engines are placed in the same cars which brought in the raw material.

The methodic handling of material commences even before the freight cars enter the receiving department. The cars are shunted around in the yard outside of the plant until those containing material which goes to the far end enter the building first, and the cars which contain material near the door enter last. Thus, as the cars come in on the track the materials are approximately in the place where they should be. Fig. 1 shows this track. In this illustration we are looking into the receiving department in the direction the cars enter. The unloading platform is subdivided from the receiving and inspection department by the white line running parallel with the track. Material which has been received must be kept within this line, and the area parallel with the track laid off by this line forms the receiving platform. The materials are inspected immediately upon receipt and placed on standard racks adapted to carrying them. All of these racks are raised from the floor on blocks of wood, so that it is possible to slip the low platforms of the industrial trucks beneath them, raise them from the floor and carry them to the stockroom. In Fig. 2 is shown one of these industrial trucks raising some cylinder blocks which have been inspected, these being taken to the stockroom by the receiving department truck.



Layout of the Continental engine plant, showing the compact, progressive system of manufacture. The rough parts are unloaded from one side of the freight cars and pass through the machine shops to the assembly chains, at the end of which the engine is tested, packed and shipped into the same freight cars from the opposite side

Receiving inspection is completed before the materials enter the bins. There are gages of all sorts to check over the material which is fabricated or semi-fabricated outside. Thus, the accuracy of the incoming parts is given a thorough check before they enter the raw stockroom, and for manufacture, all material and semi-fabricated parts are drawn from finished stock; thus the finished stockroom forms a division between the receiving department and manufacturing.

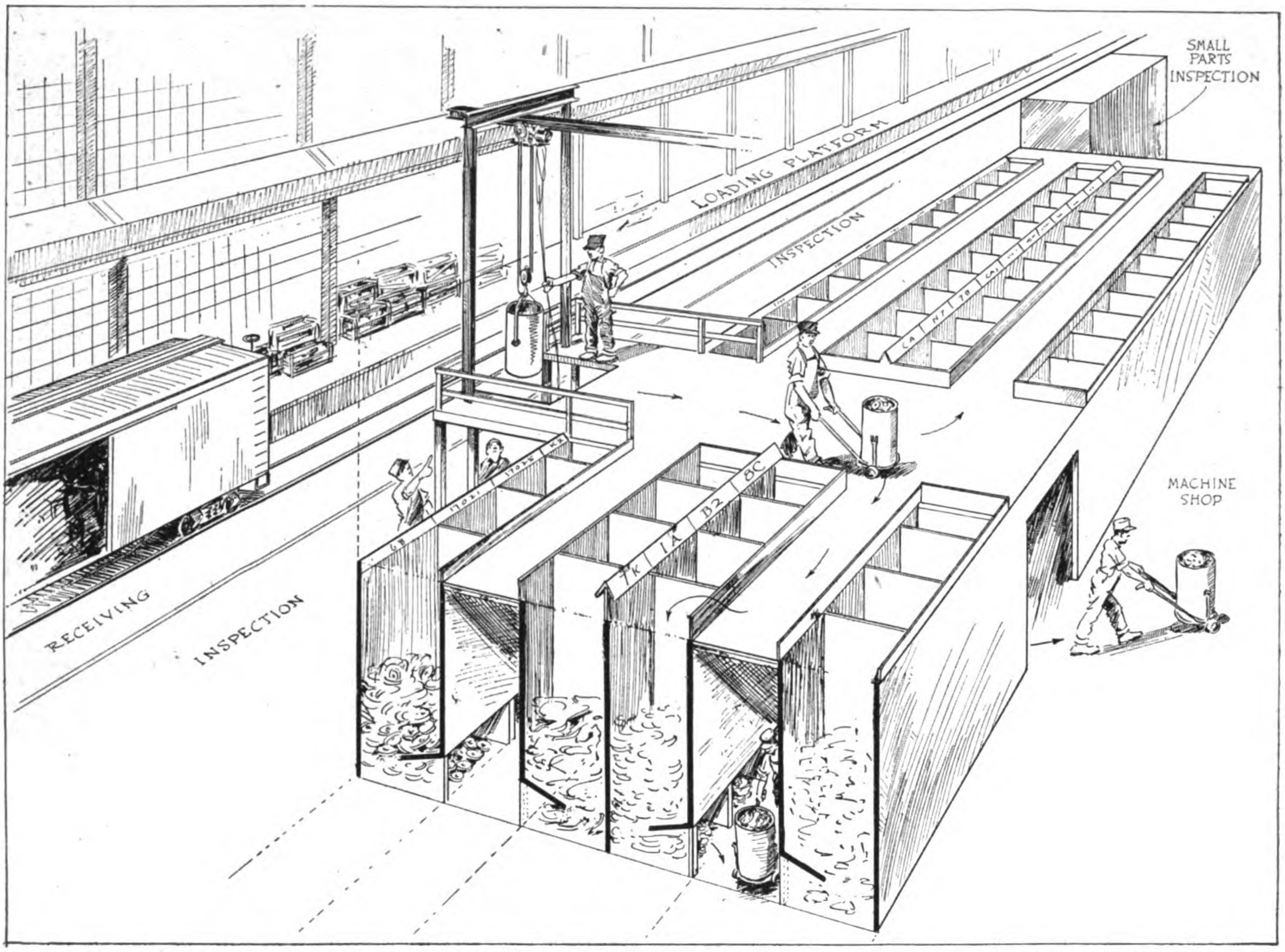
An interesting type of bin is used in the Continental raw stockroom. This is a hopper type for small parts such as timing gear blanks, etc., and is illustrated in Fig. 3. The material is used in approximately the same order in which it is put into the bin, the parts being drawn out at the bottom and put in at the top. In fact, they are loaded into the top of the bins, right from the receiving room, as will be noted by referring back to Fig. 1, where the open tops of some of these bins are shown along the left wall.

The raw material stockroom extends across one end of the manufacturing department and from this stockroom manufacture takes its start. The stockrooms are adjacent to the manufacturing departments which handle the parts contained in their particular bins, and the manufacture of these parts proceeds in parallel lines directly across the manufacturing department, terminating at the other side where there is a finished stockroom from which the parts are drawn for assembly.

In a few instances the passage across the plant would be too short to complete the manufacture of that part. In a case of this kind the parts double back and then, if necessary, back again. In the case of the crankcase and cylinder blocks, this is necessary, owing to the large number of operations on these parts and the amount of space required for the machines. Approximately, however, the lines of manufacture are parallel across the

Fig. 2—Type of electric truck now in use at the Continental factory

Fig. 3—Gravity-fed stock bins for small parts. These bins are filled from the loading gallery above



Section through the rough stock bins at the Continental plant, showing how the parts are hoisted from the receiving platform and sorted. They are withdrawn from underneath as required for the machine shop

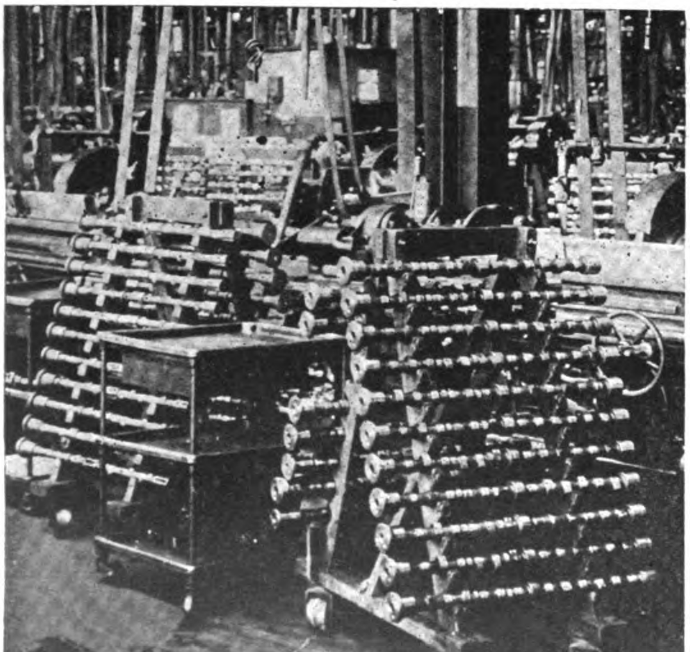


Fig. 4—Camshaft carrying racks in the finished grinding department of the camshaft floor

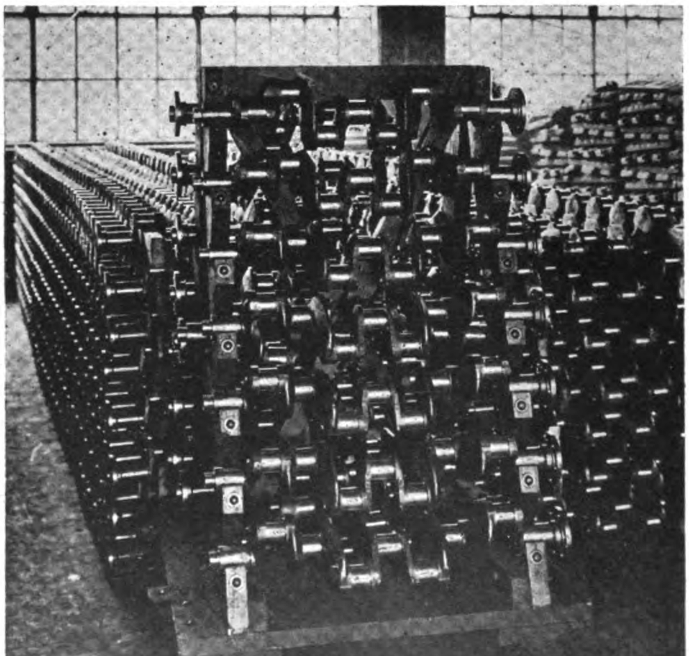


Fig. 5—Crankshafts in finished stock; also type of rack used for handling crankshafts in the grinding department

plant. One line will take flywheels; the next, crankshafts; the third, valves and tappets; the fourth, camshafts; the fifth, the flywheel covers; then there are two or three rows for the crankcases, cylinder blocks, sheet metal parts, manifolds, pistons, etc. These are the principal lines of manufacture and follow one another about in the order given, across the plant.

An effort is made to keep everything off the floor. Everyone who is familiar with engine manufacture remembers the piles of camshafts which used to lie upon the floor of an engine factory. A much neater way of handling this is by the use of racks. Fig. 4 shows a large number of these racks in the camshaft department. As may be noted, these racks are on wheels so that they can be pushed along from one machine to another, as desired. The racks handle twenty-four camshafts at a time in a neat and clean manner, and, being readily movable, a great amount of handling is eliminated by their use.

The type of rack used for handling crankshafts is shown in Fig. 5. This is a wheel type of rack, used in the departments where the crankshafts have to be moved about. It is capable of handling fourteen crankshafts and is of particular value in the grinding department and on the assembly floor where the shafts are moved along with the engines.

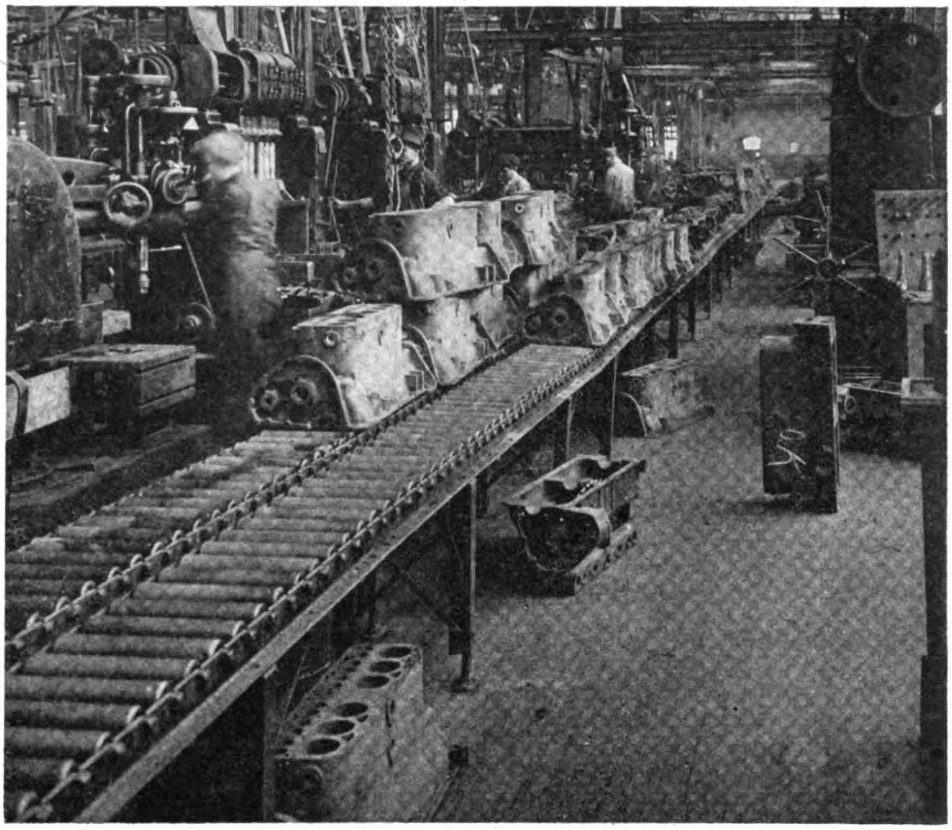


Fig. 6—One floor of the Continental cylinder boring department, showing type of carriers for handling cylinders. This railroad extends from the first operation in the cylinder department through the cylinder grinding department and connects with the conveyors in the assembly

Another type of crankshaft rack, without wheels, is used in storing the crankshafts, as the racks are very compact and result in very little waste space when they are used. Handling of the material through the manufacturing department is primarily accomplished by roller

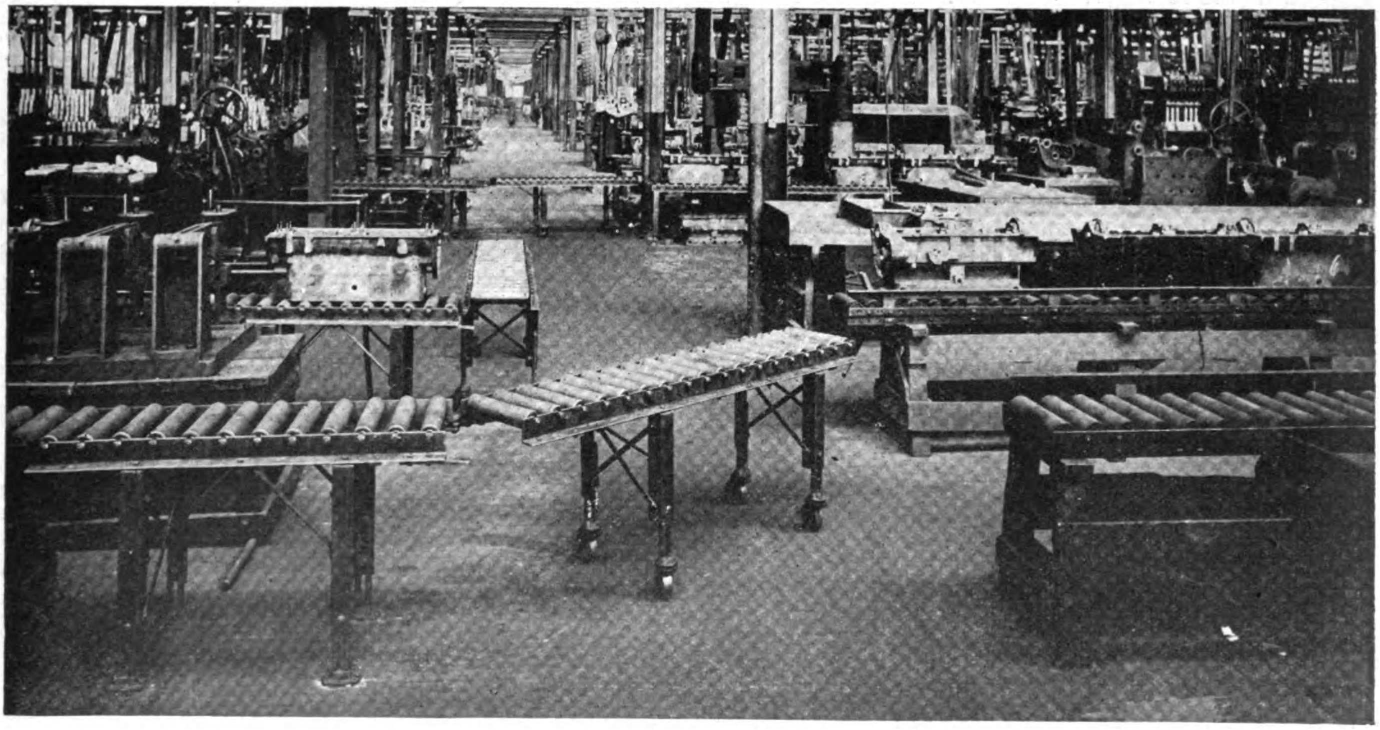


Fig. 7—General view of part of Continental machine shop, showing method of installing ball-bearing carriers where they cross the traffic aisles

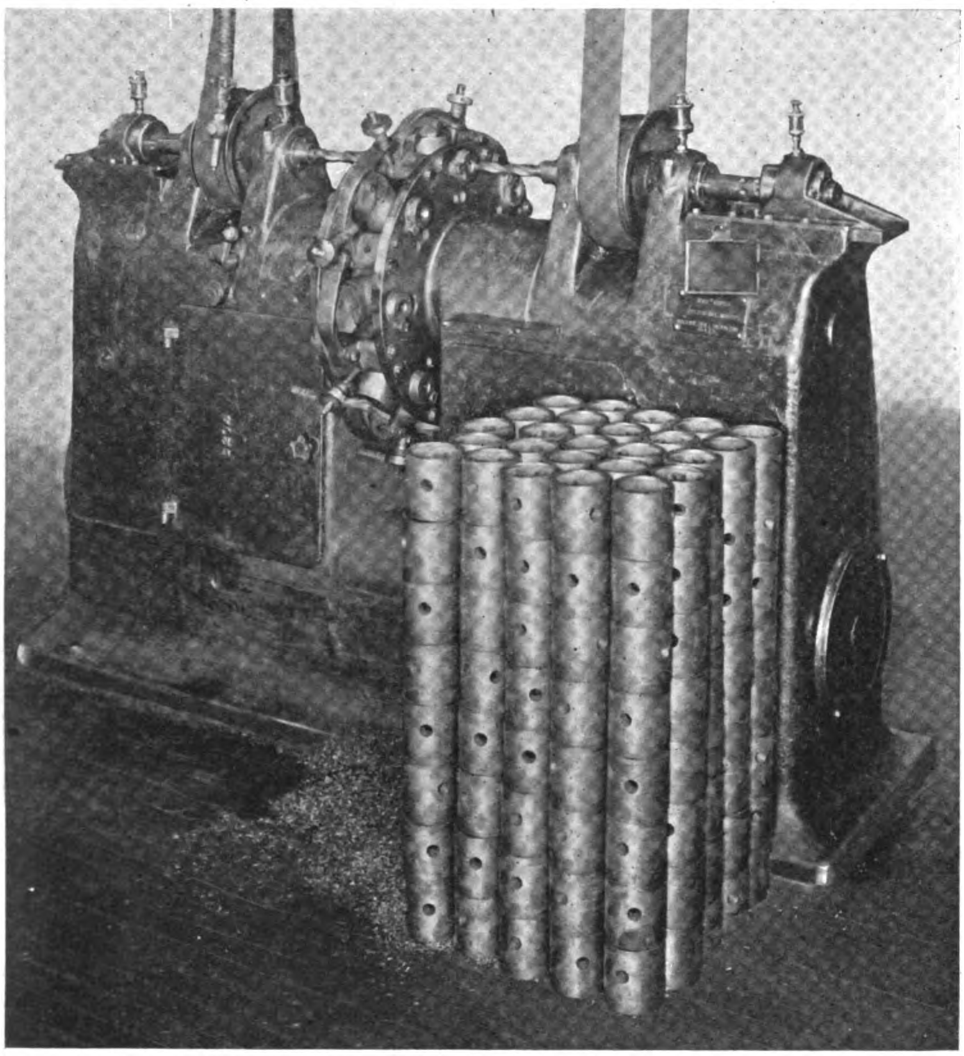


Fig. 9—Machine which drills the holes in the piston for the piston pin. These holes are drilled from each side. Machine takes eight pistons at one time

conveyors. For assembly, special types of racks, which will be explained later, are employed. The roller conveyor, however, is used to transport the materials from machine to machine, and, as will be shown in Fig. 7, a double row of these is used to handle the heavy parts upon which there are a great many operations requiring two or more rows of machines across the plant.

Fig. 6 shows the cylinder blocks working along the roller conveyor, and in this photograph they have just reached the boring department. In making use of these roller conveyors across the plant, naturally some provision has to be made for crossing the aisles, and this is done by ball bearing carriers or switch-overs, illustrated in Fig. 7. These can be swung across the aisle when necessary and are readily pushed out of the way should passage be required. They are hinged at one corner so that they are always in alignment when swung into place.

The railroad or roller conveyor system for the cylinder blocks extends from the first operation in the cylinder department through all of the boring, drilling, reaming, tapping and other cutting machine departments, to the cylinder grinding departments and finally connects with the conveyors in the assembly.

The progress along this railroad is really the determining factor in the timing of manufacture through the plant; in fact, the milling operations at the beginning of the cylinder and crankcase manufacture are the vital elements in determining the plant timing.

It is not the purpose in this article to describe, step by step, the manufacturing processes employed in making the Continental engines, as these follow conventional lines, except for a few important departures which may be pointed out as we make a brief trip through the manufacturing department before we see how the assembly works its way around to practically the point at which the engine started.

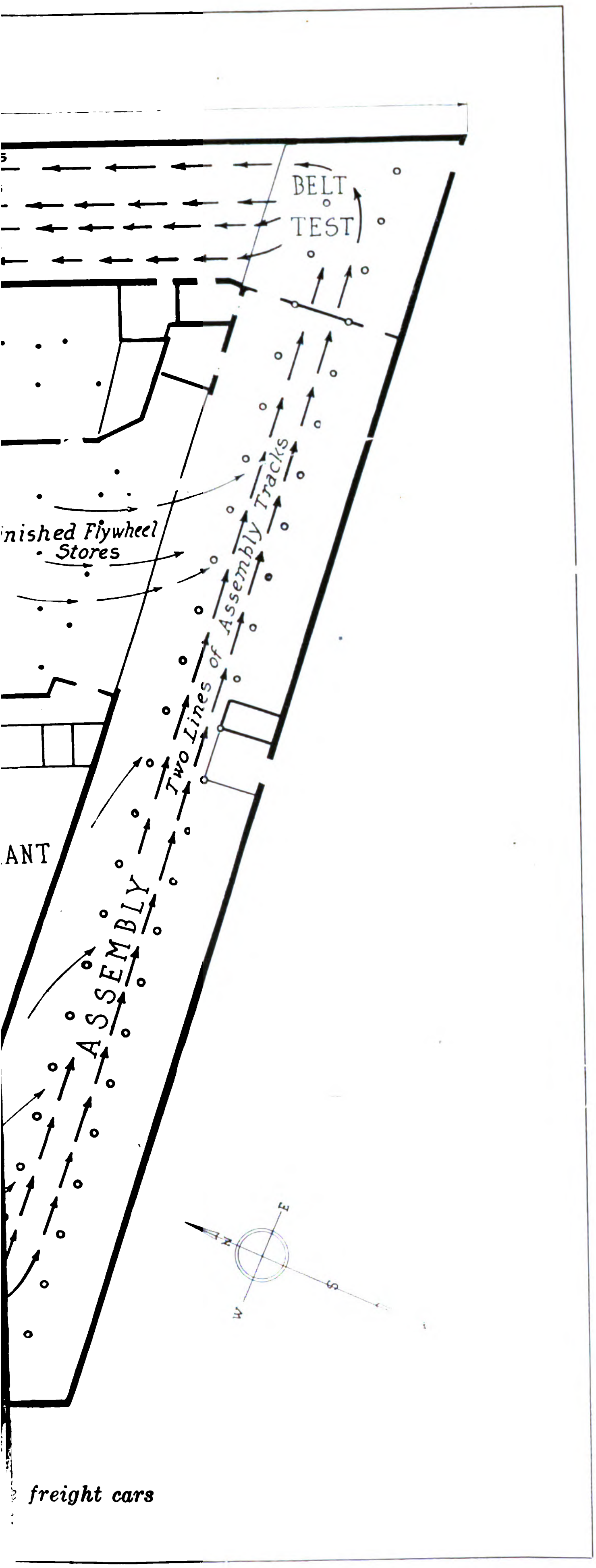
The piston department is of great interest because of the large number and variety of pistons sent through the plant every day. One of the interesting machines in this department is that for drilling the holes in the piston for the piston pin. As will be noted, the pistons are held in the circular fixture which is a part of the machine. The drills enter from both sides, simultaneously, and the machine is capable of handling sixteen of these pistons per hour. This gives a semi-automatic machine and is capable of handling the pistons for any engine, as the holder can accommodate pistons of various sizes and is easily set up. This machine is illustrated in Fig. 9. *(To be continued)*

A New Swiss Motor Plow

A COMBINED tractor and plow has been developed by the Swiss Locomotive & Machine Co. of Winterthur. The plow and motor are mounted upon the same frame, which is carried upon three wheels. The motor is an internal-combustion engine of 30 hp., suitable for light or heavy gasoline. A two-cylinder heavy-oil motor cannot be employed, owing to the scarcity of heavy oil. This motor drives the two front wheels through a shaft with differential gearing in a dustproof casing, and ball bearings are provided.

The wheels have flat strakes fixed to the rims and angle-iron lugs are bolted on for plowing. All three wheels travel on the unplowed land. The plow is a three-bottom type and the framework has a certain amount of free motion independent of the motor portion. The whole apparatus can be managed by one man. When the plow is disconnected the remainder can be used as a tractor or as a stationary engine.

The chief dimensions are as follows: Driving wheels, 63 in. diameter; third wheel, 29.5 in. diameter. Total length with plow attached, 18 ft.; breadth, 6.9 ft.; height, 6.2 ft.; weight, 6150 lb.; speed forward, either 1.7 or 3.75 m.p.h.; weight of the three-bottom plow alone, 1320 lb.; width of three furrows, 42 to 46 in. and depth of furrow, 6 in. to 14 in. The engine consumes 0.66 lb. of gasoline per horsepower hour and runs at 800 r.p.m.


BELT
TEST
nished Flywheel
Stores
Two Lines of Assembly Tracks
ANT
ASSEMBLY
N
E
S
W
freight cars

Improved Oil-Pressure Regulation in Liberty Engine

Early Engines Tended to Overoil at Low Speeds

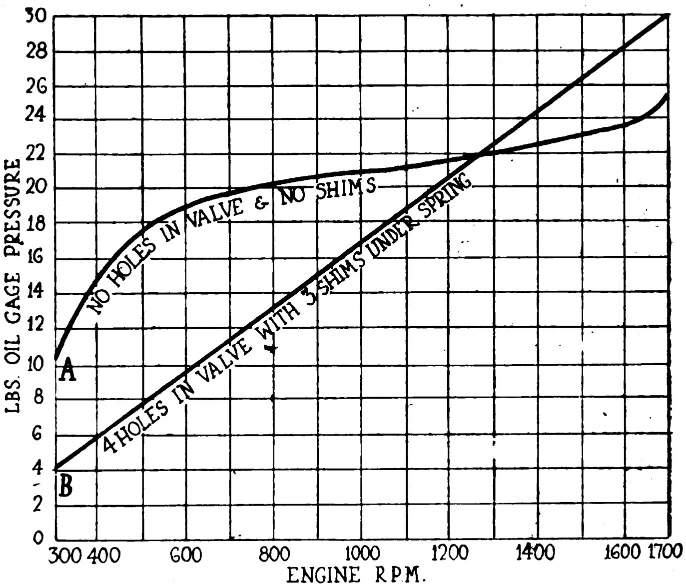
THE original design of undrilled release valve on the Liberty engine pressure oil system gave pressure results at the various engine speeds as indicated by curve A on the accompanying chart.

This shows that the oil distribution was not properly related to the engine requirements at various speeds and a tendency to overoil at the lower speeds resulted, this tendency being most marked when making a long glide with the engine turning at 800 to 900 r.p.m. and the throttle fully closed. To correct this in the simplest manner possible, four positive bypass or leak holes (No. 52 drill) were drilled through the relief valve, resulting in lower initial pressures and a curve building up more nearly in step with the engine speed. All engines are now adjusted to give 28-32 lb. pressure at approximately 1700 r.p.m., the oil at a temperature of 65 deg. C. (212 deg. Fahr.) (Liberty Aero Oil Specification No. 3501).

This adjustment is obtained by means of shims 1/32 in. thick, inserted under the relief valve spring, and from two to four of these shims will be necessary, depending on the fit of the engine bearings, the pump gear clearances, etc. Shims may be readily manufactured at the fields, or common iron washers can be secured to answer the purpose.

The later engines show 28 to 32 lb. pressure at 1650 to 1750 r.p.m. (see curve B) when thoroughly heated up by ½ hr. of 9/10 to full power flying at an altitude of 3000 to 6000 ft. with water temperature approximately 75 deg. to 85 deg. C. (165 deg. to 180 deg. Fahr.) and with average air temperatures. Ordinarily three shims will accomplish this, and, of course, the pressure will be much higher when starting out with the engine and oil only moderately warm. It may also drop somewhat lower after 2 or 3 hr. in the air, particularly if the supply gets a bit low.

If oil of higher viscosity than Standard Specification No. 3501 should be used, a smaller number of shims is required, but in no case should less than one shim be inserted. Because of the shape and location of the oil tank in the DH-4 the oil often gets up around 90 deg. C. (195 deg. Fahr.) and it will average 65 deg. C. (150 deg. Fahr.). Consequently, it is never safe to allow the supply to get lower than 6 qt., and 8 is better as a minimum. When the supply gets lower than 6 qt., it passes through the engine bearings so many times per minute that it has not sufficient time to cool and soon breaks down, resulting in damaged or burnt-out bearings.



Oil pressure chart with and without shims under valve spring

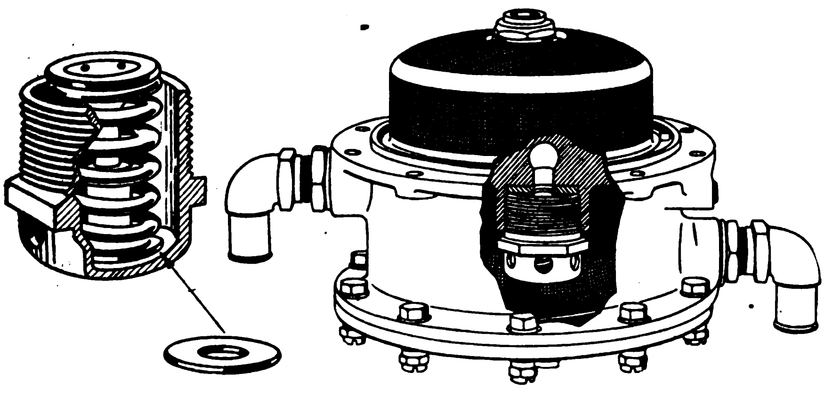
Naturally a high-viscosity oil stands up better under such punishment.

Where unusual difficulty is encountered in getting the pressure to hold up, one of the four leak holes can be plugged with a drop of solder, but this is very bad practice, since it raises the pressure too much at the gliding speeds and the plugs are almost sure to foul on a long glide with closed throttle.

On engines equipped with the hydraulic CC type of synchronizer, the cock in the line between the pressure gage line and the synchronizer must be closed when testing oil pressures. Ordinarily this cock should be opened only at intervals for a few minutes, to give the synchronizer an extra oiling, but if the guns are used excessively it may be necessary to leave the cock open when flying. In this case the pump should first be adjusted and tested as outlined above and then one leak hole plugged with solder. This is necessary because the oil in the cock is practically equivalent to one of the regular holes, and four is the maximum number that should be used. Adjustment, however, should not be made with cock open and the leak hole plugged, because the gage does not register accurately when the pressure line is being "bled" by the synchronizer feed through the open cock. Engines fitted with the Nelson synchronizer or mechanical interrupter do not have a feed of this kind, and the gage registers correctly under practically all conditions.

In cold weather difficulty will be experienced with lubrication unless full precautions are taken. Use hot oil and boiling water. Do not exceed 800 r.p.m. as a steady warm-up, although the motor can be accelerated and slowed down to throw oil up into the cylinders. Cold

(*Continued on page* 1138)



Assembly of the oil pump cut away to show the relief valve. The enlarged view of the relief valve at the left shows the two leak holes and the shim under the spring

Strong Tendency for Co-operation in Labor Ranks

Willingness of a Majority of Actual Workers to Join with Employers in Adjusting Differences and Adapting New Conditions Has Been Overshadowed by the Sensational Programs of the Radicals, Who Wish Only to Rule

By Harry Tipper

THE growth in the adoption of systems involving the combined action of management and employees upon the questions of wages, hours and other matters which affect the working conditions, has attracted less attention than the actions of the radicals in labor and the existence of excessive demands which have their basis in the program of the irreconcilables, which was mentioned in last week's article. The attention which has been accorded to the unrest among the working bodies, and tho success of the radicals among labor organizations in some localities in forcing strikes, is due in part to the change in the point of view brought about by the war and the general expectation that conditions will not go back to the pre-war organization entirely.

The vociferous demands of the radicals in labor organizations have affected the outlook of the conservative labor leaders and the affiliated organizations of labor, to this extent, that they must recognize the unrest that exists in their own ranks and the necessity for some action, where this action is not entirely destructive of the affiliated labor organization ideals. Because of these conditions there has been a general tendency to confuse the demands, which have originated with the radicals within the labor ranks, with the demands of the affiliated organizations as such. This has led many manufacturers to condemn the viewpoint of all labor in its organized endeavors, without studying the question and without realizing the conditions which exist within the labor organizations, and the fact that the leaders themselves are obliged to compromise between the conservative opinions and the radical demands within their own ranks.

Real Objects of Organization

As these matters are chronicled in the daily press and in the general publications, no distinction has been made between the objects of organizations such as the I. W. W. and the objects of the regular affiliated unions as such. It is true that in several localities within the last six months the radical part of labor opinion has been able to assume command of the local situation and to start general strikes, against the desires of the more conservative of the labor body, practically assuming control of all unions by taking advantage of the existing machinery of labor organization and diverting it to their purpose. These movements are not countenanced by the older and wiser heads in the occupational labor unions, and they can be discounted to some extent as a natural result of present conditions, particularly the restlessness and demand for expression which were not visible before the war period.

On the other hand, the growth of combined bodies within the individual industrial organization itself, by which manufacturer and employee can have equal representation in the matter of wages, hours and other working conditions, indicates a development of constructive thought and study upon the problem of human relations in industry that is far more important in its suggestions of future growth.

The whole program of the radical within the labor organization is destructive. It aims at sweeping away the present system without any constructive idea of how it is to be replaced. The more conservative and moderate members of the labor organizations and their leaders understand very thoroughly the futility of such a program, and the final result of any attempt to progress materially in that direction.

A somewhat similar condition exists among manufacturers and employers and those having control of industrial operations. The more moderate, studious and farsighted of such organizations are developing plans whereby the manufacturer and employee shall determine the conditions of work in co-operation with each other on the theory that it is the right of the employee, and the duty of the employer, to give the worker some adequate voice in the government of his own working conditions. There is a considerable section of opinion in financial and manufacturing circles, however, which still believes that it is possible to continue industrial organization on the same basis as it has been developed for years, and who see no value in any suggestions for change or even in any discussion of the subject.

Too Much Attention for Radicals

Unfortunately, the minority of radicals in the labor organization succeed in securing a majority of the attention, and similarly the views of those employers who see no value in anything but the maintenance of the old system of supply and demand are widely heralded, while the desire of the majority of manufacturers and those in control of industry to deal fairly with the matter on any adequate basis receives little or no attention. It is this feature of the situation which is somewhat disturbing. Despite general strikes in some localities, and the statements of some of the radical labor leaders, there is evidence that the extreme opinion in labor circles is the opinion of a very small proportion of the total body of labor only. Comparatively few of those in control of industry will be willing to subscribe to the platform erected by the few who have received public attention because of the strength of their denunciations and the positiveness of their position. For the most part, however, the moderates on both sides are inarticulate, and they are receiving their impressions as to the general opinion of the other side from the radicals, who are bound to develop their own program, and that only.

In the last two months in not less than 20 or 30 cases,

manufacturers have quoted to me the extreme statements of one of the irreconcilables among labor leaders and insisted that this represented the general platform of labor as it is organized in this country. Similarly a number of labor leaders have quoted the extreme statements of some of the manufacturers and have stated that nothing could be expected from bodies who held such opinions, intimating that this was the general platform upon which the manufacturer stood.

It is perhaps only the student who will patiently gather together all the records in the case. For him the situation presents elements of constructive progress that cannot be overlooked. When the manufacturer states that there is no satisfying the worker and that nothing will avert a strike, the mind reverts to the 12 or 14 cases recently recorded where the workers in an individual plant have refused to join the general strike in which their occupation was concerned. Everyone who has any interest in industry, whether from the employers' or the employees' point of view, has read of the serious strikes in the textile industry at Paterson, N. J., and of the demands of the workers, but few people know that in one large plant not a worker left his work during the strike.

Decisions of Employees Themselves

In New England, when the skilled mechanics were demanding more pay and less hours, a plant referred the question of a reduction in the number of working hours to its employees, the reduction being necessitated by the conditions of the business, and an agreement was reached to reduce the week to 4 days without any trouble.

When the labor leader insists that there is no hope of securing a fair deal from the manufacturer and that labor must force its program through in order to control the situation, the mind is immediately confronted with the records of at least 20 plants where the workers have not only refused to strike but have entirely altered their viewpoint upon wages and hours, and have testified to their faith in the square dealing of the concern by their decision on almost every possible point which might arise.

The fact that these things are occurring and are demonstrating in these individual plants the workings of cooperation between employer and employee in the settlement of working conditions is the most encouraging sign in connection with industrial organization and production development in the near future.

Ordinarily our perspective is so warped by the attention to the differences, by the desire for the sensational and the fact that things are ordinarily understood to be interesting only as they record a fight, that we are in danger of assuming a condition of affairs which does not exist, and basing our opinion and actions upon those assumptions, whereas in reality they should be based upon a different conception entirely. The future solution of this question cannot be helped by the opinions and actions of the vociferous irreconcilables on either side, who can see no possibility of value in any other program than the one which they have laid out.

Solutions for Present Unrest

Of the two, the labor irreconcilables are the most dangerous, because they would substitute for present organization, which is at least of some value, experimental organization, the value of which has not been demonstrated and which on its face does not appear to have any elements of constructive possibility. The man who is in control of industry, however, and who refuses to discuss, study or consider the question of the worker's aspirations, his point of view and his necessities is in almost as bad a position, because he cannot offer anything which will solve the present unrest, and the history of the matter shows that warfare has not decreased as industry has grown.

The work which has been done by many organizations, some of which are the largest and most important in their fields, in meeting this question of industrial relations in a reasonable and moderate way is encouraging because it indicates the practical possibility of such steps. It has gone far enough to show the practical working out of such methods, and it has been in motion sufficiently long to prove that no serious calamity necessarily accompanies the change.

The minority radicals on both sides can be reinforced into a majority only if they are allowed to govern the opinion and the action of the moderates. This is due to a general misconception as to their place and standing. If the moderates among the manufacturers are willing to adopt practical means of adjustment, will take the time and effort to study the opinion, the point of view of the workers, whether in the shops or the offices of their organization—if they will examine the changes which have been made by important and stable concerns in their endeavor to deal with the question and act upon the result of their thorough investigations, there is good reason for hope that industrial organization in this country will take a long step in advance and provide a stability which has not been secured in any other country, and which cannot be secured under present conditions.

Training Helps Workers to Help Themselves

THREE-FOURTHS of the industrial workers in America are handicapped by lack of proper training in their respective tasks, according to the U. S. Training Service of the Department of Labor. The work of the Service is to increase the efficiency of this "insufficient three-fourths," rather than to stimulate the output of the one-fourth already producing at a satisfactory rate, says a bulletin, "Some Advantages of Industrial Training," now being distributed by this branch of the government.

Bringing about a big increase in output of the average plant, the government contends is wholly within the possibilities, if the following steps are taken: (1) A careful analytical survey of the operations in the plant to ascertain where existing methods can be improved; (2) the formulation of a definite program of training, either in a separate department or "on the floor" in direct conjunction with production; (3) the instruction of those workers who are most in need of it and (4) the upgrading of those in the next higher strata. A training department helps workers to help themselves.

Another question of keen interest to the workingman and the employer alike, taken up in this booklet, is the effect of training on labor turnover. It points out that the turnover for the country at large is at least 250 per cent., placing an annual burden of $1,250,000,000 on our manufacturing industries. Basing his claim on the experience of several score of plants where training has been installed, the author maintains that such instruction in a factory causes a big reduction in turnover. The trained employees can more readily find suitable work and are more easily retained in a plant. Training contributes to a better spirit among employees and develops better teamwork with the employers.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL. Thursday, May 22, 1919 No. 21

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
Clyde Jennings, Managing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address .... Autoland, New York
Long Distance Telephone .... 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico .... One Year, $3.00
Canada .... One Year, 5.00
Foreign Countries .... One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Congressional Action Needed for Commercial Aviation

THE need of prompt Congressional action in developing regulations for commercial aviation in the United States was emphasized by the announcement of the Army Air Service to the effect that it will establish air routes between, and landing fields in, certain cities.

Military authorities cannot visualize commercial requirements. In the selection of cities and the construction of fields they will naturally be guided chiefly by military requirements. Sites will be selected more because they conform to the military plans for defense rather than because they fit into a logical scheme of development for commercial aviation.

It has been announced that the fields are to be constructed through co-operation with the municipalities in which they are to be located. It seems likely that this co-operation will be easily secured, as the advantages of commercial aviation will be readily appreciated. It is feared, however, that those who co-operate in this way are likely to experience disappointment and discouragement when, after expending large sums, they find that what they have helped to build is more suited to military than to commercial usage. If this result follows, commercial aviation will receive a setback.

The selection and construction of landing fields for commercial aviation should not be left to military authorities. They should, of course, select and build fields necessary in the system of national defense, but their activities along this line should be generally understood to be purely military.

Congress, at the next session, as one of its first acts, should enact legislation which will place the regulation and control of commercial aviation under either a new department of aviation or in the hands of one of the existing departments accustomed to co-operate with industry and commerce. Because of the importance of this latter consideration, the bill to be presented by the Department of Commerce should be given special attention.

Export Trade Demands Common Sense

THIS matter of export trade is neither mysterious nor complicated. It is a simple business proposition and demands chiefly common sense.

It calls for analysis and caution and perspective to exactly the same degree as these are exercised in domestic trade. There appears to be more anxiety than is necessary merely because of a widespread notion that export trade is a complicated affair, requiring complicated handling.

No automobile manufacturer planning a campaign in a local section of the United States would start without first considering the field, the wealth, industrial and social conditions, highways, character of the people and other essential factors. He would not fix an appropriation without a study of the possibilities of business. He would not ask an artist, never west of the Hudson, to paint a sketch designed to have local color for an advertisement in the Rockies. He would not employ a sales representative for California merely because he was born and reared there or had traveled through the State as a Pullman conductor. He would not employ local New York idioms in an advertisement intended solely for Oregon.

And similarly in the development of export business, it is first essential to study the field comprehensively, build the advertisements to fit the customs, conditions and people, spend sums conforming to the business possibilities, employ artists who know the localities, write the publicity in the native language of the people and appoint sales representatives who know both the people and the commodity or a kindred product.

It is a matter of doing business in foreign countries with the same common sense that is exercised in this country.

The Day of the Inventor and Designer

NOT for a long time have the inventor and designer occupied such important positions in the automotive field as they do to-day. Many have complained that our industry has focused its attention on production and price to such an extent that it was almost impossible for a man with a new idea to get a hearing unless that idea had something to do with shaving a few cents off the cost per car.

There are numerous instances where inventors have been placed under contract, the seal of silence placed upon them, handsome salaries paid to them and their inventions never used. They were kept silent because while those who employed them realized the importance of their inventions, they did not want to upset production or undertake the work of selling something new.

Conditions are different now in many but not all the factories. It is recognized that next January's New York Show will disclose radical departures made by many of the oldest established concerns. We know of one concern that has contracted for thousands of engines of a radically different type from those now in use, provided certain specifications can be met. And according to all advices these conditions are not only being met but will be far surpassed. Another car manufacturer is on record as about to abandon the poppet-valve engine for one with a valve design of different type.

There are literally hundreds of new things in the factories and on the roads that will make their appearance next year, and knowing this the manufacturer is more ready to try out inventions and plans that look feasible than he has been since the early days of the industry when mechanical progress was marvelous in its rapidity.

This is a healthy state of affairs. With the fuel problem before us, with the demand for performance, economy and appearance more firmly impressed on us than ever, and with the knowledge that the markets of the world are open to us as never before, inventions which better the product should be given careful consideration. The countries which were involved in the war were jogged out of their mechanical and engineering rut by war's necessities, and it is but natural that in returning to peace pursuits they will make use of their added knowledge and stimulated initiative.

There has been much complaint in the past on the part of inventors that their work was not properly appreciated. There may have been justification for this plaint, especially in times of unusual prosperity when everybody was busy and disinclined to experiment with new things. But there is certainly none now.

Industrial Devastation in Belgium

A REPORT on the wanton devastation of the automotive plants in Belgium will be printed in AUTOMOTIVE INDUSTRIES, begining next week. The report was prepared by W. F. Bradley, European representative of this paper. Mr. Bradley obtained, after much difficulty, permission to tour Belgium and visit these factories to write a report and secure photographs exclusively for AUTOMOTIVE INDUSTRIES. He spent considerable time in these plants, noting the damage that was accomplished and gathering data as to how this was done and the extent of the damage, both to the physical plants and to the future trade.

Photographs accompanying this report are evidence of the thoroughness with which the German army and industrial leaders did this work. They continued the destruction until fifteen minutes before the Armistice became effective.

Practically all of the expensive motor building machinery in the Belgian factories is gone. Those machines which were available for use in the German war material factories or field repairshops were removed on official orders, but other machines were destroyed where they stood.

At the time this was under way, it was supposed that this was done chiefly to provide raw material for war manufacturing purposes, but Mr. Bradley finds that the present opinion is that this destruction of machines was planned and carried out with a view of eliminating Belgium as an automobile exporter after the war. This view is supported by the fact that Belgian factories were run chiefly for the export trade and were no mean competitor for the Germans.

Mr. Bradley's report is exhaustive and convincing and a document of importance as to German methods and objectives.

Latest News of the

Steps Toward Armistice in the Willys-Overland Strike

Settlement Is Expected by Monday—Company Explains Status of Controversy with Union and Its Beating on Competition—Other Toledo Labor Disputes Moving Toward Settlement

TOLEDO, May 22 (Special Telegram)—An armistice in the Willys-Overland strike seems near at hand, and probabilities are that the men will be back on their jobs and the plant running smoothly on Monday. Many of the men who are returning to work are being deputized so they can carry arms to protect themselves.

Conferences have been held all week regarding the Willys-Overland affair, and both sides have agreed to settle the matter by arbitration. The union workers insist that they are not giving any ground by agreeing to an armistice and are threatening to withdraw all union funds from Toledo banks. This would amount to about $2,500,000. A further demonstration was held on Sunday, when thousands of workers, led by a soldier in uniform, marched in a parade through the city and held a mass meeting opposite the police station.

The settlement of other labor controversies here also seems near. Of the 800 strikers of the Edward Ford Plate Glass Co., 400 have returned to work and the rest, it is said, will be back the beginning of the week. The men are returning to their old wages and old hours.

—

TOLEDO, May 20—Vice-President and General Manager C. A. Earl of the Willys-Overland Co. said to-day that the Willys-Overland plant would be opened Monday morning.

In a page advertisement in the Toledo paper Saturday, Mr. Earl restates the position of the Willys-Overland Co. in the present labor trouble. He sets forth that the automobile district council, which presented the demands causing all the trouble, did not represent the majority of employees. Out of 13,000 men and women who were at work on May 5, more than 7,000 remained at their places after those employees represented by the council had walked out.

When the walk-out was decided at a mass meeting, May 3, the only point voted on at that meeting was the question of hours. Approximately 1200 men were present when the vote was taken. Less than 900 men, not over 7 per cent of the total employees of the plant, voted for the walk-out. As a result of the extraordinary action taken by this very small number, instructions were issued to walk out on Monday, May 5.

"In justice to ourselves and to the many thousands of our loyal employees," states Mr. Earl, "the company did not and cannot recognize the right of a small group of men to determine our policy, and to so vitally interfere with the inherent rights of 13,000 employees, without having in any way the authority to represent or act for them.

"It is well known that the Willys-Overland Co. has always operated an open shop, without discrimination against any man, whether he be a member of a labor union or not."

In taking up the demands as presented to the company on April 27, the company first quotes the demands of the men and follows with the statement of the company's position.

Establish 8-Hr. Day

Regarding hours, the strikers ask for an 8-hr. day and a 4-hr. Saturday for the first shift, and 8 hr. with no work Saturday for the second and third shifts. In discussing this demand, the company states that it is convinced of the reasonableness and justice of the 48-hr. week. In restoring the 48-hr. working week after the suspension of war activities, the company informed the committee that competitive conditions demanded that it continue to operate on the basic 49-hr. week.

To concede a 44-hr. basic week as against a 48-hr. basic week would mean decreasing the working hours per year equivalent to a month's output. Such a plan would mean a big loss in earnings to employees, as well as a big loss to the company.

While the 48-hr. week working basis was established in good faith and in the belief that the majority of employees want Saturday afternoon off, nevertheless the company is willing to abide by the result of the majority vote of its employees and divide the week into six days of 8 hr. each, thus fully establishing the basic 8-hr. day.

Settlement of Overtime Pay

Regarding overtime, the strikers demand that all time worked after the established hours shall be paid for at double time rates. No employee shall be required to work on more than one shift in any given 24 hr., unless they are compensated at the rate of double time for such work performed. The union wants double time on Sundays and all legal holidays; election and primary days shall be 7 hours. The union demands limited overtime not to exceed 2 hours per day and 3 days per week. They also request that no overtime demand be made upon them by the company between June 15 and Sept. 15, except in case of emergencies such as breakdown in machinery and equipment. In answering this demand, the Willys-Overland Co. declares double pay for overtime an unreasonable request, which could not be sustained under relative competitive conditions. The company is willing to pay time and a half after the regular hours established for the 48-hr. basic week. Double time will be paid on Sundays and on the days observed as national holidays.

Representation Plan

Regarding shop committees, the union demands that employees shall elect a committee of three members in each department of every plant. These committees are to be recognized by the company as being the proper representatives of the employees to take up departmental grievances with the foremen of any department wherein a grievance has arisen. If this committee is unable to adjust said difference or grievance with the foreman of the department, then the grievance with the foreman is to be turned over to the Joint Shop Committee and the proper officer of the company for adjustment. The Joint Shop Committee shall not exceed 15 members and shall be selected by the employees.

The Shop Committee shall be recognized as the proper representatives of the employees in adjusting trouble which cannot be settled by the department committee and their foremen. Members of the Joint Shop Committees will be allowed the privilege of investigating grievances in any department that are brought to their attention.

In reply to this demand the company informed the employees that it had already provided a plan of representation of all employees. This plan gives employees the right to elect their own committees, which will work in conjunction with the management in the settlement of grievances, wages and working conditions.

Under the company's employees' representation plan, committees are elected in the various departments or divisions on the basis of one representative for each 200 or 300 employees. From the ranks of these elected committeemen five employees are elected by the committeemen themselves. The management also appoints five representatives. These ten men constitute the general board of adjustment to handle all matters which can-

(*Continued on page* 1137)

Automotive Industries

Bill for Maintenance of the M. T. C. Introduced in Congress

Army Officials Urge Its Continuance as Separate Body—Work of Corps Commended by Gen. Pershing—Bill Provided for Disbandment of M.T.C. in Last Session

WASHINGTON, May 20—With the opening of Congress this week, considerable interest centers about the future of the Motor Transport Corps, the continuance of which as a separate body in control of the operation, maintenance and purchase will be urged by army officials. During the last session the army bill provided for the disbandment of the M. T. C. and the return to the old system under which the control of trucks and other motor vehicles would be placed under each separate division. This plan was followed prior to the war, when the Quartermaster Department, Signal Corps, Aviation, Engineer and other divisions each purchased and maintained their own supplies of motor vehicles, with a certain amount of confusion, conflict and a needless waste of labor. Amendments were made to the bill, however, by Congressmen who realized the value of maintaining the corps separately. The filibuster prevented its passage.

The consolidation of the motor interests in the M. T. C. as a separate organization eliminated the duplication of effort and tended to insure a standardization of army vehicles. It is planned to introduce a bill in this session which will continue the M. T. C. as a separate division and place the maintenance, design, production, procurement and operation of bicycles, motorcycles, cars, trailers and trucks under it and leaving tractors and tanks under the control of the Ordnance Department.

Army officers point to a recent letter received from General Pershing by Brig. Gen. M. C. Walker, in which General Pershing testifies to the efficiency of the M. T. C. as additional evidence of the need for a separate division.

It is anticipated that there will be some controversy about the continuance of the M. T. C. due to the fact that executive divisions of the War Department are planning to maintain the present control of the purchase of motor vehicles.

Following is the letter from General Pershing to Brig. Gen. Walker and the proposed bill which will make the M. T. C. a permanent organization:

"Brig. Gen. Meriwether L. Walker,
Director, Motor Transport Corps,
American E. F., Tours.

"My Dear General Walker:

"At this time when many officers and enlisted men are returning home and severing their connection with the American Expeditionary Forces, I am glad to take the opportunity of expressing to you, and the officers and men under you, my appreciation and thanks for what the Motor Transport Corps has accomplished.

"When war was declared, motor transportation was almost non-existent in the army. From the outset, the Motor Transport Corps had to meet the most difficult conditions, including its organization at a time when the demand for motor transportation at the front was the greatest; it always suffered from a deficiency of at least 70 per cent in required personnel and of 50 per cent in needed material. The handling of many different types of motors which had been ordered and shipped to France by the various services, combined with an entire inadequacy of spare parts, was another difficulty that had to be overcome.

"That the Motor Transport Corps was able to operate despite these handicaps and keep enough vehicles running at the front to supply the fighting troop speaks well for the energy and perseverance of your officers and men. Under all conditions of weather, on bad roads, often under heavy fire, at the front and throughout France, they labored cheerfully. Your well-considered plans would have soon borne fruit and resulted in a highly efficient service.

"In ending I cannot neglect the opportunity of thanking you personally for the energetic effort and enthusiasm you have displayed in your difficult task and which produced such fine results.

"Sincerely yours,
"JOHN J. PERSHING."

Section Referring to M. T. C. Provisions

The following is the section of the General Army bill for 1920 that refers to the M. T. C.:

For contingent expenses for Motor Transport Corps operations in the field, purchase of the necessary articles of office, toilet, desks, furniture, stationery, ice and water for office use when necessary, binding, maps, technical books of reference, professional and technical newspapers and periodicals, payment for which may be made in advance, and for other purposes incident to the Motor Transport Corps, services and expenses of necessary employees engaged in the Field Service, provided that the number of and total paid for civilian employees in the field service of the Motor Transport Corps shall be limited to the actual requirements of the service.

Provided, further, that the Secretary of War is hereby authorized in his discretion to rent or lease any building or part of building in the District of Columbia that may be required for the Motor Transport Corps during the fiscal year ending June 30, 1920, payment therefor to be made from this appropriation.

Provided, further, that the service of skilled draftsmen, expert automotive engineers, mechanical engineers and such other services as the Secretary of War may deem necessary may be employed only in the office of the Chief of the Motor Transport Corps to carry into effect the various appropriations: Provided, that the expenditure on this account for the fiscal year 1920 shall not exceed $428,710, the Secretary of War shall in the annual estimate for the fiscal year ending June 30, 1922, report to Congress the number of persons so employed, their duties and the amount paid to each.

For maintenance of the necessary automotive vehicles of the army including repairs, spare parts, etc., operation of motor vehicles, including gasoline and lubrication, hire of automotive equipment when necessary, maintenance of repair shops and units and other purposes in connection with design, production, procurement, housing, storage, maintenance, repairing, operation and replacement of Motor Transport Vehicles for the Army including accessories and mechanical supplies, no part of which to be expended for clerical employees in any capacity.

Provided, further, that in this act the term Motor Transport Vehicles wheresoever used will be construed to mean all bicycles, motorcycles, automobiles, trailers and trucks, that are fitted or may be fitted for passenger or cargo transportation. Tracklayer tractors, designed primarily for traction purposes, and tanks are not held to be Motor Transport Vehicles.

Provided, further, that the Motor Transport Corps shall be charged with design; production; procurement; housing; storage; maintenance; repairs; operation; assignment and replacement of all Motor Transport Vehicles; spare and repair parts; tools; accessories, and mechanical supplies of all Motor Transport Vehicles for the Army as herein-before described. Provided, further, that the Motor Transport Corps shall under such regulations as may be approved by the Secretary of War, establish and operate such garages, parks, depots and repair shops as may be necessary and to procure, organize, assign and technically train all persons necessary to the proper operation thereof.

Provided, further, that the procurement of Motor Vehicle chassis required for carrying special type bodies for the Army will be made under the direction of the Chief of the Motor Transport Corps.

Provided, further, that the procurement of special motor vehicle bodies not designed for passenger or cargo transportation or for Motor Transport purposes, and tracklayer tractors and tanks as hereinbefore described may be made under the direction of the bureau, corps or department for which such special equipment is designed.

Provided, further, that the procurement of special motor vehicle bodies shall be made only after the design thereof is approved by the Chief of the Motor Transport Corps.

N. A. C. C. to Make Formal Request for Reclassification of Chassis

NEW YORK, May 21—The National Automobile Chamber of Commerce is preparing to make a request that the revenue tax be removed on automobile parts and trucks. Representation is to be made to-morrow before the Internal Revenue Department for a reclassification of the truck chassis so that it will not be classified as a part and thus subject to 5 per cent tax, but will be classed as a complete vehicle and subject only to the 3 per cent tax.

The Chamber will hold a meeting of its export managers on June 6 for the purpose of mapping out a definite foreign trade program with the possibility that some form of foreign trade co-operation, as made possible in the Webb Act, may be worked upon.

Goodwin Leaves Cadillac

DETROIT, May 21—Edward W. Goodwin, engineer of the body division of the Cadillac Motor Car Co., has resigned. He will take a month's rest and then open an office here for car designing, detail and building.

Great Britain Developing Commercial Aviation Program

Large Military Air Force Maintained—Manufacturers Continue Activities—Commercial Enterprises Starting—International Air Rules Modified at Paris

LONDON, ENGLAND, May 1—The Government is conducting its military aerial program with the greatest secrecy. Not much positive information can be gained. While the demobilization of the army continues, the air force is remaining at the same figure as when the armistice was signed. The present force is believed to be 40,000 officers and 310,000 men. This means that Great Britain will continue indefinitely a large air force. The commercial aircraft manufacturers are continuing activities. None of the larger firms have slackened work, although many of the small ones have. But very few have closed down.

Handley-Page, Ltd., is now working on the following contracts:

1. Fulfilling Government contracts. They still have upwards of 1000 machines to build.
2. Running a passenger service at Hendon with five machines carrying 11 passengers apiece. Each passenger pays $10 a flight.
3. Several small contracts for the circulation of papers. The Daily Mail, the Daily Chronicle, and the Daily Telegraph, have ordered several machines apiece to be especially adapted for paper-carrying to assist in the rapid circulation of their papers.
4. Building a special machine with four engines to attempt the Atlantic flight.
5. Building a series of specially designed machines to fly Marconi wireless apparatus across the Tibetan desert to China, which has been tried by land but was found to be impossible.

Similarly the Vickers Ltd., are fulfilling a contract for 5000 double-engined bombers, of which they have so far only completed 504, so recently was the contract given.

Gets Exclusive Mail-Carrying Rights

Holt Thomas has obtained the sole rights from the British and French Governments for the carrying and delivery of mails between England and France. He is relying on this for his bread and butter, when he gets through with his present Government contracts. He is also running the present passenger service between London and Paris.

The Government is rapidly getting rid of all its obsolete types of machines by selling them at auction. Good airplanes with engines often have sold at from $1,500 to $3,000. The buyers are usually pilots of the Air Force, who have been demobilized, and who are starting in the passenger carrying business for themselves.

With regard to the smaller works, which are now left with no Government contracts, the majority are working on altogether new lines which utilize much the same type of material, and much the same type of skilled labor, as the airplane work they have been doing.

Major General Sir Frederick Sykes, K. C. B., Controller General of Aviation in Great Britain, made the following statements in a recent address to the heads of firms interested in the manufacture of aviation products:

"By May 1 the ban which has been placed on civil aviation during the war will be removed. As a result of the conferences in Paris, a draft convention has been drawn up, and it is on that that our home regulations for civilian flying will be based. It does not apply to British military aircraft.

"The first point is naturally, Who may fly? Any person wishing to fly aircraft carrying either passengers or goods must obtain a certificate to the effect that he is properly qualified to do so, and a license. Rules have been agreed on in Paris for the control of aerodrome traffic, and will be attached to the regulations, and once in the air, a definite rule of the air will be adhered to.

Will Prohibit Flying in Certain Areas

"So far as national secrecy is concerned, there will be certain prohibited areas over which none will be allowed to fly. An obvious point which has been lost sight of is the danger of alien undesirables and foreigners being landed in this country, without the police and military authorites knowing of their advent. The aliens restriction order has had provisions inserted, which cover all persons arriving in this country by air.

"The danger of smuggling by air is a very real one, and for the present it has been decided that all airplanes incoming from overseas shall only be allowed to land at four fixed aerodromes, the names and locations of which I shall give out at a later date. Persons landing elsewhere will be taken into military custody pending investigation. If, however, we find that commercial traffic develops, especially with Europe, we can always increase the number of aerodromes by an arrangement with the Customs.

"In military aviation I may say that we, through force of circumstances, lead the world. It is for us to see that we do not lose the advantage gained during the war, and that we also hold the same position in civil aviation. Flying is an international affair, and the first step has been taken to form an international code with Europe. This was the object of the Paris conference.

"Among other things agreed upon by this conference is that every machine shall be assigned a registration number, and also a nationality mark. Before these numbers are allotted, however, each machine would be inspected for design, construction, material, and actual performance in the air. All machines will be certified for a certain definite load or number of passengers, which it will not be allowed to exceed under any circumstances. Each machine will be compelled to carry log books, and will not be allowed to fly more than a certain number of hours without overhaul.

"No articles whatsoever will be allowed to be thrown overboard with the exception of water or very fine sand, as heavier articles would be likely to cause injury to people down below."

Major Foot, who is conducting a passenger carrying air line, reports that during the four days of Easter holidays his machines carried 973 passengers without accident.

Additional International Air Rules

PARIS, April 27—The Aeronautical Commission of the Peace Conference has issued an official communiqué which outlines some additional clauses of the probable international regulations for aerial transportation. In part the communiqué says:

"The Commission has decided as a matter of principle that certificates of airworthiness in the case of the aircraft and certificates of competency in the case of the crew are to be recognized as universally necessary in international flying.

"The right of flying over a State from frontier to frontier is recognized, subject to the safeguard that the State flown over may compel a landing in the interests of national security, or, in other words, where reasonable suspicion exists that the flight is not bona fide. In the interests of domestic control by each State there are provisions as to the carriage of various papers of identity, etc., upon the aircraft, and the prohibition of the carriage of dangerous articles is also provided for.

"The final provisions include an arbitration clause for the settlement of disputes and a clause which definitely places the convention on a peace basis as not affecting the rights and duties of belligerents or neutrals. Military aircraft are placed in a class apart, and may not fly outside their own country, except by the special authorization of a State visited by them, in which case they are to be treated according to the usual rules prevailing in the case of ships of war."

Automotive Activities in England on Increase

LONDON, ENGLAND, May 2—The automotive activities throughout the United Kingdom are showing considerable increase. The budget introduced April 30 makes no changes that concern American motor cars, but it shows a decided preference for cars manufactured in British colonies. An American car for instance would pay 33 1/3 per cent import duty while a British colony car would pay 2/3 less.

The Ford Co. has resumed building operations at its new factory at Brook Green, Hammersmith, London, and is now adding a third floor. The plan is eventually to make the building five stories. This building so far has been used more as a repairshop than as an assembly plant, but eventually will be a factory. The Ford interests have announced that the first castings have been produced at the Fordson factory in Cork. There was a celebration of this event at the factory.

The Pneumatic Tire Committee of the Society of Motor Manufacturers and Traders has taken up the work of international standardization of all solid tires. The work undertaken by this committee follows that of committees representing the British Rubber Tire Manufacturers' Association and the British Engineering Standards Committee. The object of this work is to eliminate a great number of types and sizes now on the market and to make tires interchangeable throughout the world. T. H. Woollen is chairman of this committee.

Westinghouse Dividend

Westinghouse Electric & Manufacturing Co., Pittsburgh, 2 per cent quarterly dividend, common and preferred, common payable July 31, preferred payable July 15, both to stockholders of record July 15.

New Navigating Instruments Made for Transatlantic Flight

Take Account of the Altered Conditions Under Which Observations Must Be Taken and Permit Very Rapid Determination of Results —Equipment of Navigator's Cockpit of NC Planes

NOVEL instruments, especially designed for use in oversea navigation, are employed for the first time by the U. S. Navy-Curtiss seaplanes in the transatlantic flight.

No airplane has ever flown far enough out to sea to warrant the use of the sun, moon and stars for fixing a geographical position, as is done on seagoing ships. Navigation, therefore, on a transatlantic flight is new and untried, and it has been necessary in preparing for this flight to design three new instruments for navigational use: 1. An aerial sextant; 2, a drift and speed indicator; 3, a course and distance indicator.

A feature of the aerial sextant, known as the Byrd sextant, invented by Lieutenant R. E. Byrd, is that a bubble in a tube takes the place of the sea horizon and observations. A specially constructed lens is used in sighting the bubble, which is reflected in a mirror. The sun is reflected in another mirror. The observer brings the sun tangent to a line at the same time he brings the bubble tangent to the line. That gives the altitude of the sun. This is of especial value, as the aviator is often above the clouds. and even when flying at low altitudes the horizon is too dim to be seen clearly. With this new aerial sextant the curvature of the earth does not have to be taken into consideration in calculating position. The bubble is lighted at night, so that night observations may be taken.

New methods of astronomical calculations also have been devised which enable the navigator to make his calculations in a fifth of the time that was formerly necessary. A zenithal projection chart of the Atlantic Ocean has been specially constructed for this purpose. This chart, a new invention, does away with difficult mathematical calculations, enabling the aviator to determine his position in a few minutes.

Another great problem of the sea-air navigator is the calculation of the speed and direction of the wind, both day and night. In spite of the reliability of the compass, it can only give the course upon which the craft heads, and in determining the true course, proper allowance must be made for the sidewise drift caused by the wind. For example, a wind blowing 30 miles an hour towards the side of the plane will blow it 30 miles an hour out of its course. This fact alone makes the navigation of the air far more difficult than the navigation of the sea.

To overcome this difficulty bombs have been invented which ignite upon striking the surface of the water and give a dense smoke and bright light for ten minutes.

An instrument is used in conjunction with this bomb which enables the navigator to determine the velocity and direction of the wind by sighting on the smoke in the daytime and the lights at night. This instrument, called the speed and drift indicator, has proved successful.

When the navigator has found the speed and direction of the wind, he must then be able to calculate the course to steer towards the Azores to allow for this wind. To do this an instrument has been designed to solve the triangle of forces, thus doing away with cumbersome mathematical calculations.

The navigator's cockpit is in the fore part of the boat and is equipped with a chart board, a chart rack and lights. He also has a specially designed headgear for telephonic communication with the pilots so that he can direct them when to change course. The noise from the four big engines is so great that it is impossible to hold conversation except with specially designed telephonic apparatus.

The navigator also has instruments which show him the altitude of the plane and the time the sun keeps with the Greenwich meridian, because in going to the eastward so rapidly it is difficult to keep the correct time. In going from Newfoundland to the Azores, over two hours is lost in a period of 20 hours, so that the navigator must be very expert in order to allow for this loss in time in making his astronomical calculations.

In aerial navigation, positions must be determined very quickly. The navigator sits down to work out his "sights," to fix his position, and by the time he arrives at results he will be far from his calculated position unless he works out his calculations very rapidly, which these instruments enable him to do.

—

Outstanding Aircraft Contracts

WASHINGTON, May 19—Of the Air Service contracts outstanding Nov. 9, 1918, which totaled $672,849,000, terminations to date include a total of $498,-039,000. Deliveries since the signing of the armistice aggregate $160,000,000 and contracts still in force amount to $14,-810,000. In percentage this results in 74 per cent of the contracts terminated, 24 per cent delivered, and 2 per cent remaining in force.

—

Dealer Contracts for 150 Airplanes

CHICAGO, May 19—The James Levy Motor Corp., Buick dealer, is distributer for the central west for the United Aircraft Engineering Corp. of New York. He has contracted for 150 of the Canadian JN-4 training planes.

These planes are being sold at $2500 and are part of the equipment bought by the United Aircraft Engineering Corp. from the Canadian Government. They have a 90-hp. eight-cylinder OX-5 "V" type engine, double control, and weigh 1600 lb. They are capable of from 80 to 90 m.p.h.

—

Manufacturers' Association Plans Export Trade Combine

NEW YORK, May 21—At the foreign trade session of the National Association held here last night it was proposed to form an export corporation to operate under the Webb-Pomerene law in the various Latin-American republics. This will be known as the Namusa South American Corporation and membership in it will be limited to members of the association. The plan was roughly outlined, but details are yet to be agreed upon. Approximately 60 groups of manufacturers are provided for, each concern owning one share of stock.

—

Flying Fields to Be Retained

WASHINGTON, May 19—Fifteen flying fields and five balloon schools are to be held by the Air Service as permanent training fields, as follows:

Government Owned

Rockwell Field, San Diego, Cal.
Langley Field, Hampton, Va.
Post Field, Fort Sill, Okla.
Kelly Field No. 1, San Antonio, Tex.

Leased—to Be Purchased

March Field, Riverside, Cal.
Mather Field, Sacramento, Cal.
Carlstrom Field, Arcadia, Fla.
Dorr Field, Arcadia, Fla.
Ellington Field, Houston, Tex.
Park Field, Millington, Tenn.
Souther Field, Americus, Ga.
Selfridge Field, Mt. Clemens, Mich.
Scott Field, Belleville, Ill.
Chanute Field, Rantoul, Ill.
Kelly Field No. 2, San Antonio, Tex.

BALLOON SCHOOLS

Government Owned

Lee Hall, Va.
Ft. Crook, Neb.

Leased—to Be Purchased

Arcadia, Cal.
San Antonio, Tex.
Ft. Omaha, Neb.

—

45,270 Planes in 9 Months

WASHINGTON, May 16—France, Great Britain and Italy produced 45,270 airplanes in the 9 months from Jan. 1 to Oct. 1, 1918, of which 79 per cent were service planes and 21 per cent were training planes. Great Britain produced 23,509; France, 1833, and Italy, 2928 airplanes.

—

British Motor Trading Corp. Opening Branches Throughout England

LONDON, ENGLAND, May 2—The British Motor Trading Corp., Ltd., has been organized with a nominal capital of $10,000,000 to establish a chain of garages and motor salesrooms throughout England. The company announces that it will carry large stocks of parts for popular cars. The company is said to have placed an initial order for Crossley cars amounting to $5,000,000. These cars will be sold throughout England and Scotland.

90% Contract Claims Filed With Boards

Large Claims Still Pending—Plan for Sale of Surplus War Material

DETROIT, May 20—Having practically all of the smaller war contract aircraft and ordnance department claims in this district cleaned up, local claim adjustment boards are now engaged in routine work awaiting the presentation of a score or more large claims still pending. These big claims represent nearly 40 per cent of the total value of all contracts in this district. The boards have scores of men aiding the factory organizations in compiling the required data and excellent progress is now being made.

Among the claims still outstanding are Packard, Ford, General Motors, Willys-Overland, Lincoln, Fisher Body, Wilson Body, and a number of others. Approximately 90 per cent of all claims have been filed with the boards and about 50 per cent approved at Washington to date. The aircraft board expects to close business between June 1 and June 15. Ordnance adjustment business will be wound up about June 30.

Both boards, however, will maintain material disposal departments, which may be in operation for over a year. These departments face the huge task of selling approximately $85.000,000 worth of machinery without shaking the stability of the machinery market.

Surplus Material for Disposal

Aircraft officials estimate that it must dispose of between $40,000,000 and $50,-000,000 worth of machinery, and the Ordnance Board has nearly the same amount. About 75 per cent of this machinery will be sold to the firms for which it was purchased and installed. The remaining 25 per cent will be sold in co-operation with machinery dealers.

The system for the sale of this machinery is simple but practical. A company may have installed a Government machine valued at $1000 and proposed working it on an order for 1000 certain parts, calculating that the value of the contract, when complete, would have absorbed the cost of the machine. The Government however cancelled the contract when but 500 parts had been complete, leaving the machine 50 per cent unpaid for.

The Government will estimate that inflated war prices caused the machine to sell 30 per cent higher than standard price and will therefore deduct that amount from the price which the company will be asked to pay. Wear and tear covering the period of its operation will also be deducted. This will range from 15 to 40 per cent. When this depreciation as well as the price reduction is substracted from the 50 per cent initial cost of the machine, which had not paid for itself due to contract cancellation, the cost of the machine to the company will range between $200 and $300. About 60 per cent of bureau of aircraft machinery has already been sold on this basis.

The machinery which is useless to the company which used it for war work, will be removed and sold, but the sale will be conducted in co-operation with machinery dealers. For instance, if a company bids for this Government machinery, the bidder will be obliged to purchase a machine from the dealer for every machine purchased from the Government. The Government machine will be disposed of at a price based upon market reduction, depreciation, etc., but a standard price must be paid for the new machinery.

The officials do not desire to remove machinery from a plant, place it in storage and keep it until a purchaser is found. It will exert every effort to sell the machinery to the company which used it for war work and will make further discount to such firms if they purchase it.

President Emphasizes Industrial Needs

WASHINGTON, May 20—The industrial needs of the nation were the dominant features of the message from President Wilson to Congress, which opened here this week. He asked for:

Labor reforms that will democratize industry and bring full recognition of the rights of both the employers and employees.

Far-reaching government assistance for demobilized soldiers through the Department of the Interior which he asks to be given the necessary appropriations to develop hitherto uncultivated regions for the returning soldiers, and through the Department of Labor, which he requests be allowed to continue its employment service.

Foreign trade policies tending to establish friendliness between this country and all other nations.

A bargaining tariff so that we have a weapon of retaliation in the event that other governments enact legislation unequal in its bearing on our products as compared with the products of other countries.

Repeal of excise taxes on various manufactures and taxes on retail sales.

Return of the railroads and telegraph and telephone with legislation that will protect the interests of the owners and the nation.

Americans to Study European Aviation

WASHINGTON, May 19—A complete study and investigation of civil aviation as being developed in Europe will be made by Assistant Secretary of War Benedict Crowell and a number of military and civil aviation authorities who will leave for Europe on May 24.

The party includes Lieut. Col. James A. Blair, of the general staff; S. S. Bradley, of the Manufacturers' Aircraft Association; G. H. Houston, president of the Wright-Martin Aircraft Corp.; C. M. Keys, vice-president of the Curtiss Airplane & Motor Corp., and Howard Coffin, of the Council of National Defense. Col. Halsey Dunwoody, chief of the air service on overseas, will join the party in France.

Hudson Motor Co. Formed to Handle Hudson Sales

DETROIT, May 21—The Hudson Super Six and Essex in Chicago territory, formerly handled by the Louis Geyler Co., will hereafter be handled by the Hudson Motor Co. of Illinois, under active direction of J. R. Histed.

War Department Buys 200 Night Bombers

Bids Received Range from $19,-500 to $60,000 for Different Quantities

WASHINGTON, May 21—The War Department will place orders this week for 200 night bombers of the Glenn-Martin type. Bids have been received from the Glen L. Martin Co., the Curtiss Aero & Motor Corp., the Gallaudet Aircraft Corp., the Boeing Airplane Co., the Liberty Iron Works, the Unit Construction Co., the L. W. F. Engineering Co. and E. Elias & Bros. Prices bid range from $19,500 to $60,000 each. The prices vary widely because the bids are for different quantities. Following is the complete tabulation of the bidders, quantities bid on and prices:

Bidder	No. of Planes	Unit Price	Total
Glen L. Martin Co., Cleveland, Ohio	50	$37,875	$1,893,750
Curtiss Aero & Motor Corp., Buffalo, N.Y.	50	25,000	1,250,000
	100	21,000	2,100,000
	150	20,000	3,000,000
	200	19,500	3,900,000
Gallaudet Aircraft Corp., East Greenwich, R. I.	30	31,000	930,000
	50	30,500	1,525,000
	100	29,500	2,950,000
	200	29,052	5,810,400
Boeing Airplane Co., Seattle, Wash.	50	37,750	1,887,500
Liberty Iron Works, Sacramento, Cal. ...	200	29,500	5,900,000
Unit Construction Co., Philadelphia, Pa. ...	25	34,740	868,500
L. W. F. Engineering Co., College Point, N. Y.	50	29,800	1,490,000
	100	27,800	2,780,000
	200	24,950	2,990,000
E. Elias & Bros., New York	1	60,000	60,000
	5	55,000	275,000
	10	50,000	500,000
	25	45,000	1,125,000
	50	42,500	2,125,000
	100	41,000	4,100,000
	200	39,750	7,950,000

Truck Tax Reopened

NEW YORK, May 22—The Treasury Department ruling covering the tax on motor truck chassis is being reconsidered. Following protests from 57 dealer associations, including the National Automobile Dealers' Association, Commissioner Roper telegraphed the N. A. D. A. as follows: "Ruling regarding tax on chassis being reconsidered. When decision is rendered you will be notified." The ruling in question classifies a truck chassis as a part and as such requires a tax of 5 per cent. The contention is that a truck chassis is a sales unit and should be taxed as a complete unit at 3 per cent.

Plan Committee on Aeronautics

WASHINGTON, May 20—A resolution was offered to-day in the Senate authorizing the Committee on Rules to report a Senate committee to be known as the Committee on Aeronautics. The general purpose and functions of the committee will be to consider all matters pertaining to aircraft and aviation.

French Motoring Restrictions to Be Removed

PARIS, May 19 (Special Cable)—There is strong reason to believe that the motoring restrictions limiting travel distances will be removed this month.

The French gasoline supply is now entirely satisfactory.

Shortly after the first of the year, all gasoline purchase restrictions were removed, but travel was restricted within a radius of 30 miles of one's home. Travel was forbidden in the army zone and in the devastated regions. The removal of such limitations will throw the devastated area of France open to visitors this summer, and will doubtless lend added impetus to car production in France.

—

Milton Wins at Uniontown

UNIONTOWN, May 20—Tommy Milton, driving a Duesenberg special, finished first in the Victory sweepstakes speedway race here yesterday, covering the 112½ miles in 1 hr. 10 min. 9.32 sec., averaging about 96.21 m.p.h. The race, which was scheduled to open the American racing season on Saturday, was postponed until yesterday because of rain.

Louis Chevrolet in his Frontenac special came in second.

—

Willys-Overland Strike

(*Continued from page* 1132)

not be satisfactorily disposed of by the departmental shop committeemen. This plan provides for the election of committeemen by all men, including both union and non-union men, and gives fair and equitable representation to the entire shop.

Concerning female employees, the union asks that they be allowed equal pay for equal service and not be allotted tasks disproportionate to their strength. The committee states that female employees would be allowed equal pay for equal work on occupations ordinarily performed by men, and would not be given tasks disproportionate to their strength. Consistent with this policy, the company established a starting rate of 30 cents per hour for women, and installed rates in excess thereof up to 45 cents per hour.

Company Refuses Wage Increase

Regarding wages, the demand sets forth specific rates for only die makers, tool makers, die sinkers, machinists, specialists, inspectors, helpers, truckers, sweepers, elevator operators, drop forgers, blacksmiths, block and machine operators, heatrs, helpers, hammer drivers, stationary engineers, firemen, repairmen, heat system men, oilers, boiler washers, flue blowers, coal passers, mail order department men, sewing machine operators, top and body trimmers, sheet metal workers, press and bench men, solderers, helpers, pipe fitters and helpers. The increases in rates demanded were a minimum of 15 cents per hour in some cases and 25 cents per hour in other cases.

The Willys-Overland Co. in reply to this demand states that increases of 15 cents per hour to all employees and 10 per cent additional for second and third shift employees would not be granted and that the company could not afford to make a horizontal increase.

Trailer Manufacturers Want Uniform Laws

Executive Committee Passes Resolution Favoring National Highway Commission

NEW YORK, May 19—Uniform legislation and the promotion of a better public knowledge of the trailer and its uses were high points in the program outlined at an all day meeting of the executive committee of the Trailer Manufacturers' Association of America held in Association offices, 110 West 40th Street, Saturday.

As a first step it was decided to ask all members for suggestions for provisions relating to the regulation of trailers, and to incorporate these in recommendations to be sent to the Highway Industries Association with a request that they be embodied in the uniform traffic bill which was drafted by a joint committee representing the Highways Transport Committee of the Council of National Defense, the Association of State Highway Officials, the National Automobile Chamber of Commerce, the Highway Industries Association and the American Automobile Association.

It was also decided to work in conjunction with interested organizations to keep in close touch with proposed legislation, with the object of obtaining proper laws that will afford protection to the highways and their users without unwisely checking the development of economical and expeditious transportation by highway. To this end, it is proposed to arrange for the introduction of a uniform traffic bill embodying reasonable trailer regulations in the various state legislatures next winter and to get prompt advice of all other bills introduced affecting trucks and trailers.

Contact is to be established with state and local motor truck and team owners' associations, automobile clubs, good roads associations and commercial organizations, and to furnish them information and suggestions for action to be taken with respect to the various measures.

Endorse Highway Commission

As an instance of this purpose, the executive committee passed the following resolution:

Resolved, That the Trailer Manufacturers' Association of America favors the creation of a Federal Highway Commission and the construction and control of a system of national highways by the United States Government through such a commission, as provided in the Townsend bill introduced during the last session of the 65th Congress, and urges the early passage of such a measure by the 65th Congress with a view to providing better military defense, facilitating interstate transportation of persons and goods, reducing the cost of haulage by highway, increasing the production of foodstuffs, raising the standard of education and living in rural sections, and uniting the thought and sentiment of the people of the country through more frequent and easy intercourse.

In the matter of general promotion work, it was decided to make a report to members and some other trailer manufacturers covering an investigation that has been made into the merits and advantages of national publicity, and to begin efforts immediately to increase the membership of the association with a view to providing a sufficient fund for the purpose. The Southern Motor Manufacturing Association, of Houston, Texas, is the fifteenth member.

Trailer Standards Committee

A Trailer Standards Committee was appointed to confer with the Trailer Sub-Division of the Truck Standards Division of the Society of Automotive Engineers in all matters pertaining to standardization of trailers, trailer hitches, etc. The members are: W. R. Hudson, engineer of the Troy Wagon Works Co., chairman; H. G. Farr, engineer of the Martin Rocking Fifth Wheel Co., and H. W. Perry, general manager of the association.

A resolution was passed thanking the National Automobile Chamber of Commerce and R. A. Brannigan, of the N. A. C. C., for their efforts in pointing out to the Commissioner of Internal Revenue that trailers and semi-trailers are not taxable under the Revenue Act of 1918. The Treasury Department, in Regulations 47, just issued, rules that 2-wheeled and 4-wheeled trailers are exempt.

The committee considered the question of advisability of including motor truck routes as common carriers to be regulated as to routes, rates and stock issues by the Interstate Commerce Commission, as proposed tentatively by Congressman Esch. No decision with regard to recommendations was reached, but it was the general feeling that while a certain amount of regulation might be beneficial, insufficient experience in the operation of motor truck transportation lines would make it difficult and inadvisable to establish a fixed scale of shipping rates and that federal control over the organization and financing of such lines at this time might retard development of such transportation.

Standardized Cost Accounting

Use of a standardized cost accounting system for motor trucking was approved and, while not endorsing any specific system, it was the sentiment of the committee that trailer manufacturers should urge truck and trailer operators to install a uniform system so that results can be compared. The general principle of controlling trailer brakes by air pressure was also endorsed.

In July a general meeting of members of the Trailer Manufacturers' Association will be held. The date and place have not yet been set, but Rochester may be selected.

Members of the executive committee in attendance at the meeting were: President W. E. Ferris (Ohio); Second Vice-President R. C. Sykes (Troy); W. R. Bonds (Detroit); C. H. Martin (Martin); H. M. Wood (Trailmobile), representing J. C. Endebrock, secretary-treasurer; and H. W. Perry, manager of the association. Several territorial representatives of member companies were also present, including A. R. Miller of Philadelphia.

New Basis for Tractor Engine Ratings

Tractor Standards Committee of S.A.E. Discusses Uniform Standards, Rating and Legislation

CHICAGO, May 19—A more uniform basis of tractor engine ratings, more conservative rating standards and uniform and fair legislation from State Assemblies were among the topics discussed at the meeting of the Tractor Standards Committee of the Society of Automotive Engineers, May 9.

Representatives of the International Harvester Co., Advance-Rumely, Aultman-Taylor, Parrett Tractor Co., in addition to other members of the committee, including Prof. Chase of the University of Nebraska, were present.

After looking over the reports of the Winnipeg, Salina and other demonstrations it appeared foolhardy to the committee to try, with any degree of consistency, to rate tractors from the results obtained in field tests on account of the wide variation of conditions. What tractor makers generally are after now is some basis of comparison.

After considering many proposed plans for bringing this about the committee felt that the best solution at the present time would be a method similar to that used in rating cars and trucks, inasmuch as the latter method is used satisfactorily and has been accepted by all the states in issuing licenses. While it is true that a car of one make, having the same rated horsepower as a car of another make, might out-perform the latter, there nevertheless is a basis upon which to make a comparison.

The new proposed rating would establish a definite single basis on which makers could rate the ability of their tractors and incidentally make it easier for the farmer to make a selection.

Car engines are rated on about 11,733 cu. in. displacement per minute per horsepower. From the fact that cars invariably use gasoline and the duty is much lower than tractor engines, it was decided to adopt the following formula basis on about 13,000 cu. in. displacement per minute per horsepower for tractors:

$$\frac{.7854\ D^2\ LRN}{13{,}000}$$

where D is the diameter in inches of the bore, L the length of stroke, R the number of revolutions per minute, and N the number of cylinders.

Under the present rating of tractors the piston displacement runs anywhere from about 9,000 to as high as 16,000 cu. in. per min. per hp. An average taken from 12 different makes of tractors shows a piston displacement per min. per hp. of 12,696, based on the tests at Columbus, Ohio, in 1918. Also the concerns who are making tractors in any quantity come very close to the proposed 13,000 figure. Obviously if the new rating scheme is put into effect, it will mean a change in the rating of some tractors where the displacement is figured on a piston displacement per min. per hp. of less than 13,000.

The new formula may be only temporary, but it offers something for the industry to work on. It is likely that in time it will be changed, possibly reduced. In any event it will be necessary to rerate tractors whose ratings are now based on less than 13,000 cu. in. to comply with the Nebraska and other state laws.

—

Tractors for Demonstration at Denver

DENVER, May 20—The following makes of tractors will participate in the tractor demonstration to be held here June 8 to 14:

All-Work	Illinois
Aultman-Taylor	I. H. C.
Avery	Lauson
Best	Leader
Case	Moline
Cleveland	National
Eagle	Parrett
Emerson-Brantingham	Rumely
Fair	R & P
Fordson	Sandusky
Four-Drive	Twin City
General Motors (GMC)	Turner
Gray	Wallace
LaCrosse	Wisconsin
Hart-Parr	Waterloo-Boy
Huber	Wheat
Holt	Bullock
	Bailor Motor Cultivator

—

New Truck Tread Attachment

DETROIT, May 15—William Coatworth and M. A. Zoulek have formed the Coatworth & Zoulek Mfg. Co. here to make a truck tread attachment. It is used on both rear wheels, providing a track on which the wheels run. The attachment is made of hard wood blocks, with pipe spacers between, through which a steel cable passes. The shoes provide traction and the tread is claimed to enable a truck to pull out of mud holes.

—

Improved Oil-Pressure Regulation in Liberty Engine

(*Continued from page* 1127)

oil in the pressure-gage pipe may congeal so that the gage will not register until thoroughly warmed. It is always best to drain the entire system after flights. Unless great care in warming-up is exercised, burnt-out bearings may result.

The oil and lubrication branch of the Bureau of Aircraft Production has developed an engine water heater which can be attached to each engine in active service. This consists of a small stove with several gasoline burners and a copper coil. The water from the engine cooling system circulates through this copper coil and is returned into the top of the radiator. The heater should be attached to the engine as soon as it comes in from the flight (it is only necessary to make one connection in the water return line), and it will keep the engine circulating water and oil warm. Priming the cylinders with excessive raw gasoline will wash the oil film off the cylinder walls, and scored pistons may result. Gasoline for priming should be used very sparingly, and only through the hand dash primer to the petcocks on the intake manifolds.—*Liberty Engine Service Bulletin No.* 8.

Tax on Truck Chassis Fought by N. A. D. A.

Taxed 5 Per Cent Because Classed as Part—Dealers Claim It Is Taxable at 3 Per Cent

ST. LOUIS, May 17—A vigorous fight against the ruling of the Internal Revenue Bureau that a truck chassis is a "part," and as such taxable at 5 per cent, is being made by the National Automobile Dealers' Association, through Harry G. Moock, business manager. In addition to a protest to Commissioner Roper, the association has asked the secretaries of 57 dealers' associations throughout the country, not only to wire protests on behalf of the organizations, but to have each individual member do so. The ruling is effective Feb. 25, although just announced.

The telegram of the N. A. D. A. to Roper follows:

"Treasury decision, Article 15, Regulation 47, classifying truck chassis as a part is contrary to all sales usages. Truck chassis is a sales unit, and is the basis of all truck sales regardless of the type or kind of body used. Therefore, classification as a part is not only an injustice, but greatly impedes truck sales and is a penalty on business. Revision of decision, therefore, should be made so that truck chassis when sold complete as a unit takes 3 per cent tax, which we believe was intended when the 1918 revenue bill was framed."

Here are the reasons Mr. Moock gives for the revision of the ruling:

"Dealers have been selling on the presumption that a chassis is a truck and, therefore, taxable at 3 per cent. Thus the ruling will cost the dealers thousands of dollars. The 1918 decisions of the revenue bill classified the chassis as the unit of sale. For three months the dealers have been parting with truck chassis with only a 3 per cent tax against them, as passed on by the manufacturer. It is very probable that the manufacturers, because of their contracts, will be able to collect the additional 2 per cent from their dealers, but the dealers, having completed the transaction with their customers, will be unable to collect the 2 per cent additional thus passed on."

A special war tax bulletin has been sent by the N. A. D. A. to its members, giving complete information on the decisions of the treasury department on the application of the new tax. One of the radical changes is the ruling that whenever a manufacturer overpays the tax to the government in one month he may take a credit on his next monthly return instead of having to pay the full amount due for the month and applying for a refund for the amount erroneously paid the previous month.

—

Booth Making New Bumper

OWOSSO, MICH., May 19—W. S. Booth, formerly of the Field Mfg. Co. and Biggam Trailer Co., has organized a company and will begin the manufacture of an automobile bumper which he recently patented. He hopes to make 10,000 bumpers this summer. The A. E. Palmer & Sons Co. will make the bumpers for him until he gets his own plant running.

Why Secretary Houston Opposes a Federal Highway Commission at This Time

Creation of New Machinery Would Cause More Confusion Than It Would Do Good in the Present Situation, Is View of Cabinet Officer---Opposing View Held by A. A. A. Leader

WASHINGTON, May 19.—In a statement issued to-day Secretary of Agriculture Houston tells why he opposes at this time the creation of a Federal Highway Commission. He believes that the injecting of new machinery into the highway situation at this time would cause confusion that would result in much harm. At present, the Secretary says, the Federal and state organizations are being dovetailed into an organization that will work out the best solution of the present problems. The statement says:

"Before expressing my views and my opinion as to whether it would be wise to take the Federal supervision of highways from the Department of Agriculture and place it under a Federal Highway Commission, it might be well for me to point out certain fundamental considerations which should be borne in mind when determining any sound policy of highway administration and development:

Five Fundamental Considerations

"(1) The roads in each section of the country are of varying degrees of importance in the service which they render or may render to the particular locality, to the State and to the nation as a whole.

"(2) This is a big country and the traffic conditions and needs vary greatly from section to section.

"(3) The State Highway Departments, being in immediate touch with local conditions, are best able to classify the roads properly on the basis of the economic purposes which they may serve.

"(4) The Federal government, under the present Bankhead Federal Aid Road Act, is co-operating in the improvement of the roads of greatest importance, the classification of which is fixed by the State Highway Department.

"(5) When this classification has been carefully made and by agreement between the highway departments of adjoining states, the roads of first importance generally meet at state boundaries, and therefore, become interstate highways of nation-wide utility. The Federal government, under the present law, is aiding the State Highway Departments in the classification of their roads on the basis of importance and needs, and Federal aid is rapidly being extended for their improvement."

The machinery provided by the Bankhead bills insures sufficient effective control of highway construction, stated Secretary Houston, and the Federal Bureau of Public Roads is already one of the largest and most effective organizations of its kind in the world and when co-operating with the forty-eight State Highway Departments is thoroughly capable of serving the public interest and there is no need for additional machinery. Each state, he said, has accepted the Federal aid act and is already co-operating with the Department of Agriculture, having appropriated large sums, passed laws and regulations which could not easily be changed, and perhaps would not be, to conform with the Federal Highway Commission plans and instead of asking for more or different legislation, he urges to proceed actively and vigorously with the construction of roads under existing arrangements.

"I have been unable to see the need for the creation of a separate Federal Highway Commission or the wisdom of substituting for the present co-operative program," said Secretary Houston, "a plan which would commit or limit the Federal government to the construction of two Federally owned and maintained trunk lines in each state of the Union. There was a bill introduced in the Senate of the United States on Feb. 13, 1919, embodying these suggestions. This proposed legislation provides for a Federal Highway Commission of five, each receiving a salary of $10,000 a year, whose duty, among other things, would be to establish, construct, and maintain a system of highways 'to comprise not less than two main trunk line roads in each state, and joining the National Highway System in the adjacent states and countries.' The Commission is given the power to select the trunk line roads to be constructed after having requested the State Highway Departments to recommend routes. The Federal Government is to assume the maintenance of these roads. The Commission is furthermore empowered to take over the work of all existing Federal agencies relating to highway transportation and '*to purchase, lease, rent, operate, and maintain such motor and other transportation facilities as it may deem necessary in performance of its duties under this Act.*'

"In July, 1916, the Bankhead Road Act was passed. It provided appropriations out of the Federal Treasury, to be matched by equal sums from the States, for the construction of roads, and provided further that no State should receive any of the money appropriated unless it had a highway department with adequate powers. The law placed the administration of the Act in the hands of the Secretary of Agriculture, in co-operation with the 48 State highway departments. It was enacted only a short time before we entered the European war and its operation was necessarily greatly interfered with by the disturbed conditions. There were also certain features of the law that made its smooth administration difficult. After the cessation of hostilities, with the approval of the President, I requested Congress to make a large additional appropriation to aid the States in highway construction and also to make certain amendments to the law, the necessity for which experience had demonstrated. Congress, through the Bankhead amendment to the Post Office Appropriation Bill, provided an additional appropriation of $209,000,000 and substantially made the amendments suggested.

No Limitation for State Roads

"Under existing legislation, there is no special obstacle, so far as I can see, to the construction, in the different States of the Union, of those roads which serve the greatest economic needs. In the first place, the definition of the kind of roads that can be constructed has been greatly broadened and, in the second place, the limitation on the Federal contribution for any one road has been increased from $10,000 to $20,000 a mile. Following this legislation, the regulations governing the administration of the Act and the standards for plans, specifications, and estimates have been modified and one of the most successful former State highway engineers in the country has been placed in immediate charge of the Federal Aid Road work.

"He has at his disposal a considerable staff of local and district engineer aids and no pains will be spared to provide any further Federal assistance that may be needed. The machinery provided by the Bankhead amendment includes not only the Federal Bureau of Public Roads, one of the largest and most effective organizations of its kind in the world, but also the 48 State highway departments, the two agencies working in close co-operation. It is also a part of the plan to have an advisory committee, composed of representatives of the State Highway Departments, selected by the American Association of State Highway Officials with due regard to geographic considerations, to work in intimate touch with the Federal Bureau, meeting with its officers at stated periods

and at such other times as may be necessary. This machinery, in effect, is an expert national commission intimately in touch through its various parts with all sections of the Union, having no other purpose than that of serving the public interest. It is difficult to see what need there can be for additional machinery.

"Very properly the Bankhead Act places on the highway authorities of the several States responsibility, in large measure, for selecting the roads to be constructed. Obviously, the local authorities are in a better position to judge what roads would serve the largest economic needs than any group of men sitting in Washington would be. It is the duty of the Federal Bureau, with its district engineers, to see that the provisions of the law are complied with. It is giving, and will continue to give, all possible assistance to the State authorities in all their technical problems, as well as in the planning of State systems and in the classification of roads. It has been the policy of the Department from the outset, in order to prevent haphazard action, to have the State highway authorities prepare and present tentative State systems of roads.

Rigid System Inadvisable

"It was apparent that a rigid system, not subject to modifications as conditions might require, would be inadvisable. Each State authority has worked out a system and, in general, it is being followed in the development of projects and the construction of roads. In a number of instances systems in general terms have been adopted by State legislatures. Of course, in formulating these systems, the engineers gave due regard to interstate connections, that is, to roads connecting the system of one State with that of another, and it is difficult to see why, as progress is made, the construction of through roads will not follow as a matter of course.

"It seems scarcely likely, in view of the fact that nearly $300,000,000 is now available out of the Federal Treasury, that the Congress, in the light of the financial situation, will make additional large appropriations; and it would be impossible, without creating many complications, to divert the existing appropriations from the purposes and plans already under way under the co-operative arrangements with the States. A considerable part of the available appropriations has already been formally tied up under agreements with State departments and contracts for large sums have been let. Additional large amounts are being pledged monthly. Every State has accepted the Federal Act and many of them have by law directed its agencies to co-operate with the Secretary of Agriculture.

"A number of the States have large sums available for co-operation, in many instances much in excess of what is necessary to meet the requirements of the Federal Act, and other States are preparing greatly to increase their appropriations. These State laws and arrangements cannot easily be changed and perhaps would not be. After the original act was passed, more than a year elapsed before many of the States were able to secure legislative action which would enable them to comply with the Federal law and to begin the construction of roads. With the passage of the amendment carrying a large additional appropriation, there arose a necessity for further legislative action in some of the States. It seems to me that, instead of asking for more or different legislation, we should now proceed actively and vigorously with the construction of roads under existing arrangements.

No Gain by Change

"I am convinced that nothing material would be gained by the proposed change. Much would be lost. As has been pointed out, many complications would be introduced. The creation of a Commission would entail unnecessary additional administrative expenditures and the Commission could not do anything that cannot now be done more effectively by the existing co-operative machinery. There would also be a radical change of policy. I do not think that the people of the States will be willing to substitute for the present policy of developing roads on the principle of serving the largest economic purposes that policy advocated by those whose interest is in two main or trunk line automobile roads in each State, nor do I think that they would be willing, even if it were legal or practicable, to have existing funds diverted from the present or contemplated projects, worked out with the aid of the State highway departments, solely to the construction of such roads.

"By far the largest service will be rendered, not only to farmers, but, in the long run, also to urban people, by following the principle of constructing roads of the greatest economic importance, selected after careful consideration by the State agencies having adequate knowledge and approved by the Federal Department. It seems to me clear also that, as the work proceeds, we shall have roads which will be equally serviceable not only to those interested immediately in long distance automobile travel and motor truck transportation, but also to those interested in getting their farm produce to the market in the easiest and the most effective manner and in the transportation of the mails. I have no prejudice against any sort of road except a bad road, or against any sort of construction except wasteful and unsubstantial construction. If traffic conditions require heavy construction, then I am in favor of it; and in any case, under the law, the construction must be substantial.

"The road construction movement is growing very rapidly. The Federal Aid Road Act has done much to promote it. It has stimulated financial aid and has caused many State legislatures to create central highway departments. Experience has brought about amendments to the law and helpful changes in administration. Comprehensive road programs have been inaugurated. They are being pushed vigorously. They will result, in a shorter time than most people imagine, not only in a network of good substantial roads in the various States of the Union, but also in the requisite interstate highways."

A. A. A. Leader Favors the Federal Commission

WASHINGTON, D. C., May 19—"That a commission, as contemplated by the Townsend-Bankhead bill, will be the method of administration adopted by Congress for building a National Highway System is indicated not only by public sentiment but by the weight of Government precedent," says Dr. H. M. Rowe, past president of the American Automobile Association and a member of the special committee of the A. A. A. Good Roads Board which will devote much time to Federal highway legislation.

"Highways should be considered in the same class of public activity as railways, waterways, merchant marine, the national banking system, and, in fact, any of the great distinctly national undertakings," continues Dr. Rowe. "It seems a self-evident proposition that the building of a national system of highways will form an enterprise of such magnitude and such complexity as to put it entirely beyond the sphere of a single bureau or other subdivision of an executive department and if, therefore, it be considered in the class of these greater national enterprises I have named, we should naturally expect to see the same kind of administrative machinery established for highways.

"By way of precedent, therefore, we may point out that the railroads while under government control are managed by a director-general who is not subject to the control of any Cabinet officer and that in the absence of government operation of railroads the Interstate Commerce Commission functions independently of executive departments. When we turn to the great shipbuilding and merchant marine industry, we find these are managed by the Shipping Board and the Emergency Fleet Corporation, both functioning apart from executive departments.

"There is no existing executive department which could legitimately take over the entire task of building a National Highway System. It might be contended that the Department of Agriculture should do the job because of the agricultual interests affected by highways, but immediately the counter-contention might be made that the War Department should build the system because of the military and national defense needs of the nation. The Post Office Department might very logically claim that its rural delivery and parcel post service should entitle it to control.

"The Department of the Interior, being almost entirely a public works department, might contend that a constructive engineering task should fall in its domain.

"As an outcome of these various contentions must come the realization that highways are of such an all-embracing and of such general importance as to make it impracticable to entrust the task as a minor undertaking to any single government department. A commission would consider the needs of all of the departments.

Indianapolis Picking Up on Production

INDIANAPOLIS, May 20—Local car production is on the increase, with the demand well exceeding the supply. The combined output at present is about 80 cars a day, with prospects of a considerable increase.

Pre-war production is being exceeded. The Nordyke & Marmon Co. has reached 18 cars per day, six more than its pre-war output. Its manufacturing facilities will be increased considerably when the new Liberty engine plant is devoted exclusively to passenger cars. Cole is running approximately 25 cars daily and plans to produce 5000 cars this year. Premier at present is turning out 10 cars daily. Its production has been delayed by material difficulties which are now understood to be overcome. Daily production at present is as follows: Cole, 25; Marmon, 18; National, 15; Stutz, 12; Premier, 10.

Studebaker Additions

SOUTH BEND, IND., May 20—Additions to the plant of the Studebaker Corp. in this city will occupy 61 acres of ground when completed and will contain between 3,000,000 and 4,000,000 sq. ft. of floor space. Twelve thousand employees will be required to operate the new plant. The capacity of the establishment will be 500 cars a day.

The power house will supply 8000 horsepower. The machine shop will be a one-story saw-tooth roof building 475 by 1125 ft. The large sub-assembly and stock building will also contain the administrative offices of the production department, besides toolrooms and the machinery maintenance department. This building is to be 192 by 1057 ft. Plans provide for a foundry, press steel stamping plant, treating and carbonizing plant, closed body plant, and the final assembly building.

American Auto Body Pays First Dividend

MILWAUKEE, WIS., May 20—A first dividend of 15 per cent has been paid to creditors of the American Auto Body Co., North Milwaukee, recently declared bankrupt. The assets were sold to E. J. Patterson for $7,750.

Officers of Franco-American Engineering Co.

DETROIT, May 17—The officers of the Franco-American Engineering Co. besides Georges Lepere, who is president, are: Vice-president and secretary, Herbert Hughes, and treasurer, S. L. De Pue.

Industry in Cleveland Increasing Forces

Employment Service Finds Most Other Lines Have Declined 30,000 Seeking Jobs

CLEVELAND, May 20—The United States Employment Service has obtained figures from 170 Cleveland manufacturers, which reveal that there are about 20,000 fewer workmen employed in Cleveland at present than the last day before the armistice was signed. In all plants from which returns were received 77,659 persons were employed. A few industries, notably the automotive industries, report more men employed now than ever before, but this increase is more than balanced by declines in other industries.

Estimate 30,000 Unemployed

The employment service estimates that the present unemployment in the city is 30,000, which includes about 6000 building trades workers. A figure of 30,000 is about 50 per cent more than what might be called normal unemployment. Data from the 170 plants showed 77,659 men at work May 5, against 100,193 at work in 155 plants early in November.

The plants were selected as a cross-section of industry as a whole, and include a few concerns which had been working almost entirely on war work. All the large Cleveland factories are included. The average number employed in each factory is placed at 457 men. The data are to be collected every week and will be forwarded to Washington. From it and similar data collected in every employment field the government expects to have before it an exact barometer of industrial conditions.

Automotive Plants Increase Employees

The Cleveland figures bring out the curious fact that the decline in numbers employed was only 12 per cent in the 35 largest factories in their lines, while the whole decline in numbers employed in the 170 factories is about 28 per cent.

The five largest Cleveland automotive plants were employing 9535 men in November. Last week they had 9,908 on their pay-rolls. Plants depending largely on the automobile parts business were employing nearly the same numbers. This also was true of railroad shops, although the men are working shorter hours.

Steel mills are operating only part time in some instances, and one or two small mills are shut down. Practically all the men are at work, however, although at shorter hours than before and sometimes only part time. The efforts of some of the companies to Americanize their plants has resulted in the wholesale discharge of unnaturalized foreigners, and these constitute a large part of the unemployed. In some plants, employees who stayed away from work to celebrate May day were discharged.

Whatever the employment situation may be, it is apparent that the returning soldiers and sailors are taken care of. The Y. M. C. A. has ten jobs for every soldier or sailor appearing at its employment office. These are mostly shop jobs and in most cases are open only to returned service men. Six of the largest factories have 1000 jobs open to such men. The revival of navigation is giving hundreds of ex-navy men jobs. The big marine companies are giving former navy men preference, because they are naturally better adapted to lake work than any other class of labor.

Working Conditions Service Created

WASHINGTON, May 16—The Department of Labor has organized a Working Conditions Service, including departments on industrial hygiene, research, education, standardization, safety engineering and general employment problems. The service will attempt to prevent sickness, accidents and labor disturbances and is developing a national information center on health, safety and labor in Washington. This information as gathered will be available to all industries.

Specialists will be sent upon request to various concerns requiring examination of the working conditions of plants. The industrial safety program will make examinations into engineering defects, unavoidable trade risks and those accidents caused by the human element. The employment division is collecting data on the source of labor supply, the organization of a centralized employment department, methods of employment, shop analysis, methods of "breaking in" men, promotion and transfer, turnover, absenteeism, restaurants and lunchrooms, housing, recreation, insurance and pensions.

Tractor Sales Climbing

DETROIT, May 19—Tractor sales are climbing rapidly, according to C. E. Sorensen, general manager of Henry Ford & Son, at Dearborn, Mich. Mr. Sorensen reports splendid sales from Iowa, Nebraska, Kansas and throughout the entire wheat district; also a gaining tractor market in Texas.

Tractor sales have been distributed throughout all the season due to the unusual winter conditions. In Iowa farmers were plowing practically all winter. One retarding feature of tractor sales is the inability of farmers to secure good prices for their horses. The customary reason a farmer gives for delaying purchasing a tractor is that he cannot get enough money for his horses.

State Roads to Aid Federal Highways

WASHINGTON, May 19—A committee of state highway officials have been appointed to co-operate with the Federal bureau of public roads to carry out the provisions of the Federal Aid Road Act. A. R. Hirst, president of the American

Association of State Highway Officials, has selected the following members for the committee: George P. Coleman, state highway commissioner of Virginia; S. E. Bradt, state superintendent of highways of Illinois; Charles J. Bennett, state highway commissioner of Connecticut; W. S. Keller, state highway engineer of Alabama, and Ira R. Browning, state road engineer of Utah.

It also was announced that the Secretary of Agriculture up to May 1 had approved 1057 project statements for Federal aid roads, involving the improvement of 10,580 miles of highways at an estimated cost of $92,933,000.

—

Dealers' Association Adds Commercial Division

ST. LOUIS, May 19—A commercial division of the National Automobile Dealers' Association has been formed to handle all problems that arise solely in the truck sales field. H. N. Cartinour of the Cartinour-Bowman Co., Indianapolis, is commissioner of the new division.

—

Import Restrictions Send English Car Prices Up

LONDON, ENGLAND, May 1—The direct result of the exclusion of automobile importation continues to make itself felt in the increasing price of cars. Thus the new Austin 20, which was listed at $2,000, was recently increased to $2,500. A few other examples of how prices are going up are: 12-hp. Rover, which before the war was very popular and listed at $1,750, is now selling without a single alteration at $3,500. The 11-hp. Arrol Johnston, which previous to the war sold at $1,875, is now listed at $3,500.

—

National Highway Industries Assn. Commended by M. A. M. A.

WASHINGTON, May 16—The Highway Industries Association has received a special communication from the Motor and Accessory Manufacturers' Association commending it and approving its work on the plan for a Federal Highway Council.

—

Additional Road Construction Planned

WASHINGTON, May 16—The U. S. Forest Service plans to construct 1643 miles of roads during 1919 at an expenditure of $12,000,000.

—

Bond Issues for Road Construction

WASHINGTON, May 17—Bond issues planned or approved in 26 states for highway construction total $823,300,000. Of this, $177,800,000 have already been authorized in 7 states, $411,500,000 have been referred by legislatures in 12 states to the vote of the people, $135,000,000 are being considered in four states, and three states have voted against measures totaling $85,000,000. The issues ratified include Oregon, $10,000,000; Nevada, $1,000,000; Utah, $4,000,000; Wyoming, $2,800,000; Michigan, $50,000,000; Illinois, $60,000,000, and Pennsylvania, $50,000,000.

Bond issues which will be considered shortly include Alabama, $25,000,000; Georgia, $60,000,000; Florida, $10,000,000, and Virginia, $50,000,000. People will vote on highway bond issues in the following states: California, $40,000,000; Washington, $30,000,000; Oregon, $2,500,000; Idaho, $2,000,000; Colorado, $5,000,000; New Mexico, $2,000,000; Oklahoma, $50,000,000; Texas, $75,000,000; Minnesota, $75,000,000; West Virginia, $40,000,000; Missouri, $60,000,000; Maine, $10,000,000, and New York, $20,000,000.

United States Exports of Cars, Trucks and Parts, by Countries, During March, 1919

Countries	Commercial Number	Commercial Value	Passenger Number	Passenger Value	Parts Value
Belgium	1	$1,685	5	$4,060	$22,852
Denmark	27	27,125	15	30,184	7,332
France	166	764,125	73	170,893	131,809
Greece	1	972	10	12,798	4,737
Iceland and Faroe Islands	...	......	2	1,271	988
Italy	...	......	...	......	10,798
Netherland	...	......	...	......	7,435
Norway	37	92,526	21	50,383	37,398
Portugal	...	......	1	1,600	......
Serbia, Montenegro, etc.	1	3,000	...	......	......
Spain	10	13,520	62	94,053	21,528
Sweden	...	......	72	109,900	1,929
Turkey in Europe	...	......	1	4,000	365
England	11	21,347	35	43,835	338,956
Scotland	...	......	...	......	1,002
British Honduras	...	......	3	2,627	441
Canada	401	1,352,690	405	430,102	672,482
Costa Rica	...	......	...	......	24
Guatemala	...	......	...	......	1,091
Honduras	...	......	...	......	827
Nicaragua	4	4,511	9	5,619	2,069
Panama	1	6,000	17	13,859	6,030
Salvador	...	......	3	5,484	3,486
Mexico	29	65,166	199	178,922	55,167
Newfoundland and Labrador	...	......	3	2,800	2,165
Barbados	3	2,856	...	......	2,305
Jamaica	3	1,650	8	7,011	6,852
Trinidad and Tobago	...	......	1	875	2,043
Other British West Indies	6	3,600	2	1,040	2,113
Cuba	61	103,121	151	171,431	124,259
Virgin Islands of U. S.	...	......	4	1,940	331
Dutch West Indies	...	......	...	......	726
French West Indies	6	6,016	12	9,051	3,408
Haiti	...	......	...	......	1,809
Dominican Republic	7	5,800	30	15,831	6,973
Argentina	7	9,675	206	223,005	209,368
Bolivia	...	......	...	......	2,969
Brazil	17	9,370	93	90,692	53,819
Chile	44	43,395	116	109,289	75,239
Colombia	3	2,840	26	19,235	4,489
Ecuador	...	......	...	......	609
British Guiana	2	1,901	2	2,500	5,039
Dutch Guiana	...	......	...	......	1,249
French Guiana	...	......	...	......	18
Peru	...	......	14	20,880	8,716
Uruguay	12	12,000	139	149,495	55,502
Venezuela	7	4,000	22	15,263	3,578
China	67	112,995	127	185,678	28,838
Japanese China	3	5,000	7	8,486	836
Chosen	...	......	4	3,403	......
British India	...	......	39	42,329	20,840
Straits Settlements	21	49,339	62	77,197	20,790
Other British East Indies	...	......	...	......	119
Dutch East Indies	44	82,753	158	282,380	99,204
French East Indies	6	3,430	12	9,040	470
Hongkong	...	......	24	27,441	8,437
Japan	137	193,602	670	816,864	150,615
Russia in Asia	...	......	3	1,900	214
Siam	3	1,613	13	13,038	559
Turkey in Asia	...	......	...	......	2,489
Australia	40	53,822	212	242,047	148,956
New Zealand	6	19,377	65	84,550	10,306
Other British Oceania	1	835	4	3,091	798
French Oceania	...	......	...	......	1,118
German Oceania	...	......	...	......	698
Philippine Islands	12	22,283	156	223,288	29,420
British West Africa	6	7,692	29	27,718	21,482
British South Africa	3	6,142	93	109,683	74,989
British East Africa	...	......	1	2,091	1,898
Canary Islands	...	......	...	......	20
French Africa	7	6,710	10	4,932	2,199
Morocco	...	......	2	3,100	......
Total	1,223	$3,124,484	3,443	$4,168,184	$2,527,620
Alaska	3	$1,479	3	$3,397	$2,041
Hawaii	44	36,222	129	93,965	37,900
Porto Rico	13	39,582	49	47,001	41,791

This table supplements the one which appeared in the May 8 issue of AUTOMOTIVE INDUSTRIES, *and gives figures for all the individual countries, including those generally grouped under the collective heading of "Other Countries."*

Great Britain Removes More Import Restrictions

WASHINGTON, May 19—Pressure regulators, lubricators, grease cups, pump and engine governors, pressure and vacuum gages, copper wire, drop-forged steel and oil cans may now be imported into Great Britain without individual licenses, according to an announcement made by the War Trade Board, as all restrictions on these imports have been removed.

—

Oil Restrictions Removed

WASHINGTON, May 19—All rules and regulations governing the production, manufacture, distribution or trans-

portation of oil in its various forms, including gasoline, and of natural gas were removed yesterday by an order of Fuel Administrator Garfield, which follows:

"The fuel administrator hereby orders and directs that all rules, regulations or orders heretofore issued or promulgated by or under authority of said United States fuel administrator governing licenses engaged in the business of importing, manufacturing, distributing and transporting crude oil, fuel oil, gas oil, kerosene, gasoline and natural gas or regulating the production, sale, distribution or use thereof and all amendments and modifications of said rules and regulations and orders be, and the same hereby are, vacated and set aside as of May 15, 1919."

—

Exports of Automobile Tires from United States for March, 1919

Countries	Value
Belgium	$29,016
Denmark	44,468
France	64,993
Greece	605
Iceland and Faroe Islands	2,530
Italy	......
Malta, Gozo, and Cyprus Islands	......
Norway	91,582
Portugal	......
Russia in Europe	......
Spain	95,193
Sweden	8,625
Switzerland	......
England	104,268
Bermuda	159
British Honduras	202
Canada	116,748
Costa Rica	2,614
Guatemala	2,434
Honduras	469
Nicaragua	910
Panama	20,999
Salvador	3,191
Mexico	55,511
Miquelon, Langley, etc.	......
Newfoundland and Labrador	407
Barbadoes	2,286
Jamaica	22,747
Trinidad and Tobago	1,000
Other British West Indies	1,907
Cuba	233,855
Danish West Indies	291
Dutch West Indies	1,009
French West Indies	14,415
Haiti	217
Dominican Republic	4,646
Argentina	123,263
Bolivia	283
Brazil	82,106
Chile	45,498
Colombia	7,264
Ecuador	2,239
British Guiana	19,261
Dutch Guiana	125
French Guiana	.....
Paraguay	1,982
Peru	6,735
Uruguay	11,932
Venezuela	22,796
China	37,549
Japanese China	......
Chosen	2,051
British India	3,366
Straits Settlements	4,070
Dutch East Indies	218,324
French East Indies	......
Hongkong	3,473
Japan	145,269
Russia in Asia	......
Siam	400
Australia	33,548
New Zealand	13,452
Other British Oceania	344
French Oceania	3,089
German Oceania	976
Philippine Islands	94,770
Belgian Kongo	......
British West Africa	39,311
British South Africa	36,618
British East Africa	500
French Africa	2,839
Liberia	......
Morocco	......
Portuguese Africa	......
Egypt	490
Total	$1,891,220

Government Vehicles for Public Sale

After Disposal to Government Departments About 1000 Expected to Be Left for Public

WASHINGTON, May 20—The major portion of all surplus motor trucks and cars purchased by the army will be transferred to the various Government departments. A comparatively small supply of used passenger and commercial cars of miscellaneous makes, not adapted for governmental use, will be sold at public auctions held at various military posts and camps beginning June 1.

More than 10,000 trucks, cars, ambulances and motorcycles have already been transferred by the War Department to other Government bureaus. Deliveries have been made to the Post Office Department and the Public Health Service. Of these trucks 5565 have been turned over to the Department of Agriculture and within a few days shipments of this equipment will be made by the Motor Transport Corps to Road Commissioners of the states to which allotments have been made by the Bureau of Public Roads of the Department of Agriculture.

As fast as the several states place the present consignments in operation, the Director of Sales will transfer additional trucks and road building machinery. The further needs of the Department of Agriculture, the Post Office Department and the other Government departments are expected to absorb practically the entire surplus of motor vehicles acquired for military purposes.

The motor equipment which is to be disposed of at public auction will be announced through advertisements in the press local to the communities in which the auctions will be held. The number which will be sold at auction will be very limited, and it is anticipated will number 1000. Detailed figures are not now available as it is possible that the Government bureaus will absorb all of the surplus.

—

Aircraft for Forest Fires

WASHINGTON, May 20—Two routes have been established for airplane patrols for discovery of forest fires. These start and end at the March Field, 12 miles southeast of Riverside, Cal. Fires discovered will be reported by parachute messages, by special landings or by return to the base. The service will start on June 1.

—

Four Permanent French Air Mail Routes

PARIS, May 10—Four aerial mail routes are about to be put on a permanent basis by the French Government. These are: Paris to Havre, Paris to Lille, Paris to London, and Paris to Brussels. Three of these lines are just ready for operation.

The Paris-Lille line has been taken over by the Breguet Co. and the Paris-London line will probably be given to a Franco-British concern. These aerial lines will not be operated direct by the French Government, but in each case by a contracting company.

In addition to the above, it is proposed to establish an aerial mail route from Paris to Nice. This will be run in two stages: the first from Paris to Lyons with stopping stations at Auxerre and Dijon, and a second stage from Lyons to Nice.

—

Moore to Double Output

DANVILLE, ILL., May 20—The Moore Motor Vehicle Co. will double its working force during June. It is claimed that by June 25 the output of the plant will reach 125 cars a day. At present the output is 62 daily.

—

Export of Tractor Engines During March, 1919

Countries	Number	Value
Denmark	30	$29,781
France	214	304,862
Greece	8	12,200
Norway	8	4,906
England	148	108,745
Iceland	38	42,104
Canada	271	239,126
Honduras	2	1,820
Mexico	14	12,902
Cuba	1	1,189
Haiti	1	1,075
Dominican Republic	8	829
Argentina	52	41,698
Brazil	23	19,983
Chile	9	16,374
British Guiana	3	825
Peru	5	6,648
British India	3	2,359
Japan	1	1,108
Siam	3	8,047
Australia	26	29,316
New Zealand	1	873
Philippine Islands	28	50,281
British South Africa	15	11,924
French Africa	31	45,762
Total	943	$994,737

—

Bureau of Enemy Trade Takes Over War Intelligence

WASHINGTON, May 20—The Bureau of War Trade Intelligence has been merged with the Bureau of Enemy Trade, and such work of the Bureau of War Trade Intelligence as is still being carried on will be conducted by the Bureau of Enemy Trade.

—

Markets for Motorcycles and Cars

WASHINGTON, May 19—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has received information that there are excellent markets for American motorcycles and automobiles at Antwerp, Holland, and for small and medium sizes of tractors in South Africa. There is a market for power shearers in South Africa. If manufacturers will send literature on tractors to Commercial Agent R. A. Lundquist, Durban, Natal, South Africa, he will distribute them.

Men of the Industry

Changes in Personnel and Position

Stratford Goes West to Associated Oil Co.

NEW YORK, May 16—C. W. Stratford, lubricating oil engineer of New York, has been appointed general consultant of the Associated Oil Co., San Francisco, and has left for his new position. The Associated Oil Co. heretofore has confined its work to topping only in the oil industry, but is now taking up the manufacture of lubricating oils. It is in connection with this work that Mr. Stratford has been engaged. He was formerly connected with the Tidewater Oil Co. and recently has been organizing an oil-testing laboratory at the Bureau of Standards in Washington.

—

W. K. Swigert, who has been superintendent of the Liberty airplane engine division of the Nordyke & Marmon Co., Indianapolis, since its inception a year and a half ago, will, after June 1, be in charge of development work of the Dort Motor Co., Flint.

—

A. W. Frehse has been appointed sales engineer of the wheel division of the Detroit Pressed Steel Co. Formerly he was in charge of design under the chief engineer of the Thomas B. Jeffery Co. Later he was assistant chief engineer of the Jordan Motor Car Co. He has recently been in Government service as consulting engineer.

—

S. H. Houser, formerly sales manager of the Standley Skid Chain Co., Boone, Ia., has joined the sales force of the Gray-Heath Co., Chicago.

—

Earl B. Wilson has been appointed director of sales of the Buick Motor Co. factory at Flint. Previously to that he was in charge of the Buick Chicago branch, and later was transferred to the Memphis branch. More recently he was manager of the Philadelphia branch of the Buick company.

—

A. E. Mason, who has been connected with the Chalmers Motor Co. as superintendent of sales in Wyoming and Colorado territory, is now connected with the Western Motor Car Co., Omaha, Neb.

—

C. V. Lyons has been appointed eastern sales manager of the Nelson Truck Co., Saginaw, Mich. He will have charge of the distribution of the John Simmons Co., New York City.

—

Williams Beckman has resigned as experimental engineer with the Duesenberg Motors Corp., Elizabeth, N. J., to become engineer and eastern representative for the Beckman Metal Products Co., Cleveland.

—

R. H. Welles, former general manager of the Badger Brass Co., Kenosha, Wis., will be representative of Charles S. Monson, Detroit, and will have his office in Chicago.

Cadillac Sales Manager Resigns

DETROIT, May 20—S. C. Howard, sales manager of the Cadillac Motor Car Co., has resigned to take effect June 16. He will stay in the automotive business, but says he hopes to work for himself. It is rumored that he will be associated with D. McCall White in a new venture.

Mr. Howard joined the Cadillac company in 1909, coming from the National Cash Register Co., Dayton. In 1910 he was made assistant sales manager and in 1912 was promoted to sales manager.

—

Blaine McGrath, former advertising manager of the Republic Motor Truck Co., has entered the sales department of the company. He has established headquarters at Birmingham and will cover Alabama and parts of Mississippi, Texas and Florida.

—

Calvert Townley, assistant to the president of the Westinghouse Electric & Mfg. Co., was elected president of the American Institute of Electrical Engineers at the annual business meeting of the Institute held Friday.

—

Major B. Hawxhurst, formerly representative of the Westinghouse Co. in Detroit, is now president and general manager of the Automotive Products Co. of Detroit and Chicago.

—

F. W. Ramey, recently released as a lieutenant from military service, has been placed in charge of sales at the Cotta Transmission Co., Rockford, Ill.

—

Karl A. Eichhorn, formerly of the Packard Motor Car Co., is manager of the new offices opened in Detroit by James Barr & Co., public accountants, New York City.

—

Edwin A. Godley, formerly connected with the eastern division of the Overland Motor Car Co. and with the Olds Motor Works, has been made general office manager of the Republic Motor Truck Co., Inc., Alma, Mich.

—

Frederick A. Crooks has been elected president of the Biddle Motor Sales Corp. Associated with him is W. H. Howill.

—

C. C. Thomas, sales engineer for the Denby Motor Truck C., Detroit, has resigned and joined the force of the Field Mfg. Co., Owosso, Mich.

—

J. C. Barlow, founder and chief stockholder of the Streator Motor Car Co., Streator, Ill., is dead.

Homer Ferguson Heads U. S. Commerce Chamber

WASHINGTON, May 16—Homer L. Ferguson, of Newport News, Va., president and general manager of the Newport News Shipbuilding & Dry Dock Co., has been elected president of the Chamber of Commerce of the United States. This annoucement was made yesterday at the offices of the chamber here as the result of a mail vote of the organization's board of directors.

Mr. Ferguson succeeds Harry A. Wheeler of Chicago as president. Mr. Wheeler declined re-election after serving two separate terms. Mr. Ferguson was nominated immediately after the the chamber concluded its annual meeting at St. Louis this month, and was unopposed.

Other officers elected by the board were: Vice-president, Eastern district, A. C. Bedford, New York; North central district, Joseph H. De Frees, Chicago; South central district, Thomas F. Gailor, bishop of Tennessee, and Western district to be filled later. Honorary vice-presidents are Harry A. Wheeler, Chicago; John H. Fahey, Boston; A. B. Farquhar, York, Pa.; Charles Nagel, St. Louis, and R. G. Rhett, Charleston, S. C. The executive committee is composed of: Joseph H. De Frees, chairman; Max W. Babb, Milwaukee; A. C. Bedford, W. L. Clause, Pittsburgh; L. S. Gillette, Minneapolis; P. H. Gadsden, Charleston, S. C.; Frederick J. Koster, San Francisco; James R. MacColl, Pawtucket, R. I.; Charles A. Otis, Cleveland; Lewis E. Pierson, New York, and M. J. Saunders, New Orleans.

—

Ungar Vice-President of F. R. Blair & Co., Inc.

NEW YORK, May 19—G. A. Ungar, who for several years has been engineering and technical director of the SKF Ball Bearing Co., has resigned to become vice-president of F. R. Blair & Co., Inc., of which company he has been a director since its organization. It was incorrectly reported in the May 8 issue of AUTOMOTIVE INDUSTRIES that Mr. Ungar would become vice-president of the SKF company. In his new position Mr. Ungar will have charge of the sale of Flexite specialties, of several of which he is the patentee.

—

Wichita Now Mid-West Tractor

WICHITA, KAN., May 19—The Wichita Tractor Co. has changed the name of its tractor from Wichita to Mid-West, but has made no change in its firm name.

—

Brotherton-Brown New Advertising Concern

Cliff Knoble, formerly advertising manager of the Liberty Motor Car Co., and Norton Brotherton, formerly of Seelye - Brotherton - Brown, advertising agents, have formed a new agency known as the Brotherton-Brown Co., with offices in Detroit.

Jordan Increasing Facilities 150 Per Cent

CLEVELAND, May 15—The Jordan Motor Car Co. is putting up additional buildings costing $175,000, designed to increase capacity 150 per cent. Five units are to be constructed, with other necessary accessories. There will be a new 2-story office building, 250 x 100 ft.; an assembly room, 100 x 300 ft.; power plant, 40 x 60 ft.; a japanning building, 50 x 100 ft., and a motor testing building, 30 x 90 ft. The present main building will be completely remodeled. There will also be built additional railroad sidings and a concrete loading platform, 600 ft. long. Work is scheduled to start immediately.

Liberty Building New Factory

DETROIT, May 19—The Liberty Motor Car Co. will have a new factory adjacent to the Hudson Motor Car Co., the Continental Motors Co., Wadsworth Mfg. Co., Maxwell-Chalmers and a number of other automotive plants. With the new factory the company hopes to double its present production. Its present plant, the old R. C. H. corporation group of buildings, is proving unequal to present manufacturing demands.

Perfection Heater Division of Standard Parts Sold

CLEVELAND, May 16—The Perfection Heater & Manufacturing Co. has acquired the entire organization of the Perfection heater division of the Standard Parts Co. The new company, which is capitalized for $300,000, has leased a building on Carnegie Avenue, near East Sixty-fifth Street, and increased production to 1000 heaters per day. W. A. C. Smith is president, and other officers are: Vice-president and general manager, C. S. Pelton, connected for seven years with the Perfection spring and the Perfection heater divisions of the Standard Parts Co.; secretary and treasurer, F. D. Kellogg. E. L. Jones, for a number of years with the Remy Electric Co. and the Standard Parts Co., will be special factory representative. L. H. Peck, formerly machine tool designer for the Foote-Burt Co. and recently released from aviation service, has charge of engineering and production.

Wheeler Radiator & Mfg. Co. Organized

CLEVELAND, May 19—The Wheeler Radiator & Mfg. Co., organized with an authorized capital of $2,000,000, will manufacture radiators for engines. W. H. Ritter is president, and will be in charge of sales and production. G. E. Wheeler, vice-president, will have charge of manufacture, and F. R. Kissling will be superintendent. The new firm is composed principally of members of English & Mersick Co., New Haven, Conn. A small factory will be erected on 1½ acres of ground on Collamer Avenue. New buildings planned will have 100,000 sq. ft. of manufacturing space.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

General Motors to Produce Half Million Vehicles Next Year

NEW YORK, May 16—The estimated output of motor vehicles of all classes by the General Motors Corp., from July 1, 1919, to June 30, 1920, is placed at 577,000. Of this total, passenger cars account for 512,000, trucks for 40,000 and tractors for 25,000. In addition, the corporation's output of farm implements is figured at 75,000. In its 41 plants General Motors employs 49,000 persons.

The General Motors company's total volume of sales for 1918, according to a booklet issued by the company, was $326,044,755, which was exceeded only by the U. S. Steel Corp., Swift & Co., Armour & Co., Bethlehem Steel Corp., Wilson & Co., and the du Pont company. Earnings on this volume, before taxes, amounted to $45,541,726. Net quick assets are shown as $150,390,492, of which more than $59,000,000 is in cash and Liberty Bonds.

Briscoe's New Car Ready

DETROIT, May 16—The new passenger car which Benjamin Briscoe and his assistant, Rodolphe Stahl, are designing for the Bellanger Freres Co., Paris, France, will be on the road in a few days. It is made entirely of American parts, most of which will be shipped to France if they cannot be manufactured at the plant of the French company.

Acason 1½-Ton Model

DETROIT, May 19—The Acason Motor Truck Co. has completed a 1½-ton model, thus completing the line from 1 to 10-ton capacities. The new model has a Waukesha engine, Timken worm drive axle, Blood Bros. universal joints, Detroit Steel Products springs, etc., and will be equipped with either 35 x 5 front and 38 x 7 rear pneumatic cord tires or 36 x 4 front and 36 x 6 rear solid tires. It will have left hand drive.

Michigan Crankshaft Improvements

LANSING, May 15—The General Motors Corp., which recently acquired the Michigan Crankshaft properties here, is equipping, enlarging and generally improving the new property. The old shops are being reroofed and painted. It is planned to triple the capacity of the former grinding plant by new equipment and enlarged floor space. A new administration building will be erected.

New Plant for Maibohm Motors

SANDUSKY, OHIO, May 20—The Maibohm Motors Co., moving here from Racine, Wis., where its plant was destroyed by fire, will occupy a new factory having 75,000 sq. ft. of floor space. The plant will be 620 x 120 ft., located on a 15-acre site. It will be of one story, sawtooth design and modern fireproof, day-light construction. It will have a capacity of 50 machines daily.

Packard Establishes Experimental Flying Field

DETROIT, May 17—The Packard Motor Car Co. has acquired a tract of land between this city and Mt. Clemens for use as a private experimental flying field in the development of its aviation program. The company will begin immediately to grade, tile and seed the new field and will erect buildings as they are needed. It should be ready for operation by midsummer.

Extra Charge for Canadian Ford Electrical Equipment

DETROIT, May 16—Canadian Ford touring cars and roadsters will be supplied with starting and lighting devices as optional equipment at an extra charge after June 1. All Canadian closed models now have the starters as part of standard equipment.

Blood & Co. to Handle Motor Exports

New YORK, May 19—W. D. Blood & Co., Inc., has recently been incorporated to handle American manufactures in foreign fields, especially automotive and hardware manufactures. W. D. Blood is president in charge of sales. He was manager of the export department of the Hendee Mfg. Co. for 7 years. John C. Gallagher is secretary and treasurer. He will be in charge of the main office at 44 Whitehall Street.

The company will have permanent representation in the South American countries. At the present time it is acting for the following concerns: Metz Corp., Waltham, Mass.; Corbin Screw Corp., New Britain, Conn.; Hawthorne Co., Bridgeport, Conn.; Witherbee Igniter Co., Springfield, Mass.; Witherbee Storage Battery Co., New York City; L. F. Benton Co., Vergennes, Vt.

Two Companies Bought by Bull Tractor-Madison Motors

ANDERSON, IND., May 19—The Bull Tractor-Madison Motors Corp. has acquired the factories and business of the Bull Tractor Co., Minneapolis, and the Madison Motor Car Co. The new company will manufacture the Bull tractor and the Madison motor car.

New Factory for Turnsted

DETROIT, May 16—Work is about completed on the new plant of the Turnsted Mfg. Co., a subsidiary of the Fisher Body Corp., and the company is preparing to move into its new quarters. The plant has a floor space of 100,000 sq. ft.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:
Muriatic, lb. .02 - .03
Phosphoric (85%), lb. .35 - .39
Sulphuric (60%), lb. .008

Aluminum:
Ingot, lb. .33
Sheets (18 gage or more), lb. .42

Antimony, lb. .07½

Burlap:
8 oz., yd. .08¾ - .09
10½ oz., yd. .10¾ - .11

Copper:
Elec., lb. .16⅜ - .16½
Lake, lb. .16¼ - .16½

Fabric, Tire (17¼ oz.):
Sea Is., combed, sq. yd. 1.40
Egypt, combed, sq. yd. 1.25
Egypt, carded, sq. yd. 1.20
Peelers, combed, sq. yd. 1.08
Peelers, carded, sq. yd. .85

Fibre (⅛ in. sheet base), lb. .50

Graphite:
Ceylon, lb. .09 - .22
Madagascar, lb. .10 - .15
Mexico, lb. .03¾

Lead, lb. .05 - .05½

Leather:
Hides, lb. .25 - .46

Nickel, lb. .40

Oil:
Petroleum (crude):
Kansas, bbl. 2.25
Pennsy., bbl. 4.00
Gasoline:
Auto, gal. .24½
68 to 70 gal. .30½
Lard:
Prime City, gal. 2.70
Ex. No. 1, gal. 1.15 - 1.20
Linseed, gal. 1.56
Menhaden (dark), gal. .75 - .80

Rubber:
Plantation:
First latex pale crepe, lb. .46
Brown crepe, thin, clear, lb. .41½ - .42
Smoked, ribbed sheets, lb. .45

Para:
Up River, fine, lb. .56¼
Up River, coarse, lb. .34½ - .34¾
Island, fine, lb. .47 - .47½

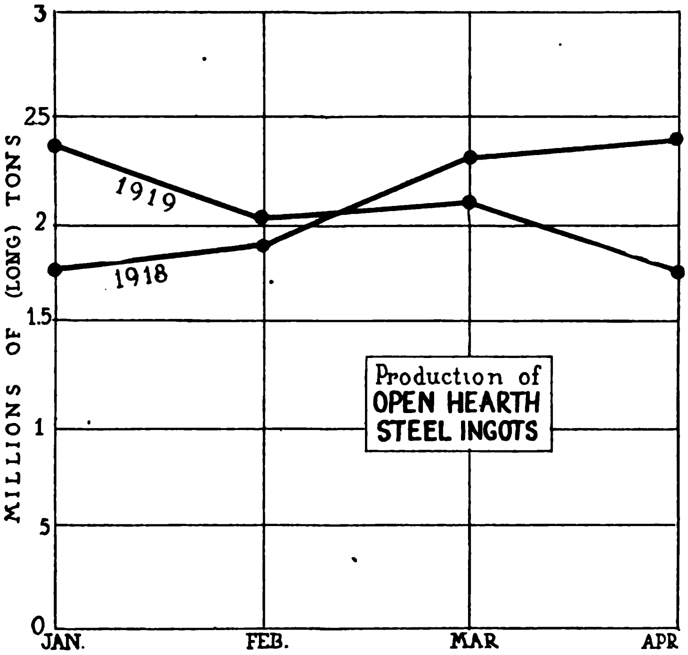
Shellac (orange), lb. .62 - .68

Spelter, lb. .06⅛ - .06¾

Steel:
Angle beams and channels, lb. .02½ - .03
Automobile sheet (see sp. table).
Cold rolled, lb. .04¼ - .04½
Hot rolled, lb. .03½ - .03¾

Tin .72½

Waste (cotton), lb. .12¾ - .17



The production of open-hearth steel ingots in the United States shows an appreciable falling off during April, 1919. Output for that month was 1,732,447 tons as against 2,377,974 tons in April, 1918

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lbs.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lbs.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lbs.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lbs.

Blank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.

Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close May 17

	Bid	Asked	Net Ch'ge
Auto Body Company	9	10	..
Briscoe Motor Car com	14	..	..
Briscoe Motor Car pfd	50	65	..
*Chandler Motor Car	155¼	157¼	+6¼
Chevrolet Motor Car	209	211	..
Cole Motor Car Co	120	125	..
Continental Motors com	8⅝	9	—⅜
Continental Motors pfd	96	99	..
Edmunds & Jones com	28	30	—1
Edmunds & Jones pfd	75	80	..
Electric Storage Bat	76	78	..
Federal Motor Truck	42	44	..
Fisher Body Co. com	73⅜	75⅜	+16⅜
Fisher Body Co. pfd	98	101	+6
Ford Motor of Canada	320	330	..
General Motors com	185	186	—3½
General Motors pfd	89¾	91¾	—2
Hupp Motor Car com	8¾	9¼	..
Hupp Motor Car pfd	98	101	..
Kelsey Wheel Co. com	35	37	..
Kelsey Wheel Co. pfd	93	95	..
Manhattan Electric S com	..	48	..
Maxwell Motor com	45⅜	46⅜	+3⅞
Maxwell Motor 1st pfd	71¼	72¼	+2¾
Maxwell Motor 2d pfd	33¼	34¼	+ ¾
McCord Mfg. com	40	41	— ½
McCord Mfg. pfd	102	..	+2
Mitchell Motor Co	45	47	..

	Bid	Asked	Net Ch'ge
Motor Products Corp	45	50	..
Nash Motors Co. com	230	..	..
Nash Motors Co. pfd	96	100	+1
National Motor Co	16	20	..
Packard Motor Car com	190	195	+20
Packard Motor Car pfd	100	102	..
Paige-Detroit Motor com	38	39	— ½
Paige-Detroit Motor pfd	9	9¾	..
Peerless Motor Truck	34	35	+5
*Pierce-Arrow M. Car com	50½	51½	+1⅛
Pierce-Arrow M. Car pfd	102	104	..
Premier Motor Corp. com	5	..	..
Premier Motor Corp. pfd	..	75	..
Prudden Wheel Company	21	22	..
Reo Motor Car Co	29	30	—2
Republic M. Truck com	46	47	—2
Republic M. Truck pfd	91	95	..
Saxon Motor Car com	8	10	+1⅛
Scripps-Booth Corp.	25	30	..
Stewart-Warner S. Corp.	90	92	— ½
Stromberg Carburetor Co.	38	40	..
Studebaker Corp. com	82	83	+4¼
Studebaker Corp. pfd	94	97	..
Stutz Motor Car Co	57½	58½	— ¼
United Motors Corp. pfd	47	49	..
White Motor Co	57¾	58¾	+ ¼
Willys-Overland com.	34⅛	35⅛	+ ⅞
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co	88	90	..
Firestone T. & R. com	158	161	+5
Firestone T. & R. pfd	100	101	..
Fisk Rubber Co. com	135	142	—14
Fisk Rubber 1st pfd	100	105	..
Fisk Rubber 2d pfd	135	142	—14
Fisk Rubber 1st pfd conv.	105	110	..
*Goodrich, B. F., com	71½	72½	+1½
*Goodrich, B. F., pfd	107½	109½	+ ½
Goodyear T. & R. com	330	340	+7
Goodyear T. & R. 1st pfd.	106	108	..
*Goodyear T. & R. 2d pfd.	107½	109	+ ½
*Kelly-Springfield com	122¼	123¼	—1⅞
Kelly-Springfield pfd	95	97	..
Lee Tire & Rubber Co	32½	33½	— ⅝
Marathon Tire & Rubber.	55	65	..
Miller Rubber Co. com	200	207	+15
Miller Rubber Co. pfd	105	106	..
Rubber Products Co	155	160	+26
Portage Rubber Co. com	171	174	+16
Swinehart T. & R. Co.	88	93	+10
U. S. Rubber Co. com	98	99	+3¼
*U. S. Rubber Co. pfd	113¼	114¼	+ ¾

*Ex dividend.

Air Mail Service Profitable in First Year of Operation

(*Continued from page* 1106)

a plane having a top speed of 75 or 80 miles against a surface wind of 40 miles or more an hour. The two types of planes in the Aerial Mail Service of this speed are the Standard JR1 mail plane, having a wing spread of 31 ft. 4 in., and the Curtiss JN-4-H, having a wing spread of 43 ft. 7⅜ in. Each type of plane is equipped with a 150-hp. motor. The motor of this strength has not enough reserve power to combat the disturbed air conditions at the surface in a wind of more than 40 m.p.h., especially so if the wind comes in descending columns or gusts. Under these conditions it is possible to make headway only with a Liberty engine, which has plenty of reserve power.

A plane equipped with a 150-hp. motor, if it succeeds in breaking through the surface wind, can make only slow and laborious headway against a full or a quartering head wind of about 40 miles. There have been many instances where the planes equipped with 150-hp. motors have been held down to a speed of between 30 and 37 m.p.h.; also many instances where a 100-m.p.h. plane equipped with Liberty motor has been held to between 55 and 60 m.p.h. of speed. A few windstorm conditions were encountered on trips where the planes at the height of the gusts were actually carried backwards.

Two Periods of Remarkable Gales

There were two periods of remarkable gales encountered during the year. One was on December 6, 1918, on the Washington-Philadelphia flight. On that day the wind reached a maximum of 50 m.p.h. at College Park, Md., during the flying hours. It blew the plane around like a leaf and put down the first small plane that attempted to get out, damaging the machine. A second plane with 150-hp. engine got through the disturbed conditions, and at an altitude of 500 ft., above which it could not rise. The wind was so powerful that it took in excess of one hour for the plane to travel from College Park to Laurel, Md., a distance of less than 12 miles.

On the same day the plane leaving Philadelphia for Washington encountered a 60-mile wind, against which it battled for 2 hr. and 41 min., in which time it covered only 113 miles.

The other gale period began on the afternoon of March 27, overtaking two of the mail flyers in the air. It helped one along on his route, but forced the other to land, the maximum velocity of the wind being 45 m.p.h. This gale grew in intensity and blew unabated on March 28 and 29, and on these two days the most remarkable flight in all history of aviation was undertaken in the face of the storm. At College Park an aviator made three attempts to take off in the storm, feeling that once above the disturbed surface conditions he could continue on his way. The highest altitude with the 150-hp. motor he could reach was 140 feet, at which height, as in the case of the other two attempts, descending currents of air pressed his machine down to the ground with such force as to injure the landing gear. The maximum ground velocity at College Park at the time the attempts were made was 46 m.p.h., but the air currents were in a great state of disturbance. The weather observer's report for Washington for this day is as follows:

"Heavy northwest gale continued throughout the day and night. Some houses were unroofed, according to press reports, and many trees were uprooted. Wire communication was interfered with. A two-masted schooner was reported sunk and crew lost 70 miles below Washington. The wind at times attained an extreme velocity of 55 miles."

At Belmont Field, Long Island, attempts were made to get away with the mail in a small motor plane in a surface wind of 54 m.p.h. The attempts with the small planes were made at the suggestion of the pilots, who believed an airplane with small wing spread stood a better chance in the gale than one of a larger wing spread, even though equipped with greater power. At Philadelphia the reserve air-mail pilot, J. N. Miller, who was a former naval flyer, essayed the trip with a Curtiss R-4 plane of 48 ft. 4⅛ in. wing spread and powered with a 400-hp. Liberty engine. He rose against a surface of wind of 43 m.p.h. and flew by compass into a snow storm then raging over New York City, and picked up a land mark in the Woolworth Tower, 300 feet above its spire, and then directed his course through the gale and storm, which the Weather Bureau reports at that hour as having a maximum velocity on the ground at New York of 68 m.p.h. The velocity of the wind was 15 per cent greater at the altitude at which this pilot was flying than on the ground. Telegraphic reports from Belmont Field at the time reported visibility at 50 ft. on the field, and the flyer, not being able to pick it up, landed at Great Neck, Long Island, a short distance beyond the aerial mail field. He set down his plane with damage to landing gear. The Weather Bureau reported on the gale over New York that day as follows:

"Snow squalls at times were heavy, obstructing the view in the harbor and interfering with traffic. Maximum wind velocity was 92 m.p.h., a record surpassed only once at this station—recorded at 9.25 p. m. The average velocity for the last 12 hr. was 62 miles, and for the last 6 hr. was 68 miles. According to the city press, the loss of life and damage to property was considerable."

At 3.25 p. m., at which time the air-mail pilot was struggling with the gale over New York City, the maximum velocity of the wind recorded by the Weather Bureau at New York was 68 m.p.h. on the ground. The performance of this flight for courage and successful handling of an airplane has never been surpassed, perhaps never equalled.

NOTE.—This pilot returned to Philadelphia by train that night and the following day he repeated the performance under almost as bad conditions.

On March 29, at College Park, the air-mail pilot again undertook three times to get under way in a small plane with 150-hp. engine. The larger plane with the Liberty engine had been rendered unserviceable by the collapse of a tent in the storm. The highest elevation reached on that day was 150 ft. In each of the three attempts the wind forced the plane almost vertically to the ground, setting it on its nose each time, resulting in broken propellers. The gale was blowing in gusts at a maximum of between 38 and 40 m.p.h. At Philadelphia the same air pilot who had flown the day before with the Curtiss R-4 and the Liberty engine, took off in a 42-mile gale with a DH-4 airplane run by a 400-hp. Liberty engine. He had better visibility on his trip, but he flew through a gale that was blowing at a maximum of 80 m.p.h. when he successfully landed with the mail at Belmont Park at 4.45 p. m.

Weather Bureau's report on wind velocity at New York City during the hours of operating the aerial mail follows:

Miles Per Hour.

	Noon to 1 P.M.	1 to 2 P.M.	2 to 3 P.M.	3 to 4 P.M.	4 to 5 P.M.
March 28	54	49	67	68	78
March 29	75	77	78	77	80

One of the first studies which were taken up by the Aerial Mail Service was to determine whether visibility is absolutely necessary to commercial flying by airplane. Assuming that forced landings have been eliminated, except under the rarest circumstances, through multiple motors accessible for repair in the air, the question then resolves itself to this: Is visibility necessary to landing on a prepared aviation field?

The first step necessary was the refinement of the existing radio direction finders to such a point as to eliminate the liability of 3 to 5 per cent of error and make absolutely certain the bringing of the ship directly to or over the field. This has been successfully worked out by the Navy Department on an aerial-mail testing plane.

The second problem was of guiding the mail plane to the center of the plot for landing. This problem has been solved by the Bureau of Standards of the Department of Commerce

in experiments conducted on the aerial-mail testing ship in connection with radio directional compass. At this time the device of the Bureau of Standards is entirely effective up to an altitude of 1,500 feet, and the refinements upon which the Bureau is at work should give it an altitude of another thousand or more feet, by means of this device the aviator circling around the field and coming down with the head of the machine always to the center of the field for the purpose of making a landing. At present a visibility on the ground of between 20 and 50 ft. vertical is necessary to enable him to gage when to set the plane down. Aeronautical engineers are working on a device for the automatic landing of a mechanically flown airplane. Such a device, or any device that will give altitude without reference to the barograph, should solve this problem. The condition of absolute invisibility requiring such a device would rarely arise, and exist only in the most blinding snowstorm, down-pour of rain, or impenetrable ground fog.

A year's flying of the aerial mail with all types and temperaments of aviators establishes the fact that 200 ft. visibility from the ground is the limit of practical flying, although a number of runs were made with the mail between New York and Washington in which a part of the trip was flown at the low elevation of 50 feet. The objection of aviators to flying above a ground fog, rain, snow or clouds with single-motor planes is due to the possibility of the motor stopping over a village or city, or bad ground, with the visibility of such a short radius that it would be impossible after gliding through the cloud or fog strata to pick a safe spot to land, whereas, if they fly just on the lower edge of the thick strata with the land constantly before them, they are in a position to skirt around the edges of cities, towns, timber, or other terrain for landing. It is generally accepted that with two or more motors the flights will be made above the clouds or fogs or rain banks, certainly as long as enough motors are running to hold an altitude. It is also clear that in a twin-motor plane, should one motor die, although the other motor is capable of carrying the plane forward, the pilot would come down below the area of invisibility and fly low as in the case of a single-motor plane.

During the year of operations a very careful record has been kept of the mechanical causes of forced landings. These have been entirely connected with the motor. There have been a total of 37 forced landings due to motor trouble, which is one forced landing for every 3460 miles flown.

Of the motor troubles sufficient to bring down a mail plane six have been due to ignition trouble, five of the six resulting from magneto disturbance, most frequently the shearing of a shaft. Disarrangement of the distributor and the failure of a generator for a Liberty engine were responsible for the other two forced landings chargeable to ignition. Work has begun in installing duplicate ignition systems for each engine, which will largely obviate forced landings from this source.

Leaking radiators or water lines are responsible for seven forced landings. It is believed that trouble from this source will be minimized by the installation of a radiator in the wing now fastened between the propeller and the engine in a position where it catches the vibrations of both the propeller and the engine.

Two forced landings resulted from valve trouble on Hispano-Suiza motors, the valves of these engines being an inherent weakness of the motor. This is a serious problem, and the Bureau of Standards has undertaken an investigation of methods to overcome it.

Failure of the gas pressure resulted in one forced landing, and this is easily remedied by the installation of an auxiliary gas tank on each plane.

Two forced landings resulted from carbureter trouble, the overcoming of which is now being studied.

There have been eight forced landings due to spark-plug fouling. This trouble can arise from several causes. It most frequently results from idling the engine in the preliminary warming-up stage before a flight. The Aerial Mail Service has urged spark-plug inventors to perfect this mechanism, and as the result of the assistance rendered one inventor has finally developed a spark plug which gives promise of entirely eliminating fouling. A set of these plugs in one bank of the low-compression Liberty engine operated 25 hr. in a test ship without being withdrawn from the cylinder for the purpose of cleaning. The plugs were then withdrawn and placed in service and have functioned perfectly. An order has been placed for this type of plugs for high compression as well as low compression Liberty and Hispano-Suiza motors.

A study of the motor troubles causing forced landings points irresistibly to the multiple engine as a solution. A multiple-power plane must be of such character that with half the power gone the remaining power will carry the airplane to its destination. Thus, in case of two motors, one motor should enable the pilot to continue his trip though at greatly reduced speed. In a three-motored plane it should be necessary to lose a second engine before a forced landing has to be made. In the specially constructed mail-carrying planes which the Department has outlined in bids to be opened on June 2, a form of construction is called for that will enable a mechanic to make important minor repairs in flight. Under these conditions it will be possible with a multiple motor to insure maintenance in the air until the objective point or terminus is reached.

OTTO PRAEGER,
Second Assistant Postmaster General.

Calendar

SHOWS

May 15-June 1—Venezuela. National Exhibit of Venezuela.
*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.
Nov. 7-15—London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.
December — Brussels. International Automobile Mfrs. Congress.
January—New York. International Automobile Mfrs. Congress.
February — Chicago. International Automobile Mfrs. Congress.
Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

May 30—College Park, Md. — Power cultivator Demonstration, Maryland State Dept. of Agriculture.
June 8-14—Denver, Col. Sectional Tractor Demonstrations, Denver Tractor Club.
July 14—Wichita, Kan. Automotive Committee of National Implement Assn.
Aug. 18-22—Aberdeen, S. D. Sectional Tractor Demonstrations.
October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

CONTESTS

May 23—San Joaquin, Cal.—Grade 2 non-stock cars, reliability contest, San Joaquin Auto Trade Association.
May 30—Atlantic City, N. J.—Airplane races—Aeronautic Convention.
May 30-31—Richmond Va.—2-Day Dirt Track Meet, Virginia State Fair Grounds Track.
†May 30-31—Los Angeles, Cal.—Los Angeles-Yosemite 3rd annual gasoline economy run.
†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.
*June 14—Sheepshead Bay, L. I. Speedway race.
July 4—Atlantic City, N. J.—Airplane races—Aeronautic Convention.
*July 5—Cincinnati, O., Speedway.
*July 19—Uniontown, Pa. Speedway race.
*July 26—Sheepshead Bay, L. I. Speedway race.
*Aug. 15 — Middletown, N. Y. Dirt track event.
*Aug. 22-23—Elgin, Ill. Road race.
*Aug. 23—Sheepshead Bay, L. I. Speedway race.
*Sept. 1—Uniontown, Pa. Speedway race.
*Sept. 20—Sheepshead Bay, L. I. Speedway race.
*Sept. 27—Allentown, Pa. Dirt track event.
*Oct. 1—Cincinnati, O. Speedway race.
*Oct. 4—Trenton, N. J.—Dirt Track Event.
*Oct. 11—Danbury, Conn.—Dirt Track Event.

†Sanctioned.
*Tentative dates.

CONVENTIONS

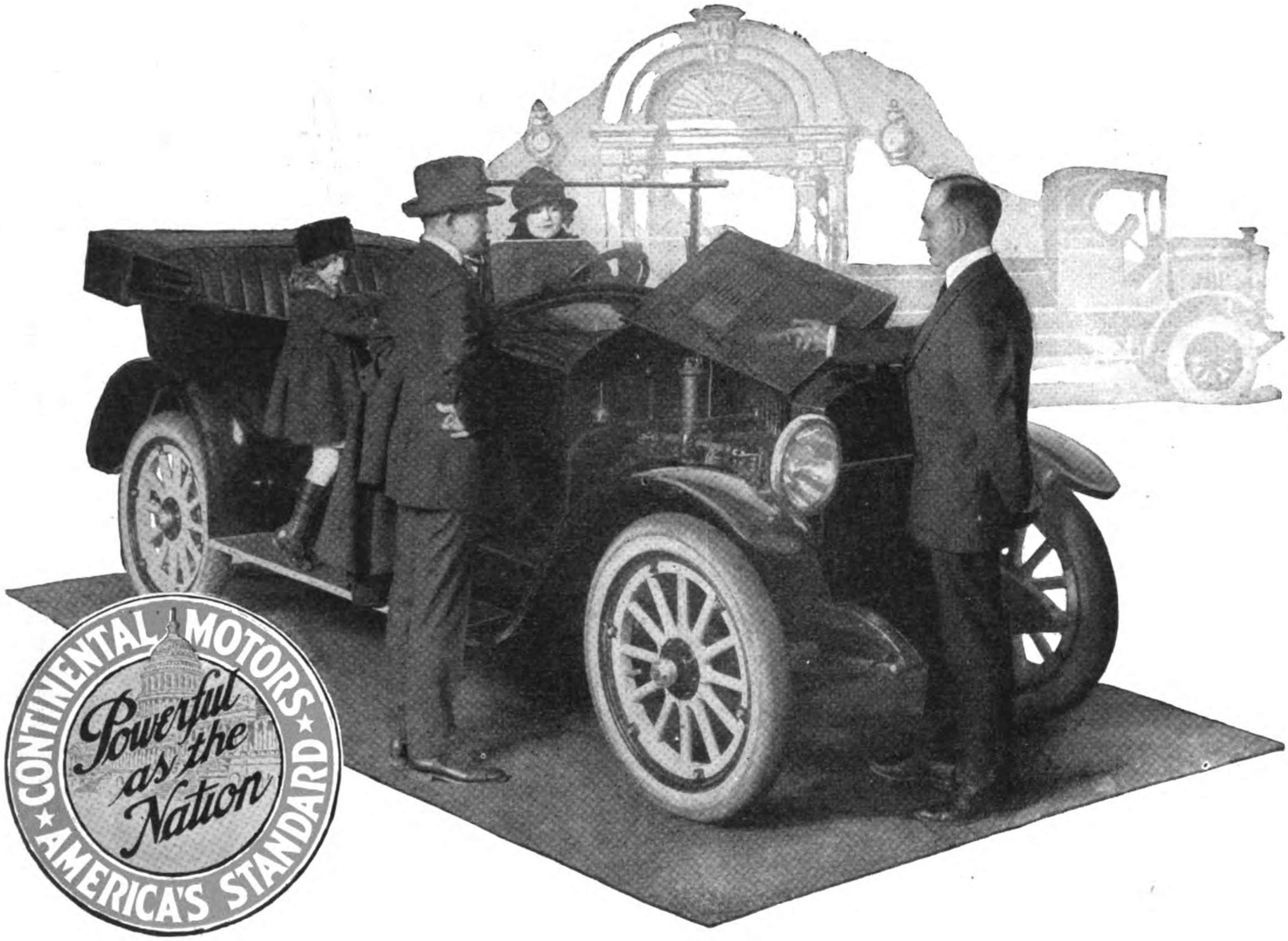
May 1-June 1—Atlantic City, N. J. — Pan-American Aeronautic Convention and Exhibition—Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.
May 21-24—Washington — Conference on Weights and Measures—Bureau of Standards.
June 2—Chicago, Ill.—Natl. Gas Engine Assn. Hotel Sherman.
June 2-6—Hot Springs, Va. Convention Automotive Equipment Assn., Homestead Hotel.
June 3-6 — Washington, Pan-American Commercial Conference, Pan-American Building.
June 23-28—Ottawa Beach, Mich.—S. A. E. Mid-summer Meeting.
Sept. 22-24 — Philadelphia. Annual Convention, National Association of Purchasing Agents, Bellevue-Stratford.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

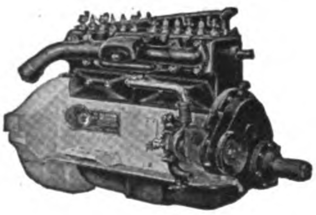
Vol. XL
Number 22

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, MAY 29, 1919

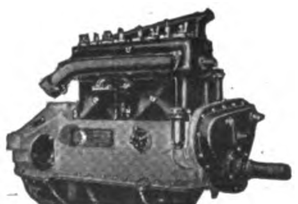
Fifteen cents a copy
Three dollars a year



His Strongest Selling Point is the Red Seal Continental Motor



America's Standard Passenger Car Motor. Look for the Red Seal Nameplate.



America's Standard Truck Motor. Look for the Red Seal Nameplate.

The argument that most often clinches the sale of an automobile or truck is the Red Seal Continental Motor.

For there is hardly a man who is not familiar with the record of *past performance*—the infallible test of motor worth—which has distinguished this motor for well over a decade.

On hundreds of thousands of automobiles and trucks, under every conceivable condition of service the Red Seal Continental Motor has *proved* its 100% dependability. In the supertasks of war, in the vigorous tasks of peace, it has stood the test of service.

Today upwards of 15,000 dealers have signified their belief in the Red Seal Continental Motor by entrusting their business prosperity to Continental-equipped cars. And their choice is the Continental because of its proved record for power, for speed, for economy, for reliability.

Today more than 160 successful manufacturers of automobiles and trucks equip their output with Red Seal Continental Motors. The judgment of these manufacturers is vindicated by tens of thousands of owners who will have no other motor.

Look for the Red Seal on the motor in the car or truck you buy—and *be sure.*

Continental Motors Corporation

Offices: Detroit, Michigan **Factories:** Detroit—Muskegon

Largest Exclusive Motor Manufacturers in the World

Continental Motors

STANDARD POWER FOR TRUCKS, AUTOMOBILES AND TRACTORS

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, MAY 29, 1919—CHICAGO NO. 22

Destruction of the Belgian Industry

By German Military and Civilians

Chiefly for Commercial Advantage

After Army Needs for Machinery and Material Had Been Met, the Work of Removal and Scrapping Was Continued with Object of Destroying Export Competition

By W. F. Bradley

> MR. BRADLEY, special European correspondent of AUTOMOTIVE INDUSTRIES, went to Belgium to investigate industrial conditions there especially for this paper. He was accorded special privileges by Government officials and owners of the various plants.
> —EDITOR.

BRUSSELS, May 1.—Germany robbed the Belgian Automobile factories of machinery, tools, materials and cars to the value of $10,000,000. This is a moderate estimate based on pre-war values. If present values were considered this figure would have to be increased by no less than 50 per cent. In arriving at this figure no account has been taken of the prejudice caused by the loss of business and unproductive capital during the four and a half years' occupation by the German armies.

Not a single Belgian automobile factory was destroyed or damaged by what may be termed direct warfare. The factories were at Brussels, Liége, Antwerp and in the Charleroi districts and were passed so rapidly by the German advance of August, 1914, that they were soon far inside the German lines and consequently never were within the range of the artillery. Notwithstanding the fact that they were outside the fighting zone, the Belgian automobile factories are ruined. The buildings stand, as in 1914, and to a casual observer appear to be undamaged. But a look inside shows that they have been stripped naked.

In any country at war it is expected that destruction will be found. When the security of a nation is at stake, the home forces may be under the necessity of destroying property to the same extent as the enemy. This article, however, does not relate to necessities of war but to a deliberately organized, and unfortunately successful, attempt to destroy an industry in order to remove a competitor.

The Belgian automobile industry was not big. In 1914 it consisted of fifteen firms, the most important of which employed 3000 men; the total production was 8000 cars per annum.

The truck industry was non-existent.

Agricultural tractors are unknown in Belgium.

In the Brussels district there had been built up an interesting customs body-building industry, which received chassis from England, France and other nearby countries and returned them completely equipped with made-to-order bodies. Of the total output of the Belgian automobile factories, 70 per cent was for export. By destroying this industry, Germany felt she would have one less competitor to meet on the resumption of business after the war.

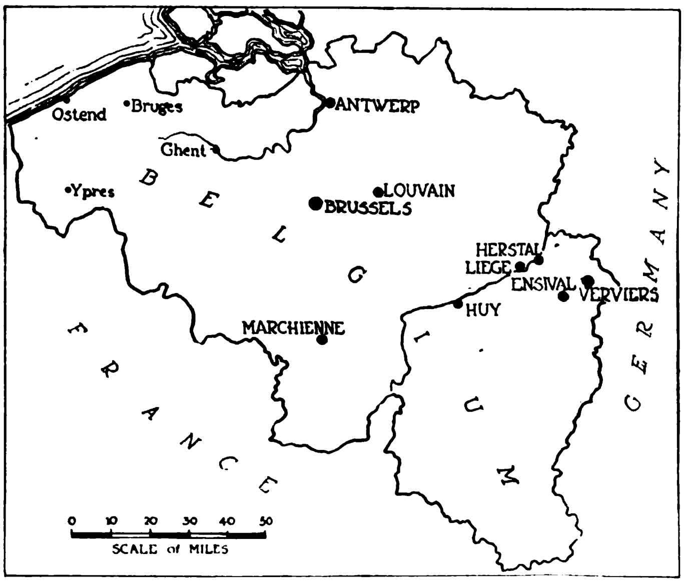
If an indictment of the German government was desired, the automobile industry would not be selected as an

Belgian Automobile Factories, Placed Roughly in Order of Importance

FACTORY	PLACE	CONDITION
Minerva	Antwerp	Completely stripped.
Metallurgique	Marchienne-au-Pont	Used as German repair shop; partly stripped.
F. N.	Herstal-lez-Liége	Lost 3600 out of 3800 machine tools.
Pipe	Brussels	Completely stripped.
Excelsior	Saventhem, near Brussels	Completely stripped.
Nagant	Liége	Completely stripped.
S. A. V. A.	Antwerp	Completely stripped.
F. A. F.	Brussels	Completely stripped.
F. I. F.	Brussels	Completely stripped.
Miesse	Brussels	Completely stripped.
Springuel	Hug	Completely stripped.
Germain	Monceau-sur-Sambre	Destroyed by fire.
Imperia	Nessonvaux	Completely stripped.
Linon	Ensival-lez-Verviers	Completely stripped.
Dasse.	Verviers	Completely stripped.
Derihon (forgings, alloy steels)	Liége	Completely stripped and wrecked.
Dyle & Bacalan (frames, etc)	Louvain	Wrecked and burned in sack of Louvain.

example. While the sum of $10,000,000 represents the value of practically the whole of the machinery employed in the production of automobiles in Belgium, the total is too small in these days of colossal figures to strike the imagination of the masses.

The mining industry and the general engineering industry were bigger prey and, although the proportions are the same, the figures are much more impressive. To take one particular instance, there was at Seraing, a few miles from Liége, the John Cockerill Engineering Co., employing 10,000 men on the production of railroad material, steam engines, Diesel engines, cranes, etc. Externally the factory is in good condition. The words "Vive la Belgique" adorn its façade. The windows are unbroken, the bricks and tiles are all in place, everything is cleanly. But inside the destruction is so complete that the chief engineer declared to me: "I should very much have preferred that the whole place had been wiped out by a bombardment. In that case we could have drafted a new plan and have built an entirely modern factory. As it is, our walls are intact, but the machinery is gone, and we are obliged to rebuild within the old walls and with the old limits and restrictions."



Map of Belgium

Not a shot was fired over the Cockerill factory, yet destruction has been effected to the extent of $13,000,000 on 1914 values and more than 8000 work people have been deprived of their means of livelihood. When the German armies took possession of Belgian territory Cockerill was asked to work for the invaders. He refused. For a few months work in the factory continued, on a reduced scale, for the home and the Dutch markets. But as raw material became scarce and as the difficulties of preventing the products finding their way into Germany became greater the factories were closed.

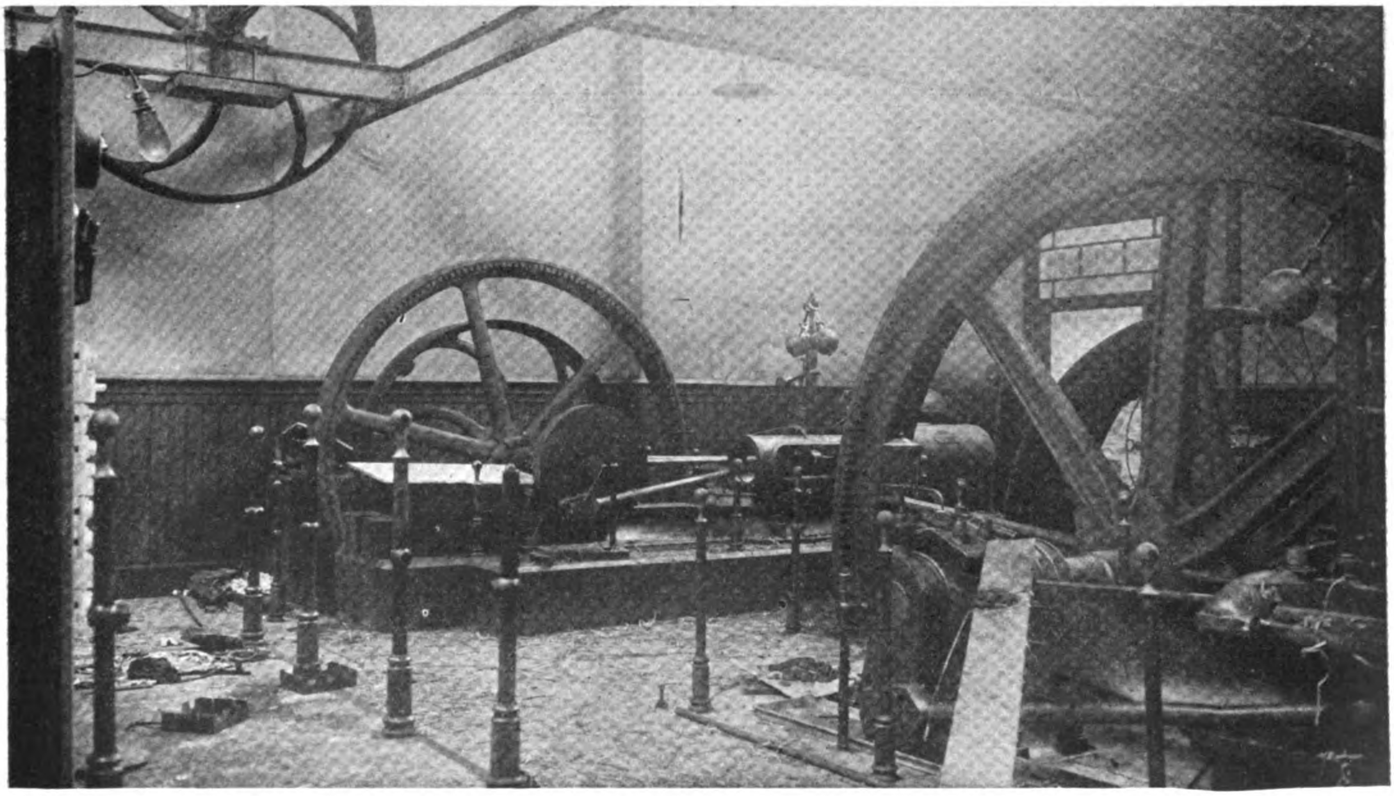
Germany was early in the field for the Cockerill machinery. The high-class tools were removed by official requisition. Engineers from Germany came, examined, photographed, went home, and returned with orders to take possession of individual machines. There was keen competition for many of the best machine tools. One particular installation was photographed and reported on by ten organizations. Officers and engineers quarreled in the factory for the possession of this machine. Finally an officer and soldiers arrived, with a duly signed order from the central German authority at Brussels. A freight car was run alongside the machine, the locomotive remained hitched up, and within an hour, by the aid of the overhead crane, the machine had been loaded and had disappeared. An hour later another officer arrived with a signed order for the same machine. He rushed to the railroad station, but the car had gone; telegraphic messages were sent in every direction, but neither the Belgian nor the German authorities could discover where the machine had been taken to.

In 1914 the Cockerill company had built a gas engine of 10,000 hp. This was the biggest engine of its kind in the world and had been produced for the Cockerill generating station to save the space taken up by the small

Derihon Machine Shops as the Germans Left Them

(Photographs made Nov. 11, 1918)

This shafting had been pulled down and was awaiting shipment into Germany. The boiler was pulled out and all tubes sawn through



Engines rendered useless and marked for removal

Machinery in Derihon plant broken up by order of the German authorities. This scrap had been ordered sent into Germany. Many such piles awaited shipment Nov. 11, 1918

individual engines and to prove that there was no practical limit to the size of gas engines.

The German engineers coveted this engine. A requisition order was presented authorizing its removal, and the directors given 4 hours in which to produce the assembly drawings; if not delivered within this time the directors of the factory would be deported to Germany. The 10,000-hp. gas engine, together with its dynamo, was shipped to Germany and is in operation in that country at the present moment. In order to dismount it rapidly the whole of the building in which it was housed was destroyed and the holding-down bolts were cut with an acetylene torch.

Even the electric standard and lamp at the entrance to the engine house were taken to Germany. A few of the machines were of German construction, and in several of these cases it was the German engineer responsible for the installation who took charge of the removal of the machines to Germany.

Until May 25, 1918, it was possible, by entreaty, by persuasion, by argument, to induce the Germans to respect portions of the plant which were absolutely essential to a resumption of activities. But on May 25 the R. O. H. M. A. swept down on the Cockerill factory and systematic destruction began and was continued without a stop until 10.45 a. m. Nov. 11, 1918—15 minutes before the armistice went into effect.

The R. O. H. M. A. was the terror of the Belgian factories. This organization was charged with the task of obtaining metal. If it could secure $500 worth of cast iron by destroying $10,000 machines it did not hesitate for a second. At the Cockerill factory the R. O. H. M. A. organization was in charge of Von Dip. Ing. C. Quasebart, professor of metallurgy at the German University of Aix-la-Chapelle. This von engineer proved a remarkable leader and should be capable of giving valuable instruction at his university on rapid and up-to-date methods of wrecking factories.

When Von Quasebart took charge at the Cockerill plant the great German offensives had been launched and appeared likely to succeed. Said one of the German officers to Mr. Tonneau, director of the Cockerill company: "This is the beginning of the end. We are certain to win. We shall not have to pay a cent to Belgium; we can do as we like." Add to this the fact that the only real competition the German engineering industry had to meet in the Dutch and Scandinavian markets came from Belgium and we have the explanation of the mad destruction ordered by the German authorities and executed by the R. O. H. M. A.

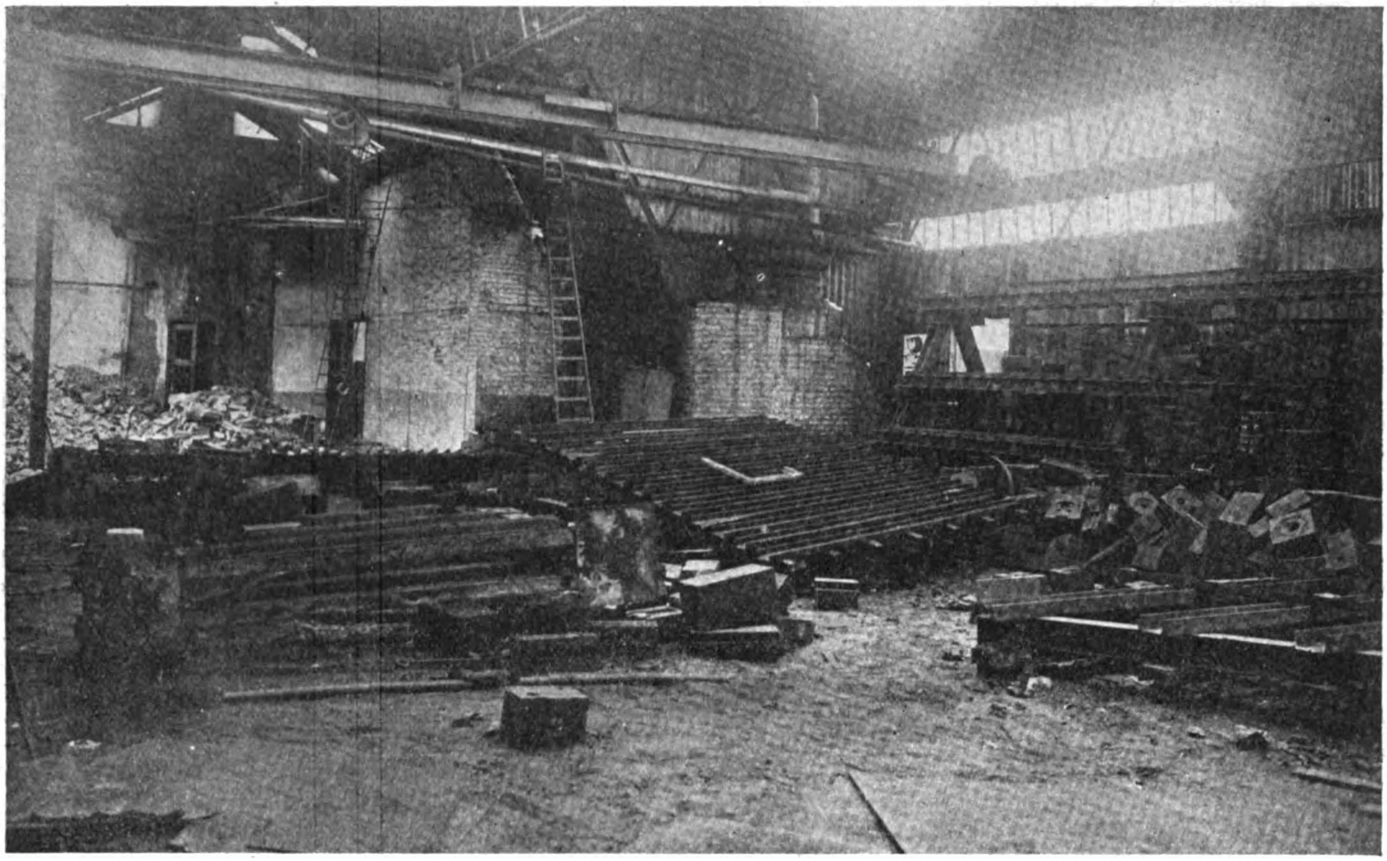
Germany's requirements, in order of importance, were copper, brass, rubber, leather, cast iron and steel. But when the R. O. H. M. A. came on the scene only iron and steel remained and the only object was to get scrap metal for the furnaces. In some cases overhead traveling cranes had been demounted and sent into Germany for further use. This so seriously interfered with the wrecking gangs that a general order was issued forbidding cranes to be destroyed. The method of operation was to cut the holding-down bolts with the acetylene torch, hitch the crane to a machine and drop it from a height of 6 to 12 ft. to break it. From their own standpoint the method was uneconomical, for from 20 to 25 per cent of the metal became embedded in the earth and could not be collected.

Nothing escaped: blast furnaces, rolling mills, cupolas, gas and steam engines, boilers, shearing machines, lathes, hardening furnaces, even the steel columns supporting the roofs of the buildings were pulled down and scrapped.

The first instruments employed were the acetylene

The Derihon Buildings Suffered Less Than Plant

(Photographs made after the armistice became effective)



This building was stripped of the steel portions and this was to be used as scrap. In the background the walls have fallen as result of removing pillars. Note the dies, which are treated as scrap

To facilitate the removal of machinery, the German troops destroyed a portion of this building

Herr v. d. Has in Brüssel
hat dem Kraftwagenpark Brüssel ein Chassis
überlassen.
Marke: Sheffield Simplex Fabrik-Nr. 1157 / A 1168
P. S. 30 Anzahl der Plätze:
Karosserie: –
Zubehör: –
Zustand: –
im Werte von Mark 4800 in Worten:
Mark viertausend achthundert
und ist nicht berechtigt, ~~diesen Betrag aus der Kasse des Kraftwagenparks Brüssel, früheres Kriegsministerium, Löwenerstr. Nr. 1, 1 Stock, Stube 39a, Werktags, mit Ausnahme von Samstag, in der Zeit zwischen 3 und 5 Uhr nachmittags~~ zu empfangen, der Besitzer in England
Brüssel, den 1er DEC 1914 191
Die Ankaufskommission:
Hauptmann. Oberingenieur
Dieser Kraftwagen hat im Park Brüssel die Nr. erhalten.
Unterschrift des Uebernehmers im Park Brüssel:

Receipt given by the Germans for a seized Sheffield-Simplex chassis. The price allowed for this new chassis is 4,800 marks (approximately $1,200). The market value was $6,000

torch—it was too slow to unscrew nuts—and the crane. So great was the effort in tearing up machinery that the hook of the most powerful overhead crane was broken. Where no overhead crane existed, a block and tackle was attached to the girders. Engineers would have feared that the entire building would collapse. The Germans had the luck merely to break the girders.

For the big machinery, dynamite was used. If a building made the removal of a machine difficult, the building was destroyed. In some cases, after the holding-down bolts had been cut, the desired machine was attached to a traveling crane mounted on rails in the yard, and pulled through the window. After the first two or three efforts the opening was large enough to allow the free passage of the biggest machinery.

The Cockerill plant is described as an example of destruction on the biggest scale. The treatment accorded to the Derihon Brothers plant differed only in volume. A few miles to the north of Liége, the Derihon company possessed a modern plant devoted exclusively to the production of forgings and stampings for the automobile industry. Derihon B. N. D. steel had a universal reputation, and was always employed when the very best was desired. As an indication, practically all the essential parts of Peugeot and other French racing cars built before the war, and now in America, were of Derihon B. N. D. steel.

When the invasion began, one of the Derihon brothers escaped to England, where he erected a factory for the production of special alloy steels for automobiles and airplane engines. The technical staff, left behind, began the manufacture of shock absorbers in order to keep the workers employed and to forestall any excuse the Germans might offer for seizing the machinery. In 1916 the factory was asked to work for Germany. It refused, was threatened, and refused again. In consequence the plant was sequestered, or put into the hands of an official receiver. The plan was to remove the entire Derihon plant into Germany where it would be put into operation as a direct competitor after the war.

German engineers, who were specialists in the making of forgings, came to the factory, exacted the plans under threat of deportation, and superintended the removal of machinery and plant. One of these specialists was photographed. His name is not known, but the company he represents is the Rhein-Elbe Gelsenkirschner A. G. Abt. Aachener Hütten-Verein, at Düsseldorf. It is declared that the entire Derihon plant was to be transferred to this firm. The entire laboratory disappeared; the microscopic camera, the Brinell machines, the impact testing machines, the pyrometers, the chemical apparatus, the test pieces, even the diagrams, photographs, and charts on the walls were sent into Germany.

All Machinery Despatched to Germany

The furnaces, forges, drop hammers, presses, compressors, blowers, lathes, shearing machines, power saws, shafting, belting, wiring, electrical equipment were all pulled down, loaded on freight cars and despatched over the border for the benefit of the German industry. It was not until 1917 that the real work of destruction began, but during these 18 months the enemy had the time to tear out every machine and to remove every inch of shafting. The two steam engines were left behind, although marked for removal, but all the steam pipes were broken with a hammer and the boiler was pulled out and the tubes sawed through.

The wreckage was piled up at one end of the building until it went through the glass roof. Although everything had been torn out and labeled for shipment to Germany, time had been too short to get it all loaded on freight cars. At midday, Nov. 11, 1918, when the armistice became effective, German soldiers came to the factory to load goods for Germany. The Derihon staff had the satisfaction of kicking them out.

Derihon never was visited by the terrible R. O. H. M. A. But evidently there are other organizations no less destructive, for when it was abandoned the Derihon factory was in a condition defying description.

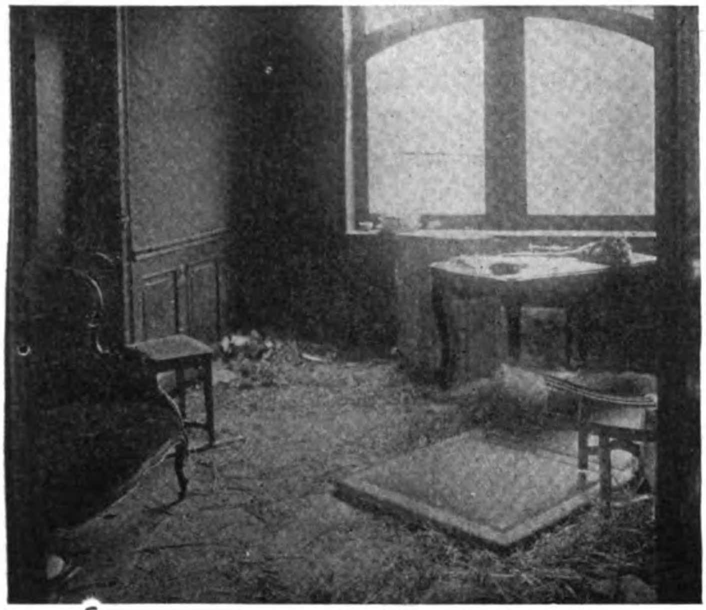
After practically everything had been removed it was learned from one of the soldiers that all the dies were to be taken for scrap metal. To avoid this terrible loss, the small staff left at the works smuggled many of the dies to a place of safety. The German soldiers saw the men at work and even helped to load some of the dies on a wagon, but were satisfied with the explanation that this was being done to facilitate the work of the soldiers who were to come on the following day. The officers were not so easily fooled. The manager of the factory was court-martialed and kept in prison for 3 months.

The Germans gave receipts for all machinery they requisitioned. Sometimes this was done correctly, sometimes it was not. At the Derihon factory one army department gave a receipt for goods seized and shortly afterward another army department took that receipt away by force. Derihon does not possess a single original receipt for machinery seized. The precaution was taken, however, of photographing all the receipts before the German officers caused them to be given up. One of these photographed receipts is shown on this page.

[In a further installment of this article Mr. Bradley describes other factories he visited by special permission granted to him as the representative of Automotive Industries.—Editor.]

When the Germans Left the Derihon Offices

(*Photographs made Nov. 11, 1918*)



A corner of one of the offices

Office of the general manager as the Germans left it

Portion of the main office. German troops lived here

Four Wheel Drive Trucks

Militor Four Wheel Drive Ordnance Truck Described and the Reasons for Its Design Discussed Before S. A. E. Metropolitan Section

THAT there is a wide field for the four wheel driven truck in commercial work was asserted by George Dunham and L. C. Freeman, in a paper read at the last meeting of the season of the S. A. E. Metropolitan Section, held on Thursday of last week. This field extends all the way from where that of the two wheel driven truck leaves off to where that of the chain track tractor begins. Mr. Freeman claims not only better weight distribution and greater adhesion under difficult traction conditions, but also asserts that as regards fuel economy and tire mileage, the two wheel driven truck will have to look to its laurels.

In the introduction of his paper Mr. Freeman explained that the subject would not be covered as broadly as the title "Four Wheel Drive Trucks" might indicate. He had been associated with Mr. Dunham in the development of the ordnance four wheel drive truck, and it was his purpose to describe the features of this truck and give reasons therefor.

The Ordnance Department saw the necessity for the use of the four wheel drive in trucks where the conditions of operation were very severe. The Militor Corporation was asked to develop a four-wheel-driven truck, and the author said that he wanted to acknowledge at this time the invaluable assistance that was given the engineering staff of the company by outside consulting engineers, and by the engineers of parts makers and other truck makers.

Features Desired by Ordnance Department

At the outset, elaborate and continuous tests were made on all four wheel driven trucks then manufactured in this country, as well as on a four wheel drive Renault tractor. Some of the features that the Ordnance Department insisted upon were high-ground clearance; light weight, short turning radius, short front overhang and low center of gravity.

In the design of the trucks, two objects were kept in view, namely, the greatest production possibilities and maximum interchangeability, even with parts of other vehicles. It was also endeavored to make the truck symmetrical as far as possible, as this tended farther toward interchangeability. One of the principles laid down for the design was that as each problem arose, it should be considered basically as a problem and anyone called in for consultation should be either convinced that the design selected was right, or else the plan of the consultant should be adopted.

In the first place it was decided that the standard seating arrangement, with the driver behind the engine, should be adopted. Next, on account of the requirement of a high-ground clearance, it was decided to adopt the internal gear driven axle, with the differential located on top of the axle.

When the problem of selecting a suitable engine came up, it was first suggested to make use of the Military Class B engine, but this plan was abandoned because it was found possible to obtain an engine already in production, which permitted of making the front overhang of the truck 6 in. less, and which also reduced the weight by 350 lb. The radiator was placed back of the engine, the chief reason for this being that it tended to reduce the front overhang. The reason for making the front overhang small, was clearly brought out in some of the moving pictures shown, which illustrated tests made with the truck under the most unusual and difficult conditions. If there is a large overhang in front, if the front wheels go into a ditch, the forward end of the frame is likely to strike the opposite bank. The picture showed that the Ordnance truck had no trouble of this kind.

Hele Shaw Clutch

For the clutch, the Hele Shaw was selected. It was found that it would be necessary to use a four-speed transmission with an unusually high reduction low gear, and the class B truck transmission was adopted, with the exception that the low gear was made special. The gear reductions required were worked out on the basis of the traction ability which had been specified for the class B truck. It was figured that in a two wheel driven truck only 80 per cent of the total weight is available for traction purposes. Hence, in a four wheel driven truck of the same total loaded weight, the traction ability should be greater in the proportion of 10 to 8. The Ordnance four wheel drive truck is a 5-ton machine and a gross weight of 16,000 lb. was figured upon, but as a matter of fact, the truck did not come out quite as light as had been expected. Gear reductions were selected in accordance with the traction effort requirement on high and low gears, the high gear reduction chosen being 9.6, and the low gear reduction 73.6:1. With this high gear reduction ratio and 40 in. wheels, the truck travels 15 m.p.h., at an engine speed of 1210 r.p.m.

While standard units were selected as far as possible, the transfer case, that is, the member through which the power is transmitted from the end of the transmission shaft to the propeller shaft, has no equivalent on two wheel driven trucks, and had to be designed specially. In the design of this member, consideration was given to the different methods of power transmission by spur gears, silent chain, etc., and a decision in favor of the silent chain was finally made. Means for adjusting the chain tension were provided which allowed of using the chain for a much greater length of time. The two chain wheels of the transfer case were made of nearly equal size, so that by interchanging them, a different reduction ratio could be obtained.

Universal Joints and Propeller Shafts Identical

The two universal joints and propeller shafts were made identical and interchangeable. The differential housings of the front and rear axles were also made identical and interchangeable. Brakes were located on both sides of the differential housing.

It was known in advance that the truck would be used under very difficult conditions, and the greatest attention was paid to provisions against frame distortion. Full 3 point suspension is used, and the drive and torque reaction are taken up on the spring. The latter are symmetrical and interchangeable.

There were really only three parts to the truck that were entirely new, these being the axle, the transfer case and the radiator, all other parts being stock parts which could be purchased in the open market. The truck was provided with a winch which was designed with a reduction gearing of such power as to be capable of breaking a new 1½-in. manila rope.

Commercial Use of Four Wheel Driven Truck

In concluding his paper, Mr. Freeman made some references to the outlook for the four wheel driven truck in the commercial field, stating that this type of vehicle fitted in between the two wheel driven truck and the caterpillar. He admitted that there were more parts on a four wheel driven truck, and that the cost of manufacture would be slightly greater, but said these parts were duplicates of other parts, and they were smaller than the corresponding parts on a two wheel driven truck. The tire life, he said, had been found very satisfactory with four wheel driven trucks, which was probably due to the fact that since the driving effort was divided between all four wheels, the strain on the tire was comparatively low. In regard to fuel consumption, also, he regarded the four wheel truck as on a par with the two wheel driven machine.

Colonel L. B. Moody, of the Ordnance Department, who is in charge of the transportation of this department, was present, and made some remarks on the need for four wheel driven trucks in ordnance transportation. Colonel Moody said that the four wheel driven truck described in Mr. Freeman's paper was one of the finest pieces of engineering work ever turned out for the Ordnance Department. He dwelt at length upon the reasons why four wheel driven trucks were needed for ordnance transportation. In connection with military operations, there are two kinds of transportation: transportation directly behind the fighting line, where the roads are usually torn up by shells, and transportation in the rear. The former constitutes practically 50 per cent of all the transportation work necessary.

Two Wheel Driven Trucks Fed Guns at Front

The point has been made that our Allies used very few four wheel driven trucks, but this was due to the fact that they used animal transportation very largely, directly behind the lines. The American Army discarded animal transportation on account of the difficulty of getting the horses to Europe and of shipping the necessary feed. Under certain exceptional conditions, two wheel driven trucks could be used effectively close to the battlefront. Thus, during the Somme battle, a couple of days before the British took Peronne, two wheel drive trucks fed the guns at the front very nicely, but this was possible because the Germans in their retreat, for one reason or another, failed to mine the roads. Directly north and south of the section to which this remark applies, there was hardly a ghost of a road, and even a tank had trouble in getting ahead.

Experience With Trucks at the Front

During the American offensive in the Argonne, some two wheeled trucks were also being used for hauling up ammunition, and they got stuck promptly. The ammunition was thrown off, and they could not even extricate themselves when empty, with the result that the road was blocked for four hours. When the Ordnance Department cut out horse transportation, it had a choice between four wheel driven trucks and caterpillars. The latter were largely used, but owing to the larger field of service for four wheel driven trucks it was decided to also develop this class of vehicle.

Some additional information regarding the Ordnance truck was brought out in the discussion. Thus, it was stated that one reason for the rear location of the radiator was that it was better protected against shocks in that position. Self-locking type differentials were used, and gave very satisfactory service. It was known in advance that these would see very severe usage, and thus what might be called an oversize was selected. The Ordnance 5-tonner was made both as a truck and as a tractor, and one of the differences between the two models was that the truck had two wheel steer, while the tractor had four wheel steer. In the tractor, both the front and rear axles were identical and interchangeable.

No Trouble with Locking Differentials

In answer to a question, Mr. Dunham said that some of the trucks had been run 25,000 to 30,000 miles and not the least trouble had been experienced with locking differentials, which, when they had been taken out, had looked as good as new. As regards fuel consumption, it was stated that the truck would do 3½ miles on a gallon of gasoline.

It was found that in order to secure traction under the most difficult conditions it was necessary to use 14 chains on each wheel. At first only 6 chains were used, but on soft or slippery ground the wheel would begin to slip when no chain was on the ground and would dig itself in.

Resistance of Animal Glues to Moist Air

THAT there is a close relation between the viscosity, and therefore the grade of animal glues and their moisture resistance is strongly indicated by recent tests made at the Forests Products Laboratory.

Test specimens were made of two pieces of ⅛-in. birch veneer glued together with the grain in opposite directions so as to give 1 sq. in. of glued joint surface. The specimens were suspended in a humidity chamber with a 1-lb. weight hung on each, and the time required for failure of the glue joint was noted. The first two tests were made at 98 per cent humidity. In the third test the specimens were kept at 90 per cent humidity for 120 hours, after which the humidity was raised to 98 per cent. No failure occurred at 90 per cent. The temperature used in each test was about 80 deg. Fahr.

The results indicate that the moisture resistance of animal glues is proportional to the viscosity, jelly strength and grade.

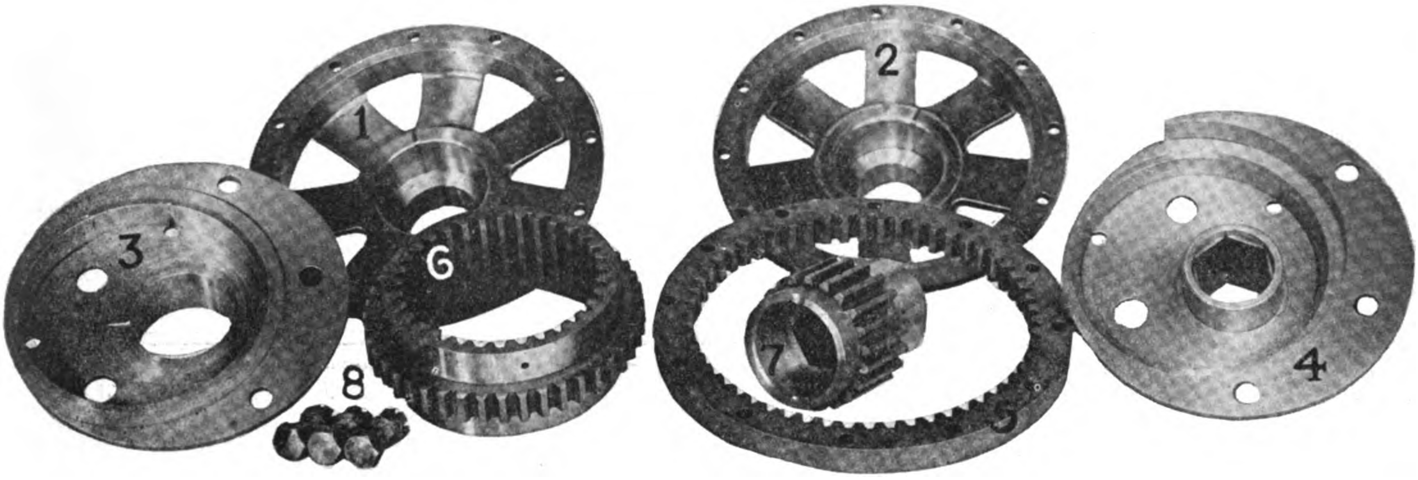
Resistance of Glues of Different Viscosity to Moist Air

Glue Used			Test No. 1		Test No. 2		Test No. 3	
No.	Relative Viscosity (Engler)	Jelly Strength by Smith Tester	No. Specimens Used	Average No. Hours Before Failure	No. Specimens Used	Average No. Hours Before Failure	No. Specimens Used	Average No. Hours Before Failure†
13	1.62	222	2	10½	4	12	4	24
7*	.....	.....	.....	.....	4	12	4	24
36	1.70	219	2	12½	4	14½	4	24
37	1.92	256	2	13	.....	.....	4	44
34	2.00	267	2	17	4	26½	4	48
35	2.90	315	2	42	4	36	.....	.....
19	4.98	356	4	59½	.....	.....	.....	.....
21	4.14	338	.....	.....	4	48	4	66
9	5.48	416	.....	.....	4	66½	4	198

*A vegetable glue.
†After raising humidity to 98 per cent.

The Elbertz Positive Drive Differential

An Adaptation of the Epicyclic Gear to a New Purpose—Prevents Slipping of Wheel Without Traction and Drives Through Inner Wheel at Corners

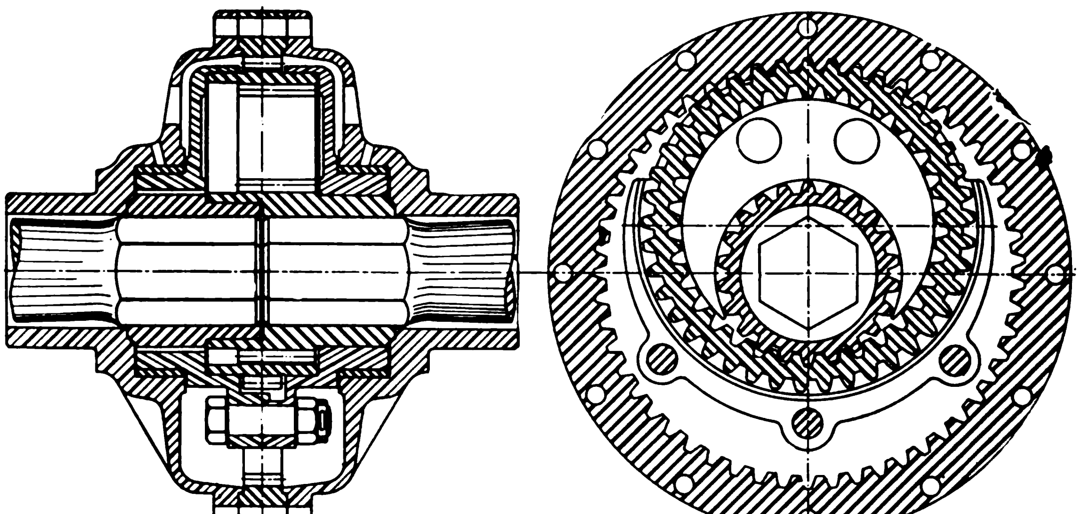


Parts of the Elbertz positive drive differential

THE Elbertz positive drive differential is a new design of differential gear intended to obviate spinning of drive wheels and consequent loss of traction when one wheel of a truck or car gets onto a piece of slippery road. When driving straight ahead it distributes the power to both driving wheels up to the limit of their respective traction abilities. Under normal conditions the power is delivered equally to both wheels, but when the traction limit of one wheel is reached the excess power is delivered to the other wheel up to the limit of its traction. In turning corners it allows the outer wheel to run ahead of the inner one.

The Elbertz differential comprises seven main members, as shown in the accompanying illustration. These are known, respectively, as the differential cases 1 and 2, the crank members 3 and 4, the internal gear case 5, the intermediate gear 6, the shaft gear 7, and three sets of bolts and nuts 8, the latter retaining the two crank members as one unit when assembled. This differential gear is an ingenious arrangement of an epicyclic train of gears, consisting of an internal gear case 5, secured to the differential housing, 1 and 2, which in turn meshes with intermediary gear member 6. The latter can revolve about a bearing on the crank arm or eccentric member 3, 4. The eccentric member engages with one axle shaft and turns with it. The other axle shaft engages with shaft gear 7, the latter meshing the internal teeth of the intermediate gear member 6.

We are informed that the parts shown in the illustration were photographed after being in service in a prominent make of 3½-ton truck, which had covered approximately 9000 miles up to the time of disassembling. We are also informed that several axle builders have secured manufacturing rights from the B. F. Everitt Co., of Detroit, the licensor, and are now producing differentials for their own requirements.



Two sectional views of Elbertz positive drive differential

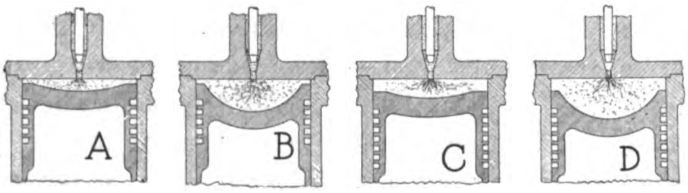
—

WITH so-called closed circuit battery systems of ignition the contacts of the interrupter may remain in closed position when vehicle stops. This causes overheating of coil and runs the battery down. In order to prevent this from occurring, a method is given in French Patent No. 486105 of the Soc. Anon. pour l'Equipment Electrique des Véhicules. A relay is provided by which the current flowing in the primary winding of the spark coil is interrupted. The current taken by the relay winding has to pass through a filament of one of the rare earths that only become conducting at high temperatures. The heating of this filament is produced by a resistance in the circuit of the primary winding. The relay is so designed that, having acted at a given temperature of the filament, the primary circuit of the spark coil is kept open until it is closed by pressing a knob that resets the armature of the relay.

Diesel Engines for Automobile Work

Method of Fuel Injection and Conditions of Combustion Limiting Factors—Fuels Available for Use in Diesel Engines

SOME light was thrown on the difficulties encountered in adapting Diesel engines to automobile work in a recent paper by Charles Day before the Institution of Automobile Engineers. According to Mr. Day, the method of introducing the fuel into the cylinders and the conditions of combustion are at present the limiting factors.



Form of combustion chamber with short and long strokes respectively at beginning and end of fuel injection period

In regard to the spraying of the fuel into the cylinder, it will be readily appreciated that time is a factor in forcing oil through a pulverizer, also that as the viscosity of the oil increases the time required to force the oil through will increase, unless the pressure behind the oil is increased or the design of the pulverizer modified. With free-flowing petroleum residue oil, and with an air pressure of about 1000 lb. per square inch, the author is of opinion that pulverizers of prevailing designs can, with suitable oils, be arranged to deal with speeds up to about 500 or even 600 r.p.m. At 600 r.p.m. the time during which the oil has to be sprayed into the cylinder is approximately 1/200 of a second. For higher speeds pulverizer modifications will need to be developed.

The character of the fuel oil is a factor in the permissible engine speed, both from the point of view of pulverization and of combustion. Viscous oils are more difficult to pulverize than thin and free-flowing oils, and cannot be put through a pulverizer so quickly.

Rate of Combustion Dependent Upon Fuel

Again, the combustion of heavy and tarry oils is not so rapid as that of refined oils, such as kerosene or gasoline, and if the engine speed is so high as not to allow sufficient time for the combustion of the fuel, difficulties will arise from sticky valves, smoky exhaust or dirty cylinders. For rapid combustion, a very finely divided spray is of importance, as obviously large drops of oil take a longer time to burn than very small ones.

From this it would seem that high speed engines may need refined oil, in which case one of the great advantages of the Diesel engine will disappear.

The fuel is sprayed into the cylinder during a very short period of the stroke, commencing with the piston at approximately the top of the stroke. With a short stroke engine the combustion space into which the oil has to be sprayed is very shallow, as owing to the high compression necessary the clearance volume must be low, say about 7 per cent of the total cylinder volume. Remembering the small clearance space, the difficulty of spraying the oil so as to distribute it throughout the air is obvious. Failure to thoroughly mix the oil spray and air will lessen the possible power of the engine by reducing the quantity of oil which can be burnt.

Improvement in distribution is obtained by dishing the piston top. In the accompanying illustration, *A* shows diagrammatically the best obtainable combustion space for a short stroke engine, assuming reasonable clearance between the outer edge of the piston top and the cylinder head, while *B* shows the possible shape of combustion space if the stroke of the piston is doubled.

The combustion space at the latest point of fuel admission is shown by *C* and *D* respectively. A glance at these diagrams shows how much easier the spraying problem becomes in the long stroke engine than it is in the short stroke engine, especially when it is remembered that it is desirable to avoid spraying or splashing the fuel oil on to the water-cooled cylinder head or on to the piston.

In connection with gasoline engines, much attention has been given to the production of a turbulent condition of the gases at the time of ignition; in the author's view such a condition at the commencement of spraying-in is not so important in a Diesel engine, but, on the other hand, a considerable amount of turbulence should result from the spraying-in of the oil so as to insure the utmost possible mixing of the oil and air.

Another factor which must be kept in mind for automobile work is range of speed. In the Diesel engine ignition depends upon the temperature of the air at the end of compression, but if the speed of the engine is reduced very much it may happen that the cooling effect on the slowly compressed air is enough to prevent the compression raising the air temperature sufficiently for ignition. There is thus a limiting factor to the slowness of speed, and the range of speed permissible with the Diesel engine is not so great as with gasoline engines, in which the ignition is obtained by means of a spark.

Difficulties to Be Overcome

Before Diesel engines are likely to be applied extensively to automobile work, development along the lines indicated will be ncessary, so that higher speeds of rotation can be adopted and reduction of space and weight thus secured.

The difficulties to be overcome before the Diesel engine is suitable for automobile work have been stated, but it is important to make clear that the expression "automobile work" is not intended by the author to cover locomotives, for the Diesel engine as at present developed is applicable to locomotive work, and should find an important field there, owing to the great economy of working. For outlying districts and for long journeys through sparsely populated areas and countries, locomotives operated by Diesel engines should prove very advantageous, as for such districts electrical operation from fixed power stations is unsuitable.

Compared with the steam locomotive of existing types, the internal combustion locomotive would be cheaper in fuel, and would, if operating electrically, give much higher torque both when starting and when climbing stiff gradients, and it would also use a much smaller quantity of water. Reliability in service and a reasonable cost of upkeep will come with experience. The elimination of stand-by losses and immediate readiness for use are factors of importance in this service.

Fuel Oils

A very wide range of fuel oils can be used in Diesel engines, as, for instance, petroleum residues, tar oils, some crude tars, shale oils, kerosene, naphtha, alcohol or gasoline. Gasoline is only mentioned to illustrate the wide range of fuels permissible, and not as a desirable fuel, for obviously the much cheaper oils would be selected. As already explained, the working of the engine depends upon the spontaneous ignition of the oil when sprayed into the hot air in the combustion space—hence the temperature at which the spontaneous ignition of different oils occurs is a matter of importance.

The Bargaining Tariff

THE United States should have the means of properly protecting itself whenever our trade is discriminated against by foreign nations, in order that we might be assured of that equality of treatment which we hope to accord and to promote the world over. Our tariff laws as they now stand provide no weapon of retaliation in case other governments should enact legislation unequal in its bearing on our products as compared with the products of other countries. Though we are as far as possible from desiring to enter upon any course of retaliation, we must frankly face the fact that hostile legislation by other countries is not beyond the range of possibility and that it may have to be met by counter legislation.—PRESIDENT WILSON *in Address to Congress.*

WHEN President Wilson mentioned a retaliating tariff, or as it is commonly known, a bargaining tariff, in his address to the present session of Congress, he touched upon a problem that is being seriously considered by the Departments of State and Commerce and the U. S. Tariff Commission. His plan, which calls for a bargaining tariff that will allow the United States to enact discriminatory provisions against foreign countries that discriminate against us, is one which has been approved of by the U. S. Tariff Commission, but is looked upon as a doubtful measure by other governmental departments and officials.

The bargaining tariff is a system somewhat different from the European policies. France, for example, has a maximum and minimum system in which there are two rates fixed by the Legislature, according to the statement made by William S. Culbertson, member of the U. S. Tariff Commission, in an address before the Sixth National Foreign Trade Convention.

Germany, he said, has a general and conventional tariff system in which there is a general schedule of rates fixed by legislation and a lower conventional schedule of rates fixed by bargaining with other countries and embodied in treaties and conventions.

The United States has clung to the single-tariff system with only occasional attempts to make it more flexible. It now proposes to enter upon the policy that a nation deserves and seeks equality of treatment in international dealings. It plans to enact tariff legislation giving equality to all nations, but carrying a power to discriminate by means of high import duties against those nations that discriminate against us.

Officials Object to Plan

Objections to this plan have been voiced by officials who maintain that the only course that is profitable and logical is one whereby this country will conclude individual treaties with the different nations and in which those commodities that the United States produces to the greatest quantities and is most desirous of exporting will be specifically arranged for.

The United States tariff act of 1890 provided for certain bargaining methods, but these were found undesirable. Hides and certain edibles were admitted free of duty, and the President was authorized to proclaim without further act of Congress special penalty duty on these products when they were imported from any country that imposed unequal or unreasonable duties on American products. This was penalizing, not a discrimination against the United States but rather a high levy on American goods, a levy higher than was regarded as fair, and the President was consequently given the power to place the goods of one nation on a less favorable basis in our markets than similar goods imported from other countries.

Penalty Provision in 1909 Tariff Act

In 1897 the tariff act included three bargaining provisions, all offering and seeking special concessions. One provision was similar to that of 1890, another authorized the President to make special reduction on certain commodities in return for reciprocal and equivalent concessions. The third provided that any such treaties would have to be approved by Congress before they became effective. Most of the treaties failed ratification in the Senate and therefore never took effect.

In the tariff act of 1909, and which terminated the provisions of the 1897 act, a penalty provision was included to remove discriminations against American interests in foreign markets. It was based on the principle that every country granting our products equal treatment with similar products of other countries was entitled to equal treatment in our markets. There was a maximum tariff and a minimum tariff, the maximum tariff including an additional 25 per cent ad valorem rate to the minimum tariff. The President was authorized to grant the minimum tariff to those countries which imposed no discriminations on American products and the maximum where there were discriminations. This tariff act was found somewhat sound in principle but not sufficiently flexible. Many of the countries continued their discriminations regardless of the imposition of the maximum tariff.

This act also included the ratification of Congress be-

fore the agreements with foreign nations could become effective. The U. S. Tariff Commission objects to this provision because it states that in the complex conditions of commercial bargaining no consecutive policy can be carried out by negotiating treaties or agreements here and there which, in each case, must be submitted to the Senate for ratification or to Congress for approval.

Again in 1916 Congress enacted a provision for retaliation against prohibitions of American imports into foreign countries, allowing the President to prohibit the importation into the United States of articles from any country that prohibits the importation of similar articles from the United States.

The U. S. Tariff Commission in its report recommended that the United States should ask for no special favors and should grant no special favors, but should exercise its powers and impose its penalties not for the purpose of securing discriminations in its favor but to prevent discriminations to its disadvantage, and recommended the enactment of legislation authorizing the imposition of additional or penalty duties at the discretion of the President against the countries not granting equal treatment to the United States.

This is the policy that meets with objection in many of the official quarters in Washington. It is pointed out, for example, that an automobile tariff act by England might specify certain weights, prices and power alike to all countries and yet be discriminatory against the United States because the cars with the highest duties applied to them might be those manufactured in this country. For instance, the United States exports chiefly low-priced, light-weight, lesser power cars to England. France manufactures higher priced, heavier and higher powered machines which she sells to England. If a tariff act specifies a particularly high duty against the lower priced, the lower power and lesser weight cars without mentioning any country, it would be a discrimination against the United States, but it would be equal treatment to all countries literally and could not be denounced by this country.

It is because of this condition and similar conditions that there are opponents to the bargaining tariff plan who are in favor of concluding separate individual treaties with each country.

Again there are objections to the bargaining tariff which would discriminate against similar products imported from abroad when the foreign country discriminated against like products imported from this country. It is pointed out that the United States is the greatest manufacturer of automobiles. No other nation would be seriously harmed if we attached a high duty against automobiles imported into this country as a penalty to nations which placed a high duty on automobiles imported from the United States. The results could only be harmful to this country, as it would reduce the exports, while having no effect on the automobile imports, which form an insignificant amount.

The legislation favored by the tariff commission calls for an act in which Congress should define in general terms the kind and degree of unequal treatment which is to be penalized, which will enable the President to penalize not only upon discrimination, but also those discriminations more or less concealed in custom regulations, transportation rates, sanitary provisions, classification, etc. This legislation would eliminate the objection that now exists against penalties imposed on similar commodities.

The law should also name a variety of products selected with the view of inflicting a maximum penalty on foreign countries that discriminate against us and the minimum injury to the American consumer, and it should enumerate all the articles or commodities on which the penalty or maximum duties may be imposed and should specify the maximum limit of these duties. It should permit the President a free hand to administer the law within these limits in order to insure the necessary flexibility.

How Industry Can Aid

IT will be particularly profitable to American industry to take an active hand in the formulation of the new tariff laws which will be considered by the present Congress and which were suggested by the President in his message.

Congress comprises chiefly men thoroughly versed in law and less familiar with business. The Revenue Act is an excellent example of Congressional construction. It is now an act filled with conflicting and dubious phrases due solely to the lack of intimate knowledge of the details of each industry that would be necessary to insure a fool-proof and equitable law.

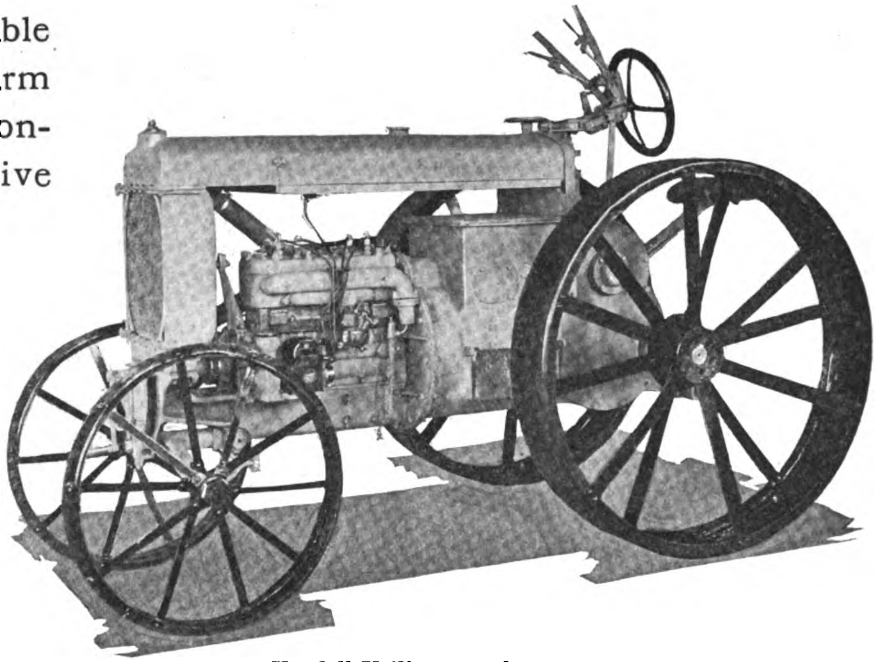
It was not possible for Congressmen to know, for example, of such details as the practice of dealers buying chassis and bodies separately and bolting them together. And it is not strange that no provision was made to prevent the double taxation that occurs with this transaction.

Similarly Congress does not know the intimate details of the automotive industry in its relation to a tariff, and whether we have a series of tariff treaties, a bargaining tariff or some other form, it is essential that industry should take an active part in drafting the bill.

Our export trade, which has gathered such great momentum and now gives promise of huge development, can be ruined completely by the formulation of a law that lacks the fine points which business men only can add to it.

Kardell Utility Tractor

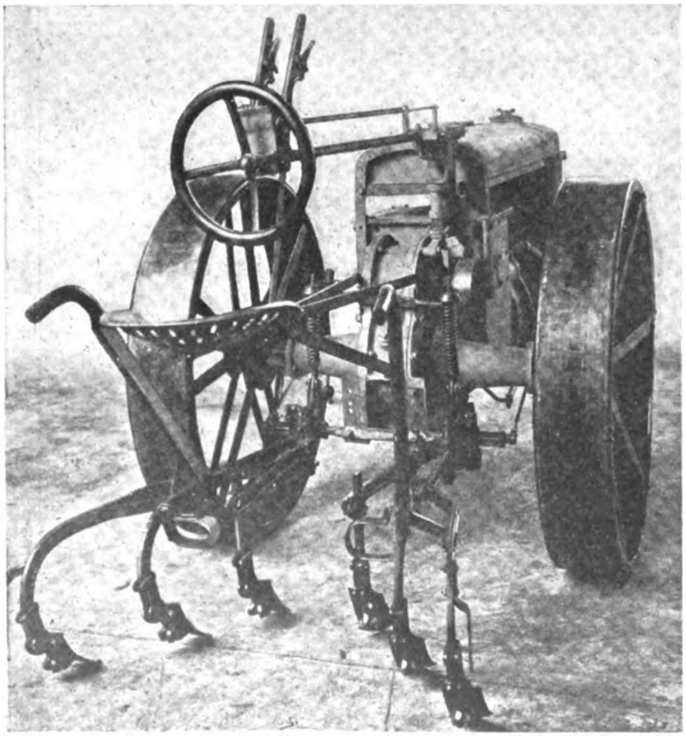
A 2-Plow Tractor Also Suitable for Cultivating and Other Farm Work—Backbone Frame Construction and Enclosed Drive



Kardell Utility two-plow tractor

A LIGHT tractor with several up-to-date features is announced from St. Louis by the Kardell Tractor & Truck Co. In the words of the makers, the utility of the machine is not limited to plowing and other operations necessary in preparing the seed bed, but it serves equally well for handling any type of cultivator, mower, grain or corn binder, hay rake, manure spreader or wagon, and for belt work. The machine is of compact design, the four-cylinder engine and transmission, bolted together, spanning the distance between the front and rear axles, and the wheelbase is comparatively short. The engine is of the company's own make. It is a four-cylinder design, of 3¾-in. bore by 4¼-in. stroke, all four cylinders being cast in a block, with a detachable cylinder head. The crankcase is cast separately and is of the barrel type. It is cast at the rear end with a large flange, to which the transmission is bolted, and at the front with a heavy bracket swiveled on the front axle.

As regards fuel, the makers say that either gasoline or kerosene can be used. The fuel tank, which forms the cover over the engine, is of heavy gage sheet metal, and is of ample capacity. A Bennett carbureter is used, and all air is drawn in through a Bennett air cleaner. Ignition is by a Dixie high-tension magneto with impulse starter. Lubrication of the engine main bearings is by force feed, but all other bearings are lubricated by splash. The plunger-type oil-circulating pump is clearly shown in the side view of the tractor. All gears are fully enclosed in a dustproof case and run in oil. Circulation of the cooling water is effected by gravity. The honeycomb radiator has cast-iron top and bottom tanks and side spacers. The latter are strong enough to afford ample protection to the radiator core. The total water capacity of the cooling system is 10 gal. It will be noticed that the belt-driven fan behind the radiator is enclosed by a shroud.



Rear view of Kardell tractor, with cultivator attached. Note seat and control extension used

Transmission Design Unconventional

The arrangement of the transmission is out of the ordinary. There are two parallel shafts back of the engine, a primary shaft in line with the engine crankshaft and bolted to it and a secondary shaft vertically above the former. The primary shaft is of the splined type and carries three gear pinions of ample face width upon it. Two of these pinions, for the first and second forward speeds respectively, can be slid along the shaft by means of a suitable sliding arm. The secondary shaft carries three large diameter spur gears, for the first and second forward speeds and the reverse speed respectively, the two forward speed gears being combined in one. All these gears are free upon the shaft, but can be secured thereon by plate clutches of the Kardell company's own design, one clutch serving for the two forward speeds and the other for the reverse. Thus, there are two independent friction clutches, one for forward operation and one for reverse, and as these are not located inside the flywheel the gear case is somewhat more bulky than is usual. Naturally, as the clutches operate at a much lower speed than if they were carried on the primary shaft, they have to be of considerable size. The speeds of the tractor are given by the company as 1½-2½ m.p.h. on low gear and 3-6 m.p.h. on high gear. This points to the fact that no governor is used, and the speed can be controlled by the throttle to quite an extent. From the secondary shaft of the transmission the drive is through a bevel pinion and bevel gear to an intermediate shaft on top of the rear axle, and thence by spur

gear to the differential gear on the rear axle. All gears are completely enclosed and run in oil. Anti-friction bearings are used throughout the drive.

A belt pulley is provided; it is not visible in the illustrations. It is located at the forward end of the tractor, parallel with the wheels, and any belt slack can therefore be quickly taken up. The pulley has a diameter of 9 in. and a width of face of 5 in.; at normal engine speed it turns at 1000 r.p.m., giving a belt speed of 2300 ft. per minute.

The rear axle is of the live type, and carries the differential gear at the center. The central portion of the axle housing is cast integral with the transmission housing, and over the large openings in this central portion are secured horn-shaped housings of cast steel, which surround the axle shafts. Gurney ball and Hyatt roller bearings are used in the rear axle and Timken roller bearings in the front wheels.

Driving Wheels of Latest Tractor Design

The driving wheels are 48 in. in diameter by 8 in. width of face, and are equipped with quick-detachable lugs. These wheels are of the latest tractor design, with flanged rolled-steel rims, flanged cast hubs, and flat spokes which are riveted to both hub and rim. The front wheels are 36 in. in diameter and are provided with skid bands. Steering is by means of a hand wheel on a rearwardly extending shaft which carries a bevel pinion meshing with a larger bevel gear on a vertical shaft. The steering gear is so arranged that the tractor can be operated from the implement. Directly in front of the steering wheel there is a double sector on which the clutch and change-gear levers are mounted. A band brake is fitted to a drum on the shaft of the spur pinion, outside the transmission housing.

The hitch of the Kardell tractor is located 7 in. below the center of the draft line, which is claimed to obviate all tendency of the tractor to "rear." The I-section front axle is so mounted as to allow a free movement of oscillation, thus permitting the tractor to accommodate itself to any unevenness of the ground surface, and of running the wheels on one side of the tractor in the furrow without subjecting the tractor to any additional strain. The front end of the engine crankcase forms a support for the front axle and radiator, starting crank and belt pulley. The spring support of the front end is shown in the longitudinal sectional view, and although the spring used is of the coiled type there is no sliding motion corresponding in extent to the spring play, the part on which the spring rests having a pivot support on the bottom of the crankcase, and having only a slight rocking motion.

The total length of the Kardell Utility tractor is 98 in., and its width 56 in., but the driving wheels can be reversed on the axle and thus the width reduced to 40 in. when desired. The height of the tractor is 52 in. and the weight approximately 2200 lb.

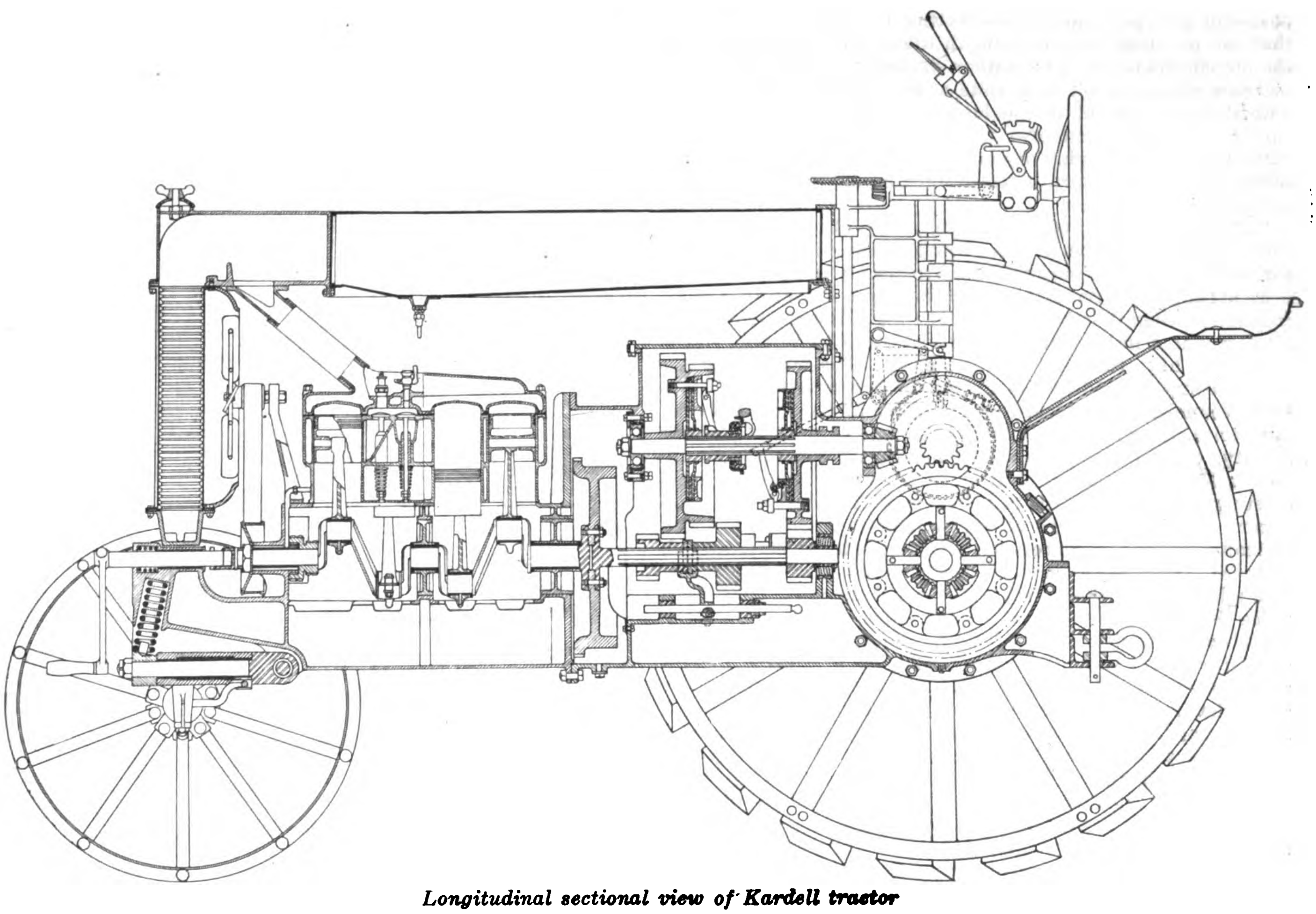
The tractor is rated at 8-16 hp., and is recommended for pulling two 14-in. plows. Provisions are made on the engine for installing an electric generator for night illumination and also for mounting an electric starter.

There is a dash secured to the rear end of the transmission housing, and the fuel tank extends between this dash and the overhanging top water tank of the radiator.

Anti-Friction Bearings in Grain Binders

AN important advance in the construction of grain binders has just been made by the Moline Plow Co., Moline, Ill., which has adopted the use of Hyatt roller bearings in its binders.

One enthusiastic writer compares this step to the invention of the Marsh harvester in 1864 and the development of the Appleton knotter in 1880. Not less than 37 of these anti-friction bearings are used on the Moline, and among the advantages gained are that the friction is reduced, the need for the daily oiling of numerous bearings obviated, and the binder is suited for operation at tractor speeds, which are considerably higher than horse speeds.



Longitudinal sectional view of Kardell tractor

Benzol Production at Gas Works

Steps Being Taken by British Benzol Producers to Insure General Distribution of the Fuel—Description of a Small Rectification Plant

PREVIOUS to the war benzol was used as a motor fuel only in France and Germany, but in recent years much interest has been aroused in its possibilities in Great Britain and some even in the United States. Great Britain is interested chiefly because of her keen desire to find a suitable home-produced fuel. It is only natural that most of the pioneer work in connection with new fuels should be done abroad, because the United States is the greatest petroleum producing country in the world and the price of gasoline has always been materially lower here than in the principal European countries. However, we have recently had our attention focused on the fact that our unmined supply of petroleum is rapidly dwindling, and as this is brought home to the consuming public and to the industries which are mainly dependent upon a volatile liquid fuel interest in substitute fuels will grow rapidly.

Most people having anything to do with automobiles know that benzol is a by-product of the coking of coal in gas works or coke oven establishments, but few know anything of the details of the process nor of the quantities in which the fuel may be recovered. Some light is thrown on these subjects by a recent article in *The Engineer*.

The Problem of Distribution

"The sudden termination of hostilities found British gasworks and coke-oven undertakings wholly unprepared with a post-war policy as to the marketing of their benzol. Now that the producers are faced with the problem they find that the distribution of several million gallons per annum is by no means a simple problem, in spite of the demands for the fuel. Two distinct lines of action have been proposed, namely, to turn the whole output over to the gasoline interests and to make use of their highly organized distributing machinery, or to set up the necessary organization for an entirely separate scheme of distribution.

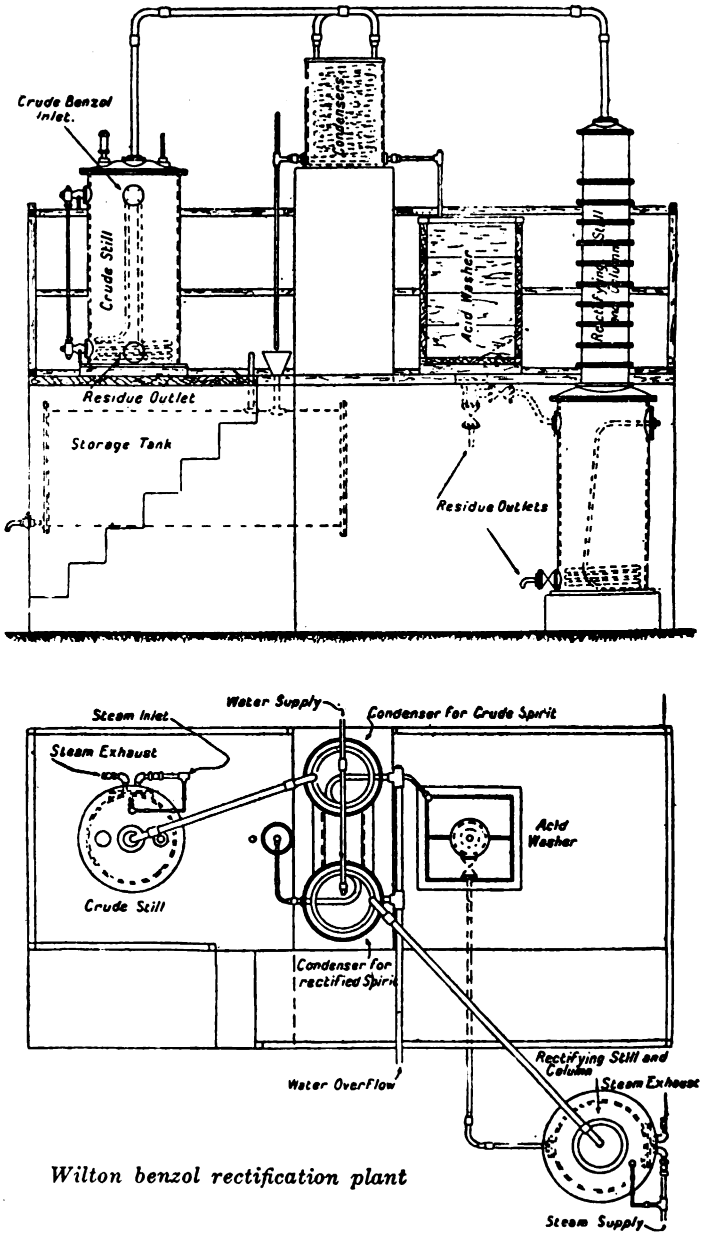
"At the present time, of course, many of the large coke-oven undertakings place their benzol at the disposal of motorists, but they are only prepared to supply in 50-gal. drums—an arrangement not altogether alluring to any but the large consumer, when it is borne in mind that coke-oven works are all segregated in the northern districts, and that special railway rates have to be paid on the spirit. The whole problem is now being tackled by the Benzol Producers' Association, a small committee of which, representative of the gas and coke industries, is considering such questions as specifications for quality, etc. It is understood, too, that the gasoline purveyors have been approached as to use being made of their existing facilities for distribution, and that the benzol producers consider a charge of approximately 2d. per gallon as appropriate for the concession. From what can be gathered, however, it is believed that the negotiations have fallen through owing to the petrol purveyors demanding more than twice that sum.

"It has often been argued that, owing to the ubiquity of gasworks, there should be no difficulty in arranging for innumerable depots for supply in all parts of the country, but while that is true in a sense, it must be remembered that it is exceptional for gasworks to take the process any further than the recovery of the crude spirit, which would be most undesirable as a fuel. This crude spirit is accordingly dispatched to the isolated centers at which plants for purification and rectification are found. Thus the double handling and transport have proved a costly item.

"In the past it has not been considered a commercial proposition for any but the largest gasworks to put down rectification plant, but the demand for a simple process of the kind has now led to the introduction of apparatus which can, without doubt, be profitably installed at all those gasworks employing 8000 tons of coal per annum and upwards. There are approximately three hundred works in England alone—exclusive of Wales and Scotland—which would fall within the limits named. As a supplement to these stations, there would be the coke-ovens in the North, and some provision could probably be made for increasing the poorer resources of the southern districts from them.

Every Gasworks a Depot

"Already a number of the miniature rectification plants, suitable for the small producers of the crude spirit, have been put on order. A plant of the kind, operated on the Wilton



Wilton benzol rectification plant

principle, is shown in the accompanying illustration. This plant appears to possess the merit of combining simplicity with moderate capital outlay. The crude benzol, recovered in the ordinary manner by means of the comparatively simple process of oil-washing, is, in the first instance, run into a crude still which merely consists of a small boiler to which is attached a simple column. Distillation is effected by means of steam coils, and the light products are distilled off, passing through a water-cooled condenser of ordinary construction from which, in the liquid state, they gravitate to the washer.

"In the larger motor spirit plants it is usual to arrange for secondary distillation, that is to say, the 'once-run' spirit is collected in a separate storage tank, and subjected to further distillation in the secondary still prior to undergoing the washing process. This secondary distillation, however, may be eliminated if the precaution be taken to work up the original crude spirit to a strength of from 70 to 80 per cent at 120 deg. Cent.

"One of the contingent advantages attached to the process of recovering crude benzol is the freedom gained from naphthalene troubles. The wash-oil with which the coal gas is treated, if of the correct composition, not only removes the light-boiling hydrocarbons, but the greater proportion of the naphthalene as well. Thus, benzol recovery offers a further very substantial inducement. It is for this reason that the residue which remains in the crude still of the motor-spirit plant consists of creosote oil highly charged with naphthalene. The economics of the process are such, however, that no product need now be regarded as waste, so that the creosote oil may be separated and sold as a by-product, while the naphthalene may also be refined, when it will command a good price. The creosote, of course, is derived from the original wash-oil employed, a small proportion of which invariably comes over with the crude spirit during primary distillation.

"As regards the light products obtained from the still of the motor-spirit plant, they contain such impurities as tar acids, tar bases, and sulphur compounds, which, of course, must be removed. For this purpose the distillate is treated with sulphuric acid and caustic soda. In the larger rectification plants agitation during washing is carried out by mechanical means, but, with the plant for the small gasworks, hand agitation is arranged for in order to avoid every possible complication. After the purification treatment the distillates are run by gravitation to the final rectification still, which consists of a dephlegmating column standing on a boiler. The contents of this final still are distilled off by means of steam, the distillates—representing the finished motor spirit—passing away through a water-cooled condenser, and thence to the underground storage tank."

Cammen Carsafe Load Governor

A SAFETY device which makes it impossible to start a motor truck when it is overloaded has been developed by the Cammen Laboratories, 42 West Thirty-ninth Street, New York. It consists of two parts, a registering device (Fig. 1) and a control device (Fig. 2). The registering device takes the place of the usual spring shackle and is a casting which has to be designed specially for each make of truck. The upper part, A, of the registering device is attached to the chassis and the lower part, B, carries the spring bolt, the two parts being hinged together at the right in Fig. 1. Part A carries an oil reservoir on which pressure is exerted by a plunger through a welded-in bronze-diaphragm. This pressure is transmitted to the Bourdon tube in gage C.

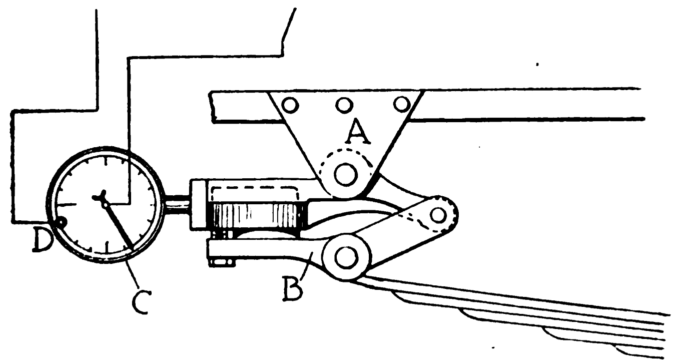


Fig. 1—Outline drawing of Cammen Carsafe.

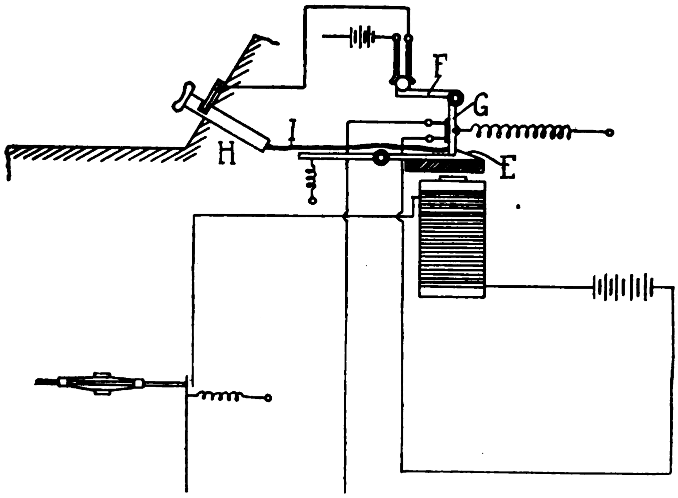


Fig. 2—Diagram of electrical connections.

The gage C is equipped with a circuit closing device so located that it is reached by the pointer when the load on the truck exceeds a safe limit. Let us say that the manufacturer or user desires to have a useful load of not more than 2000 lb. This, for a given truck, means that the load on each side of the rear axle should not exceed, say, 1600 lb. The circuit closing pin is then set at 200 lb., which is the load registered through the hydraulic transmission by the gage when the load on the truck is 1600 lb. for each side of the rear axle. It is generally sufficient to equip one side of the rear axle with a governor, the load being usually evenly distributed on the truck.

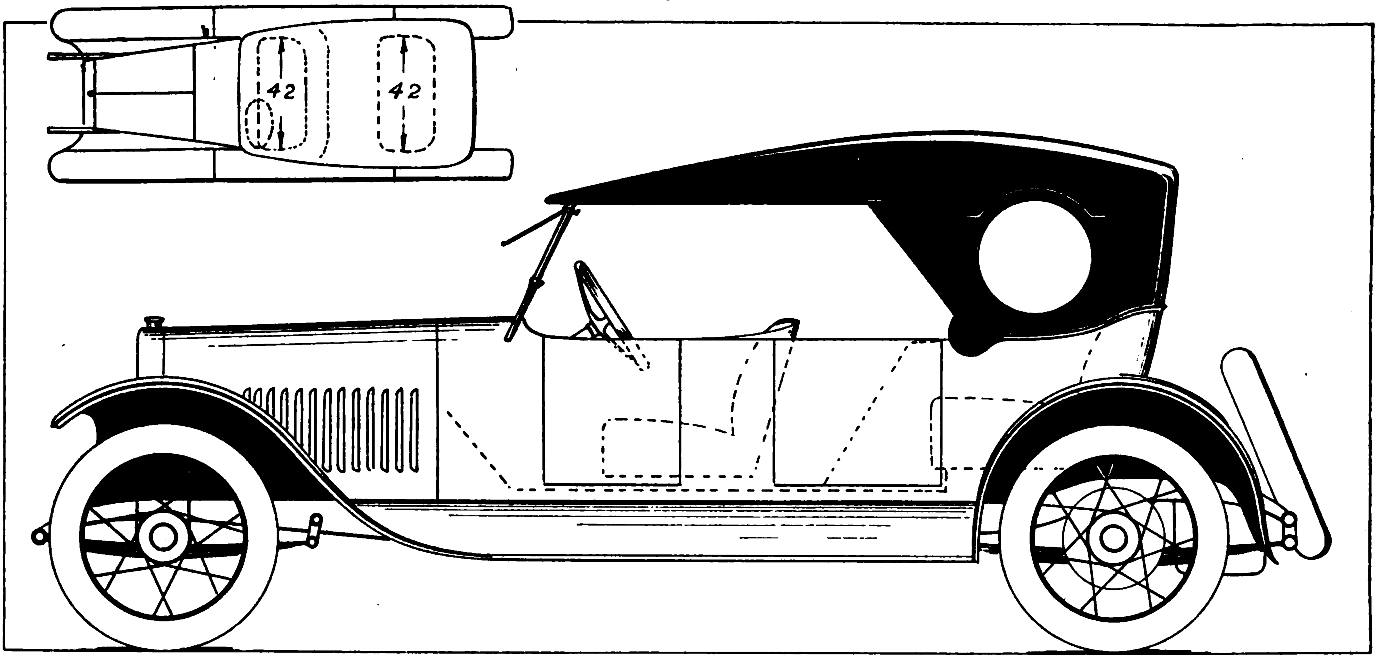
When the load exceeds the safe limit the pointer of the gage reaches the circuit pin D and thereby closes an electric circuit. This energizes an electromagnet (Fig. 2) and the latter then attracts its armature. This in its turn withdraws the catch, E, and permits the spring to pull over the bell crank, F, thereby opening the ignition circuit so that the engine cannot be run.

At the same time, however, the swinging out of the bell crank draws away the metal plate, G, against which press contact brushes, which opens the circuit around the electromagnet. In this way both the ignition circuit and the control circuit are automatically opened. The advantage of this is that the electromagnet may be made to carry quite a heavy current without exhausting the battery.

When the spring draws back the bell crank the latter strikes a bell (not shown in the drawing), which notifies the driver that the truck is overloaded.

Once the ignition circuit has been opened it will stay open until closed again by the driver. To do this the driver has to pull the rod, H, as far as it will go.

To prevent drivers from tampering with the governor the pull rod, H, which closes the ignition circuit, is made interlocking with the ignition switch. A slot is provided in the rod and the ignition circuit can be closed only when the switch feeds into this slot; but when the rod is in such a position that the ignition switch does feed into the slot, the cable, I, is quite loose and the bell crank cannot be held manually against the tension of the spring, which would be the only way to hold it if the truck was overloaded and the circuit through the electromagnet closed.



Close-coupled touring body with top having Victoria lines and windshield extension

A New Design Touring Body Top

Built on Lines of Victoria, with Windshield Extension and Drop Curtains Entirely Enclosing Rear Seat

By George J. Mercer

NUMERICALLY, the touring body is still the most favored of the body designs, although it has been predicted that it would be succeeded eventually by some type of closed body, because the occupants of the rear seat of open cars are subjected to the discomforts of dust when touring. But the touring body still holds its own and there have been many additions to make it suitable for all-year use, such as demountable and convertible tops as well as several forms of touring tops that have either a window or curtain arrangement that serves very well in keeping out the wind and rain.

The most popular type of touring body to-day is the close-coupled for four or five passengers. The chief advantage of this body type is that the rear seat is well forward of the axle, permitting a better arrangement for the comfort of the rear passengers. For example, with no auxiliary seats to be accounted for, a second windshield can be designed and fitted with an assurance that it can be made to work, because adequate space is available for operation.

Windshield with Drop Curtain

The design illustrated is an entirely new design of top that can be used with any close-coupled touring body. While it would be possible to make it demountable, far better results will be obtained if it is made permanent with the body at the time of construction. As it is intended to have the side windows drop down full length, pockets must be provided for them and the top must be well braced. A permanent ironed job is better than a take-on-and-off design.

This top has the lines of the well-known Victoria with the addition of an extension to the windshield. The design illustrated does not fold down, therefore no side braces with joints are needed and the windows can be made much larger. The rear lights are stationary.

The novel feature about this top is the windshield that with the aid of a drop curtain entirely closes in the rear seat. In Fig. 2 the shield and attached curtains are shown in position entirely closing up the front of the top. This glass is 21 in. long by 44 in. wide, and when in position has the same slant as the front line of the top. At the top are two spring pins that rest on the guide plates, on each of which there are two depressions. The pins rest in these depressions when in the two positions illustrated by dotted lines. In explaining this, we will start from shield position No. 1, which is also shown on the section. Position No. 2 is reached by releasing the shield from its fastening at the bottom and pushing it over as indicated by the arrows until the bottom is in line with the pocket into which it will eventually drop. In making this swing the shield is supported by the pins at the top which rest in the rear depressions in the guide plates.

When the shield is in this position, No. 2, a lip or plate on each side of the pocket is thrown up by revolving a knob, preventing the shield from swinging back again to the perpendicular. The shield is now resting loosely in the pocket opening. In order to provide room for getting in or out, the top of the shield is pushed along the guide plate until the pins engage in the depressions at the forward end of the plate. This brings the shield into the perpendicular position, No. 3. The shield may be used in any one of these positions. When not in use, it is first moved back to No. 2 position, and the pins drawn out of the depres-

sion in the plate by compressing the springs by means of the knobs on the frame for this purpose. The shield is then lowered into the pocket, position No. 4, where it is safely stored away and is flush with the top edge of the body.

When the shield is in use as in position No. 1, the rest of the space down to the floor is taken care of with a curtain, fastened to the back side of the shield with buttons and kept away from the knees by being fastened to each door, so that it has a tent shape that will be more comfortable. Above the shield the space is similarly enclosed by a short curtain fastened permanently to the top, and to the upper edge of the shield in the same manner as the lower curtain. This upper curtain is detached when the shield is dropped into the pocket.

This shield actually makes a combination body that is a novelty. In position Nos. 2 and 3 protection is assured from stormy winds and in position No. 1, with the drop curtain in place, the interior at the rear is virtually a closed body. When it is desired to put the shield away, it is dropped into the pocket at the rear of the front seat and carried with the minimum of strain on the body because the weight is low. It is out of sight and always ready for instant use.

There are similar top and combination shields used on the Pacific Coast, and are called California Tops. In all cases, however, they are an adaptation of the Demi-Limousine type and the shield is either slid up to the top and held there when not in use, or is parted in the center and turned inward toward the side when open for entrance or egress. Carrying the shield in the roof is very objectionable, as the additional weight is liable to weaken the top supports.

Wood and Aluminum Frame

The frame work of the top is of wood and quite stout. The round corners of the rear and the top are best formed of aluminum sheet and the imitation leather stretched over. A metal foundation of the rounded surfaces will insure a permanent shape and add to the durability of the goods, as all action set up by straining will be obviated. A drip molding is used on the sides to guide off the water from the top and a cod piece similar to that used on a real Victoria is formed at the base to add to the appearance. The top is lined on the under side, and as it will get a deal of dust, a tan or tan and gray shade of cloth will be best suited for wear, and slip cover should be used over all, or if unlined either painted wood finish or cane work are equally adaptable.

The side glass can be much larger and of different shape if desired, but that will be a matter of individual taste; as to the color of the top, any shade can be had and any one will give service provided the quality is there. Imitation leather for ordinary work and real leather for high class would be a sensible specification.

This design should be very acceptable to that considerable class of car users in the large cities that have favored Victoria tops both in season and out. It has enough of the Victoria to be of the same family, and in addition it possesses distinctive features that make it well adapted for town car use. The several positions on which the shield can be used will accommodate all kinds of weather, and in particular, will the closed-in position be a distinct adjunct.

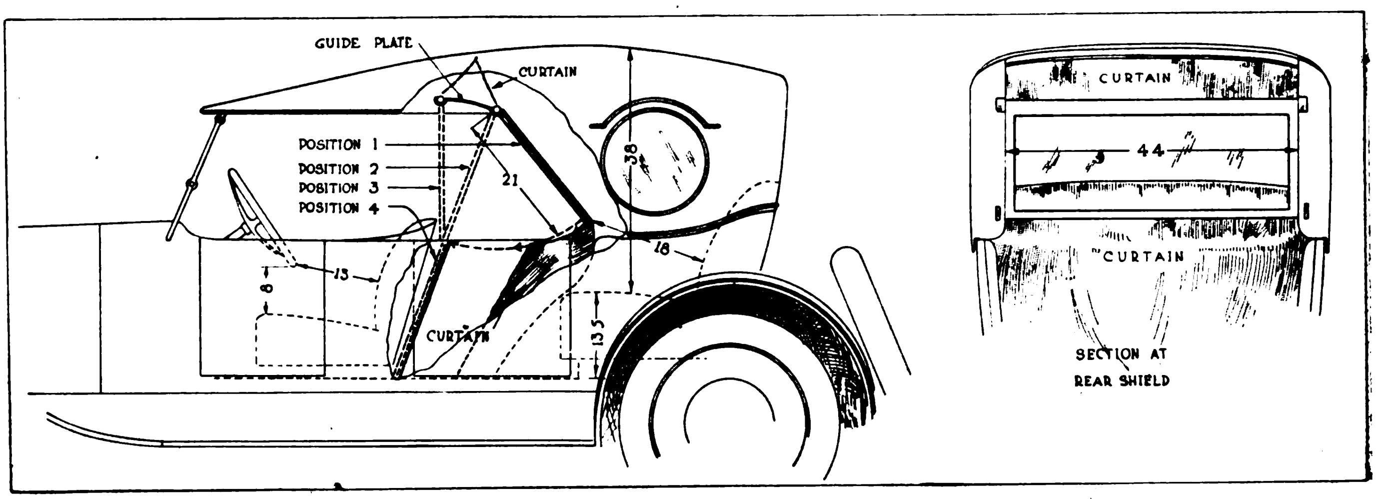
Should Appeal to Users of Victoria Top

The turning of a body of this type will be more elaborate than with the ordinary touring body. There should be a speaking tube or phone for communicating between the seats when the rear is closed. This can be easily carried on the roof. The trimmings can be a combination cloth and leather, the latter being entirely used for the driving seat.

The body design is similar to the accepted type seen at the recent shows. The seats are ample for comfort. The rear cushion is higher from the floor than the front, making it easier for a stout person to rise to a standing position than if the seat were low, and ample leg room is provided for all occasions. The extra tire is at the rear, where the weight is needed on most cars, especially when no passengers are carried on the back seat.

The dimensions of the body side light as well as size of doors, etc., are omitted in the drawings, but can be easily ascertained by measuring. One of the top dimensions, it is well to call attention to, is the distance between the lower edge of the shield and the turning of the back. This is 18 in. and is a very generous distance so as to remove any use of being packed in, when the shield is in position No. 1.

ACCORDING to the *American Gas Engineering Journal*, toluol being no longer used in large quantities for T. N. T., stocks are rapidly accumulating. A brisk demand for both benzol and toluol is predicted as a result of the establishment of the dyestuffs industry in this country. But there is no need to wait for that. Benzol, toluol, and solvent naphtha, now a drug in the market, can be sold mixed for motor-fuel. For that use it is worth 20 per cent more than gasoline.



Windshield and attached curtains entirely close front of top when in position

Continental Plant Layout Facilitates Production—II

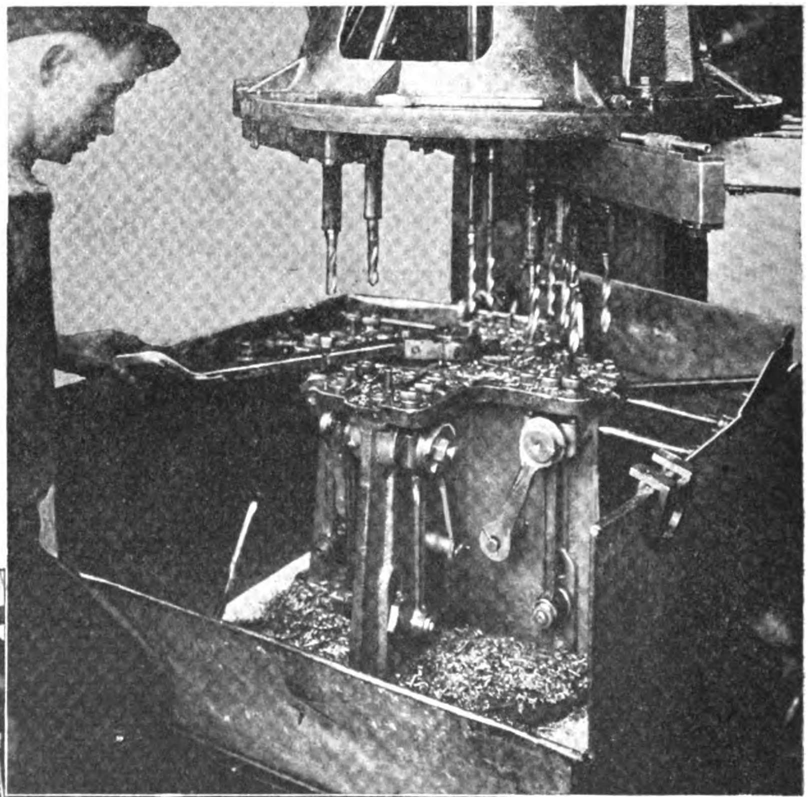
Engine Shipments Go Out on Same Tracks on Which Raw Parts Enter—True Progressive System Used

By J. Edward Schipper

ANOTHER important semi-automatic, compound machine in the piston department at the Continental plant is that which turns the pistons and grooves them. This machine is capable of turning and grooving 100 pistons per hour. The turning tool first descends, roughly turning the pistons to size. After this has done its work in a vertical direction, the groove cutters move over against the piston and cut the grooves to the proper depth. As soon as this depth has been reached the machine cuts off automatically. The pistons then pass on to be finish-turned and finish-grooved, ground and drilled for set screws, etc., finally entering the assembly department.

A machine in the connecting rod department which is of particular interest is that for drilling the holes for the connecting rod bolts in the crankshaft end of the rods. This machine, illustrated in Fig. 10, has ten spindles and a square table. The fixture accommodates eight rods at one time, six rods being actually machined at once, while the remaining two are being set up by the operator. The machine is capable of handling fifty-eight rods per hour. By the use of this machine, with the operator continually setting up two while the other operations are taking place, one man is able to handle this work on a single machine.

The oil pans and other deep drawn parts are made in the Continental factory, there being a special department for this purpose, where large presses are used. These



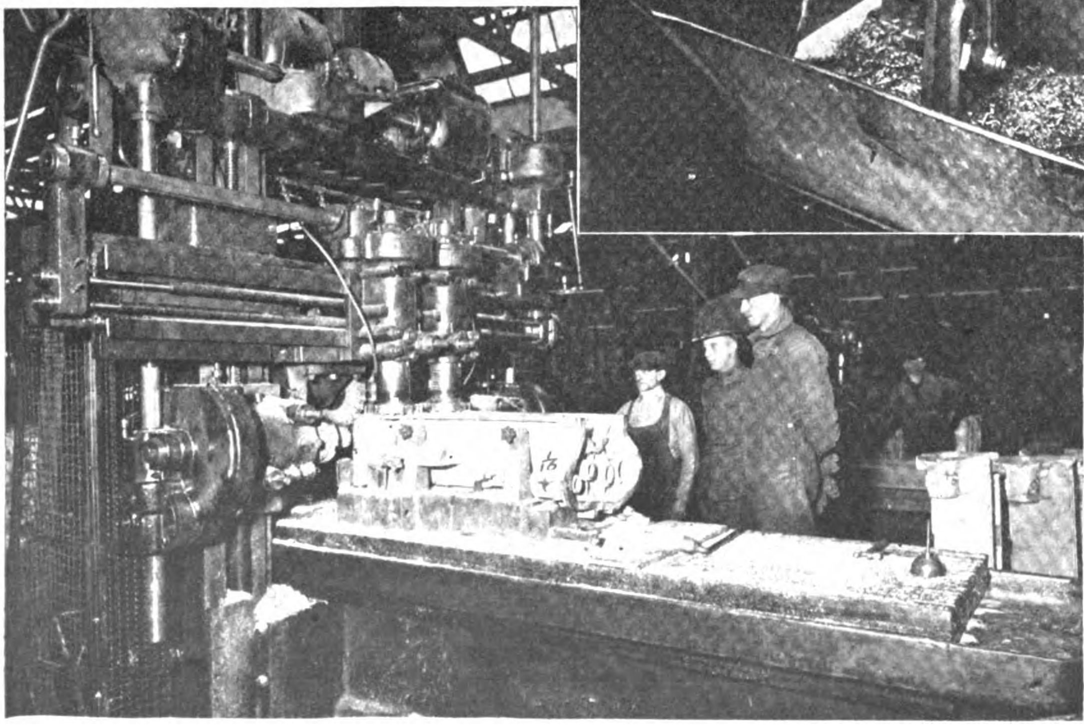


Fig. 10 — Fixture for drilling holes for connecting-rod bolts in crankshaft end of connecting-rods. This fixture accommodates eight rods at one time. Six rods are machined at once

Fig. 11—Machining operation on aluminum crankcase. Six surfaces are being machined at one time

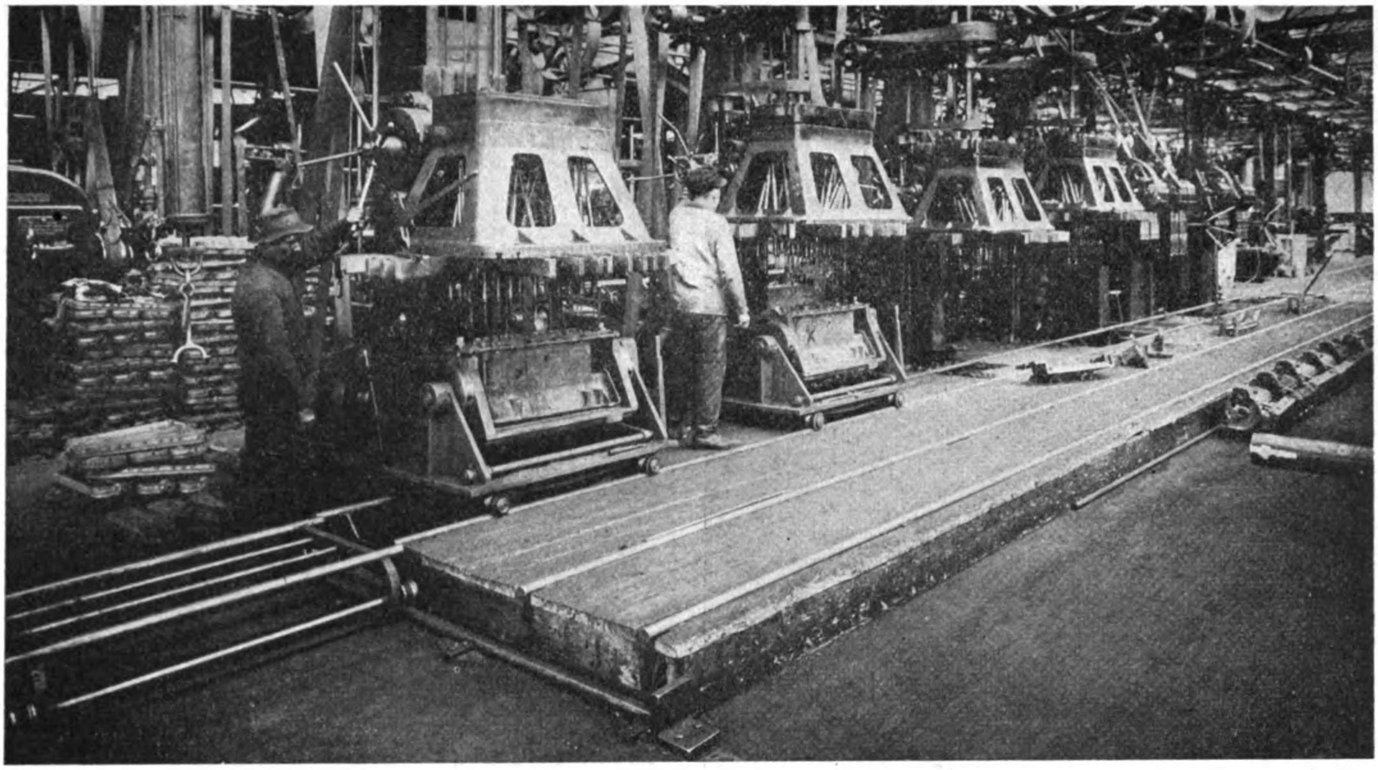


Fig. 12—Railroad fixture for drilling and reaming holes in cylinder block for valve stem and push rod guides. This set-up also takes care of valve seats and all holes and machine work related to the valve mechanism

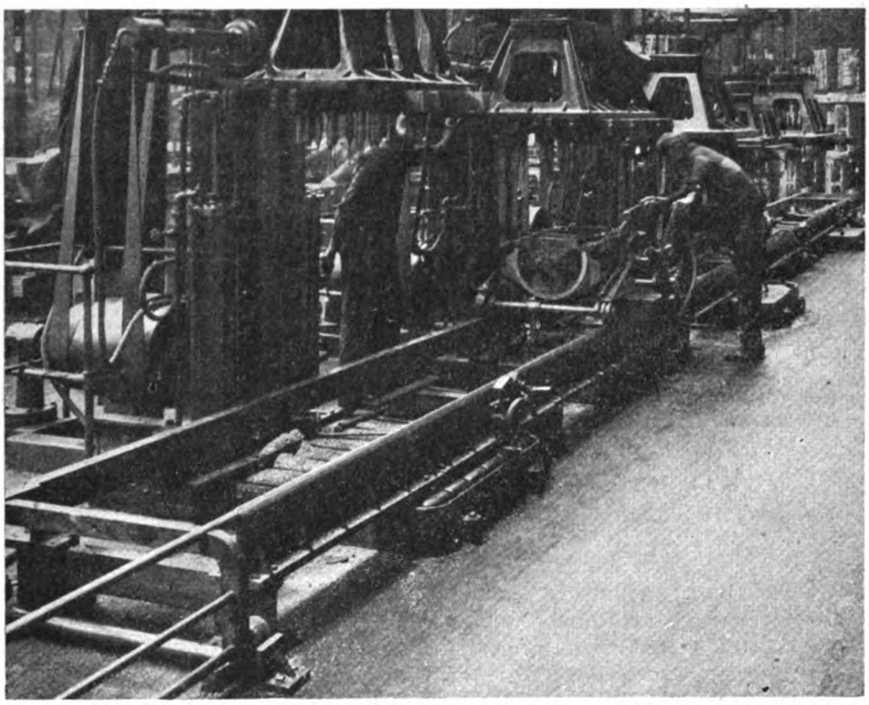


Fig. 13—Railroad fixture which drills all holes in aluminum crankcase. This fixture is operated by two men and requires approximately 3 min. for drilling all the holes

machines are the product of the E. W. Bliss Co. of Brooklyn, N. Y., and are capable of handling the deep drawing necessary for the oil pans in one operation.

In the crankcase departments a great variety of machinery and operations are necessary due to the six different models which are passing through. Some of the models have aluminum cases, and in one particular model, the Continental 7 W, the top part of the case is in unit with the cylinder casting. On the aluminum cases the greatest number of operations are performed, these being for the larger and more complex models. The milling machines for the aluminum case, shown in Fig. 11, are milling six surfaces at the same time. This is a long table machine and is the true starting point in manufacture on this case. The machine is capable of handling nine cases per hour. A high-speed miller is used for milling off the face of the crankcase to which the cylinders are bolted.

The drilling, reaming and tapping work on the aluminum cases is handled on a railroad-type drill with a single jig traveling along a rail. This railroad is a single-track type in which the jigs work along in one direction and is then rolled back. This railroad outfit is shown in Fig. 13. There are five sets of spindles to take care of the major part of the operations of this nature on the case.

A more complete type of railroad drill is used in connection with the cylinder manufacturing operations. This is shown in Fig. 12. It is a double track railway with a cross-over at each end, so that the carriers for the jigs can be moved back on the outside rail. There are eight operations on these jigs, and it takes a cylinder block of the type shown in the illustration about 20 min. to go the length of the railway. Four cylinder blocks are usually in process at a time. These spindles take care of practically all of the drilling, tapping, reaming and similar operations on the block, and the jigs are so arranged that

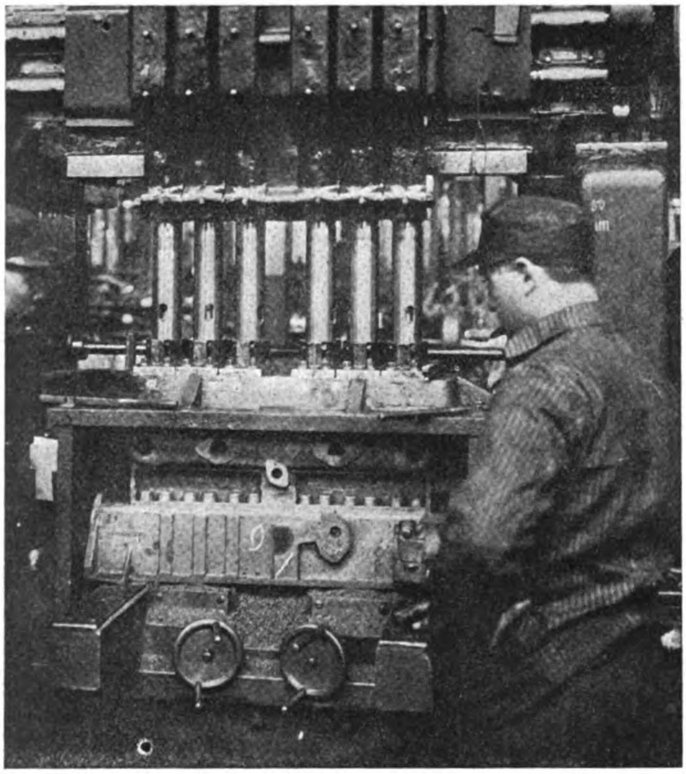


Fig. 14—Boring six cylinders at one operation

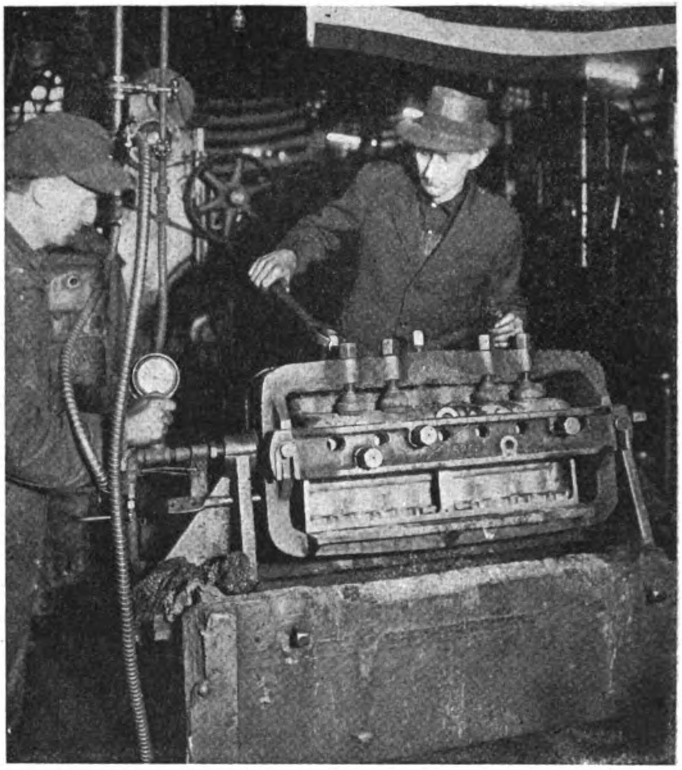


Fig. 15—One of the three water tests given each cylinder block. The first test is on the rough casting; second, after the cylinders are bored; third, after the cylinders are ground

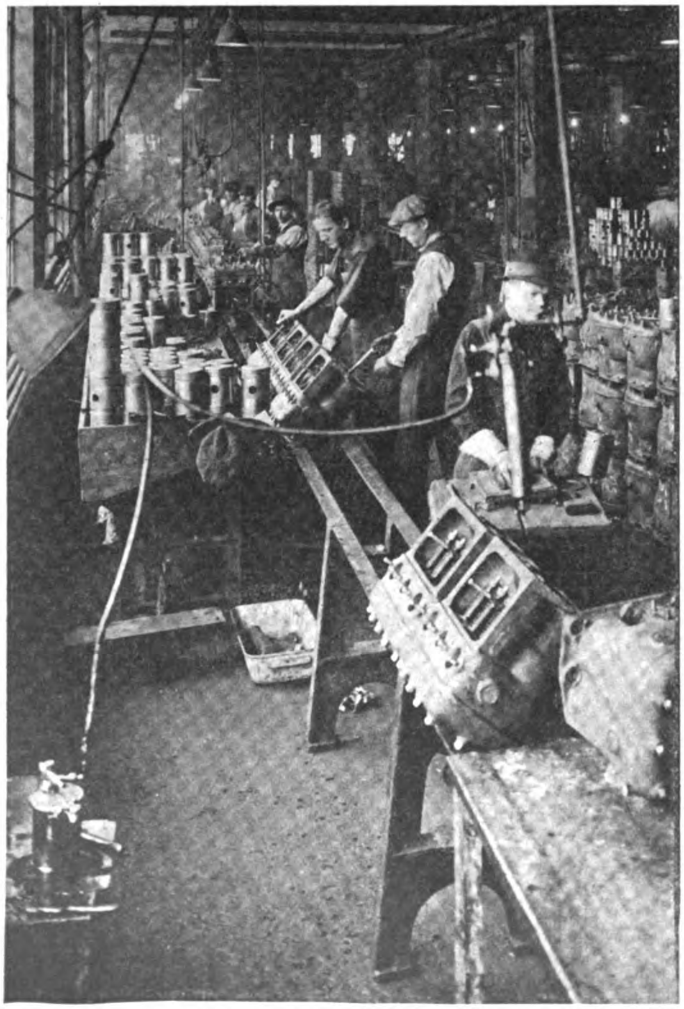


Fig. 16—Assembly department, showing racks tilted to the proper angle for fitting pistons to cylinders.

they can be turned over in the carriers to accommodate the block to the required position for the different operations.

In cylinder boring, all six are bored at the same time, this operation bringing the cylinders within 0.002 in. of the finish bore and preparing them for grinding. The boring machine, operating on six cylinders at the same time, is shown in Fig. 14. It takes about 30 min. to handle one six-cylinder block.

All of the manufactured parts go to the finished stockroom before they are started to the assembly line. This stockroom is on the opposite side of the manufacturing department from the raw stock, from which manufacture started. From here the parts are drawn at the proper point along the assembly line.

Assembly starts with the crankcase working along one line and the cylinder along the parallel one, the first operation being the passing of the castings through Blakeslee washing machines, where they are cleaned in hot alkaline solution. They are then air cleaned and the standard assembly operations started. The assembly starts along the back end of the building, and, as shown by the map herewith, works its way around three sides until it returns to the assembly and shipping departments, as shown on the diagram.

As the engine cylinder block progresses, the valve guides are pressed in and a set of piston rings selected so as to have a gap of 0.002 to 0.004 in. at the bottom and from 0.004 to 0.006 in. at the top. The cylinder head water jackets are given a water test, as illustrated in Fig. 15, so that leakage due to sand holes or other defects in the castings will be determined before the engine has passed along the assembly line. The gage in the illustration shows about 90 lb. pressure.

Along the assembly line the racks are all so arranged that the engine is at a convenient angle for the operator. Referring to Fig. 16, a sort of groove support is used

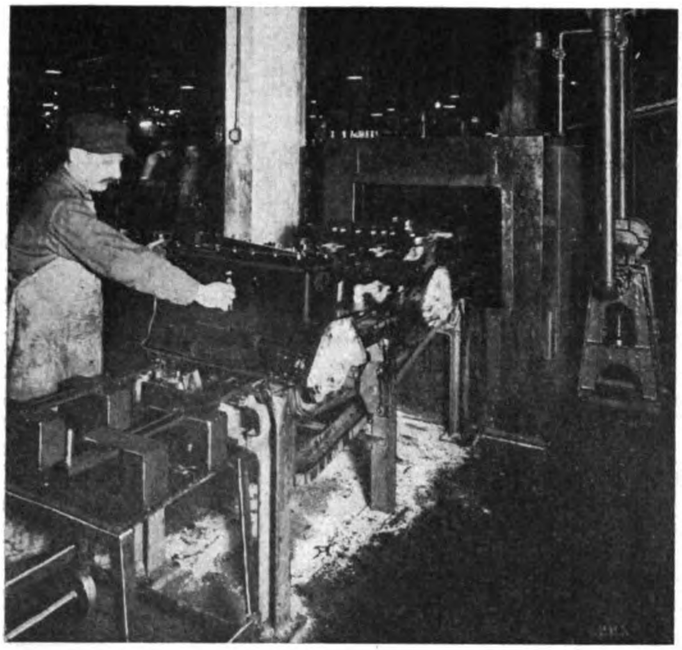


Fig. 17—Entrance to drying oven at Continental plant. Cylinders are fed through this oven on endless chain, the drying process being completed by the time the cylinder reaches the opposite side of the oven

for the blocks so that the operator can readily use his eyes in selecting the pistons, etc. Further along, the blocks will seem to be vertically upright where the operations are such as to require or make it advantageous to use the vertical support. The pistons are arranged in bins in the assembly department and are segregated in groups according to weights, so that all pistons which go into one engine weigh approximately the same. These groups of pistons are shown in the background of Fig. 16.

The valves are ground with a carborundum compound, after which the seats are cleaned with kerosene and the valves, caps, springs, etc., put in place. After the heads are put on, the cylinder blocks are painted, then passed through a gas drying oven, as shown in Fig. 17. The cylinders are fed to the drying oven on an endless chain, so timed that the drying process is complete by the time the cylinder reaches the opposite side of the oven. The smaller pieces have the paint sprayed on them in booths.

Final Assembly

After the painting has been completed the cylinder blocks move along to join the crankcase, upon which assembly has also been proceeding at the same time. When these parts are joined there is an overhead conveyor which carries the practically assembled engine over to the second side of the building, along which it moves on its way to the testing department. Here the final work is done on the assembly, the camshafts, manifolds, oil pans, etc., being put on, after which the tappets are adjusted, the timing gear cases fitted and all the minor accessories put in place, until the engine is complete and ready to be belted in.

Engines in practically completed state are shown in Fig. 18. These are just receiving their final assembly touches and are on their way to the testing department. The engines are run under outside power for 3 hr. at a speed of 150 r.p.m. They are then picked up by an overhead crane and set down on one of the testing blocks. Here they are run for 3 hr. under their own power, after which they are taken down and inspected and moved to a set of final test blocks for at least 2 hr. or until they have passed the final inspector's rigid test, at an average speed of about 900 r.p.m. The final testing room is shown in Fig. 19.

When they have satisfactorily passed their final test they are picked up and taken to the shipping department or are placed on the traveling chain, or endless belt shown at the right of Fig. 19. This carries them to the shipping room, seen in the rear in Fig. 23, and which is shown in a closer view in Fig. 20. Thus there are three

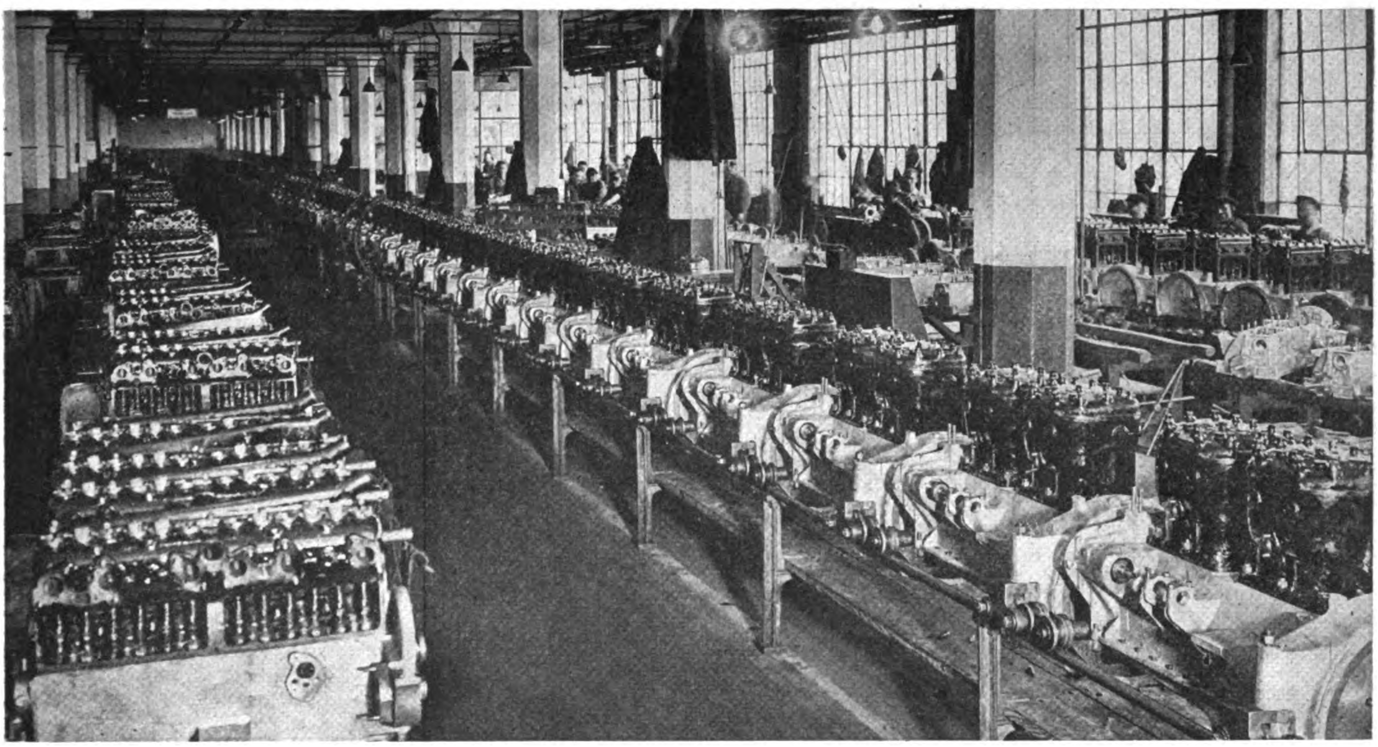


Fig. 18—Partial view of Continental final assembly department. This shows long lines of engines on their way to the testing department

Continental Block Testing Department

Fig. 19—This illustration shows the electric starters on tracks between test block and the endless belt on upper right which is controlled from and carries engines direct to shipping platform

parts to the Continental test: First, the running in, in which they are driven by external power; second, the first test run where they run under their own power; and, third, the final test before shipping. Should anything develop at the final test, the engines are taken down, adjusted and corrected, and again tested until they are satisfactory. It takes three overhead cranes to move the engines around the various parts of the test department, and, in addition, the endless belt carries them to the shipping department from the test room.

The shipping department parallels the track upon which the raw material first came in, the shipping platform being on the opposite side of the track from the receiving platform. Thus the engines in passing through the Continental factory have completed a circuit and, while never once retracing their path, have been progressively manufactured and assembled from start to finish.

This layout, which was developed during the time the company was engaged in the manufacture of Class B Government trucks, is being continually perfected and is resulting in increasing plant efficiency.

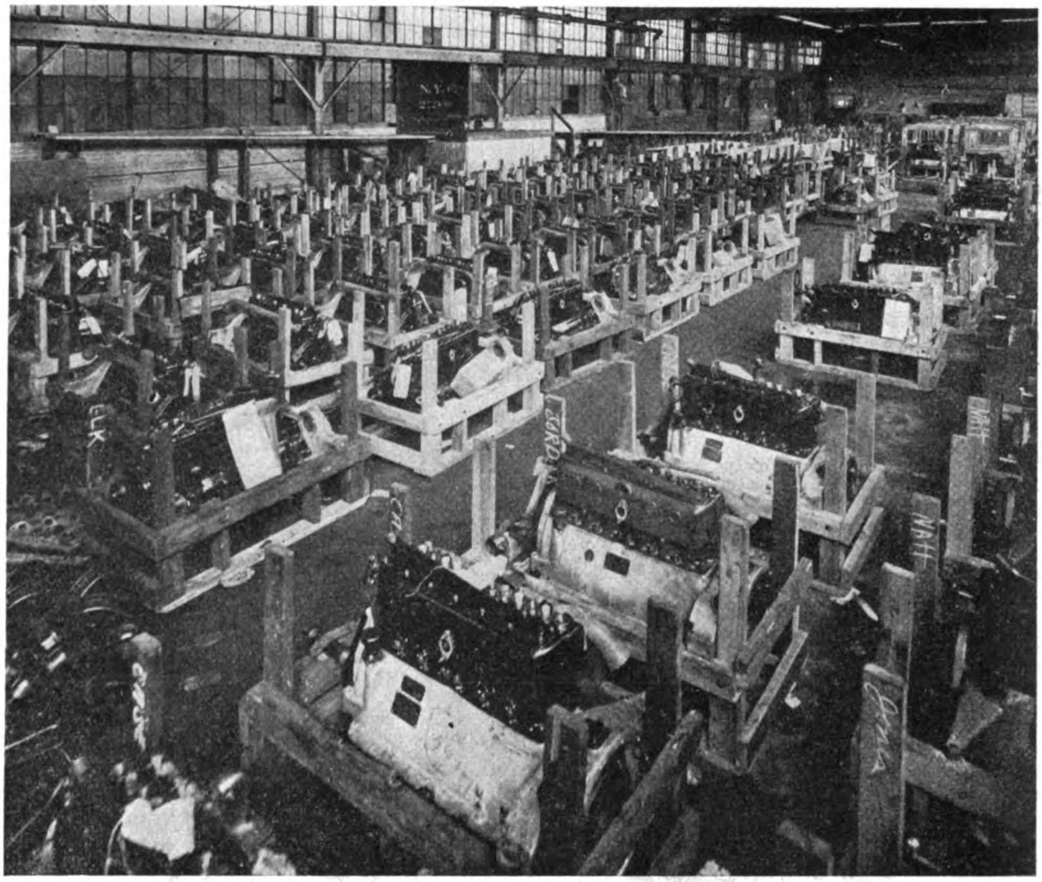
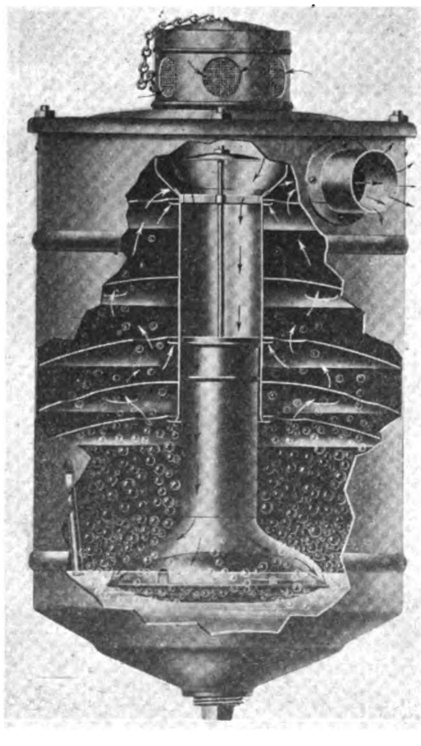


Fig. 20—Shipping platform, showing engines in crates ready to be packed in the cars. The type of crate shown is used only when engines are shipped in carload lots

R. W. Parrett Water-Type Air Cleaner

ROSS-WORTHAM CO., McCormick Building, Chicago, is manufacturing the Parrett water-type air cleaner herewith illustrated. Air enters at the top and is drawn downward through the central tube. The lower half of this tube is flared out "bell shaped" and is supported on a metal float of elliptical cross section slightly smaller in diameter than the bottom of the bell. The air passes through the narrow ring-shaped opening between the bell and the float at very high velocity. On account of the shape of the air stream no large air bubbles can pass through the water, and on account of the high velocity of the air the heavy dust particles are thrown directly into the water. The air itself is so thoroughly mixed with the foaming water that the lighter dust particles are also trapped and the mud settles to the bottom of the tank, whence it can be drained off daily, or as often as is necessary.

This thorough mixing of the air and foaming water settles the dust, but the next big problem is to separate the water particles from the air before it leaves the washer. A series of baffle plates is claimed to do this very effectively, and experience has shown that not over one quart of water is evaporated in an ordinary day's operation.



The restriction of the air flow through the washer is practically negligible, being about 2 in. of water under full engine load, which is very small compared with the drop through the carbureter. Tests are said to have shown that in spite of the slight frictional resistance, engines have developed slightly more power with the washer.

An overflow is provided to limit the high water level and an indicating disc attached to the float tube not only shows the amount of water in the tank, but also automatically shuts off the air inlet when the water level reaches the low point.

While high efficiency is claimed for this air washer, the makers wish to call attention to the fact that the washer can be placed to better advantage than in the very dustiest part of the tractor and that all air piping from the washer to the hot air stove and thence to the carbureter should be absolutely tight.

The need of air cleaners is now fully recognized and practically every tractor carries one.

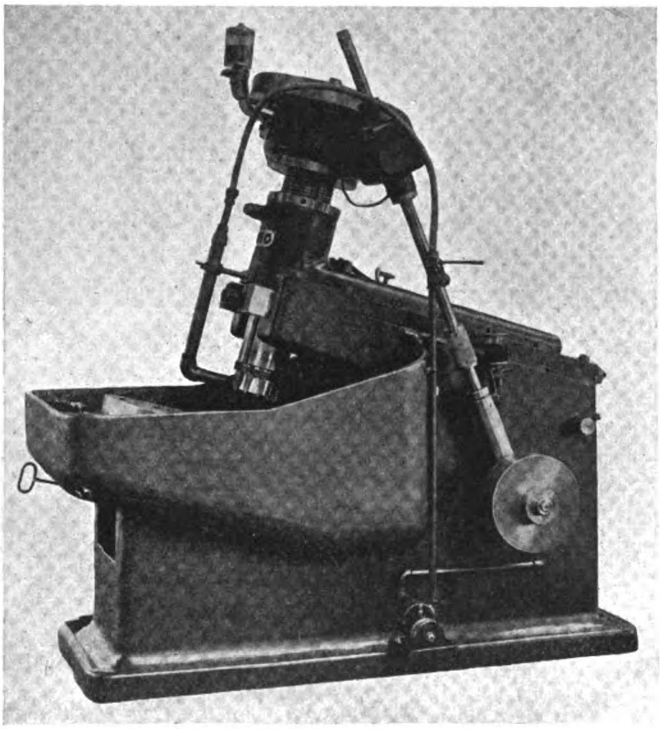
The Ohio Tilted Rotary

A Heavy Duty Machine Tool of a New Type Designed to Reduce Idling Time and to Insure the Best Cutting Conditions

THERE are certain recognized disadvantages in conventional milling machines that have limited their use in manufacturing operations in the past. These may be classified as follows:

1. Idle time between cuts.
2. Lack of rigidity due to the multiplicity of parts required when great versatility is aimed at in a single machine.
3. Insufficient lubricant for cooling cutters.

The Ohio Tilted Rotary is a continuous production milling machine designed with complete disregard for precedent. The designer's object evidently has been the production of a machine sufficiently rigid and powerful to overcome the limitations enumerated above. The different phases of the problem were studied separately and the features of construction and application of the new machine can best be studied by analyzing it from these three standpoints.

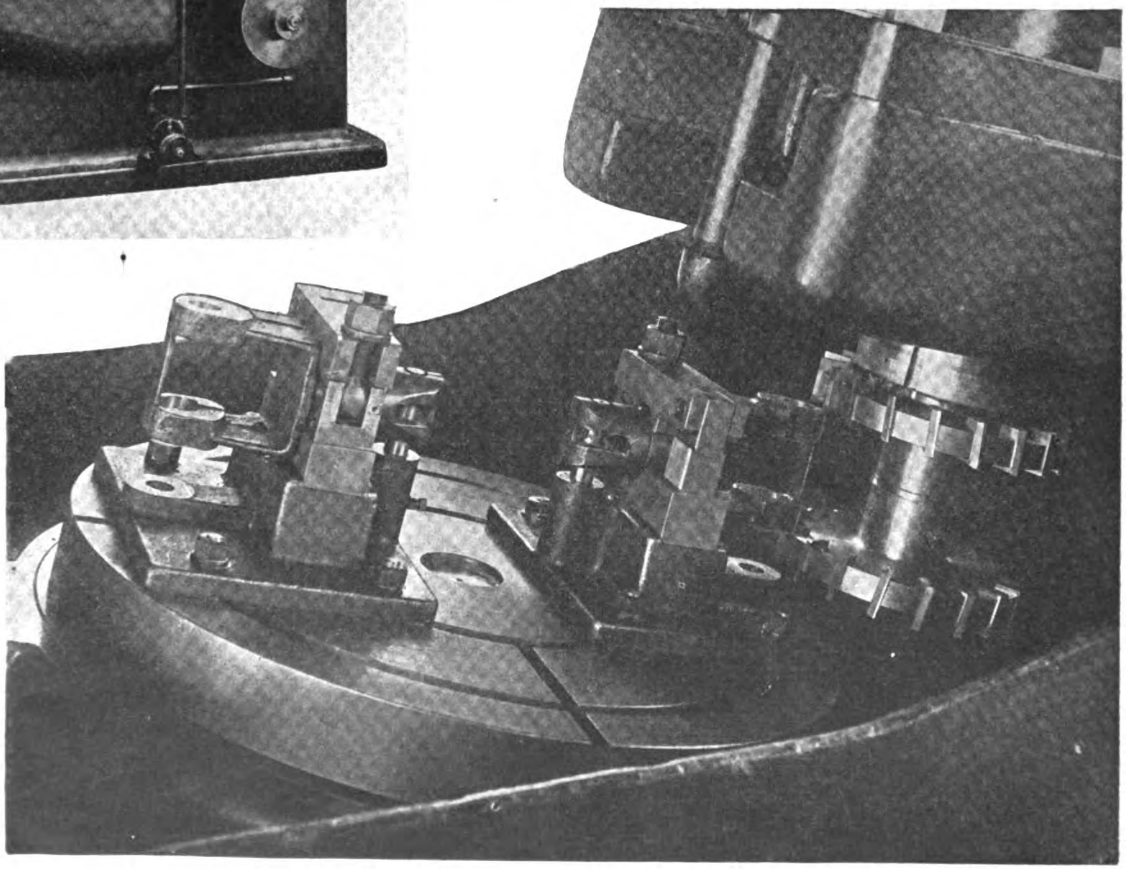


Side view of the Ohio tilting rotary, showing coolant circulating pump, drive of cutter head, etc.

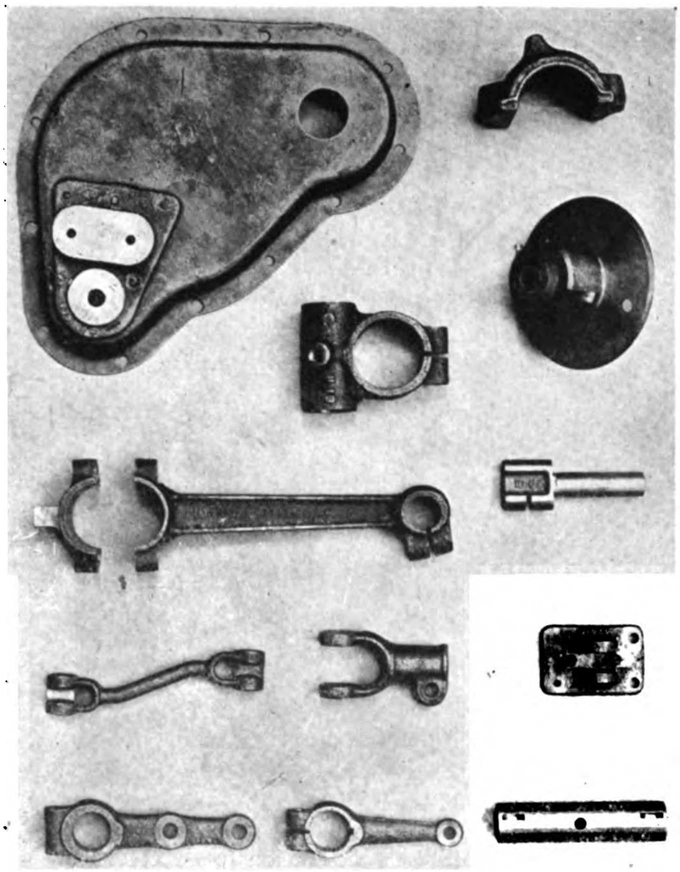
Idle Time Between Cuts

The time spent in returning the ordinary sliding table, removing the finished work, clamping the new piece in the fixture and again bringing the cutter to the working position is non-productive time. Continuous milling eliminates this time loss, with a consequent increase in the output per hour. This is accomplished on the Ohio Tilted Rotary by a rotary table which carries the work to the cutting position, and on which work is being replaced at the opposite side during the cutting operation. This continuous operation of the machine not only eliminates loss of time, but also sets the pace for the loading operation and results in a uniform output over a given period of operation.

The cutter can be held in a fixed position and the table



Straddle milling an automotive part in the Ohio tilting rotary



Samples of automotive parts that can be advantageously finished in the Ohio rotary

rotated continuously by automatic feed for continuous milling, or the cutter may be reciprocated radially in combination with an intermittent motion of the table, controlled by an indexing mechanism. This indexing mechanism is capable of from 2 to 72 divisions, and the table revolves rapidly between divisions so as to reduce the idle time.

By feeding the cutter radially over the surface of the work the loss of time between milling of the surfaces is avoided on such jobs as cannot be compactly spaced. Other advantages gained are that non-productive time of cutter approach is avoided, that the cutter travels the shortest possible distance, that two or more simple fixtures may be used instead of one large fixture, and that the machine will work efficiently on small lots.

Rigidity

Rigidity is secured by using a minimum number of parts and making these of massive construction. The body of the machine is cast in one piece, which in its general lines resembles a punch press or a shear. The working surface of the table and the cutter spindle are both contained in this massive casting, and the possibility of deformation under load is therefore reduced to a minimum. The body of the machine is directly under the circular table. There is no overhang on any part of the machine, the ram bearings being extended in front so that even in the advanced position of the cutters the full length of the ram is effective.

A worm wheel of 28 in. pitch diameter, driven by a worm of 1¼-in. pitch and 4-in. diameter, drives the circular table. The worm wheel is located as close to the table surface as the taper table bearing will permit, and is bolted and pinned to the table at the end of the bearing, the central stud merely serving as a means of aligning the worm wheel and table. This table bearing comprises 475 sq. in. of bearing surface, and this surface is straight. The ram bearing has a total surface of 1000 sq. in. and three gibs are provided for adjustment in all directions.

The spindle carries a No. 16 B & S taper and the cutters are positively driven by means of a clutch in the end of the spindle. A flywheel is mounted on the other end of the spindle to steady the motion of the cutter as it is driven through the work. This feature, in connection with the massive construction of the machine, tends to eliminate vibration, which latter is detrimental to the permanence of the cutting end of the tool.

Provisions for Cooling Cutters

Coolant is raised by means of a pump (circulating 35 gal. per min.) several feet above the surface of the table, and is then expanded into a large pipe so that it falls on the cutter and work under practically no pressure. This system prevents splashing that would be caused by a high velocity of flow, and the coolant is carried around by the revolving cutters so that it passes over the cutting edges during their idle travel.

The tilting table gives a low, pocket-like cutting position, and a greater flow of lubricant may be used without splashing than would be possible on a horizontal table. The flow washes practically all the chips away from the work, the tilting table assisting in condensing them in the space provided in the base of the machine.

The tilting table makes it possible to use an auxiliary pan so that the cutters could be run entirely beneath the surface of the coolant, and the work emerge from it at the loading position. The coolant drains from the chips into the base of the machine, which forms a reservoir of 60-gal. capacity. This "sub-surface" cutting is not provided for in the regular equipment, however.

General Description of Machine

The machine is driven by a 4-in. belt from a line or jack shaft on top of the machine. Power for driving the spindle is transmitted from the pulley, through mitre gears to an intermediate shaft which connects with the first change gear shaft in the speed box by means of a second pair of mitre gears. A single pair of change gears connect the first and second change gear shafts. "Pick-off" gears are used on the two shafts to vary the spindle speeds. A bevel pinion on the second change gear shaft meshes with a bevel gear on the spindle.

The intermediate shaft is splined at the upper end, at the pulley shaft and first intermediate shaft trunnion, to allow reciprocation of the ram.

The intermediate shaft is made in two sections which are joined by means of a coupling. By uncoupling and turning the first change gear shaft through half a revolution the opposite end of the upper half of the intermediate shaft couples with the lower section. This reverses the direction of rotation of the spindle and allows the use of either right or left-hand face mills as desired.

The "pick-off" change gears provide 30 spindle speeds, using 30 (15 pairs) change gears. Ball bearings are used in the driving mechanism wherever practical.

The spindle is carried in a sleeve, on the upper end of which is the speed box casting. The lower spindle bearing is 4½ in. in diameter and runs in a phosphor bronze bushing. The upper spindle bearing is a radio-thrust ball bearing. A clutch in the end of the spindle provides for positive driving of arbors, and the spindle is bored for a No. 16 B & S taper shank.

A flywheel weighing 250 lb. is mounted on the upper end of the spindle. The spindle sleeve is adjustable vertically by means of a graduated collar engaging with a coarse thread on the spindle sleeve. The spindle sleeve

is clamped firmly in the split barrel of the ram after adjustment.

The ram is fed radially over the surface of the table by means of a cam. The cam feeds the ram forward slowly during the cutting operation and allows it to drop back rapidly at the end of the stroke. The relative radial travel of the ram is made adjustable by means of a slide mounted under the ram. The slide is operated from the side of the ram by means of a ball crank lever and is clamped by means of a knurled knob. A double row ball bearing serves as a cam roller.

The pulley shaft extends through the machine and drives the feed box mechanism. Operations of the feed box are controlled by a push rod extending along the side of the machine to within reach of the operator.

The camshaft is driven by a worm and worm wheel in the feed box. A four-gear feed change mechanism regulates the feed of the table when the continuous table motion is used, or the rate of revolution of the cam when the indexing mechanism is used. The cutting feeds, therefore, are established by the ratio of these change gears. "Pick-off" gears are used to obtain these ratios.

The entire indexing mechanism and cam may be omitted for a machine on which only the continuous feeding table is desired, or the indexing mechanism may be added to a continuous feeding machine at any time.

It should be noted that the feed change gears regulate the rate of travel of the ram, and the throw of the cam regulates the length of travel of the ram.

A crank operated shaft is provided so that the feed mechanism may be operated by hand when setting up or trying out a job. A lever is also provided for tripping the index mechanism.

The cam is driven by jaw clutch teeth and may be quickly removed by withdrawing the camshaft.

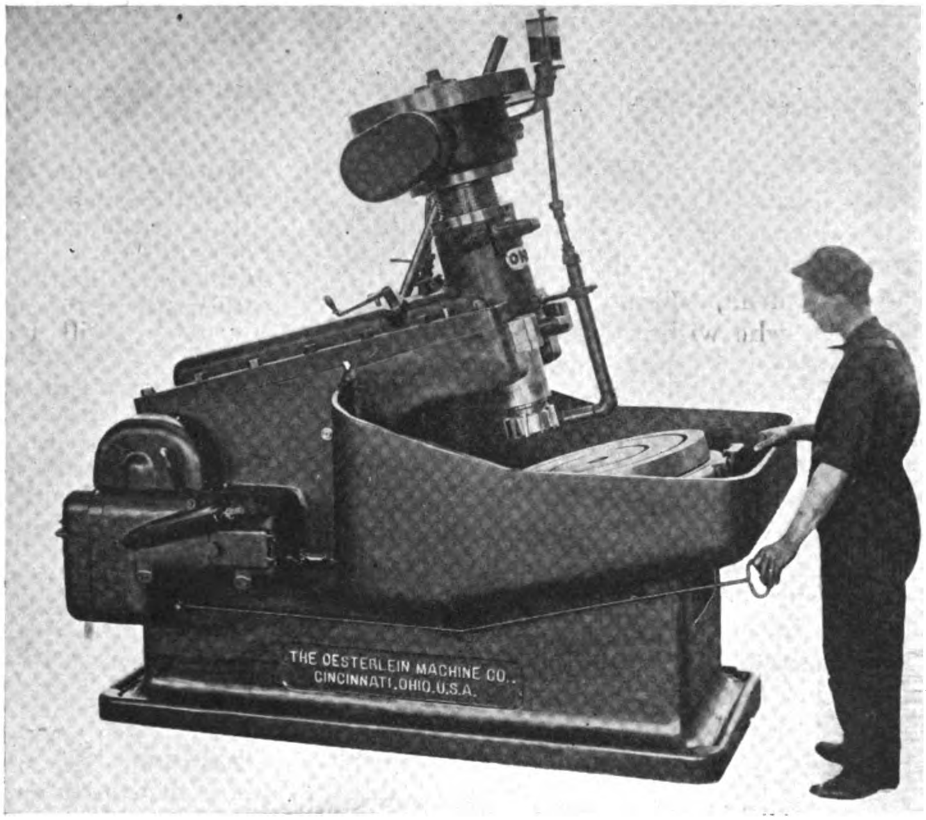
The rotary table is set at an angle of 15 deg. and is 30 in. in diameter. It is driven by a hardened worm and a worm wheel.

A large central distribution oiler on the speed box provides for speed box and spindle requirements, and a similar oiler lubricates the pulley shaft. A central oiling point located at the top of the ram provides distribution to the ram slide, and similar provisions are made for the feed box mechanism and for the table bearings.

Recording wattmeter tests show that the machine running at high speed without cut consumes 1½ kw. of power, including the motor and the lubricant pump. The pump alone delivering full stream requires about ½ kw

Applications of the Machine

The mechanism necessary to provide for quick adjustment of the machine has been omitted, so that simplicity of construction and rigidity may be obtained. The machine is, therefore, a production miller, applicable in a practical way only to such jobs that by reason of the quantity justify the necessary set-up time.



Ohio tilted rotary and operator

The machine when used as an indexing machine permits of the use of two or more simple fixtures instead of a large one-piece fixture holding many pieces. This feature greatly broadens the field of application and reduces the expense of tooling. By feeding the cutter radially over the surface of the table the advantage is gained that the table is indexing while the cutter drops back to the starting position, and the radial travel eliminates cutter approach and also the non-productive time spent in passing from one piece to another on the continuous feeding machine.

The Indexing Table

The indexing table in connection with a radially feeding cutter permits of dropping a cutter into the work, and such operations as Woodruff key-seating are possible with the indexing system, whereas they are impossible on a continuous feeding machine.

Other applications of the machine when used as an indexing miller are: Cutting a keyway along the length of a shaft or stud; facing off bosses or other surfaces in a plane that is not accessible to a stationary cutter and a continuous rotary table feed, and the milling of small surfaces on large pieces, where the loss of idle continuous feeding time would more than offset the gain of continuous loading.

The adaptability of both the continous rotary and indexing combinations permits of the advantageous use of the machine in shops where several widely varying operations are performed and the lots are comparatively small. As an example of the above, in a shop producing 200 warehouse trucks per month, six pieces requiring nine operations entering into the construction of the machine may be performed with equal facility on either the continuous feeding or the indexing combination of the Ohio Tilted Rotary.

Looking Forward—The Engineering Issue

ATTENTION is called to the Engineering Issue of AUTOMOTIVE INDUSTRIES, which will be issued June 12. The material for this special number is well in hand, and it will become an important part of the data of the engineer who wishes to be fully informed of developments in the automotive field.

The AUTOMOTIVE INDUSTRIES' staff has searched the field and special articles, prepared by men connected with different branches of the industry, have been obtained.

The tractor field, which is developing at a marvelous rate, will be discussed from every angle. In addition to several articles on the principles of design there will be an article discussing tractor features from the user's standpoint.

Trucks are presented from similar viewpoints. The question of loading and unloading, always a vital one in the use of the vehicle, is given special attention. The effect of truck design on sales is an interesting question.

The airplane industry has before it some great primary problems. These also are presented by the men who must be depended upon to reach a satisfactory conclusion.

Trends in automobile design, both in this country and abroad, will receive attention, and the articles under this heading will prove both timely and interesting.

The new factors in the labor situation, recently a strong feature of AUTOMOTIVE INDUSTRIES, will be reviewed. The progress made toward the solution of these problems will be presented in an informative and helpful article.

Foreign trade is rapidly developing for the automotive industry, and every factory going into export production now is confronted with new problems in this connection. You will find some of them treated in the Engineering Issue.

Finance, tariff, production and other important phases of the manufacture of automotive products are all covered in this Engineering Issue. They form the link that connects the laboratory and factory with the executive departments.

The war led to much productive research on materials and fuels. These fields are changing, and reports from investigations made for war purposes are becoming available for publication. Some of these reports will be found in the Engineering Issue and they will throw much light on the progress of the industry.

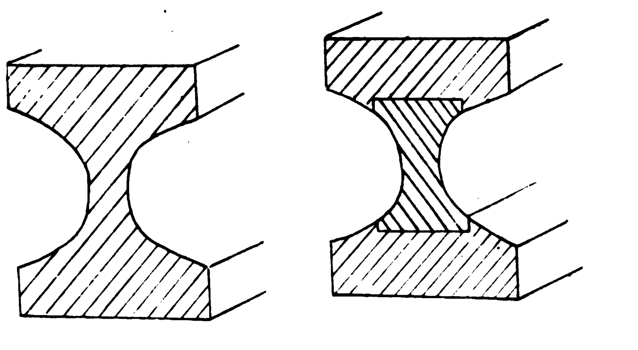
Three-Piece Wing Beams as Strong as Solid Beams

BENDING tests conducted upon DH-4 I-beams built up of three parts (two flanges and a web) and solid beams of the same cross section indicate that the two types have practically the same strength.

Ten test beams of each type were constructed as shown in the accompanying sketch. The specimens were made of closely matched material, the solid beams and the flanges of the 3-piece beams being cut side by side from planks of clear Sitka spruce. Cold casein silicate glue was used in making the built-up beams.

Under 4-point loading, which simulates the actual loading in service, the average maximum loads sustained by the two types were nearly the same. The difference was in favor of the built-up beams, but was too slight to be significant.

The construction of I-beams of 3 pieces as suggested offers certain obvious advantages. It permits the utilization of cross-grained material in the web, and since smaller pieces are required than in the case of the 1-piece I-beam, it is probable that from two to four times as many beams could be produced from a given amount of lumber.

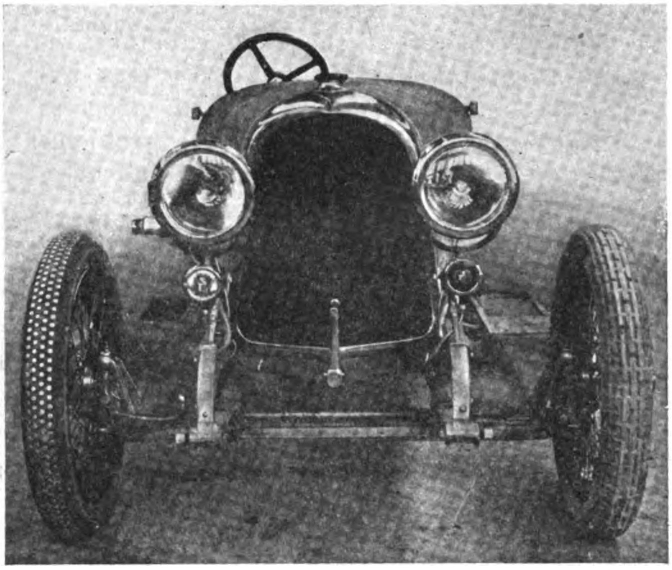


Use of German Army Trucks During the Transition Period

THE German Government "Reichsverwertungsamt" (Reconstruction department) has just organized three new sub-departments with a view to the utilization of returned army trucks, etc., for transit purposes in the country, to help out the situation owing to railway traffic difficulties. The first of these deals with the sale of trucks, tires, etc., the second is concerned with the control and release of available vehicles and the distribution of new tires. The latter, however, are only available in very limited numbers—much less than necessary to meet requirements. There are branches of these organizations in various towns. The third section deals purely with transport matters, and is described as a "general utility undertaking."

Voisin's Initial Chassis

By W. F. Bradley



Head-on view of the Voisin

PARIS, May 1—Gabriel Voisin, pioneer airplane builder, has entered the automobile industry with a high-class 4-cylinder, 30-hp. Knight engine car. The Voisin, which will be built in small volume with a view to the highest possible quality, has a number of distinctive, detail features.

The cylinders, which are a block casting of 95 x 140 mm. (3.5 x 5.5 in.), have a detachable cover over the head completely enclosing the spark plugs. The magneto is driven from a cross-shaft, which also operates the water pump, and the ignition wires are taken to the plugs through a passage cast in the cylinder block. When the fan is removed no working parts are visible.

Although a comparatively small engine, the crankshaft is carried in five bearings, the main bearings having a substantial length of 3.1 in. Lubrication is under pressure to the main bearings and by means of constant level troughs to the connecting rod bearings. In addition to this main lubricating system, there is a supplementary oil feed to a point around the exhaust ports. This supplementary supply is only opened when the throttle is in full open position. Further, the pressure on the supplementary line is reduced by means of a reducing valve in relation to the pressure on the main line. It is found that the pressure suitable for the main bearings is altogether too high for delivery to the sleeves.

In general features of design, the engine follows the usual Knight practice. It should be pointed out, however, that the Knight patents are no longer valid in France. The decision of the courts rendered just before the outbreak of war held that the Rolland-Pilain sleeve valve engine constituted a priority.

In designing the Voisin, considerable attention has been paid to those details which interest the man who spends a considerable amount of time on the road; for instance, the number of sizes of bolts and nuts has been reduced to three throughout the car. The mechanism has been made as self-lubricating as possible. The design is simple, and wherever possible parts have been rounded off in order that dust and dirt may not collect.

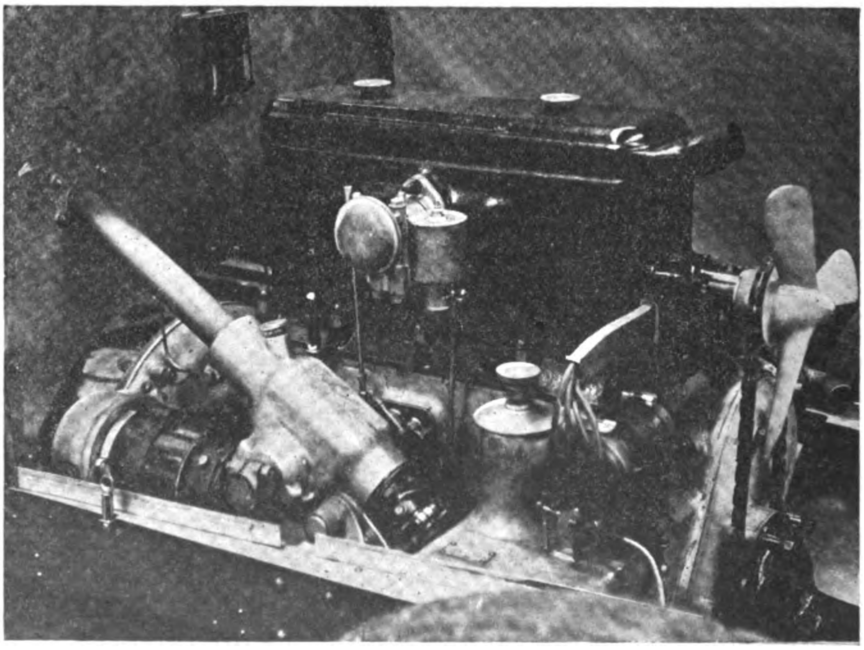
The carbureter is a Zenith horizontal, fed with gasoline by means of the vacuum system. On the right-hand forward crankcase hanger there is a combined oil filler and breather. When this is swung back to allow oil to be poured in the base chamber, a level cock is opened so that if the engine is filled with oil in the dark it is impossible to raise the level above the required limit. At the same time there is an oil level indicator on the side of the engine base chamber.

Water Pump

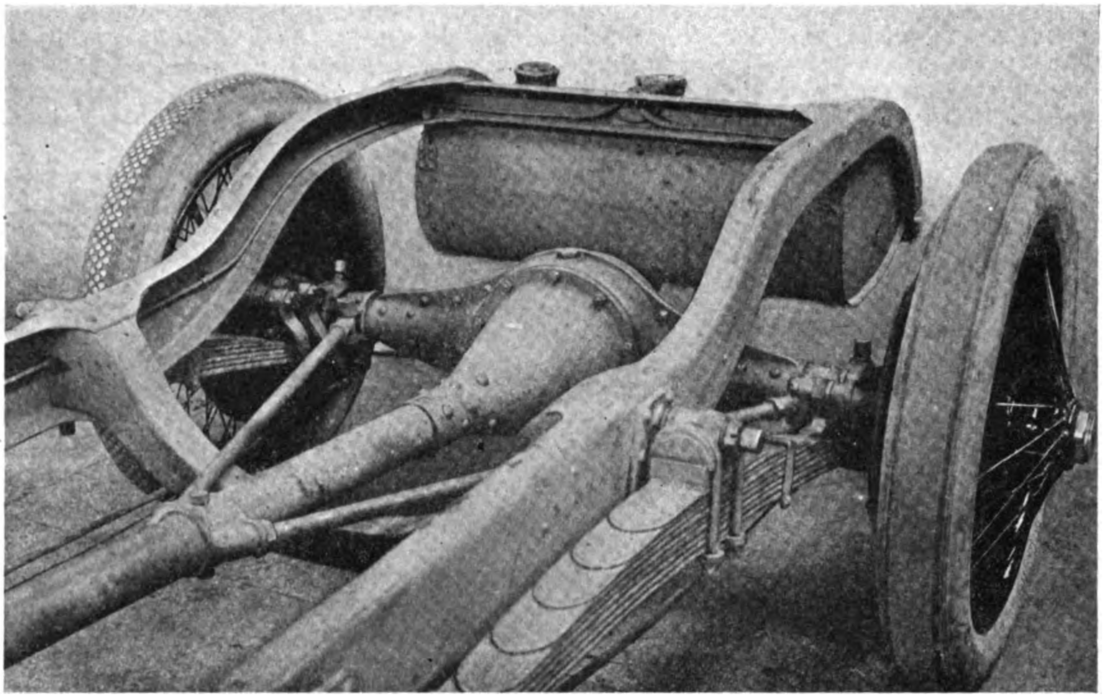
The water pump has a gland kept tight by an internal spring. A case aluminum three-blade fan is fitted, but the claim is made that this is not required except for work in hot cities. The fan and bracket are demountable and a small metal plate covers up the fan attachment.

Aluminum pistons are made use of with forged I-section connecting rods, the wrist pins moving in bronze bushings fixed in the pistons.

A two-unit lighting and starting set is provided, the generator being on the left side, just ahead of the flywheel housing, and the starter on the opposite side, immediately behind the starting gearbox. Unit construction of engine and gearbox with three-point attachment to the frame is adopted. The clutch is a plate type with Ferodo lining.



Carbureter side



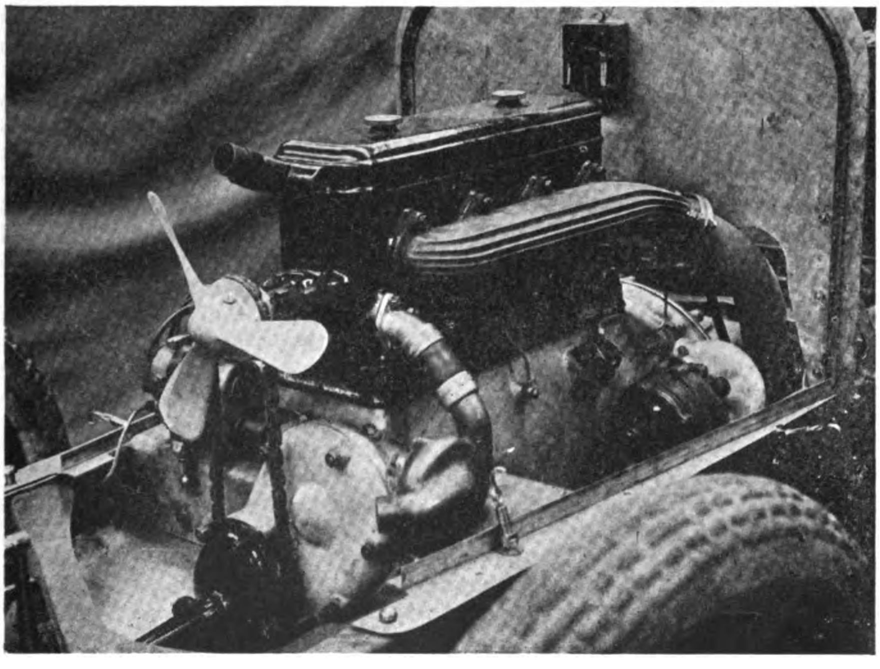
Rear axle construction

A particularity of the gearbox is that it is cast in one piece, with a detachable plate on the right side. This plate carries the change-speed lever, which consequently is quite independent of the frame members, and it also serves to insert the gear shafts. There are oil collectors immediately above the gearbox bearings, and after lubricating the rear bearing the oil flows to the forward universal joint.

The rear axle is of the banjo-type, formed of two forgings, riveted and welded together. To the forward face of the axle housing is bolted the casing carrying the driving pinion, and riveted to this casing is the tube surrounding the propeller shaft. There is diagonal bracing from the two ends of the axle to a collar on the propeller shaft housing. On the rear of the axle housing there is a light aluminum inspection cover.

Springs are long, cantilever type, pivoted to a bracket on the side frame member and attached to the axle by means of a spherical instead of the usual cylindrical attachment. Although a lubricator is provided for the collars receiving the rear ends of the two springs, any oil which leaks along the propeller shaft is carried to this collar and thus provides additional lubrication. Both sets of brakes are on the rear wheel drums, but instead of being set side by side, as is the usual European practice, they are mounted concentrically. The brake shoes are lined with ferodo, and instead of the operating cams coming into direct contact with the shoes, they attack a hardened adjustable nut on the latter. This gives an additional brake adjustment, and also enables the brake cam to operate at a correct angle at all times.

Right-hand steering is adopted, and a polished aluminum dashboard with a false front for carrying the instruments is provided. Standard equipment comprises either detachable wire wheels or the Michelin steel-disk wheels. All chassis are built to receive custom bodies, but the chassis are turned out complete with wheels, tires, wheel carrier, electric lighting and starting, head, side and tail lights.



Exhaust side

—

Italy's Needs in Machine Tools

THE provision of machine tools for their expanding industries after the war is exercising the minds of prominent Italians. One-tenth of these imports before the war was supplied by England, three-tenths by America, and six-tenths by Germany. The last named country will, however, cease to count among Italy's suppliers, and her requirements will have to be met elsewhere. To this end, says *Engineering*, a company was recently formed at Milan which, pending the time when Italy is able to provide for her own wants, will control the business of machine tool imports, among which agricultural motors and machinery take a leading place.

Savings Facilities for Employees Make for Stability of Organization

Plan Must Be Without Taint of Paternalism and Workers Must Have the Freedom of Dealing at Will with Regularly Recognized Financial Institutions—Real Property Interest Serves to Stabilize the Interest in the Work and in the Community

By Harry Tipper

IT requires only a cursory comparison of the present day attitude toward the workers with the attitude of ten or fifteen years ago to determine the advance which has been made in the understanding of the effect which the physical surroundings of the worker have upon his industrial capacity. It is obvious, further, that we have developed a more human standpoint in the consideration of industrial organization and are not ashamed of some sentiment in connection with our business requirements.

We are not yet at the point where we realize that production efficiency is almost a by-product of organization harmony, but we have begun to realize that a man's health, his home conditions, his financial status, his recreation and his surroundings all exercise an influence upon his productive capacity which is none the less important because it is not capable of exact measurement.

There has been a big development in the last fifteen years in the direction of providing light, airy, comfortable and pleasant places to work, in extending the facilities of the industrial establishment for the purpose of the workers' recreation, in establishing hospital facilities and other arrangements calculated to maintain the health of the worker and in providing such surroundings as will tend to suggest pleasant, comfortable and healthful associations and not merely the grinding necessities of labor, which were frequently suggested by the older factories in their deficient conditions and depressing environment.

Surroundings That Stabilize Labor

Managers and employers of labor all over the country are giving attention and consideration to all possible factors which may have a bearing upon either the stability of labor in its productive work, or its efficiency in quantity of production. A trip into this or that factory is always suggestive to the man whose eyes are open, because of the different methods employed by the different concerns in dealing with these human necessities and in endeavoring to provide such working surroundings as will stabilize the conditions.

It is indicative, as a natural development out of the work of the previous years and the present conditions in the building trades, that so many manufacturers should be interested in the housing question at this time and actively engaged in finding a solution, or providing a solution, for the housing trouble in their immediate localities.

Much discussion has occurred upon the best ways of tackling all these matters, the best methods to be adopted in taking care of the necessities of the case and upon the developments which can be worked out without the stigma of paternalism on the one hand or without radical departures from practice, on the other hand, which may not be justified.

About two weeks ago the writer visited a large concern in New England, one of the old established New England manufacturers engaged in the metal trades, noted for fair treatment of the worker and for the justice of their dealings with the workers' demands or necessities. This concern established, some little time ago, a system of representation by elected representatives of the employees upon a joint committee with an equal number of representatives of the management; to have jurisdiction over the question of wages, hours and working conditions which demand consideration from time to time and to evolve a method of dealing with the personal grievances of the individual employee in such a way that they would be properly adjudicated.

System Considered Satisfactory

This system is based upon a similar plan to those adopted by the Standard Oil Co. of New York, The Midvale Steel Co., Colorado Fuel & Iron Co. and others that have been mentioned in AUTOMOTIVE INDUSTRIES. It has been in operation for about a year, and conversation with the executives of the company and with the workers developed that it is considered entirely satisfactory on both sides. The employment manager in this particular institution, or, rather the manager of industrial relations, has proved to be an unusually capable man, having fully satisfied the owners of the concern, and at the same time sufficiently satisfied the workers that his position and the justice of his actions have been commended by the labor leaders in that vicinity.

In the course of the working out of this system, or during the year, it developed that a number of the workers were carrying large amounts of cash, representing their savings, because of the inability to open bank accounts during the hours when they were off duty and their diffidence about going to the banks to deposit money or draw it out during the hours of work while wearing working clothes. This suggested to the management the possibility of making an arrangement with the local banks by which the employees could open savings accounts at the pay office of the company, receiving receipts for these accounts and having them credited on the books of the savings banks as though they were deposited at the receiving teller's window in the ordinary way. The system by which this was arranged was copy-

righted by the man who got it up and bought from him for use by this concern.

In many of its details it is somewhat similar to the thrift stamp book, except that each bank has its own books and stamps and methods of receipting, which have no value outside of its own doors. The details of the system, of course, are important in its actual operations, though the problem is sufficiently simple that any intelligent accountant can arrange for a proper system of taking care of the actual transactions.

The interesting point about this whole thing was that in this manufactory, which is some distance from the business section of town, there were thousands upon thousands of dollars lying idle in the pockets of the workmen, not because they did not see the value of a bank account or because they were unwilling to trust the bank, but because it was inconvenient to get to the bank during the hours when it is open; while during the leisure time of the worker when he was prepared to go into the center of town all the banks were closed and there was no possibility of depositing or withdrawing any money.

Has Met With Enthusiastic Support

It further developed that there was a great deal of enthusiasm among a large proportion of the workers for the opportunity presented by this arrangement and a great many of them took immediate advantage of it to deposit considerable sums, representing savings which they had been obliged to carry around for lack of any other means of care.

This is not the only case in which arrangements have been made to stimulate the saving of money by the workers and to make it easy and convenient for them to deposit those savings in a recognized institution for the purpose.

A departure from this scheme, with the same object in view, was indicated in the annual report of the Lever Bros., Ltd., makers of Sunlight soap, in Liverpool, England. It was stated in this report that the company had decided to do away with the method of paying the workers at the office, necessitating their standing in long lines waiting to be paid, and instead it had arranged with the banks in Liverpool to open an account for every individual employed with the company and had arranged to deposit at the bank each week an amount equal to the amount earned by the employee, which amount could be withdrawn from the bank or used as an account at the bank in the usual way. It was calculated that with the number of employees at the works it was necessary for some of them to wait half an hour in order to be paid, and that this was not only inconvenient for the workers but distasteful to them as well, besides making it troublesome for them to go to the bank afterward and deposit any money. It is understood that the banks arrange to be open special hours to accommodate the employees of this company who may desire to deposit or withdraw money and who cannot arrange to be at the bank during the ordinary hours of operation.

Wherever it has been made convenient for the workers to deposit money in the regular financial institutions and to save money, there has been a large response from a very considerable body. Although the examples of industrial corporations offering these opportunities to their workers are not very numerous, they suggest that the reason why so many of the workers have not used the banks as depositors is not so much because of their dislike for the banks or their desire to spend what they earn, but that the inconvenience of reaching a bank to deposit the money which represents their surplus may have a great deal to do with their neglect in this matter. The advantage, of course, of workers saving money is so obvious that it is not necessary to dwell upon it. The advantage of encouraging them to deposit their savings in the regular banks so that the money may be kept in circulation is equally obvious; but there is an additional advantage to the concern which provides opportunities of this kind for its workers, that they are directly contributing to the stability of the individual worker and to the stability of the workers as a part of their organization and providing a service, the value of which a considerable proportion of the workers appreciate and take advantage of.

The plan, of course, calls for a slight additional expense on the part of the company, and this must be justified by the importance of the matter. The executives of the companies who have adopted the idea in one form or another evidence their information of its value and their impression of its importance from the spirit in which it has been received by the workers and the advantage that has been taken of it wherever any such plan has been put in motion.

It is mentioned because all items of that kind have a bearing upon the labor situation and the interest of the worker in the banks of his locality. The interest of the worker in saving is an important element in stabilizing the organization and in introducing a more conservative viewpoint among the workers themselves. They are apt to judge matters more carefully when they own a little property and have a real interest in the locality and the country.

Property Ownership Creates Sense of Responsibility

Comfortable housing conditions and the ownership of property, either in the form of a house or in the form of bank savings, bonds or some other tangible property, are very important incentives to the development of responsibility and a sense of orderly necessity in politics and in business. It is not a mere coincidence that most of the irresponsible radicals of all types are born and brought up in the cities or among the classes who have no interest from a financial standpoint in their local community, in their national government. To such people any change is a good change. Having no responsibility either from the standpoint of ownership or the direct payment of taxes, but possessing political power to the extent of the vote, they cannot lose much as far as they see by any radical development, no matter how theoretical it may be, and they may gain a great deal.

The stability of the French nation is largely due to the individual financial interest in the Government and the locality, and the employer who encourages, even to the extent of considerable expense, the habit of saving and the development of property ownership, by extending the convenience so that it will be easy for the workers to arrange such savings, is providing an opportunity for the development of stability in its organization and its locality which will more than compensate for any expense which may be involved.

BRITISH aircraft papers publish particulars of the Tarrant Giant triplane, said to be the largest heavier-than-air machine ever built. It has six Napier Lion engines, four of which are mounted on the bottom plane and the other two between the middle and top plane. The fuselage is of the monocoque type and of very good streamline form. Originally the machine was designed for long distance bombing, but after the armistice was signed it was decided to convert her into a passenger carrying plane. The span of the middle plane is 130 ft. and the height from the ground to the top plane 37 ft. 3 in. The weight of the machine is approximately 45,000 lb., of which 9000 lb. is available for passengers and cargo and 10,000 lb. is taken up by the fuel.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL. Thursday, May 29, 1919 No. 22

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address - - - - - - - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - - - - - - - - One Year, $3.00
Canada - One Year, 5.00
Foreign Countries - - - - - - - - - - - - - - - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobi'e (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Less Publicity, More Action

IF official Washington would actually put into effect but a small percentage of the numerous excellent plans for co-operating with industry that have been announced in the past six months, the American government would be the most helpful of all governments to the industries of the nation.

The desire for publicity has become the "wrench in the gears" of government operation. Department heads apparently call meetings of their subordinates, ask for suggestions, list them and then call for the publicity director, who turns out many pages telling what the department plans to do for the benefit of American industry.

Newspapers and other publications carry the stories. The bureau clips the notices and files them for evidence to be presented to the Congressional committees, and then, as the main object—publicity—has been secured, the enthusiasm wanes and the schemes die. Later a new set of ideas is compiled and the same plan followed. When the bureaus and departments think more of aiding industry—of direct profitable action—and less of publicity, the only value of which is to obtain the appropriations necessary to insure jobs, there will be a more genuine governmental co-operation with business.

What Shall We Do With Our Bureau of Standards?

DURING the past two years the Bureau of Standards at Washington was engaged almost entirely in scientific work connected with the prosecution of the war. Feverish activity was developed by practically every department; new buildings were erected, much new equipment was installed, and the personnel was greatly increased. Under the imperative demands of the war the Bureau grew as much in two years as it probably would have grown in two decades under normal conditions.

The cessation of hostilities, and of practically all manufacturing activities in connection with the war, has caused a slackening in the demands made upon the Bureau. As an instance in point, the immense amount of work which was done in connection with the development of the Liberty engine and its accessories has been carried to fruition, and there is less demand than during the war for the use of the special facilities collected for this work. The activities of practically all branches of the Government are shrinking at a very rapid rate, and the calls made by Government departments have greatly lessened.

We are thus left with a highly developed national institution for scientific research, without any definite program for its utilization for the best interests of the Nation. True enough, the Bureau was originally organized for a definite purpose, and previous to the war it had a well-defined program, but anyone who watched its expansion during the war knows that it has long outgrown this program.

During the past few years, industrial research has become a subject of tremendous importance. It was well-organized research that gave Germany its lead in certain industrial lines previous to the war. Thus, when hostilities broke out the allied countries were cut off from their sources of dyes, optical glass, and certain medicines, among other products. Their only salvation lay in rapidly organizing for intensive research work, and this the respective countries did at once. According to all accounts, the work undertaken along these lines proved highly efficacious. The men engaged in it thus proved themselves capable research workers, and incidentally the value of scientific research was strongly brought home to many people who formerly were inclined to scoff at it. In England, particularly, there has been much talk of co-operative industrial research, and a committee has been appointed under Government auspices to look into plans.

It is generally felt that in the coming struggle for the world's markets for manufactured products,

scientific research will play a very important rôle. At the present time very effective research work is being done by a few of our large corporations, such as the E. du Pont de Nemours Corp., General Electric Co., Eastman Kodak Co., and others, but the great majority of our manufacturers cannot afford their own research laboratories, and if these are to be benefited by the possibilities of research work it must be carried on co-operatively or through the instrumentality of the Government.

As already stated, the Bureau of Standards has far outgrown its original purpose. It is no longer an institution merely for calibrating thermometers and checking weights and measures, but it is a vast research laboratory well organized, well equipped and well staffed. It is quite apparent that the Bureau could be of great service to the Nation's industries, and particularly to the automotive industries, if it were placed on a somewhat different basis. At the present time it concerns itself only with the scientific problems which arise in the work of the various Government departments. Of course, during the war these problems covered nearly the whole range of industrial activities, but in peace times the situation is entirely different.

The Bureau of Standards could act both as a research and a testing laboratory for the industries. As a testing laboratory, it would be an authority in which the public would have confidence. It may not be amiss to mention a specific example of the class of testing work in which the Bureau could engage. Since the sharp increase in the price of gasoline some years ago, a large number of so-called fuel savers have been placed on the market, for some of which rather extravagant claims have been made. It is impracticable for the manufacturers or dealers to give a convincing demonstration of these devices to each customer, as to do so would often involve expense greater than the cost of the instrument. If the inventor or manufacturer of such a device could have it tested by the Bureau, and get a certificate of performance, it would be a tremendous help to him if the performance was creditable. In this way the Bureau would help to gain recognition for inventions of merit, while at the same time its activity would tend to keep off the market devices without practical value, as the public probably would soon become educated to asking for an official performance certificate.

The Bureau and the Automotive Industry

To the automotive industry the Bureau could be of immense service in connection with fuel problems. It is true that problems connected with the production of petroleum fuels are being dealt with by the Bureau of Mines, but this department does not concern itself with the utilization of the fuels in engines. Other automotive problems that can only be solved by scientific research on a large scale relate to lubrication, ignition, and to the properties of metals and other materials of construction.

We would urge upon the automotive industry and the various organizations representing it, such as the National Automobile Chamber of Commerce, the Motor and Accessory Manufacturers, the National Boat and Engine Manufacturers' Association, and the National Implement and Vehicle Association, to ponder this question thoroughly. If they believe that the Bureau of Standards can be of material service to them it behooves them to speak out and ask that it be made available for that purpose. The fate of the Bureau rests with Congress. But we cannot expect our Senators and Representatives to try to find work for the Bureau. If no demands are made for its services from the industries, then it is likely that appropriations will be withheld and that some parts of the institution will be closed. We all know that there is a strong demand for retrenchment, and the tendency for Congress would be to cut expenses where it could be done with the least opposition.

Now, economy is generally regarded as a virtue, and correctly, but there is such a thing as false economy, and it would certainly seem false economy to condemn to idleness an institution in which the Nation has invested millions of money, which during the war demonstrated its ability to "produce results," and which could be of great assistance to our industries in improving their products.

More Intimate Contact Needed

What is needed is more intimate contact between the Bureau and the industries. The Bureau should be organized on such a basis that its services would be available to any firm requiring research or test work done for such equipment as the Bureau possesses is necessary. Of course, the tests or other work should not be made entirely gratis, as in that case the staff might be overwhelmed with requests for investigations of matters of little importance. Some of the expense might well be borne by the Government, however, as any results achieved would be of commercial advantage to the Nation, and it is a legitimate function of the National Government to aid the Nation's commercial interests. In any case, any fees paid for tests should go directly into the National Treasury and not to the Bureau, the latter being supported entirely by Government appropriations, so that any causes that might tend toward commercialism would be eliminated.

If the automotive industry feels that it can profit from continued research work of the Bureau, somewhat along the lines on which the latter has been working the past two years, then it should not fail to make its voice heard immediately, for once a decision has been made it is always difficult to get a question reopened for discussion. Let the National Automobile Chamber of Commerce, the Motor and Accessory Manufacturers, the National Boat and Engine Manufacturers' Association, the National Implement and Vehicle Association, the American Gear Manufacturers' Association, the American Drop Forge Association, the Electrical Equipment Manufacturers' Association and other industrial organizations petition Congress. Let every individual manufacturer write to his Congressman, that the necessary appropriation should be made to keep the Bureau of Standards going at full capacity, for the benefit of American industries.

Latest News of the

Average Speed of 92.46 M.P.H. Made by NC-4 in Flight to Lisbon

Last Leg of Trip Made Without Incident, Under Favorable Conditions—Hawker Made 1289 Miles Before He Was Forced to Alight

NEW YORK, May 28—The flight of the NC-4 yesterday from Ponta Delgada to Lisbon, 921.21 land miles, in 9.44 hr., completes the initial flight from American to European shores. The NC-4, an American naval plane, was commanded by Lieut. Commander A. C. Read. The following data of the flight, reduced to land miles, were compiled at Washington:

Course	Date May	Distance Miles	Time Hrs.	Speed M.P.H.
Rockaway-Chatham (forced landing about 100 miles off Chatham)	8	345.45	5.45	59.87
Chatham-Halifax	14	368.42	3.51	97.87
Halifax-Trepassey	15	529.69	6.20	83.60
Trepassey-Horta	16-17	1,381.81	15.18	90.27
Horta-Ponta Delgada	20	172.72	1.45	99.83
Ponta Delgada-Lisbon	27	921.21	9.44	94.50
Complete Ocean Flight Trepassey-Lisbon		2,475.75	26.47	92.46

The average speed of the planes is an interesting part of the table. The wind velocity is a factor in the variation. The NC boats in tests before this flight developed an average speed of 65 m.p.h. in still air.

The NC-1 and the NC-3, which started with the NC-4 from Rockaway Air Station, made the flight to Trepassey successfully, but failed to reach Horta because of fog. The NC-1 was within 250 miles of Horta when forced to descend to get its bearings and was unable to again take the air. The plane became waterlogged and the crew had despaired of rescue when picked up by the steamer Ionia. The steamer took the plane in tow but the line broke and the craft was lost. The NC-3, commanded by Commander Towers, lost its bearings in the fog and was forced to alight 80 miles south of the course. The flight was equal to the distance to Ponta Delgada. Only a 2-hour supply of fuel remained and no effort was made to take the air. Instead the NC-3 taxied to Ponta Delgada, 205 miles, entering the harbor under its own power. These flights were not in competition for the London Daily Mail prize.

Hawker Rescue

The dramatic rescue of Harry G. Hawker, pilot, and Commander McKenzie Grieve, navigator, of the Sopwith biplane, as announced last Sunday, was a feature of the week's air news. This plane started from St. John's, Newfoundland, at 1:51 (New York time) Sunday, May 19, competing for the London Daily Mail prize of $50,000 for a continuous transatlantic flight.

The plane and crew were not heard from after the start until the Danish steamer Mary signalled on Sunday that the men were aboard. The steamer had no wireless and had been unable to announce the rescue of the aviators. Hawker and Grieve were taken off the Mary by a British destroyer and given a tumultuous welcome in Scotland and England on their trip from Scapa Flow to London.

Hawker, in his own account of the flight, says that for the first 5½ hours of the journey all went well at a height of 15,000 ft. Owing to choking of the filter, the plane was lowered, but after 12 hours of flight the circulation system again choked. It was found that the trouble was caused by solder and other refuse and it was realized that the trip could not be continued. Then the plane turned across the steamer lane and after two hours sighted the steamer Mary and dropped to the water in front of it. Owing to the rough sea, the men were taken off with difficulty and the airplane and contents were abandoned, but later picked up intact by the American ship Lake Charlottesville and will be taken to Falmouth.

An official announcement by the British Admiralty was:

THE HANDLEY-PAGE TRANSATLANTIC FLIER

Handley-Page "Berlin Bomber," which will attempt a transatlantic flight from Newfoundland. It is fitted with Rolls-Royce engines and with both tractor and pusher propellers, the latter having four blades. It was a machine of this type which last winter made the flight from England to India, a distance of approximately 5800 miles, including 700 miles across the Mediterranean.

Automotive Industries

"Hawker and Grieve were picked up in làtitude 50.20, longitude 29.30, having alighted close to the little Danish steamer Mary, owing to stoppage of circulation in the water pipes between the radiator and the water pump."

This statement would indicate that the aviators landed in the Atlantic 813 land miles from the coast of Ireland and approximately 1289 land miles from the point of their departure from Newfoundland.

Hawker, in his statement, says that he and Grieve were picked up 14½ hours after the start from St. John's.

—

A French Flight

It was announced from Paris that Lieut. Roget left that city at 6 a. m. May 24, and flew 1367 miles to Kenita, 18.6 miles from Rabat, at an average speed of 118.8 miles per hour. He has started on a transatlantic flight to Brazil by the way of Rabat. His descent was caused by engine trouble and the machine was damaged in landing on rough ground. It is expected that the flight will have to be abandoned.

—

Wills and Lee to Put Up Plant for New 6-Cylinder Car

DETROIT, May 28—C. L. Wills and John R. Lee, both recentiy connected with the Ford Motor Co., to-day announced that they have taken an option on 2000 acres on the St. Clair River between St. Clair and Port Huron, 50 miles north of Detroit, on which they will build an automobile factory to employ, eventually, 35,000 men.

The factory will build a 6-cylinder car which Mr. Wills has designed. The price of the car has not been announced.

The site has a 3-mile frontage on the St. Clair River and a plant will be designed for the entire production. Arrangements are being made to bring iron ore from the mines by boat.

Included in this site is a village which will be the foundation of a model city to be constructed by this company.

Mr. Wills was chief engineer of the Ford company and had been associated with Henry Ford for two years before the present company was organized. He had been with the Ford organization for 18 years.

Mr. Lee was in charge of the social welfare, profit sharing and bonus departments of the Ford Motor Co.

These men are regarded as having ample capital, but reports have it that other men are associated with them, but no names are mentioned.

Belgian Manufacturers Preparing to Get Back Into Production

Plants in Deplorable Condition—Ready Cash Scarce—Minerva Motors Reveals Definite Plans of Production and Gives Picture of Recovered Factory

ANTWERP, May 1.—(Special Correspondence.)—The automobile manufacturers of Belgium, who recovered their factories shortly after the signing of the armistice, are at a loss to predict when they will be able to resume production. The plants were in a deplorable condition, and most of the manufacturers have been so busy cleaning up and restoring their plants that they have been unable to give the proper attention to future work. Another drawback is that most factories have an abundance of requisition bonds and no money, and it is difficult in the present market to buy without ready cash.

An exception to this is the Minerva Motors Societe Anonyme. S. de Jong, director of the Minerva works, has definite plans for production, and says that he expects his company to be the first in the market. Mr. de Jong began his preparations for production while in exile in Holland and now will benefit by the plans and the work done there during the war. To a representative of AUTOMOTIVE INDUSTRIES, Mr. de Jong said:

"The first impression when I walked through our plant was that a few thousand Bolsheviks had been let loose in our place for a certain length of time, after which an earthquake had knocked everything to pieces. Not one thing was in its accustomed place, where we left it in 1914. Things which used to be on the ground floor at one time we found in the opposite direction on the roof on the sixth floor.

"We missed 750 machine tools which the Germans had carried somewhere in Germany, with the necessary electric motors, shaftings, pulleys, belting and lots of other installation material. Our warehouses have been robbed of a great part of their contents, and especially of practically every part of brass, aluminum, antimony and other valuable goods. The last six months the Germans had requisitioned us to deliver them every week 1,000 kgs. of brass or bronze goods, and, of course, our stock of spares in that metal has practically disappeared.

"On the other hand, as they had been repairing cars in our place for the last four years, we found several hundreds of broken up lorries of German make, and a few hundred broken up passenger cars from the same source. They were of the most heterogeneous types and ages, and probably included all cars found unrepairable during the war.

"More than 200 beds were distributed in practically all parts of the building, as parts of it had been used for sleeping quarters.

"The first few months we have been employing 400 to 500 men in cleaning the premises. We have been whitewashing, cleaning, painting as much as we could. Everything which did not belong to us has been removed and we have put in order as much as possible what remained that belonged to us and tried to take an invenotry of what was missing.

"We are having some trouble with labor, but fortunately until now these troubles are not so great that we cannot overcome them. Practically all our workmen, a great many of whom had been spread all over England, France, Holland and other countries, have come back and are happy to work in the old place again.

"Fortunately, we had been working during our stay in Holland to prepare substitutes for what we knew had been taken away from our factory. Several hundreds of special machines had been ordered in your country, many others in England and in Holland. During the war we have been making, with the help of a few hundred interned Belgian soldiers, 150 machine tools which we have since brought here.

"As soon as we returned we started buying material and as we have prepared to a great extent the jigs and tools for the new types of cars we will bring out soon, we are now simply awaiting the steamers which will bring over in time the machines and material from your country, as well as from England and France, to be able to start deliveries of our new cars within four to five months.

"In the meantime, we have about 300 men busy repairing the cars for the Belgian army, which army, as you know, has still in use a great proportion of Minerva cars. These were requisitioned in August, 1914, from the private owners and have all been through the war. Some of these cars requisitioned in 1914 were of respectable age then."

France Will Drop 45 Per Cent Import Duty to 15 Per Cent in 1920

Import Restrictions and Heavy Duty on American Cars During War Led Manufacturers to Protest to C. C. Hanch—Demand for American Cars Interrupted by War

Special cable to AUTOMOTIVE INDUSTRIES

PARIS, May 26—It is announced that after the signing of the Peace Treaty, France will adopt a 45 per cent duty on American automobiles until January, 1920. After that date, the duty will be made 15 per cent.

—

This announcement by cable from W. F. Bradley, European correspondent of AUTOMOTIVE INDUSTRIES, follows recommendations of similar import that were made by the International Congress of Automobile Manufacturers, which met in Paris early in March. The Congress, which included automobile manufacturers of all European countries except the German allies, recommended a tax of 10 per cent on European automobiles and a 45 per cent tax on American.

At that time the import tax in France was 70 per cent on vehicles weighing less than 2700 kilos, but the importation was allowed only by license. About that time the Groupement des Importateurs d'Automobiles Americaines sent a protest to C. C. Hanch, then in Europe as representative of the N. A. C. C. This protest asked Mr. Hanch to take up at once the problem of opening French trade to American cars. The importers in this protest said:

"Before the war the customs duty on American automobiles was frs. 750 ($150) per 100 kgs. Now, on June 24, 1916, the tariff was increased to 70 per cent ad valorem on the value of the goods, augmented by all charges for the transportation, war and maritime insurance; this in order to protect French industry, as all the factories were occupied on war work. At this rate, a car costing, say, frs. 8500 ($1700) in America would pay about frs. 10,000 ($2000) duty. On April 1, 1917, the French government passed a law prohibiting, purely and simply, all importations of cars of foreign manufacture."

They also pointed out that during the period of hostilities they made no plea for their trade but had waited patiently until conditions had changed. At the time of writing the protest they asserted that the French manufacturers were advertising new models as ready for sale to the public. Hence, the further restrictions of importations could not be with a view of protecting the French manufacturers. They expressed the belief that importation of American cars would be beneficial to the entire country. They did not ask a return to pre-war custom tariffs but asked a tariff that would permit them to resume business.

Figures on American passenger cars exported to France follow:

Fiscal years ending June 30

Year	Number	Value
1912	574	$469,721
1913	818	615,086
*1914	1,427	919,060
1915	451	252,909
1916	2,087	1,428,825
1917	1,367	836,557
1918	1,169	1,518,858

*Government year 1914 includes 1914 to June 30—two months before declaration of war.

Calendar year 1918 (to Dec. 31)	1,003	1,134,818
(Obviously this overlaps fiscal year 1918)		
1919		
Jan.	28	128,619
Feb.	82	281,131
Mar.	73	170,893

These figures indicate that there was, before the war, a growing demand in France for American cars. The interruption of the growth of this business in 1915 was due to war conditions. The figures during the war have no direct bearing on the trade situation.

—

Champion to Make 35,000,000 Spark Plugs

TOLEDO, May 26—The Champion Spark Plug Co. proposes to make 35,000,000 plugs this year. Last year 25,000,000 were produced as against 24,000,000 in 1917. Increased production is made possible by the enlargement of the plant through the purchase of the old Bissell Mfg. Co. buildings. The company now employs 850 in Toledo and 750 in its insulator plant in Detroit.

—

Nitro Carbureter Sales Through C. A. S. Engineering

NEWBURGH, N. Y., May 26—The Sunderman Carbureter Corp. has closed a deal with the C. A. S. Engineering Co., Detroit, whereby the latter company will handle the sales of the Nitro carbureter to the manufacturing trade.

Hollier Back in Production

CHELSEA, MICH., May 26—The Lewis Spring & Axle Co. is now getting into fair production on the Hollier six. Manufacture of this car, which was discontinued during the war, has now been permanently resumed, but no production schedule has been prepared for the coming year. About 400 men are on the payroll and this number will be increased as production expands.

—

Standard-Detroit Tractor Dissolving

DETROIT, May 26—The Standard-Detroit Tractor Co. has filed a petition for dissolution in the circuit court. The petition was signed by M. L. Pulcher, head of the Federal Motor Truck Co., and Edward P. Hammond, both stock holders in the company, and others. Assets amount to $1,811, and liabilities $59,490. The company was incorporated some time ago for $100,000 for the purpose of manufacturing a tractor attachment to Ford cars.

—

Annual Convention of Drop Forge Assns.

PITTSBURGH, May 26—The annual convention of the American Drop Forge Association and of the Drop Forge Supply Association will be held June 12 to 14, at the William Penn Hotel. Some of the subjects to be discussed are: "The Bonus System in the Entire Forge Shop;" "Testing Materials;" "Electric Welding as Applied to the Forging Industry;" "Sand Blasting versus Pickling;" "Heat Treating Problems That Originate in the Forge Shop;" "Powdered Coal Developments in the Forging Fields."

Officers of both organizations will probably be continued in office. Officers of the American Drop Forge Association are: President, E. J. Frost, of the Frost Gear & Forge Co., Jackson, Mich.; vice-president, J. F. Connelly, of the Champion Machine & Forging Co., Cleveland; secretary, A. W. Peterson, of the American Drop Forger, Pittsburgh; treasurer, E. B. Horne, of the Packard Motor Car Co., Detroit.

Officers of the Drop Forge Supply Association are: President, H. N. Taylor, of N. & G. Taylor Co., Philadelphia; vice-president, Charles Harmon, Jr., of the National Machinery Co., Tiffin, Ohio; secretary-treasurer, A. L. Wurster, of the Sizer Forge Co., Philadelphia.

—

Passengers Landed on Hotel Roof

WASHINGTON, May 24—An army dirigible type A-4 made a successful landing of passengers on the roof of the Hotel Statler, Cleveland, to-day, following a flight from Akron. The dirigible discharged two passengers and took two others aboard for the return trip. The transfer was made on a landing stage built especially on the roof of the hotel.

—

Record Washington-New York Flight in 84 Minutes

WASHINGTON, May 26—An airplane piloted by Col. Gerald C. Brant and Lieut. Howard Birkett flew 220 miles, from Washington to New York, Saturday in 84 minutes, an average of 157.2 m.p.h., breaking all speed records between these points. The aviators had the advantage of a 60-mile gale behind them. They maintained an altitude of 8000 ft. This trip ended a flight from Houston, Tex., by way of Dayton, Ohio, and Washington. The entire distance of 1725 miles was covered in 994 minutes of actual flying time.

—

National Gas Engine Assn. to Discuss Bigger Business

CHICAGO, May 26—Bigger business is the general theme of the annual convention of the National Gas Engine Association to be held here at the Sherman hotel, June 2-3. Informal group meetings will consider stationary and oil en-

gines, farm engines, tractor engines, farm lighting plants and accessories. The two-day meeting will be closed by a Victory dinner Tuesday night at which the guest of honor will be W. B. Wilson, Secretary of Labor. He will speak on relations of capital and labor before and after the war. James H. Carter of the National City Bank of New York is the other speaker for the dinner.

—

150 Manufacturers to Be Represented at Denver

DENVER, May 27—About 100 tractors and 750 farm implements, representing a total of nearly 150 manufacturers, will take part in the Mountain States National Tractor Demonstration, to be held June 9-12 under the auspices of the Denver Tractor Club, Denver Civic and Commercial Association and the civic body's Agricultural and Livestock Bureau. On the 2300-acre demonstration ground, 100 tents will be put up for the exhibiting firms.

—

Investigation of Rubber Substitute Wanted

WASHINGTON, May 26—Investigation and study of methods for using sage brush and greasewood to produce rubber, alcohol and acetic acid was asked in a bill introduced in Congress by Representative Raker. The bill provides for the appropriation of $5,000 for making the investigations and tests.

—

Extend Time of Tax Payments

WASHINGTON, May 26—An extension of time has been allowed to automobile and parts manufacturers and operators of motor truck, freight or express routes for filing return of taxes due under the Revenue Act for the periods from February 25 to March 31, and from April 1 to April 30, 1919, until June 15, 1919. The extension has been granted because of an unavoidable delay in the printing and distribution of the necessary blank forms for making the returns.

The specific sections of the Act referred to are No. 900, which is on the manufacturer's selling price of trucks, passenger cars, motorcycles, accessories and parts, and No. 500, which imposes the tax on transportation of goods by freight or express on motor trucks competing with rail or water.

Delay has also been granted for the filing of returns on admissions to automobile shows for the same reason, until June 15.

—

Splitdorf Training Foremen

NEWARK, N. J., May 24—The Splitdorf Electrical Co. has organized a group of foremen of its various departments to study modern production methods. The course will last three months and will include training in handling men, a complete study of materials from purchase to final product, a study of the plant, organization, costs, industrial relations, safety and co-operation.

Labor Shortage In Detroit Reduced

Automotive Concerns and Other Agencies Brought Many Here—Fear of Losing Foreign Labor

DETROIT, May 24—The last week has seen a great improvement in labor conditions in Detroit. The shortage, which a month ago was estimated at 50,000 workers, has been decreased to 20,000 by the efforts of all automotive concerns, the United States employment office and other employment agencies, which have brought thousands of men to Detroit. Many of the factories are advertising outside the city for men, while others have field representatives busy in many sections. Hundreds of mechanics and other skilled workers have come in from Buffalo and New York City within the last few days.

Grand Rapids Short 2000 Men

Grand Rapids, a furniture center, is short 2000 men, while Pontiac, Battle Creek, Flint, Jackson, Lansing, Traverse City, Port Huron, Saginaw, and Bay City have all sent in urgent requests for workers at once. The shortage seems to be general in all of the manufacturing cities of the State.

Hundreds of men, both skilled and unskilled, are being brought from the copper countries. Work in the copper fields is slack at this time, many of the mines operating only on a 50 per cent schedule, resulting in a labor surplus there. So many automobile labor representatives from Detroit, Flint, Lansing and other lower Michigan points are working in upper Michigan, employing workers for the industrial centers, that the newspapers of that section are voicing a protest. The press is urging the workers not to be stampeded because there is a little lull in the copper industry, following a very high pressure in production because of war needs. They declare that with the signing of peace terms a great boom is due to hit that section.

Workers Brought from Other Cities

Factories bringing the men in from outside find this method very costly and sometimes without fair results. One plant recently brought 300 workers to Detroit from Chicago and nearby points. The men were told to report for work at a certain time, but out of the 300 only 75 appeared. There are many instances of this sort. Pontiac recently imported 400 workers, 320 of whom left town within a week. The great reason for a laboring man leaving is the living condition. He finds homes unobtainable, rents excessive and food prices extravagant. If Detroit and neighboring industrial towns hope to solve the present shortage by bringing in men from the outside, they must first solve the housing and living problems.

Common labor in Detroit is being paid from 50 cents to 60 cents an hour, while skilled labor runs from 65 cents up to $1.25. Tool makers and other highly skilled mechanics are working on scales ranging from 80 to 90 cents an hour. The minimum day wage for common labor is approximately $5, and in some cases more. The skilled employee is averaging between $35 and $50 weekly.

One problem causing the employer of labor more or less concern is the exodus of foreign workers and a threatened permanent shortage of common labor. In the last 4 months 2700 Detroit aliens have left for their native lands. Between 600 and 700 are applying monthly at an emigration office for passports. If this exodus of aliens continues, and there is every indication that the movement is spreading, Detroit alone is going to lose between 10,000 and 12,000 workers within the next few months. Emigration restrictions are rather rigid at present, owing to the continued enforcement of war rulings, but with the declaration of peace there will be a relaxation of many emigration laws, and hundreds of men barred because of technicalities at present will then be permitted to leave.

Few Germans Apply for Passports

The greatest percentage of those desiring to return are Italians, Belgians, Russians, Serbians, Austrians, and French. The Austrian, while clamoring for passports, is held up, except in rare cases, because he is still an alien enemy. Few Germans have applied for passports because they know they will be refused.

Employers here are closely watching legislative developments at Washington regarding immigration. It is feared that Congress may decide to bar newcomers, which manufacturers regard as serious, taken in connection with the tendency on the part of many European countries to keep workers at home.

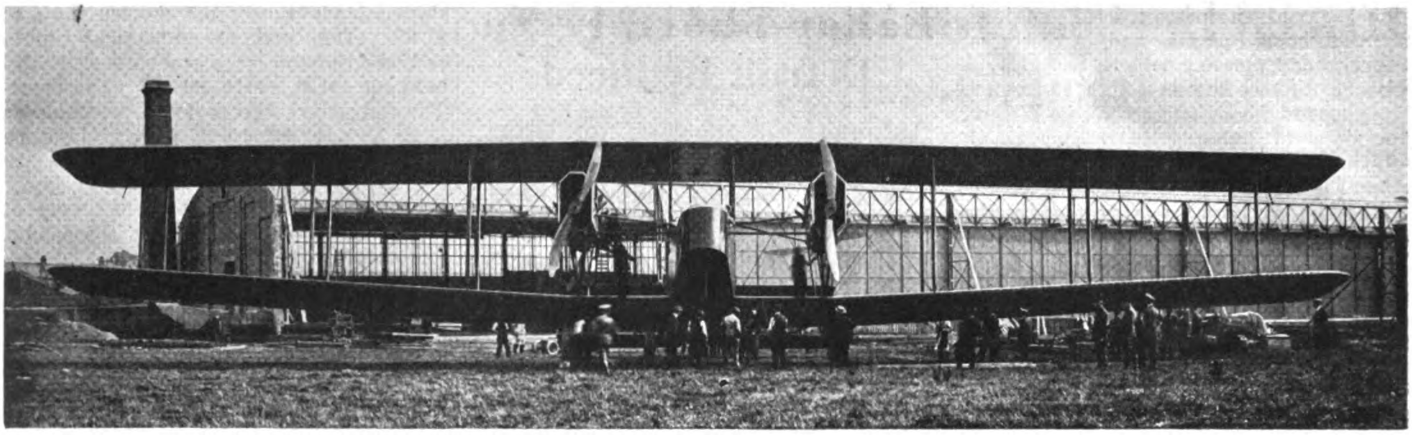
—

Employment Conditions Improve

WASHINGTON, May 23—Reports received from the U. S. Employment Service for the week ended May 17 show an improvement in unemployment conditions. Reports from 87 cities show 39 reporting a surplus as compared with 42 cities reporting a surplus the week previous. Fifteen cities report a labor shortage.

New York reported 126,000 surplus, Cleveland 30,000 and Pittsburgh, 20,000. The Middle Atlantic and New England states report labor surpluses. Cleveland, Youngstown, Cincinnati, and Dayton report unemployment, and Akron reports a shortage.

There is a shortage of labor throughout the South, chiefly in the agricultural district. Los Angeles reports 5600 unemployed, San Francisco, 2000 and Oakland a shortage of 350. Conditions in the Northwest are good, with a shortage of labor reported from all cities. The aggregate surplus of labor shortage of the country of 310,000 is not a serious total and is considered close to the normal.



The Handley-Page airplane, now at Newfoundland in preparation for a transatlantic flight

Rubber Exports for February from Brazil and Peru

WASHINGTON, May 28—The total exports of crude rubber from Para and Manaos, Brazil, and Iquitos, Peru, during the month of February, 1919, amounted to 9,242,309 lb. compared with 6,587,710 lb. for the same month in 1918. Shipments to the United States aggregated 4,434,206 lb. and to Europe 4,808,-103 lb. compared with 3,453,272 lb. and 3,134,438 lb., respectively, last year.

The several grades of rubber are shown in the following table:

	From Para		From Manaos		From Iquitos	
	To United States lbs.	To Europe lbs.	To United States lbs.	To Europe lbs.	To United States lbs.	To Europe lbs.
Fine	634,075	1,863,401	1,274,344	1,570,468	.....	317,444
Medium	111,422	38,147	585,247	122,965	.....	4,256
Coarse	334,319	98,152	821,488	152,251	.....	14,521
Caucho	189,533	348,617	439,686	242,817	44,092	34,064
Total	1,269,349	2,348,317	3,120,765	2,089,501	44,092	370,285

Foreign Trade Opportunities

WASHINGTON, May 27—The Bureau of Foreign and Domestic Commerce has received requests for cars and parts, airplanes and parts, tractors, motorcycles, and accessories agencies of business from individuals and companies in foreign countries. For further information address the Bureau of Foreign and Domestic Commerce, Department of Commerce, and specify the Foreign Trade Opportunity number.

Norway—Cars and supplies. Quotations should be f. o. b. New York. Terms, cash against documents at destination. No. 29403.

New Zealand—Cars, accessories, trucks; electric trucks, ½ to 7-ton; tractors. No. 29420.

Uruguay—Cars and motorcycles. No. 29423.

Switzerland—Cars, bicycles and pneumatic tires. Correspondence may be in English. No. 29434

Italy—Trucks, 5- to 7-ton, heavy construction. High grade passenger cars. Correspondence should be in Italian or French. No. 29440.

Brazil—Rubber tires. Correspondence may be in English. No. 29443.

France—Tractors. Terms cash. Correspondence in French. No. 29448.

Spain—Cars. Correspondence in Spanish. No. 29449.

Italy—Cars, chassis, wheels, tires, etc., accessories and supplies. No. 29456.

Denmark—Cars for Poland and Scandinavian countries. No. 29470.

Norwegian—Cars, motorcycles, accessories for Scandinavian countries. No. 29473.

Australia — Automobile accessories. No. 29481.

Gillett Products to Have Plant

HOWARD CITY, MICH., May 26—The Gillett Motor Products Co., recently organized to make automobile parts, is breaking ground for a new steel and concrete manufacturing building.

E. M. Landis Co. Newly Incorporated

TOLEDO, May 24—The E. M. Landis Co. has been incorporated to take over the plant and business of E. M. Landis at 6 North St. Clair Street, and to manufacture a kerosene carbureter and automobile lock. The officers of the new company are: President, E. M. Landis; vice-president, Eugene Rheinfrank; secretary, C. E. Shanteau; treasurer, A. J. Hilt. The latter two gentlemen are the new members of the firm. The company will also continue to sell and repair gas engines, trucks and farm machinery.

National Tool Becomes Bluebird

ST. LOUIS, May 23—The National Tool & Manufacturing Co., maker of Bluebird products, has changed its name to the Bluebird Manufacturing Co. to more closely identify itself with its products.

India Tire Dividend

India Tire & Rubber Co., Akron, 2 per cent quarterly dividend on common, 1¾ per cent on preferred, declared payable July 1.

Router to Make Tools

OSHKOSH, WIS., May 26—The Router Mfg. Co. has been organized with a capital stock of $100,000 to engage in the manufacture of tools, metal goods, hardware, motor car accessories and similar goods. William P. Casey, E. G. Race and James C. Casey appear as incorporators.

To Reintroduce Townsend Highway Commission Bill

WASHINGTON, May. 24—The reintroduction of the bill providing for the establishment of a Federal Highway Commission to take over the control of the national highways, the distribution of funds under the Federal Road Aid Act and to co-operate with the state highway departments was forecast by a meeting held here recently by Senator Charles E. Townsend, father of the bill, with members of the automobile and highway industries.

The bill, which takes over the present duties and authority of the Bureau of Public Roads, Department of Agriculture, greatly enlarges the scope and duties of the road authorities.

Senator Townsend is the chairman of the committee on post offices and post roads. He informed the convention here to-day that he plans to again introduce the bill as soon as he can add various amendments and improvements that have been suggested since the last Congress.

Among those present at the meeting were Roy D. Chapin, president of the Hudson Motor Car Co.; W. O. Rutherford, vice-president of B. F. Goodrich Co.; S. N. Williams, president of the Highway Industries Association; Pyke Johnson, representing the National Automobile Chamber of Commerce and the National Automobile Dealers' Association; Windsor T. White, the White Co.; David Ludlum, president of the Autocar Co., and various road officials.

Auto Specialties Foundry in Operation

ST. JOSEPH, MICH., May 26—The first heat in the newly completed foundry of the Auto Specialties Co. was drawn May 17. The new foundry is now in full operation with enough orders ahead to keep it running several months.

Connor Physical Director for Goodyear

AKRON, OHIO, May 26—Edward Connor, former athletic director at Lincoln High School, is now with the Goodyear Tire & Rubber Co. as physical director. He was athletic director at Camp Sherman during the war with the title of major.

Official Decision for Disposal of U. S. Army Vehicles in France

Manufacturers Oppose Sale of American Cars and Trucks in France —Dealers and Users Anxious to Buy—Service Stations and Repair Shops to Be Disposed Of

PARIS, May 10 (Special Correspondence)—An official decision regarding the disposal of the American Army trucks and passenger cars now in France is expected within a few days. At the end of December, 1918, the Army possessed 7575 passenger cars and 32,500 trucks. Only a small number of these is required for the Army of Occupation, and the rest must be disposed of in Europe or returned to America. This week the Liquidation Board prepared a detailed statement of automotive material no longer required by the army and submitted the same to the French Government, which alone has authority to say whether the material shall remain in France or not. It is hoped that the French reply will be received early, as the clearing up of this question will permit the Americans concerned to return home.

The situation is rather peculiar. French automobile manufacturers are bitterly opposed to any American army cars being allowed to remain in France, and are bringing the greatest possible pressure to bear on the Government to force their return to America. They maintain that if it is necessary to sell these vehicles in France, the purchasers should be called upon to pay the 70 per cent import duty which is now in vogue, not on their present value, but on the original value of the cars and trucks.

Dealers and users, on the other hand, are just as earnest in their endeavors to buy this army material. One of the officers of the Liquidation Board said: "Buyers are literally shaking good money in our faces in order to get delivery of these automobiles."

Offers are coming from all quarters and from men with the best financial backing who want to buy in big quantities. No offers can be accepted, however, until the French Government decision has been rendered as to the conditions under which the material shall be disposed of.

It is stated that the Army has neither Dodges nor Fords for sale, all those now in hand being required for the Army of Occupation. The only other car of which large numbers exist in France is the Cadillac; but while this has an excellent reputation, it is too powerful a car and has too high a gas consumption to suit the average purchaser of used cars in France.

Some of the American army vehicles have already been sold to Allies other than France, who are in urgent need of them. A number of trucks has gone to Roumania, Serbia and Belgium. In addition, the Reconstruction Department of the French Government has taken for its own use some American army trucks.

When these purchases have been made, the officers of the Liquidation Board have insisted on sufficient spare parts being taken to keep the vehicles in efficient service for at least 6 months. This has been done in an unofficial manner in order to protect the interests of the American manufacturer. Nothing could be more disastrous to the reputation of the American automotive industry than to allow trucks to go to foreign countries without any means of maintenance.

In addition to the vehicles, there are large service depots and repair shops to be disposed of. The most important of these is the Reconstruction Park at Verneuil. This place has big machine shops and immense stocks of spares, including 146,000 solid tires. Owing to the shortage of buildings, these tires had to spend the winter out of doors without protection and have suffered a little in consequence. Probably they will be sold with the trucks, for they are inch sizes and could not be used on European vehicles.

Numerous rumors have been afloat regarding the disposal of the Verneuil shops. One of the most persistent is to the effect that the White Co. had an option on the entire place. Inquiries at headquarters show that while the White people are interested, no option has been given to them.

New British Engine Combines Internal Combustion and Steam Principles

LONDON, May 27—A new design of liquid fuel engine, for which a thermal efficiency higher than that of the Diesel is claimed, was described in a paper before the Society of Arts yesterday afternoon. It is the invention of William Joseph Still, who spent the past eight years on its development.

With the ordinary internal combustion engine a greater amount of heat than is converted into useful work passes into the cooling jacket and is dissipated by the radiator. Still recovers some of this heat by making the cylinder jacket into a steam boiler and using the steam generated therein in the same cylinder in which the combustible charge is expanded, but at the opposite end of the piston. The engine is thus double-acting and, inasmuch as there is always a store of energy in the steam and hot water of the boiler, the engine cannot be stalled by temporary small overloads.

It appears that the engine is intended mainly for marine propulsion where the use of large units would increase the importance of any saving in fuel and minimize the objection to increased complication of plant. It is claimed that a marine propulsion set weighs 20 per cent less than a geared steam turbine plant, and uses 2000 tons less fuel for a double journey lasting 1000 hours, this comparison being based evidently on a vessel of given tonnage and speed.

C. C. Hanch Returns

NEW YORK, May 28—C. C. Hanch, secretary of the National Automobile Chamber of Commerce, returned Saturday from a 4 months' investigating trip in European countries. Mr. Hanch is engaged in preparing reports of his investigations abroad.

Schwab Elected President of Adams-Williams

NEW YORK, May 27—F. C. Schwab, who resigned as president of the Adams-Williams Manufacturing Corp. to enter government service, was re-elected to that position at a special meeting of the directors of the company. S. H. Crittenden, who also returned from service recently, was elected vice-president. Leo W. Schwab was re-elected secretary and treasurer. Plans have been completed to enlarge factory space and increase production this year.

Wright-Fisher Engineering Co. Formed

DETROIT, May 24—The Wright-Fisher Engineering Co. has been formed here by James A. Wright, W. Ruben Fisher, W. E. Jominy, Albert Harwith, William J. Kurth and L. F. Merritt, all of whom were engaged until recently in the Bureau of Aircraft production. The company will engage in the designing of tools, dies, jigs, fixtures, special machinery, automatic machinery, heat treating equipment, etc.

Increased Production for Marshall Starter

ADRIAN, MICH., May 26—The Adrian Castings Co. is increasing its working force and the output of the Marshall automobile starter. The Marshall starter is the invention of Hal Marshall of this city, and was manufactured for over a year by the Page Steel & Wire Co. before it was taken over by the Adrian Castings Co. The latter is preparing to produce 200 starters per day.

John Bohnet to Make Truck Bodies

LANSING, May 26—The John Bohnet Co. has increased its capitalization $100,000. The company will enter the truck body field, making a specialty of hearse, delivery and ambulance bodies.

Rubber Association to Study Taxes

AKRON, May 26—The Rubber Association of America has appointed a committee of seven to make a study of the new federal tax on tires, tubes and accessories. Among those on the committee are F. C. Van Cleef of the B. F. Goodrich Co.; B. M. Robinson, Firestone Tire & Rubber Co.; and C. L. Landon of the Goodyear Tire & Rubber Co.

New members of the association just admitted include H. J. Adams, C. R. Quine, Akron Equipment Co.; T. M. Gregory, Jr., M. D. Kuhlke Machine Co.; John Hadfield, Lincoln Rubber Co.; Leo Meyer, A. P. Whetlen and F. E. Holcomb of the J. K. Williams Foundry & Machine Co.; Paul E. Collette of the Oak Rubber Co., and Joe S. Benner of the Electric Rubber Reclaiming Co.

N. A. C. C. Meetings to Discuss Problems of Industry

NEW YORK, May 26—The National Automobile Chamber of Commerce has arranged a number of special meetings to be held at the general headquarters in New York during the week of June 2, to deal with problems arising in the industry. There will also be meetings at Washington.

Following is the schedule of meetings:

June 2, 10 a. m., Washington, D. C.—Export Committee, J. Walter Drake, chairman, for conference with officials of Department of State and Department of Commerce on foreign trade limitations.

June 3, 10 a. m., Washington, D. C.—Meeting of Tax Committee in connection with elimination of taxes on cars, trucks and parts.

June 4, 10 a. m., New York Headquarters—Directors' meeting.

June 4, 2 p. m., New York Headquarters—Meeting of Truck Committee, Windsor T. White, chairman.

June 5, 10 a. m., New York Headquarters—Annual meeting of members.

June 5, 1.30 p. m., New York Headquarters—Regular meeting of truck manufacturers, members of N. A. C. C.

June 6, 10 a. m.—Meeting of export managers, N. A. C. C., New York Headquarters.

Highways Committee to Study Short Hauls

WASHINGTON, May 26—The Highways Transport Committee, Council of National Defense, will make an intensive study of short haul problems at Boston, New York, Philadelphia, Pittsburgh, Baltimore, Washington, Atlanta, New Orleans, St. Louis, Chicago, Detroit, Cleveland, Omaha, Denver, Dallas, San Francisco, Los Angeles, Portland and St. Paul. The committee asks the co-operation of all manufacturers and dealers so it may obtain the maximum amount of data. Any information relative to the names and addresses of operators, number and capacities of trucks in use, routes and schedules and rates with copy of the tariff when it is available is desired. Such information should be sent directly to the Highways Transport Committee, Council of National Defense, Washington, D. C.

Haynes to Increase Capacity

KOKOMO, IND., May 26—The capacity output of the Haynes Automobile Co. will be increased to 15,000 cars annually, according to plans which were decided upon at a recent meeting of the directors of the company. To make this expansion possible the directors voted to construct a large new factory building and a forge shop and to increase the capital stock from $3,500,000 to $5,000,000.

A. G. Seiberling was elected second vice-president. He will continue as general manager. March Haynes, son of Elwood Haynes, was chosen assistant treasurer and secretary.

The new factory building will be 4 stories, 500 x 150 ft., adding 300,000 sq. ft. The building will be of fireproof steel and concrete construction, and will be used for assembling, trimming, painting and storage. It is estimated the normal output of the enlarged factory will be 50 cars a day. Work on the new building has been started.

"Wilson-Built" Trade-Mark

DETROIT, May 26—The C. R. Wilson Body Co. will trade-mark with the Wilson triangle, containing the words "Wilson-Built," all bodies turned out by its plant.

Suggestions Asked as to Form of Census of Automotive Manufactures

Tentative Form for General and Supplemental Information—Bureau of Census Anxious for Suggestions and Criticisms

WASHINGTON, May 24—A survey of the manufactures of 1919 will be taken by the Bureau of Census, Department of Commerce, in connection with the next census. A blank form has been prepared for both general and supplemental information, the latter including the kind, quantity and value of manufactured product, and will be mailed to the manufacturers of the automotive industry in December of this year.

The form which is presented herewith is tentative and subject to revision, and the Bureau of Census will welcome every suggestion from the industry that will be helpful to a better presentation of the statistics and which will be in harmony with the bookkeeping methods of the manufacturers.

All recommendations and criticisms may be addressed directly to the Chief Statistician for Manufactures, Bureau of The Census, Department of Commerce, Washington, D. C.

8-4338 *Confidential* [NN3-457]

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
Sam. L. Rogers, *Director*

CENSUS OF MANUFACTURES, 1919
Eugene F. Hartley, *Chief Statistician for Manufactures*

AUTOMOTIVES
(INCLUDING TRUCKS AND TRACTORS)
SUPPLEMENTAL SCHEDULE

NAME OF ESTABLISHMENT.......................
NAME OF OWNER.......................
LOCATION OF FACTORY { State.......................County.......................
Post office.......................Street and No.......................

1. PRODUCTS: Give the number and selling value or price at the factory, and account for all products and by-products manufactured during the year (whether sold or not). If the establishment makes automobiles using different kinds of power, give the number and value of each kind separately. *Establishments manufacturing motorcycles and bicycles, carriages and wagons, or engines, should report such products on the supplemental schedule for these industries.*
The total value of products in this schedule must agree with the total in the General Schedule.

Kind	Internal Combustion Engines		Electric	Steam	Value
	Gasoline	Other*			
	Number	Number	Number	Number	
Passenger vehicles:					
Open:					
Roadsters					
Runabouts					
Touring					
Closed					
Other varieties (specify):					
....					
Public conveyances:					
Cabs					
Omnibuses, sightseeing wagons, etc					
Government, municipal, etc.:					
Ambulances					
Fire department apparatus (specify):					
....					
Mail delivery					
Tanks (specify):					
....					
Patrol wagons					
Other (specify):					
....					
....					

*Name kind: Alcohol, naphtha, kerosene, Natolite, Liberty, etc.

Reverse of sheet on next page

Reverse Side of Census Questionnaire

Kind	Internal Combustion Engines		Electric	Steam	Value
	Gasoline	Other*			
	Number	Number	Number	Number	
Business vehicles:					
Delivery wagons					
Trucks					
Tractors:					
Farm					
Road					
Other (specify kind):					
Other varieties (specify):					
Chassis					
Trailers ... Number					
All other products, including parts, etc					
Amount received for custom work and repairing					
Total					

*Name kind: Alcohol, naphtha, kerosene, Natolite, Liberty, etc.

2. Number of Machines by Horsepower Rating: The number of automobiles reported in answer to this inquiry should correspond with the number reported in answer to Inquiry 1.

	Less than 10 H.P.	10, but less than 20 H.P.	20, but less than 30 H.P.	30, but less than 50 H.P.	50, but less than 90 H.P.	90 H.P. or More
Passenger vehicles:						
Open:						
Roadsters						
Runabouts						
Touring						
Closed						
Other						
Public conveyances:						
Cabs						
Omnibuses, sightseeing wagons, etc						
Government, municipal, etc.:						
Ambulances						
Fire department apparatus						
Mail delivery						
Tanks						
Patrol wagons						
Other						
Business vehicles:						
Delivery wagons						
Trucks						
Tractors:						
Farm						
Road						
Other						
Other						
Chassis						

3. Remarks:

Seventh Foreign Trade Convention Next May

NEW YORK, May 26—The Seventh National Foreign Trade Convention is scheduled to be held in San Francisco on May 12-15, 1920. This will be the first convention of the National Foreign Trade Council to be held on the Pacific coast, and will give special opportunities for the study of export possibilities in South America, China, Japan, Siberia, India, and Australasia.

May Make Licenses Valid Everywhere

WASHINGTON, May 23—A bill has been introduced in Congress to allow anyone qualified to drive an automobile in his residential state to go into another state for business or pleasure without taking out an additional license or tag or paying an additional tax. It is also provided that no owner of an automobile who has complied with the laws of his own state shall be required to make any additional registration or pay any additional tax to operate an automobile in any other state. The bill, which was presented by Senator Pittman of Nevada, was referred to the Committee on Interstate Commerce.

Government to Standardize Army Tractors

DETROIT, May 26—The Government has established at 1492 Federal Avenue an experimental station for artillery tractors which is in charge of Don Ferguson, consulting engineer. Associated with Mr. Ferguson at the station is William H. Oliver, former chief engineer of the Hyatt Roller Bearing Co. The station will devote its efforts to standardizing the army tractor. There is a large corps of regular army men, enlisted men and civilians.

Grand Central Palace for Commercial Exhibits

NEW YORK, May 24—The Grand Central Palace will be used as a show place for all sorts of manufactured products when it is returned from service as a base hospital on September 30. The Merchants and Manufacturers Exchange will take it over as a commercial exhibit building, and plans for reconstruction of the interior to make it suitable for this purpose are under way. It is a 12-story structure, each floor having approximately 60,000 sq. ft. of floor space.

The four lower floors will continue to be used for annual expositions, and the eight upper floors will be divided among the industries for permanent showings of their products, to be opened beginning Oct. 15. Some of the industries will occupy an entire floor, such as the International Farm Tractor and Implement Exchange, to occupy the sixth floor. Detailed information may be obtained from the Merchants and Manufacturers Exchange, Room 421, 405 Lexington Avenue.

Whitcomb Heads Kenosha Wheel

KENOSH, WIS., May 26—The Kenosha Wheel & Axle Co., organized with a capital stock of $500,000, as already reported, has completed its organization by the election of the following officers: President, James A. Whitcomb; vice-president, Adolph Epstein; secretary and treasurer, Lloyd E. Wood; directors, Martin P. Winther, F. E. Dunnebacke. Mr. Whitcomb is the owner of the Whitcomb Tool & Machine Co., Kenosha, which merges its business with the new concern. Mr. Wood was associated with the Mitchell Motors Co., Racine. The former plant of the Winther Motor Truck Co., Winthrop Harbor, Ill., has been acquired by the new company and is being equipped for use until a new manufacturing group is built in Kenosha.

Sunbeams Barred From Race

NEW YORK, May 26—The two Sunbeams brought over for the Indianapolis 500-mile race on May 31 by Louis Coatalen, their designer, have been barred from the event because the machines were found to be oversize with a piston displacement greater than that permitted by the American Automobile Association. This means that Dario Resta and Jean Chassagne, who were to have piloted these cars in the 500-mile Victory sweepstakes, have lost their chance to take part.

Discontinue Motor Transport Shipments to A. E. F.

WASHINGTON, May 24—Cables from the A. E. F. have ordered cancellation of all shipments of motor transport corps supplies to France. The supplies now on hand in Europe are sufficient to meet the requirements until evacuation is completed.

$300 Fee for 7-Ton Trucks Proposed

Charge from $10 Up Recommended by Massachusetts Legislature Considered Prohibitive

BOSTON, May 26—The Roads and Bridges Committee of the Massachusetts Legislature has recommended registration fees for trucks that are regarded as practically prohibitive for the use of larger trucks. The report begins with $10 for 1-ton trucks and is increased to $50 for 4-tons, $200 for 6-tons and $300 for 7-tons.

The present fees are $5 for the 1-ton truck, rising gradually to $23 for 7-ton trucks. When the Truck Dealers' Committee was asked for suggestions, they recommended fees ranging from $10 for a 1-ton truck to $46 for a 7-ton. The Massachusetts Highway Commission outlined a scale of fees ranging from $10 for a ½-ton truck and $20 for a 1-ton to $260 for a 7-ton truck.

The controversy over the fees has had a material influence in retarding truck sales. Users now decline to buy heavy trucks until this question is settled.

The truck owners protested any increase, basing their objection on the fact that they pay heavy personal property taxes as well as registration fees. Truck owners did not at any time admit that the registration fees should be increased. The bill as drafted by the committee has been referred to the Committee on Ways and Means and the opponents plan that if they do not get a report to their liking in the committee they will carry it to the floor of the House.

One element entering into the present controversy is the fact that the Highway Commission is to be reorganized and this may change the general status of the proposed legislation.

Complete Airplanes Made by Mexican Government

WASHINGTON, May 27—The Mexican Government has established aviation shops, together with an aviation school, on the outskirts of Mexico City. Both the school and shops were opened in January under direction of the War Department. There are 40 airplanes in Mexico, 10 of which were constructed at the shops and the others assembled there.

The shops are equipped for the manufacture of complete planes, and the present capacity is placed at one airplane and six propellers per week, with facilities for increasing the propeller capacity to 40 per week. At first European and American engines were used entirely, but reports now indicate that engines are being manufactured at the shops. This engine, known as the Aztatl motor, is described as being 80-hp., 120 r.p.m., and functions perfectly at 2500 meters. Work is also being done, according to reliable reports, on an engine of 150 to 180 hp. Propellers of good quality are maufactured from mahogany and other native wood. The anahuac propeller, made of mahogany and "pople," functions perfectly at 2500 meters. It reached 1200 r.p.m. Steps have been taken toward the construction of bombs for airplanes and of bombing planes. The Government expects to build armored bombing machines this year.

Goliath Attains Record Height of 16,730 Feet

PARIS, May 10 (Special Correspondence)—Henry Farman's biplane, the Goliath, which for the past 3 months has been running between Paris and London, and Paris and Brussels, has established a height record of 16,730 feet with 25 persons aboard. This altitude was attained in 1 hr. 15 min.; the descent occupied 25 min. The Goliath, with its load, weighed over 4 tons, made up as follows:

	Lb.
25 passengers	3582
Airplane	4400
Gasoline	770
Oil	66
	8818

The Goliath is fitted with two Salmson star engines developing a total of 550 hp. During the record flight the engines were never run at their full power, in order not to subject the plane to undue strains. It is asserted that the pilot never made use of more than 360 hp.

This biplane has made two previous attempts at height records. On April 1 it attained an altitude of 20,670 ft., with 5 persons aboard, in 65 min., and 3 days later it rose to 20,340 ft. in 65 min. with 14 persons aboard.

Young Industries Gets Patterson Plant

HOLLY, MICH., May 23—The L. A. Young Industries, Inc., Detroit, at a receiver's sale, purchased the plant of the Patterson Manufacturing Co. here, and will start operating immediately. The company will make cushion springs for automobiles and 250 men will be employed. Plans for the building of 50 homes for the new workers are also under way.

New Automobile Signal Co.

GRAND RAPIDS, MICH., May 21—The Automobile Signal Co. has been formed with a $400,000 capital. Of the capital stock, $100,000 is preferred stock subject to redemption at par April 1, 1949, and the holder is entitled to an 8 per cent dividend. It is provided that the corporation may redeem the preferred stock on any dividend date at 105 per cent of its par value, plus accrued dividends. None of the common stock has been subscribed, but all of the common stock has been paid in through the receipt of United States and Canadian patents and the trade-mark registered in the U. S. patent office. The stockholders are Joseph Renihan, V. I. Cilley, and I. J. Cilley.

Program Outline for Pan American Meeting

Aviation Up for Discussion—All Aspects of Pan-American Trade to Be Considered

WASHINGTON, May 26—The Pan-American Commercial Conference will open here on June 2 at 4 p. m. instead of June 3 at 10 a. m. as was first planned. The change has been made to allow certain speakers to attend who will be absent at the later days.

Aviation will be one of the topics discussed, particularly in its relation to Pan-American commerce.

Beginning June 3 at 9.30 a. m., and continuing thereafter with morning, afternoon and evening sessions, the conference will take up the following principal topics:

I—General Review of Pan-American Export and Import Situation.

II—Trading Methods for Both Exports and Imports, subdivided into:
- (a) Business ethics,
- (b) Merchandising,
- (c) Commission service and direct trade,
- (d) Export and import combinations.

III—Shipping and Other Transportation, subdivided into:
- (a) Steamship lines and ships.
- (b) Other transportation, including airplanes as an aid to commerce.

IV—Financing Trade; Investments; Loans, Etc., subdivided into:
- (a) Banking,
- (b) Credits,
- (c) Investments, loans, etc.,
- (d) Government aid to commerce, including the War Finance Corporation.

V—Engineering Aids to Commerce, subdivided into:
- (a) Railways and highways,
- (b) Waterways and harbors,
- (c) Irrigation,
- (d) Sanitation.

VI—Parcel Post, Trade Regulations, Etc., subdivided into:
- (a) Parcel post,
- (b) Patents and trade marks,
- (c) Consular and other trade regulations,
- (d) Packing and insurance.

VII—Commercial Intelligence, subdivided into:
- (a) Advertising and publicity,
- (b) Newspapers and periodicals.

VIII—Educational and Social Auxiliaries to Commerce, subdivided into:
- (a) Vocational training,
- (b) Language study,
- (c) Exchange of students and professors,
- (d) General influences.

The governors of the various states have been invited to attend or send representatives. The conference will open on Monday afternoon with addresses by Vice-President Marshall, the Ambassador of Mexico, the Minister of Bolivia and others. Speakers on various topics at the following sessions include William C. Redfield, Secretary of Commerce; Dr. Carlos de Cespedes, Minister of Cuba; Dr. L. S. Rowe, Assistant Secretary of the Treasury; Don Julio Zamora, Financial Commissioner of Bolivia; Dr. José Santiago Rodriguez, Special Commissioner of Venezuela; Julius G. Lay, Foreign Trade Adviser of the State Department; Francisco J. Yanes, Assistant Director of the Pan-American Union; Don Ernesto Perez, Argentine Consul General of New York, and Dr. Burwell S. Cutler, Chief of the Bureau of Foreign and Domestic Commerce.

Wireless Telephony at S. A. E. Meeting

Connection Will Be Made Between Boat on Lake and Lecture Room—450 Reserved

NEW YORK, May 28—A demonstration and lecture on wireless telephony will be the feature on Tuesday evening, June 24, at the Summer Meeting of the Society of Automotive Engineers at Ottawa Beach. E. H. Colpitts, of the Western Electric Co., who has been identified with the development of wireless telephony, and who spent many months in France during 1918 on radio transmission, is preparing to give a combined lecture and demonstration that will occupy an hour to an hour and a half.

A high speed motor boat is being fitted with apparatus and the lecture room at Ottawa Beach will also be equipped so that all of those attending the lecture can listen to the conversation by wireless telephony between the demonstrator and the operator on the motorboat, which will be several miles out on Lake Michigan. In addition Mr. Colpitts will explain wireless telephony by means of many illustrations, still pictures, and various demonstrating apparatus.

One of the sessions will be given over to members of army and navy departments, who will tell to members of the S. A. E. what their plans are with regard to the future, so that industry may be kept as closely in touch with government as possible. Already the Aircraft Department, Ordnance Department and Motor Transport Departments have agreed to send representatives to Ottawa Beach for this express purpose. Not only will they outline the program of these departments but will answer questions.

The forenoon, given over to the future passenger car, promises to be of unusual interest. Already seven or eight leading engineers have prepared their views on the future passenger car, and it is expected that upwards of 50 or more engineers will express their opinions on this subject during the session given over to it.

It is very probable that an exhibit of captured German trucks will be one of the features of the meeting. These trucks are already on their way to America and it is expected that a portion of them will be on hand at Ottawa Beach.

Four hundred and fifty reservations have been made at the hotel for the entire 5 days of the meeting. Reservations are coming in at the rate of practically 30 per day.

—

Advance Pump Additions

BATTLE CREEK, May 26—The Advance Pump & Compressor Co., Battle Creek, is adding to its plant and equipment. Building additions and installations of machinery aggregating $75,000 in value are being completed.

Exports by Countries for April, 1919, and Nine Months Ending April, 1919

	Cars		Trucks		Cars		Trucks	
	No.	Value	No.	Value	No.	Value	No.	Value
Denmark	115	$169,514	...	....	273	$432,242	....	....
France	4	18,900	251	$1,062,593	682	930,687	3,356	$14,098,262
Norway	93	161,483	...	....	327	639,006	....	....
Russia in Europe	...	......	...	....	6	6,605	....	....
Spain	114	90,450	...	....	680	850,988	....	....
United Kingdom	120	158,392	...	....	251	344,960	869	2,531,039
Canada	1,401	1,224,294	168	2,470,454	3,790	3,491,431	1,656	3,023,656
Mexico	304	225,574	...	....	1,639	1,565,580	....	....
Cuba	224	279,538	87	1,701 695	1,550	2,235,117	543	1,058,805
Argentina	57	61,135	...	....	1,267	1,564,574	40	96,363
Chile	81	157,725	...	....	1,007	1,568,961	....	....
Uruguay	293	298,664	...	....	919	902,159	....	....
British India	140	168,464	...	....	251	312,962	....	....
Dutch East Indies	528	659,999	...	....	1,915	2,491,733	....	....
Russia in Asia	...	......	1	3,800	6	13,634	16	22,000
Australia	134	133,911	...	....	2,729	2,598,318	....	....
New Zealand	298	330,223	...	....	1,296	1,327,175	....	....
Philippine Islands	215	225,615	...	....	1,261	1,402,430	....	....
Br. So. Africa	19	16 883	...	....	922	961,614	....	....
Other countries	1,086	1,123,159	522	8,690,408	7,421	8,365,903	3,484	5,954,611
Total	5,226	$5,503,923	1,029	$13,928,950	28,192	$32,006,079	9,964	$26,784,736

Exports of Automotive Equipment for April and Nine Previous Months

	1918		1919		1918		1919	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	...	....	....	....	18	$19? 620	43	$577,600
Airplane Parts	...	$536,806	....	$999,874	....	6,496,796	....	11,185,973
Commercial Cars	657	6,401,160	1,029	2,352,647	10,512	27,900,334	9 973	26,784,736
Motorcycles	881	192,067	1,955	505,691	8,809	1,931,634	8,692	2,135,933
Passenger Cars	4 534	3,962,255	5,226	5,503,923	46,413	39,615,513	28,192	32,006,079
Parts, not including engines and tires	...	2,895,600	....	3,866,237	....	26,878,157	....	28,845,103
Totals	6,072	$13,987,888	8,210	$13,228,372	65,752	$103,015,054	46,900	$101,535,424

	1918		1919		1918		1919	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas	2,738	$384,771	3,257	$487,089	31,253	$3,664,992	20,456	$3 201,929
Marine, gas	654	217,452	1,232	624,966	6,405	2,121,668	6,135	3 279,469
Stationary, gas	3,199	285,732	2,674	368,040	22 440	2,501,908	19,450	2,788,656
Tractor, gas	3,788	3,916,555	2,305	2,138,049	19,539	19,724,593	17,816	19,302,722
Total	10,379	$4,804,510	9,468	$3,618,144	79,637	$28,013,161	63,857	$28,572,776

Overland Strikers Resume Work

Thirty Departments Opened Monday—Number of Men Back Is Disputed

TOLEDO, OHIO, May 27—The Willys-Overland Co. resumed operation in 30 of its departments yesterday. Thirty more departments opened to-day and to-morrow will see the remaining units in operation. In spite of the strike, which has been in progress for 3 weeks and the fact that the plant was heavily picketed by the strikers, the returned workers were not molested. There was no disorder. All gates to the plant were heavily guarded by police, special deputies, Overland guards and United States troops. Two hundred soldiers, members of the 135th Field Artillery and 147th Infantry, under command of Colonel Loyd W. Howard, are on duty.

Car Production Curtailed

No cars were made yesterday, the departments in operation producing parts only, and it is doubtful if the company will get back into production this week. Vice-President Clarence A. Earl was unable to give an estimate of the number of men returning to their posts. From the number of men still out, it is apparent that the trouble is far from settled, and it will take the company 2 or 3 weeks to get back into reasonable production. Practically all the machinists are holding out.

Workers Not Interfered With

When the company closed its doors 2 weeks ago it was producing 435 cars daily. In a statement to AUTOMOTIVE INDUSTRIES, Mr. Earl said: "We are very much pleased with the result of the first 2 days' operation. I cannot tell how many men have returned. Workmen who quit because of fear have been given ample protection."

Joseph D. LaDonde, head of the workers' wage committee, said: "Not over 800 men went to work Monday. Of this number about 350 were foremen and assistant foremen. No attempt was made by pickets or union supervisors to interfere with the returning workers."

—

Henry Ford & Son Resume

DEARBORN, MICH., May 28—Henry Ford & Son, which closed for inventory the first of the month, has resumed operations. Completed tractors will be coming through again in quantity by June 1.

—

Wright-Martin Merging With International Motors

NEW BRUNSWICK, N. J., May 27—The Wright-Martin Aircraft Corp. and the International Motors Corp. are formulating plans by which the two companies will be merged. All plans are tentative and no details can be obtained.

General Motors Officers Visit Michigan Plants

DETROIT, May 26—A delegation of officers and directors of the General Motors Corp. and du Pont de Nemours Co. visited this city last week for an inspection of the corporation's plants in Michigan. The executives, headed by President W. C. Durant, spent one day each in Detroit, Pontiac, Saginaw, Flint, and Lansing.

The visiting executives included Irenee du Pont, Felix du Pont, Eugene du Pont, E. E. du Pont, H. F. du Pont, J. A. Haskell, H. G. Haskell, William Coyne, H. F. Brown, F. Donaldson Brown, F. W. Pickard, F. G. Tolman, H. F. Pierce, J. J. Raskob.

—

Horace Mills, director of sales of the Stroh Casting Co., Detroit, has resigned and will be associated with Walter O. Adams in a new enterprise. **E. Betts**, foundry engineer, has also resigned to become interested in the same project.

—

Benjamin Briscoe, president of the Briscoe Motor Corp., Kalamazoo, Mich., who is also a Lieutenant-Commander in the U. S. Navy, has just been made a Commander and has been taken from the retired list. He has been ordered to Great Lakes Naval Training Station and will again assume active duties.

—

J. G. Cashin, for four years with the Curtis Co., Detroit, has been made advertising manager of the Standard Motor Truck Co., Detroit.

—

George Ostendorf, formerly with the Tropical Paint & Oil Co., Cleveland, has joined the sales force of the Hilo Varnish Co., Brooklyn, N. Y., and will make his headquarters in Cleveland.

—

W. D. Hopson, who for three years represented the Studebaker Corp. of America as service supervisor in the Orient, has been appointed service representative for the General Motors Export Co. in the Far East. He expects to sail for Shanghai about June 15.

—

J. A. Teach, contracting, mechanical and structural engineer, is now at the New York office of the Minneapolis Steel & Machinery Co. C. W. Hadden continues as export manager.

—

T. C. Luce and **W. Storrie** have been added to the engineering department of the Apco Manufacturing Co., Providence. Mr. Luce for the past five years has been on the engineering force of the American Chain Co. Mr. Storrie was one of the early designers of Argyll cars, made in Glasgow, Scotland.

—

Raymond G. Lambe, formerly on the purchasing staff of the Ford Motor Co., has been appointed sales manager of the Detroit Reamer Salvage Co.

Men of the Industry

Changes in Personnel and Position

Mahoney New Buda Sales Manager

HARVEY, ILL., May 24—J. P. Mahoney, for three years general purchasing agent of the Buda Co., has been appointed sales manager to succeed Lon R. Smith, who resigned.

—

Fred C. Young will be in charge of the Cleveland office of the Union Drawn Steel Co., Beaver Falls, Pa., which was recently opened at 608-610 Rockefeller Building.

—

Donald P. Hess, director of the Priorities Section of the Motors and Vehicles Division of the War Department during hostilities, has been appointed assistant factory manager of the Timken Roller Bearing Co., Canton, Ohio.

—

A. H. Jessup, a captain in the Sanitary Corps with the 77th Division, has received his discharge from service, and has returned as plant engineer to the Lakeside Forge Co., Erie, Pa.

—

A. J. Collins has been appointed advertising manager of the Ajax Rubber Co., New York. He was formerly assistant to the publicity manager of the Atlas Portland Cement Co.

—

A. R. Ruggles, vice-president and production manager of the Panhard Motors Co., Grand Haven, Mich., has resigned, due to ill health.

—

E. P. Barnett has been appointed sales manager in the Milwaukee territory for the Titan Truck Co., Milwaukee. He was formerly connected with the Sterling Motor Truck Co. and M. D. Newald & Co., Stewart distributers at Milwaukee.

—

E Leidich has been appointed foreign sales manager of the Columbia Motors Co., Detroit. He was formerly in a similar position with the Paige company.

—

William J. Moore, who has been director of purchases at the Fordson Tractor Co. almost from the time the company was organized, has resigned. His future plans are not known.

—

Charles A. Sinclair, assistant secretary and treasurer of the Anderson Forge & Machine Co., Detroit, died suddenly of pneumonia on May 22. He was 45 years old and was connected with the company for 8 years. He leaves a widow and two sons.

Pope to Represent S. A. E. at Engineering Conference

NEW YORK, May 23—At the May meeting of the Society of Automotive Engineers, Metropolitan Section, held at the Automobile Club of America last night, N. B. Pope was appointed a delegate to a conference of representatives of New York sections of engineering societies. For the nominating committee of the S. A. E., the Metropolitan Section appointed C. F. Scott as first choice and H. W. Slauson as alternate.

C. F. Scott spoke on preparations for the summer meeting at Ottawa Beach, Mich., and urged everyone to attend. The paper of the evening, on Four Wheel Drive Trucks, is abstracted elsewhere in this issue.

—

Frank H. Dewey, for some time truck engineer for the Packard Motor Car Co., Detroit, is now associated with the Horizontal Hydraulic Hoist Co., Milwaukee, as sales engineer, and has opened a Detroit office for the company.

—

Bruce E. Anderson, formerly with the Ideal Engine Co., has been appointed general manager of the Lansing Body Co., Lansing, succeeding Frank Thoman, who has retired from the managership, but retains his position on the board of directors.

—

Glenn H. Harker, who spent 21 months in France, has now become manager of the Falls Tire Co., Detroit. He was connected with the Federal Tire & Rubber Co. when he enlisted.

—

Harry S. Finkenstadt, who enlisted in the aviation corps shortly after the United States' entry into the war, has recently been honorably discharged and returned to Detroit as western sales agent of the Carbon Steel Co., Pittsburgh.

—

L. R. Scafe, who was comptroller of the Dayton-Wright Airplane Co., Dayton, is secretary and treasurer of the American Finance Investment Co. of that city.

—

John H. Hertzler, who was with J. S. Bretz, has been appointed sales manager of the Cleveland Worm Gear Co., Cleveland.

—

Miss Jelliffe Leaves S. C. Johnson & Son

RACINE, WIS., May 23—Miss Sarah Jelliffe, who has been advertising manager of the S. C. Johnson & Son Co. for a number of years, is resigning to become connected with the Western Advertising Agency.

—

Jordan Erecting New Buildings

CLEVELAND, May 26—The Jordan Motor Car Co. has commenced work on several additions to its factory, which include a power plant, assembly plant, office building, japanning plant and engine test building.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

M. & S. Now Powrlock

CLEVELAND, May 26—The M. & S. Corp., which recently moved here from Detroit, has changed the name of its product from the M. & S. differential to Powrlock, and has also changed its corporate name to the Powrlock Co. M. T. Walker, formerly vice-president and general manager of the Walker-Weiss Co., is president of the new concern. Other officers are: sales manager, L. O. Haskins; factory manager, R. S. Townsend; chief engineer, R. H. Goodrich. A new plant is in operation which will give increased manufacturing facilities.

Kalamazoo Sheet Metal Co. Organized

KALAMAZOO, May 24—The Kalamazoo Blow Pipe & Sheet Metal Co. is a new concern organized by H. F. Brundage and Harry Baird. It will act as sheet metal engineer and contractor, and render specialist service in installing exhaust and blow piping, heating and ventilating, air drying and cooling systems.

Chicago Pneumatic Tool Coming East

NEW YORK, May 23—The Chicago Pneumatic Tool Co. will put up a 10-story brick building here at 6-8 West 44th Street, and will move its general offices to this city from Chicago.

Buda Establishes Service Companies

HARVEY, ILL., May 24—The Buda Co. will establish Buda engine service companies all over the country. The first will be opened in Los Angeles, San Francisco, Seattle, and possibly Portland, Ore. The establishment of a service company in Kansas City will take care of the Middle West, and New York City will be the eastern headquarters.

International Corp. Groups Subsidiaries Under Allied Machinery Co.

NEW YORK, May 23—An increase in the capital stock of the Allied Machinery Co., bringing it up to $5,000,000, was made necessary by the decision of the American International Corp. to group all its machinery export selling subsidiaries under one head. The Allied Machinery Co. of America will thus become the parent organization of the Allied Machinery Co. de France and the Allied Machinery Co. d'Italia and of the Horne Co., Ltd., of Japan, purchased early in the year by the American International Corp. These companies will, however, retain their corporate entities.

The Allied Machinery Co. of America formed in 1911 was taken over in 1916 by the American International Corp. J. W. Hook is president in general charge of the business. Other officers are: Vice-presidents, F. A. Monroe, in charge of administrative affairs, S. T. Henry, in charge of sales and advertising, and T. G. Nee, who is at present in Japan, in the interests of the Horne Co., Ltd. R. P. Redier is general sales manager with headquarters in Paris.

The Detroit, a New Assembled Truck

DETROIT, May 24—Leonard B. Orloff Co., automobile distributer, will assemble a 1-ton truck bearing the name Detroit. The truck will be on exhibition at the Orloff salesrooms, 811-815 Second Avenue.

The truck is assembled almost exclusively of units turned out in local factories. The engine is a Continental model N; the frame is from the Detroit Pressed Steel Co.; the springs from the Detroit Steel Products Co.; the front axle is Timken and the rear, Russel; the clutch and transmission from the Detroit Gear & Machine Co. factories; the radiator is made by the Long Mfg. Co.; the steering is Gemmer; the wheels are made by the Hayes plants; the fenders and hood by the Motor Metal Products.

Kalamazoo Motors Takes Over Lane Truck

KALAMAZOO, MICH., May 23—The Kalamazoo Motors Corp. has been formed with a paid in capital of $250,000 to take over the business formerly conducted by the Lane Motor Truck Co. The officers of the new company are: President, H. A. Crawford; vice-president, C. J. Johnson; secretary, R. M. Gregory; treasurer, W. B. Milham; chief engineer and production manager, L. W. Coppock. The company has already taken possession of the Lane Motor Truck Co. building. The truck which will be made by the new company will be known as the Kalamazoo, and will come in three sizes, 1½, 2½ and 3½-ton models. The company plans an output of 1000 trucks a year.

Harroun Issues Additional Stock

DETROIT, May 23—The Harroun Motors Corp., because of its inability to secure an adjustment on a war claim of approximately $700,000, has just issued a call on its stockholders for funds, the basis being the purchase of additional stock at $5 per share. Lack of operating capital has prevented the Harroun company from getting into passenger car production, and drastic steps to re-finance it are now being taken. A committee representing Kansas City investors, who advanced $650,000 some time ago, is supervising affairs of the plant at Wayne.

The company, it is explained, exhausted its working capital through government work. The money received from shareholders will be needed in changing to a normal basis. The entire output now in contemplation has been sold to its distributers for five years.

Liberty Building New Plant

DETROIT, May 25—The new factory site for the Liberty Motor Car Co. comprises 12 acres, on which three principal buildings and a power house are being erected. The administration headquarters will front on Charlevoix Avenue, and will be 50 x 200 ft., of brick colonial construction. Production offices and display rooms will be on the first floor, and executive and sales offices on the second. The second building, 60 x 320, immediately behind the first, will include a service, experimental and closed body mounting department. Back of this will be the main assembly building, which is to be 120 x 600 ft., and power house will complete present plans.

Van Dorn to Put Up New Building

CLEVELAND, May 23—The Van Dorn Electric Tool Co. will erect a $100,000 4-story concrete manufacturing building. It will cover ground space 60 x 100 ft. with a 1-story addition 125 ft. deep.

Briscoe Devices Co. Succeeds Jackson Carbureter

JACKSON, MICH., May 24—The Jackson Carbureter Co., maker of Dave Buick carbureters, will be succeeded by the Briscoe Devices Co., and its product will be known as the Scoe carbureter. Frank Briscoe is president and general manager of the new concern. A. W. McCalmont, formerly with the Jackson Automobile Co. and the Briscoe Motor Co., and more recently an engineering officer in the Air Service in France, will be sales engineer.

KAENJAY Moves to New Jersey

NEW YORK, May 24—The Auto Leather Mfg. Co. has removed its plant and equipment from 21 Warren Street, New York, to a new building in Arlington, N. J. The company manufactures KAENJAY products.

Republic Opens Eastern Office

ALMA, MICH., May 24—The Republic Motor Truck Co., Inc., has opened Eastern headquarters in New York City with J. Martin Van Harlingen as district manager. John Sawan will be associated with Mr. Van Harlingen. He will make his headquarters at Pittsburgh, operating from the New York office.

Airplanes in Stewart Salesroom

BOSTON, May 23—C. E. West, manager of the Stewart Truck Co., has leased ground at Boxford, and six hangars are being erected, each of which will be 190 ft. long, 48 ft. wide and 48 ft. high. This will be used as training grounds for flyers and for an exhibition field. Mr. West has five machines in shipment and five more are to be delivered before June 15. He has one on exhibition in his salesrooms, where he will also keep a stock of parts. The machines are of the Curtiss JN-4 type, each with a 90 hp. engine. They were used by the Canadian government. One sale has been made.

24,199 War Contracts Cancelled

Claims for $150,000,000 Are Awaiting Examination and Adjustment by War Department

WASHINGTON, May 28—The War Department has cancelled 24,199 contracts to date since the signing of the armistice, of which 15,756 have been finally disposed of by release, supplementary agreement or award. In addition, definite agreements have been reached on 2500 others, and of those remaining all have been taken up by the Claims Board and are in process of examination and verification. A total of $150,000,000 of claims has not yet been formally presented because of their extent and complexity. These facts about the war contracts were revealed to-day in a report made by Assistant Secretary of War Benedict Crowell to Secretary Newton D. Baker.

It is estimated that the total cost to complete those contracts that have been eliminated would have been $3,600,000,000, and this figure has been reduced by the termination of the orders to claims amounting to $700,000,000. Up to date $153,476,000 has been awarded and $125,000,000 paid.

Following the passage of the act authorizing payment of informal contracts, and up to May, 17,568 awards were made under the law, including a total of $38,081,623 to be paid, of which $33,596,168 has been paid. The total number of claims filed under the act amounts to 2844.

Outlining the methods of settlement, the report states that where performance of a contract was curtailed adjustment was effected by agreement as to the extent of the curtailment, the contractor accepting a reduced order in lieu of the original one, and payments in addition to those for completed articles being only nominal.

Where the contractor made expenditures or commitments on the uncompleted portion of the contract he is reimbursed for the expenditures or commitments with an additional remuneration for the use of his capital and services that did not result in completed articles. In detail this settlement is made according to the following plans:

1. Reimbursement to the contractor for raw materials, direct and indirect, and component parts on hand in an amount not exceeding the requirements for the completion of the contract: Cost plus inward handling charges plus such portion of overhead as is directly applicable, less such sums as may represent the fair agreed value of all or any portion thereof, if the title and possession of the same are retained by the contractor.

2. Reimbursement to the contractor for articles in process, in an amount not exceeding the requirements for the completion of the contract: Cost of raw materials and labor plus such portion of overhead as is directly applicable, less such sums as may represent the fair agreed value of all or any portion thereof, if the title and possession of the same are retained by the contractor.

3. Payment to the contractor of a fair and equitable remuneration (1) for expenses and services of the contractor in connection with the items included in paragraph 1, but not to exceed interest at 6 per cent per annum on the capital invested therein, or, if the capital was borrowed, interest at the rate paid by the contractor; and (2) for expenses and services of the contractor in connection with the items included in paragraph 2, but not to exceed 10 per cent of the cost thereof.

4. Reimbursement of the contractor for such amounts as are properly paid by him in the adjustment and termination of unperformed sub-contracts and unperformed commitments for supplies which were properly entered into or made in connection with the performance of said original contract.

5. Reimbursement to the contractor for pay rolls and expenses paid or incurred with the approval of the contracting officer, or properly paid or incurred without such approval, for the custody and protection of property since the date of suspension above recited and pending final settlement.

6. Reimbursement to the contractor where special facilities were properly provided in connection with the performance of the original contract, necessity of which was contemplated by the contractor and included in his estimate of cost at the time the original contract was made, of such portion of the cost thereof as would reasonably have been recouped had the uncompleted portion of the original contract been performed.

7. Payment to the contractor of such additional sums, if any, as the Secretary of War may deem necessary fairly and justly to compensate the contractor for expenditures, obligations, and liabilities necessarily incurred, including work, labor, and service necessarily rendered, under the original contract or in preparation for the performance thereof, or under this supplemental agreement.

Explaining the task of settling the huge number of contracts, the Assistant Secretary stated that many contracts involve the history of a vast amount of material, complicated questions of the apportionment of overhead and the determination of the contractor's own obligations on his commitments on his sub-contracts which he has had in turn to curtail by reason of the termination of his contract by the War Department. In some prime contracts the sub-contracts run into the hundreds in number, and each must be verified by the department before settlement is made. Because of this the local bureaus were established in 34 sections of the country to first handle the claims before they were transmitted to Washington.

Racine-Sattley Will Put Up Engine Plant

SPRINGFIELD, ILL., May 24—The Racine-Sattley Co. has purchased land adjacent to its present site and will erect a $300,000 plant for the construction of gasoline engines from 1½ to 15 horsepower. Employment will be given to 600. It was planned to construct these buildings two years ago, but postponement was forced by the war.

Post Tractor Factory

CLEVELAND, May 15—The Post Tractor Co. has taken a 10-year lease on a structure to be erected as the first unit of its tractor plant. It will be increased in size as business permits.

Detroit Axle Bought by Puritan Machine

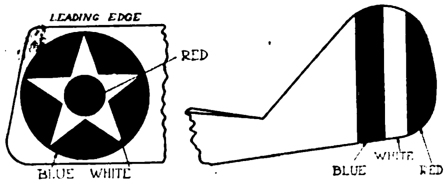
DETROIT, May 23—The entire stock and equipment of the Detroit Axle Co. has been purchased by the Puritan Machine Co.

Tower Truck Enlarging Plant

GREENVILLE, MICH., May 24—The Tower Motor Truck Co. has increased its capitalization from $200,000 to $500,000. New buildings will be erected at once to accommodate production increases on both the 2- and 3½-ton models.

New Insignia for U. S. Military Airplane

War and Navy Departments Authorize Change in Emblems for Wing and Rudder



Wing Insignia *Rudder Insignia*

WASHINGTON, May 24—The distinguishing insignia on American aircraft has been changed by order of the War and Navy Departments and will hereafter be a red circle inside of a white five-pointed star inside of a blue circumscribed circle. The circumference of the inner circle will be tangent to the lines forming a pentagon made by connecting the inner points of the star. The inner circle will be red, that part of the star not covered by the inner circle, white, and that part of the circumscribed circle not covered by either the inner circle or star will be blue.

The insignia is to be placed on the upper and lower surfaces of the upper and lower planes of each wing so the circumference of the circumscribed circle will be tangent to the outer tips of the planes. One point of each star must be pointed directly forward and the diameter of the insignia which can be either painted on or applied by decalcomania transfer, must be 60 in.

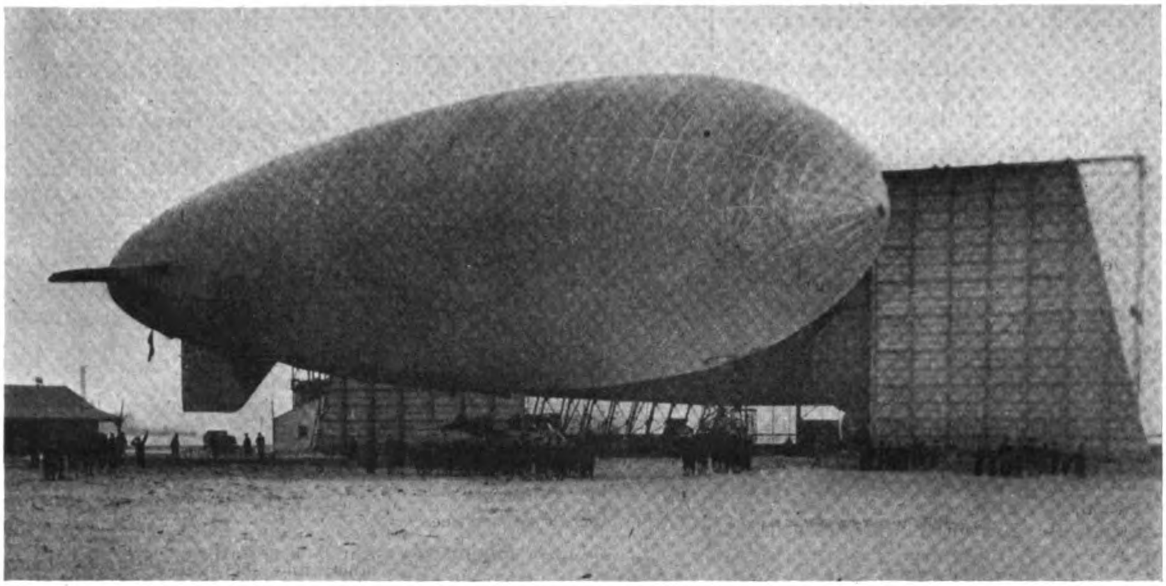
The rudder insignia will be three equally wide bands, red, white and blue. Both sides of the rudder, in the rear of the rudder post, will be striped parallel to the vertical axis of the plane, with the blue stripe nearest the rudder post, the white in the center and the red at the tail of the rudder.

Two Companies Under Bates Machine & Tractor Co.

JOLIET, ILL., May 23—The Bates Machine & Tractor Co. is the successor to the two merged firms of the Bates Machine Co. and the Joliet Oil Tractor Co.

New Steam Carbureter on Market

DETROIT, May 24—The Security Sales Co. is marketing a steam carbureter operating on any gas or kerosene engine for cars, trucks and tractors. According to the company, the water taken from the motor drips into the valve, where it is converted into steam, then uniformly injected into all cylinders by operating the control from the dash or steering column. The extra hydrogen from the steam gives perfect combustion, it is said. The company is now getting into production on a fair scale.



C-1
The type of dirigible now used by the Navy

Fleet of Dirigibles for Navy Recommended by Navy Board

WASHINGTON, May 24—The construction of a fleet of dirigible aircraft for the Navy is expected to be recommended by the General Navy Board in its report to Secretary Daniels within a few days. As a result particularly of the NC seaplane flights, and also because of other general investigations and experiments, the board believes that a great part of the future aerial expansion will include dirigibles. The opinion prevails here that this aircraft can make the flight across the Atlantic with heavy loads and are safer because they can remain in the air indefinitely while any mechanical damage is being repaired.

Secretary Daniels says that in his opinion the Navy should make no effort toward any large aerial expansion during the next year or two but should experiment to improve existing types. He anticipates further flights similar to the transatlantic attempt as new airplanes and dirigible aircraft are developed. He pointed out that the transatlantic flight had already shown defects in the NC seaplanes which, he said, are now far in advance of the development along this line reached by any other country.

It is expected that the naval bill which was lost in the filibuster of the last Congress, and which contained an appropriation for $10,000,000 toward the development of dirigible and other lighter-than-air machines, will be re-introduced in this special session.

Chicago-Cleveland Air Mail Successful

WASHINGTON, May 23—The air mail service established between Chicago and Cleveland on May 15 has had an unusual record for its first week of operation. In the 7 days 4160 miles were flown out of a possible 4480, and 28 trips accomplished out of 30, making a score of 93⅓ per cent.

There were no forced landings, but a 43-mile gale made the trips impossible one day. A total of 87,200 letters were carried west from Cleveland and 74,600 east from Chicago. The average flying time from Cleveland to Chicago was 3 hr. 40 min., and from Chicago to Cleveland 3 hr. 20 min., the difference being due to prevailing head winds. The best time made was on one trip from Chicago to Cleveland when the 325 miles were traveled in 2 hr. 48 min., and the longest trip was 4 hr. from Cleveland to Chicago. The rebuilt De Haviland fours are being used, equipped with Liberty engines. These have a mail carrying capacity of 400 lb. each.

Dallas-Boston Flyers Continue Flight

WASHINGTON, May 23—The six De Haviland airplanes flying from Dallas to Boston are continuing their flight according to schedule. Following is the route traveled:

May	From	To	Miles	Min.
15	Dallas	Oklahoma	208	105
17	Oklahoma	Camp Funston	300	170
20	Camp Funston	Topeka	60	45
		Total......	568	320

Col. H. B. Claggett, commanding the flight, has received requests to make several stops en route to Boston and will give them favorable consideration if landing facilities are adequate. Capt. W. H. Chandler, the automobile racer, who tested the first Liberty motor; Lieutenants J. E. Duke, Jr., R. F. Midkiff and W. T. Campbell, well-known stunt fliers, are in this service. During the flight a record will be made of the condition of land passed over, photographs taken, and emergency and regular landing fields noted.

Wright Field Re-Leased

WASHINGTON, May 26—The Wilbur Wright aviation field at Dayton has been re-leased by the War Department and will be used as a permanent storage and training depot. The field comprises 1100 acres.

Allied Planes Double Number Controlled by the Enemy

WASHINGTON, May 23—The Allies had 5972 airplanes at the French-Belgian front on Nov. 11, 1918, when the armistice was signed, as compared with 2730, the total number controlled by the enemy. The balloon strength of the enemy, however, totaled 170, as against 144 of the Allies.

France had the greatest number of planes with an aggregate of 3321; the Germans, 2730; Great Britain, 1758, and the United States, 740. Italy controlled 812 planes over her front, against 622 under the Austrian forces. Following is the tabular comparison showing the number of planes at the fronts when the armistice was signed:

French-Belgian Front	Number of Planes
France	3321
Germany	2730
Great Britain	1758
United States	740
Belgium	153
Total Allied	5972
Total Enemy	2730
Italian Front	
Italy	812
Austria	622

Following is the comparison of balloon strength:

French-Belgian Front	Number of Balloons
Germany	170
France	72
Great Britain	43
United States	23
Belgium	6
Total Allied	144
Total Enemy	170
Italian Front	
Italy	32
Austria	26

Air Service Studies Meteorological Conditions

WASHINGTON, May 26—That the upper currents of air run parallel to isobars was discovered in recent studies of currents and meteorological conditions by the Army Air Service in Nebraska, Arkansas and Missouri, when balloon

ascensions were made for this purpose. Two 35,000 ft. hydrogen filled balloons started at the same time, one maintaining an altitude of 5000 ft., the other 10,000 ft. The balloon at 10,000 ft. rose at 10.30 p. m. at the U. S. Army Balloon School, Ft. Omaha, Neb., and landed at 1.30 p. m. the following day at Arcola, Miss. The lower altitude balloon remained in the air 16 hr. and landed at Little Rock, Ark.

71.3 Per Cent Casualties Among French Aviators

PARIS, May 10—During the first six months of 1918 casualties among French air pilots and observers attained 71.3 per cent. This included 16 per cent killed, 25.8 per cent wounded and 29.4 per cent missing. Of these latter 70 per cent were afterward reported killed. In aerial flights 116 pilots were killed, and 218 by accident. In comparison with this it may be stated that the infantry during the same period lost only 51 per cent. Gunners, bombers and mechanics are not included in the figures of losses.

Experimental Station for Tractors

WASHINGTON, May 24—The Mexican Government has granted a concession of 247 acres to a Mexican citizen at Mazatlan and as much more ground as may be necessary at Ose, State of Sinaloa, where an experimental farm will be established and American manufacturers can demonstrate their tractors at a nominal cost. The plan is to promote the sales of American tractors and farm implements and educate the people in modern farming methods. There are no Mexican import duties on tractors, and it is stated that any farmers taking advantage of the offer will be exempt from all local taxes. The soil offered for experiment is level and fertile, and during the dry season can be irrigated from the Quila River.

Huge Increase in Exports

WASHINGTON, May 23—April exports surpassed previous high records by nearly $100,000,000, according to total figures announced to-day by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Exports for the month totaled $715,000,000, as compared with $623,000,000 for January, the previous high mark. For March of this year the total was $605,000,000, and for April a year ago $501,000,000. For the ten months ended with April the exports were valued at $5,705,000,000, as against $4,884,000,000 for the corresponding period last year.

Imports for April totaled $273,000,000 in value, a gain of $5,000,000 over the $268,000,000 announced for March and a decrease of $6,000,000 as compared with the $279,000,000 for April of last year. Imports for the ten months ended with April are put at $2,474,000,000, as compared with $2,362,000,000 for a similar period in 1918.

Ford Enters Denial In Infringement Suit

Thomson Spot Welding Alleges Illegitimate Use of Patent Welding Device

DETROIT, May 23—The Ford Motor Co. has been charged by the Thomson Spot Welding Co. of Lynn, Mass., with infringement upon the patents held by the Massachusetts firm on an electric welding device which the plaintiff alleges is being used in the Ford plants without their permission or license. Damages, which may total millions, are being asked by the complaining company, which has just filed its declaration of action in the Federal Court of Equity here.

The plaintiff alleges that on Jan. 3, 1903, Johann Harmatta, an Austrian, invented an electric spot welder and filed his application for a letters patent on the same. One month prior to applying for a patent, the inventor, in writing, assigned his invention and patent right to the Thomson Electric Welding Co. In December, 1912, a letters patent, No. 1,046,055, was issued. The Thomson company then granted exclusive rights under the patent to the Universal Electric Welding Co., New York, and the two concerns assigned their joint rights to the plaintiff, the Thomson Spot Welding Co.

In March, 1913, the Thomson company started infringement proceedings against the Barney & Berry Co., but after two years of litigation lost their action when the Massachusetts district court ordered the bill of complaint dismissed. The case was appealed, however, and on Oct. 5, 1919, the Circuit Court of Appeals reversed the decision and returned the case to the district court for a new trial. Here the district court declared an infringement and granted an injunction prohibiting the Barney & Berry Co. from further use of the patents and awarded costs and damages.

In charging Ford with infringement upon the patents, the Thomson company asks for a perpetual injunction and a temporary injunction prohibiting the use of this welding device during the pendency of the suit. Damages, royalty for past use, and costs are also asked.

The Ford Motor Co., in its answer, which also has been filed, admits the existence of the patents in question, also ownership of these patents, but denies that it used and sold articles whose manufacture was covered by these patents, and adds that it never practised the patented process. The Ford company also declares that it was never duly notified of an infringement and denies that it was a party to the Barney & Berry litigation.

The company further states that upon investigation it finds that the patents are invalid and that they had the right to use them if they desired, because 19 American patents were filed on a similar process prior to the filing of the original Thomson application in 1903. The first of these alleged priority patents was filed in 1886 and the last in 1909. Besides the American patents, similar devices have been patented in France, Great Britain and Germany. The defendant also declares that seven United States manufacturing concerns are daily using the same device and process, and asserts that the Thomson Spot Welding Co. is involved in a patent interference proceedings brought by Sebastian De Ferranti, who claims he holds patents on the same process, granted as early as 1900.

Mexican Employees for Ford Held Up

DETROIT, May 24—Henry Ford's delegation of Mexican workmen, which he was bringing here to take a course of instruction in tractor manufacture, has been held up at the border by order of the United States Immigration Department, and will not be permitted to enter the United States until Mr. Ford puts up a bond of $500 for each man.

There are 50 Mexicans in the party, all of them recommended as especially adapted for manufacturing by the Mexican government. It is Mr. Ford's idea to make shop superintendents, department heads and foremen out of them and he has arranged for a school at his Dearborn plant. They will be employed in the Mexican tractor plant which Mr. Ford proposes to build soon. He refuses to pay the bond required and has appealed to Washington.

King Company Fighting for Purchase Option

DETROIT, May 23—The King Motor Co. has filed suit against the Wadsworth Real Estate Co., Morgan & Wright, the United States Rubber Co., Central Trust Co. of New York, and James N. Wallace, trustee of New York, to enforce an option the King company claims it holds on the site of its proposed new factory.

Under a 10-year lease given by the Hupp Motor Car Corp., the King company occupies a plant, the lease of which contains an option permitting purchase at any time during the life of the lease for $27,500, plus the value of improvements. Buildings erected by the owners have been appraised at $65,925. A year ago the King company formally notified the owners of its desire to exercise the purchase option on May 1, 1919. On that date, and on the day previous, formal tender of the sum stated was made to the owners of the property, but they declined to accept the cash or execute a deed. The King company is now asking the court to enforce the option.

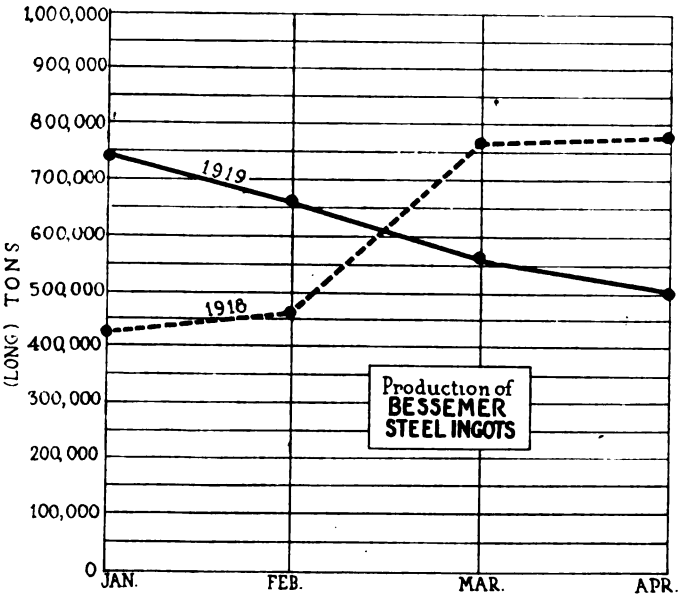
Foreign Agencies for Duplex

LANSING, May 23—The Duplex Truck Co. has established agencies in Barcelona, Spain, and Copenhagen, Denmark. The company now has 65 direct distributers covering every part of the United States.

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:	
Muriatic, lb.	.02 - .03
Phosphoric (85%), lb.	.33 - .37
Sulphuric (60%), lb.	.08
Aluminum:	
Ingot, lb.	.33
Sheets (18 gage or more), lb.	.42
Antimony, lb.	.08 - .08¼
Burlap:	
8 oz., yd.	.10
10½ oz., yd.	.11½ - .11¾
Copper:	
Elec., lb.	.16½ - .16¾
Lake, lb.	.17
Fabric, Tire (17¼ oz.):	
Sea Is., combed, sq. yd.	1.40
Egypt, combed, sq. yd.	1.25
Egypt, carded, sq. yd.	1.20
Peelers, combed, sq. yd.	1.08
Peelers, carded, sq. yd.	.85
Fibre (⅛ in. sheet base), lb.	.50
Graphite:	
Ceylon, lb.	.09 - .22
Madagascar, lb.	.10 - .15
Mexico, lb.	.03¾
Lead, lb.	.05 - .05¼
Leather:	
Hides, lb.	.25 - .46
Nickel, lb.	.40
Oil:	
Petroleum (crude):	
Kansas, bbl.	2.25
Pennsy., bbl.	4.00
Gasoline:	
Auto, gal.	.24½
68 to 70 gal.	.30½
Lard:	
Prime City, gal.	2.70
Ex. No. 1, gal.	1.15 -1.20
Linseed, gal.	1.56 -1.58
Menhaden (dark), gal.	.75 - .80
Rubber:	
Plantation:	
First latex pale crepe, lb.	.46 - .46½
Brown crepe, thin, clear, lb.	.40 - .41
Smoked, ribbed sheets, lb.	.45½ - .46
Para:	
Up River, fine, lb.	.56¼
Up River, coarse, lb.	.34½ - .34¾
Island, fine, lb.	.47 - .47½
Shellac (orange), lb.	.85
Spelter, lb.	.06⅛ - .06¾
Steel:	
Angle beams and channels, lb.	.02½ - .03
Automobile sheet (see sp. table).	
Cold rolled, lb.	.04¼ - .04½
Hot rolled, lb.	.03½ - .03¾
Tin	.72½
Waste (cotton), lb.	.12¾ - .17



Monthly production of Bessemer steel ingots, although showing a substantial advance during January and February, 1919, fell off considerably during March and April. Output of open-hearth steel shows a similar drop

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
- Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lbs.
- Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lbs.
- Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lbs.
- Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lbs.

Blank Sheet Extras to Apply to Narrow Widths:
- Oiling, 10c. per 100 lb.
- Patent leveling, 25c. per 100 lb.

Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close May 24

	Bid	Asked	Net Ch'ge
Auto Body Company	9	10	..
Briscoe Motor Car com.	14	..	..
Briscoe Motor Car pfd.	50	65	..
*Chandler Motor Car	181	183	+25¾
Chevrolet Motor Car	209	211	..
Cole Motor Car Co.	120	125	..
Continental Motors com.	8¾	9⅛	+ ⅛
Continental Motors pfd.	96	99	..
Edmunds & Jones com.	27	30	—1
Edmunds & Jones pfd.	78	82	+3
Electric Storage Bat.	76	78	..
Federal Motor Truck	42	44	..
Fisher Body Co. com.	77	79	+3⅝
Fisher Body Co. pfd.	98	101	..
Ford Motor of Canada	320	330	..
General Motors com.	188⅞	189⅞	+3⅞
General Motors pfd.	89⅛	91⅛	— ⅝
Hupp Motor Car com.	9	9½	+ ¼
Hupp Motor Car pfd.	98	101	..
Kelsey Wheel Co. com.	35	37	..
Kelsey Wheel Co. pfd.	93	95	..
Manhattan Electric S com.	..	48	..
Maxwell Motor com.	44	45	—1¾
Maxwell Motor 1st pfd.	72½	73½	+1¼
Maxwell Motor 2d pfd.	35½	36½	+2¼
McCord Mfg. com.	39½	41½	— ½
McCord Mfg. pfd.	102	104	..
Mitchell Motor Co.	43	45	—2
Motor Products Corp.	45	50	..
Nash Motors Co. com.	230	..	..
Nash Motors Co. pfd.	96	100	..
National Motor Co.	16	20	..
Packard Motor Car com.	192	196	+2
Packard Motor Car pfd.	100	102	..
Paige-Detroit Motor com.	37	38¼	—1
Paige-Detroit Motor pfd.	9	9¾	..
Peerless Motor Truck	36	38	+2
*Pierce-Arrow M. Car com.	51⅝	52⅝	+ ⅞
Pierce-Arrow M. Car pfd.	102	104	..
Premier Motor Corp. com.	5	..	..
Premier Motor Corp. pfd.	..	75	..
Prudden Wheel Company	21	22	..
Reo Motor Car Co.	29	30	..
Republic M. Truck com.	49	50½	+3
Republic M Truck pfd.	90	94	—1
Saxon Motor Car com.	8½	10½	+ ½
Scripps-Booth Corp.	25	30	..
Stewart-Warner S. Corp.	91	93	+1
Stromberg Carburetor Co.	38	40	..
Studebaker Corp. com.	84⅝	85⅝	+2⅝
Studebaker Corp. pfd.	94	97	..
Stutz Motor Car Co.	60	61	+2½
United Motors Corp.	47	49	..
White Motor Co.	57	58	— ¾
Willys-Overland com.	35	36	+ ⅞
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	85½	87½	+2½
Firestone T. & R. com.	156	159	—2
Firestone T. & R. pfd.	100	101	..
Fisk Rubber Co. com.	133	134	—2
Fisk Rubber 1st pfd.	105	115	+5
Fisk Rubber 2d pfd.	135	142	..
Fisk Rubber 1st pfd. conv.	105	110	..
*Goodrich, B. F., com.	71	72	+ ½
Goodrich, B. F., pfd.	106⅞	108⅞	— ⅝
Goodyear T. & R. com.	300	305	—30
Goodyear T. & R. 1st pfd.	106	107½	..
*Goodyear T. & R. 2d pfd.	107	109	— ½
*Kelly-Springfield com.	120	121	—2¼
Kelly-Springfield pfd.	95	97	..
Lee Tire & Rubber Co.	32	33	— ½
Marathon Tire & Rubber	..	55	..
Miller Rubber Co. com.	195	201	—5
Miller Rubber Co. pfd.	104	106	—1
Rubber Products Co.	145	155	—10
Portage Rubber Co. com.	155	165	—16
Swinehart T. & R. Co.	90	95	+2
U. S. Rubber Co. com.	97½	98½	— ½
*U. S. Rubber Co. pfd.	113½	114½	+ ¼

*Ex dividend.

Calendar

SHOWS

May 15-June 1—Venezuela. National Exhibit of Venezuela.

*Oct. 15—Paris. Grand Palais. International Automobile Mfrs. Congress.

No. 7-16—London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December — Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

May 30—College Park, Md. — Power cultivator Demonstration, Maryland State Dept. of Agriculture.

June 9-12—Denver, Colo. Sectional Tractor Demonstrations. Denver Tractor Club.

July 14—Wichita, Kan. Automotive Committee of National Implement Assn.

July 28-29—Columbus, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 1-2 — Piqua, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 6-7—Fostoria, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 12-13—Akron, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 18-22—Aberdeen, S. D. Sectional Tractor Demonstrations.

October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

CONTESTS

May 30—Atlantic City, N. J.—Airplane races—Aeronautic Convention.

May 30-31—Richmond, Va. 2-Day Dirt Track Meet, Virginia State Fair Grounds Track.

†May 30-31—Los Angeles, Cal.—Los Angeles-Yosemite 3rd annual gasoline economy run.

†May 31—Indianapolis. Indianapolis Motor Speedway Assn., 500 miles.

*June 14—Sheepshead Bay, L. I. Speedway race.

July 4—Atlantic City, N. J.—Airplane races—Aeronautic Convention.

*July 5—Cincinnati, O. Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15 — Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

*Tentative dates.
†Sanctioned.

CONVENTIONS

May 1-June 1—Atlantic City, N. J. Pan-American Aeronautic Convention and Exhibition—Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

June 2-3—Chicago, Ill. Natl. Gas Engine Assn. Hotel Sherman.

June 2-6—Hot Springs, Va. Convention Automotive Equipment Assn., Homestead Hotel.

June 3-6 — Washington. Pan-American Commercial Conference, Pan-American Building.

June 12-14—Pittsburgh. Annual convention of American Drop Forge Assn. and Drop Forge Supply Assn., William Penn Hotel.

June 23-28—Ottawa Beach. Mich. S. A. E. Mid-summer Meeting.

Sept. 22-24 — Philadelphia. Annual Convention, National Association of Purchasing Agents, Bellevue-Stratford.

May 12-15, 1920—San Francisco. Seventh National Foreign Trade Convention.

Foreign Trade Opportunities

WASHINGTON, May 24—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has received requests for automobiles or parts, airplanes, trucks and tractors and accessories agencies from individuals and companies in foreign countries. These are listed below. For further information address the Bureau of Foreign and Domestic Commerce and specify the foreign trade opportunity number.

Belgium—Medium priced cars and accessories. No. 29337.

Denmark—Medium priced cars, accessories and tractors in the Scandinavian and Balkan countries. No. 29342.

Spain—Cars, motorcycles and bicycles. Correspondence should be in Spanish. No. 29346.

American firm to represent manufacturers throughout Holland, Belgium and France in the sale of cars and accessories, etc. No. 29352.

American firm—representative to South America via Cuba—cars and accessories. No. 29365.

Mexico.—Tractors for Northern Mexico. Correspondence may be in English. No. 29390.

Spain.—Cars, bicycles, motorcycles and automobile accessories. No. 29400.

A National Trademark

WASHINGTON, May 24—A bill introduced in the House yesterday by Congressman Sims provides for a trademark to be selected by the Secretary of Commerce and which will be known as "The National Trademark." It is to be registered in the Patent Office in the name of the United States of America, without limitation of time and covering all classes of goods which are recognized under trademark laws.

The Secretary of Commerce is authorized to issue licenses for the use of the trademark under certain rules and regulations to any American manufacturer or producer. He is also given the right to institute and maintain proceedings when the rights of the trademark have been infringed upon.

The bill provides for the sum of $25,000 to be used in the expense of carrying the provisions of the act into effect, and has penalties for using any trademark similar enough to deceive purchasers into believing it to be the national trademark.

Change in British Import Restrictions

WASHINGTON, May 24—All restrictions have been removed on a number of commodities to Great Britain which may be shipped without individual licenses and which include: lubricators, injectors and ejectors, expansion joints, iron or brass pressed steel union couplings, copper, steel and iron wire rods, waste or scrap rubber.

Restrictions on the importation of motor car jacks have also been removed by Great Britain.

Farm tractors and tractor plows will be allowed only under special licenses and only in exceptional cases.

Lotex to Make Casings and Tubes

FOND DU LAC, WIS., May 24—The Lotex Tire Co. has been organized with an authorized capital of $100,000 to manufacture pneumatic casings and tubes. Work will begin in about a week on the erection of the first unit of its plant here to cost $35,000. The factory will employ 60 to 75 operatives at the start.

Goverment Places Orders for Parts

WASHINGTON, May 24—The Motors and Vehicles Division, War Department, has placed orders as follows:

B. F. Goodrich Rubber Co., Akron, 500 35x4½ fabric Q. D. clinchers, non-skid casings, and packing, $11,672.50.

Continental Motors Corp., Muskegon, Mich., miscellaneous spare parts for maintenance of 738 light aviation trucks, including boxing, $17,686.25.

Kelly-Springfield Motor Truck Co., Springfield, O., spare parts for 280 trucks, $14,223.26.

The Nash Motors Co., Kenosha, Wis., spare parts for trucks, $442,354.74.

Garford Motor Truck Co., Lima, O., four sets spare parts for repair and maintenance of 1½-ton trucks, $740,604.16.

International Motor Co., New York City, spare parts for maintenance of Mack 5½-ton trucks, $1,482,080.76.

Macomber & Whyte Open Branches

KENOSHA, WIS., May 23—The Macomber & Whyte Rope Co. has opened a branch at Birmingham, Ala., under the management of James A. Boope, southern manager, at 805 American Trust Bank Building. A New York City branch, with E. E. Robirds in charge, has been opened at 30 Church Street.

New York to Spend $16,000,000 on Roads

ALBANY, N. Y., May 23—The expenditure of over $16,000,000 is contemplated by New York state this year. The state is to receive from the Automobile Bureau in 1920 over $8,000,000 to be spent for maintenance and repair of highways as against $2,700,000 from the same source in 1918. In addition the various towns and counties will spend over $5,000,000 for the same purpose.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

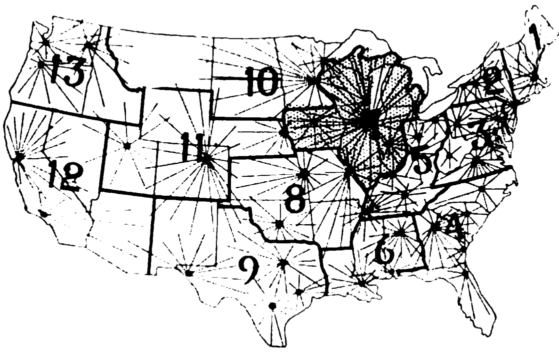
Vol. XL
Number 23

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, JUNE 5, 1919

Fifteen cents a copy
Three dollars a year

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, N. Y., under the Act of March 3, 1879.

Link Advertising To Merchandising



This nation of 100,000,000 people cannot be handled efficiently from a sales standpoint until it is broken up into sections. Every large organization purporting to cover the entire United States finds branch houses, district managers, sales territories, etc., absolutely imperative. With population equal to half a dozen European kingdoms, and vast distances, it becomes elementary common sense to break the United States up into a number of logical merchandising units such as are shown on the map above.

This map pictures how each of these zones, and therefore the entire United States, can be covered by advertising in the forty-eight cities indicated, using newspapers with radiating circulation. The last four columns of the tabulation below prove that metropolitan newspapers cover the territory OUTSIDE the cities in which they are published even better than this territory is covered by any magazine.

Cultivate Each Jobbing Zone Intensively by Means of Metropolitan Newspapers

No jobber can sell the Chicago grocer but the Chicago jobber. No jobber can sell the San Francisco grocer but a San Francisco jobber. The grocers of Vinton, Iowa, are sold by jobbers from Chicago and from Iowa cities, but seldom by New York jobbers. The grocers of White Pigeon, Michigan, are sold by jobbers from Michigan and from Chicago, but never by jobbers from Philadelphia.

These are obvious merchandising axioms. One would think that his everyday knowledge of their truth would inspire every advertiser to adopt the corollary of localized advertising effort. Nevertheless, many advertisers seem to feel that general publicity thinly spread over a continent constitutes "national" advertising. As a matter of fact it is merely "geographical" advertising—advertising which covers the map of the United States but does not reach the people of the United States. The only true national advertising is that which moves the American people.

Note that the 78 Sunday newspapers listed below have a circulation in excess of 10,000,000 and a rate of .0015 per agate line per thousand. Twenty-one "general" or "standard" magazines have a combined circulation of 6,184,658 with considerable duplication and a rate per agate line per thousand four times that of the 78 Sunday newspapers.

	NO. OF CITIES	FAMILIES IN CITIES	FAMILIES OUTSIDE	MORNING NEWSPAPERS	CIRCULATION	GROSS RATE MORNING	EVENING NEWSPAPERS	CIRCULATION	GROSS RATE EVENING	SUNDAY NEWSPAPERS	CIRCULATION	GROSS RATE SUNDAY	SUNDAY CITY CIRCULATION	FAMILIES PER NEWSPAPER IN CITIES	SUNDAY OUTSIDE CIRCULATION	FAMILIES PER NEWSPAPER OUTSIDE CITIES
Zone 1..	1	514,823	916,504	2	597,598	.55	1	220,771	.20	2	693,367	.70	423,964	1.214	268,082	3.415
Zone 2..	4	1,818,774	825,504	7	1,206,067	2.03	5	1,193,283	1.53	8	2,131,744	2.64	1,454,665	1.25	667,463	1.238
Zone 3.	6	1,260,697	1,649,047	9	703,808	1.46	7	948,897	1.36	12	1,404,994	2.41	966,171	1.305	422,477	3.905
Zone 4..	5	215,275	1,338,257	5	154,547	.39	1	59,017	.08	6	268,413	.425	137,657	1.61	128,967	11.376
Zone 5..	6	723,176	1,213,420	7	941,594	1.15	4	329,479	.705	9	862,403	1.565	505,953	1.429	346,592	3.501
Zone 6..	3	369,762	852,910	3	125,037	.29	2	120,364	.20	5	302,162	.605	218,094	1.695	81,263	10.742
***Zone 7..**	**5**	**1,201,200**	**2,148,605**	**5**	**759,436**	**.94**	**5**	**644,883**	**.75**	**7**	**1,348,629**	**1.67**	**835,525**	**1.438**	**490,331**	**4.382**
Zone 8..	3	372,841	1,463,566	3	459,026	.6075	2	377,225	.5475	4	789,973	1.15	408,138	.911	379,340	3.858
Zone 9..	4	134,730	833,209	4	171,601	.42	2	83,685	.25	6	324,585	.72	194,516	.693	126,306	6.597
Zone 10..	3	187,975	645,681	3	160,064	.21	3	512,062	.38	4	366,164	.56	173,286	1.085	187,131	3.449
Zone 11..	3	156,760	411,655	4	155,357	.245	4	232,810	.335	6	419,198	.635	203,457	.77	209,050	1.969
Zone 12..	2	350,000	310,187	4	413,507	.785		.....	.....	4	741,486	1.22	396,980	.7	233,438	1.329
Zone 13..	3	230,000	329,707	3	155,091	.37	2	135,707	.25	5	358,294	.725	229,728	1.001	119,507	2.759
TOTAL.	48	7,536,010	12,911,315	59	6,489,755	9.4475	38	1,858,183	6.5875	78	10,011,412	15.025	6,148,134	1.226	3,659,947	3.528

**Zone 7 is the Chicago Territory, dominated by The Chicago Tribune.*

The material on this page is but a brief extract from the 1919 BOOK OF FACTS on advertising and merchandising which The Tribune will send free to manufacturers, agents and advertising or sales managers if requested on business letter-head

The Chicago Tribune

THE WORLD'S GREATEST NEWSPAPER

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, JUNE 5, 1919—CHICAGO No. 23

Indianapolis Speedway Adopts the 3-Liter Limit for Future Races

Recent Contest Convinced Officials That 300 Cu. In. Cylinder Displacement Cars Had Developed Too Much Speed for Track — 183 Cu. In., New Maximum, Is Same as for French Grand Prix — Europe's New Cars a Disappointment — Mechanical Notes

INDIANAPOLIS, June 2—Next year's 500-mile classic in the speedway here will be confined to cars having a maximum cylinder displacement of 183 cu. in. This was announced, after Saturday's race, by Carl Fisher, the moving spirit behind the oval. Fisher said that he and his associates had become convinced that the 300 cu. in. cars have developed too much speed for the track, also that the track was too rough for 500 miles at the speed of the larger cars.

Fisher's idea is that, as the Indianapolis track is maintained for the purpose of developing motor cars, its best service to the industry will be the encouragement of smaller engines and lighter cars. His position is that there are many more cars being made with a smaller displacement than 300 cu. in. than there are above that figure.

The new limitation is the 3-liter limit adopted for the French Grand Prix and is the size to which all of the new European racing models will be built. With the support of the French rule, it is not anticipated that there will be any objection to this decision on the part of the Indianapolis officials. It will probably encourage European competition, but it will not lessen the advantage that will come to American racing and the American industry. It is worthy of note that Boillot's baby Peugeot is even smaller than the new limit, and this car ran well until it turned over within 20 miles of the finish, when it was in third place.

The victory of Howard Wilcox, driving a Speedway-owned Peugeot, was not a victory of speed so much as it was a victory of preparedness, thorough acquaintance with the track, and generalship, combined, as always, with good luck. The Peugeot is the same car with which the late Aitken campaigned so successfully. It has been worked over so much and so many parts of American manufacture incorporated, that it cannot now be called foreign. Wilcox has it in such shape that he went through the race without having to make adjustments. His three short halts at the pits were for tires and supplies. He did not drive exceptionally hard; made no exceptionally fast laps. He won because others, who drove faster while on the track, could not keep going.

The race this year did not make a record for the distance. Wilcox's time was more than 10 minutes longer than DePalma's record for the 500 miles in 1915. Saturday's average speed was 87.12 m.p.h., 2.72 m.p.h. less than the 1915 records.

If DePalma or Gaston Chevrolet, who between them led the field for the first half of the race, could have kept on the track, the record for the distance would have been broken. DePalma led the field for the first 150 miles at an average of better than 92 m.p.h. His stop threw Chevrolet in the lead and the speed dropped to 90 m.p.h. The Italian gained the lead again and pushed the pace up to 91.6 m.p.h., until valves and wheel bearings checked him. His speed of 92.20 at the 100-mile mark is a track record for that distance.

Wilcox led almost the entire last half of the race, taking the pace when the Packard was held at the pits for repairs. The Peugeot, which the winner drove, was well up among the leaders most of the way. It was in third place at 25 miles and second at 50. Then Wilcox fell out of the money for nearly 50 miles, but, climbing steadily, at 125 miles he was back in third place and crowding DePalma and Gaston Chevrolet. He took second place when the Frontenac hung up at the pits at 200 miles and was in

Official Time of the 33 Starters in the 500-Mile Victory

Car No.	Name of Car	Driver	25 Miles Hr Min Sec	50 Miles Hr Min Sec	75 Miles Hr Min Sec	100 Miles Hr Min Sec	125 Miles Hr Min Sec	150 Miles Hr Min Sec	175 Miles Hr Min Sec	200 Miles Hr Min Sec
1	Chevrolet	Clif. Durant	0:20:00.40	0:36:10.25	1:01:19.90	1:17:58.00	1:35:03.35			
2	Frontenac	R. Mulford	0:15:12.00	0:32:41.90	0:49:32.90					
3	Peugeot	H. Wilcox	0:14:56.25	0:30:54.45	0:48:34.90	1:04:53.50	1:21:20.45	1:37:55.95	1:54:23.25	2:10:07.40
4	Packard	R. De Palma	0:14:55.20	0:29:20.70	0:45:40.40	1:01:31.45	1:17:36:95	1:36:16.90	1:52:43.25	2:08:31.50
5	Richards	W. Brown	0:15:22.80							
6	Peugeot	Jules Goux	0:15:25.00	0:31:41.30	0:52:01.80	1:09:11.90	1:26:24.70	1:43:35.70	2:00:58.60	2:18:50.40
7	Frontenac	L. Chevrolet	0:15:05.70	0:29:29.90	0:46:01.65	1:02:32.50	1:18:59.80	1:37:01.70	1:52:23.90	2:09:16.50
8	Stutz	Earl Cooper	0:14:57.65	0:31:00.90	0:47:41.90	1:04:29.90	1:21:20.80	1:38:16.75	1:55:09.85	2:11:42.15
9	Duesenberg	Tom Milton	0:15:28.10	0:31:37.30	0:48:31.55	1:04:52.15	1:25:18.85			
10	Duesenberg	E. O'Donnell	0:15:27.20	0:32:01.85	0:48:57.90	1:05:41.85	1:22:59.90	1:40:27.70		
12	Roamer	Kurt Hitke	0:15:34.35	0:32:05.40	0:49:21.50	1:06:15.75	1:26:38.75			
14	Durant	Eddie Hearne	0:15:13.90	0:31:15.55	0:47:56.85	1:04:57.45	1:22:10.90	1:40:28.55	1:57:26.45	2:14:24.70
15	Roamer	L. Le Cocq	0:15:31.00	0:32:02.00	0:48:59.85	1:05:37.95	1:23:13.90	1:40:24.90	1:57:10.10	2:13:24.90
17	Hudson	Ora Haibe	0:19:59.70	0:41:38.65	0:59:40.90	1:16:58.10	1:40:15.70	1:58:42.00	2:16:26.00	2:35:48.30
18	Thurman	A.Thurman	0:15:44.40	0:30:30.00	0:52:59.10	1:09:45.30				
19	Detroit	C. Kirkpatrick	0:16:01.70	0:39:58.85	1:08:01.80	1:29:37.65	1:49:12.35	2:16:06.00	2:48:55.50	
21	Stickel	D. Hickey	0:16:13.45	0:35:19.35	0:53:16.60	1:11:22.75	1:28:16.25	1:46:36.98	2:04:07.15	2:21:58.00
22	Duesenberg	W. D'Alene	0:15:18.45	0:30:21.20	0:47:38.20	1:04:43.90	1:22:10.20	1:39:41.25	2:02:03.90	2:17:34.40
23	Shannon	E. Shannon	0:17:09.80	0:35:45.35	0:54:05.80	1:12:12.40	1:32:05.40	1:50:03.55	2:07:36.90	2:28:16.25
26	Bender	Tom Alley	0:17:15.05	0:33:46.75	0:51:29.45	1:08:38.90	1:26:10.80	1:43:38.45	2:00:39.50	2:21:58.00
27	Hudson	Ira Vail	0:15:32.25	0:32:06.90	0:51:14.10	1:08:22.90	1:25:38.50	1:43:09.95	2:02:08.90	2:19:39.35
28	Oldfield	R. Sarles								
29	Peugeot	Art. Klein	0:15:21.20	0:33:49.90	0:51:27.35	1:08:45.55	1:26:05.95	1:43:27.85	2:19:18.45	
31	Ballot	Rene Thomas	0:14:56.75	0:30:55.30	0:47:16.95	1:05:09.50	1:21:29.90	1:38:45.20	2:05:39.95	2:23:20.85
32	Ballot	A. Guyot	0:15:08.85	0:31:08.95	0:47:45.35	1:04:20.90	1:21:13.90	1:44:56.30	2:02:00.90	2:18:51.65
33	Ballot	P. Bablot	0:15:29.50	0:31:24.15	0:47:17.95	1:05:03.75	1:25:18.30	1:42:24.45		
34	Ballot	L. Wagner	0:14:59.90	0:31:00.40	0:49:29.25	1:06:02.90				
36	McCoy	J. J. McCoy	0:20:26.25	0:39:41.25	0:59:04.85					
37	Baby Peugeot	A. Boillot	0:16:47.15	0:33:45.85	0:49:28.50	1:07:05.90	1:24:45.35	1:42:26.00	2:00:01.15	2:17:11.35
39	Frontenac	Joe Boyer	0:15:09.80	0:29:34.30	0:46:08.90					
41	Frontenac	G. Chevrolet	0:16:49.90	0:31:05.30	0:49:20.30	1:05:51.15	1:24:01.80	1:40:38.30	1:57:08.00	2:17:08.30
43	Toft	Omar Toft	0:16:46.10	0:34:35.50	0:52:53.75	1:11:36.90				
48	Peugeot	Ray Howard	0:16:04.20	0:33:01.35	0:50:26.70	1:07:58.10	1:25:55.50	1:44:43.80	2:17:25.55	2:44:55.20

position to take advantage of DePalma's difficulty at the halfway mark. This put Wilcox in first place with only a slight lead over Cooper. The menace of the Stutz ceased, however, when the Californian stuck a valve, but continued, slowly dropping behind while the engine thumped a wail of protest that could be heard half around the track.

By the time the race was within 60 miles of the finish, the field had divided itself into two sections. With Wilcox leading Hearne by 5 miles, and 14 miles ahead of Goux for third, Alley, Guyot and Louis Chevrolet, at the wheel of Gaston's car, were fighting for position. This bunch of six cars was 40 miles ahead of the rest of the field, with Vail's Hudson and Boillot's Baby Peugeot fighting for the doubtful honor of leading the second contingent.

Hearne Finishes Second

Hearne, by heady driving, brought his Durant Special into second money and finished less than 2 minutes behind the leader. He made only two stops and these for supplies. Like Wilcox, Hearne scored by steady, consistent driving. There never was a time during the race when he was not in the money and he climbed till, when the race was half over, he was in second place and only 10 miles behind the leader. This was the status till Willcox stopped to prepare for the final dash, which gave Hearne a chance to pick up two laps.

The Durant Special which Hearne drove was entered by Clifford Durant, son of W. C. Durant, one of the big men of the industry. The car is the Stutz that Gil Anderson drove.

Two Out of Four Ballots Finished

Another Speedway-owned Peugeot captured third place under the piloting of Jules Goux, winner of the 1913 sweepstakes. Goux did not show among the contenders until the race was about half over, but at 350 miles he had climbed into fourth place, jumping to third with 50 miles to go when the Frontenac got into difficulties. Goux made only 5 stops, all of short duration.

Of the four Ballots started, only two finished, but both in the money. Guyot captured fourth place, and Rene Thomas, winner of the 1914 race, nosed into the purse for tenth place. The other two came to grief. Bablot's machine, with Chassagne, the former Sunbeam pilot, at the wheel, turned over. Louis Wagner's machine broke a wheel early in the day.

The Ballot cars, built especially for this race at an expense of $120,000, and brought over from France with a

Sweepstakes Race on the Indianapolis Speedway, May 31

225 Miles Hr Min Sec	250 Miles Hr Min Sec	275 Miles Hr Min Sec	300 Miles Hr Min Sec	325 Miles Hr Min Sec	350 Miles Hr Min Sec	375 Miles Hr Min Sec	400 Miles Hr Min Sec	425 Miles Hr Min Sec	450 Miles Hr Min Sec	475 Miles Hr Min Sec	500 Miles Hr Min Sec	Pos. at Finish
2:26:10.50	2:42:08.75	2:58:57.20	3:18:45.50	3:35:27.75	3:51:56.90	4:08:27.55	4:25:31.16	4:42:57.15	5:05:02.40	5:22:35.65	5:40:42.87	1
2:24:15.90	2:40 18.40	3:15:26.40	3:31:56.85	3:46:44.80	4:03:07.80	4:19:38.25	5:04:04.90	5:20:42.70	5:37:27.90	5:53:58.30	6:10:10.64	6
2:35:53.35	2:53:08.20	3:12:58.30	3:30:05.45	3:47:41.10	4:04:56.90	4:22:01.75	4:40:22.35	4:57:26.30	5:14:36.93	5:31:42.40	5:49:06.18	3
2:28:48.50	2:45:27.75	3:27:11.30	3:46:03.00	4:06:07.10	4:23:58.50	4:43:04.85	5:01:50.30	5:19:03.20	5:37:37.90	5:53:58.75	6:10:10.92	7
2:28:24.45	2:47:29.95	3:05:35.45	3:23:36.35	3:55:43.95	4:13:45.65	4:34:15.15	4:59:56.30	5:20:36.35	5:42:10.15	6:02:58.60	6:21:35.05	
2:31:27.00	2:48:16.10	3:05:34.60	3:25:09.95	3:42:12.85	3:59:12.55	4:16:23.50	4:33:28.95	4:50:31.00	5:08:03.20	5:26:20.10	5:44:29.04	2
2:29:48.25												
2:53:35.90	3:11:50.35	3:29:44.90	3:47:19.40	4:08:01.50	4:26:08.30	4:46:51.20	5:19:03.25	5:37:21.60	5:56:48.80	6:15:33.90	6:34:28.09	
2:40:19.40	2:59:28.90	3:23:55.45	3:43:27.75	4:02:48.45	4:21:24.35	4:41:40.00	5:00:21.25	5:18:52.65	5:37:46.55	5:56:01.60	6:13:57.24	9
2:34:54.70	2:53:10.50	3:12:28.65	3:33:22.90									
2:46:47.30	3:06:25.60	3:26:24.80	3:48:48.60	4:08:05.25	4:27:12.20	4:48:08.25	5:09:43.35	5:31:12.90	5:50:35.80	6:12:14.65	6:30:50.75	
2:38:59.50	2:56:45.00	3:14:23.15	3:31:55.85	3:49:26.90	4:06:38.20	4:26:02.65	4:43:32.75	5:09:31.85	5:27:47.70	5:46:12.85	6:05:03.92	5
2:37:04.25	2:56:57.70	3:15:44.80	3:34:35.90	3:53:30.90	4:12:18.10	4:34:29.35	4:53:56.30	5:13:28.00	5:33:19.35	5:53:42.90	6:12:42.85	8
2:41:07.00	3:07:33.20	3:25:43.90	3:44:25.60	4:03:39.60	4:28:42.55	4:47:03.55	5:05:19.90	5:23:58.35	5:42:30.30	6:00:48.00	6:21:10.92	
2:37:31.80	2:54:48.35	3:12:35.90	3:34:52.90	3:52:20.85	4:09:47.65	4:26:55.35	4:45:58.28	5:03:03.35	5:20:10.93	5:38:38.55	5:55:16.27	4
2:34:25.00	2:51:26.50	3:09:03.85	3:26:24.80	3:43:57.40	4:04:17.95	4:22:09.25	4:40:03.60	5:00:54.15	5:18:24.40	5:35:54.75		
2:33:32.30	2:49:52.50	3:06:41.90	3:23:26.45	3:39:53.70	3:57:13.10	4:25:47.35	4:42:09.30	5:09:38.25	5:43:36.95	6:00:20.90	6:17:21.79	10
3:09:10.50	3:32:47.90	3:53:50.85	4:21:07.75	5:18:28.85								

crew of Europe's best drivers, did not come up to expectations. That they had speed was shown in practice and in the elimination trials. They did not stand the 500 miles on the bricks. Guyot only made three stops, and these not of long duration. Thomas made five stops for supplies and tires. He seemed to be taking things very easy.

Joe Boyer, in his Frontenac, threw a left rear wheel and broke the axle. The accident occurred near the pits and the car coasted in on the hub of the broken wheel.

This accident resulted in a serious tie-up of the whole race.

Toft Seriously Injured

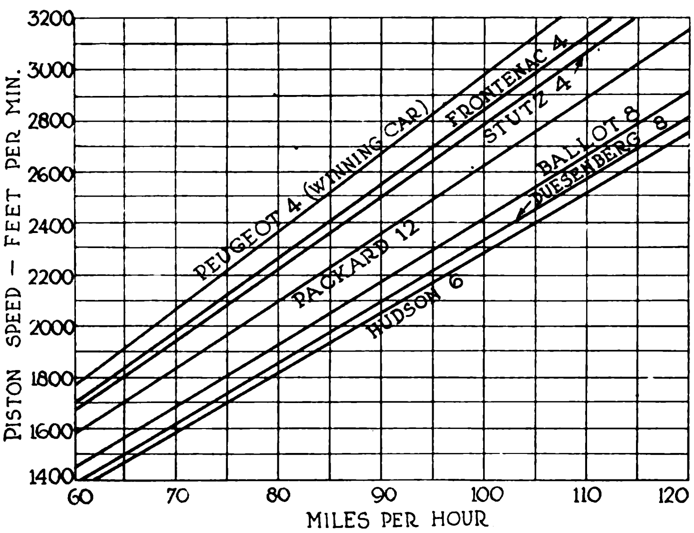
The car crossing the timing wire with its broken wheel cut the timing wire. Omar Toft in his Toft Special was following Boyer. The wire released from the tension of the springs curled up in the air and struck Toft, cutting him severely in the throat and opening the jugular vein. Toft was bleeding profusely, but continued to drive his car. He was forced to stop for medical attention, though, in the thirtieth lap. Inspection showed that he was injured rather severely and therefore did not continue the race.

The breaking of the timing wire also caused some commotion in the timing stand. A new wire was hastily substituted and the click of the chronometer continued.

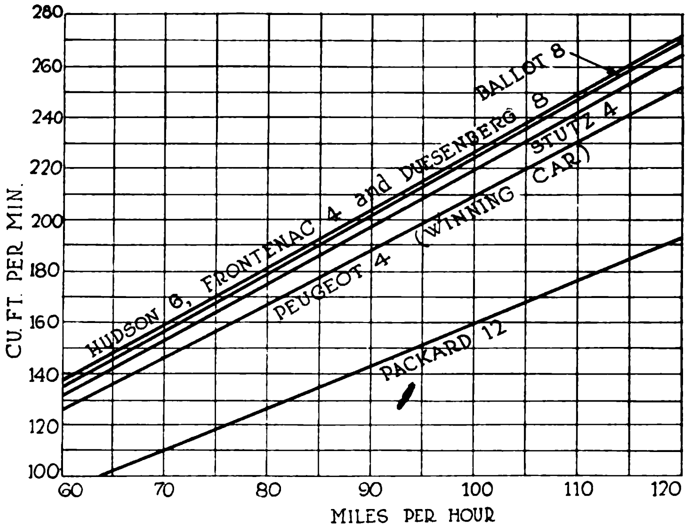
The real race was between Louis Chevrolet and DePalma for sixth and seventh places. Lap after lap they fought, DePalma coming up from the ruck after changing a wheel bearing and Chevrolet fighting to make up the time lost in changing a steering knuckle. The battle brought the grandstand folk to their feet time after time, this after the race had been won. So close was the finish that only a re-check of the timing tape could determine who got in first. In the re-check DePalma, who had been given sixth, unofficially, had to take seventh in favor of Chevrolet.

The Frontenacs seemed too lightly constructed for the track. Boyer lost a wheel and Louis Chevrolet lost two by the aluminum drum failing. The latter also broke a steering knuckle and Mulford broke an axle driveshaft.

It was estimated by Speedway officials that there were over 100,000 present. In addition there were a great number of machines in the center of the oval and around the inside of the ring. The roads leading to the course were heavily congested with traffic an hour after the race had started.



Piston speeds in feet per minute of some of the cars in the race



Cubic feet of gas displaced per minute at different speeds by some of the cars

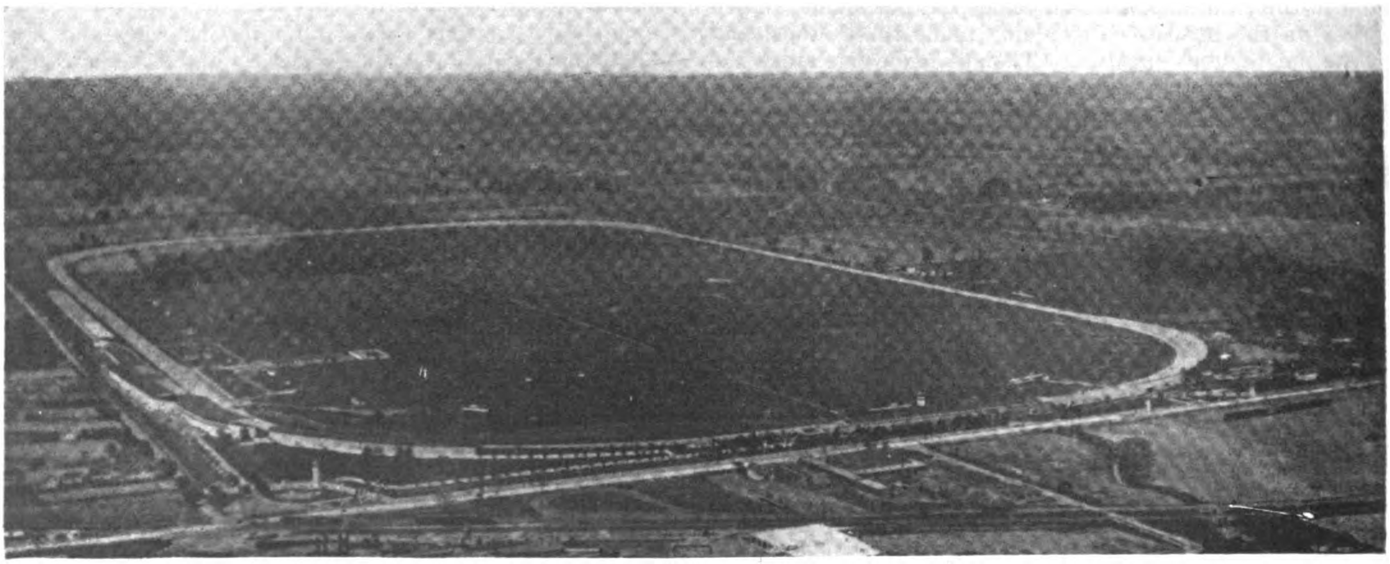
Mechanical Notes from the Race

One of the best reasons for racing is that it enables us to determine the weakest links in the chain of car components and by this knowledge to profit in the design and construction of vehicles intended for passenger or commercial purposes. The mortality among racing cars is always so high under the severe stresses which they are compelled to stand that the conclusion of a race brings to light a total list of minor and major troubles which often indicate to the designer what it is permissible to do in ordinary construction.

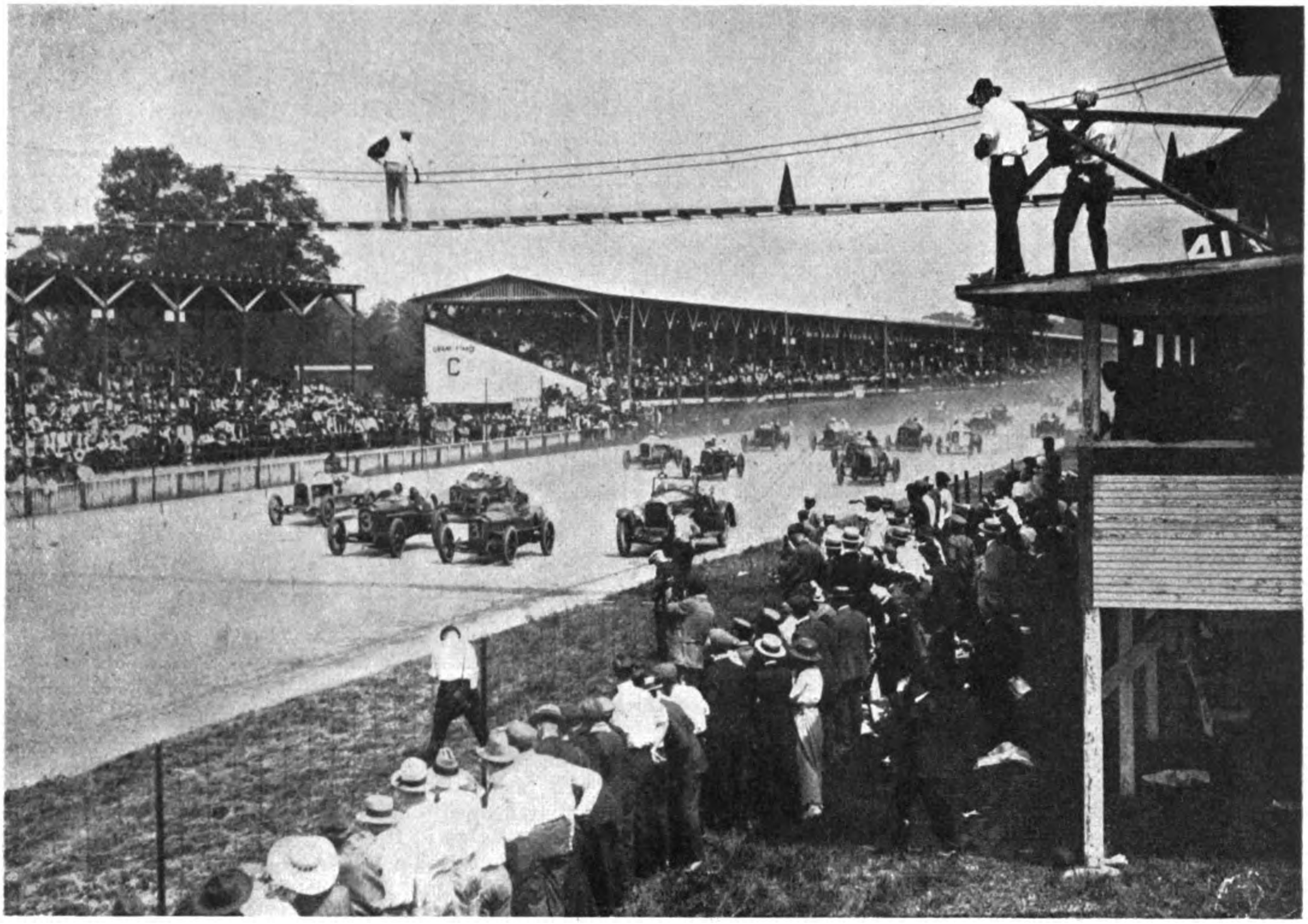
Furthermore, from a theoretical standpoint there is much to be learned in regard to what can be done in the handling of gases at high velocity and what is the limit in allowable piston speeds. Little or no problems of carburetion are, as a rule, apparent, but there is always much to learn in manifold design and, particularly, weak spots in the cooling system are brought to light by the failure of spark plugs and often through the tendency to overheat, as indicated by excessive steaming, etc.

The major number of stops at the pits was directly due to tire failure. This would be expected, as the race was run under a burning sun on a track which was already superheated by two days of exceedingly hot weather which preceded the start of the classic. Sixty-seven tire changes were made. Of this number thirty-one, or nearly 50 per cent, were right rears, which is the usual percentage for the Indianapolis track. Fifteen were left rears, twelve left fronts, and nine right fronts. It would be wrong to assume from these figures that tire performance has not improved. In the first place, probably 30 per cent of the tires were changed before it became necessary, because the cars were drawn up to the pits for other purposes, affording the opportunity to make the replacement. Secondly, the conditions as far as heat and direct sunlight were concerned were never equaled at an Indianapolis race. During practically the entire period the track was in the direct glare of the sun, with no sheltering clouds in sight.

Three cars changed tires six times, these being De Palma's Packard, the Hudson Special driven by Haibe, and the Ballot driven by Guyot. Three cars changed five times; two changed four times; three changed three times and the remainder changed at least once. No car went for the entire distance without a change.



Airplane view of the speedway



As usual, the start was a flying one, J. G. Vincent and Eddie Rickenbacker pacing the pack for a lap and then drawing to one side. This is the end of the paced lap

The winner made only one stop, at which time he took on a complete set of tires as well as oil, gas and water, and he also tightened his shock absorbers. Disregarding this stop, it was the steady running program of Wilcox which won. De Palma and Louis Chevrolet, who proved in the early part of the race that they were the most dangerous contenders as far as actual speed was concerned, had to make stops for failure in vital parts. De Palma had to make adjustments on his valve drive mechanism during his first stop, and on his second stop had to replace an entire front right wheel bearing assembly. This took such a long time that it put him out of the running so far as first place was concerned. While the car was on the track, however, its steady, fast running made it the pace maker, and had it not been for these two mechanical mishaps, De Palma probably would have been the winner. At the 100-mile and 200-mile marks he was in the lead, having broken the speedway record for these distances.

The failure of the Frontenacs showed that they were too lightly built to withstand the stresses imposed by the Indianapolis track. In fact, dangerous weakness was apparent on the rear axle drums. Before the race, on the brake test, the drum on Louis Chevrolet's car cracked under the strain imposed by bringing the car to a stop. This break became apparent immediately the brake was applied. It was on the left rear drum carrier. The right rear drum on the same car broke during the race.

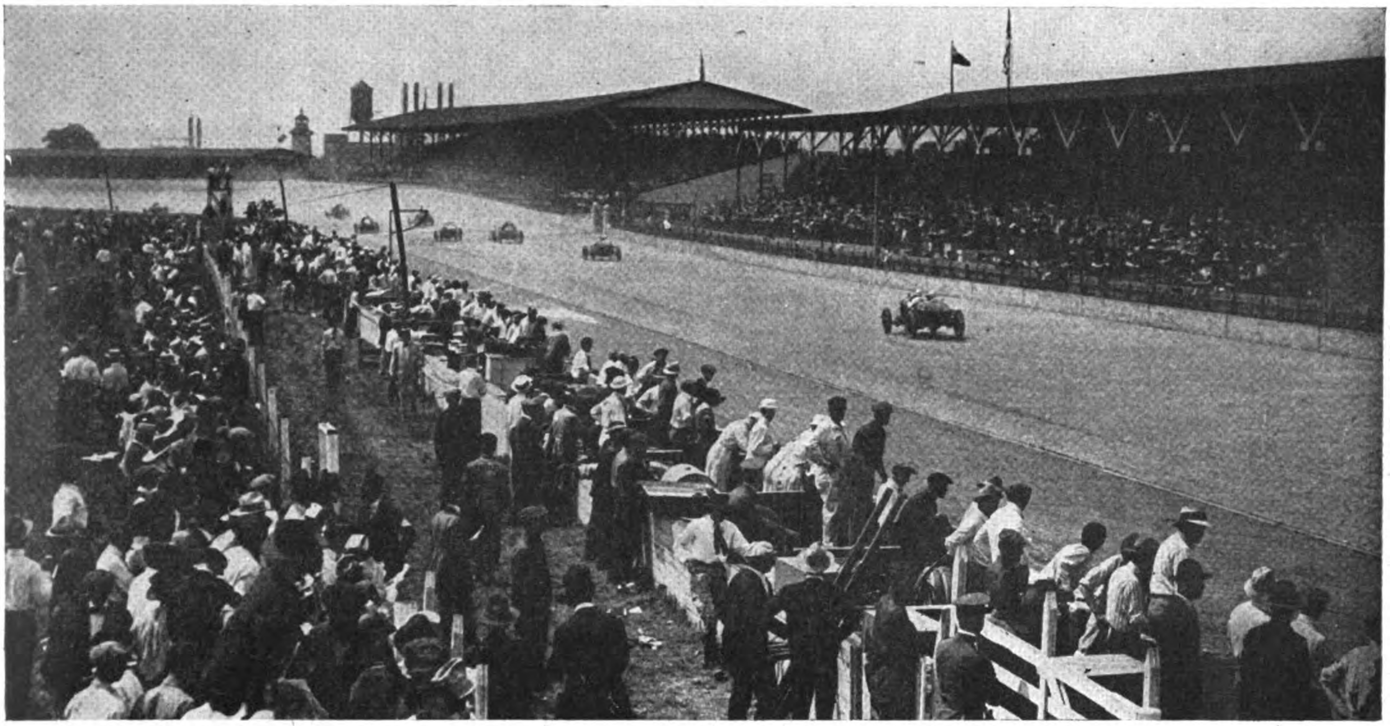
The front axle was also too light, at least the steering knuckle spindle. This became crystallized, due to the continuous bouncing over the rough track, and when the car was on the turn entering the home stretch it broke off, throwing the wheel over the fence, and it was only by the most skillful driving that Chevrolet was able to bring the Frontenac to a halt before his pit on three wheels.

Twice during the race this three-wheel performance was necessitated by failures of the front and rear axles on these cars. The rear axle failures were evidently due to the fact that the aluminum employed was not strong enough to endure the torsional strains resulting from the tremendous acceleration upon leaving the curves.

The Indianapolis track is banked for 90 m.p.h., which makes it distinctly a drivers' track and allows the human element to enter in the management of a car on the turns to a far greater extent than on the 120 m.p.h. New York Speedway. For this reason spark plug troubles are always more apparent on this track, due to the fact that it is necessary to shut off on the turns, allowing the oiling systems a chance to load up before the throttle is again opened. Puffs of smoke are always apparent at the entrances to the back and home stretches, due to the use of the accelerator in gaining speed for the straightaways. It is not surprising that there were twelve stops for spark plugs, during some of which the whole set of plugs was renewed.

The Ballot cars proved a disappointment. While steady, they either did not possess the necessary speed to bring them into prominent position, or else the drivers did not take the same chances on the curves as the others.

The Sunbeams were withdrawn just before the race, and a rumor went around that this was due to the fact



Cars bunched at the southeast turn

that their cylinder displacement was 304 cu. in. and thus beyond the set limit. Investigation has about disproved this, and it is now stated that Resta, in a test drive, found that at 2500 r.p.m. of the engine there was a critical speed at which vibration was so severe that it would have been impossible for the cars to withstand a 500-mile grind. The cars are to be shipped back to England.

There is no doubt that the rough track greatly bothered the Ballot drivers. These cars may show higher speeds in future events than they did at Indianapolis, as there was a feeling before and during the race that they were being held back.

Engineering opinion is growing that 300 cu. in. is too high a limit for cars for the Indianapolis track: it is felt that the limit should be materially reduced in order that racing may be of the greatest possible benefit to the designer. Under present conditions, the cars are so much faster than the drivers (to use a track expression), particularly on tracks like the Indianapolis, that most of the value of the race is lost.

The Duesenberg 4-cylinder, 16-valve engine of 3¾-in. bore by 6¾-in. stroke, was used by O'Donnell (Duesenberg), Hitke (Roamer Special) LeCocq (Roamer Special), Thurman (Thurman Special), and D'Alene (Duesenberg-Shannon Special). These cars showed sufficient speed to put them well up in the race, but owing to the inexperience of their drivers, two of the cars were involved in fatal accidents.

A careful study of the race makes it very apparent that practically all of the cars were much faster than the drivers, which is to say that the cars were capable of developing a speed beyond the limit at which their drivers could safely handle them. This is particularly

Drivers and Specifications of Cars, with Their Equipment

Car and Driver	Cylinders		B. & S.	Pist. Disp.	Valves		Operation	Ignition	Carburetor	W. B.	G. R.	Tires	Plugs
	No.	Cast			No.	Location							
Peugeot, Wilcox	4	Blk.	3.6x7.6	274.6	16	Head	Dual cam	Bosch	Miller	108	2.6–1	34x4½ 33x5	Oleo
Durant, Hearne	4	Blk.	3 13/16x6½	296.8	16	Head	One cam	Bosch	Miller	102½	2.6–1	32x4½ 33x5	A-C
Peugeot, Goux	4	Blk.	3.6x7.6	274.6	16	Head	Dual cam	Bosch	Miller	108	2.6–1	34x4½ 33x5	Oleo
Ballot, Guyot	8	2 Blks.	2 29/32x5 33/64	296.0	32	Head	Dual cam	Ballot	Claudel	108	..	33x5	Doublel
Bender, Alley	4	Blk.	3⅝x7	289.0	16	Head	One cam	Bosch	Miller	107	..	32x4½ 33x5	Bosch
Frontenac, Chevrolet	4	Blk.	3.87x6.37	299.5	16	Head	One cam	Bosch	Miller	104	..	32x4½ 33x5	Rajah
Packard, DePalma	12	V Blk.	2 21/32x4½	299.2	24	Head	Dual cam	Delco	Zenith	110	..	34x4½ 33x5	A-C
Hudson, Hickey	6	Blk.	3.5x5	288.6	12	L-head	One cam	Delco	Hudson	107.5	..	32x4½ 33x5	A-C
Frontenac, G. Chevrolet	4	Blk.	3.87x6.37	299.5	16	Head	One cam	Bosch	Miller	104	..	32x4½ 33x5	Rajah
Ballot, Thomas	8	2 Blks.	2 29/32x5 33/64	296.0	32	Head	Dual cam	Ballot	Claudel	108	..	33x5	Doublel

All cars carried Goodyear tires. All cars carried Hartford shock absorbers. All cars carried Rudge-Whitworth wheels.

Valve Sizes of Some of the Cars

Car No.	Car	Diameter Exhaust Valve, In.	Diameter Intake Valve, In.	Lift Exhaust, In.	Lift Intake, In.
6	Peugeot (Goux)	2	1	1/2	1/2
37	Peugeot (Boillot)	1 3/8	1 [illegible]/16	[illegible]/16	[illegible]/16
46	Premier	1 [illegible]	1 [illegible]	3/8	[illegible]
47	Premier	1 [illegible]	1 [illegible]	3/8	[illegible]
45	Peugeot (Wilcox)	1 [illegible]	1 [illegible]	3/8	[illegible]
15	Roamer (Le Cocq)	2 3/8	2 3/8	3/8	3/8

Most drivers are very secretive about valve sizes. Those given in the table are known to be accurate.

true in those cases where the drivers had had little or no experience in track racing. The Ballot cars may show up better in races on speedways which are banked for a speed of 120 m.p.h. The drivers on the Ballot cars were also too much exposed to the wind pressure. This should be corrected and the seating arrangement should be so changed that the drivers may occupy a more lax position than was possible in the Indianapolis race, where they were notably tense and not at all at ease.

Car Characteristics

Widely differing characteristics were possessed by the cars entering the race. An analysis shows that the winning Peugeot had the highest piston speed of any of the cars. At 87.9 m.p.h., the average speed maintained by the Peugeot in winning the race, the piston speed was 2620 ft. per min., or about 600 ft. per min. more than that of the Hudson, which had about the lowest piston speed of any of the cars in the race. The accompanying chart gives graphically the piston speeds of the typical cars in the race and it will be noticed that the winning Peugeot was considerably faster as regards piston velocity for a given car speed than the other cars.

Considering gas velocities, in the absence of complete statistics on valve areas, these may be plotted on a basis of cubic inches of gas displaced at definite speeds. It is interesting to note that outside of the twelve-cylinder Packard, the winning Peugeot had a lower displacement per minute at any given speed than the other types. This is in spite of the fact that its piston velocity was the highest and is due to the dimensions of the Peugeots, which have a piston displacement of 287 cu. in., as compared with the others, which are close to the 300 mark. The only small displacement car in the race was 150 cu. in., this being the Baby Peugeot with a 2.15 15/16 x 5½ in. engine.

The 12-Cylinder Packard

The Packard 12-cylinder car, which, from its performance on the first 100 miles of the race, was probably as fast as any car on the track, if not the fastest, has only a 4½ in. stroke. Thus, although turning at sufficient speed to give it an intermediate position as far as piston speed is concerned, its position is low on a gas volume basis, and the car probably would show up notably from an economy standpoint were it possible to secure accurate records. Unfortunately, this is not the case, owing to the impossibility of measuring the fuel remaining in the tanks at the conclusion of the race or of measuring the amount put in during the race because of the quantity spilled.

From close observations it appears that the 500 miles were run by the winner on 45 gal. of gasoline. This would give an average of approximately 11 miles to the gallon, showing a high thermal efficiency, as would be expected under conditions of practically wide-open throttle at high speed.

The spark plug troubles were due to fouling more than to fusing, as only little of the latter was seen. The fouling trouble is no doubt the result of the oil-loading due to the acceleration on the turns, as previously pointed out. The only car which showed symptoms of plug fusing due to overheating was car 19, Hudson Special. This car had to change plugs four times and took on water six times, showing that it was badly troubled with overheating. On this same car a sticking valve gave a great amount of trouble.

In studying the reasons which eliminated the different cars, the fact becomes apparent that more failures were due to drivers not experienced on the Indianapolis track than to any imperfection in the cars themselves, although such defects showed up in some instances. The list of eliminations is as follows:

Car No.	Lap		Cause
5	11	Frontenac	Burned out rod bearing
39	30	Premier	Broken hub
28	9	Baby Peugeot	Broken rocker arm
2	37	Durant Special	Broken driveshaft
9	49	Richards Special	Burned out rod bearing
34	45	Ballot	Broken right rear wheel
12	57	Duesenberg	Burned out bearing
18	44	Hudson Special	Turned over on back stretch
10	66	Stutz	Broken piston pin
33	63	Ballot	Ran into wall on back stretch
29	71	Mesaba Special	Burned out connecting rod bearing
1	55	Durant Special	Broken steering connection
43	45	Thurman Special	Trouble unknown
36	37	Ogren Special	Broken oil line
19	70	Hudson Special	Broken oil line
15	96	Roamer	Burned up
22	119	Hudson Special	Broken steering gear
37	191	McCoy Special	Turned over on back stretch

While it is almost impossible to tell the cause of accidents such as those which marred Saturday's race, it is certain that in practically every case the lack of experience was one of the main factors.

Minor Troubles Cause Delays

As in all long-distance races, minor troubles were responsible for a great many delays. For instance, one of the Peugeots had to come into the pit twelve times owing to oiling troubles. This car could not hold its pressure and had to draw up to the pit to have the oil pump manipulated at frequent intervals. Trouble of this kind can, of course, be readily avoided if it is foreseen. The same ap-

(*Continued on page* 1245)

Wilcox, the winner receiving congratulations

Co-operation Profitable to Employer and Worker

IT IS not always easy to see the practical application of plans dealing with the question of human relations and containing departures from the general practice.

The questions asked by manufacturers to-day indicate the desire to see results. If the human side of industry had been studied with the care given to the more mechanical elements of production, those questions would not arise so insistently. Under the circumstances, it is fortunate that there are a number of cases in practice which can be reported upon from the results obtained, and the account printed here tells of the benefits to one manufacturer after two years' experience with such a plan.

By Harry Tipper

IN previous articles AUTOMOTIVE INDUSTRIES has explained in more or less detail the organization and form of "employes' representation" plans as adopted by several important American industrial establishments. It will be of interest now to study the results of some of these experiments and to find out just how they work out in actual practice.

A good example of an "employes' representation" plan or "Industrial Democracy," as it is called, is that in operation for the past two years at the tobacco pipe manufacturing plant of Wm. Delmuth & Co., at Richmond Hill, Long Island, N. Y., where 900 men and women are employed.

Leopold Delmuth, president of the company, who considers the experiment a success, says that the plan is "based upon the confidence and co-operation of the whole body of workers." According to Mr. Delmuth, "one of the best features of the plan is that it has succeeded in establishing a happy relationship between employer and employes. It has also helped to produce more and still better pipes."

Profit Sharing an Incentive

Not only does the plan bring about co-operation between the employer and employes in the conduct of the works, but it also provides a means for giving the workers a share of the profits, as the savings obtained under the plan through increased output or reduction in overhead are divided between the company and the employes on a 50-50 basis. The profit-sharing is made effective every two weeks, the employes receiving separate pay envelopes marked "Employe's Dividend." In two years this bi-weekly dividend has never been less than 6½ per cent the wage and it has been as high as 17½ per cent.

Regarding this method of profit-sharing, Mr. Delmuth says: "We believe that profit-sharing is one method, and ours, based upon actual performance of the worker, is another. The profit-sharing plan has many worthy features, but we do not believe that many workmen understand the inevitable variation of the percentage of profit. Furthermore, we do not believe that he should be made to suffer for any losses connected with sales, finances or raw merchandise investments, all of which are beyond his control. Our plan is based upon a saving accomplished by the worker in both production as well as overhead.

"Furthermore, under our plan whereby we give our employe his dividend every two weeks, incidentally in a separate envelope marked "employe's dividend," he does not have to wait for what seems to him the indefinite future to learn whether or not the employer is living up to his promises. He can watch his dividend grow larger or smaller, and soon he will begin to learn that when every machine is running all the time he makes more money than when his fellow workers take holidays and machines are left idle. Thus he comes to know that co-operation means a larger pay envelope."

What's in a Name?

It makes little difference as to what name a plant organization of this kind is given, whether "Employe's Representation" plan, the name applied at the plants of the Colorado Fuel & Iron Co. and the Midvale Steel & Ordnance Co., or "Industrial Relationship" plan, as it is named by the Standard Oil Co., or "Industrial Democracy," the name adopted by the Delmuth Co.

In England the much-talked-of "Whitley Councils" plan of "Works Committees" is of a similar character, except that it goes further and provides for District and National Joint Councils of employers and employes. In America co-operative methods of this kind have been applied only to individual industrial enterprises.

In the Delmuth plant the originators have chosen to give the plan character by calling the representatives, or council, chosen by the employes the "House of Representatives." Carrying the governmental idea of or-

ganization further, they call the council of foremen and heads of departments the "Senate," and they call the sessions of company executives the "Cabinet."

In several of the "employe's representation" plans adopted by other industrial enterprises in this country machinery is provided by means of which differences between the employers and employes can be carried up from the body directly representing the employes to higher and still higher authorities, and finally, if necessary, settled by some form of arbitration.

In the plan used at the Demuth works no provision appears to have been made for arbitration of differences. In fact, if the employes take action contrary to the opinion of the company executives, means are provided by which such action can be "vetoed" by the "Cabinet" or company officials. It is stated, however, that during the past two years the "Cabinet" has never had occasion to exercise this power.

The first question that naturally arises is, "Why did Demuth & Co. feel that it was wise or necessary to inaugurate such a plan in their works?"

Mr. Demuth denies emphatically that the scheme was inaugurated because of labor trouble, or for fear of any. He says they went ahead with it simply because they considered it a wise and liberal, "as well as a paying policy." As he puts it: "When the growth of our business made intimate relationship between the employer and employe impossible, we realized that only through giving the worker his say in the running of the plant could we get the co-operation so urgently needed to further promote business. Hitherto, the labor leader has been the only teacher of the working man, and we knew it would pay us to endeavor to educate the worker in a way that would teach him the value of co-operation."

Effect on Production

As to whether the plan turned out, as was hoped, to be a "paying" investment, Mr. Demuth is equally emphatic in his affirmative, though he says the profit of the plan to the company was indirect, defining his opinion as to the results as follows: "We did not, in the beginning, have any illusion that Industrial Democracy would keep our costs down to pre-war basis. How much lower they have been under Industrial Democracy than they would have been without this plan is largely a matter of speculation. We honestly feel that we have benefited distinctly from this point of view. We are convinced that under the old system we would have had a much more rapidly rising scale of wages, and would have had the difficulties with employes suffered by many other firms, all of which would have increased costs far beyond the point to which they did rise.

"Many of our men are piece workers. Some were in the habit of rushing their work so that they could make the most money regardless of the quality of their output. At the meetings of the Lower House, the representatives of the workers learned that this policy was lowering their dividends, for it was resulting in a large amount of waste. The representatives brought home this fact to the workers, who began to realize that any gain made by rushing their work was more than offset by the loss in dividends caused by this method. Consequently, they soon began to turn out better pipes.

"Another important factor in raising the standard of quality is that, by reason of his having a voice in the management of the plant, the worker takes more pride in his product, as in the case of the craftsmen of old."

Another good effect that the plan has had upon the business of Demuth & Co. has been in the reduction of the turnover. This has gone down to so low a point at this plant that it is no longer a serious factor. During the height of the war, when the high wages of the munitions plants were tempting all workers, and other manufacturers were feeling the shortage of labor, the mutual interests created by the Industrial Democracy plan at the Demuth works kept the men at their jobs. Knowing that lack of help would reduce their dividends, the employes saw to it that their fellow workers stayed.

Before the plan became operative, the employes worked fifty-three hours a week. At one of their "House of Representatives" meetings they voted to reduce the working time to fifty hours. The "Cabinet" did not veto the change, and it became effective. A trial of the new time schedule showed that instead of a decrease in output, the production had been increased 8 per cent.

This change worked out so well that another reduction was made in the working week to forty-eight hours. The company officials admit that this reduction of working time has not decreased production.

How the Workers Like It

At the start many of the employes looked upon the plan with suspicion and doubt, but all now seem to favor it. As one workman reviews it:

"I have seen Industrial Democracy in operation at this factory for the past two years, and the main reason I am for it heart and soul, is because I know that, through it, I can always get a square deal.

"When a man in my department has a grievance, he comes to me and tells me about it, and he knows that I will take the question up at the next meeting of the 'House of Representatives,' and, consequently, the foremen in the 'Senate' and the 'bosses' in the 'Cabinet' will know about it. They will act on it one way or another, and my experience has been that every question has been settled fairly.

"Nowadays at the plant you never hear a foreman urging the men to get on the job. There is no need for it. We all know that by doing our best all the time we are increasing our own dividends. Now whenever a man 'knocks off' early, comes in late or takes a holiday, it is not the boss who wants to know the reason, but the other men and women workers whose dividends he is lowering Before Industrial Democracy was put into effect, it was every man for himself; now it is all for one and one for all.

Things Are Different Now

"Years ago, if a worker had a grudge against the foreman he would probably lay down on the job whenever he thought he wasn't being watched; but that is a thing of the past, for whatever complaints a man has are now quickly settled in a way satisfactory to everybody.

"And another thing, Industrial Democracy has proven that some of our men had, stored up in their minds, ideas for new machinery and other labor-saving devices; but they kept these plans to themselves because they were not sure how they would be received by the management. Now, a man with a good idea knows that not only will his suggestion be welcomed, but that if practicable it will be rewarded. In our plant to-day, labor and time-saving machinery, invented by the men, is lowering the cost, increasing production, and thus earning dividends.

"Industrial Democracy has given us 'a say' in the management of the shop; it has reduced our working hours from 53 to 48 a week; it has given us insurance; it has given us a lunch room where we can get good meals for 20 cents; it has made this shop a better place to work in; it is teaching English to our foreigners and helping them to become Americans; it has taught us that the firm has troubles and worries just the same as we have, and that by working together we all benefit."

German Destruction of the Belgian Automotive Industry

Only One Factory Escaped the Complete Blight, Due to the Use of Plant As Machine Shop—Its Present Capacity Is One Car Daily—Country Likely to Prove New Field for Trucks and Tractors

By W. F. Bradley

THE Minerva automobile factory at Antwerp has as its managing director Mr. S. Dejong, who is of Dutch nationality. It might have been thought that this would have had a restraining influence on the German authorities. Mr. Dejong was under no delusions. He fled to Holland the day the German army entered Antwerp and was not long in receiving an official communication in the name of the German Emperor ordering him to return and take control of the factory.

Taking possession of the Minerva factory in October, 1914, the German forces immediately began to strip it. When the armistice went into effect they had removed 750 machine tools, all the automobiles and stocks of raw material to the value of $1,200,000, on pre-war estimates. Removals were continued until the last moment. On Nov. 11, 1918, boxes were standing in the street labelled for shipment into Germany. The electric transformers were not taken away, for these were required to furnish current for lighting the buildings. They had been numbered and catalogued, however, in view of a requisition. During the last 6 months they were in possession the Germans exacted 1 ton of brass or bronze goods per week. This was the work of the R. O. H. M. A. (Rettung, Ordnung und Hilfe, Militarische Abteilung).

When the Germans departed, there was not a single machine tool in the whole of the Minerva factory. But the buildings were stacked with wrecked German automobiles and automobile trucks, and the refuse of war was to be found everywhere, even on the flat roofs. Two hundred beds had been placed in the factory buildings. There was unmistakable evidence that these had not been used exclusively by soldiers. The filth was indescribable.

When I visited the Minerva factory I was shown a most complete selection of drills, taps and dies, reamers, jigs, etc. The question naturally was asked why this valuable material had been left behind when everything else had been taken away or destroyed.

From the beginning of the war to the middle of October, 1914, when Antwerp fell into the hands of the German army, the Minerva factory had been producing war material. The directors realized two weeks in advance that the city would fall, and in the belief that the war could not last more than 6 months they had all their small tools, jigs, dies, etc., wrapped in oiled paper and hidden in the factory chimney. For 4 years German soldiers leaned against the chimney, within which this valuable material was hidden.

One day they suggested that a fire should be made in this particular chimney. One of the staff remaining at the factory informed them that there had been an accident at an earlier date, and suggested that the fire should be made elsewhere and the pipe brought into the chimney above the obstruction. His advice was taken, and more than 4 years later, when the enemy retreated, this material was found practically intact.

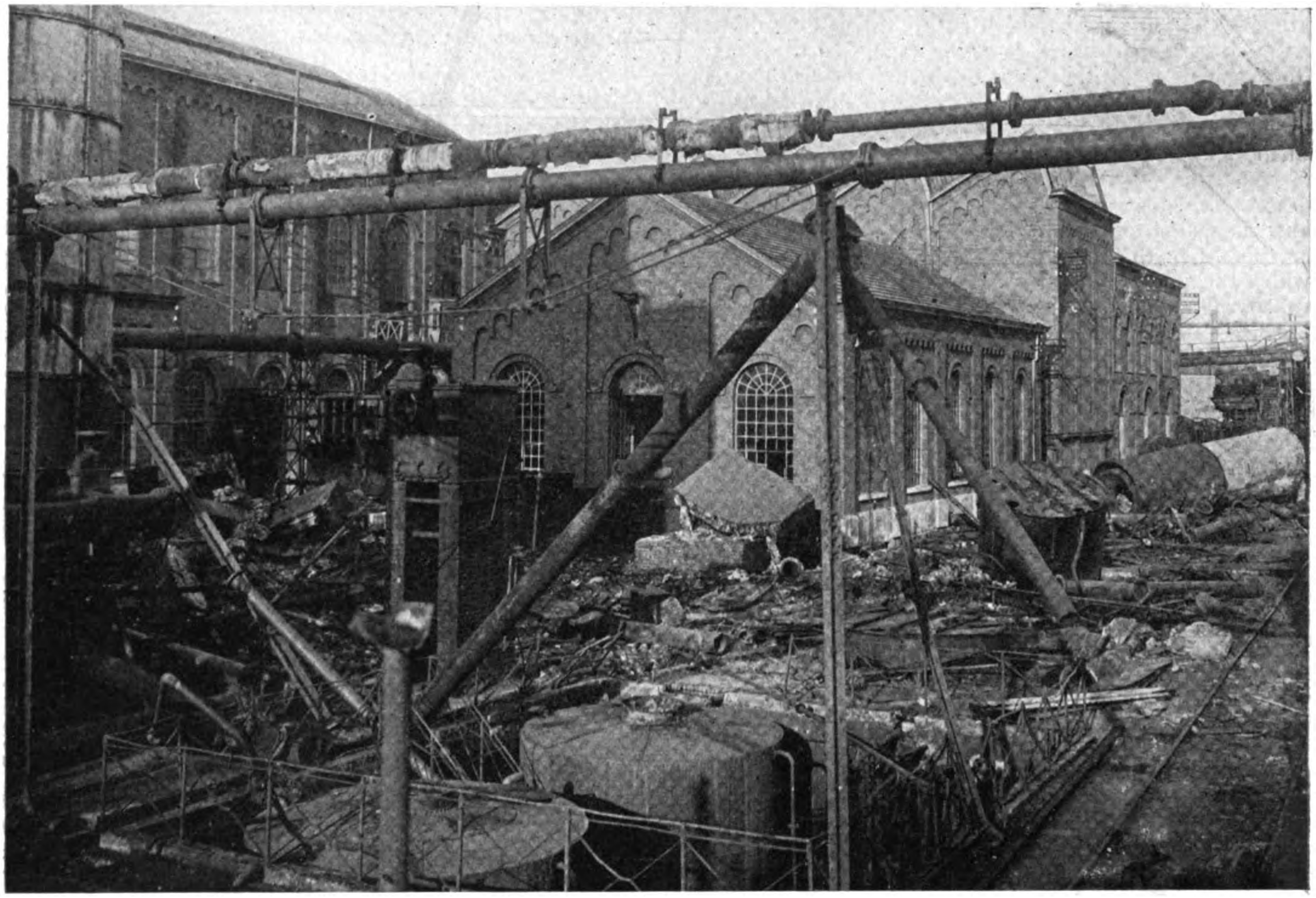
Soon after seeking refuge in Holland, Mr. Dejong began to get machinery together to be used when the war was over. With Belgian refugees he began the construction of 150 lathes. This work was proceeding very satisfactorily, when the German authorities were informed of it and placed Mr. Dejong on the blacklist. The consequence was that no raw material could be obtained, for Germany had practically complete control of this, and that all the Belgian refugees were thrown out of work. Although the lathes could not be finished, work was found for the men by the Dutch Government.

Fortunately American lathes and other machinery were found on the Dutch market, and were purchased in anticipation of a resumption of business. The managing director of

THIS is the second of a series of articles by W. F. Bradley, special European correspondent of AUTOMOTIVE INDUSTRIES, on the destruction of the automotive industry in Belgium. Last week the general situation was graphically described. In this article Mr. Bradley tells of the conditions he found at the various factories. In the big fact that production ability was destroyed in all but one factory the situation is common. But in each factory a different degree of barbarity was practised. Mr. Bradley went to Belgium to investigate the automotive industry for this publication and as its representative he was accorded many special privileges by government officials and leaders in the industry.

—EDITOR.

The Exteriors of Two Factories Are Typical of Scores

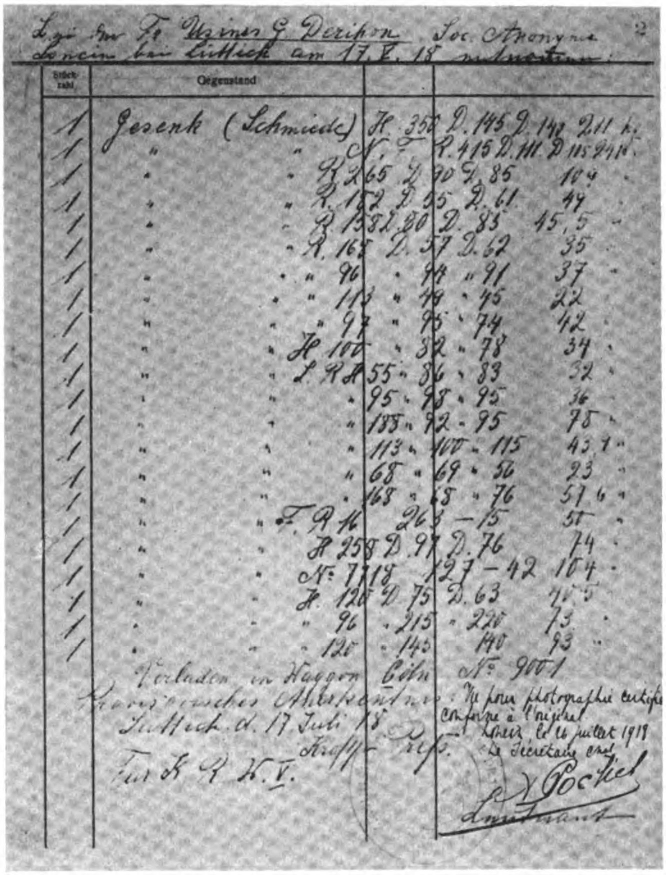


The Cockerill steel works when the Germans left. The avowed object of this wrecking was to obtain metal to be used as raw material

Shop fittings were ripped out and thrown into the yard. The Germans had no use for wood partitions so left them outside the Derihon factory

the Minerva company was also able to visit America and arrange for the purchase of machinery, to be delivered when the war was over. In consequence of this, the Minerva factory, although stripped bare by the enemy, probably will be in production before the end of the year. At present, repair work is being done for the Belgian Government, while the shops are being cleaned, shafting erected, and machinery laid down.

The treatment accorded to the Nagant company at Liége is an example of rapidity. Before the end of 1914 much of the machinery had been seized. Even at that date a complete organization existed for receiving and disposing of machinery seized in the countries which the Germans had invaded. This business was handled by the E. Sonnenthal company of Berlin. The receipts stated that this machinery was taken on a loan and would be returned later with an allowance of 10 per cent depreciation if kept for more than 6 months and 5 per cent if kept less than 6 months. The Germans fixed the value of the machinery they seized, but the Nagant brothers refused to recognize this price.


Stückzahl
Gegenstand
Gesenk (Schmiede)
Verladen in Waggon Cöln No 9001
Lüttich d. 17 Juli 18
Für K. R. W. V.
Lieutenant

Type of receipt given by the German authorities for requisitioned machinery

In early 1915 an engineer arrived at the Nagant factory with a story that he was entrusted with the task, on behalf of the German Government, of protecting the Belgian industry. He suggested that the factory should be turned to work for Germany on non-war materials. The Nagant brothers refused. It was pointed out to them that they were risking deportation to Germany. They replied that they would risk death rather than work for the enemy.

"I shall be obliged, then, to take entire possession of your factory," replied the delegate of the Imperial Government. From that time to the date of the armistice the owners were not allowed to go inside their own factory buildings. Their connection with the plant was limited to one small office, in which they could sit and receive the requisition slips the invaders handed to them. Later they were turned out of this office. They then found a small shop available and began work on an experimental model until this was discovered by the enemy and all further activities stopped.

Robbed of $200,000 Worth of Material

Altogether the Nagant factory was robbed of $200,000 worth of machinery and automobiles. Notwithstanding the close scrutiny, it was possible, in August, 1914, to hide a number of automobile parts, and efforts are now being made to get together sufficient machinery to assemble these into complete automobiles.

Throughout the entire period of occupation, the Belgian people displayed an indomitable spirit. They refused to help the enemy in any way whatsoever, and although open defiance was generally unwise, they frustrated to the limits of their power all the efforts of Germany to obtain material.

The Excelsior Factory

The directors of the Excelsior factory, at Saventhem, a few miles out of Brussels, made desperate efforts to keep their plant in running order to provide a livelihood for their workpeople. The argument was used that if the machinery were taken, the men would be thrown out of employment and starve. The directors contended that all machines were used all of the time. In order to carry out this deception, a warning bell was placed at the main door. When this bell sounded, every machine within the building was set into motion and kept running until inspectors or other visitors left the factory.

This deferred the calamity, but it soon became evident that it could not be averted. Very early during the occupation, 60 automobile tires and a large quantity of copper, brass and aluminum were hidden in the base of a chimney of a nearby factory belonging to a neutral who had fled the country. After 4½ years the tires were ruined, but there was the satisfaction of knowing that Germany had not been able to get them.

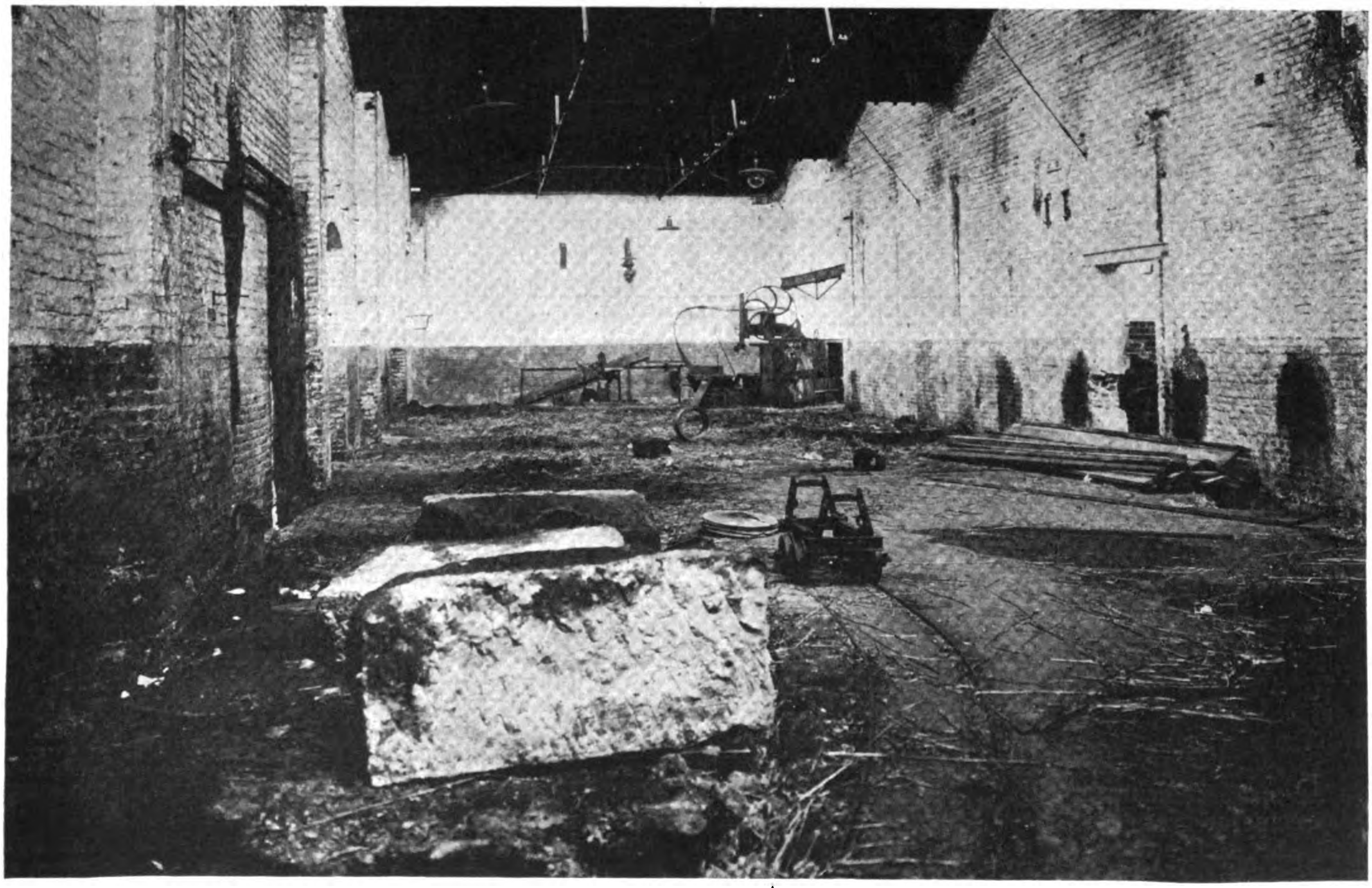
Many automobile parts and essential parts of lathes were loaded on a wagon and with the help of a forged passport were carried into Brussels and buried. This trip was made at least a dozen times over a main road closely guarded by German troops, who stopped every passerby and had the right to search whomever they liked. The men who made these trips had to pass the spot where Edith Cavell, and other victims of German barbarity, had been shot and buried.

The first lathes were taken from the Excelsior factory in April, 1915. The main removal began at the end of 1916, when the company lost everything but the hidden parts. The method of giving receipts at the Excelsior factory was very loose. In many cases a mere slip of paper, stating "one lathe, one drill press," etc., without details, without price, without signature, was all that the company obtained.

De Coninch, the Excelsior engineer, was resolved that no work should be done in his plant for the benefit of Germany; also that he would frustrate every attempt of the enemy to destroy the Belgian industry. Unable to produce, he spent practically 4 years experimenting on automobile designs. In a tiny shop concealed from the enemy, he produced a new rear axle, a gearset, suspension, and braking system and got out designs for a new type of over-head-valve engine. It was obviously impos-

Machine Shops Little Resembled Well-Fitted Workrooms

The hole in the center of this picture shows where the drophammer foundation was dug up. The hammer which featured this shop was taken to Germany



The machine shop. The stone blocks in the foreground were foundations for machines

sible to build a complete car, for the parts had to be hidden as finished. Nevertheless, all the essential parts of the two axles, the springs, the gearset and the brakes, were finished, and on the occasion of my visit to the factory I was given an opportunity of testing this roughly made experimental car, which is really remarkable in many respects. The greatest difficulty of the firm is that it has no means of production.

This experimental work was carried on in complete ignorance of what was happening in the outside world. The only technical information Mr. De Coninch received from the outside world was from an occasional copy of *Motor Age*, smuggled into Belgium through Holland.

Pipe, one of the leading Brussels firms, built armored cars until the day the German army entered the capital. When the invaders left, after the armistice, not even a file or a punch could be found in the Pipe factory.

The value of the stolen machinery is $700,000 on 1914 evaluation.

In addition to this practically all the patterns for the pre-war models have been destroyed. Unable to produce, the firm is now doing automobile repair work for the Belgian Government. Some of the stolen machines have been traced. They are as far apart as Zeebrugge, Turkey and Bulgaria. New machinery cannot be found in Belgium. Only a few days ago a man was sent out, with cash in hand, to bring back a few forges. He returned with the money in his pocket. Pipe estimates that it will be impossible to begin production in less than 15 months.

One of the finest engineering establishments in Belgium before the war was the Fabrique Nationale, at Herstal, near Liége. Being a small-arms concern, it is not surprising that the Germans treated it with severity. After having refused to work for the enemy, the managing director was deported to Germany, where he remained 4 years. The drop hammers were the first to be requisitioned, but in 1915 the whole plant was seized and every Belgian connected with it was turned out. Of the 3800 machine tools possessed by the F. N. in 1914, 3600 have been seized or destroyed. The remainder had all been listed for removal and would have gone into Germany if the war had continued another two weeks.

The total value of the material and machinery seized is $6,000,000 on a 1914 valuation.

Not more than one-fifth of this machinery, however, was used for the manufacture of F. N. automobiles, motorcycles and bicycles. Receipts were given for all material taken away, and the valuation was fairly reasonable.

When they made these seizures, in 1915, the Germans appeared to be of the opinion that they would certainly win the war, and that they could afford to act generously. After all, it cost them nothing, for not an ounce of seized material has been paid for, and all that the Belgian manufacturers have are scraps of paper of doubtful value. As in all other factories, the F. N. management is convinced that the seizures were made more to destroy a competitor than to get machinery and metal. Some of the first machines removed were handled with care, but the great majority of the tools were handled in such a way that they were seriously damaged before being taken out of Belgium.

One of the German engineers (unidentified) responsible for the destruction of the Belgian automotive industry

This photograph was obtained without knowledge of the German authorities

Toward the end of the war there were a great lack of discipline and a considerable amount of pilfering by German soldiers. The men stole magnetos and sold them to their own government. Most of the glazed bricks in the walls of the engine room were stolen by the German soldiers and sold to the German army. Just before the armistice went into effect, and immediately afterward, the soldiers offered to sell good touring cars for $100 each. In several cases, stolen F. N. cars were offered for sale by German soldiers to managers of the F. N. company.

When the German army moved across the Rhine, in November, 1918, the F. N. factory contained 200 machine tools, all of its gas engines, with the exception of one which had been wilfully damaged, the complete electric lighting installation, but no electric power equipment, and 426 German trucks in a more or less damaged condition. The buildings were not injured otherwise than by neglect.

At the present time, instead of its original staff of 4000, the F. N. is running with a staff of 1500 workpeople, who are engaged in repairing and replacing machinery and shafting and repairing abandoned German automobile trucks and staff cars. The tools left by the Germans have been united in one of the shops and are being used for repair work and for motorcycle construction. It is intended to produce first motorcycles and touring cars.

While F. N. makes little complaint about the German valuation of seized goods, the Van Den Plas body works at Brussels reports a curious case of robbery. This company had in hand 12 Rolls-Royce and an equal number of Sheffield-Simplex chassis, sent from the factories in England to have high-class bodies fitted. These were requisitioned at 4800 marks (approximately $1,200 each), although the market value at that time was $5,000 and during the war rose to nearly double the value—$9,000.

In answer to a protest the German authorities stated that in their opinion 4800 marks was all a Rolls-Royce chassis was worth. Notwithstanding the lower valuation, there was intense rivalry among the higher German officers for the possession of these cars.

In a very few cases the factories were requisitioned and made use of by the Germans for their own purposes for practically the entire period of the war. In such cases the damage inflicted was naturally less. The Metallurgique factory was treated in this way, being used as a central repair depot for the automobile service of the German army. Some machines were removed, but sufficient were left behind for the factory to be in a position at the present time to produce one car a day.

The Germain factory, on the other hand, was completely burned, while Springuel has sustained such losses that it is doubtful if the firm will be revived.

When Louvain was sacked in August, 1914, the Dyle & Bacalan factory was razed, thus depriving Belgium of practically its only automobile frame producing plant. The difficulty of obtaining frames is so great that the

Stockrooms Often Were Used as Stables and Piggeries

This stockroom of the Derihon factory was typical of factory stockrooms in Northern Belgium on Nov. 11, 1918

Even the papers and books left in this Derihon stockroom were made useless

firm has placed orders in America, and in the repair shops broken parts, which normally would be thrown away, are patched in a most unusual manner.

The entire situation is full of difficulties for the Belgian automobile manufacturer. Fully 90 per cent of the machinery is gone. Some of it has been removed to Germany, where it is being identified with the greatest difficulty. In many cases it has been completely destroyed. The manufacturers hold German receipts which, in many cases, describe the material in the vaguest manner, and in other cases give to that material a ridiculously low valuation. It is reported that the Belgian Government will shortly make an advance of 50 per cent of the value of the machinery seized; but in view of the increase in price of all material this will not represent more than 25 per cent of the present value.

Germany Should Make Good the Losses

Obviously Germany should completely refund these manufacturers and be made to return every machine that can be found.

In consequence of this condition, it is not surprising that some of the smaller manufacturers should be disheartened and should be questioning the advisability of continuing in the automobile industry. A majority of the manufacturers, however, refuse to admit themselves defeated by the Kaiser. In place of money they hold bits of German paper; the exchange rates are high; raw material is scarce; manufactured goods are hard to obtain; workers have been killed or have emigrated and those remaining are asking for working conditions equal to those of England and France. It will take at least a year to equip the factories and, in the meantime, foreign automobiles can be brought in under the pre-war tariff and France, England and America are likely to get the export trade that Belgium formerly held.

An effort is being made to induce the Government to raise the import duties from 12 per cent to 45 per cent. This proposition, however, is strongly opposed by Belgian dealers, who realize that they can only obtain foreign cars for a full year.

Undoubtedly the first firm to produce will be Minerva. This company is working hard on reconstruction and has already brought to the factory the machinery that was purchased in Holland and is beginning to receive the machines ordered from America.

While the war was in progress new designs were prepared. There are to be two models, a four and a six cylinder, each with a Knight engine, 90 by 140 mm. Among the improvements are electric lighting and starting, cantilever suspension, and spiral bevel gears in the axle. Although only high-grade cars are to be built, the demand is so great, both in Belgium and abroad, that Minerva estimates it will be fully 2 years before production will overtake demand.

Metallurgique will be early in production.

Excelsior Has Designs Ready

Excelsior has designs all ready for a very interesting new model, but is experiencing great difficulty in getting machinery with which to build it.

Most of the other firms are in such difficulties that they are glad to continue repairing army trucks and cars while getting together the necessary plant for the production of automobiles. Even if they could, by some miracle, obtain all their old machinery, they would not immediately be in much better condition, for foundries and forges throughout Belgium have been destroyed as thoroughly as the automobile factories.

Notwithstanding these difficulties, it has been decided to hold an automobile show in the Cinquantenaire Palace next December. This building, one of the finest in Brussels, was used by the Germans, for 4 years, as the headquarters of their Motor Transport Corps.

Before the war there was only one automobile truck manufacturer in Belgium, and very few trucks were in service. This was because the country was so well provided with light railroads that road transportation was at a disadvantage. Now there is an increased interest in trucks, and the Belgian representative of the English Austin company reports that he is delivering 30 3-ton trucks a week.

The Tractor Future

Before the war the horse-breeding industry was so extensive in Belgium that there was no room for the farm tractor. During the occupation of Belgium, the Germans did their best to transfer the horse-breeding industry from Belgium to the east of the Rhine, and they appear to have succeeded to a wonderful degree.

Thousands of draft horses were stolen and sold in Germany. In the city of Cologne alone, 6,800 Belgian horses were sold and the profit of 3,694,847 marks paid into the German war chest.

Dr. F. O. Waldmann, writing in *Der Rheinische Bauer*, of Feb. 2, 1918, stated that before the war Belgium exported 30,000 horses per annum of a total value of about $10,000,000. He cynically stated that by reason of the activity of the German Government the Belgian horse-breeding industry had been ruined to such an extent that for a number of years Belgium would not only be unable to export, but would have difficulty in meeting her own requirements. Germany, on the other hand, is in an excellent condition so far as horse breeding is concerned.

Because of these conditions, the Belgian engineers are turning their attention to the agricultural tractor. It has been decided that the first tractor demonstration shall be held in the fall near Termonde; it is doubtful, however, if any but foreign machines can be presented.

(To be continued)

British Aircraft Standardization

DURING the past year and a half the British Engineering Standards Association has been responsible for the preparation of all specifications for aircraft materials on behalf of the Department of Aircraft Production. During this period some 70 standard specifications for aircraft materials were issued, and a further 60 were practically complete at the time of the cessation of hostilities. These specifications were distributed to the makers by the department, as the whole of the British aircraft production was under its control. These conditions are now changing, and at the request of the Air Ministry and the Department of Aircraft Production, the British Engineering Standards Association has been requested to continue the preparation of specifications for aircraft materials and parts, as well as undertake their distribution, together with the issue of manufacturing instructions and notes on testing procedure which were formerly prepared and issued by the Technical and Inspection Departments of the Department of Aircraft Production. The request has been accepted.

It is proposed to reorganize on a peace basis the various sub-committees concerned with the preparation of these specifications. These sub-committees, when reorganized, will undertake the revision of the specification for peace purposes. In the meantime all the 200 specifications in use by the Department of Aircraft Production have for immediate purposes been adopted as interim British standards. A small charge is to be made for the standards sheets, either 2 or 3 cents per copy.

The FORVM

Follow-Up System for Engineering

By John Younger

IN reading over AUTOMOTIVE INDUSTRIES for March 6, I was interested in noting the follow-up system for engineering, described on page 539.

Without in the least way taking from Major Kalb the credit, I would point out that this particular system was away back many years before this, and is really a development of the control board, which I believe was first of all suggested by the late Dr. Fred. W. Taylor.

When the Pierce-Arrow Motor Car Co. was working on a truck to follow the May, 1917, Army specifications, the matter of getting the work through the drafting room quickly was taken up between Mr. Davis, Mr. Seelbach and the writer at the plant, with the result that we put in a control board in the drafting room, on which, first of all, a very close approach to the Bill of Material for the truck, item by item, assembly by assembly, was printed, and we then assigned a special man, whose sole duty was to go the rounds of the draftsmen and find out in exactly what state his subject was. These lines were run on progressively by this control board, which was nothing more or less than a calendar chart, so that the status of each particular subject could be immediately determined. This was carried out still further by also marking on this the progress of patterns, ordering of dies, etc.

It might interest you to know that the installation of this control board actually allowed us to design this complete new truck and get the sample through in ten weeks, which is, I believe, as fast as the Class B truck was gotten out.

This system was also introduced into the Engineering Division, Motor Transport Corps, and Major Kalb improved on it because of the large number of different jobs that we had by giving a summary for executive use.

There is no question but that this system is of tremendous value.

Military Truck Discussion

By A. P. Brush

IT is affirmed that a specialized non-commercial type of truck for military use by the United States Government has been, is and *must* continue to be a military and economic liability for the following several reasons:

As to the last war period, the designing and experimental work on the B truck and the Militor was an economic liability to the country because that work diverted a very considerable amount of expert talent from other occupations at a time when there was a critical shortage of such talent.

This work of designing and all of the experimental and production work on the B truck and the Militor were a military liability because the military forces of the country needed trucks in quantities taxing the maximum truck-producing capacity of the country, and the introduction and development of new types of truck construction at that time reduced the truck-producing capacity of the country out of all proportion to the possible service of the specialized constuctions to our military forces.

These specialized truck constructions were a further military liability in that they involved the maintenance of an additional set of parts and supplies and the familiarity of the military operating personnel with the care and operation of an additional type of construction.

The continuance of a specialized non-commercial type of truck construction for military purposes will, in the future, be a military and economic liability to the country for the following reasons:

It is an undebatable fact that, in any war emergency calling for a considerable portion of the potential military strength of the country, the need for trucks will of necessity be on a scale which will tax the total truck-producing capacity of the country.

Neglecting for the moment any consideration of the excellence or lack of excellence of a specialized non-commercial military truck design, it is a fact that no type of truck construction differing from that already in production can be substituted throughout the truck-producing plants in the country without a disastrous, temporary reduction in the production rate at a time when national safety demands the maximum.

Since any serious war emergency in the future will compel the use of a commercial truck chassis for military purposes, familiarity with the use, care and capacities of commercial truck chassis by the military operating personnel is almost, if not quite, a military necessity.

The exclusive use of a specialized non-commercial military type of truck construction in peace time will prevent the military operating personnel from becoming familiar with the operation, care and capacities of commercial truck chassis types, and such standardization is, therefore, a military liability even in peace times.

The standardization of a non-commercial specialized type of truck chassis construction for military purposes will effectually prevent the proper development of commercial truck chassis construction toward military adaptability, and such standardization is, in this respect alone, a sufficient military liability to stamp any effort at such standardization as the epitome of military folly.

It is the duty of the Society of Automotive Engineers to recommend to the Government of the United States that each year a competitive test of commercial truck chassis be held for the purpose of determining the military value of the different commercial truck chassis, and base upon the result of such test the purchase of an annual supply of truck chassis from commercial sources for the needs of the peace-time military establishment.

This policy will stimulate progress in truck-chassis adaptability to military needs, and if carried out will be of incalculable value in any future military emergency.

The policy outlined and recommended will further stimulate the development of the truck chassis in ways to make the truck production of the country of additional economic value. It will keep the military operating personnel familiar with the care, operation and capacities of the types of truck chassis which must be used in any large military emergency. It will keep the military authorities in more intimate touch with the commercial manufacturing establishments upon which the military forces of the country must rely in an emergency, and will insure a better liaison between the military authorities and the commercial interests of the country than existed during the past war emergency.

On the other hand, the proposed standardization of military truck chassis construction will mean an unjustifiable stagnation in truck chassis development both for military and commercial purposes. Such standardization will also insure a dangerous ignorance on the part of the military operating personnel regarding the use, care and capacities of commercial truck chassis.

Molybdenum in Steel

UPON the outbreak of the war the price of molybdenite suddenly rose in a remarkable degree, apparently because Germany bought it in quantity as a substitute for tungsten. During the war both England and France found themselves short of tungsten, and they, too, had recourse to molybdenum in the production of high-speed steels. Steel companies were parties to large contracts for molybdenum; but before the steel was actually put to use, the war ended.

Good Tractor Prospects in Peru

Slow-Moving Ox and Crude Plow Being Supplanted—Fuel Question Serious—Motion-Picture Advertising Effective

By A. C. Shumway*

THIRTEEN Fordson tractors are in daily use in and around Lima and one in Chimbote, a valley north of Lima, a day's run up the coast on a steamer. This latter tractor is at work on one of the estates of the President-elect of Peru, whose family owns numerous haciendas, and who will probably purchase many tractors.

In connection with the plowing, only one difficulty has been encountered, and that is that when the plow becomes worn, the point has a tendency to throw the plow upward instead of downward, and this trouble cannot be overcome by altering the attachment of the plow to the rear of the tractor. The only remedy is to attach a new plow point.

The small parcels of land, running from 7 to 20 acres, require a tractor that is easily handled and has a short turning space. With the Fordson type of tractor it is possible to negotiate most of the small irrigation ditches running lengthwise of the field, and very often it is possible to plow out an old irrigation ditch so as to level up the field.

The tractors evidently receive terrible handling on the way down here. Out of the fourteen which have been received, two arrived with the radiator top tanks broken, and the drawbar cap and foot bracket were also broken. The cases that the tractors came in were in terrible condition when they reached here. One tractor had the four sides and top completely separated from the bottom, and out of the fourteen tractors, ten had their tools taken away and one had the crank handle stolen from the crate.

Fuel Question

The question of fuel is serious here at present, on account of the very high price of gasoline, gas oil and kerosene. Although we have our own oil fields here in Peru, at Lobitos and Negritos, the price is out of all reason. It seems that Messrs. Milne & Co. have a contract with the London & Pacific Petroleum Co. that has 2 years more to run, and they claim they have to charge the price they do on account of the lack of tin cans and boxes to bring the fuel down in; they also claim that the retail dealers are to blame for the high price.

Mr. Montevon has recently taken charge of the business of the London & Pacific Petroleum Co., and I am trying to see what arrangements can be made to have the oil sold in steel drums to consumers. If this can be done we would get away from the box and can business.

The prices change almost weekly, according to the supply here in Lima, and to-day the retail prices are:

Gasoline, case	1.200	equal to	$6.00	Am. cy.
Gas oil, case	.950	equal to	4.75	Am. cy.
Kerosene, case	1.000	equal to	5.00	Am. cy.
Medium cyl. oil per gallon	.250	equal to	1.25	Am. cy.
Heavy gear oil per gallon	.250	equal to	1.25	Am. cy.
Grease per pound	.060	equal to	.30	Am. cy.

The foregoing prices are for goods in quantity; prices are considerably higher the farther away from the coast one goes. I am now endeavoring to see what can be done to get a good grade of the above placed here at a lower price.

There are quite a number of oils on the market here, as many of the larger houses carry several agencies of oil companies in the States, and they are pretty well represented through the Republic in the smaller towns. From inquiries I have received I judge that they are alive to the situation, realizing that there will be a considerable demand, and they are going after the market, so I do not think that the cylinder oil question will bother me.

I have sent a good man out with each machine of the present lot, so as to break in the help available on the different haciendas. The men stay sometimes a week and sometimes 2 weeks. There has been no trouble whatever along that line, and I must say that I am surprised at the way that the cholos have taken to the machine.

One of my strongest selling points has been that the machine could be run by the most stupid cholo, for all the other machines down here need mostly a good mechanic. As yet they have handled them splendidly, and when parties come in to have me take them to see the machines working, it always impresses them to see the way that the common help take hold and control the tractor, just as if they had been used to it all their life.

Labor Difficulties

The labor question here in the country is a very difficult one, and the tractor relieves about fourteen men, for one Fordson here is doing the work of from twelve to fourteen men, mostly plowing from seven to eight acres a day of 8 hr.—work which requires twelve to fourteen yoke of oxen, and a man for each yoke, and then the ground is far better plowed than with the oxen.

Upon the arrival of the next lot of tractors, I will send up men to the different agents, so as to set up and deliver the tractors to them. The men I break in here, on one or another of the haciendas near me, for they are all friends and are pushing the sale of the tractor just the same as if I was paying them to do so. One good point about the South American is that he is all with you or all against you.

The moving picture was and is a great success. The first time it was shown I hired the best theater in Lima, advertised for 3 days in the papers and sent out special invitations to the people interested. I furnished them with music and had a good-sized crowd. They were very much interested, as this form of advertising was entirely new to them. The film is now being shown by contract all over the Republic through some forty different picture houses, and I have received many congratulations from different parties on the splendid advertising it is giving.

Best Advertising Method

The Spanish folders I am sending to all of the agriculturists by mail, and my sub-agents are doing the same, so we will be sure to reach them all.

The best advertising is the work that the tractors are doing here around Lima, for all the Peruvians come to Lima, and at the hotels and cafés they meet and tell their troubles and what they are doing. In this way the fame of the tractor has been spread all over the country. Besides, my agents are busy, for from the letters and telegrams I have received from them I know that the tractors that are to arrive are just about disposed of, and before you receive this letter I will probably have sent in another order larger than the last.

As the business increases, I will eventually have a dealer for each of the valleys, but for the present my representatives are those given in the following list:

Paita & Piura, Graham Rowe & Co., Piura.
Eten & Chiclayo, Vda Russo Y Hijos, Chiclayo.

*Mr. Shumway is a Fordson dealer in Lima, Peru.

Salaverry & Trujillo, Sr. Tomas Morante, Trujillo.
Pacasmayo, Sr. Tomas Morante, Trujillo.
Cerro Azul, Canete, Sr. A. E. Romero, Canete.
Tambo Mora & Chincha, P. O. Macera, Chincha.
Pisco & Ica, Nazco, Palpa, G. Badaracco, Pisco y Ica.
Mollendo, Arequipa, Cuzco, C. Arenas Sucs., Arequipa.
Huancayo, Chas. Guislain, Huancayo.

I am now sending a man down through the lower valleys around Mollendo and Arequipa, taking in Cuzco, to see what he can do with the tractor, and to place other agencies where needed, for I do not want Arenas of Arequipa to lose any business on account of having too much territory. Up to the present the amount of business there has been almost nil, it being somewhat different from the rest of Peru.

We have some haciendas along the coast where the disc harrow cannot be used to advantage, on account of the very great number of stones of all sizes. I have seen them plow through a huaca that they were trying to get rid of where no one in the States would think of plowing.

Full of Stone Heaps

The Indians in the time of the Incas and for thousands of years before had the habit of clearing off the best land by placing all the stones in a heap somewhere in the field, and so Peru presents a different appearance than most countries, for many times these huacas cover an eighth of an acre and are high in comparison; the fields that I have mentioned as not using the harrow are places that the Indians could never have cultivated, for they would have piled the stones in heaps. Often they covered these heaps of stones with their fortresses and buildings made of adobe, which still exist everywhere.

The Indians numbered about 10,000,000, against 3,000,000 inhabitants to-day, and were an agricultural people, building their large heavy adobe forts and fortifications in all the valleys, the ruins of which still exist. They had a wonderful irrigation system, and coming down the valleys you will see way up the mountain sides the irrigation ditches—ditches that would do credit to a modern engineer, and must have taken thousands of Indians years to build. It may interest you to know that the potato and tomato are supposed to have come from Peru.

The natives here, when they plow with the pointed stick and oxen, so as to open up the furrow wide, always tie two horse or burro skulls on opposite sides of the plow. They prefer the burro skull to the horse skull, as the bone is harder and lasts longer.

There is a wonderful outlook for the tractor in Peru. The requirements are that it should be simple and strong, have plenty of power, be easy to run and need little attention in comparison with others on the market. The Fowler has always been the favorite here, but the cost is about $30,000 American currency, I understand; it plows about the same amount as the Fordson, but can go 14 in. deep if needed. There are two steam machines, one at each end of the field, which are connected by cable by which they pull a heavy plow or harrow. They require a horse and car to bring the water and wood for making steam, requiring ten or more men.

[In addition to the fourteen tractors mentioned in the Peruvian dealer's report digested above, the export concern of Fordson has just shipped forty-nine more to five ports in Peru. Good business is expected from this country, as considerable farming is done on all-irrigated land, and all of the work is done with the slow moving ox, as mentioned in the report.—EDITOR.]

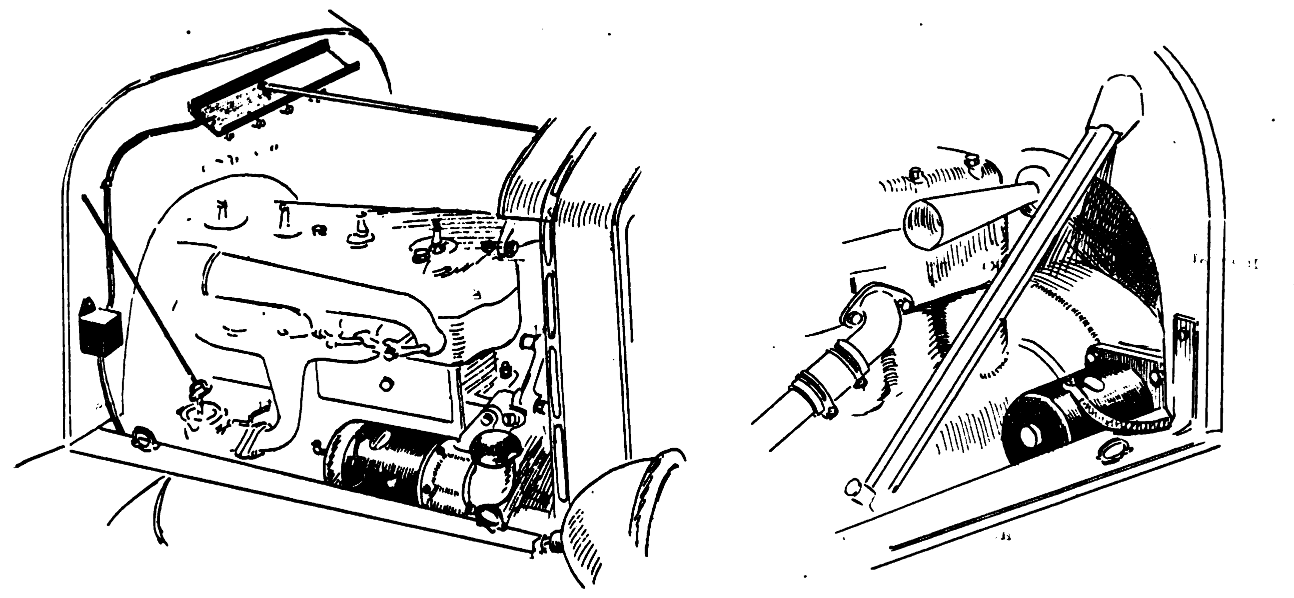
Hayne's Wearever Runningboard

THE process of rolling linotile and similar products upon board is being introduced as a means for runningboard construction by J. T. Hayne of Buffalo, N. Y. This process comprises the molding of linoleum or rubber tile on wood to the exact size of the runningboard.

The wood has on its surface numerous holes or grooves, with their walls slanting inward, into which the material is forced. This anchors a thin layer to the base and makes it impossible for it to bulge, as often occurs with the ordinary methods of laying linoleum.

Instead of a foot pad fastened to the step with several screws, it is possible with the Hayne type of runningboard to mold the foot pads into the design. It is also possible to mold into the design monograms or any other markings desired on the car, making it a factor in theft prevention as well as identification.

Installation of Liberty Starting-Lighting Equipment on New Fords



These two views show the location of the generator (left) and the starting motor (right). Both are quite small and have been built into the Ford assembly in an inconspicuous manner. The left view shows the addition of a rain gutter over the coil to prevent short-circuits caused by rain coming through the hood hinges and between the hood and cowl

Gear Steels*

Classification of Gears According to Application and According to Materials and Treatment—Properties of Gear Steels—Methods Employed in Carbonizing and Heat Treatment

By Dr. J. Heber Parker

FROM a commercial standpoint gears may be divided into three groups: Gears for automotive service; gears for electric car service; and what may be called commercial or jobbing gears.

Gears for automotive service include those used for automobiles, both trucks and pleasure cars, airplanes, tractors, motor boats, machine tools, etc. Upon gears of this group there has been devoted a great deal of study and work as regards different types of analyses and the heat treatments for each type, and also the matter of design as applied to the metallurgical side of the question, such as minimizing the matter of warpage in hardening, etc. In fact, it may be said that the story of the development of gear steels for automotive work is in great part the story of the development of alloy steels of the last 15 years with which the writer has been closely connected.

Case-Hardened and Tempered Gears

Steels for this work are divided into two groups: Steels for case-hardened gears, where there is a hard surface and soft core, and steels for tempered gears, where there is uniform hardness throughout the entire tooth section. Much has been said about the relative merits of each group. It is a long story and may be passed over by expressing the opinion that, in a general way, each has its own special field, the case-hardened gears for constant-mesh service, and the tempered gears for change or clash-gear service. Certainly the tempered steel clash gear does not realize the experience of the case-hardened gear in the same service, when hard, case-hardened clash faces are chipped off with the resultant exposure of the soft core, and consequent trouble with bearings impregnated with hard steel chips. Tempered gears have sometimes been criticised on account of pitted tooth surfaces which were found after limited service. It is believed that this pitted condition is caused by excessive unit tooth pressure due to several causes. A few experiences where the condition of pitted surfaces was corrected may be of interest:

First.—Misalignment of gears was believed to be the cause of the trouble, thus throwing an excessive load upon only a part of the tooth and vastly increasing the unit tooth pressure. When the gears were properly adjusted and the load properly distributed, pitting disappeared.

Second.—A little lower drawing temperature after hardening, which resulted in an increase of about five points in scleroscope hardness, eliminated pitting. The slight increase in hardness was sufficient to enable the gear tooth to withstand the unit tooth pressure put upon it.

*Paper read at the Cleveland meeting of the American Gear Manufacturers' Association.

Third.—The horsepower of a car had been changed without any change in the transmission. The pitting which occurred was eliminated by increasing by one-eighth inch the length of the tooth face. This increase resulted in decreasing the unit tooth pressure to a safe figure. Properly case-hardened gears, which have a scleroscope hardness of about 90, will undoubtedly withstand, without pitting, unit tooth pressures which will give trouble in the case of a tempered steel gear which is about 75 scleroscope hard. The case-hardened gear, however, is not as tough nor as strong, and in clash service has the disadvantages mentioned above. The tempered gear also will warp less in heat treatment than the case-hardened one, for it reaches an elevated temperature only once in heat treatment, and that for only a few minutes, as compared with the long high heat for carburizing, and two subsequent elevated hardening temperatures for treatment after carburizing.

Six Grades of Case-Hardening Steels

For automotive work case-hardened steels of six types are generally used, three of the types quite commonly, while the other three have a more restricted use on account of their higher cost with, perhaps, a little more careful heat handling requirements. Following you will find a table giving type analysis of each, together with the physical properties of the core, when properly heat treated, which may be expected when these steels are made by mills having more of the quality than a tonnage perspective.

The physical properties given in the table were secured by treating a standard test piece, .025 in. full to size, by heating in sand for the length of time and at the same temperature as would be used in carburizing, for the various types of steel. Test pieces were then allowed to cool in a box and given a full double treatment which would have been given a piece of the respective steels to put them in their best possible case-hardened condition. Test pieces were then ground to size and pulled.

In regard to the operation of carburizing, so much has been written upon this subject that it would be superfluous to go into it here in detail. Case carburizing compounds have been very thoroughly developed and compounds are available which will produce in the case different carbon contents—that is, 60 per cent, 80 per cent, 100 per cent carbon, etc.

Carburized pieces should not be quenched directly from the carburizing box, and this practice should not be followed, except in cases where a hard surface only is desired and nothing in the way of strength and toughness of core is expected. If carburizing temperatures are relatively low—i. e., about 1550 to 1560 deg. Fahr.—good results may be obtained by a single quench after pieces have cooled in the

Name	C.	MN.	Si.	P.	S.	Cr.	Ni.	E.L.	T.S.	El.	Red	Brinell	Sclero	Gullery Impact	Sclero of Case
Simple carbon	.20	.50	.20	.04	.04	....	....	50,000	75,000	20	55	190	30	18 Kgm	90
Mild chrome nickel	.20	.60	.20	.04	.04	.40	1.25	100,000	150,000	12	40	287	40	10	90
3½% nickel	.20	.60	.20	.04	.04	....	3.50	105,000	160,000	13	45	302	50	11	90
5% nickel	.15	.40	.20	.04	.04	....	4.75	125,000	175,000	15	50	321	54	10	90
Medium chrome nickel	.17	.40	.20	.03	.03	1.00	1.75	140,000	180,000	13	50	340	58	11	90
High chrome nickel	.12	.40	.20	.03	.03	1.25	4.00	150,000	200,000	13	52	375	60	10	90

carburizing box and have again been reheated to the proper temperature. For best results, however, a double quench after carburizing is desirable—the first quench from a temperature sufficiently high to refine the core, which is low in carbon, and the second quench at a proper temperature to refine the case, which is very high in carbon. Drawing after final hardening is desirable to relieve hardening strains and to secure increased toughness.

Warpage of case-hardened gears, as a result of heat treatment, always occurs to a greater or less extent. The warpage will be somewhat reduced if care is taken to anneal forgings before machining.

Forgings as they come from the hammer, and cooled under varying conditions, always have some internal strains. The release of these strains, by annealing, leaves the metal in a state of rest which makes possible a decrease in warpage in the finished pieces, for without the annealing, the strains in the metal, due to forging, often are relieved during the case-hardening operations, with the result that they are the direct cause of some of the warpage frequently experienced.

Tempered gears are made principally from four types of steel, two of which are in common use, while two types are more rarely used, especially one of the latter, an air-hardening chrome nickel steel, which has been used very little in this country. The table [on page 1220] will give you the type, analyses and physical properties of these steels in gear condition.

In addition to these standard types there has been sold a silico-manganese steel of approximately .50 per cent carbon, .75 per cent manganese and 1.50 per cent silicon, which has, when hardened and drawn for gear condition, an elastic limit of approximately 225,000 lb. per square inch. This steel when properly hardened remains practically constant as to size, and has proven most satisfactory as a steel for clash or change gears.

[The sections of Dr. Parker's paper dealing with gears for electric car service and gears for commercial and jobbing work are here omitted.—EDITOR.]

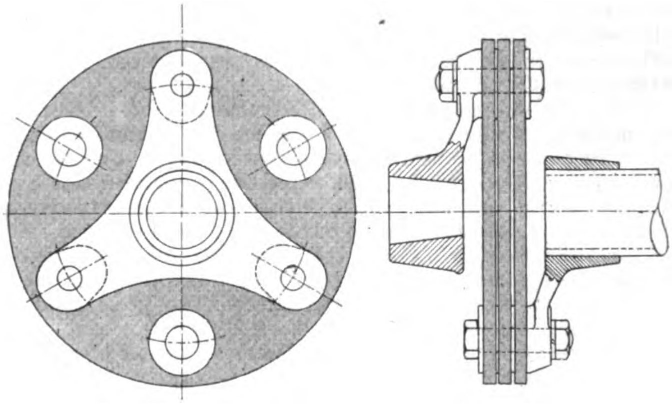
Layout for Flexible Universal Joints

THERE has been considerable discussion from time to time regarding proper layouts in connection with the flexible type of universal joints, such as the Thermoid-Hardy. The accompanying layout is typical, and has given good results on cars such as the Lexington Howard, Crow-Elkhart, and the Stewart trucks made in Buffalo.

The couplings are made up of laminated Hardy disks, and, as shown in the layout, consist of three disks, each joint having an overall diameter of 7 in., and being ¼ in. thick. This joint is capable of taking care of ⅞-in. lateral movement. Considering two joints for the propeller shaft, this would give each set of disks a movement of 7/32 in. each way, making a total of ⅞ in. play for the two joints.

The purpose in providing this range of lateral movement is to eliminate the use of splines on passenger cars wherever possible. In order to successfully do this the springs must be so flat that the lateral movement is within the limit of the joint. This is in line with present tendencies, as spring layouts are becoming flatter.

The coupling shown will stand an average driving angle of 6 deg., with a maximum of about 10, according to the manufacturers.



Typical layout of Thermoid-Hardy joint calculated to do away with sliding joints in cars with flat springs

Van Sicklen Chromometric Temperature-Corrected Tachometer

DURING the period of the war, the Van Sicklen Co. of Elgin, Ill., manufactured for the U. S. Government an instrument specially developed for airplane use, known as the Van Sicklen Type B tachometer. Tests are said to have shown this to be a highly accurate instrument. It measures either shaft speed or surface speed, indicating the shaft speed in revolutions per minute, and the surface speed in linear feet per minute. No watch is necessary in taking a reading.

The dial of the instrument is divided into hundreds. Revolutions per minute are registered up to 2500, and feet per minute up to 1250. By means of adapters it is possible to apply the instrument directly to the moving member. It takes just one second until the first reading can be taken. The indicating hand is held at this point for a second, is then released, and a new reading is given, showing whether the speed of the moving member has either increased or decreased during the interval. When the instrument is removed from the moving member the hand returns to zero.

These instruments are being manufactured in the works of the Elgin National Watch Co., which fact is being pointed to as a guarantee of their high-class construction. Two adapters are regularly furnished with each instrument, one of which transmits one-half the speed of the moving member to the instrument, the other the exact moving member speed.

The Van Sicklen tachometer comprises a complete watch mechanism, its principle of operation being that the counting mechanism is allowed to run for one second, and the number of revolutions made by the driving member during that period is indicated. The mechanism really divides into four parts, namely, 1, the driving mechanism, which takes the power from the flexible shaft and transmits it to the power plant; 2, the power plant, which furnishes power for driving the watch mechanism; 3, the counting mechanism and the synchronizing cam, which latter times the action of the counting mechanism; 4, the watch mechanism which times the action of the synchronizing cam and the counting mechanism.

Attendance and Turnover Records of Women Workers

A Comparison of the Lost Time Factors with Male and Female Operators—The Effects of Illness, Hours of Labor and Idle Shop Time—The Value of Rest Rooms and Rest Periods

IN considering the employment of women in industrial occupations, a factor which must be reckoned with is their attendance record. In the past, industrial experience has generally indicated that in this particular women employees fall below the standard set by men.

An analysis of the attendance records of 115 establishments in which an investigation was recently conducted by the National Industrial Conference Board disclosed that in 44 of these establishments the attendance of women employees is better than that of men. It is worse in 31 of the 115, and, in the remaining 40, there is little to choose between the records of the two sexes. The establishments in which the attendance of women was worse than that of men employed a total of 18,045 women, while those establishments in which women's attendance was better than men, employed only 10,481. The establishments in which the attendance records of men and women were equal, employed 9974 women. In other words, it can be said that with only 27.2 per cent of the total number of women in all 115 establishments was their attendance better than that of men.

In seeking for the reasons for the variation of attendance, an analysis of the sources from which the women workers came to these establishments did not give any clew to the cause. Furthermore, the type of work performed did not, apparently, in any way explain the differences in attendance. This latter statement is borne out by the fact that practically all operations on which women were engaged were represented among those establishments reporting poor attendance of women as well as among those reporting it as good or better than that of men.

Apparently the number of women employed bore some relationship to their attendance record. In more than half of the establishments, where the attendance of women was reported as better than that of men, and in half of those where it was equal to the attendance of men, there were employed 100 or less women, whereas nearly 80 per cent of the establishments reporting a poor attendance record for women employees employed a much larger number.

It is suggested by The National Industrial Conference Board, which compiled the data used in this article, and from whose report on the wartime employment of women in the metal trades the matter here printed is very largely taken, that there is a possibility that more individual adjustment and greater attention to health factors and to morale were possible where only a few women were employed.

TABLE I.—ATTENDANCE OF WOMEN WORKERS COMPARED WITH ATTENDANCE OF MEN IN 115 ESTABLISHMENTS
(National Industrial Conference Board)

	Establishments		Women Employees	
	Number	Per Cent of Total	Number	Per Cent of Total
Total	115	100.0	38,500	100.0
Women's attendance better than men's	44	38.3	10,481	27.2
Women's attendance equal to men's	40	34.8	9,974	25.9
Women's attendance worse than men's	31	26.9	18,045	46.9

While the replies to the schedule of inquiry which the Board sent out did not indicate a significant difference between the attendance of men and of women, when experience in other industries and other countries is considered, it appears that a higher average time loss because of absence must be counted among the unavoidable disadvantages connected with the employment of women.

Attendance of Married Women

Contrary to rather generally expressed opinion, it appeared that attendance of married women was fully equal to that of younger unmarried girls. The following table summarizes the information secured on this point:

TABLE 2.—ATTENDANCE OF MARRIED WOMEN WORKERS AS COMPARED WITH SINGLE WOMEN, IN 76 ESTABLISHMENTS
(National Industrial Conference Board)

	Number of Establishments	Number of Women	Number of Married Women	Per Cent of Married Women to Total Number of Women
Total	76	15,666	2,222	14.2
Women's attendance better than men's	33	4,965	575	11.6
Women's attendance equal to men's	23	3,488	723	20.7
Women's attendance worse than men's	20	7,213	924	12.8

No significant data were submitted in respect to the relation of illness to attendance of women workers. There is little doubt, however, that their poor attendance is largely due to illness. One-sixth of the women leaving their employment in a large machine tool plant gave poor health as their reason, a much larger proportion than among men.

Experience in Germany on this point is of interest. Data collected by the Leipzig Sick Benefit Society from 1887 to 1910 show that, among metal grinders and polishers, women averaged 1456 days of sickness compensated for per 100 members as compared with an average of 1215 days for men; among iron founders and machinists, women 1666 days; men 1189. The compensation records of German Sickness Insurance Societies from 1903 to 1908 indicate a 3 per cent to 5 per cent higher average time loss by women in most occupations than by men.

While these German figures include accidents they nevertheless indicate a higher illness rate among women.

The experience of a benefit society maintained in a large American silk factory is also significant. In March, 1918, $1,124.35 were paid in benefits to 1079 women members as against only $761.75 to 1843 men members. For the entire period from November 1, 1910, to March 31, 1917, the claims paid to men amounted to only $91,580.35 out of their contributions of $116,686.76, while the claims paid to women were $87,592.51, more than twice their contributions of $41,640.04.

A comparison of days lost through illness in 1914 by approximately 16,000 employees of the Government at Washington, D. C., over 4000 of whom were women, showed that the women averaged 8.90 days per annum, the men only 4.82.

All these figures indicate either more frequent or more serious cases of illness among women than among men.

Although poor attendance was frequently a disadvantage connected with women's employment, the greater stability of the female labor force offered some compensation. Of 94 employers reporting the comparative labor turnover of women and of men, 8 found that women's record was worse, 26 that it was equal, 60 that it was better, often by 20 per cent to 30 per cent.

A frequent comment by employers is that women are "steadier than men."

One reason advanced by some employers for the smaller turnover among women employees was their superiority to the class of men at present available. Another important consideration is that skilled men now have more opportunities to better their position by reason of keen competition for their services, and therefore are tempted to change from one factory to another.

Among the elements favoring stability of women employees has been the practically unlimited supply. Women, once secure in their positions, were naturally conservative about changing, and the sharp competition in the labor market reinforced this tendency. But the generally observed disposition of women to take their work and its surroundings more personally may, by proper organization of the factory, be made a valuable auxiliary in the reduction of labor turnover. Again, the home associations of women are more likely to restrain them from seeking employment beyond a limited field, since they usually feel a greater reluctance about breaking domestic ties and frequently have stronger social motives for remaining in their accustomed environment.

High Wages Cause Dissatisfaction

Yet an analysis of some of the cases reported indicates that with women, as with men, an increase in the demand for workers will be accompanied by a more active labor turnover. One manufacturer stated that high wage rates are making his women workers dissatisfied and that they are "trying out every job possible until they find something that suits." The treasurer of an establishment manufacturing machine needles reported a marked shortage of girls and a labor turnover of female employees 20 per cent higher than that of men. In a bolt and nut factory in Cincinnati it has been found necessary to hire twice as many women as men to maintain the force in a department where the majority of the women employed are working. Moreover, since a shortage of female labor is reported in many cities by the United States Employment Service, competition for women workers, unless regulated, will naturally increase, especially for those who have acquired some degree of mechanical skill. Nevertheless, even if radical industrial changes rendered women workers as much valued and sought after as men are at present, it is probable that both social conditions and psychological characteristics would restrain them from shifting from place to place as freely as men.

Working hours of women employed in industrial plants are limited by law in most states of the Union. The following list shows the daily and weekly maximum hours prescribed by law in states where the establishments included in this investigation are located.

TABLE 3.—LEGAL LIMITATIONS OF WORKING HOURS FOR WOMEN IN STATES WHERE THE ESTABLISHMENTS INCLUDED IN THIS INVESTIGATION ARE LOCATED

State	Daily Hours	Weekly Hours
Indiana	No limit	No limit
Iowa	No limit	No limit
Illinois	10	..
New Jersey	10	60
Connecticut	10	55
Wisconsin	10	55
Massachusetts	10	54
Pennsylvania	10	54
Rhode Island	10	54
Michigan	9*	54
Minnesota	9	54
Missouri	9	54
New York	9	54
Ohio	9	50
California	8	48

*As an average; 10 in any one day.

Table 4 shows the weekly nominal hours of work for women reported by 106 establishments, arranged geographically. In many establishments the hours for women were shorter than for men.

TABLE 4.—WEEKLY NOMINAL HOURS* OF WORK FOR WOMEN IN 106 ESTABLISHMENTS, BY STATES

(National Industrial Conference Board)

Geographical Distribution	Total Establishments	56 or Over	55	54	53	52	51	50	49	48	Under 48
Total	106	2	11	27	1	7	1	32	5	16	4
California	1									1	
Connecticut	11		7	3†				1			
Illinois	5	1		2‡		1				1	
Indiana	4		1			1		2			
Iowa	1	1†									
Massachusetts	12			5		2	1	3		1	
Michigan	17			7		1		7			2
Minnesota	1									1	
Missouri	2							2			
New Jersey	6		2	1				1†		2	
New York	17			7‡	1	1		1		6†	1
Ohio	23							13	5	4	1
Pennsylvania	3			1		1		1			
Rhode Island	2			1				1			
Wisconsin	1		1								

*In a very few cases hours are fractionally greater than indicated in the heading
†One establishment shorter hours in summer.
‡Two establishments shorter hours in summer.

This table shows that in 57 establishments women were working not over 50 hr. per week, while in 49 they were working longer hours, in most cases either 54 or 55. In 58 establishments in those states where a legal limit is set, women are working fewer hours than the law allows. The number of establishments reporting women employed on night work was almost negligible.

The following table, showing weekly nominal hours of work for women in the same establishments, by industries, makes it apparent that the specific industry as such had little influence on the length of the working day for women, since in each of the industries included the hours of work varied widely.

TABLE 5.—WEEKLY NOMINAL HOURS* OF WORK FOR WOMEN IN 106 ESTABLISHMENTS, BY INDUSTRIES

(National Industrial Conference Board)

Industry	Total Establishments	56 or Over	55	54	53	52	51	50	49	48	Under 48
Total	106	2	11	27	1	7	1	32	5	16	4
Automobiles and automobile accessories	9			4				4			1
Typewriters and other light machines	5			1				1		2	1
Electrical machinery, apparatus, and supplies	15		1	2	1	1		7†	1	2	
Foundry and machine shop products	32	1		10‡		4		8	2	6†	1
Munitions	11		3	2		1		2	1	2	
Railway equipment	3					1				2	
Tools, cutlery, and hardware	14		3	5†			1	3	1	1	
Miscellaneous metal products	17	1†	4	3†				7		1	1

*In a very few cases hours are fractionally greater than indicated in the heading.
†One establishment shorter hours in summer.
‡Three establishments shorter hours in summer.

The character or arrangement of work in many industries leaves more or less time during factory hours when employees are not engaged in actual physical effort or in concentrated attention.

An attempt was made to secure data on this point concerning women employees in the metal trades, but a question regarding the actual time lost because of pauses, waiting for stock, changes in tools and machinery, and similar interruptions, met the general response that the length of such delays was difficult to determine and that any statement must be based only upon estimates. No accurate data are available, but estimates by manufacturers place the loss from zero up to 25 per cent, and in one case, 50 per cent; they most fre-

quently ranged from 10 per cent to 20 per cent. The proportion varies, of course, in different occupations. In a machine shop where the average time lost was estimated at 20 per cent, it was put as high as 40 per cent for gear cutting operations and at 10 per cent for small turret lathe work. A manufacturer of electrical equipment who has had large experience with women workers for a number of years stated:

In setting tasks for women it is our practice to allow an average of 20 per cent for lost time. This allowance varies according to the nature of the work from 15 per cent to 25 per cent, but we believe 20 per cent is a fair average.

A machine tool establishment where women perform all kinds of machine and bench work reported as a rough estimate that for about forty-five minutes per day of 9 hr. women employees are not engaged in actual physical effort. A very small part of this was attributed to waiting for work or stock, or to delays caused by the management, but the loss was largely due to ordinary relaxations attending employment.

On the other hand several establishments reported the proportion of idle factory time as practically negligible. In one plant women performing machine operations were shifted to bench work during repairs or setting up; in another, extra machines were available. In other cases, routing of stock was so carefully planned as to reduce delays to a minimum.

It should be remembered, however, that where no provision is made for systematic rest periods, chance pauses contribute to the recuperation of the employees. Furthermore, such time losses are also common where only men are employed.

Rest Periods

The relation of regular pauses during work hours to output and to avoidance of accidents is receiving increasing consideration by students of labor problems as the importance of the subject is made more evident by scientific research and practical experiment. Rest periods are evidently of special importance for women. Of the 127 establishments furnishing data for this investigation, only 20 were maintaining systematic rest periods; in three others they had been tried but discontinued. Several other manufacturers stated that they were seriously considering their introduction. The total number of women employed by the 20 firms was 18,546, of whom 14,954 were in 6 establishments manufacturing munitions.

In most of the factories where rest periods have been established, the pause varies in length from 5 to 15 min., usually in the middle of the forenoon and afternoon. In one factory a 10-min. rest period is allowed in the morning; in another, 10 min. near the end of the day; in a third, the women are at liberty to leave their machines two or three at a time for a lunch period once in the forenoon. It is doubtful whether the full benefit of the practice is secured by the last method, since the time allowed is not definitely specified, and there is danger that ambitious workers will cut short or omit the pause allowed.

In some establishments light physical exercise or recreation such as music or dancing is combined with rest periods.

The length and distribution of rest pauses is sometimes determined by the character of the work. For instance, in a munition factory where women are engaged on operations which involve close concentration and considerable eye-strain, a rest period of five minutes is allowed at the end of each hour.

Many of the opinions expressed were favorable to the plan of two rest periods a day. An establishment manufacturing cash registers reports:

We have recess periods of 10 minutes in the morning and 5 minutes in the afternoon. We have had this plan in operation a number of years and are thoroughly sure that it is profitable to the employees as well as to the company.

A plant making machine tool fixtures, with 140 women at work, reported:

We allow women employees 15 minutes rest in the forenoon and afternoon. They also stop work 5 minutes earlier at noon and 10 minutes at night, making 45 minutes in all; we find it works out very satisfactorily.

In numerous establishments where no regular rest periods are arranged, the understanding is that women workers may rest when they feel it is necessary.

An automobile manufacturer stated:

We have not inaugurated rest-periods in our factory; but the women in our employ are at liberty to leave their work at their pleasure. Where it is necessary, we have utility women to fill in in such cases.

A compulsory rest period would probably be of greater advantage to both employer and employees. Workers take rest periods, whether they realize it or not, but often at irregular and ill-chosen intervals. Moreover, women are generally reported as more inclined than men to overwork, and the temptation of a high piece rate may lead them to continuous overexertion which ultimately contributes neither to the output of the establishment nor to the health and earnings of the worker.

In some other factories rest periods of an indefinite character are under control of supervising matrons in the different departments, who look after the general physical welfare of women workers.

In the majority of establishments making no specific provision for rest periods, apparently little attention had been given the subject. Usually no comments were offered, but it was sometimes stated that the work was very light, or that rest periods were not needed, or that the workers could rest when they pleased, as they were employed on piecework.

Rest Period Results Uncertain

In a very few instances employers reported no positive advantage from rest periods. A munitions establishment stated that the results were "intangible." In this case pauses were allowed only to women polishers and inspectors. A manufacturer of enamel ware employing women on dipping, labeling, and wrapping did not consider the practice of special value. In one factory where rest periods were tried but given up, the workday was proportionately shortened.

In some factories opposition comes from the employees who do not wish to lose the time from piecework. Such objections of pieceworkers do not appear to be well founded, since rest pauses do not necessarily involve a loss in production. One large typewriter factory reported:

The management has established two general rest periods of ten minutes every day, which have proved to be very satisfactory. By means of a chart plotted some time after the installation of rest periods, a slight increase in production was shown to have taken place. While it is not claimed that this is due to rest periods, it at least shows that there has been no loss in product due to this cause.

Extensive evidence, notably the experience of British munition factories, indicates definitely that rest periods are advantageous from an economic point of view both to employers and employees. In British factories tea is often served to the workers at their machines during rest periods. This custom is generally regarded as a valuable aid to output. A similar practice prevails in some American establishments, where milk is furnished at cost.

In its final report the British Health of Munitions Workers Committee said:

Pauses, well distributed and adapted in length to the needs of women workers, are of the highest value in averting breakdown and in giving an impetus to output. The Factory Acts permit in textile factories a maximum of four and a half hours continuous work; in non-textile the limit is five, but many managers believe that four hours is the longest period during which a woman can maintain continuous work at full vigor. Within this period a pause of ten minutes has been found to give excellent results, and where the spell is continued for five hours some such pause should certainly be made for a cup of tea or cocoa. It is particularly valuable in the morning spell in those numerous cases where breakfast has been hurried or omitted altogether.

In view of the favorable results obtained from rest periods, the problem calls for most careful investigation, to which employers can contribute valuable assistance by observation of the results of experiments as to the proper length of the pause and its position in the work period as well as its relation to the type of occupation and worker. Such considerations, moreover, are applicable to men as well as women workers.

Provision of such facilities as first aid and hospital rooms, rest and lunch rooms, as well as generally attractive working surroundings, is especially important where women are employed.

Effect of Water Injection on Gasoline Engines

Bureau of Standards Tests Show No Power Gain or Decrease of Carbon Deposit Except in Case of Engines with Defective Cooling Systems

THE practice of injecting water in conjunction with the fuel is quite common in kerosene engines, the object being to keep down the cylinder temperature under conditions of heavy loading and prevent preignition. In fact, it seems almost impossible to operate an Otto cycle kerosene engine and get satisfactory results without water injection. There also has been considerable experimentation with water injection (or induction) in gasoline engines, not by the manufacturers of the engines, but by makers of fuel conditioners and their customers, who believe that the injection of water will lessen or eliminate the formation of carbon deposit and increase the fuel economy.

In the development of aircraft engines the suggestion was made that if water injection had these effects it should be beneficial in aircraft work. The problem was assigned by the National Advisory Committee for Aeronautics to the Bureau of Standards, and an extended investigation was made. The tests were carried out on a Class B military truck engine, and also on a Rutenber 6-cylinder, 3 x 5-in. engine, which operated at high jacket temperature. Thus, although the investigation was made at the instigation of the Aircraft Department, the tests were conducted on a truck and an automobile engine, but the results, of course, are of general application.

Two Series of Tests Made

In a general way, two series of tests were made, one to determine the effect of water injection on the maximum power obtainable from an engine and its fuel economy, and the other to determine its effect upon the carbon deposit on the piston head and cylinder walls.

It may be recalled that the Class B truck engine is a 4-cylinder design with a bore of 4.75 in. and a stroke of 6 in. The compression ratio is 3.7 and the piston displacement 425 cu. in. Compression tests made by means of an O-Kill indicator showed an average compression of practically 48 lb. per square inch at 100 r.p.m., the water jacket temperature being 131 deg. Fahr. In the tests this engine was connected up to a 125-hp. Sprague dynamometer, by means of which the horsepower output was measured.

In the first test the Class B engine was fitted with a Zenith L-6 carbureter. Each series of tests consisted of three runs. After the engine had been brought up to operating temperature the carbureter was adjusted for maximum engine power at full speed, only gasoline being fed into the cylinders. After the engine had been run 5 min. under these conditions, another run was made with water injection, with the same carbureter and spark setting. Finally, during the third run, also of 5 min. duration, the water injection was continued, and the spark was adjusted to give the greatest engine output. Series of tests of this kind were made at speeds of 400, 600, 800, 1000 and 1200 r.p.m. The water was admitted to the manifold at a point 1¾ in. above the throttle valve, and the amount of water fed was read off from a graduated glass cylinder of 1000 cu. cm. capacity, while the time was taken from a stopwatch. A stopcock in the line between the graduated cylinder and the intake manifold permitted of controlling the water feed.

Three complete series of tests, each covering the whole range of engine speed, were run with the Zenith carbureter. In the fourth test a Stromberg N-3 carbureter, with a 1 5/32 in. choke and a 0.0635 in. bleeder, was substituted for the Zenith, this carbureter permitting of varying the fuel mixture for different speeds. Thus, the effect of water injection could be studied when the fuel mixture was adjusted to be as lean as possible consistent with smooth running, and also when a rich mixture was being fed. In one of the runs a metal plate, with asbestos gasket, was inserted between the intake and exhaust manifold, so as to shut off some of the heat flow from the exhaust to the inlet manifold and permit of determining the effect on the operation due to the lower temperature of the mixture thus obtained.

The final tests with the Class B engine were made under spark-and-throttle conditions simulating road-operating conditions of the motor truck.

Amount of Carbon Deposit

One of the chief claims made for water injection in gasoline engines has been that it reduces the amount of carbon deposit and that it will even remove deposits already formed. In order to test the validity of this claim, a Rutenber six-cylinder, 3 x 5-in. engine was mounted on the test stand and fitted with a fan brake to load it down. Cooling water was circulated by gravity, and in order to form a carbon deposit of some thickness the engine was run for several days with a rich mixture, late ignition, and low jacket temperature. Occasionally oil was injected into the cylinders. At the end of the 6-hr. period, all interior portions were covered with a substantial layer of carbon.

The engine was then run for another 6-hr. period under wide-open throttle, water being injected into the manifold as in the previous tests. During this run the waterjacket temperature was kept high, the outlet temperature being maintained constant. At the conclusion of this run the cylinder head was removed and the carbon deposit in the combustion chamber examined, but no noticeable effect was found. Other similar tests were made, the rate of water injection and the temperature of the jacket water being varied. The rate of water feed varied from 2.4 pints to 7.05 pints per hour. With the higher rates of water feed the engine power output was noticeably decreased.

The results arrived at have been summarized by the experts of the Bureau of Standards somewhat as follows:

No appreciable effect is produced upon the power, fuel economy and general operation of a gasoline engine by the injection of water into the cylinders at rates varying from 0.03 to 0.44 lb. per brake horsepower-hour. When water is injected at a higher rate than 0.44 lb. per brake horsepower-hour there is an appreciable decrease in the power output, fuel economy and smoothness of operation. It is quite probable that in a badly carbonized engine, or an engine of defective design, in which there are hot spots that cause preignition, the injection of the water results in an increase of power. In an engine operating at high waterjacket temperature the injection of water in amounts between 2 and 8 lb. per hour produces a softening and slight reduction of carbon, this reduction not exceeding 25 per cent and being most noticeable on the piston heads and valves. However, water injection at the maximum rate also causes a considerable reduction of power.

What Return of Railroads Means to Automotive Industry

Shippers Expect Improved Relations to Result—Hope for a Slight Reduction in Rates—Increased Efficiency Is Anticipated When Competition Is Resumed

By Allen Sinsheimer

"The railroads will be handed over to their owners at the end of the calendar year."—PRESIDENT WILSON'S *Message to Congress.*

WASHINGTON, June 2.—What does the return of the railroads mean to the automotive industries? Their return to their owners is practically assured by President Wilson's message and the well-defined sentiment of members of Congress. Under the existing law the President may return the railroads without the aid of Congress. The Legislature can, however, if it desires, pass legislation before the end of the year which would continue the Government control despite the Presidential declaration; but this is not anticipated. There is an almost universal demand that the roads be returned to private control.

The control over the roads by the Government had broad effect on automotive shipments. There has been an unprecedented rate increase. The time of shipments has increased. There has been remarkable improvement in car service supply. There has been a loss in general efficiency despite this one improvement.

The lack of competition, with a consequent lessened eagerness to give service as an inducement to hold business, is the chief disadvantage resulting from Government control, according to traffic managers. They do not like the present system, which lacks the keen competition of the past, when railroads vied with one another for business, and as a result were constantly improving service. For example, the freight shipments to-day are frequently from 24 to 36 hr. slower than in 1915 or 1916. From Detroit to St. Louis, for instance, it requires four days now, as compared with three days before Government control. Traffic managers find it useless to appeal for improvement. They find themselves as helpless as the ordinary citizen who attempts to purchase a postage stamp exactly one second after the closing hour of the post office. Likewise, because of a lack of competition and the zest for business which it creates, there have been arbitrary rulings, regulations and freight-rate changes made under such conditions that shippers were not allowed sufficient time to adapt their business, and were forced to comply at a loss.

Those who have studied the railroad situation recommend that the return of railroads to their owners should:

Be preceded by government legislation authorizing combinations and pooling of equipment and resources;

Be preceded by formulation of standard rates and regulations;

Contain legal provision protecting weaker roads;

Be preceded by regulation of wages;

Include strict government regulation.

Again, under the non-competitive arrangement there has been a policy of "if it doesn't go to-day it will go tomorrow." Work was discontinued on Sundays. Important trains were taken off.

The return of the roads to their owners, it is believed, will mean a resumption of the competitive basis to a certain degree, with a consequent renewal of the former business methods of constant improvement to gain new business. A number of railroads have suffered the transfer of their business to other roads under the Government management, and it is anticipated that these will be particularly keen to regain the lost trade.

The probability of a reduction in freight rates is slight. There may be a small saving effected in operating costs by the railroads under private management, as compared with Government operation, which has been costly, and this may allow some slight decrease. Wages, however, are an important factor in freight rates, and the great increases that have been awarded the railroad employees by the Government will probably stand in the way of freight-rate reductions. Some idea of the increase in freight rates can be gained from the following comparison:

Automobile Freight Rates Per 100 Lb.

	1914	1916	1919
Detroit to New York..........	64.5	67.5	97
Detroit to St. Louis............	50.5	53	87.5

Under private control, freight rates will again be determined by the Interstate Commerce Commission, instead of by railroad officials, and this is expected to result more favorably to shippers. Under the existing plan, local boards in certain districts comprising three railroad men and a minority of two shippers determine the rates, and the shippers have found themselves at a complete disadvantage because of their minority.

One of the most important advantages that automobile shippers have found under Government control is in the distribution of au-

tomobile freight car equipment, due to the fact that the Railroad Administration placed representatives in each shipping center to allocate the cars. This arrangement, combined with the fact that the Administration ruled against shipments of partly filled freight cars, has created a surplus of shipping equipment.

Under private control, any such plan whereby freight cars would be pooled and apportioned would be in direct violation of the existing anti-trust laws, and consequently shippers are urging Congressional legislation which will allow the private owners of railroads to combine and pool their resources on a plan similar to that employed by the Railroad Administration. If the railroads can pool certain resources, shippers urge every advantage developed under Government control will continue under private control, together with the other advantages of competition which were lost under Government supervision.

Shippers expect the return of the railroads will:
Increase the general shipping efficiency;
Bring slightly lower freight rates;
Improve the time of shipment between points of shipment and destination;
Create better personal relations between shippers and the roads;
Renew the constant improvements in service that existed under the competitive plan.

That there must be legislation before the roads can be returned to private owners has been recognized by practically all authorities. The speeches before the U. S. Chamber of Commerce convention at St. Louis, by W. B. Hines, Director General of the Railroad Administration, Senator A. B. Cummins, and the report of the Chamber's Railroad Committee, all advocated legislation permitting reasonable competition and a consolidation of the railroad systems that would enable the merging of the weaker roads with stronger ones, thereby leveling the inequalities of costs and revenues. This would mean the formation of all roads of the country into eighteen or twenty systems, under private control, but regulated to an extent by the Government.

Railroad owners object in part to this plan. They desire legislation authorizing combinations, but prefer to be allowed to form voluntary combines. As a permanent solution of the railroad problem Mr. Hines suggested that the railroads should have a fair return on the fair value of their property. This value must be determined before the necessary legislation can be passed. Out of the 180 railroad companies operating, generally at the same rates, and regardless of operating costs, some earned 2 per cent, while others earned as much as 10 per cent, and, said Mr. Hines, legislation must provide protection for the weaker roads by some combination plan whereby certain strong roads will be obliged to absorb or work in conjunction with the less profitable systems.

Merging of Roads Would Cure Many Ills

The existing absence of standards of rates and regulations, the disparity between the profits of the weaker and stronger roads, the absence of a definite point of contact between the Government and private management and the possibilities of overcapitalization and exploitation are the problems that must enter into Congressional consideration and legislation. These can all be overcome, said the Director General, if the roads are merged into a few large competitive systems, with from twelve to twenty combinations in the three great sections of the country—the West, the East, and the South—with each combination including enough of the more or less profitable roads to equalize the situation.

There should be, he claimed, an official capitalization, Government representation on each controlling board, and standardization of rates and regulations.

The plan advocated by the Chamber of Commerce committee recommends that:

1. Corporate ownership and operation of the railroads should be adhered to under Government regulation.

2. Remedial legislation should be enacted prior to the return of the roads to their owners.

3. Public authority should be granted for consolidation of the railroads into a limited number of strong competing systems, so that each principal traffic center of the country will be served by more than one system.

4. That railroads engaging in interstate commerce shall be required to change from State to Federal corporations, with suitable provisions for taxation and police regulation by the several States.

I. C. C. to Pass on Expenditures

5. That the Interstate Commerce Commission should be authorized to pass upon expenditures of capital in excess of a stipulated amount by the roads and to determine the conditions of the issuance of securities.

6. That the Interstate Commerce Commission be given authority to regulate intrastate rates when those rates affect interstate commerce.

7. That rates and fares fixed by the Interstate Commerce Commission must by law be sufficient to yield the companies a fair return upon a fair value of the property, the value to be determined by public authority.

8. Legal enactment of rules of profit sharing whereby railroads will turn over excess profits to be used to strengthen the credit of all railroads and make them more efficient.

9. That a Federal Transportation Board be created to develop transportation by rail, water and highway.

The Chicago & Northwestern Railroad and the Chicago & Great Western Railroad were pointed out by Senator A. B. Cummins as examples of weak and strong roads and of overcapitalization. The Chicago & Northwestern, which is capitalized at $46,000 per mile, has an average net operating income of 6.13 per cent on its property investment account, while the Chicago & Great Western, capitalized at $77,000 per mile, has an income of 1.77 per cent. "It requires no argument," stated the Senator, "to convince one that the Chicago & Great Western company cannot perform its duty to the public and survive under such conditions."

He advocated a series of consolidations to merge weak roads with strong ones, a Government guarantee of a return upon the capital invested in railways, and the operation of the roads through private corporations under the strictest Government control. "The Government," he declared, "cannot operate the railroads either economically or efficiently. It costs the Government more to do anything in a country like ours than it costs anybody else to do the same thing."

Temperature Control on A-C Speedometer

New Magnetic Instrument Is Fitted With Thermostatic Compensator

New A-C magnetic speedometer with flexible shaft. Note how flexible shaft is connected to center of back of speedometer

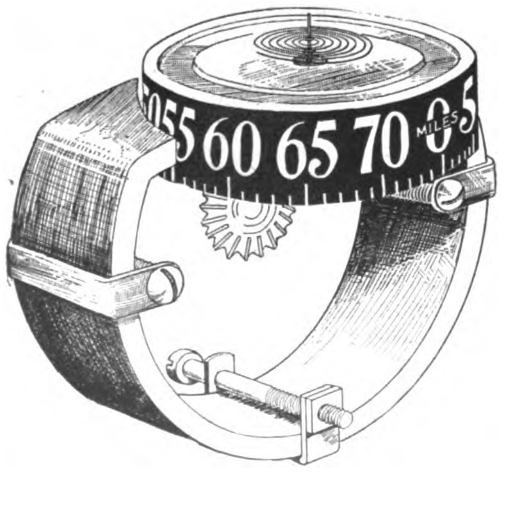
THE A-C speedometer brought out by the Champion Ignition Co., Flint, Mich., is a magnetic type of marked simplicity, and with an ingenious method for regulating and maintaining accuracy in spite of variations in temperature.

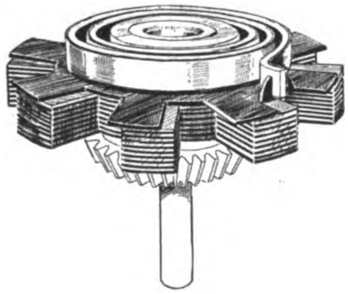
The speedometer operates entirely on the magnetic principle, having a stationary permanent horseshoe magnet held securely in the interior of the instrument in a manner which is similar to magneto and galvanometer construction. The magnet is stationary and the armature rotates within it, being driven by the flexible shaft which is connected with the driving mechanism of the car. The armature revolves in the magnetic field between the poles of the horseshoe magnet, the magnet poles being ground to receive it.

The armature is segmented into poles, the magnetic current passing through them and thrown or shunted in the direction of rotation, carrying with it a non-magnetic element in the form of an inverted aluminum cup having on its periphery the scale which indicates the velocity of the vehicle either in miles or kilometers per hour. The light weight of the aluminum cup renders it so sensitive to the magnetic drag that the instrument starts to register at a speed of 1 mile per hour. The speedometer is graduated up to 75 miles per hour, with graduations indicating every mile. The indicating element is a hair line crossing the glass window through which the speed is read in much the same way as the hair line on a slide rule indicator.

Objections to magnetic speedometers in the past have generally centered around the fact that the magnet expands in warm weather, thereby removing the poles to a greater distance from the armature. This slight variation is compensated for in the A-C instrument by an automatic thermostatic control which changes the relation of the armature laminations one to the other, thereby advancing or retarding the magnetic flux as may be necessary. In this way the speedometer will give correct reading regardless of the temperature conditions. There is an adjusting screw for making the primary setting on the magnet, and this is set at the factory and then sealed so that it cannot be tampered with by the ordinary user to throw the speedometer out of adjustment.

The construction of the instrument is such that the speed recording elements are contained in one-half of the housing and the odometer components in the other. The only connection between the two is a worm shaft which operates the odometer. The odometer will register mileage covered by the vehicle up to 100,000 miles and repeat on the total, which in this instrument is placed on the right hand side, it being considered more natural to read totals summed up to the right. The trip register, which can be reset at will, either forward or backward, to any desired figure, is placed at the left. It registers in miles and tenths of miles to 100 and repeats, the tenth figure being the same color as the unit figure, but divided by a decimal point, just as it would be read in a touring




Magnet and rotor of A-C speedometer, showing thermostatic compensator on rotor

guide book. The reset guide or button is placed in the center of the face, which makes the instrument symmetrical. The resetting knob is very much the same as the stem wind knob on a watch, and it is quick in action, requiring only a straight pull out, whereupon the reset may be rapidly made.

The two halves of the speedometer are assembled and united by a steel band forced over the broad flange surface of the instrument by pressure. The moving parts are fully jeweled, having two large jewels of sapphire and garnet. There are several design features which are unique in the instrument, a valuable point being the connection of the flexible shaft to the back, so that it can be hidden completely from view in mounting on a car. The neck to receive the shaft is concentric with the instrument and has a 7/8-18 S. A. E. (spark plug) thread. The ferrules have a tapered fit, making alignment perfect.

The speedometer is held into the instrument board of the car by a patented band clamp having slots tapered so that when turned projections go into the slots and cause a forward movement of the clamp, thereby securing it. It is locked by tightening a screw.

The front face of the instrument is metal, being die cast of aluminum, with an enamel finish of gun metal shade. The escutcheon flange is either nickel or enamel or can be made in any desired finish. The back part of the instrument is also die cast and oxidized black. The reset knob in the center is nickeled. The figures on the indicating and registering member are white on black as a standard, but can be had reversely. The Caslon type of figures are used because of the ease with which they can be read.

A special flexible shaft has been made for this instrument and greater durability and strength are claimed for it. The cable is made of alternately wound monocoil music wire of four layers, each layer having four strands totaling 3/16 in. diameter. The cable ends are secured by patented process and guaranteed by the manufacturer not to break loose. The coupling nuts are made large for good contact. The casing is of tempered material wound with two strand wire and coiled tightly to hold grease in case of severe bends and still keep its shape. All of the parts are rust proof. The flexible shaft runs at 168 r.p.m. at 10 miles per hour, varying directly with the velocity of the car, or in other words 1008 revolutions at 60 miles an hour. The travel of 1008 revolutions per mile is the basis for figuring all gearing with which to drive it.

The instrument will be standard equipment on Buicks and other cars during the coming season.

PAINTS sensitive to temperature changes are used a great deal for indicating dangerous heating in machine bearings, electric plant, etc. The double iodide of silver and copper is usually red, but blackens at 188 deg. Fahr., and again turns red when the temperature falls by the same amount.

A writer in *Die Werkzengmaschine, Zeitschrift des Vereines deutscher Ingenieure* gives a satisfactory recipe for making the paint. Copper sulphate and sodium iodide are dissolved separately in distilled water, the sodium oxide solution then being gradually stirred into the other until the deposit which at first forms disappears. A strong solution of chloride of mercury is then added, the double iodide of mercury and copper being precipitated. The deposit is filtered and dried, and is in the form of a red powder. It is then mixed with a weak solution of gum arabic, and can then be applied as a paint. Another medium is the double iodide of mercury and silver, which is light yellow when cold and turns a dark orange or brick red at about 113 deg. Fahr. This paint resumes its original color if not overheated.

Baker Two-Speed Axle

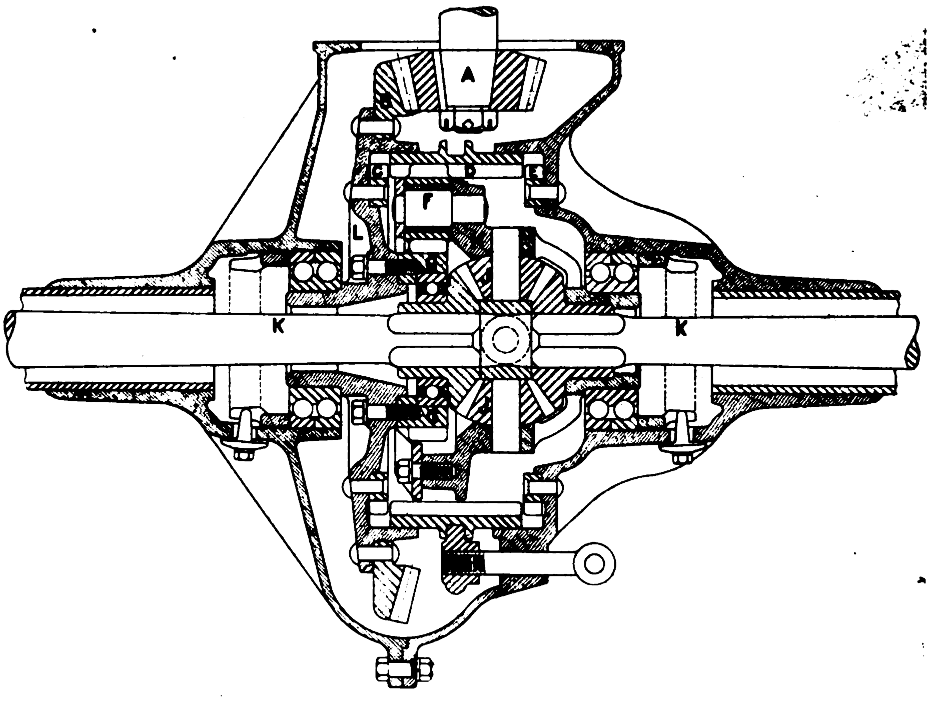
AN interesting form of two-speed axle has been invented by A. F. Baker and is being marketed by the Perfecto Gear Differential Co. of Seattle. This axle has been under test for some time on a 1-ton truck, and the maker claims that it has shown very satisfactory performance. The axle furnishes two ratios, one of 10.9 to 1 and the other of 3.9 to 1 on high speed. The two speeds are secured by means of an internal gear arrangement, as will be shown.

Referring to the section of the axle, the drive enters the axle housing at the bevel pinion *A* meshing with the ring gear in the customary manner. The ring gear *B* is riveted to carrier *L*. The annulus *D* is the chain speed gear. When it is in mesh with *C* it is in high gear and the drive is given solidly through the ring gears to the differential housing in the usual manner. When the annulus *C* is in mesh with *E*, which is riveted to the casing *M*, the internal gear action is set up resulting in the greater reduction.

On high gear the drive passes from the pinion *A* to the ring gear *B* and thence solidly through the fixed gear *C* to the annulus *D*, the pinion *F* and thence to the differential housing *H* and through the differential gear *J* to the axle *K*. This is quite similar to the usual bevel gear drive.

In low speed the annulus *D* is thrown over to mesh with the fixed gear *E*, which is riveted to the casing *M*. In this instance the drive passes from the bevel gear *A* to the ring gear *B*, which carries with it the front wheels *G*, which in turn carry with them the planet wheels *F*, rotating on the entire differential housing *H*.

Thus the double reduction is secured and the low speed ratio provided.



Lubricating Oil Program of the Bureau of Standards

An Outline of the Problems Which It Is Proposed to Solve by Experimental Research Work

A GENERAL experimental investigation of the subject of lubricating oils has been undertaken by the Bureau of Standards. A special oil laboratory has been fitted out in the Northwest Building of the Bureau at Washington and a program of experimental work has been laid down which, if carried through, should throw much new light on the subject of lubricants.

During the war the various divisions of the War Department having to do with automotive apparatus often needed information on lubricants. They found they could not get this from the oil companies, and so it was decided to install equipment at the Bureau of Standards to determine the facts at first hand. The demand for information came chiefly from the Bureau of Aircraft Construction, and it will appear from a perusal of the program that it was laid down with a special view to the lubrication requirements of aircraft engines; but we are in position to state that it is planned to make a parallel study of the lubricating requirements of other classes of automotive apparatus as well.

One thing that should make the proposed study of great economic value is the enormous waste occasioned by throwing away the oil from the crankcases of kerosene-burning tractor engines after it has served from 30 to 40 hours. This oil retains practically all its original lubricating value, and the only trouble with it is that it contains a considerable proportion of light hydrocarbons which act as a diluent. If systematic attempts were made to regenerate this oil it should lead to a great saving.

The program as printed below has been laid out under the direction of C. W. Stratford, a well-known oil expert. Mr. Stratford also selected the equipment of the laboratory. This lubricating oil section of the Bureau evidently needs and deserves the whole-hearted co-operation of the automotive industries as well as that of the oil industry.

THE PROGRAM

The general purpose of this investigation is to collect as much information as possible pertaining to the many problems involved in the lubrication of internal combustion engines. The majority of these problems have been well recognized in the past but their real importance and the necessity for their solution have been further emphasized during the war, especially in aircraft engine and farm tractor engine operation.

The secondary purpose of the investigation is to determine the real value and importance of laboratory methods now used in oil testing and of the significance of the results as an indication of the value of oils in practical service. It is hoped that new tests of value may be developed to supplement those now in use.

It is the earnest desire of the Bureau to secure the whole-hearted co-operation of oil refiners, large and small oil users and other interested parties in this investigation. All suggestions for the improvement of the program and constructive criticisms of same from all sources will be heartily appreciated.

So far as present knowledge goes the ideal lubricating oil should possess the following characteristics:

(a) Maximum reduction of friction.
(b) Minimum amount of wear of rubbing surfaces.
(c) Maximum length of time that oil can be used in service.
(d) Minimum rate and minimum amount of decrease in lubricating efficiency.
(e) Minimum carbonization in combustion chambers.
(f) The greatest security against seizure consistent with maximum lubricating efficiency.

It is proposed to determine what oil or oils most nearly approach this ideal.

Some Specific Problems

(1) To determine the cause of reduction of lubricating efficiency, i.e., whether it is due to change in viscosity alone or to the presence of decomposition products in the used oil or to both of these factors.

(2) Does the lubricating efficiency of an oil depend upon any other characteristics than those usually recorded in specifications, such characteristics as for instance adhesion, specific heat, thermal conductivity, "body," etc.?

(3) What relationship exists between the flash and fire points of an oil and its boiling point range?

(4) What predictions may be made of the specific consumption of oil in an engine from the values of the flash, fire, and boiling point range? Should the entire boiling point range or any part of the boiling point range of an oil be limited?

(5) What are the relative values of the Conradson carbon residue test and the Waters or other oxidation oven tests as means of predicting the decomposition which will occur in any lubricating oil in service?

(6) Does the presence of emulsifying products in an oil affect its lubricating efficiency in service? What disadvantage in reclamation processes are caused by the use of emulsifiable oils?

(7) Does the presence of colloidal matter such as deflocculated graphite, carbon or carbonaceous matter affect the lubricating efficiencies of oils? What is the relative value of settled unfiltered cylinder stock (which contains colloidal matter as well as solid or semi-solid matter in suspension) compared to the same cylinder stock in the filtered condition when these oils are used for blending with light hydrocarbon oils?

(8) What are suitable oils for use in Gnome or other similar types of rotary engines—castor, mineral blended with castor (using oleic acid as a binder), or mineral blended with other fatty oils?

(9) Is it desirable to blend fatty oils (high or low acidity) with mineral oils and what effect does the presence of fatty oils have upon the decomposition of mineral oils of paraffin and naphthene bases?

(10) To what extent do lubricating oils of paraffin and naphthene base, blended with fatty oils, absorb fuel vapors?

(11) How may it be judged when an oil has reached such a condition that it should be discarded or reclaimed?

(12) How may the appropriate viscosity or other characteristics of an oil for any given engine be determined, giving due consideration to seasonal changes in temperature, wear of engine parts, peculiarities of lubricating systems, etc.

(13) What are the relative merits in service of lubricating oils manufactured from paraffin and naphthene petroleums?

(14) To what extent does the character of bearing metals in contact and the condition of their surfaces influence lubrication?

Engines and Engine Test Methods

It is proposed to make tests of oils in the following aviation engines:

(1) Liberty twelve-cylinder.
(2) Liberty six-cylinder.
(3) Hispano-Suiza 150 hp.
(4) Gnome rotary.

Mechanical Conditions—Record peculiarities of engine lubricating systems, bearing clearances, specific bearing pressures, compression ratio, type pistons and rings, piston clearance and all other mechanical features of importance. The large bores in the crankshaft should be plugged with aluminum to facilitate removal of oil from system without taking down between test if desired.

Rate of Oil Flow—The oil flow from the pump to bearings will be measured by a venturi. If possible the actual rate of oil flow through all bearings should be determined at the normal revolutions per minute of engine by direct measurement.

Running Records—Barometer, temperature, inlet air, humidity.

Constant	*Variable*
(1) R.P.M. of engine.	(1) Horsepower.
(2) Fuel consumption.	(2) Oil consumption. (a) Burned. (b) Leakage. (c) From breathers (vapor).
(3) Jacket water inlet temp.	(3) Oil temp. outlet to cooler.
(4) Oil, inlet to pump temp.	(4) Oil temp. from crankpin cheeks.
(5) Oil pressure.	(5) Water temp. outlet.
	(6) Condensate from breathers. (a) Oil. (b) Volatile. (c) Gas.

Test Periods—It will be necessary to determine whether the same amount of decomposition can be obtained in 1 hr. runs as in 5 hr. or longer periods. A standard test period will be chosen for all tests.

Special Tests—(1) Fuel Absorption. Runs should be made with paraffin base and naphthene base lubricating oils using as fuels, (a) dry gasoline vapor, (b) aviation gasoline and (c) average automobile gasoline with each oil for the purpose of determining the relative amount of fuel absorbed by each and the character of the compounds absorbed.

(2) Carbon Deposits. Runs should be made with (a) paraffin, (b) intermediate and (c) naphthene base lubricating oils and a record made by photographing the piston heads and noting the amount and character of the carbon deposits on the remainder of the explosion chambers.

Standardized Test Fuel—A sufficient quantity of aviation gasoline made from the same refinery distillate should be provided for the completion of all engine tests. Whenever any change is made in fuel, then a standardized lubricating oil should be used to determine whatever variation may occur because of the change in fuel.

Standardized Lubricating Oil—It is highly advisable to standardize some lubricating oil for use during all engine tests to check any variation other than that caused by lubricating oil. A sufficient quantity of this oil should be provided to meet the requirements of all check tests.

Theory of Lubrication

Adhesion—(1) Determination of method or methods of measuring adhesion on the following groups of oils:

(a) Hydrocarbon oils of different bases, and each of different viscosities and volatilities.
(b) Fatty oils—prime lard, "acidless" tallow, castor and sperm, also same with different proportions of oleic acid, cotton-seed, etc., also cutting oils.
(c) Blends of hydrocarbon oils and fatty oils, also hydrocarbon and castor blends with oleic acid as a binder.

Study of cutting oils, and the bearing cutting oil properties have on lubrication. Power consumption for cutting operations with and without cutting oils.

Study of Oil Films—1. Behavior of films at constant temperature on plates, also on plate with temperature gradient, to determine drainage and rate of spread.

2. Behavior of films on different metals with localized heating.

3. Behavior of films on water, as a possible means of throwing additional light on the present knowledge of oil films as applied to lubrication.

Thermal Properties—Specific Heat, Heat Conductivity and Thermal Expansion on same groups of oils as given under Adhesion.

Friction Machines

The practical usefulness of friction machines in general has been widely commented upon and questioned in the past. In order to definitely settle the real value of friction machines the following program of investigation is proposed:

(1) Study of present stage of the art.
(2) The analysis of all existing machines comprising the following general items:
(a) Information is desired as to whether a reading can be made of the critical point of film breakdown, *i.e.*, incipient seizure of bearing at different loads, speeds, and viscosities at the temperature of oil film in the bearings, also when using different bearing metals.
(b) Method of applying lubricant to rubbing surfaces.
(c) Method of regulating all operating conditions.
(d) Recording devices, automatic or otherwise.

In the preparation of the above analysis it is desirable to draft a chart in which as much information as possible may be given in tabular form for direct comparison.

With all the above data at hand, then complete detail specifications should be prepared of an Ideal Friction Machine on which all determinations desirable could be made.

Division VIII, Metallurgy and the Division studying lubricants will fully co-operate with reference to bearing metals and tests.

Routine Tests

Fresh and Used Samples

1. *Gravity.*
2. *Flash.*
3. *Fire.*
4. *Viscosity.* (Saybolt Universal) at 100 deg., 150 deg., 212 deg. Fahr.
5. *Color.* 1. Fresh.
   2. After heat test.
   3. Used oil from engine.
6. *Emulsion*—Shaker (Coles).
   Demulsibility—Herschel; Stirrer.

Note—Oils more viscous than 50 sec./212° will be blended 50/50 with standardized petroleum ether for shaker emulsion tests.

7. *Cold Test*—A. S. T. M. method.

Special Laboratory Examination

Carbon Residue—Carbon residue values will be determined by means of the Conradson carbon residue apparatus as described in the A. S. T. M. proceedings. All outside oil samples and special engine test oil samples will be subjected to the Conradson test.

Oxidation Oven—All oil samples both outside and those used in special engine tests will be subjected to tests in both the Waters and Stratford oxidation ovens for the following determinations: (a) Evaporation loss, (b) Petroleum ether insolubles, (c) "Varnish"—resins.

In making a general study of the susceptibility to oxidation of engine oils full consideration should be given to constitution and methods of manufacture of anahydrous switch and transformer oils. The same remark applies to viscous "water-white" oils, such as Squibbs or Nujol medicinal oils.

Standardized Petroleum Ether—In making petroleum ether insoluble determinations it is imperative that the same standardized petroleum ether be used throughout all tests. Spec-

ifications for standardized petroleum ether are as follows:
Gravity, Baumé 77 to 80 (incidental).
Initial Boiling Point—110 deg. to 120 deg. Fahr.
Final Boiling Point—220 deg. to 245 deg. Fahr. Unsaturated content not over 4 per cent (Bureau of Mines method).

Note—Above distillation range determined by Saybolt distillation method.

Volatility—It is desirable to investigate by distillation the volatility of the different compounds contained in lubricating oils. In order to properly make this investigation it may be necessary to determine a part of the boiling point range or the whole of that range.

There are four general distillation methods applicable:
(a) Destructive distillation under atmospheric pressure.
(b) Dry distillation under high vacuum (40 to 50 millimeters Hg.).
(c) Distillation under high vacuum (40 to 50 millimeters Hg.) with the introduction of superheated steam.
(d) Distillation under atmospheric pressure with the introduction of superheated steam.

It is proposed to determine by experimentation which of the above four methods is most applicable to the study of the constituency of lubricating oils with least decomposition of oil and with the most concordant results.

Other Determinations—(a) Sulphur content, (b) ash, (c) fatty oils, (d) acidity, (e) alkalinity, (f) tarry or suspended matter, (g) moisture, and (h) odor.

List of Oil Samples for Examination

Commercial Oils—A two-gallon sample of all available American hydrocarbon oils, intended for the lubrication of internal combustion engines, will be examined for their physical and chemical characteristics. This list of oils will comprise all of those now sold in sealed containers and having reasonable distribution and volume of sales. These oils will not at present be run in the engine tests. It is proposed to purchase these samples at regular intervals, say quarterly, and to retain a four-ounce sample for reference from each of the samples purchased.

Special Oils—The following Liberty Aero Engine Oil Types will be procured and subjected to a complete examination, including engine tests. Specifications for these oils will correspond to the limits prescribed by Signal Corps Specification No. 3501.

Paraffin Base—(1) Lubricating oil made from paraffin base crude petroleum (Penna.) of high boiling point range.
(2) Lubricating oil made from paraffin base petroleum (Penna.) with low boiling point range.

Naphthene Base—(1) Lubricating oil made from naphthene base crude petroleum (Gulf Coast) of high boiling point range.
(2) Lubricating oil made from naphthene base petroleum (Gulf Coast) with low boiling point range.

Fatty Oil Blends—Fatty oil (prime lard) blends will be made with each of the two oils given above under the heading of Paraffin and Naphthene Bases. The physical properties of these blends will be made to correspond to Signal Corps Liberty Aero Oil Specification No. 3501.

The above oils have been selected to determine the difference if any in their lubricating efficiencies in service. Such differences may occur because of different chemical structure or peculiarities of refining processes applied in their manufacture.

If the data from the tests on this list of oils show marked tendencies it may then also be advisable to carefully investigate lubricating oils made from natural mixtures of paraffin and naphthene base crudes (Mid-Continent), or same made from blends of the lubricating distillates from these two crudes at some stage in their manufacture.

Miscellaneous Oils—Various special oils will be used in the study of the effect of processing methods, i. e., acid treatment, sulpho-compounds, etc. Also the effect of filtration to different colors.

(a) Prime lard, (b) sperm, (c) castor oil, cold pressed, (d) rape seed oil, (e) rape seed oil, blown, (f) cylinder stock, low cold test highly filtered, (g) cylinder stock, strained low cold test unfiltered, (h) "paraffin," and (i) acid treated oils.

Regeneration of Used Oils

It is proposed to make a study of commercial processes applied to the regeneration of used oils and to determine what is the best and cheapest means of converting used oils into good lubricants. Also to determine the relative lubricating efficiency of regenerated oils as compared to that of the same oil in its fresh, unused condition.

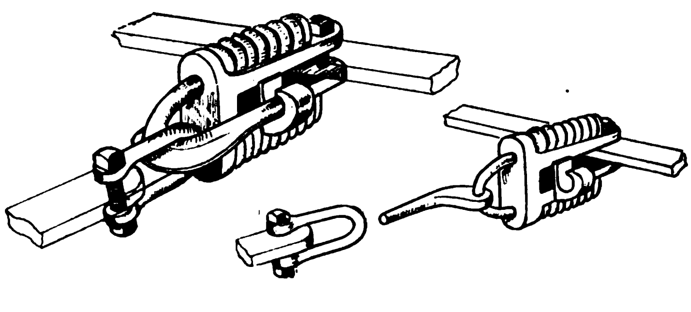
Problems Involved
1. Removal of solids in suspension.
2. Separation (distillation) of very volatile products.
3. Separation (distillation) of light oils.
4. Removal of heavy oxidized compounds by treating with soda ash and blowing with steam.
5. Removal of moisture.
6. Filtration, Fullers earth.
7. Blending filtered oil to required viscosity if necessary.

Proposed Samples for Regeneration
1. Used oils made from paraffin crudes (Pa.).
2. Used oils made from intermediate crudes (Mid-continent).
3. Used oils made from naphthene crudes (Tex.).
4. Used oils made from California crudes.
5. Used oils made from blends of hydrocarbon and fatty oils.
6. Slop oils consisting of a mixture of oils and greases.

The Greer Tractor Release Clevis

ERWIN GREER AUTOMOBILE CO., Chicago, has placed on the market a clevis for use in hitching the drawbar of a farm tractor which insures an automatic release of the implement drawn whenever the load is abnormally increased. The sketches clearly show the construction of the device. The pull is transmitted through a single-arm lever, the free end of which is normally held by a hook or catch, which can be adjusted on the clevis. Under the effect of the pull, the two coiled springs are compressed, and when the pull exceeds a certain amount the end of the lever is released from the hub and the implement is automatically detached.

This device is said to be of great value in plowing rocky fields or fields in which there are tree stumps. The position of the hook, which determines the amount of load for which the implement is released, can be adjusted at will. The clevis weighs only 17 lb.



Sketches showing Greer clevis in working position and released

Electric Arc Welder
for Portable and Stationary Use

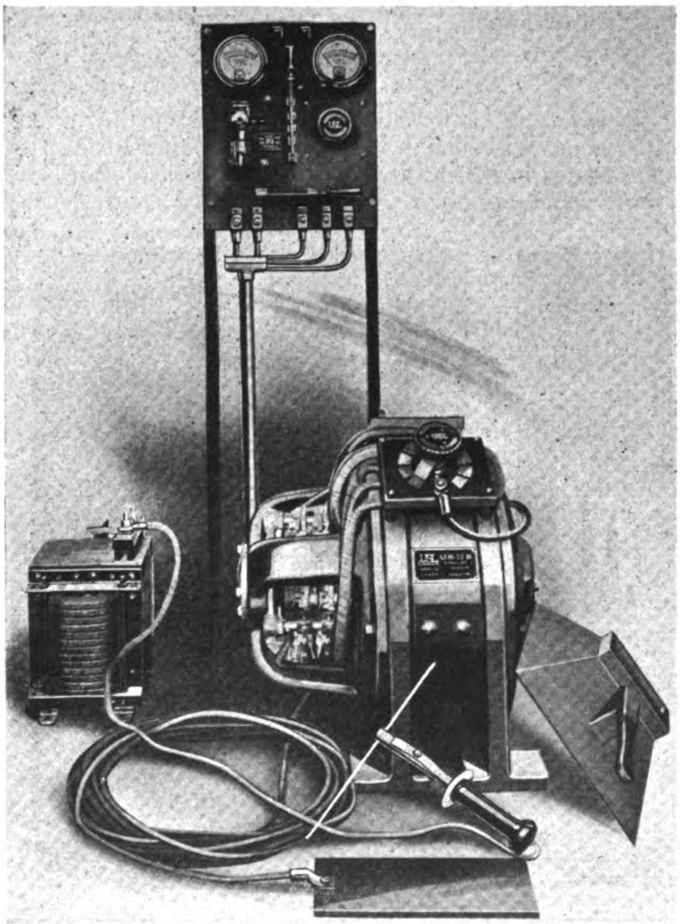
Designed for Operation on Either Direct or Alternating Current Lines, the Alternating Current Outfit Including a Motor Generator Set

AFTER an exhaustive investigation into the requirements of manufacturing institutions, garages and machinery repair shops, the U. S. Light & Heat Corp. at Niagara Falls, N. Y., has developed a line of electric arc welding machinery to meet the requirements for every character of work.

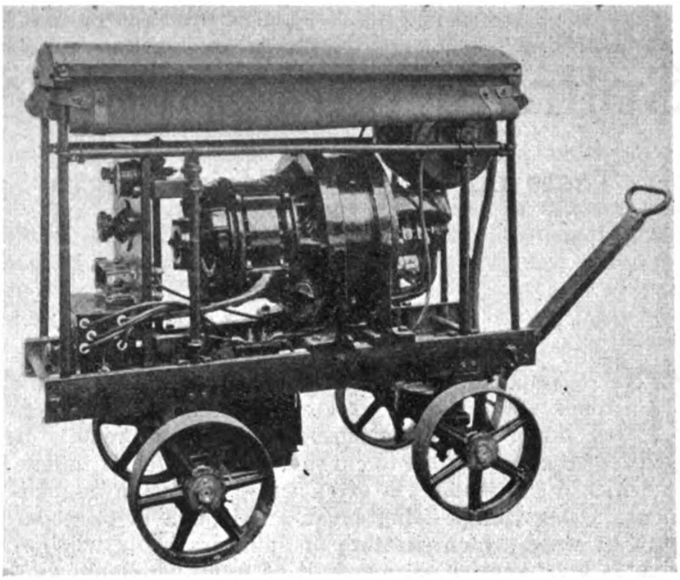
For the smaller shops where it is possible to bring the parts to be welded to within 50 or 75 ft. of the welding apparatus, a stationary type is provided. Where it is necessary to take the electric welding apparatus to the work, a portable type is provided.

The USL arc welder, as the machine is called, has a rated capacity of 4 kw. and gives 200 amperes direct current or less. It is of the variable voltage type, with a range of open circuit voltage from 35 to 65 volts. Tests of the USL arc welder show that it delivers practically constant energy throughout the range of voltage used in welding. This characteristic, together with other special features of design, keeps the arc strong and steady and aids the operator in securing a steady flow of metal into the weld.

The welder is made in the form of a converter for use on 100 to 125-volt direct-current circuits only, and in the form of a motor generator for all other circuits. The converter is inherently regulated, weighs only 665 lb. and delivers current at the arc through the arc stabilizing reactor with an efficiency of 65 to 70 per cent.



Stationary type of U. S. L. arc welder



U. S. L. arc welder in portable form

The motor-generator type of welder consists of a 7½-hp. motor mounted on the same shaft with a special 4-kw. generator. This generator is inherently regulated, compound-wound, self-excited, and has a drooping voltage characteristic which keeps the current within safe limits on short circuit. Motor-generator equipments are available in any standard d.c. voltage and in any generally standard a.c. voltage, phase and frequency.

Converter and motor-generator types are made up both for portable and for stationary use. The portable truck with cover is 28 in. wide, 55 in. high and 54 in. long. Completely equipped with motor generator, switch and metal panel, cover, cable reel and flexible cable, it weighs 1530 lb.

—

Foamy Glues

GLUE which is foamy when spread is likely to give unsatisfactory results, owing to the formation of dry spots in the joints by the air bubbles. Spots as big around as a pea are sometimes thus formed and numerous smaller bare spots are to be found in any joint made with foamy glue. Such breaks in the glue film, of course, weaken the joint appreciably. A loss of 25 per cent has been noted by the Forest Products Laboratory in the shear strength of plywood due to the use of foamy glue, and even greater losses were found when the glue coat was heavy.

Foaming in animal glues may be caused by running the spreader too rapidly, or by running it idle, or by over-heating the glue. Foaming is also dependent on the amount of grease the glue contains, the kind of stock used and the method of manufacture. Alkaline glues are more subject to foaming than glues of acid reaction. Unless a special foamless glue, which most manufacturers are prepared to furnish, is used, or some more desirable preventive measure is taken, the addition of a little grease or oil may allay foaming troubles in animal glue.

Fish oil, corn oil, mineral oil and preparations containing tallow are in use for this purpose.

Foaming in casein glue is commonly the result of mixing at too high a speed or for too long a time. Casein glue mixed at high speed may have twice the volume it would have if mixed at the proper speed, owing to the incorporation of air. Foaming is also caused by improper operation of the spreader. Blood glue has a marked tendency to foam when used in a mechanical spreader. The addition of sulfonated oils has been suggested as a remedy, and it is probable that improvements in the glue formula also will reduce the foaming tendency.

Splintering Properties of Airplane Woods

Tests on Relative Resistance to Splintering Under Rifle Fire, Carried Out at the U. S. Forest Products Laboratory

By G. E. Heck*

THE importance of determining which airplane woods will offer the greatest resistance to splintering under rifle or machine-gun fire can readily be realized when one stops to consider the shower of bullets to which a battleplane is often subjected in an engagement. Other things being equal, an airplane or propeller built of wood which shatters or splinters badly will not give as good service as one built of wood which shows a relatively small, clean-cut hole when struck by a bullet.

The determination of the relative resistance to splintering under rifle fire of some of the most common airplane woods was one of the problems submitted by the War and Navy Departments to the Forest Products Laboratory, Madison, Wis., for investigation during the war.

The laboratory investigation covered the ten species of wood shown in the table, which gives the moisture content and specific gravity of the test panels.

Three Panels Tested

Three panels 15/16 inch by 8 inches by 16 inches of each species were tested, except in the case of the mahoganies, for which four panels were used, two of high-density and two of low-density material.

Model 1898 United States Army rifles shooting 30-calibre, 220-grain, steel-jacketed ball cartridges with an initial velocity of 2000 feet per second were used in the test.

In the first series of tests the panels were placed perpendicular to the line of fire, each panel presenting a target 8 inches wide by 16 inches high. Two bullets were fired through each panel from a range of about 35 yards. The result of one of these shots is marked "S" on Fig. 1.

The second series of tests was similar to the first, except that the panels were inclined 45 deg. to the horizontal plane. The result of one of these shots is shown at "F," in the same photograph.

The third series was made with the panels hung vertically, as in the first instance, but revolved 45 deg. about a vertical axis.

Thus there were three angles at which the bullets cut the grain of the wood—at right angles to the grain, 45 deg. with the grain, and 45 deg. across the grain.

The splintering effect of the bullets on leaving the wood, in typical panels of each species, is shown in the illustrations. Fig. 1 shows a bullet hole in a wood with no splitting and small splinters. Fig. 2 shows one in a wood with considerable tendency to split and form long coarse splinters.

Results of moisture content and specific gravity determinations on test panels based on oven-dry weight and oven-dry volume, are shown in the table.

Average for Each Species Tested

Species	Moisture, per ct.	Sp. Gr.
Sitka spruce	10.5	0.41
Black walnut	12.6	0.58
Prima vera	13.3	0.47
Tanguile	15.3	0.59
White oak	15.0	0.69
Yellow birch	12.3	0.66
African mahogany		
High density	11.0	0.56
Low density	10.5	0.42
Central American mahogany		
High density	9.5	0.51
Low density	13.0	0.36
White pine	9.6	0.36
White ash	11.9	0.64

Observations show that the ten species may be divided into two groups—one in which there was very little or no splitting, or in which the splinters formed were short and fibrous; and the other in which the wood showed a de-

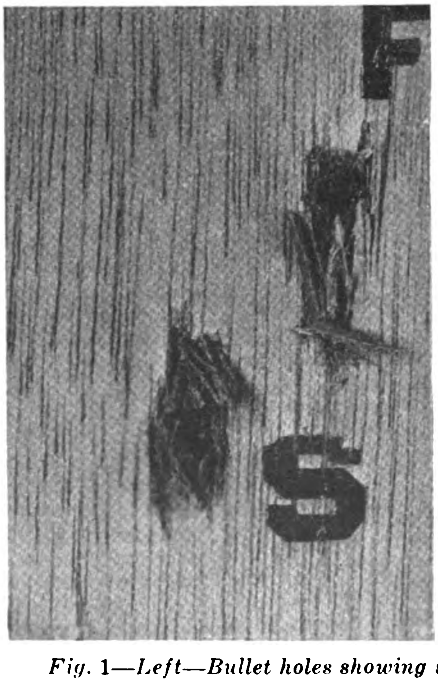


Fig. 1—Left—Bullet holes showing small splinters and no splitting. Fig. 2—Right—Bullet hole showing large splinters and tendency to split S—Line of fire perpendicular to grain; F—Line of fire 45 deg. with the grain

*Engineer in Forest Products, Forest Products Laboratory, U. S. Forest Service, Madison, Wis.

cided tendency to split, or in which relatively long coarse splinters were formed.

The two groups are as follows:

GROUP 1	GROUP 2
Woods with No Splitting Tendency	*Woods with Decided Splitting Tendency*
Tanguile,	Black walnut,
Yellow birch,	Sitka spruce,
Prima vera,	White oak,
White pine,	White ash.
African mahogany,	
Central American mahogany.	

A tendency of the wood to crack or split is indicated on the photographs by a dash under the letter designating the bullet hole.

There was apparently very little difference in the splintering effect due to the change in the angle at which the bullet entered the wood. All the panels had holes of irregular outline, and splinters of various sizes formed on the back surface where the bullets pierced the wood.

The African mahogany panels seemed to offer a greater resistance to splitting than the white oak. The splinters of the latter species were long and coarse, while those of the former were short and fibrous.

There was no apparent difference in the relative resistance to splintering between high and low-density mahogany. No comparison was made between high and low-density specimens of the other species.

Although black walnut was placed in group 2 on account of the tendency to split, the splinters formed were small and the bullet holes were not so large as those of the other species in this group.

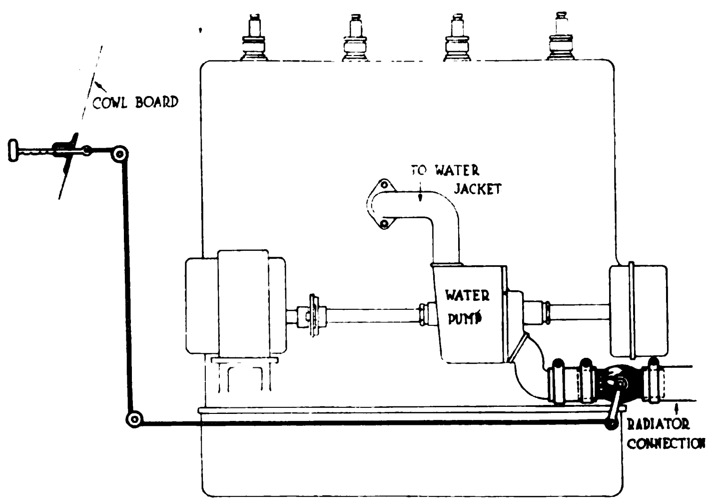
White ash seemed to split the worst and formed large splinters. The largest holes were made in the panels of Sitka spruce, although this species did not seem to split so badly as white oak and white ash.

The "Flocontrol" Cooling Regulator

TO provide an efficient, yet an inexpensive means of controlling the temperature of the engine regardless of the climate or load conditions, the Fulflo Pump Co. of Blanchester, Ohio, manufacturer of the Fulflo water circulating pump for engines and Fulflo lubricant pumps for machine tools and grinding machines, is marketing a new device sold under the trade name Flocontrol.

The Flocontrol enables the driver to regulate the flow of water through the engine and radiator, giving him control of the engine temperature. It is so arranged that the flow can never be completely shut off, a slight circulation being always maintained through the radiator, thereby preventing freezing in cold weather and the possibility of the engine heating too rapidly. The manufacturers argue that on cars equipped with a Motometer the driver has a means of telling when his engine is too hot or too cold, but he has no means of remedying the condition. Installation of a Flocontrol enables him to regulate the flow of water in accordance with the indications of the Motometer.

The Flocontrol is made in several standard sizes, so that it is applicable to any make or model of truck, tractor or passenger car. In order to install the device, it is only necessary to cut a small section out of hose connection between the radiator and the pump and insert the Flocontrol, attach the metal cords and run the cord to and attach it to the dash regulator.



The Flocontrol—diagram of installation

The device is furnished complete, consisting of the valve, regulator, necessary metal cords, eyelet screws and hose bands. It will also be furnished to manufacturers, arranged for direct connection to the water pump intake.

German Engineers in Conference

FOR the first time delegates from all the engineering institutes, trades and schools in all parts of the Empire except the occupied districts met in conference at Eisenbach recently. Among those who attended were the postmaster general, the president of the Württemberg Technical Association, the presidents and delegates of the great mining technical organizations, and representatives of the German Engineers' Association, the Electrical Engineers' Society, various chemical associations, the Society of Architects, the Railway and Postal Technical Officials, etc. The conference is a result of the revolution, which brought to realization the long-entertained plan of a meeting of the entire German technical interests.

The conference proceeded to settle its organization, especially the constitution and by-laws. It recommended that technical knowledge should have some part in all school programs of study, and that in the high schools of other professions some instruction in technical affairs should be given; further, that the people should be made familiar with the working and importance of technical ideas for economy and culture, and technical experts of the necessary personal capability and knowledge should have a greater share than before in the work of public bodies with the powers of full members.

The association will also undertake to further the civil rights of its members and adherents. It has already achieved success, in that among the members of parliament elected since the revolution the number of engineers has increased tenfold. These have been in many cases consulted by the Foreign Office in the consideration of the peace conditions, and their influence is on the increase. The limits of their competence were, however, clearly recognized by the conference, and the statement was applauded that great questions must not be regarded only from the technical standpoint. Great anxiety was evinced over the terms imposed by the Entente for the prolongation of the armistice, and the conference passed a resolution for transmission to the Government and National Assembly in Weimar, pointing out the great dangers of such concessions as the handing over of locomotives and agricultural machines, and asking that such pledges should not be made without previous consultation of the technical experts.

Class B Rules for Tractor Tests

The American Society of Agricultural Engineers Drafts Plan to Make Data Gathered at Field Trials Comparable and of Educational Value to All Branches of Industry

THE American Society of Agricultural Engineers has drafted two sets of tractor demonstration rules. The society is working to bring about uniformity in tractor demonstrations and to make these demonstrations productive of figures that will be of value to both the manufacturer and the user.

In its statement the society says:

"The object of these rules, instructions and data is to make all tractor demonstrations of this kind comparable and of educational value. Any one who has conducted tractor demonstrations in the past has realized the necessity of some standard rules to follow, and those who afterward have referred to the results deplore the lack of uniformity in the demonstrations and the data.

"The value of these demonstrations depends largely upon the accuracy of the data reported on both the conditions and results. The fuel consumption per acre, for instance, is much more interesting when the condition of the soil is known, and this varies so often in the same field that the conditions for each tractor should be carefully considered and specified in the data.

"Fuel tests should not be undertaken unless the work is under the direction of a competent engineer, and preferably representatives of the Agricultural Engineering Department of the State Agricultural College."

The Class B rules, which are printed herewith, are designed to govern State or national demonstrations conducted by manufacturers, distributers, dealers, agricultural institutions and county agricultural agents. The society also has drafted Class A rules, which are designed to govern demonstrations of a more local character. Copies of these rules will be supplied upon request to F. W. Ives, secretary of the American Society of Agricultural Engineers, Ohio State University, Columbus, Ohio. The rules are copyrighted by the society.

Data Sheet for Tractor Tests—Class B

Place of test .... Date ....

TRACTOR DATA

Name and model of tractor .... Serial No.........
Make of plow ....No. of bottoms........
Size .... Type Ben. Purpose ....
Stubble .... Sod........................

FIELD DATA

Kind of soil ....
Condition: Wet..........; Moist..........; Dry..........
Character of land: Level............; Rolling............
Previous crop grown ....

PLOWING DATA

Length of field (headland to headland), ft. ....
Width (edge to edge of furrow, less width of land plowed before test), ft. ....

Note—All lands for economy tests to be within 10 per cent of the same length. (See instructions.)

Average depth of plowing..................................
Total area plowed, acres ....
Total time of plowing.....hr.,.....min. Time out.....min.
Duration of test ......hr. ......min.
Rate of travel .... ft. per min.
Gal. of kerosene used........ Gal. of gasoline used........
Sp. gr. of fuel gas........... Kerosene ....
Water used: Radiator ....; Engine ....
Fuel used per acre:
Gasoline .... Cost of fuel per gal............
Kerosene .... Cost of fuel per gal............
Average drawbar pull, lb. ....
Average drawbar horsepower ....

Drawbar horsepower to be based upon rate of travel during fuel test.

Fuel used per drawbar horsepower hours ....gal.

Rules for Maximum Brake Test

Rules 1 and 2—Governing plowing tests of Class B, apply also to this test.

Rule 3—Time—Each entrant will be given two hours, if necessary, in which to make adjustments and trials before starting the brake test. Duration of brake test will be two hours' continuous running.

Rule 4—Fuel—The same fuel used in plowing test must be used in this.

Rule 5—Speed—The belt pulley should be run within 10 per cent of its rated speed.

Rule 6—Equipment—(a) Prony brakes will be used which will all be of the same design and will be calibrated before the tests. These brakes will be of approved design, water cooled, equipped with a continuous revolution counter and well mounted.

(b) The belts furnished will be 5 and 6-inch rubber belts 80 ft. long, and 7 and 8-inch rubber belts in 100-ft. lengths, and will be furnished by the committee.

Rule 7—Altitude and Temperature—All results will be reduced to a basis of 14.7 lb. barometric pressure. All results will also be corrected to atmospheric temperature of 70 deg. F.

Rule 8—Rating—The rating recommended for the tractor will be based upon the results of this test; 90 per cent of the horsepower developed throughout the test will be the recommended A. S. A. E. rating.

Rule 9—Re-entry—If an entrant is disqualified for any reason, he may apply for another trial. Such request must be made immediately.

Note—Any necessary interpretation of all rules will be made by the committee in charge of the test.

BRAKE DATA

Place of test .... Date...........
Name and model of tractor.............. Serial No.......
Fuel: Gasoline ....; Kerosene.................
Sp. gr. of fuel gas .... Kerosene.................
R.p.m. of belt pulley ....Pulley diameter.......
Pulley Face..........
Brake horsepower sustained ....
A. S. A. E. recommended belt rating (90 per cent of 2-hr. max.) ....
Test Committee—
.... Chairman
.... Brake
.... Data

Rules for Plowing Tests

Rule 1—Assignments—The company's representative should report for assignment to the committee in charge of tests upon the arrival at the ground. (Note instruction 3-B.)

Manufacturers must have tractors ready at the time assigned them or forfeit the privilege to that test.

Rule 2—Entries—(a) Only one tractor of each model of the same make may be entered.

(b) All tractors entered for test to be stock machines as regularly sold.

(c) Each tractor should carry a prominent placard 20 in. in height and 30 in. in width. If other size is used, dimensions should be of similar proportions.

Rule 3—Duration and Time of Test—Duration of all economy plowing tests will be four hours. The time for the tests will be set by the committee and company representative when assignments are made.

Rule 4—Position on Fields—The entrant will draw for his position on the field. The plots will be numbered, and the number drawn entitles the entrant to the plot bearing that number.

Rule 5—The Field—All lands will be of uniform length, and the width will be determined and marked before the test.

The entrant will not be required to finish his land as a part of the test. Special care will be used in selecting the fields for tests that all conditions will be as nearly uniform as possible.

Rule 6—Draft Test—Two preliminary rounds will be made to adjust the outfit. In the third round the average draft will be recorded with a dynamometer, after which the test will start. Following the four-hour run, another dynamometer test will be made, and the average of the two will be taken as the draft during the economy test.

The draft as was shown by the dynamometer will be reduced to the actual resistance in the direction of the line of travel. The angle of the dynamometer unit will be determined with a suitable geniometer.

The drawbar horsepower will be based upon the draft as obtained above and the average rate of travel taken during the plowing period. A dynamometer record should be secured for the complete round.

Rule 7—Fuel—The test should be made only on one fuel. This will eliminate the necessity of including more than one fuel in the final results. The fuel level in the tanks will be measured just before starting the test, and at the end of the test the fuel used will be determined. (See instructions.) The fuels commonly used in the particular locality in which the test is held will be supplied the entrants from one source. The lowest type of fuel available for which the tractor is recommended by the manufacturer should be used in the test.

Rule 8—Water—The water used in the radiators will be measured by the same method as used in measuring the fuel. If water is used in air washer or with fuel, it will be kept separate from the water used in the cooling system.

Rule 9—Travel—The rate of travel should be within 10 per cent of the speed at which the tractor is entered. This speed is to be maintained throughout the test.

Rule 10—Plows—The same plows with the same hitch and adjustments are to be used throughout the test, and no one will be allowed to handle or adjust the plow other than the operator of the outfit.

Rule 11—Depth—The depth is to be checked every 10 rods by the A. S. A. E. (Heylman) depth gage.

Rule 12—Width—The width cut by the plows should be checked at least every other time the depth is taken, and the operator should be made to maintain a uniform width of cut.

Rule 13—Delays—If it is found necessary to stop the tractor due to tractor trouble more than 30 min. in the aggregate the test is annulled.

Rule 14—Re-entry—If an entrant is disqualified for any reason, he may apply for another trial. Such request must be made immediately.

Rule 15—Data—All data will be the property of the individual manufacturers and of the test committee of the A. S. A. E. and it will be made public, unless the manufacturers desire to withdraw the results, and then no part of such data may be issued later. No partial data from any one test may be used as A. S. A. E. data unless the entire results of that particular test are published.

Note—Any breach of rules disqualifies the entrant. Interpretation of all rules and questions not covered by the rules shall be made by the committee in charge of test. (See instructions which cover and form part of these rules.)

Instructions for Conducting Tractor Plowing Tests

1B—Each company should place one man in charge of its interests in the tests who will consult with the test committee for assignments not later than one day before the time of the first test. The time for the tests and position in the field will then be assigned. Entrant must have his machine in the field ready to start the test at the time allotted, or forfeit the privilege to that particular test.

2B—(a) Only one tractor of each model of the same make may be entered for the same test. (b) All tractors entered for the tests must be stock machines as regularly furnished the trade. No special attachments or accessories will be used that are not regularly furnished with the machine. (c) Each tractor should carry a placard giving the following information:

Name .... Rating..........
No. of cylinders .... Bore......... Stroke...........
Normal Engine r.p.m. .... Travel..........M.P.H.
Travel..........M.P.H.
Travel..........M.P.H.
Fuel ....

The rate of travel at which the tractor is entered in the demonstration should be given in bold figures in the upper space; the other speeds, if tractor has more than one speed, in small figures in the lower space.

3B—To get any reliable and comparable data, it is necessary to have the tests of the same length. Experience has demonstrated that short tests are seldom satisfactory and results have little meaning to the practical man, hence tests of four hours are recommended. The time for the tests will be arranged by the company representative and the committee at the time of assignment.

4B—The entrant will draw for his position in the field at the time assignment is made. The plots will be numbered and the number drawn entitles him to the plot bearing that number. Special care will be used in selecting the fields for tests so that all conditions will be as nearly uniform as possible.

5B—The land will be laid out with headlands of sufficient width for turning and all lands will be within 10 per cent of the same length. This is done in order to place all tractors as nearly as possible on the same basis.

Stakes will be set up at both ends to indicate the starting line and the entrant may place as many intermediate stakes as he desires. He will be required to make a straight furrow in starting out and should maintain an even width throughout the test.

6B—Two preliminary rounds will be made to adjust the outfit. The dynamometer will be used the third round and the average draft will be recorded. Following the outfit on the third round, the observer will place at intervals of ten rods small stakes to mark the inner edge of the furrow bottom.

A link of equal length to the dynamometer unit will be placed between the plow hitch and tractor draw bar so the plow adjustment will not be disturbed when the dynamometer is used.

At the end of the third round, the dynamometer will be disconnected, the fuel measured, and the test started. The final

(*Continued on page* 1251)

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, June 5, 1919 No. 23

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
Clyde Jennings, Managing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address - - - Autoland, New York
Long Distance Telephone - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - One Year, $3.00
Canada - - - One Year, 5.00
Foreign Countries - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.
Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.
Member of the Audit Bureau of Circulations.
Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Air Development

EVERY support should be given to the attempt of the Army Air Service to develop aviation in the United States by its proposed plan to establish landing fields in thirty-two important cities reaching from coast to coast.

It is argued that the military authorities cannot have a commercial viewpoint and will build fields chiefly from a military conception, and that this may harm commercial aviation rather than further it; but any steps that will awaken public interest and recognition of commercial aviation are important, and there are no other government departments at this time that can do so much as the Air Service.

The only other department is the Post Office, which has not the power necessary for large development of commercial air routes and which lacks the initiative of the Air Service.

The Air Service probably will establish fields that are not logical for commercial usage, and even in some instances, after awakening public interest and expenditure of public funds, cause some revulsion of feeling by more or less impractical work; but this will be better than to allow aviation completely to revert to its pre-war state and require a long, slow process of evolution.

This matter of the control and regulation of aviation is one that should receive early consideration by the next Congress. There should be a department of aeronautics to control aviation under charge of a cabinet member so that the problems may be handled by one organization, which will make for consistent decisions.

Exchange and Credit

THE American manufacturers who are entering the export business are confronted with many extraordinary conditions. Not the least of these is the credit situation—always a matter for serious consideration in foreign trade.

The present complication of that situation is the high rate of exchange. This is one of the results of the long war period and the general upset of financial conditions. Foreign buyers naturally do not like to pay for their goods at the present rate of exchange. Most of the buyers in other countries feel that the rate of exchange will be adjusted within the year and that when this adjustment is brought about they would be burdened with merchandise paid for under the abnormal rate, which would be an important factor in computing their profits.

Bankers who have followed the exporting trade for years are suggesting that under present circumstances unusual credit extended the reliable firms would be a strong inducement to them to place large orders. If the credit were made 9 months or a year, the customer would feel that the exchange rate adjustment would come within that time and that he were on the same basis as firms that might buy later. This phase of the credit situation is presented without relation to other credit reasons or practices.

A successful exporter of lumber to South American countries was asked some months ago how he had succeeded where so many had failed. He answered: "I have always tried to adjust my collections to low exchange periods. A South American merchant greatly appreciates an extension when exchange is high, and most of my customers shorten their credit period of their own accord if exchange drops to a low figure. Especially is this true since they have learned that I make every effort to adjust my end of the credit to the exchange rate. Before the war my customers were shortening credits about equal to the extensions I granted."

At the time of this conversation the present situation did not obtain, but the practice mentioned was developed merely as a "good business policy." Foreign merchants, especially those in Latin America, respond to such favors.

Tractor Demonstration Rules

THE publishing of tractor demonstration rules by the American Society of Agricultural Engineers, and also the publication of the rules governing the British Tractor Demonstrations for this year, suggest the prime importance of tractor demonstrations which shall furnish data that are of use not only to manufacturers but to the entire tractor industry.

Heretofore American tractor demonstrations have been practically useless and valueless from an educational point of view. The national tractor demonstrations have been mere exhibitions of plowing and tilling.

The agricultural engineers are to be congratulated on drafting what is known as their Class A rules, which are good, but do not go far enough. In some instances these rules check up sufficiently well with the British rules to give them an international significance; but in other respects the British rules are more embracing and will furnish more educative data.

The American and British rules agree in plowing demonstrations extending over a number of hours. The British insist on 5 hours plowing per day, whereas the A. S. A. E. (American Society of Agricultural Engineers) rules call for 4 hours plowing per day. Either is immeasurably superior to 2 and sometimes 3 hours of plowing, as has been the custom heretofore at national demonstrations.

If space is available, there should be plowing from 8 o'clock in the morning until 6 in the evening. This would give a clue as to the strain of the tractor on the operator, which is a very important matter, and one not considered by any existing rules.

The British tractor rules require an observer to attend each tractor throughout its performance and in this respect are superior to the American rules. The object of the observer is not only to secure an indisputable report on the tractor performance and tractor stops, thus providing valuable data, but also to insure fair rulings in every possible way.

The British rules are commendable in that they allow 1 hour for refilling tanks, oiling, and repairing each day. The repairing, if done by the operator, does not result in penalty to the machine, but if outside assistance is needed the tractor is penalized on a man-minute basis, the assumption being that additional help costs the farmer money, and in an official demonstration made for commercial purposes only, such added cost should count against the score of the tractor.

The practice of letting the tractor be taken at night to the headquarters of the manufacturer where it can be repaired, adjusted, or refitted, as necessary, is not permitted under the British rules, the assumption being that the public has a right to be told the entire story of what has had to be done to the tractor during the demonstration. This is sound logic.

It is scarcely ethical to publish a fifty report when it really should be a fifty-fifty one. If we tell the exact performance of the tractor, we should also tell the work that must be done on the tractor during the demonstration to make this performance possible.

Tractor accessibility is not sufficiently recognized in either the American or British rules. Under the British regulations it may come to the surface in that repairs only be made in the 1 hour; and under the American rules, the provision is that the tractor is disqualified if more than 30 min. are needed for tractor troubles during the test. We do not think a 30-min. period is a fair test. No piece of machinery is perfect, and picking out an arbitrary time limit, which, if exceeded, results in disqualification, is a dangerous policy to follow. Why not follow the British policy of penalizing on a man-minute basis?

One commendable feature in the British rules is that limiting the warming up or starting period of the engine for 10 min. The farmer has learned that whether gasoline or kerosene is used in warming up the engine or in plowing, the net result on his pocketbook is the same.

The question of arranging blanket speed rules for plowing, and requiring that a tractor must plow within 10 per cent of its rated speed, is a difficult task. It is one thing to plow at a rated speed on the 320-acre field of Kansas, and another thing to plow at the same speed on hilly ground in Pennsylvania, where there is a goodly proportion of stones.

It will not be possible successfully to use the A. S. A. E. rules in all states in the Union and have the same speed regulations, as demonstrated in many of the tractor trials last year.

The Class B, A. S. A. E. rules as they are officially known, are recommended for demonstrations by manufacturers, distributers, dealers, agricultural institutions, and county agricultural agents. They do not place any time limit on the demonstrations outside of the 4-hour plowing period. It is hoped that the demonstrations will at least occupy 2 days.

Latest News of the

Revised Tax Rulings Issued

Treasury Dept. Makes Changes as Result of Protests of N.A.C.C., N.A.D.A. and Other Associations

WASHINGTON, June 2—As a result of numerous protests from the National Automobile Chamber of Commerce and the National Automobile Dealers' Association and other bodies, the Treasury Department has issued new rulings relating to some of the excise taxes on cars, trucks and parts. The tax on tires, accessories and parts does not apply when sold to the manufacturer or producer of passenger cars, trucks or motorcycles for the sole purpose of being used in their manufacture or for sale as a part of the manufactured product. In all such sales, however, it will be necessary for the purchaser to furnish a certificate showing that the parts or tires will be used as prescribed.

The ruling on chassis, whereby all chassis were classed as passenger cars and taxable at 5 per cent, has been changed, and any chassis with a superstructure that will allow its use as a truck without any substantial additions is regarded as a truck and taxable at 3 per cent. All other chassis, however, remain taxable at 5 per cent.

Under the original regulations a manufacturer, who is also engaged in retail business, was allowed to base his tax on the average monthly wholesale price. Under the new regulations, where it is impracticable to follow this plan, the taxpayer can base his tax on the ordinary regular wholesale price for which like articles were sold in the month previous.

When tires are returned for replacement, due to the fact that they have not traveled the guaranteed number of miles, a tax on the replacement is figured on the actual price of the transaction.

Following is the complete amendment:

EXCHANGES PURSUANT TO GUARANTY.

Where any article taxable under Section 900 is returned to the manufacturer thereof, for adjustment, replacement, or exchange, under a guaranty as to quality or service, and a new article given pursuant to a guaranty, free or at a reduced price, the tax shall be computed on the actual price, if any, to be paid to the manufacturer for the new article.

Article 14 of Regulations No. 47, entitled "Tires, inner tubes, parts, and accessories sold to manufacturer" is hereby modified to read as follows:

"Subdivision (3) Section 900 of the Act exempts from tax sales of tires, inner tubes, parts, or accessories to a manufacturer or producer of automobile trucks, automobile wagons, other automobiles, motorcycles, tires, inner tubes, parts, or accessories. To come within the exemption the sale must be to such a manufacturer for use by him in the manufacture or production of automobile trucks, automobile wagons, other automobiles, motorcycles, tires, inner tubes, parts, or accessories or for sale by him on automobile trucks, automobile wagons, other automobiles, or motorcycles or in connection therewith or with the sale thereof or for free replacement under contract or guaranty. If sold to such a manufacturer for any other purpose, such as resale to a dealer or for the rebuilding of used cars, the sale is taxable. In order for the sale to come within the exemption of the statute, the manufacturer must at the time the goods are shipped or sold (whichever is prior) have in his pos-

(*Continued on page* 1252)

Work on Wills-Lee Plant Starts

Expected to Be in Operation by Fall—Design of New Car to Be Announced Soon

DETROIT, June 3—Work will start at once on the first three units of the automobile plant to be built here by C. Harold Wills and John R. Lee, former Ford executives. The units will each have a length of 1000 ft. Construction plans will be rushed and it is hoped to have a complete plant in operation by fall.

It is expected that the new organization will announce the design of its new car within the next 60 days. Reports are that the machine will sell at between $1,200 and $2,000, and will be a light 6-cylinder machine, embodying many new features in body and engine design. Mr. Wills has been working on the car for several years and he states that experimental machines have been driven as much as 180,000 miles.

It is said that many of the ideas of the Hispano-Suiza car have been adopted by Mr. Wills and that he controls a number of the American patents on the French car. It is also rumored that the new Wills engine is exceptionally light, and that it is air cooled.

The construction of a self-contained factory, as outlined by the promoters, will entail an investment of millions. There are many who believe that Henry Ford is directly interested in the new enterprise, although this is doubtful. Both Wills and Lee have been close to Ford, having left that organization but a few months ago.

In Port Huron it is reported that Wills and Lee have invested $1,000,000 in the 2000-acre factory site. A big portion of this site they have purchased outright and have taken options on the rest of the land, which is located on the St. Clair river three miles below the city.

John R. Lee has purchased a residence in Port Huron and will move there at once to superintend the construction work.

German War Trucks Are Brought Here

Col. Slade of Armistice Commission Has 47 Surrendered Vehicles at Baltimore

NEW YORK CITY, June 2—Lieut. Col. A. J. Slade of New York City, who was a member of the Permanent International Armistice Commission with headquarters at Spa, has returned to America and expects to be discharged within a few weeks. Col. Slade, who, previous to going to France, was in engineering work, was the representative of the A. E. F. Motor Transport Corps on the Armistice Commission. He had to do with making definite arrangements for the handing over of the 5000 German trucks, 1250 of which were turned over to the Americans. These 1250 were placed in parks and over 300 of them immediately put into reconstruction work. All were fitted with steel tires. Col. Slade selected types of the principal makes and had a very complete technical report of them prepared. He has brought 47 of these trucks to America and they are at Baltimore, where they are awaiting complete technical inspection by a committee appointed by the Motor Transport Corps.

Driver's Cab a Feature

In fitting these trucks with steel tires the speeds were cut down to approximately 8 m.p.h. and improvements made in the spring suspension. The use of supplementary spiral springs is very general in them. Many of the trucks are fitted with narrow dual steel tires. A characteristic of these German trucks, and one in which they greatly surpass American trucks, is the cab equipment for the driver. On all makes this is particularly complete.

In general the trucks are of the 4-cylinder type, a few of these using block castings, but the majority with twin castings. Valve-in-the-head construction is used in a few cases. Cone clutches, 4-speed gearboxes, and chain drive are characteristic of practically all. The Germans gave more attention to frame construction than is general in American truck practice. The majority of the frames are bottle-neck pressed-steel designs.

F. W. HENNINGER DIES

DETROIT, June 3—Frederick W. Henninger, 46 years old, president of the Sheet Metal Stamping Co. and vice-president of the Bellevue Mfg. Co., died here Friday morning.

Automotive Industries

Overland Factory Shut After Riots

General Manager Earl, in Statement, Says Union Leaders Promoted Attacks

TOLEDO, OHIO, June 4—Rioting at the Willys-Overland plant last night which resulted in killing of two men and injury to scores of others caused the company to close down to-day, and it will remain closed for an indefinite period. A mob, several thousand strong, attacked loyal workers as they were leaving the factory last night.

Guards fired into the crowd and a fight followed.

Mayor Schreiber of Toledo declares the city is powerless to further protect the factory. He has appealed to Governor Cox for troops and it is expected that Toledo will be placed under martial law.

During the day there were three riots. Early street cars carrying loyal employees to the plant were attacked, windows smashed with bricks and passengers pulled into the street and beaten.

C. A. Earl, first vice-president and general manager of Willys-Overland, ordered the plant closed. Work was resumed a week ago after two weeks of idleness and, until the outburst yesterday, the situation was thought to be well in hand.

In a statement to AUTOMOTIVE INDUSTRIES, Mr. Earl charges union leaders with responsibility for rioting.

His statement follows: "The Overland plant will be closed to-day at the urgent request of the mayor, as a result of rioting. Toledo faces the most critical hour of her history. She is squarely face to face with the question:

"Shall American citizens, residents of Toledo, exercise their constitutional rights to earn an honest living, or shall violent, irresponsible thugs drive thousands of workers from their work, and dominate the city with brutal and murderous intimidation?

"The riots occurred at exits and entrances of the plant and at street car transfer points. Strikers even attacked the office building and its occupants. Last night many were injured and two were killed in an attack made in the home district of our Polish employees.

"These mob attacks have been credited by some newspapers to disorganized men and I. W. W. The public should know that men hiding behind these cowardly attacks on women and old men are leaders in the machinists and other unions, who, by their speeches and advice to the men, have stirred up and created this condition. The blood of the dead and injured men and this disgrace to Toledo are on their heads.

"The condition demands that we must go to the limit in doing what is required to meet the situation."

Gas Warfare Talk at S.A.E. Summer Meet

NEW YORK CITY, June 5—Gas Warfare will be the subject of the Wednesday evening lecture at the summer session of the S. A. E. at Ottawa Beach, June 25. J. Johnston, Professor of Chemistry at Yale University, who has had a great deal to do with the development of gases for war uses, will speak. This, coupled with the lecture on wireless telephony, with demonstrations on Tuesday evening, June 24, gives an importance to the summer sessions that has not been present in former years.

It is very probable that there will be an exhibit of German trucks which have been brought to America by the Motor Transport Corps, and which will be shipped to Ottawa Beach.

Commander J. C. Hunsaker will give an address on the progress of naval aircraft. Another paper added to the program is that by H. Heindlhofer on tests of truck axle and worm bearings.

Total reservations to date are 515.

325,000 TONS OF STEEL FOR G.M.C.

NEW YORK, June 5—The placing of an order for 325,000 tons of steel by General Motors Corp. has been confirmed by Judge Gary, chairman of the United States Steel Corp. This is one of the largest orders placed since the signing of the armistice, and the purchase is for the subsidiary companies of the G.M.C. The exact tonnage of various kinds of steel has not been announced. It is understood that the stabilization prices govern the sale.

It is said that Willys-Overland, Inc., has placed a large order for steel.

MAXWELL-CHALMERS PLANS

NEW YORK, June 5—A meeting was scheduled for to-day at which final details of the Maxwell-Chalmers merger plan were to be worked out, preliminary to the making of an announcement as to what these plans are. The postponement of the meeting will, however, delay the announcement, which it is now expected will be made within the next week.

WHITING OF BUICK IS DEAD

FLINT, June 3—J. H. Whiting, who brought the Buick Motor Car Co. to Flint, 16 years ago, died Monday morning in New York City.

1920 Show Dates Fixed by N.A.C.C.

New York Exhibit Jan. 3-10—Chicago, Jan. 24-31—Truck Shows Same Dates

NEW YORK, June 5—The New York Automobile Show will be held Jan. 3-10, 1920, in the Grand Central Palace. The Chicago show will be held Jan. 24-31 in the Coliseum.

Truck shows will be held in both cities on the same dates. The place of the New York show has not been decided upon, but the Chicago show will be held in the Drexel Pavilion, in the stockyard section. S. A. Miles will again be manager of both shows.

These dates were decided upon by the directors of the National Automobile Chamber of Commerce yesterday. The members of the N. A. C. C. met to-day and will decide upon details concerning the shows. C. C. Hanch, who has recently returned from Europe, addressed the members.

An export managers convention will be held to-morrow.

GAS ENGINE ASSN. MEETING

CHICAGO, June 3—The National Gas Engine Association, at to-day's session, adopted the new constitution permitting of sectional organization.

The following officers were elected for the ensuing year: President, L. A. Ward, Cushman Motor Co., Lincoln, Neb.; first vice-president, T. C. Menges, Associated Manufacturers Co., Waterloo, Iowa; second vice-president, Henry Kennedy, Lally Electric Light Corp., Detroit. The executive committee is composed of J. F. Richards, Alamo Farm Light Co., Hillsdale, Mich.; F. E. McKee, Manning, Maxwell & Moore, New York City; George Cormack, H. C. Dorman Co., Oshkosh, Wis., and the presidents of subsidiary sections, who automatically become members of the executive committee. H. R. Brate, secretary of the association for a number of years, handed in his resignation. The subsidiary sections will report on their organization later.

TRUCK AUCTION DELAYED

WASHINGTON, June 3—The War Department announces that delays incident to the inventorying of its stock of surplus motor equipment which has been found to be unsuitable for Government use, will necessitate a postponement until after June 15 of the public auctions of used passenger and commercial cars, which had been announced for June 1.

Michigan-Ohio Output Hit by Strikes

May Daily Production Fell 396 Cars Below April — Labor Trouble Responsible

DETROIT, June 2—Daily car production figures for Michigan and Ohio during the month of May follow:

Car	April	May
Buick	500	500
Briscoe	75	75
Barley	10	10
Cadillac	100	80
Chalmers	80	80
Chandler	60	70
Chevrolet	700	726
Columbia	18	20
Dodge	500	500
Dort	100	100
Ford	3000	3000
Harroun	15	15
Hudson	100	100
Hupp	75	60
King	10	10
Liberty	30	30
Maxwell	250	250
Olympian	10	12
Oldsmobile	140	150
Overland	600	200
Packard	25	25
Paige	70	75
Paterson	15	15
Jordan	12	15
Reo	125	125
Saxon	50	35
Scripps-Booth	45	50
Studebaker	200	150
Winton	10	10
Essex	100	100
Grant	50	50
	7084	6688

Car production in Michigan and Ohio during May was hard hit by labor trouble, statistics revealing a falling off in the daily production of many factories. During the month daily production averaged 6688 cars as compared with 7084 produced daily during April. Strikes in the plants of parts makers were largely responsible for the subnormal production, although in the cases of Willys-Overland and Studebaker No. 3 factory, Detroit, the strikers effectively tied up manufacturing work.

Saxon and Hupp Also Affected

Saxon, Hupp and others were hit by the Wilson Body Co. strike, which curtailed the supply of bodies. The walkout at Timken-Detroit Axle Co. hampered Cadillac and one or two other companies, and the Salisbury Wheel & Axle Co., Inc., strike at Jamestown, N. Y., if it develops seriously, is threatening Paige production. The Willys-Overland Co., which was running 600 cars daily at the time of its strike, has not produced a car in three weeks. Studebaker production was affected by a walkout, but to just what extent is not known at this time.

All of the car makers are oversold, some of the companies, as the Jordan Co., Cleveland, having sold its entire production for the next eight months.

75 PAIGES A DAY

DETROIT, June 2—May production at the Paige-Detroit Motor Car Co. averaged approximately 75 cars daily. The high mark was 110 machines in one day and the low mark 40 completed cars. The plant's normal capacity is 100 machines daily, but this figure will not be reached before August. The company has orders for five times more cars than can be produced.

JORDAN MAKES 15 A DAY

CLEVELAND, June 2—The Jordan Motor Car Co. has run up its production to 15 cars daily, with its entire output for the next eight months sold in advance. The company will produce 4000 cars this year and hopes to have its new factory in operation by July 15. Work on the new plant is now under way.

1020 SCRIPPS-BOOTHS IN APRIL

DETROIT, June 2—The Scripps-Booth Motor Car Co. produced 1020 cars last month, working on a basis of 22 days to the month.

500 BUICKS A DAY

FLINT, MICH., May 28—The Buick Motor Co. is not yet back in normal production. The plant is turning out between 450 and 500 cars daily. While some difficulty has been experienced in getting certain parts, this situation is rapidly clearing up.

ROAMER ORDERS

KALAMAZOO, MICH., June 2—The Barley Motor Car Co., maker of the Roamer, is 500 orders ahead of production. The company is running between 6 and 10 cars daily, but is having some trouble getting a steady supply of bodies. The plant is now employing approximately 200 men.

15 OLYMPIANS DAILY

PONTIAC, MICH., June 3—The Olympian Motor Car Co. is producing 12 cars daily and is preparing to increase this production to 15 cars at once.

FEDERAL TRUCK PRODUCTION

DETROIT, June 2—The Federal Motor Truck Co. is running 20 trucks daily and has business on its books in excess of production.

AUTO BODY SCHEDULE

LANSING, MICH., June 2—The Auto Body Co. has just closed contracts for new business, which with other orders on hand, will fill the working schedule for more than 6 months. Orders are from the Olds Motor Works, the Reo Motor Car Co., Briscoe Motor Corp. and the Auburn Automobile Co.

Fewer Strikes in the Detroit Field

Nearly All Trouble Cleared Up and Men Back at Work—Ford Plants Threatened with Walkout

DETROIT, May 31—Automotive labor difficulties in Detroit are clearing away. The number of strikes is much reduced, the only ones being among tailors, butchers, box makers, etc.

The Liberty Starter Co.'s trouble is being rapidly eliminated. Of 700 men who originally walked out of this plant, 50 per cent are now back on the job.

The Timken-Detroit Axle Co. has several hundred men out. Several departments have been effectively closed. The company is operating, although its production has been greatly curtailed.

Malleable Iron at Standstill

The Michigan Malleable Iron Works and moulders are still in deadlock. Approximately 150 men are idle and the company is unable to get into production.

The Wadsworth Mfg. Co. is operating in spite of the strike which has been on there for 3 weeks. The output of Ford sedan bodies has been badly cut, but the new $6 minimum wage scale inaugurated by Wadsworth has proved an inducement which has brought hundreds of the striking employees back. This plant is still being picketed by the union, which claims that nearly 1000 men are still out.

The strike at the Aluminum Castings Co. has dwindled down to a minor affair. There are less than 200 men out, and dozens are returning daily.

The Commonwealth Brass Co. is closed tight because of a strike. Approximately 200 men are out.

The L. A. Young Industries Co. has about reached an agreement with its workers, 800 of whom quit their jobs 2 weeks ago. Nearly one-half of the strikers are back and others are returning daily.

Union Threatens Ford Plants

The United Automobile Vehicle and Aircraft Workers of America, which called the strike at the Wadsworth plant, are bending every effort to bring about a general walkout at the Ford Motor Co. and Fordson tractor plants. When the Wadsworth plant was closed by the strike Ford rushed hundreds of his men into that establishment to prevent the stopping of his supply of sedan bodies. These men were brought in under guard on army motor trucks. With the assistance of Ford, Wadsworth has been able to keep up a fair production, much to the chagrin of the outlaw union.

The Studebaker Corp. had a walkout at the No. 3 Detroit plant yesterday, several hundred men quitting. The trouble resulted from the expulsion of four foremen. The men now refuse to return to their jobs unless granted a substantial wage increase and shorter hours.

Novel Conditions for British Tractor Trials in September

Each Machine Will Be Rated by Dynamometer Before Listed for Entry at Society of Motor Manufacturers and Traders, Ltd.—Plowing Tests at Lincoln

LONDON, May 15—British tractor trials will be held at Lincoln, England, during September, 1919, by the Society of Motor Manufacturers and Traders, Ltd., which is the national automobile organization of Great Britain. It was expected that the Royal Agricultural Society of England would hold tractor demonstrations this year, but this society seemed to think that 18 months were necessary for the tractor manufacturers to recuperate from the war, and it will not hold tractor demonstrations until the fall of 1920.

The trials to be held next September are typically British in their searching character. They are not to be merely a demonstration, but will be a thorough test of the machine as well. For example, on the first day there will be plowing on heavy soil from 10 a.m. to 5 p.m., with an hour interval at lunch. On the second day there will be a similar program of plowing on light soil. On the third day there will be 2 hours plowing in the morning and 3 hours of cultivating land previously plowed in the afternoon.

Previous to the plowing, there will be a draw-bar dynamometer test for the purpose of guiding the entrants as to how many plows they can handle and also to ascertain the pulling capacity of the tractor. The tractors will be fitted with a recording dynamometer and readings taken at a speed of 2.5 m.p.h.

The total gear ratio on each gear, the driving wheel diameter in the case of wheeled vehicles, or the pitch diameter and pitch of the track sprockets in case of a track or creeper type machine must be declared and marked on the sign carried on the tractor.

During the plowing work an observer will accompany each machine and completely report on everything connected with its work.

At the end of each day the tractors will be parked, but no repairs, renewals, or adjustments will be made on them during the night, except by special arrangement with the judges. Any necessary adjustments must be made during the period of one hour immediately previous to the start of work in the morning.

Only 10 minutes will be allowed for warming up engines before the plowing starts. In case of steam tractors 30 minutes is allowed.

The judges of the trials will take into consideration the following factors in making their awards on the machines:

a—Weight of machine in full working order with spuds
b—Weight per sq. ft. on front and back wheels separately in the case of a wheeled machine, or with per sq. ft. of track in contact with the ground for a track machine, in each case calculated on a sinkage of 1 in. only
c—Cost of fuel and lubricating oils per acre, in proportion to the draw-bar pull
d—Water evaporated per acre
e—Ease of handling, including starting time and turning at headlands
f—Reliability (freedom from mechanical troubles)
g—Capital cost in relation to draw-bar pull in lbs.
h—Mechanical construction, having special regard to simplicity and access to wearing parts.
i—Safety of operation.
k—Number of attendants
l—Suitability for haulage and threshing purposes as shown by construction
m—Efficiency of adhesion
n—Working cost per acre
o—Capacity in acres per day of 8 hr.

Implements will be judged on the basis of:

a—Construction and operation
b—Adaptability for different widths and depths of plowing or cultivating
c—Quality of work done

It is the spirit of the rules that during the hour given each morning for refilling with fuel and making necessary repairs, that the operator or operators are the only ones who can work on the machine without penalty. If further assistance is required, the tractor on which such work is done will be penalized by recording the number of man-minutes for assistants so employed.

One grade each of gasoline, benzol and kerosene will be furnished. No cooling medium other than water is permitted.

Entries may be made by the British importer or the American manufacturer. Many entries have already been received and more than 50 different makes are expected.

Although the performance of implements is to be judged, entries of implements are not being taken. Plow and other implement manufacturers should get in touch with tractor makers if they wish their implements represented.

COALITION MEETING

NEW YORK, June 3—The Material Handling Machinery Manufacturers Association will hold a coalition meeting of all manufacturers of mechanical handling machinery and equipment and accessories in the United States, at the Hotel Astor, June 11, morning, afternoon and evening. This includes all manufacturers of cranes, winches and hoists; elevators; gravity and power conveying machinery and apparatus; industrial trucks, tractors and trailers; bulk handling machinery; and all makers of equipment and accessories such as storage batteries, bearings, ropes for hoists, buckets, electric controllers and apparatus, etc. Advertising managers of companies manufacturing these products will hold a preliminary conference at the Hotel Astor, June 10, at 8 p. m., at which time it is planned to form an advertising council of the M. H. M. M.

Among the speakers for the day meeting are: James H. Collins, special writer of business articles, and Francis Holley, director of the Bureau of Commercial Economics. A general Forum discussion will be conducted in the afternoon and a mass meeting is planned for the evening, at which addresses will be made by Hon. Theodore Burton, former U. S. Senator, and Murray Hulbert, Commissioner of Docks, New York.

GOODRICH INCREASES MILEAGE

NEW YORK, June 2—The B. F. Goodrich Rubber Co. has revised its adjustment schedules on both fabric and cord tires. Effective at once, fabric tires are to be guaranteed 6000 miles instead of 3500, and cord tires 8000 instead of 5000 miles. Goodrich tires already in the hands of purchasers, no matter when they were purchased, will be adjusted under the new mileage guarantee.

DECREASE IN AIR TRAINING

WASHINGTON, June 2—A decrease in the number of hours flown at training fields in this country is shown in a report by the Air Service. A total of 10,135 hours were flown in the week ended May 15, 1919, as compared with 23,943 for the week ended Nov. 11, 1918. The total attendance at training schools has decreased from 5099 on Nov. 11, 1918, to 294 on May 15, 1919.

The flying fatality rate has increased since the signing of the armistice. The rate now is one fatality to every 1467 hours flown as against one to every 3149 prioi to the armistice.

The table shows the attendance at training schools and fatality rate.

Attendance	Elementary Schools	Advanced Schools.	Total
Nov. 11	2,423	2,676	5099
May 15	276	18	294
Graduations			
Nov. 11	208	96	304
May 15	155	..	155
Hours Flown at Flying Fields			**Hours Flown**
Week ended Nov. 11			23,493
Week ended May 15			10.135
Period		**Fatalities**	**Hours Flown per Fatality**
June 1 to Nov. 11		156	3,149
Nov. 11 to May 1		71	1,467

The serious accident rate (exclusive of fatalities) reflects a similar tendency.

Period	Serious Accidents	Hours Flown per Serious Accident
June 1 to Nov. 11	169	2,907
Nov. 11 to May 1	71	1,467

Citroen Stirs Up French Industry

Announcement of Low-Priced Car Perturbs Other Manufacturers —His Successful Advertising

PARIS, FRANCE, May 5—Automobile France is still perturbed over the activities of André Citroen, the automobile manufacturer, who, following the war, announced the turning over of his enormous munitions factory in Paris to the manufacture of a cheap car, of which he prepared to produce 100 per day.

The Citroen car, described some time ago in AUTOMOTIVE INDUSTRIES, is the nearest approach of any French manufacturer to a Ford, but the Citroen does not quite measure up to Ford capacity. It is a satisfactory light car for two passengers, but general sentiment is that it is not suitable as a 4-seated car.

There is no denying the fact that Citroen has had a very marked influence on the automobile industry in France. One example is that of advertising. Up to the time of the war, French car manufacturers did not understand the elements of advertising. The little money they expended was practically wasted, and some of the largest firms placed their advertising in the hands of men who were no better qualified than stenographers in advertising experience.

When Citroen came out with his large advertising program he got away from the narrow old French view of advertising. This advertising made a strong appeal and Citroen has been able to get in heavy deposits at the rate of 1000 francs or $250 per car. This is a particularly heavy deposit, when the reported profit that a dealer makes from the sale of a car is 650 francs or $130.

The French automobile industry, which must be looked upon as a very close body, resented Citroen's activities. The old firms were thoroughly stirred up by his activities. The reports that Citroen was not given space at the Lyons Fair can scarcely be credited, as his name appeared on the official list. He did not exhibit in one of the Fair spaces, however, but secured a corner store immediately opposite to the automobile section of the Fair. His exhibit was always well attended, as were practically all of the other car exhibits.

TRUST CONTROL IN ENGLAND

LONDON, May 16—The Committee on Trusts, appointed by the British Minister of Reconstruction in February, 1918, has prepared its report on the action it considers necessary in view of the probable growth of trade organizations and combinations. The report has not yet been published, but the American Chamber of Commerce in London understands that the chief recommendation is that the Board of Trade should establish tribunals for investigating the operations of monopolies, combines and trusts, and then report to the government for action to remedy any abuse. All members of the committee are believed to have signed the report, but three members have submitted an addendum expressing the opinion that the recommendations are insufficient.

Their view is that capitalistic combination influences the price of practically every commodity sold to the public. They recommend, therefore, that the Board of Trade should establish a Trusts and Combinations Department to draw up a program to protect the community against the evils of monopolies and to secure economic benefits resulting from better industrial organization.

British Import Rules Penalize the Consumer

LONDON, ENGLAND, May 13—The prospects are that the duty on automobiles imported into England after Sept. 1, 1919, will remain at 33⅓ per cent, and that restriction of imports such as exist to-day will be entirely removed. Nothing definite on this will be known until after Aug. 1. In the meantime the British situation is unsatisfactory to practically everyone. There are almost no deliveries of British cars and consequently the consumer is penalized, and the British dealers, no longer having their various forms of war work, are worse off financially to-day than they were during the war. The new preferential tariff will permit import of Canadian cars at 22 per cent after Sept. 1, 1919.

British manufacturers have been amazingly slow in getting into production, and many of the biggest firms have not yet delivered a single car to the public, and in some cases they have not delivered a demonstrating car to their dealers.

The rationing scheme for British importers whereby they obtain from April 1 to Sept. 1 50 per cent of the 1913 imports is not proving satisfactory. This scheme is generally considered unfair, because the government did not take the pre-war year, that is the 12 months ending July 31, 1914, but the earlier period, namely, the calendar year of 1913. There was no apparent reason for this action except that it enabled the government to handicap the importer a little more and restrict his activities.

The Olympia Motor Show in November is going to mark the real start of the British industry after the war. There will also be a Scottish national show at Glasgow in January, 1920. Add to this the tractor trials to be held in September, and the exhibition of commercial vehicles in the spring of 1920, and also the aero exposition in the spring of 1920, and you have enough indications that beginning with Nov. 1 the British should be fairly well under way.

CHANDLER INCREASES DIVIDEND

CLEVELAND, June 3—The Chandler Motor Car Co. will increase its dividend from $12 to $16 per share per annum, and has declared a regular $4 quarterly dividend.

New Zealand Dealer on Foreign Situation

Clarkson Gives European Car Makers Two Years to Get Back to Normal—Demand Heavy

NEW YORK, June 2—J. B. Clarkson, one of the largest operators in motor cars, accessories, and motor apparatus in general, in New Zealand, arrived in America last week on his annual visit. Mr. Clarkson came from England, where he spent much time studying the industry. He is of the opinion that it will be at least two years before the European automobile organization is at its full 100 per cent effort.

The delay of European organizations getting into full production is, according to Mr. Clarkson, largely the result of the 4½ years of war. The reaction has made itself felt for many months and is still making its impression. The factory workers thought of nothing but the war from 1914 up to Armistice Day, just as the troops did, and there is a spirit of unrest that will not disappear for some time.

Mr. Clarkson is one of the directors and handles De Dion cars in practically all parts of the world outside of France and America. There are probabilities that the manufacture of De Dion cars will be taken up outside of France.

The car demand in New Zealand is found to be exceptionally heavy because the country has not been obtaining all the cars necessary during the war, and much money has been made from wool, meats, dairy products, etc.

The New Zealand business is entirely independent and not connected with Australia, as is so often imagined. New Zealand approximates 1000 miles, or a 5-day boat trip from Australia. Wellington, in the North Island, and Christchurch, in the South Island, are the major distributing centers, and Mr. Clarkson has large interests in both cities.

TIRES FOR GREAT BRITAIN

WASHINGTON, May 31—Rubber tires can now be exported to Great Britain on a basis of 50 per cent of the 1913 importations. The shipments will be rationed by the British government.

F. W. D. IN CANADA

CLINTONVILLE, WIS., June 2—J. D. Cotton will be president of the new corporation just formed to take care of the F. W. D. truck production in Canada as a branch of the Four Wheel Drive Auto Co. of this city. Henry Nyberg is vice-president and sales manager; Archie Kerr is secretary, and W. G. Cleghorn treasurer. The officers, with E. C. Kahel, W. T. Barrie and H. J. Sims, form the board of directors. Of the $200,000 capitalization, $100,000 of the stock is held by the Wisconsin company.

A site is to be selected and building operations commenced immediately on a structure 200 x 120 ft.

"Sufficient Fast Ships" Is Hurley's Promise to Pan-American Conference

Chairman of Shipping Board Says New York-Buenos Aires Time Will Be Cut from 24 to 15 Days—Other Speakers Tell of Use to Be Made of Capital

WASHINGTON, June 4—It is necessary for the stability of the trade in South and Central America to send not only salesmen but American intelligence and American capital into every Latin American country. Traveling salesmanship, as practiced in the past, will not suffice.

This will mean a complete revolution in the present and past methods of our doing business, but it will also mean a stable and permanent prosperous trade between the United States and its sister republics on the American continents. These principles are the keynotes of the discussions at the Pan-American conference which is being held here this week.

Every speaker from the Latin American countries dwelt upon the need of the investment of American capital and American intelligence in these countries, and Secretary of Commerce Redfield pointed out specifically, and in great detail, that American manufacturers must prepare for this permanent method of establishing trade if they went to maintain and develop the foothold gained in the last 4 years.

America has in 4 years become a creditor nation. Four years ago it was obliged to use the ships, insurance companies and banking facilities of its European competitors. It was a debtor nation. To-day it has ships, banking facilities, trade news sources, and has become the creditor nation of the world. It need no longer gain its trade news through competitors and allow them the opportunity of using the information thus acquired. Its financial turn from a nation with debts totaling $5,000,000,000 to a nation with credits of more than $12,000,000,000 has created a different situation which calls for different methods of foreign trade.

Brazil, which exported $119,000,000 worth of wool to the United States in 1918, has exported but $8,000,000 worth in the first 4 months of 1919; $22,000,000 worth of hides exported in 1918 has decreased to $4,000,000 in the first 4 months of 1919. This indicates that the trade between Latin America and the United States which, in 1918, was exports from the United States amounting to $685,941,239 and imports from South America to the United States totaling $1,105,274,492, will this year result in a reverse balance and means that Latin America will not have the cash to pay for her merchandise. This means further that if we increase the trade balance unfavorably to the Latin American countries by increasing shipments from this country, we must find some method by which Latin America can pay its bills. And, stated Secretary Redfield and all of the representatives of the Latin-American countries, the only way by which payment can be made will be through the investment of American capital in South America in the construction of highways, railroads, factories, petroleum industries and the purchase of Latin American securities.

By this means American commerce will secure three-fold results:

1—It will have a direct return to the United States of profits accruing from the investments.

2—It will have a flow of foreign trade to the United States as the result of the increased prosperity created in the Latin American countries by American capital.

3—It will have a development of wealth in Latin America which in turn will increase the buying power per capita in those countries.

Similarly the investment of American capital in Central and South America will mean to the Latin American countries the development of new lands, of new resources, the discovery of new riches, efficient economic organization and the employment of labor.

In making their investments, however, American manufacturers were urged by the Latin American speakers and Secretary Redfield to devote their capital honestly.

"There must come into our mutual trade," said the Secretary, "the spirit of service. Unless we serve you we shall fail; unless you serve us you will fail. The United States is now suffering from an overdose of prosperity. We have a huge reserve of gold behind our currency and in every element of economic power stand at the very height of prosperity.

"Because we are creditors on an enormous scale we must help those who owe to pay us what they owe and out of this problem comes the constructive type of foreign trade which offers the only solution to it. Our constructive service calls on us to let this capital flow out into the world for the world's enrichment. There will come inevitably to the United States rewards from such use of its wealth abroad. There will come, I hope, to the lands in which that wealth is used far greater rewards than can come to us."

Assurance that a fast and sufficient merchant marine will ply between the North and South American continents was given by Edward N. Hurley, Chairman of the United States Shipping Board. His statement, which is regarded as highly important because shipping transportation is considered of almost as equal importance as financial investment abroad, met with considerable applause.

Mr. Hurley stated that 226 ships of 863,000 deadweight tons have already been allocated to Latin American trade and the Shipping Board is now surveying the situation to establish regular American lines to ply between all the important ports of North and South America. The plans call for two lines from New York to serve the West Indies, a line from Valparaiso and other western ports to Mobile or New Orleans, a line of service between Valparaiso and Seattle, New York and Rio de Janeiro and other similar systems.

Ships will be used capable of 23½ knots per hr. which, stated Mr. Hurley, will reduce, for example, the time between Buenos Aires and New York from 24 days to 15 days. This will have an important effect upon first-class and parcel post mail and upon capital or business.

Development of the parcel post arrangements was urged by Otto Praeger, Second Assistant Postmaster General.

Individual representatives of the various Latin American countries told of the desire of continued and increased commerce with the United States. Statistics were quoted to show the increase in business in the past few years, one of the most astonishing reports being that on Cuba, which, with a population of slightly more than 2,000,000, had a foreign trade of $680,000,000.

3-LITER LIMIT FOR FUTURE RACES

(*Continued from page* 1207)

plies to the Detroit Special, which had leaky water connections.

It is quite apparent that Ralph De Palma and Louis Chevrolet would have been further up in front toward the end and would probably have given each other and the winners a breathless contest for first honors if they had dodged their troubles. In fact, both of these drivers made major repairs on their cars during the race and yet finished well up in the money. Louis Chevrolet had to stop seven times. These cars did not possess sufficiently strong axles to withstand the great acceleration made possible by the powerful engines. A broken steering knuckle on one of the cars, a broken right rear hub on another, and a left rear wheel coming off, and a third, because of failure of the aluminum shell construction in the rear axle, tell the story of the Frontenac in the race. It was only by exceptional driving that the Chevrolets were able to finish with two of their Frontenac cars.

NO TAX REPEALS NOW

WASHINGTON, June 3—The possibilities of a repeal of the taxes on motor trucks, which have been considered likely by the industry, do not appear favorable at present. Congress apparently is opposed to the repeal of any taxes and is even objecting to the repeal of the soda water tax, which it is said by many to be very unjust.

Men of the Industry

Changes in Personnel and Position

BROWNE OAKLAND MANAGER

NEW YORK, May 31—Charles M. Browne, president of the Automobile Dealers' Association, Inc., of New York City, and for the past 10 or 11 years manager of the New York branch of the Winton Co., has severed his connection with Winton. On June 1 he becomes manager in New York for the Oakland Motor Car Co., which will convert its dealership into a factory branch. Mr. Browne first became connected with the Winton company in 1905 in that company's Chicago branch. After half a year there he was sent to San Francisco to open a branch on the Pacific Coast and a year later came to New York.

He is succeeded by H. J. C. Miller, who has been his assistant.

Coincident with the change, the Oakland business, which has been handled by the Sidney A. Bowman Co. since 1913, will be removed to the C. T. Silver building. The contract between the Oakland company and the Bowman company does not expire until July 1. The Bowman company has not yet made public its plans for the future.

Birger Jacobsson, manager of the Scandinavian division of J. B. Crockett Co. and the Clyde Cars Co., is in the United States for a short stay and will return to his territory soon.

A. H. Savage has been appointed sales representative of the Roller-Smith Co., New York, for Minnesota, North Dakota and part of Wisconsin and South Dakota, with headquarters in the Pioneer Building, St. Paul. Prior to 1914, Mr. Savage represented the Ft. Wayne Electric Works, and since 1914 has been representative in St. Paul of the Wagner Electric Manufacturing Co., St. Louis.

F. W. Marshner has been appointed manager of the Detroit branch of the New Departure Manufacturing Co., Bristol, Conn., succeeding the late Samuel B. Dusinberre. He has been in the Detroit office of the company for nearly seven years.

John R. Marchant, son of George F. Marchant, president of the Geo. F. Marchant Co., Chicago, and himself a member of the firm, was killed in action in France on Oct. 11, 1918, fighting as first lieutenant in the 131st Infantry of the A. E. F.

L. B. Fijux has been appointed Detroit district representative of the automobile equipment department of the Westinghouse Electric & Manufacturing Co., with an office in the Kresge Building. T. G. Haugh will assist him. Mr. Fijux was assistant manager of the Willard Storage Battery Co. for six years and manager of the Detroit office of the Bijur Motor Appliance Co. for five years. He succeeds W. A. Haines, who died last February.

Bernard M. Robinson has recently been appointed resident counsel and head of the legal department of the Firestone Tire & Rubber Co., Akron, taking over the duties of Mr. Hamill, who has been appointed secretary to President Harvey S. Firestone.

ARMLEDER ADDS SALESMEN

CINCINNATI, June 2—W. D. Thompson, formerly wholesale manager of the Lexington Colorado Auto Co., has joined the sales force of the O. Armleder Co. as western representative with headquarters in Denver. Jack Parker, with the Oldsmobile organization for the past five years, is also connected with the Armleder concern, and Charles F. Ward, Providence, R. I., is covering Massachusetts and Connecticut for the company. C. B. Harvey will have charge of the Middle West with headquarters at Chicago.

FRIEDE JOINS HAYNES

KOKOMO, IND., June 4—Julian S. Friede, recently released from the British Royal Flying Corps, has joined the engineering staff of the Haynes Automobile Co. Previous to his aviation service he was on the engineering staff of the Paige Detroit Motor Co.

Frank R. Boyd has resigned as assistant treasurer of the Oakland Motor Car Co., Pontiac, and will devote his time to personal affairs.

M. V. Smith has been made general superintendent of the Supreme Motors Corp., Warren, O. He was production manager of the Essex engine at the Hudson Motor Car Co. plant, Detroit.

W. S. Stevenson, general sales manager of the Bethlehem Motors Corp., Allentown, Pa., since its organization, has resigned on account of ill health.

Roy S. Davey succeeds W. S. Stevenson, who recently resigned as general sales manager of the Bethlehem Motors Corp., Allentown, Pa. Mr. Davey was formerly on the sales staff of the Chandler Automobile Co. and of the Packard Co. He has been with the Bethlehem Motors since its organization. Mr. Clay will succeed Mr. Davey as assistant general sales manager in charge of sales promotion.

Charles A. Greene, Chicago representative of the Borden Co., Warren, O., has opened an office for the company in Room 501, 549 West Washington Boulevard.

Edward A. Hefferman, recently returned from naval aviation service, will have charge of the office of the Ahlberg Bearing Co., recently opened in the City Bank Building, Kansas City, Mo.

C. E. MacTavish, who has been manager of the Chevrolet Motor Co. branch at Regina, Sask., has been transferred to the head office at Oshawa, Ont.

E. T. Causer has recently resigned as works manager of the R. D. Nuttall Co., Pittsburgh.

STANDARD PARTS VICE-PRESIDENTS

CLEVELAND, June 2—Dan C. Swander and John G. Utz have been elected vice-presidents of the Standard Parts Co. Mr. Swander will continue as supervisor of sales and Mr. Utz as supervisor of engineering. Both men have been with the company since its organization. Mr. Utz was formerly director of engineering of the Perfection Spring Co. Mr. Swander previously was eastern sales manager of the Firestone Tire & Rubber Co.

C. H. Bassett, Detroit, has been appointed a southern district sales representative by the Fulton Motor Truck Co., Farmingdale, L. I. He was formerly with the Studebaker Corp. and the Elgin Motor Car Corp. and was a dealer and distributer at Jacksonville, Fla.

George W. Brooks has been appointed representative of the Hudson Motor Specialties Co. for Texas, New Mexico, Oklahoma, Kansas and Arkansas.

Major Howard Blood, connected with the airplane experimental station at Dayton during the war, has been appointed general manager of the plants of the General Motors Co. at Walkerville, Ont. Two plants are now being built for manufacture of engines and axles.

Stephen A. Douglas, Detroit Section S. A. E., has been appointed chairman of the committee on activities at the annual mid-summer meeting at Ottawa Beach in June.

M. B. Hoagland has been appointed director of sales of the Signal Motor Truck Co., Detroit. He was with the American Steel & Wire Co. for 17 years.

J. Gordon has been appointed middle western sales representative of L. V. Flecher & Co., New York City.

UNIVERSAL TOOL SALESMEN

DETROIT, June 3—The Universal Tool Co. has appointed A. E. Hrobskey to cover New York and the New England states, with an office in New York. C. E. Hinckley will cover Pennsylvania, New Jersey, Maryland and Delaware, with headquarters at the York, Pa., factory. J. E. Nebrick will cover Ohio, Michigan and Indiana, with headquarters at the Detroit office. Merritt Campbell will cover Illinois, Missouri and Iowa, working from the Indianapolis office. Beginning June 1, the main office of the company will be in the McKerchey Building, Detroit. In the last few months the company has opened factories in Detroit and Windsor, Ont., in addition to the plant in York, Pa.

EMPIRE AXLE REORGANIZED

DUNKIRK, June 2—The Empire Axle Co. has been reorganized with a capital of $400,000, as a subsidiary of the Watson Corp., Canastota, N. Y., with the following officers: President and assistant treasurer, O. F. Hakes; vice-president, chief engineer and assistant secretary, E. de H. Caldwell; sales and advertising manager, R. W. Foley. It plans to increase the capacity of its plant.

RECEIVER FOR MAXIM

NEW YORK, June 2—The Maxim Munitions Corp., which was formed in 1915 with $10,000,000 capital, to take over the inventions of Hudson Maxim, and which in June, 1918, announced its intention of making and marketing a farm tractor, as well as acting as domestic and export distributer for the trucks manufactured by the Dart Motor Truck Co., Waterloo, Iowa, has been placed in the hands of a receiver. The courts have appointed H. H. Henry, who for the past two months has been president of the company and prior to that was vice-president and general manager.

It is understood that the assets and liabilities of the company are about $1,000,000 each, and it is stated that there appears an excellent possibility of the company being reorganized and continued. Until the creditors and stockholders meet, however, nothing definite can be stated with regard to future plans. A meeting is scheduled for the near future and in the meantime the business will be temporarily discontinued.

NEW CHEVROLET SALES ZONES

FLINT, MICH., May 31—The Chevrolet Motor Co. has just created seven new sales zones in the United States and one in Canada. This gives the company a total of 15 sales zones in the United States and two in the Dominion. One of the new zones will have its headquarters in Chicago and another in Cincinnati, where the Chevrolet company is already operating retail sales branches. The wholesale departments in these two cities will start business Aug. 1. The Cincinnati department will be in charge of John Flynn, who was with the Baltimore branch for 4 years. H. H. Monday, for several years connected with the Washington branch, has been transferred to Chicago to handle the wholesale business there.

While the Chevrolet company has been operating on a fixed schedule of 700 cars a day, this production is constantly being exceeded, the average production for last week being 726 cars.

KENTUCKY WAGON BUILDING

LOUISVILLE, KY., June 2—The Kentucky Wagon Manufacturing Co. will begin on Aug. 1 the construction of a new 2-story steel and brick building costing approximately $100,000. According to present plans the structure will be occupied by the car, upholstering, paint and assembly departments, which are part of the car and truck branches. The plant of the Kentucky Wagon company at the present time consists of 32 acres.

LANSING BODY DOUBLES SPACE

LANSING, June 3—The Lansing Body Co. has started the erection of a new building which will double the present floor space. The new structure will house the painting and finishing department.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

NEW COLUMBIA FACTORY

DETROIT, June 3—The Columbia Motors Co., which has been contemplating an addition to its plant for some time, has purchased from the Detroit Seamless Tubes Co. 6 acres of ground, on which a new factory will be erected. The proposed plant will be completed by Jan. 1, 1920. It will have a floor space of 150,000 sq. ft. Part of the site is occupied by the Fisher Body Corp.

OLD TRUCK PLANT SOLD

WYANDOTTE, MICH., May 28—The old plant of the Detroit-Wyandotte Motor Truck Co. has been sold to John J. Marx of Detroit. It has a floor space of 40,000 sq. ft., and is located on a 2½-acre site. The plans of the purchaser have not been announced.

REPUBLIC SPECIAL BODIES

ALMA, MICH., June 2—The Republic Motor Truck Co., Inc., is furnishing dealers with a complete line of special bodies made to their specifications. These bodies are built entirely by the Republic body department and can be mounted on trucks at the factory or shipped separately.

PARKER GETS MORE CAPITAL

MILWAUKEE, June 2—Capitalization of the Parker Motor Truck Co. was increased from $350,000 to $500,000 in the form of preferred stock at the annual meeting of the company. Adam J. Mayer was re-elected president and other officers are: Vice-president, F. H. Parker; secretary-treasurer and general manager, L. L. Newton. Directors were re-elected.

TOOL SALVAGE DROPS PENINSULAR

DETROIT, June 2—The Peninsular Tool Salvage Co. has changed its name to the Tool Salvage Co. This action is taken because of the difficulty customers found in spelling and pronouncing the word "peninsular."

ATTWOOD BRASS MOVES

GRAND RAPIDS, MICH., June 2—The Attwood Brass Co. is moving from its present plant into much larger quarters, having purchased a 2-story factory building formerly occupied by the Steel Furniture Co.

LAKESIDE FORGE ADDS

ERIE, PA., June 2—The Lakeside Forge Co. is adding a building 104 x 81 ft., of brick and steel, for increasing its office and shipping space.

MERGER PROGRESSES

NEW YORK, June 2—Negotiations pointing to an early merger of the International Motor Co. and the Wright-Martin Aircraft Corporation are indicated by operations which have been in progress for some time. It is expected that next week the stockholders of the Wright-Martin organization will approve a plan whereby the New Brunswick factory of Wright-Martin is sold to the International Motor Co. in exchange for stock in the latter organization. The factory will be used at increased capacity for the manufacture of trucks and should permit of the International doubling its truck output. The New Brunswick factory has 500,000 sq. ft. area and has been used to manufacture Hispano-Suiza engines during the war.

The Wright-Martin Corp. will be reduced in capitalization and continue to exist as an aircraft corporation for the carrying on of necessary aircraft development and manufacturing work.

The International Motor Co. has not announced any definite plans as to whether the New Brunswick factory of the Wright-Martin will be used solely in the manufacture of truck engines or if Mack trucks will be manufactured in their entirety there.

TRACTORS FOR FRANCE

SANDUSKY, OHIO, June 2—The Dauch Manufacturing Co., makers of the Sandusky tractor, has received an order for the immediate shipment of 500 of their 10-20 model J tractors to France to be used in reconstruction work. Two hundred machines will be the standard 10-20 model J type, the balance being for a new frameless type model which the Dauch company has just perfected. Shipments are going forward at the rate of 25 a week.

HIGHWAY MOTORS TRUCKS

CHICAGO, June 2—The Highway Motors Co. has recently been incorporated to build American Knight-motored trucks in 3½- and 5-ton capacities. It has purchased the assets of the Motor Trucks, Ltd., Brantford, Ont.

OMOLITE CREDITORS TO MEET

JAMESTOWN, N. Y., May 29—A meeting of the creditors of the bankrupt Omolite Co., Inc., has been called for June 11, in the Federal Court Room of this city to pass on the reports and account of distribution of funds on hand when the case is closed.

The financial account, as it stands, is as follows:

Receipts from sale of assets		$10,000.00
Disbursements, administration expense	$743.76	
Preferred claims	1,447.05	
First dividend paid	4,158.74	
Total		6,349.55
Balance on hand		$3,650.45

PACKARD EXTRA DIVIDEND

Packard Motor Car Co., Detroit, 2½ per cent extra dividend in addition to regular 8 per cent dividend.

Automobile Trade With Allies Discussed

Car Makers and U. S. Officials Talk Over Export Problems of the Immediate Future

WASHINGTON, June 2—The Allied governments and peoples are disposed to regard the United States unfavorably because of the stand of the American Peace Commission against large indemnities from Germany, and as a result it is difficult for the State Department to approach the Allies on any commercial questions, without danger of creating a wider diplomatic breach, was the statement of foreign trade advisers of the State Department to-day to members of the export committee of the National Automobile Chamber of Commerce.

This statement was made in reply to the expressed belief of the export committee that its members thought that immediate resumption of normal business conditions would work best for both the Allies and the American manufacturers. "All the cars sold in the allied countries of American manufacture," they stated, "will help those nations to recover, and will not interfere with their own automobile manufacture."

England, it was pointed out, is paying 100 per cent above the list price of new cars for used cars.

The meeting was attended by W. Frost, C. H. Albrecht and A. C. Millspugh of the Department of State, J. Walter Drake of the Hupp Motor Co., J. Rathbun of the White Co., P. S. Steenstrup, General Motors Corp., C. G. Young, Willys-Overland Co., Louis Domeratzcy, Department of Commerce, Alfred Reeves, Pyke Johnson and H. R. Cobleigh of the National Automobile Chamber of Commerce.

The disadvantages of the American tariffs, which include a 45 per cent duty on automobiles imported into this country valued at $2,000, and 30 per cent on those under $2,000, was pointed out by J. Walter Drake. The foreign countries sell the United States only high priced cars and as they have to pay a 45 per cent duty on these, they are inclined to regard our entire tariff duty as 45 per cent, and consequently in enacting their tariff laws base them on an American 45 per cent duty. Recommendations for the repeal of this duty with a straight 30 per cent tariff in its place were made. The government department officials replied that this matter could be handled only through Congress when it revises the tariff.

C. H. Albrecht said that the American Ambassador in France is trying to get the French government to remove its embargoes and restrictions on American cars and parts. Nothing can be done through diplomatic channels toward effecting reduction in the French tariffs, it was stated, until after the American tariff is revised.

The fact that France is not in favor of the sale of the American army cars and trucks to individuals in France met with serious objection from the automobile export managers. Peter Steenstrup stated that there are about 1900 Cadillac passenger cars in France with the American army, and if these are bought by the French government and later sold to individuals, according to present plans, the General Motors Corp. fears that there will be no attempt to furnish parts or service, and the reputation of the company may suffer in consequence. He stated that if France will remove its embargo and allow parts to be shipped into the country, the General Motors Corp. will undertake to provide parts and service for Cadillac owners.

It was also suggested that this government should take steps to have France change its plan to allow cars to be sold by the American army. The government officials stated that this was a War Department matter and must be taken up by the N. A. C. C. through the War Department.

The delays in the mails and cables and the British censorship were stated by Drake to be serious obstacles to American foreign trade at present. The State Department announced that all censorships to neutral countries by Great Britain had been abolished and that a protest has been made by this government against all other mail censorship by England, in which it was asserted that the information obtained from this censorship is being used for the benefit of British manufacturers. Great Britain has replied denying this and the American government is seeking specific instances. It was further stated that there is no censorship on cablegrams to the Far East and that any delay is due to congestion.

An interpretation of the British restrictions on American automobile exports to 50 per cent of the 1913 exports was given by Louis Domeratzcy. He said that instead of this percentage applving to the exports of that year, it applied to the imports. Importers who were in business in 1913 can import from the United States 50 per cent of the imports for that year, regardless of the makes and types. This interpretation removed the fears that manufacturers who had started in business in 1913 would not be able to ship cars under the British ruling.

A statement that Germany will likely resume normal trade conditions before any of the Allies can get back into peace time production was refuted by government officials, who stated that the peace commission found conditions in Germany so bad that it had to cut down the indemnity and that, because of this, the Allied experts are certain that German commerce cannot be resumed in the near future.

The government officials were asked to make arrangements with the British government so that automobile manufacturers with branches in Canada will know what percentage of cost must enter into an automobile manufactured in Canada to overcome the British restrictions. They asked the government officials to make such arrangements, if possible, whereby a car assembled in Canada, with 50 per cent of the cost in assembling, and 50 per cent in the parts exported from the United States, will be recognized by Great Britain as a Canadian product.

Requests were also made by the N. A. C. C. for more government investigators of foreign car markets. The answer was that the appropriations to the departments are insufficient to allow the sending of more men to foreign countries at present.

If the manufacturers will send their own investigators abroad, it was stated, the Department of State will arrange that these men can have full co-operation of the consuls.

Although there was no definite result from the meeting, it was felt that the problems had been properly placed before the government officials and the way opened for definite results at future meetings.

Tax Hearing Promised to Car Builders

Chairman Fordney Tells N. A. C. C. Committee He Is in Sympathy with Plea

WASHINGTON, June 2 — Alfred Reeves, manager of the National Automobile Chamber of Commerce, and a party of automobile manufacturers called on the House of Representatives Ways and Means Committee to-day and were assured by Chairman Fordney that they would be granted a hearing on the subject of manufacturers' tax as soon as it was possible to arrange it.

Mr. Fordney assured the automobile men that he was in entire sympathy with their plea for the removal of the manufacturers' tax. First, however, it would be necessary to remove the so-called luxury tax, that on clothing and similar articles. As soon as that is disposed of, the committee will be willing to take up the manufacturers' tax. One important condition in considering the removal of this tax is the need of the government for money. The manufacturers, he said, would do well to remember that government expenses are still running high.

Mr. Reeves said that it had been intended to take up this matter with the Ways and Means Committee to-morrow, but their success in meeting Chairman Fordney made it unnecessary to stay over. As soon as the date is set for the hearing, notice will be given to the National Automobile Dealers' Association, the Automobile Jobbers' Association, the Motor Accessories and Manufacturers' Association, the Rubber Association and other organizations which have been helpful in presenting this matter to government officials. The plan now is to urge the repeal first of the parts taxes, second, of the tax on motor trucks, and third, on the passenger cars.

2750 Mile Flight Planned by Army

Martin Bombing Airplane Will Fly Across Continent from Mineola to San Francisco

WASHINGTON, June 3—The War Department announces that the Army Air Service has planned a one-stop transcontinental flight of 2750 miles, by a Martin bombing airplane to be undertaken within a few days. Capt. Roy N. Francis and 1st Lieut. E. A. Cline will pilot the machine. Two or three mechanics will be carried.

The start will be made from Mineola, N. Y., field. The stop will be at North Platte, Neb. San Francisco is the destination. The tentative schedule calls for an average speed of 100 m.p.h. The distance from Mineola to North Platte is 1502 miles, the next leg being 1248 miles. The plane will start from Mineola at 3.30 a. m. on a day to be set. It will stop at North Platte from 8.09 p. m. that evening until 3.30 a. m. the following morning, and is scheduled to arrive at San Francisco at 5.58 p. m.

The Air Service authorized the following description of the machine in which the transcontinental flight will be attempted:

Martin Military Bomber Selected

"The United States Martin bomber is the airplane selected by Capt. Roy N. Francis to attempt the one-stop transcontinental flight because of especial suitability. The airplane was originally designed for military purposes as a day or night bombing plane or for long distance photography.

"The power is supplied by two Liberty motors of 400 horsepower each, mounted in the wing gap on each side of the body. The body is well designed and commodious. At the nose is the cockpit for the front gunner. He has access to a passage through which he can go aft to handle the rear lower gun or sit beside the pilot on a folding seat. The pilot is placed on the right hand side of the body and well up, so that his range of vision is the best possible. He is provided with a wheel type control and has a splendid view of the instrument board. Behind the pilot are the three main gasoline tanks. To the rear is a mounting for the lower gun, which commands a large field of fire to the rear, below and to both sides.

"The wing structure is very light. The designer was particular to observe the principles of stream line, rigidity and strength. The total wing and control area is 1355 square feet. The span of the upper and lower wings is 71 feet 5 inches and the depth of each wing is 7 feet 10 inches. The gap between the wings is 8 feet 6 inches. The length over all is 46 feet and the height over all 14 feet 7 inches.

"The under carriage is composed of four 800 by 150 mm. wheels. The axles are hung on the usual rubber cord suspension, but have a great amount of freedom not only vertically but in the other two directions. All of the lateral forces are taken up by the centre trussing under the body. The two outside struts are free to swing laterally, and hence only absorb the vertical component of the landing shock. A single wheel and foot bar control is provided for the pilot's cockpit.

"There are four equal ailerons for the maintenance of lateral stability. The tail services are of steel and wood construction. The elevator is one piece and with its generous area and ease of operation forms a positive control to be relied upon in any emergency. Two balanced rudders working in synchronism permit the pilot to control his direction under any conditions with ease. In fact, when flying with one engine dead, the amount of rudder necessary to correct the offsetting force of the other engine is surprisingly small.

"Three sturdy gasoline tanks, mounted securely inside of the body, contain the main supply of gasoline. This airplane is particularly adaptable to the requirements of civil aeronautics—for passenger, mail and express service, coast, border and forest patrol. This adaptation would not involve any important changes, for the same machine less the military equipment is immediately serviceable for the carrying of one ton of mail or of twelve passengers at a speed of from 100 to 105 miles per hour. Requirements of safety, so important in our transport, are especially well fulfilled by this machine because it can fly and climb on one engine."

NC-4 Averages 78.7 M.P.H. From Rockaway to Plymouth

NEW YORK, June 3—Secretary of the Navy Daniels has ruled that the NC-4, which concluded its flight to Plymouth, England, May 31, shall be brought home by ship. This decision was based on the argument that the NC-4, the first airplane to cross the Atlantic, should not again be risked in long flight but should be sent home and properly preserved as an historical relic. Some naval men thought the NC-4 should try a non-stop flight home, or a flight with only one fuel stop in mid-ocean. It was decided, however, that seasonable winds made a successful westward non-stop flight highly improbable. Lieut.-Commander Read and the NC-4 crew have been much feted in England and visited Paris at the request of President Wilson. The NC-4 record, as unofficially compiled at Washington, is:

Course	Date, May	Distance, Miles	Time, Hrs.	Speed, M.P.H.
Rockaway-Chatham (forced landing about 100 miles off Chatham)	8	345.45	5.45	59.87
Chatham-Halifax	14	368.42	3.51	97.87
Halifax-Trepassey	15	529.69	6.20	83.60
Trepassey-Horta	16-17	1,381.81	15.18	90.27
Horta-Ponta Delgada	20	172.72	1.45	99.83
Ponta Delgada-Lisbon	27	921.21	9.44	94.50
Lisbon-Mondego River	30	115.10	2.07	56.20
Mondego River-Ferrol	30	253.30	4.37	52.50
Ferrol-Plymouth	31	523.30	6.59	74.60
Complete Flight—				
Rockaway to Plymouth	8-31	4,519.70	57.16	78.70
Transatlantic Flight—				
Trepassey to Lisbon	16-27	2,150.00	26.47	80.30

FRENCH PLANES TO U. S.

WASHINGTON, June 2—Following the settlements of contracts with France for airplanes, it is estimated that 600 Spad-4 airplanes, 1000 Nieuport-28 airplanes, 1000 Hispano-Suiza 220 hp. engines and 800 Gnome Monosoupape engines will be available for shipment to the United States. There is still on order with France a contract for Hispano-Suiza 300 hp. engines, 406 of which have been delivered, leaving 94 still on order.

Twenty-one per cent of the total number of De Haviland-4 airplanes produced before the armistice reached the zone of advance before hostilities ceased. Following is a table showing the production and distribution overseas of the De Haviland airplanes:

		Per cent of total produced
Produced	3227	100
Floated	1885	58
Received, A. E. F.	1440	45
Dispatched to Zone of Advance	667	21
Dispatched to training fields, A. E. F.	293	9

CAPITAL INCREASES

NEW YORK, June 3—The B. F. Goodrich Co., Akron, proposes an increase in capital from $84,000,000 to $109,000,000. The $25,000,000 new stock will be preferred, and $15,000,000 will be sold immediately to holders of common and preferred stock. The sale of this additional stock is to provide funds to take up $15,000,000 2-yr. notes maturing next November.

The Fisk Rubber Co., Boston, will offer to stockholders $15,000,000 new first preferred stock and $2,500,000 new second preferred stock. Present first preferred stockholders of record June 10 and present second preferred and common stockholders of record July 15 will have the right to subscribe. Funds from this sale will be used to retire the $4,025,000 outstanding first preferred and $5,000,000 convertible first preferred stock and will leave an increase in the capital of the company of $8,475,000.

March Petroleum Stock Satisfactory

PRODUCTION

	March 1919	February 1919
Crude oil (bbl.)	27,886,775	25,232,876
Gasoline (gal.)	311,306,755	285,518,194

STOCKS ON HAND

	March 31, 1919	Feb. 28, 1919
Crude oil (bbl.)	15,106,361	14,820,601
Oils purchased to be re-run (bbl.)	1,121,963	1,176,483
Gasoline (gal.)	546,062,429	458,449,187
Kerosene (gal.)	294,677,623	303,062,436
Gas and fuel oil (gal.)	749,067,806	692,816,000
Lubricating oil (gal.)	165,495,254	152,297,163
Wax (lb.)	235,588,922	209,908,707
Coke (ton)	37,642	33,716
Asphaltum (ton)	113,949	102,547
Miscellaneous (gal.)	468,035,524	500,413,825

WASHINGTON, June 4—Although production of crude oil and gasoline for March shows an increase over the February figures, the fact is discounted by the circumstance that March has 31 days against February's 28. Nevertheless the position continues satisfactory.

Stocks on hand indicate a healthy condition, particularly in regard to gasoline, which is substantially in front of February and is nearly 20,000,000 gal. better than March, 1918. Gasoline and fuel oil and also lubricating oil show an appreciable gain when compared with February totals and an even greater advance over the figures of a year ago.

The comparative analysis of production and consumption of gasoline, kerosene, gas and fuel oil and lubricating oil for the first three months of 1919 and 1918, as shown in table herewith, indicate a satisfactory position. With the exception of the kerosene item matters are now distinctly better than was the case in 1918.

—

AIR MAIL CARRIES 408,560 LETTERS

WASHINGTON, June 3—The Chicago-Cleveland Air Mail Service, during its first half month, has made a daily 100 per cent performance, except two half trips May 21 when the field at Bryan, Ohio, was so flooded that the planes could not rise from the ground.

Out of a possible mileage of 11,050, a total of 10,725 was accomplished, making a performance of 97.1 per cent and 408,560 letters carried. Since May 21 the daily trips in each direction are about 325 miles, non-stop. Twenty such non-stop trips were made without engine trouble of any kind, and with a single mishap in the nature of a fire in the pilot's cockpit of a plane operated by Pilot Frank McCusker, resulting in the death of that pilot. This has been the only fatality to any pilot carrying the mail since the service was established May 15, 1918.

The long distance non-stop flights on the Chicago-Cleveland route are being performed by the De Haviland planes strengthened for cross country mail carrying and equipped with low compression Liberty engines. The best time made on any trip between Chicago and Cleveland was 2 hr. 42 min. for 325 miles, and the longest trip was 4 hours, due to a bad head wind. The average speed for the half month was 98½ m.p.h. and the average gas consumption was 23 1/5 gal. per hour. The mail leaves Cleveland and Chicago at 9.30 o'clock each morning, including Sundays, and arrives at its destination usually between 12 and 1 o'clock in the afternoon.

Airplane Provides for Mail Clerk

WASHINGTON, June 3—Recent requests for bids for airplanes by the Air Mail Service resulted in eight bids, of which the lowest are from the Lawson Air Line Co., Milwaukee, which has designed a plane embodying mail car equipment, and allows for the employment of a mail clerk en route. The engines will be installed by the government and it is expected that the Liberty engine will be used.

The airplane is of the biplane type, with the chassis built between the two wings, with engine space provided at each side. There is sufficient space so that the men can walk around the body, which is enclosed in glass. A rack has been designed in which the mail may be distributed during the flight, and a drop chute allows for the discharge of mail bags at principal cities without stops. A model of the plane has been ordered and will be demonstrated here when completed.

Comparative Analysis of Production and Consumption of Petroleum Products (Gallons)

First Quarters of 1919 *and* 1918

	Gasoline		Kerosene		Gas and Fuel		Lubricating	
Income	1919	1918	1919	1918	1919	1918	1919	1918
Stocks Dec. 31, 1918 & 1917	297,326,983	412,256,833	380,117,829	497,750,082	659,001,357	577,899,112	138,853,574	136,855,348
Production, first quarter	898,535,505	746,584,631	492,973,977	391,804,511	1,718,257,965	1,646,017,449	197,871,680	184,232,690
Total	1,195,862,488	1,158,841,464	873,091,806	889,554,593	2,377,259,322	2,223,916,561	336,725,254	321,088,038
Outgo								
Exports	96,639,064	123,470,462	184,740,900	136,526,782	*232,970,028	351,051,012	72,081,945	62,106,421
Shipments to our insul. pos.	3,048,527	3,389,345	4,548,619	2,583,213	26,250,840	494,554	556,588	557,948
Domestic consumption	550,112,468	505,599,271	389,124,664	393,864,058	1,368,970,648	1,388,923,268	98,591,467	111,851,271
Stocks March 31, 1919 & 1918	546,062,429	526,382,386	294,677,623	356,580,540	749,067,806	483,447,727	165,495,254	146,572,398
Total	1,195,862,488	1,158,841,464	873,091,806	889,554,593	2,377,259,322	2,223,916,561	336,725,254	321,088,038

*Includes fuel or bunker oil for vessels engaged in foreign trade. 1919—2,017,955 bbl. 1918—1,357,044 bbl.

Output of Refineries of the United States by Months

1918	Crude (bbl.)	Other Oils (bbl.)	Gasoline (gallons)	Kerosene (gallons)	Gas and Fuel (gallons)	Lubricating (gallons)	Wax (pounds)	Coke (tons)	Asphaltum (tons)	Miscellaneous (gallons)	Losses (bbl.)
January	23,842,587	2,300,334	242,632,044	119,358,184	547,866,248	56,623,425	39,238,858	41,216	54,854	70,995,829	1,078,181
February	23,386,676	2,298,333	234,324,618	121,218,320	510,165,397	58,300,914	35,087,337	42,371	42,033	75,134,088	983,992
March	26,239,662	3,696,872	269,627,968	151,228,007	587,985,804	69,308,351	43,597,019	44,248	56,901	94,865,148	1,097,489
April	26,201,544	3,956,244	293,396,162	153,703,682	578,255,341	71,022,204	40,173,524	45,674	51,242	89,242,012	1,182,020
May	28,510,698	4,112,023	319,391,202	160,590,760	631,586,209	79,589,735	42,544,633	48,864	60,449	88,627,491	1,269,281
June	28,140,479	3,483,270	315,023,445	151,840,252	628,842,033	74,420,996	41,317,794	46,605	50,321	81,110,922	1,282,177
July	29,170,718	5,951,537	332,022,095	156,828,826	658,439,682	79,303,107	41,691,551	48,914	58,433	159,374,139	1,338,304
August	28,534,275	6,376,353	330,335,046	149,678,850	671,113,871	72,892,879	41,829,516	51,759	59,715	163,345,034	1,337,327
September	28,390,431	5,485,747	314,595,959	164,963,798	653,085,050	70,593,079	42,704,894	48,052	49,157	138,201,963	1,236,834
October	29,237,767	5,571,847	314,251,318	164,928,640	661,780,441	72,244,633	43,470,132	48,820	51,878	166,109,867	1,161,545
November	27,411,636	3,857,754	312,968,640	169,278,105	604,403,494	72,178,602	49,642,007	51,393	35,387	75,430,160	1,236,818
December	26,958,157	3,474,890	291,744,465	161,742,713	587,873,987	64,987,842	43,847,092	41,747	37,596	84,273,730	1,352,657
Total	326,024,630	50,565,204	3,570,312,963	1,825,360,137	7,321,397,557	841,465,767	505,144,357	559,663	607,968	1,286,710,383	14,556,625
1919											
January	26,967,332	3,919,492	303,710,556	158,501,260	589,630,056	68,304,613	44,987,603	59,003	54,074	92,324,236	1,183,767
February	25,232,876	3,997,025	283,518,194	164,181,787	553,853,753	62,503,072	42,702,886	57,200	41,348	88,515,735	1,115,040
March	27,866,775	3,351,821	311,306,755	170,290,930	574,774,156	67,063,995	43,255,128	58,642	50,139	107,880,754	1,176,746
Total	80,066,983	11 268,338	898,535,515	492,973 977	1,718,257,965	197,871,680	130,945,617	174,845	145,561	288,720,725	3,475,553

CLASS B RULES FOR TRACTOR TESTS

(*Continued from page* 1237)

width will be obtained by measuring the width plowed, from outside to outside edge of furrow, measured every 10 rods as indicated by mark stakes, and then deducting the width between the mark stakes which is not included in the test. The rate of travel during the dynamometer test should be the same as during the plowing period.

7B—Before the test commences the fuel tanks will be filled to the top with tractor set level. The run will be made on one fuel only to eliminate the necessity of including two fuels in the final result. If kerosene is to be used, the motor may be warmed up on gasoline and the fuels switched just before starting the test. The fuel will be supplied the entrant from a common source in the field.

8B—The water will be measured by the same method as used in measuring fuel. The water used in the cooling system will be kept separate from that used with the fuel and air washer.

9B—The rate of travel will be adjusted in the preliminary rounds so as to come within 10 per cent of the rated speed.

The same rate of travel should be maintained throughout the test and the observer will keep an accurate check on this by timing every second round, excluding the time required in turning at all stops and at the ends. However, the time consumed for turning at ends will be included in the plowing time.

10B—The plow will be adjusted in the two preliminary rounds and no change of adjustment will be permitted during the test and including the first preceding and following rounds when the dynamometer tests are made.

11B—The depth will be checked every 10 rods in order to obtain accurate average of the depth plowed. These distances will be indicated by mark stakes.

The plow will be set for the upper depth before the test is started and that depth maintained throughout the test.

12B—The width cut by the inside plow will be checked by the observer at least every second time depth is taken and the operator will be required to maintain even cut.

13B—If in the aggregate it is found necessary to stop the tractor more than thirty minutes, the test is annulled.

14B—This rule, at the discretion of the committee, provides an opportunity to re-enter an outfit that has been disqualified.

15B—Much of the data will be available and turned over to the company representative promptly at the completion of each test, but the committee reserves the privilege of checking it and will submit the complete results in standard forms before 10 p. m., for all tests conducted during the day.

All data will be made public unless a manufacturer, for any reason, desires to withdraw the results of some machine and then no part of such data may be issued later.

Automobile, Truck and Parts Exports from New York for April

	Cars		Trucks		Parts
	No.	Value	No.	Value	Value
Argentina	57	$61,135	..	......	$190,823
Australia	85	92,951	11	$18,810	79,802
Barbadoes	2	1,500	..	......	1,096
Belgium	28	40,875	20	85,122	5,194
Bolivia	..	......	..	......	1,179
Brazil	216	163,095	6	3,765	32,098
British East Africa	13	10,576	..	......	1,652
British East Indies	..	......	..	......	936
British Guiana	5	6,995	6	5,457	3,566
British Honduras	..	......	..	......	260
British India	138	166,134	12	27,886	35,965
British Oceana	..	......	..	......	138
British South Africa	1	500	1	844	5,175
British West Africa	19	17,787	3	3,688	3,155
British West Indies	..	......	2	1,100	3,856
Chile	81	157,725	16	26,960	118,472
Colombia	11	8,857	4	4,815	3,578
Costa Rica	1	1,436	..	......	739
Cuba	33	25,680	21	56,937	92,163
Danish West Indies	2	2,425	..	......	282
Denmark	114	167,014	46	79,976	12,924
Dutch East Indies	205	280,907	61	123,223	51,266
Dutch Guiana	5	2,712	..	......	375
Dutch West Indies	3	1,450	1	600	197
Ecuador	7	8,922	..	......	2,866
Egypt	39	19,812	..	......	5,664
England	116	150,600	..	......	313,341
France	4	18,900	134	483,093	290,061
French Africa	34	28,244	1	600	243
French East Indies	1	2,300	..	......	328
French Guiana	..	......	1	550	......
French West Indies	11	7,023	..	......	7,855
Gibraltar	12	17,718	..	......	40
Greece	5	7,890	..	......	1,324
Guatemala	1	2,559	..	......	755
Haiti	22	25,840	..	......	3,230
Honduras	..	......	..	......	295
Hongkong	..	......	..	......	20
Ireland	..	......	..	......	212
Jamaica	14	10,405	3	1,521	4,763
Japan	..	......	..	......	13,784
Mexico	11	14,570	1	5,250	7,019
Netherlands	42	54,064	8	18,000	120,613
Newfoundland	6	9,952	2	2,711	986
New Zealand	298	330,223	8	14,516	47,710
Nicaragua	1	1,644	..	......	3,488
Norway	88	152,031	36	95,213	16,437
Panama	15	9,184	20	11,326	......
Peru	87	105,729	34	23,990	16,917
Portugal	7	4,300	..	......	25,205
Russia in Asia	..	......	..	......	49,113
Portuguese Africa	..	......	..	......	66
Russia in Europe	..	......	..	......	510
Salvador	9	13,703	..	......	1,550
Santo Domingo	14	8,105	1	3,000	12,252
Serbia	..	......	1	1,200	......
Spain	114	90 450	2	4,500	20,188
Sweden	57	68,005	1	1,800	1,000
Straits Settlements	..	......	..	......	7,340
Trinidad	24	13,383	8	5,160	11,868
Uruguay	293	298,664	18	24,731	72,259
Venezuela	50	40,670	9	4,989	13,765
Totals	2,401	$2,722,944	499	$1,145,733	$1,727,556

MINERAL OIL EXPORTS FOR APRIL

WASHINGTON, May 29—Fewer gallons of mineral oil were exported last month as compared with a year ago, but the value shows a marked increase. The figures are: April, 1919, 208,515,323 gal. valued at $27,893,100; April, 1918, 227,998,969 gal. valued at $25,689,393. Gasoline exports total 27,546,646 gal. valued at $6,981,164 for April, 1919, as compared with 46,857,293 gal. valued at $11,280,216 for April, 1918. Following are the detailed exports:

Oil Exports for April and Ten Months Ended April, 1919

	1919		1918		1919		1918	
	Gallons	Value	Gallons	Value	Gallons	Value	Gallons	Value
Crude mineral oil	11,672,578	$537,847	16,157,468	$830,259	145,651,356	$8,936,055	143 998,382	$6,975,092
Illuminating oil	93,181,947	10,051,032	50,347,085	4,281,504	521,354,359	56,932,297	461,771 212	40,401,781
Lubricating oil	30,115,439	7,939,346	16,184,235	4,481,224	228,925,692	72,143 000	220,065,653	52,800,761
Gasoline, naphtha, etc	27,546,646	6,981,164	46,857,293	11,280,216	410,398,052	102,038,031	366,166 374	88,521,479
Residuum, fuel oil, etc	45,998,713	2,383,711	98,442,888	4,816,190	801,449,637	45,170 766	1,021,249,360	50,023,617
Totals	208,515,323	$27,893,100	227,988,969	$25,689,393	2,107,779,096	$285,220,149	2 213,250,981	$238,722,730

STARTER PRODUCTION DOUBLED

ADRIAN, MICH., May 28—The Adrian Steel Castings Co., which is making an automobile starter, has found it necessary to increase its force to meet the demand for the product. The company is producing approximately 100 starters a day, but with a night shift in action 200 starters will be turned out daily.

Calendar

SHOWS

*Oct. 15—Paris. Grand Palais. International Automobile Mfrs. Congress.

Nov. 7-16—London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December — Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

June 9-12—Denver, Colo. Sectional Tractor Demonstrations, Denver Tractor Club.

July 14—Wichita. Kan. Automotive Committee of National Implement Assn.

July 28-29—Columbus, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 1-2 — Piqua, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 6-7—Fostoria, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 12-13—Akron, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 18-22—Aberdeen, S. D. Sectional Tractor Demonstrations.

October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

CONTESTS

†June 14—Sheepshead Bay, L. I. Speedway race.

July 4—Tacoma, Wash. Annual speedway races.

July 4—Atlantic City, N. J.—Airplane races—Aeronautic Convention.

*July 5—Cincinnati, O. Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15 — Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

*Tentative dates.
†Sanctioned.

CONVENTIONS

June 2-6—Hot Springs, Va. Convention Automotive Equipment Assn., Homestead Hotel.

June 3-6 — Washington. Pan-American Commercial Conference, Pan-American Building.

June 12-14—Pittsburgh. Annual convention of American Drop Forge Assn. and Drop Forge Supply Assn., William Penn Hotel.

June 16-19—Detroit. American Society of Mechanical Engineers spring meeting, Hotel Statler.

June 23-28—Ottawa Beach, Mich. S. A. E. Mid-summer Meeting.

Sept. 22-24 — Philadelphia. Annual Convention. National Association of Purchasing Agents. Bellevue-Stratford.

May 12-15, 1920—San Francisco. Seventh National Foreign Trade Convention.

TRACTORS IN CUBA

WASHINGTON, June 2—The tractors used on the sugar estates of Cuba, according to consular report, are of two kinds: the round wheel and the tracklayer types. They are used almost exclusively for plowing. In the northern section of the Cienfuegos Province, owing to the hard, sticky, clayish soils, the tracklayer type seems to be most successful, as it is claimed that round wheel tractors constantly slip with the consequent loss of power and breakdowns. In the central and southern part of this district, the round-wheel tractors seem most successful.

In the southern section tractors of 8 to 16 and 12 to 25 hp. have been used to some extent for hauling purposes as well as in connection with cane planting machines. Experiments have also been made here with the tracklayer type for cultivating between the rows of cane. The chief objections to this type seem to be that its first cost is much higher than the round wheel; that it is complicated and therefore more liable to breakage, and more difficult for inexperienced operators to handle. Several plantations are to experiment with different kinds of tractors, and especially with the tracklayer type, for the purpose of hauling cane.

JAPANESE ROADS LIMIT CARS

WASHINGTON, June 2—Japanese roads and bridges are so unsatisfactorily constructed that the government is obliged to limit the weight of automobiles to 3000 lb. and trucks to 2 tons complete, with the body weighing not more than 5800 lb., according to a letter received by the Highway Industries Association. A few cities and towns have streets and roads that are practical for passenger hauling, but 90 per cent of these have unsatisfactory bridge conditions. The roads are narrow and it is difficult for two machines to pass. Close to the cities, however, roads have greater width and two trucks can pass without scrapping mudguards.

In Tokyo the majority of the streets are from 18 to 20 ft. wide. On all streets under this width a permit from the police is required for travel. There are no sidewalks, and congestion consequently is heavy. The Japanese have not become accustomed to right and left traffic rules and usually keep to the middle of the road.

The Japanese Government has sent a commission of engineers to the United States to study highways and it is expected that this commission will recommend a construction of a national highway system to relieve the present conditions.

China is also looking into the question of improving her highways, and one of the peace commissioners, Dr. Wang, is collecting data on road administration and construction, and will soon visit the United States to make a personal study of this problem.

REVISED TAX RULING ISSUED

(*Continued from page* 1240)

session an order or contract of sale, with certificate of the purchaser in writing printed thereon or permanently attached thereto, showing that the tires, inner tubes, parts, or accessories so purchased are to be used in the manufacture of new automobile trucks, automobile wagons, other automobiles, motorcycles, tires, inner tubes, parts, or accessories or for sale on automobile trucks, automobile wagons, other automobiles, or motorcycles or in connection therewith or with the sale thereof or for free replacement under contract or guaranty. Following is a form of the certificate or statement which will be accepted:

The undersigned hereby certifies that the tires, inner tubes, parts, or accessories purchased hereunder are purchased with the intention of using them in the manufacture or production of automobile trucks, automobile wagons, other automobiles, motorcycles, tires, inner tubes, parts, or accessories, or for the sale on automobile trucks, automobile wagons, other automobiles, or motorcycles, or in connection therewith or with the sale thereof, or for free replacement under contract or guaranty. In case any of the tires, inner tubes, parts, or accessories sold hereunder are diverted from this use, the purchaser will account for such tires, inner tubes, parts, or accessories to........ ...., the manufacturer thereof, at least once during each calendar year and will pay the tax thereon to him at the time such accounting is made.

Signed............

If it is impracticable to furnish a certificate for each order a certificate covering all orders between given dates (such period not to exceed a month) will be acceptable. If in any case such an order and certificate cannot be produced on demand of any authorized agent of the department the tax in respect to the sale will be considered in default.

Substitute in place of the next to last sentence of Article 15 of Regulations 47, which reads as follows:

"A chassis is a part of an automobile and taxable at the rate of 5 per cent when sold separately regardless of whether it is a chassis for an automobile truck or wagon or for any other kind of automobile."

"A chassis provided with a superstructure of such design that it is without substantial additions adaptable for hauling heavy loads is an automobile truck or automobile wagon and taxable at the rate of 3 per cent. A chassis not so equipped is an 'other automobile' taxable at the rate of 5 per cent. Unless the manufacturer has actual knowledge that the chassis is to be used as an automobile truck, or automobile wagon, or has in his possession at the time the chassis is shipped or sold (whichever is prior) an order or contract of sale with a certificate of the purchaser in writing, printed thereon, or permanently attached thereto showing that the chassis specified in the order is to be so used, the tax shall be 5 per cent upon the manufacturer's selling price."

Article 34 of Regulations No. 47, entitled "Manufacturer also Retailer" is supplemented by adding a new paragraph to read as follows:

"In cases where it is impracticable to compute the tax in respect to articles sold at retail on the average wholesale price for which like articles were sold during the previous calendar month, the taxpayer has the option of basing the tax upon the ordinary or regular wholesale price for which like articles were sold during the previous calendar month."

ENGINEERING AND INDUSTRIAL FORECAST NUMBER

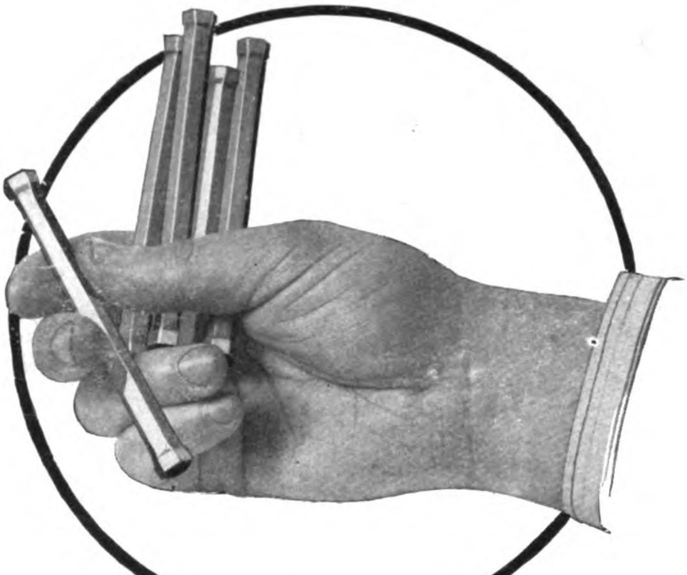
AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

Vol. XL
Number 24

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, JUNE 12, 1919

Twenty-five cents a copy
Three dollars a year



BULLETIN

The Indianapolis Speedway 500-Mile race May 30th was won with a Fedders stock Radiator on Howard Wilcox's Peugeot Car.

Individual Cellular Tubes

An Exclusive Feature of this Fedders Radiator

Damaged radiators may be repaired by a novice; simply remove and renew injured tubes.

INFRINGEMENT NOTICE: This radiator is fully covered by patents and we will vigorously defend our rights against its unauthorized manufacture, sale or use.

These cell-like single tubes are an exclusive feature of the Fedders Genuine Honeycomb Radiator—and the very foundation upon which the success of this type radiator is based.

Fedders Radiators built of these **individual tubes** should not be confused with any of the various **ribbon types** made of sheets rolled and joined together to look like Fedders Individual Tube construction—the original of its kind, and the one with which we won our present Supremacy in the radiator field.

The core of this Radiator is built up wholly of these tubes placed in a horizontal position and anchored to the adjoining tubes by all **six flat surfaces** at their expanded ends, to form circulating water spaces around and between the tubes, not merely thin line edges or points of contact as with other radiators made to resemble this in outward appearance.

As a result of **genuine tube** construction, this Fedders Radiator has no equal in Cooling Efficiency, Ease of Repair, Resistance to Overheating, Freezing or Leakage.

Let us send full descriptive information

FEDDERS MFG. CO., Inc., BUFFALO, N. Y.

FEDDERS

GENUINE HONEYCOMB RADIATORS

(AEROPLANE TYPE)

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, JUNE 12, 1919—CHICAGO NO. 24

Some Immediate Problems

Engineering Comment on Pertinent Questions of Design

A NUMBER of engineers were asked by AUTOMOTIVE INDUSTRIES to write their opinions of certain features of design for automobile, truck and tractor control for the Engineering Issue. The comment was directed by questions which are printed with this article. The replies are an indication of the trend of opinion on these topics. You will find them interesting.

IF you could sit at luncheon with a dozen prominent engineers in the automotive industry and participate in the round-table discussion which would ensue, you could not fail to come away with many thoughts and perhaps a few inspirations. The status of the industry makes the views of engineers of the highest importance at this time.

In the following pages AUTOMOTIVE INDUSTRIES is presenting to you the approximate results of just such a conversation. The problems discussed are uppermost in the minds of automobile, truck and tractor manufacturers. We all realize that we are on the eve of many departures from what has been regarded as standard practice in the past. Changes, which on the surface appear radical, but which are really the fruits of development extending through several years, are about to be made. Never were the inventors, designers and engineers so busy in boldly carrying out principles which have been evolved in the laboratory, but which have not as yet been put into practice.

A War Benefit

It took the war to jog us out of a mechanical rut. The quality of workmanship in the automotive industry has gone up, due to the experience gained in the manufacture of airplanes, airplane engines and parts requiring closer degrees of inspection than anything we have ever had to do with in commercial work. The demands of the government inspectors, which appeared unreasonable in many instances, have acted as a spur toward more accurate manufacture.

The entire automotive industry is focused around the power plant. It is the development of the internal combustion engine in small units which has created this rapidly growing industry. Refinements which perfect the engine, increase the efficiency of the products of the industry and consequently are of the utmost importance to all engineers. It is not strange, therefore, that when engineers get together one of their prime considerations is the power plant. Many new things are developing in automotive engines.

The fuel situation has made it imperative that we must operate at higher thermal efficiency than the 15 to 20 per cent with which we have been content during the past decade. Some believe that the superinduction engine points the way toward higher thermal efficiency, but a reading of the views of other engineers shows that this opinion is by no means unanimous.

Is it possible to secure a much greater efficiency from an engine of definite size by ramming an excess charge into the combustion chamber so that the filling will not be 75 or 80 per cent, but, instead, will be possibly 105 or 110 per cent at the beginning of the stroke?

There are many possibilities in the future for piston developments. Nowhere else is there such a variety of opinion to be found. The question of the aluminum or

cast-iron piston, which we have been struggling with for 4 years, has not as yet been definitely answered. The questions which will be answered only by the future include whether or not the coming piston will be something along the lines of the hour-glass type or some other form of non-continuous wall, or whether it will be along the lines of the full cylindrical type. The Riccardo type of piston, which has both a guiding and a sealing element, has created an unusual amount of interest.

Aluminum pistons are being made by different makers for different purposes. Some are using aluminum because it is light, and these make their sections as light as is structurally possible, in order to cut down the reciprocating masses in the engine. Others use aluminum because it is an excellent conductor of heat, and these, in order to get the heat away from the center of the piston as rapidly as possible, use heavy section aluminum pistons, which weigh practically the same as those of cast iron.

How to get endurance and long life from the tractor engine has been a subject which is far from being exhausted. The engine builders are divided into two schools. One designs the engine to get all the power possible from a given displacement; the other designs the engine with restricted intake passages to automatically prevent the engine from being overworked.

Lubrication

Another important development in the tractor engine is the question of lubrication. A short time ago we were of the opinion that pressure lubrication was the only system for the tractor engine. That this opinion is by no means universal will be perceived from the discussion in these pages and conversation with various tractor engineers. The opportunity for allowing the oil to settle, produced by the splash system of lubrication, is important according to some, while others believe that the only way a tractor engine should be lubricated is by oil positively fed to all spots under high pressure.

Some of us who have watched performances on kerosene and have witnessed results which are far from satisfactory are wondering if it would not be better to discontinue the kerosene pretense and come out flat-footedly on a frankly gasoline basis. Some tractor engineers are thinking the same thing, but not all of them. Some believe that the few cents saved in fuel is more than made up by the amount spent in replacing lubricating oil and in repairing the damage due to the destruction of the oil film. The increased crankcase dilution due to the use of kerosene is believed by many to more than pay for the fuel price difference.

Trucks, passenger cars and tractors are all presenting transmission problems which are keeping engineers awake at night. In the passenger car field practically everyone is dissatisfied with the modern selective transmission, particularly as regards its noise on first and second speeds. The question is, can the present type of gearbox be improved so as to give the desired silence by superior design and workmanship, or is it necessary to go to some other type, which may perhaps be a radical departure from that in use.

There has been much criticism that the weight of rear axles, both of passenger cars and trucks, is too great. It has been often asked by engineers if it is not possible to materially reduce the axle weight by superior design. Little change has been made in the axle in recent years and the impression prevails that this point has not been fully taken care of. This is a big field for useful discussion.

Braking System

In no other matter is the opinion of engineers so unanimous as it is in regard to brakes. There is not an engineer who does not say that, taken as a whole, the brakes on American cars and trucks are inadequate. You cannot drive any American-made car or truck from Philadelphia to Pittsburgh over the Lincoln Highway and use the brakes like they should be used. The engine must be used as a brake in order to help out the inadequate system on the drum. This is not denied by any engineers with whom we have had an exchange of views. What are we going to do about it? This is a most important matter and one which should be taken care of immediately. Is the transmission brake the answer?

What do engineers think of the transmission brake as a hand brake possibility, thereby removing the linkage from the rear axle and also providing an independent drum not subject to the heat generated by the application of the foot brake? This, of course, gives a brake which would perhaps be more satisfactory to continuous hill work, but objections are advanced in the way of chatter, of excessive strains on the universals, and, where metal to metal brakes are used, of the extreme noisiness.

The Engineers' Forum

These problems, and others, are of such importance that the time has come for us to lay our cards on the table and throw the suggestions, which we all have, into the common melting pot, to evolve the answer. These problems are not going to be solved by any one individual or by any firm. The industry, as a whole, is going to be advanced as soon as they are solved and American-made products are going to increase their reputation throughout the world at a rate governed by the manner in which we handle these vital questions which now confront us. AUTOMOTIVE INDUSTRIES maintains an open forum in its pages and engineers are invited to discuss pertinent problems through its columns. In the following pages are given some of the opinions of leading engineers on the matters outlined in the foregoing.

As to the Automobile and Truck

By D. McCall White

I believe there is much to be said for superinduction for the purpose of ramming an excess charge into the combustion chamber, thereby increasing the volumetric efficiency, etc. This will, however, have to be accomplished in quite a different manner than in the devices I have seen. There are instances where crankcase compression has been used for this purpose and this appears to me to be quite an ideal way of doing the job, except for the fact that the entrance and exit of the air causes a considerable shuddering noise, which is very objectionable. Where supercharging is used, the means taken for injecting this charge into the cylinder must be such as to accomplish its purpose without objectionable noise.

On the matter of the future of piston development the hour-glass is a type of piston which I developed in England and which was in a measure successful. The only unfortunate thing about this is that, in view of the fact that reciprocating gases must be as light as possible, the pistons must be made short. In designing the hour-glass

THE QUESTIONS

THE views of representative engineers given on these pages are in answer to the following definite questions:

Passenger Car and Truck Questions

1—Do you believe in superinduction charges for the purpose of ramming an excess charge in the combustion chamber, thereby increasing the volumetric efficiency and consequently mean effective pressure?

2—What do you think of the future of piston development? Is it coming along the lines of the hour-glass type of pistons or some form of non-continuous wall, or do you believe that the full cylindrical type will prevail?

3—What do you think of the heavy type of aluminum piston as a possibility; also. what do you believe of the die cast aluminum pistons, perhaps used in certain such types as the Riccardo with a guiding element and a sealing element?

4—Do you believe there is any chance for a radical change in transmissions, getting away from the noisy performance on second and first speeds? What do you believe will be done to combat this noise in ordinary transmissions?

5—Do you think that rear axles are too heavy for the power transmitted? Will it be possible by superior design to greatly improve the rear axles?

6—What do you think of the transmission brake as a hand brake possibility, thereby removing the linkage from the rear axle, and also providing an independent drum not subject to the heat generated by the application of the foot brake; also, giving a brake which would be a true emergency brake and useful for continuous hill work?

Tractor Questions

1—What do you think of governing tractor engine performance by restricted intake passages.

2—What do you think of the splash vs. pressure lubricating question for tractor engines?

3—Do you think it would be better to sell tractors on a frankly gasoline instead of kerosene basis?

type, one is apt to cut out too much surface. There is no doubt that the hour-glass type is a very stiff piston, but I believe that the full cylindrical type of piston will eventually prevail, because it has a maximum amount of surface, which is the best preventive against condensation getting past the piston walls and down into the crankcase. Likewise, it also forms the best possible seal to prevent the oil from passing upward into the combustion chamber.

Aluminum pistons I do not regard as a possibility under present circumstances, owing to the great amount of change in shape due to temperature. It may be possible to design a piston having a light cast-iron shell, with an aluminum head to carry away the heat, and this probably would be a good deal better than a complete aluminum piston.

Transmission Brakes

I believe there is a radical change coming in transmissions. This change will take the form of the epicyclic gear, electric transmission, chain transmission, or some other type differing from the designs in use. Likewise, in rear axles a change is coming. As they are designed at present, they are entirely too heavy for the power transmitted. By careful and scientific design I am certain that the rear axle can be greatly improved.

Transmission brakes have many things in their favor, and, likewise, against them. I have had a good many years' experience with transmission brakes, not only as a service proposition, but also as emergency brakes. In its favor it may be said that it has a great deal of power. However, the velocity of the drum itself is very great and rapid wear on the asbestos lining is sure to take place. If cast iron is used, there is sure to be much noise. Brake chatter is also very prevalent with the transmission brake, but there is no doubt that all of these things can be overcome by careful design and the matter is well worth careful investigation.—D. McCall White, Former Vice-President Cadillac Motor Car Co.

By E. Planche

It is, in my opinion, of paramount importance to completely fill the cylinders with the best explosive mixture during the complete range of speeds of the motor, especially since the general use of the heavy gasolines which have been furnished to the public in the last few years. This question has had my careful attention during the last 6 years and all motors I have designed during that period have had a specially designed inlet pipe, of conical shape, inside the cylinder block, thereby increasing the speed of the gases. I have also brought the carbureter as

(*Continued on page* 1356)

A New Method of Determining Rate of Flame Propagation

Originated by Dr. Donald MacKenzie of the Bureau of Standards and Successfully Applied to a Single-Cylinder Liberty Engine

By P. M. Heldt

ONE of the most interesting questions connected with the internal-combustion engine is that regarding the rate at which the flame or explosive wave is propagated from the point of ignition to the more remote parts of the combustion chamber. The term "rate of flame propagation" has been much used, especially in glib talks on the efficiency of different types of ignition apparatus, but it must be admitted that our knowledge on the subject so far has been exceedingly limited. It is true that a number of experiments have been made, but in practically every instance the explosion took place in a closed vessel, so that the effects of turbulence of the mixture and change in volume of the chamber were not brought out.

Just now the question of flame propagation is of peculiar interest, because of its bearing on the subject of knocking in engines. Various theories as to the causes of knocking have been advanced, and it has been impossible to check them because of imperfect knowledge of exactly what occurs in a cylinder after the spark has passed at the plug.

Principle of New Method

Dr. Donald MacKenzie of the Bureau of Standards has evolved a new method of measuring the rate of flame propagation which is based on the principle that when the atmosphere surrounding a pair of spark terminals is flame, the electrical pressure required to break down the resistance of the gap is reduced. Thus, if there is an extra, inactive spark plug in the combustion chamber, the spark terminals of which are subjected to a voltage which is just short of creating a spark when the gap is under the normal compression pressure, then as soon as the flame reaches the gap ionization takes place; that is, there is a transfer of electricity from one electrode to the other. By passing both the sparking current and the discharge across the terminals of the inactive spark plug through the coil of an oscillograph, wave diagrams of both of these discharges can be recorded on the same sensitive plate. If, in addition, the sine curve of an alternating current from service mains of known periodicity is recorded on the plate, an accurate time scale is automatically obtained, and the time it took for the flame to travel from the working to the inactive plug can be readily measured.

Experiments are being conducted on a single-cylinder Liberty engine which is set up in a temporary structure at the Bureau of Standards. The work is being done by Dr. MacKenzie and R. K. Honaman, who in a recent paper before the American Physical Society at Washington gave a description of the set-up employed and an outline of their plans.

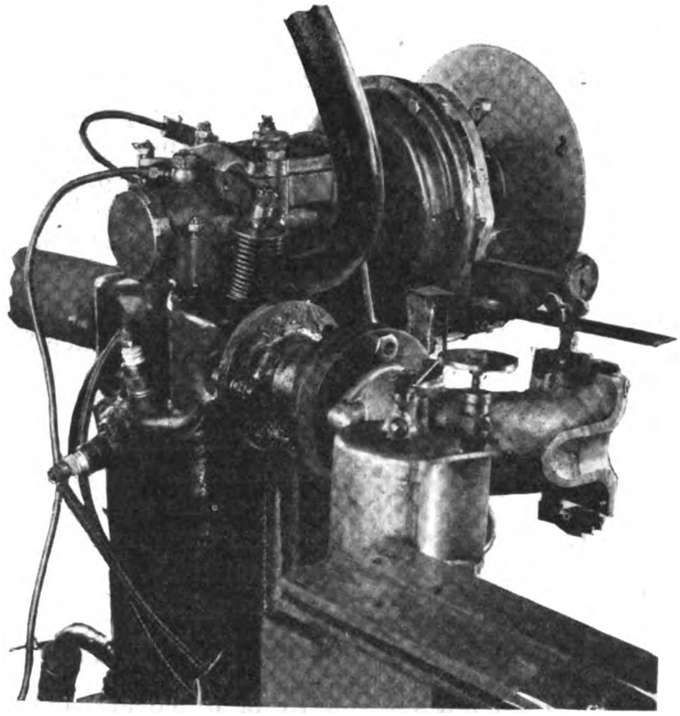


Fig. 1—Single-cylinder Liberty engine used in experiments to determine rate of flame propagation

A photograph of the Liberty single-cylinder engine used in the experiments is reproduced (Fig. 1). As is well known, the standard Liberty cylinder has two spark plug bosses, both in the cylinder head, in the corners between the valve pockets. In this particular cylinder a third spark plug boss has been provided at the side of the combustion chamber. The spark plug in the last-mentioned boss is used for ignition, while the two other spark plugs are used for observations on flame propagation.

In Fig. 2 is shown a diagram of the electrical connections. To obtain the high voltage required at the terminals of the inactive spark plugs, use is made of a transformer by means of which alternating current from service mains is stepped up from 100 to 5000 volts. Both terminals of the secondary of this transformer are connected to Kenetron tubes, or vacuum tube valves. For the benefit of those not familiar with this type of electrical device, it may be explained that a Kenetron valve is a vacuum tube containing two electrodes, one in the form of a disc and the other in the form of a coiled filament, which can be brought to incandescence by current from a low-voltage battery. The battery circuit is closed through the filament and the complete device is then included in the alternating-current circuit, one alternating lead being connected to the filament electrode and the other to the disc electrode. During that part of the cycle when the hot electrode is negative, electrons, or

small particles of negative electricity, are projected from it toward the cold, positive electrode, these electrons forming current carriers. There is no corresponding action during the other half of the cycle, when the hot electrode is positive. Hence, only impulses in one direction pass through the vacuum tube.

The unidirectional high electromotive force obtained from the transformer, through the vacuum tube valves, is used to charge two condensers, C^1 and C^2, through high resistances R^1 and R^2. Toward the end of the compression stroke, a moment before the spark passes at spark plug No. 1, condensers C^1 and C^2 are electrically connected to the central terminals of spark plugs Nos. 2 and 3 respectively, by means of a contact disk which is mounted on the overhead camshaft (and which can be seen in Fig. 1). Thus, when the spark passes at plug No. 1, plugs Nos. 2 and 3 are subject to a static pressure of about 3000 volts. As soon as the flame of the explosion reaches the gap of spark plug No. 2 ionization takes place and the condenser connected to this plug will discharge. By tracing out the connections it will be seen that the discharge current has to pass through the oscillograph vibrator. The same thing is repeated a moment later at plug No. 3.

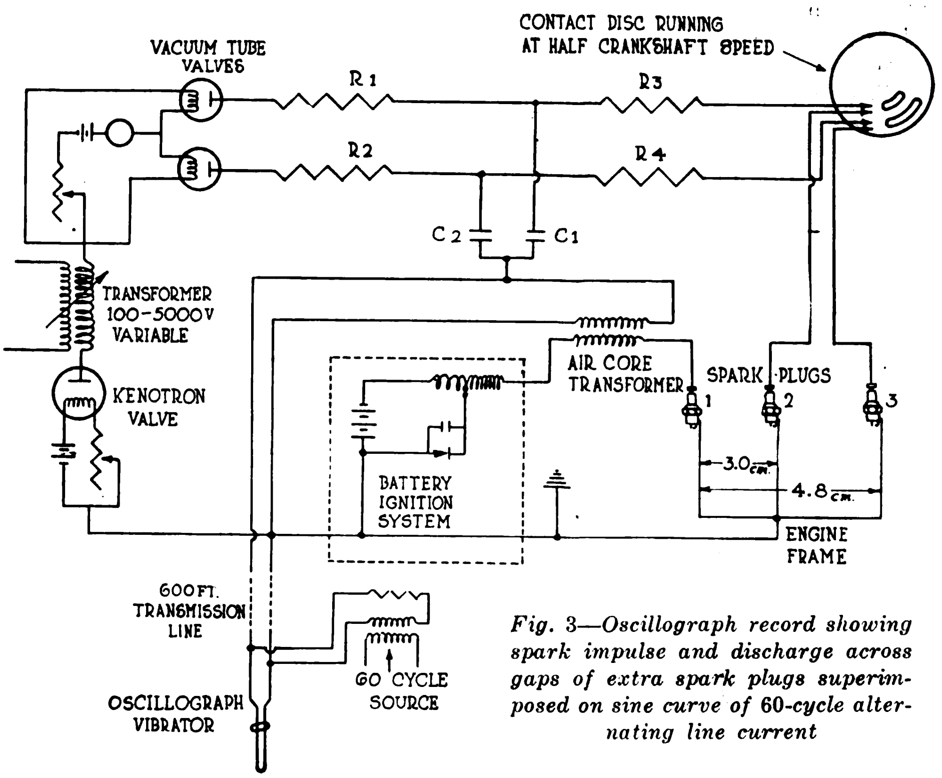


Fig. 3—Oscillograph record showing spark impulse and discharge across gaps of extra spark plugs superimposed on sine curve of 60-cycle alternating line current

The regular battery ignition system is used for igniting the single-cylinder engine, the secondary terminal of the ignition coil being connected to spark plug No. 1, at the side of the combustion chamber, through the primary of an air core transformer. The secondary winding of this air core transformer is connected in circuit with the oscillograph. This instrument is located in another building, and connection to it is made through a 600-ft. transmission line. A 60-cycle alternating current is also sent through the oscillograph, and this traces a sine curve on the oscillograph plate, which serves to determine the time scale.

Character of Oscillographic Record

The effect obtained on the oscillograph plate, therefore, is as follows: A continuous sine wave is traced by the current from the 60-cycle source. When the spark occurs at plug No. 1, an impulse is induced in the secondary of the air core transformer, and this produces a corresponding impulse of the oscillograph vibrator, which is superimposed upon the sine curve. A moment later, as the explosive wave reaches the gap of spark plug No. 2, condenser C^1 discharges through this plug, and since the discharge passes through the oscillograph, the record of this sudden current impulse is also superimposed upon the sine curve. The same phenomenon is repeated a moment later when the explosive wave reaches the gap of spark plug No. 3.

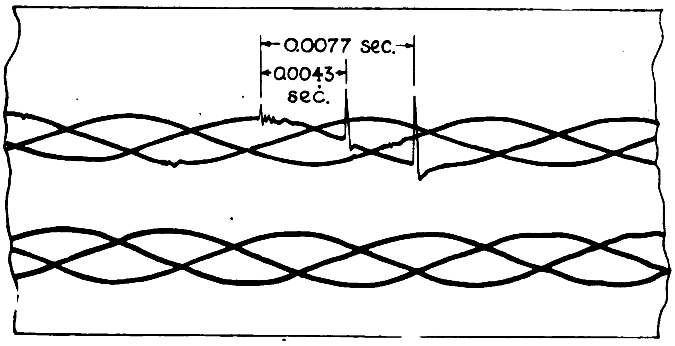


Fig. 2—Diagram of electrical circuits

Some of the details of the electrical circuit require further explanation. There might be a question as to the need of the contact disk at the end of the camshaft, as the open circuit at the spark plug should prevent a discharge of the condenser taking place. It was found that in order to make the apparatus most effective, the voltage applied to the spark plugs must be not far short of that required to produce a disruptive discharge under full compression. Such a pressure on the spark plugs, however, would cause a spark to pass at the beginning of the compression stroke, when there is little compression in the cylinders. Hence, the contact disk is needed.

An expedient resorted to in order to obtain as sharp a signal as possible upon the arrival of the explosive wave at the inactive spark plug consists in making the values of the resistances R^1 and R^2 from 40 to 50 times as large as those of resistances R^3 and R^4. This minimizes the current from the vacuum tube valve flowing through the spark plug circuit, while, on the other hand, the low value of resistances R^3 and R^4 allows a rapid discharge of the condensers through the spark plugs. Also, the charging of the condensers from the transformer through the valves is distributed over a comparatively long time. The actual values of the resistances are 15,000 ohms for R^3 and R^4 and 600,000 ohms for R^1 and R^2. The two condensers C^1 and C^2, which have a capacity of 0.0034 microfarad each, are charged to a potential of about 3000 volts. This results in an initial discharge current of about 0.1 ampere and gives a deflection of the oscillograph vibrator of 20 mm. (0.8 in.). On the other hand, the maximum rate at which charge enters the condensers is only about one-twentieth of this.

It will be noted from Fig. 3 that three Kenetron valves are used, one on one side of the transformer secondary and the other two on the opposite side, in parallel. Valves B^1 and B^2 are required only because if resist-

ances R' and R² were both directly connected to the secondary of the transformer, current from condenser C² would discharge through R¹, R² and R³ into spark plug No. 2, so that the potential of C² would be greatly reduced before the flame reached plug No. 3, and no discharge would take place across the gap of this plug. Valves B¹ and B² allow charging to take place freely, but prevent an interaction of the two discharging circuits.

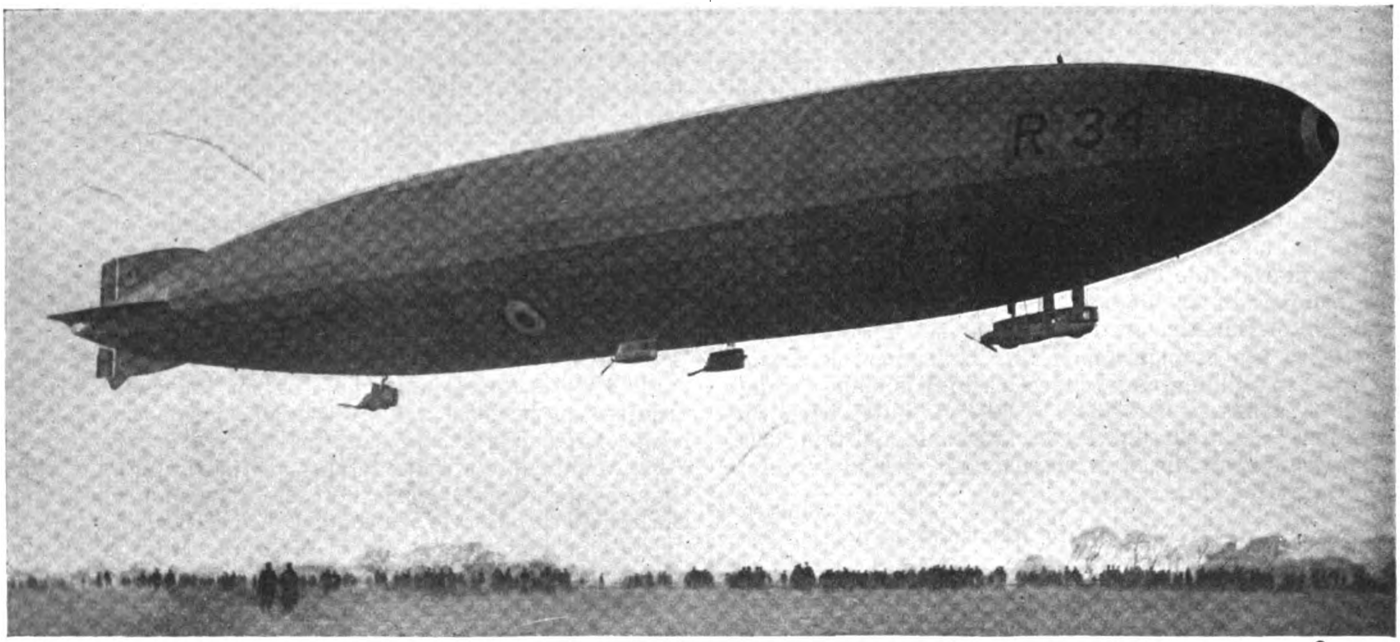
A somewhat puzzling feature of Fig. 3 is that there are 3 sine waves on the slide. The reason for this is that the shutter of the oscillograph was held open for three successive revolutions of the drum. The equal phase relation of the three curves was obtained by properly adjusting the speed of the drum.

It will be noted that the ignition spark is indicated on the oscillograph by a number of successive pulsations. This curve, of course, is no direct record of the spark, but a curve of its first derivative, as it is the secondary current from the air core transformer that produces the record on the plate.

As noted in the diagram, Fig. 2, the distance between spark plugs Nos. 1 and 2 is 3 cm., and the distance between Nos. 1 and 3, 4.8 cm. Fig. 3 shows that under the particular conditions of operation under which this oscillogram was obtained it took the flame 0.0043 second to travel the first-mentioned distance, and 0.0077 second to travel from plug 1 to plug 3. Measurements taken on different films have shown that the rate of flame propagation varies greatly with the conditions under which the engine is operated. Some of the factors affecting it are the richness of the mixture, the compression ratio, the heat content of the ignition spark, and the degree of turbulence within the combustion chamber. It was found in all cases that the velocity of flame propagation increased with the distance from the ignition plug. For the first 3 cm. (the distance between the ignition and the nearest inactive plug) the values varied between 5 and 25 meters per second, and for the first 12 cm. (the distance between plugs 1 and 3) it varied all the way from 15 and 60 meters per second.

The practicability of the method having thus been established, it is planned to carry out a complete series of tests to determine the effect upon the rate of flame propagation of all the different factors, such as mixture, composition, degree of compression, spark advance, intensity of ignition spark, grade of fuel used, etc.

Measurements and Tests of the British R-34



RECENT cable messages tell of an unusual test sustained by the British airship which is expected to start a trip across the Atlantic in the near future. This test flight was not planned, but was the result of the dirigible becoming lost in a fog and being in the air 21 hours and returning to her hangar under her own power.

"R-34 was built for the British Admiralty at the Airship Works of Wm. Beardmore & Co., Ltd., Inchinnan, Renfrewshire, Scotland, and the photo shows the vessel in the air prior to carrying out a successful trial flight on March 15. The ship is about 650 ft. long by 80 ft. in diameter, and it has a capacity of more than 2,000,000 cubic feet, with a useful lift of over 30 tons. She is fitted with Sunbeam engines and capable of attaining a speed of about 70 miles per hour. The preliminary trial extended over a period of 4½ hours under favorable weather conditions and the ship flew at various altitudes up to 2,000 feet. The ship's complement numbered about 30, including several technical members of the Beardmore staff. "R-34" is a great improvement over the other dirigibles which the firm completed and delivered to the Admiralty during the War. The time occupied in the construction of this vessel, in her shed, was about 6 months.

"R-34," subsequent to her trial flight, completed with satisfaction an endurance non-stop flight of 19 hours, during which trial all kinds of weather were encountered, rain, fog, snow, mist and squalls, but the vessel was able to carry out her program of visiting Ireland and otherwise circling about the British Isles before returning to her large hangar at Inchinnan.

Sundry details are being carried out at the moment and it is expected that the British Admiralty will permit the vessel to start the voyage across the Atlantic at an early date. The vessel has been fitted with fuel tanks of sufficient capacity to enable the journey to be effected easily, and she also possesses all other necessary requirements.

Carburetion of Low Grade Fuels

Some Points on the Design of Inlet Manifolds for Heavy Fuel Engines—Easy Bends vs. Chokes at Crotches

By O. H. Ensign

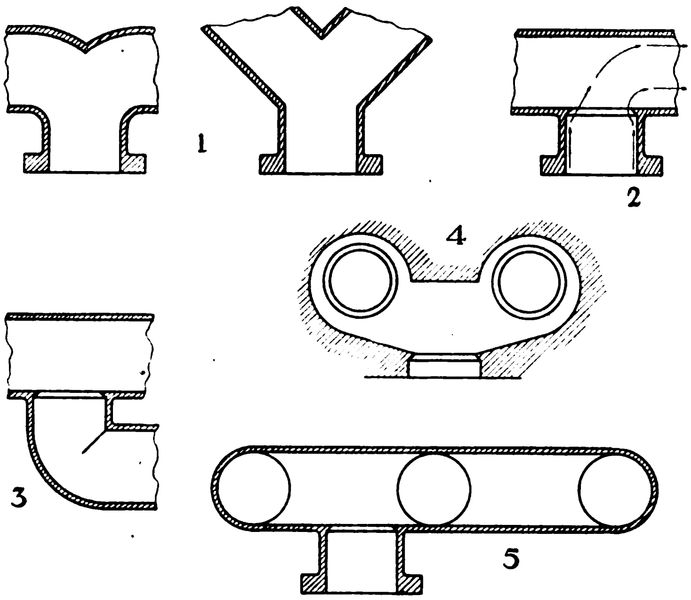
ONE of the most difficult problems in connection with the present fuel situation is the correct design of manifolds. Most of the existing automotive apparatus has been designed around the requirements of an easily vaporized fuel. Such a fuel approximates in performance a mixture of air and fixed gas, and in the design of manifolds it is necessary only to consider the fluid friction of the mixture and the absolute pressure loss involved in the change of direction at branches and Y's. But modern gasoline has an initial boiling point as high as 150 deg. and an end point as high as 450 deg., which calls for an entirely different solution of the problem, and this remark applies all the more strongly to any efforts to burn kerosene or distillates between kerosene and our so-called gasoline.

We are compelled to consider the practical use of a so-called wet mixture, for as soon as we get into the realm of the perfectly dry mixture, the size of the engine, its weight and expense rise rapidly; so the attack of the problem must be along the line of making the best use of a mixture, which involves utilizing the lighter bodies of the fuel with enough heat to make sure of good ignition and flame propagation, and of carrying the heavier constituents into the engine cylinder, finely enough divided and homogeneously distributed through the mass of mixture to give correct or reasonably correct combustion. In other words, to vaporize a portion by the use of vacuum and heat, and by turbulence and agitation, continued right down to the opening of the valve, to mechanically handle the heavier elements in such a manner as to bring about the above result.

It has been demonstrated that when a well vaporized mixture passes through an elbow there is always considerable condensation. Therefore, beyond every elbow and at every turn or branch, the mixture should be violently agitated, because poor distribution to the various cylinders and lack of homogeneity of the mixture in any cylinder may be easily demonstrated to be much greater causes of power than the friction involved in the following constructions.

Y branches such as shown in Fig. 1 are decidedly wrong for low grade fuels. Assume the mixture approaching such a Y branch with the fuel uniformly distributed throughout the stream of air; when coming to the Y, the fuel being denser than the air, part of it that should go to the right, will pass right on and fall dead in the quiet air to the left, being deflected by the "splitter." This fuel is picked up by the next impulse to the left, with the result of a puff of black smoke from the exhaust after it has reached the cylinder. In order that all cylinders may get sufficient fuel for each explosive impulse, the mixture must be made richer, because, as above described, a portion of it is separated from the air into relatively large drops and is not available as explosive fuel.

The proper construction for a branch is shown in Fig. 2. The arrows show how the fuel flows with the air in the right direction. The fuel in the air stream nearest



INTAKE MANIFOLDS—1, Ordinary manifold joints with "splitters" (defective). 2, Proposed design of manifold. 3, Elbow with sharp inner edge. 4, Siamesed valve passage. 5, Recommended design of triple outlet manifold

the side calling for it is thrown into the center of the stream, and that from the opposite side is deflected in the right direction. There is excessive turbulence at such a branch, not easily shown by arrows, and remixing occurs. Also there is always more or less of the heavier fractions on the walls, in liquid form, and with this construction these globules are thrown out into the air stream again and remixed. Fig. 3 illustrates the construction which should be followed in passing an elbow; the inner edge should always be sharp. As mentioned above, the mixture in passing around an elbow is separated more or less from the air stream. Immediately beyond the elbow there should be a sharp edge choke that will tend to throw this fuel back into the air stream. Fig. 4 represents the ideal construction for connection to siamesed valve pockets. Here again we have a branch, but by setting the wall opposite the entrance so that it is about on the center line with the two intake valves, we obtain an increase in flexibility, power and economy, for in this case the fuel mixture is properly maintained until it enters the cylinder, upon entering which it is again broken up and finally delivered in the form in which it will develop the maximum mean effective pressure.

There is a great variety of manifold designs for connecting up three or six cylinders. Fig. 5, laid out in detail as explained above, will give by far the best results and is the simplest form possible. The writer has

(Continued on page 1353)

Study of Air Resistance and Air Flow

Laws of Air Resistance Determined for a Wide Range of Air Speeds—Eddies Produced by Obstacles—Practical Applications to Aircraft and Automobile Problems

By H. Levy, M.A., D.Sc., F.R.S.E.*

THE problem of the forces brought into play by the motion of a body through the air at rest, or, what is in many respects identical, by the steady motion of air past a body at rest, is one which, although it has sprung into importance during recent years on account of the rapid development of aerial flight, is of no small consequence in other branches of engineering. The question has long been recognized as one which vitally affects such questions, for example, as the design of bridges and light buildings exposed to the forces of winds and gales. On the other hand, automobile engineering design, in common with other branches of locomotion, fighting as it is for the last inch in efficiency, cannot afford to neglect the effect of wind resistance to its motion and modifications that might be introduced into design, both to reduce this parasitic force and to minimize the effect of the associated evils of dust raising.

These are only a few of the branches of engineering to which the question should appeal with cogency, but it will become apparent that the question of air flow is not alone applicable merely to the motion of bodies in air, but is exactly equivalent to the corresponding problem of motion of bodies through water. There are at once, therefore, opened up whole fields of marine engineering on which an analysis of the problems of fluid flow will throw light.

In illustration, the exact contour of the hull and shells of sea craft of all descriptions, including submarines, torpedoes, etc., cannot possibly be accurately determined without a thorough knowledge of the forces due to the interaction between the body and the fluid, while the magnitude and directions of these forces are determined entirely by the nature of the flow set up by the body in its neighborhood.

Understanding of Medium First Essential

Before coming to a detailed study of the disturbance set up by a body in its motion and the resistance experienced, it is necessary to understand clearly the properties of the medium, air, upon which the whole phenomena depend. Although for the moment we restrict ourselves to a gas, the parallel with a liquid—water in general—will be brought out shortly.

It is an accepted fact that any volume of air is ultimately composed of an immense number of discrete molecules, flying about in all directions, each molecule possessing its own mass and velocity. By the impact of these molecules against the side of any vessel containing it, or against the surface of any body immersed in the gas, a pressure is originated whose magnitude at any point may be measured by the change of momentum experienced per second, perpendicular to the surface, by the molecules impinging on unit area. That is to say, we may conceive the body as being a man bombarded on all sides, and at every point of him, by footballs, so that the pressure he will experience will depend on the change in velocity of these balls on the rebound. The pressure thus originated may be regarded as a static pressure which exists even when the body is at rest and is what is commonly recognized, in the case of a liquid, as the hydrostatic pressure. An extra complication arises, however, if the body be in motion, for the particles of gas impinging upon it will not otherwise come into being.

In essence, the distinction between the two cases is equivalent to that which occurs where a football strikes a foot at rest, and where the football is deliberately kicked. The pressure on the foot in the latter case will in general be greater. On the surface of the moving body therefore an additional pressure—it may even be a diminished pressure if the foot be moving away from the ball on impact—will be experienced at each point, frequently referred to as the dynamic pressure.

Skin Friction

If the effect of the body, however, were merely to cause a change in momentum perpendicular to the surface, many of the complications that arise in aerodynamic and hydrodynamic analysis would be removed, but an additional trouble arises due to the fact that at the surface of the body there is a distinct tractive effect, some of the molecules of the gas becoming involved in the molecules of the surface of the body, with the result that the latter continually drags in its neighborhood a layer of the gas it would otherwise throw off. There is originated as a consequence a surface dragging force recognized under the more common name of skin friction. To this, however, we shall return shortly.

Before it is possible to proceed further, it is necessary to extract from this exceedingly complex state of affairs the properties of the gas which can be recognized as vital for determining the phenomena.

To trace out and sum up the effects of the impacts of the individual molecules, is clearly impossible. But this continual sweeping of the particles to and fro in all directions produces in the gas as a whole three distinctive properties which if once postulated may be regarded as defining the medium. The question will be approached by regarding the sum of the effects due to the rapid series of impacts really as an average effect.

The particles at any instant enclosed in any small region have each their own velocities, but there will, however, exist over the region an average velocity, average both in magnitude and direction. Each molecule possesses its own distinctive mass, but the total mass in a unit volume can be considered as the density of the gas at that point, and on this will depend the amount of momentum which can be communicated to it

*Professor Levy is in charge of the wind-tunnel investigations for the National Physical Laboratory of Great Britain, which corresponds to the U. S. Bureau of Standards. He is the author of some of the best technical books on aviation.

by impact with the body, either directly or indirectly through the medium of other masses of gas. Density therefore is the first property we must lay down.

The next property will depend on the nature of the force exerted by one layer of the moving gas on its neighbor.

Suppose A and B be two adjacent layers of gas, both moving in the directions indicated by the arrows, the average velocity in A, however, being slightly greater than that in B. The molecules in A do not always remain there, but flying about in all directions some of them will become inveigled in the layer B, while at the same time an equal mass from B will become inveigled in the layer A. The result of this is that A increases the momentum of B, while the latter tends to decrease the momentum of A. There is, in fact, along the surface between the two layers a rate of change of momentum, or in other words the equivalent of a force. This applies to all regions of the gas in which there exists a variation of gradient and velocity, and this dragging force of the one layer on its neighbor is known as the force of viscosity. Viscosity, in fact, is the second and in many respects the most important property of the gas.

There is one remaining property which concerns us. By the application of an external force to any volume of the gas—it may even be by the forces originated within itself by its own motion—the volume may be decreased or compressed. It is clear that if this should take place to any appreciable extent, not only will energy be used up in the compression, that is to say, not merely will the resistance of the body causing the compression be increased, but the actual nature of the air flow may be fundamentally altered.

For the present purpose we need then to restrict ourselves only to these three principal properties: Air is dense; it is viscous; it is compressible.

Effect of Compressibility

Although, as far as the present discussion is concerned, air may be defined in terms of these three factors, and these three only, they are not all equally important in their effects on the resisting forces brought into play by the motion of a body in that medium. Experimentally it has been found that the stress to be laid upon each of them is largely a question of the speed of the body. During the war a large amount of aerodynamic analysis of this nature has been carried through, and one important fact in particular, recognized certainly to some extent before the war, has emerged. This is concerned with the extent to which compressibility affects the resistance. In Fig. 2 is shown a picture of the waves set up in air by the motion of a bullet. This has been obtained by using the fact that the refractive index for air varies with density, so that, as a consequence, if condensations or rare factions take place, these would show themselves on a photographic plate.

From this photograph it appears that compressibility waves of this nature are brought into being by bodies such as projectiles moving at exceedingly high speeds, but at moderate speeds these waves do not become apparent. It is clear that each of these waves contains a certain amount of energy which is being transmitted through the air, and originates from the body in its motion.

As a consequence, the resistance of the body would tend to increase at a much greater rate than it would otherwise do at those speeds at which these waves begin to make themselves evident. It would in fact appear that after a certain speed is attained, the effect of compressibility without which these waves could not originate becomes a very vital factor in the resistance.

If this critical speed lies anywhere in the region of the normal speed of flight for aircraft, compressibility is clearly a question which must be carefully scrutinized. If, however, as will be seen is the case, this critical speed is well above normal flight speed, no serious error may possibly be introduced by ignoring it, while the advantage of considerable simplification will be obtained.

Analysis of Shell Motion Valuable

Recent analysis of the motion of shells in gunnery has afforded just the evidence required, for here we have a body projected at an extraordinarily high speed and slowing down by the retardation of the atmosphere. If the resistance of the shell at each point of its path could be measured it could then at once be determined from a consideration of this resistance whether a critical speed of the type anticipated exists.

The results obtained have afforded a startling justification of the theory. At first sight it appears an extremely difficult problem to determine the resistance of a projectile varying as it does from point to point, but a simple analysis of the following nature gives accurate enough results. Shells of the same type are projected at the same initial velocity and elevation, passing all approximately along the same trajectory.

By altering the fuse setting the shells may be made to burst successively at different points of the path and the times taken between firing and bursting. From these the trajectory may be drawn and the time of arrival of the shell at each point marked upon it. It is then no difficult matter to obtain by graphical means the speed and deceleration of the shell at each point. The resisting force on the body is then easily estimated from the deceleration by the usual application of Newton's laws of motion. A chart can then be constructed showing the variation in resistance of the shell for the large range of speeds passed through in its motion, viz., approximately 2200 feet per second to 300 feet per second.

To illustrate the law of resistance and its dependence on speed, however, it is not necessary or even most instructive to plot resistance as ordinate. Numerous experiments have shown that most bodies, at normal speed, experience a resistance to flight approximately proportional to the square of the speed, and the divergence from this law can best be seen, not by plotting resistance against velocity, giving a curve approxi-

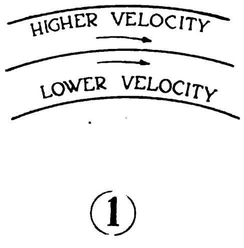


Fig. 1—Diagram to illustrate air viscosity

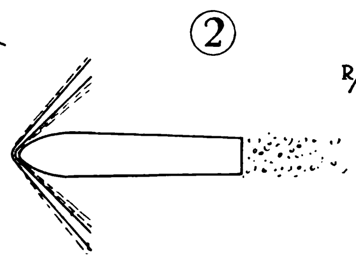


Fig. 2—Waves set up in air by motion of bullets

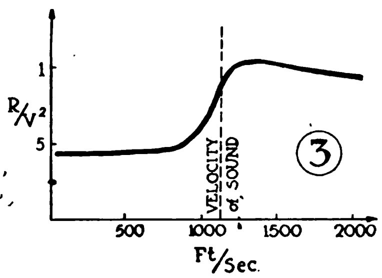


Fig. 3—Change of air resistance with air speed

mately parabolic, but rather resistance divided up by the square of the velocity giving approximately a straight horizontal line.

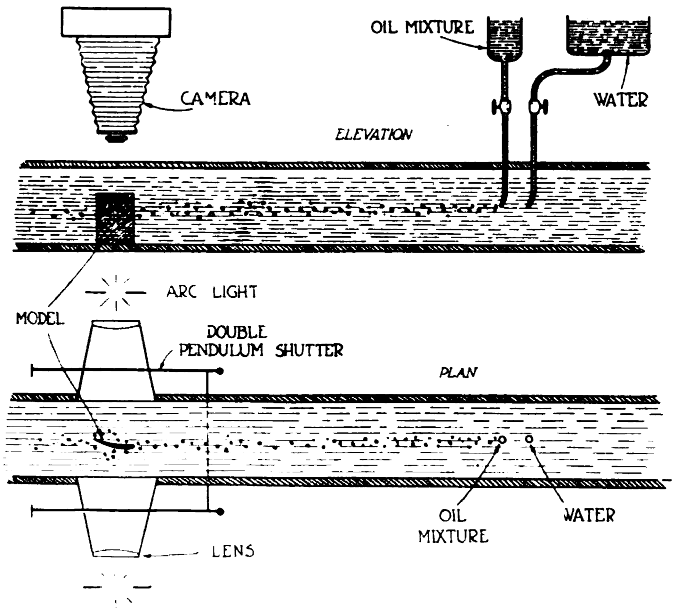
In the case under discussion therefore the most instructive manner of representation will be by plotting R/V^2 against V, where R = resistance and V = velocity. The chart obtained for the case of the projectile is then that shown in Fig. 3.

An examination of this curve indicates a rather remarkable phenomenon. It shows that up to speeds somewhat below the velocity of sound in air, up to say 500 ft. per second, the resistance is practically proportional to the square root of the velocity. In the region of the velocity of sound, resistance increases with great rapidity, evidently according to some much higher power than the square, and then, well above this critical speed, it tends to revert once more to the square law, although at a higher consant of proportionality than previously. This remarkable result fits in quite consistently with the considerations previously brought forward.

Well below the velocity of sound the body in its motion expends very little energy in the production of compression or sound waves. The resistance is almost entirely due to viscous forces. As it approaches the speed of sound, waves commence to be produced, traveling off ahead of the body at approximately 1100 ft. per second. When the body moves itself at this speed it rides on the crest of the waves, which it itself produces, while above this speed it cuts into undisturbed air, leaving its waves behind.

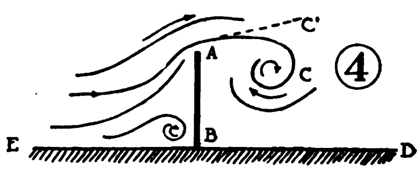
Incidentally, an interesting conclusion in gunnery may be at once deduced. For a body such as a shell or projectile which cleaves its way through the air at a speed well in excess of that of sound, a sharp pointed and tapering nose will clearly be most efficient, since by this means the energy lost in cutting through the medium would be reduced to a minimum, while the effect of the rear part of the shell must of necessity be of minor importance, since at these high speeds of flight where there is practically a vacuum behind the shell, the contour in that region cannot affect the nature of the air flow to any considerable extent.

From the point of view of the present discussion, however, where we are concerned with investigating the



Figs. 5 and 6—Plan and elevation of water channel for experimental determination of lines of flow

Fig. 4—Eddies produced by a flat plate perpendicular to line of motion



properties of air that are of importance in affecting the resistance at normal speeds of flight, an extremely important deduction follows from the foregoing conclusions, viz., that the property of compressibility upon which the production of sound waves depends may at normal speeds be completely ignored, and we are accordingly left with the simple fact that the whole problem for us depends purely on the density and the viscosity.

This conclusion immediately opens up to us an experimental method of handling these problems where otherwise grave difficulties would be experienced. To study the flow of air in the vicinity of a moving body, to determine where and how the eddying motion is produced and its effect on the resistance is extremely difficult in the case of air on account of its invisibility. But since, as has been shown, only density and viscosity are the important factors, while the air may be regarded as incompressible, we may have recourse to any other fluid which is dense, viscous and practically incompressible, provided the motion set up may be rendered visible and the exact law of comparison, the conditions under which deductions from the fluid to the air is clearly understood.

A substance satisfying these requirements is water, which is both dense and viscous and to all practical purposes incompressible. By a method shortly to be described it will be seen that the motion of the individual particles may be quite easily followed.

Consider what takes place in the neighborhood of a flat plate A B, Fig. 4, placed perpendicular to the direction of the streaming, whether of air or of water, E D being a wall. Such a case occurs, for example, with the wind screen of an automobile in motion, the blade of an oar moving in water, or the passage of a wind past a billboard or building.

Along A B the fluid is retarded in its motion, the stream line A C which just misses the edge would normally, in virtue of the inertia of the motion, be shot off along the direction of A C′. The particles of the fluid, however, in virtue of the retardation and viscous forces of the layers in their immediate neighborhood are reduced in motion and compelled to move along a path of smaller radius of curvature.

Similar causes continuously operating drag the particles further and further inwards, so that just beyond the edge a form of eddy or whirlpool is produced. It is a familiar enough experience to feel the back draught of this eddy on the rear seat of an omnibus or to produce the actual whirlpool as dimples on the surface of tea by gently drawing the tea spoon through the fluid.

Much of the dust raising due to the motion of a motor car along a road is undoubtedly caused by the particles of dust on the surface of the road being caught in these whirlpools as they are produced behind the car in its motion. Improvements in connection with these difficulties could undoubtedly be secured by simple modifications in designs, so arranged as to reduce this eddying to a minimum. Before this can be achieved, however, an accurate study of the conditions under which eddying is produced must be made.

The experimental method of analyzing the process that takes place during the flow past a body is exceedingly simple and interesting. An accurate study of the

problem demands a knowledge not merely of the lines of flow or stream lines past the body, but a measurement of the speed of the fluid at each point. This is necessary for numerous reasons but principally because from a knowledge of the distribution in velocity can be determined which regions of the fluid and which portions of the body are chiefly responsible for the dissipation of energy in the fluid and, therefore, for the production of resistance.

The experiment is conducted in a water channel $4\frac{1}{2}$ in. wide by 6 in. deep approximately and about 3 or 4 ft. long, fed continuously by water at a head sufficient to maintain the speed at about 1 in. per sec. For accurate work it is extremely important to keep either the speed or the dimensions low; in fact, to keep the product of the speed and breadth small, since when this quantity attains above a certain value it is impossible to obtain steady flow in the channel. This is consistent

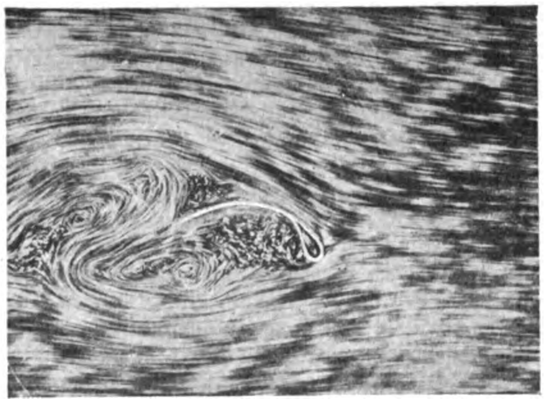


Fig. 4a—Flow of fluid past barriers

with the general statement that for all problems of flow past bodies there is a critical value of $v\,l$, where

v = speed of the body,
l = length of body,

above which the flow passes from one of uniform streaming to violent tubulence. This is equally true whether it be the flow through a pipe or channel or the streaming past an obstacle, but the corresponding value of $v\,l$ will be different in each case. It can be shown, in fact, to depend only on the shape of the body concerned. In the present instance where it is necessary to study the flow past the body, and as far as possible to eliminate the effect of the walls of the channel, it is exceedingly important to keep the value of $v\,l$ sufficiently low to be well below the critical for the channel itself. A rough indication of the principal features can be seen from the diagram, Figs. 5 and 6.

Details of Experiment

The light from the arc lights is projected by means of the cylindrical lenses as long, narrow beams onto the glass sides of the channel. This glass is blackened except for a narrow horizontal slit so that only a very narrow layer of the fluid in the channel in the neighborhood of the model gets illuminated, while by means of the double pendulum this light may be cut off periodically at intervals of, say, one-half second. To render the motion of the fluid particles visible a mixture of xylol and carbon tetrachloride in certain proportions gives a fluid which is of the same density as water so that it floats, but forms spherical drops in it like oil. The very small particles of this oil which are allowed to float along the channel past the model are

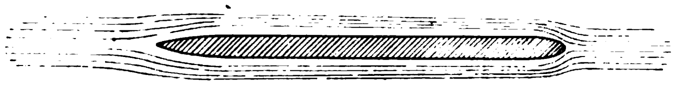


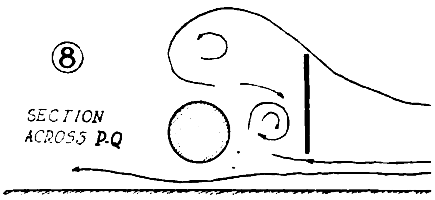
Fig. 7—Diagram drawn from photograph showing lines of flow past thin plate

produced by means of a simple form of atomizer, whose position in and relation to the water channel is obvious from Fig. 5.

The very small globules of oil produced at the atomizer A float down the channel, and those which lie within the thin layer of fluid illuminated by the arc lamps are visible from above as a series of brilliant points of light, alternately appearing and disappearing for intervals of one-half second as the light is shut off by the double pendulum.

Under these circumstances a loaded camera placed as in the diagram vertically above the region of the model, and focussed on the illuminated plane in the fluid, will take an image of the system of stream lines and provide the speed of each point, for each brilliant point of light will appear on the photographic plate as a series of dashes along the path it traced out in its motion, each dash being proportioned in length to the distance traversed in the half seconds during which the field was illuminated. The lengths of these dashes are therefore proportional to the speed of the fluid at the midpoint of the dash. Such a photograph of a simple nature is that shown in Fig. 7, representing the flow past a thin plate.

An analysis of the flow of liquids along these lines has thrown a considerable amount of light on the conditions under which eddying originates, and on the relation between resistance and eddying. It has become apparent, for example, that for a body of given shape at a particular value of $v \times l$, violent eddying originates in the rear of the body. If the nose of the body be nicely rounded with a tapering tail the eddying or turbulent region becomes confined to a narrow region in the wake; the nar-



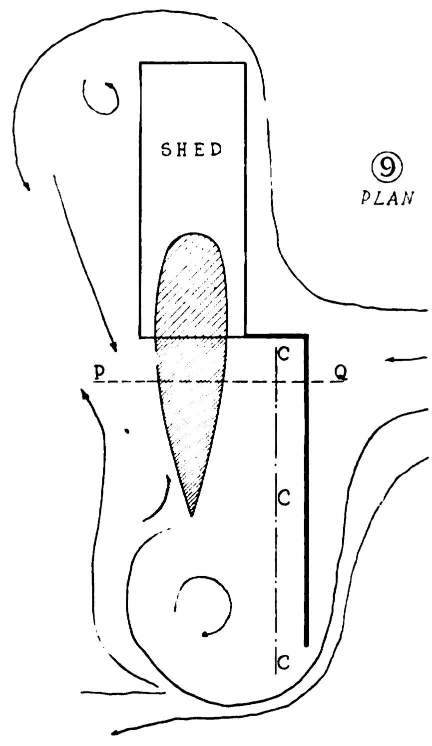


Fig. 8—Illustrating effect of air eddies on dirigible while entering hangar

Fig. 9—Arrangement of screen for hangar designed to prevent dirigible being pumped against ground

rower this wake the smaller the resistance. For example, the resistance of a wire or circular rod can be diminished to almost one-sixth of its value by fixing a fairing piece to the rear, the presence of this additional piece facilitating the smooth flow of the air. This principle is utilized in the design of aircraft to a very great extent, even to minute details. Struts, body, wires, and even nuts, are all smoothed and tapered off to reduce the parasitic resistance to a minimum.

But it is not merely in its effect on resistance that eddying is of such importance. The problem of housing airships, bringing them into and removing them from their sheds has raised many difficult problems. A gust of wind eddying over the edge of the airship shed may circulate in the region of the ship, buffet it about and dash it into the ground. In the early days of the war difficulties of this nature caused much worry and anxiety, but experimental analysis of the flow of air in the neighborhood of airship sheds and screens served to throw considerable light on the problem at issue. Smoke issuing from thin pipes, small balloons attached to strings, and, when dealing with wind channel tests on models, small pieces of cotton wool attached to the ends of silk threads were all used to show the direction of air-streaming, where and how the eddying, turbulence and circulation arose.

The annexed diagram, Figs. 8 and 9, gives a rough plan of the shed and simple screen, with the airship half out of the shed. There are in general three centers of violent turbulence. A form of whirlpool is thrown off from the vertical edge of the screen, inflicting by the back draught a heavy blow on the tail of the ship, driving it into the screen. Superposed on this, but not nearly so violent, is the eddy formed at the vertical edge P of the shed. Both these centers of disturbance have the effect of driving the tail toward the screen. But a much more insidious eddy is formed than either of these two. The top horizontal edge of the screen, acting as an eddy-forming center—an eddy with horizontal axis C C C—gives rise to a violent down draught on the top of the airship, tending to drive the tail into the ground. For practical purposes an upward force would not have serious drawbacks, as it could be counterbalanced by dragging ropes, but a downward pressure cannot be directly warded against. To counterbalance this, the lower edge of the screen is not allowed to reach the ground, but about 6 ft. of clear space is allowed to permit the wind to enter below the ship and exert an upward pressure. Fig. 8 gives an indication of the nature of the air flow resulting.

Although all the evils caused by these eddying centers cannot be avoided, by a suitable adjustment of the screen with reference to the prevailing winds, suitable fixing of heights and spacings, their effects may be considerably mitigated. The diagrams given indicate that the prevailing wind is at right angles to the direction of the screens. As the vertical edge of the screen is turned in a clockwise direction, the center of turbulence moves farther and farther off, until when the vertical edge has been turned through about 50 deg., the effect is almost inappreciable. As far as the present discussion is concerned, it is sufficient to note that by an analysis of the type of flow and the principal factors affecting it, the nature of the forces brought into play may be predicted and to a considerable extent safeguards taken.

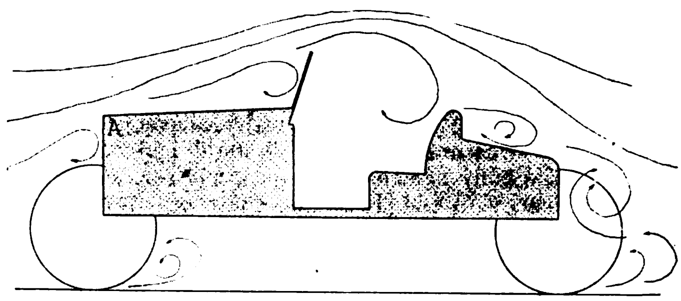


Fig. 10—Eddies produced by motion of automobile

From the general considerations outlined above and illustrated, a fairly accurate picture may be drawn of the nature of the air flow in the neighborhood of a body of almost any given shape—experiments analyzing the flow of air past the projecting portions of an automobile and the forces on the component parts measured with a view of determining whether reductions in resistance can be secured by suitable modification. Roughly, the nature of the flow is of the type shown in Fig. 10.

Several points at once become apparent. The eddying of a violent nature behind the body of the car, coupled with the eddying behind the wheels, will tend to pick up the dust in whirlpools. A more streamline overall shape would undoubtedly help to diminish this. The presence of sharp projections, as cited, likewise contribute to the parasitic resistance. Two cars fitted with different bodies and tested for resistance showed that at a speed of 30 miles per hour nearly 1 hp. could be saved by simple body considerations alone, while the mudguards, to which generally no attention is paid with a view to diminishing their parasitic resistance, are responsible for fully half the total air resistance of the complete car.

Commercial Aviation in Australia

ALREADY there are in existence in Australia three companies formed for the expressed purpose of engaging in commercial aviation. They are probably only the first swallows of the aeronautical summer that is about to burst upon us, for legally, as far as aviation is concerned, this continent is still under the shadow of the War Precautions Act.

So, as already prognosticated in these pages, civil and commercial aviation is upon us before Australia is ready for it. In the case of every one of these companies, it looks as though the money of the shareholders will have to be spent on work that should long ago have been done by the Government.

If a company proposed to start a motor service between Sydney and Manly, it does not expect to have to survey a road, build bridges or inaugurate a punt service at the Spit. Both our Governments—National and State—knew that commercial aviation was most assuredly coming. Also, they both knew that the war would end some day, and that if it ended in our favour there would be some hundreds of first-class, war-trained aviators returning to this country.

They owed it to themselves and the country to see that Australia should have the benefit of that splendid material.

However, nothing has been done.

Fortunately this is a business in which it is never too late to mend. There is nothing to prevent the Australian or the various State Governments starting a hurry-up movement in connection with aviation. In fact, they simply have to get the proverbial move on. Aviation is like every other great world movement, and will wait for no Government. It is here. If the Goverment isn't ready to meet it, so much the worse for the Government, and those whom the Government represent. It is as impossible, once peace is declared, to prevent the Australian people taking to the air as it was to prevent them taking to the surf some decade and a half ago. They'll do it, for a certainty. From *The Motor in Australia.*

Farm Tractor Design

A Mathematical Discussion of Some of the Problems That Must Be Solved, Together with Tabulated Data on Power Requirements, Soil Packing and Other Items

By Joseph Jandasek, M.E., E.E.

A GREAT deal of matter has been written about farm tractors, but most of it deals with the subject in a popular way. Such articles, while useful in their proper sphere, are of little value to a practical tractor designer. The tractor has already passed its period of invention and is now a manufacturing object; therefore, the cut and try methods by which most of the machines have been built in the past will no longer do. To turn out a good product, the design and development of a new machine must be placed in the hands of an experienced engineer who is thoroughly posted on the subject from the theoretical as well as the practical point of view. It cannot be emphasized too strongly that theory and practice must always go hand in hand and support each other, if we want to obtain the best results. Among our technical men there is a strong prejudice against the mathematical theory of machines, and many a first-class engineer, dreading the reputation of an over-technical theorist, rather adopts an inferior but more conventional method of design. This attitude, however, is bound to change gradually, to the benefit of our industries in general.

Tractors will be needed in almost every part of the world. Our tractor manufacturers have at present exceptional opportunities to secure a good foothold on foreign markets, if they only offer the right product, i.e., a product built on principles of quality and service. We must not forget that the foreign maker also is devoting his attention to the tractor. We know that he is making a very thorough investigation of the results that we have already obtained, and there is no doubt that he is going to make use of our experience and build on the basis that we have established. If we do not look out, he may eventually reach a higher plane of development than we.

To retain our supremacy in the tractor industry we have to put our research work on a more scientific basis. The world war proved unquestionably how much real scientific research work is worth to a nation. No matter how perfect a product seems to be, there is always room for improvement, and as long as the tractor is still far from a state of perfection there is much room for improvement. Most of the larger manufacturers have their experimental departments, but they are still very often conducted on the old cut-and-try principle. If the research work were carried on in the right manner and by men properly fitted for the task, it would be of great value for the concern in particular and for the whole tractor industry in general.

Before starting the design of a new machine the designer should get thoroughly acquainted with the status of the art, study carefully the existing machines and

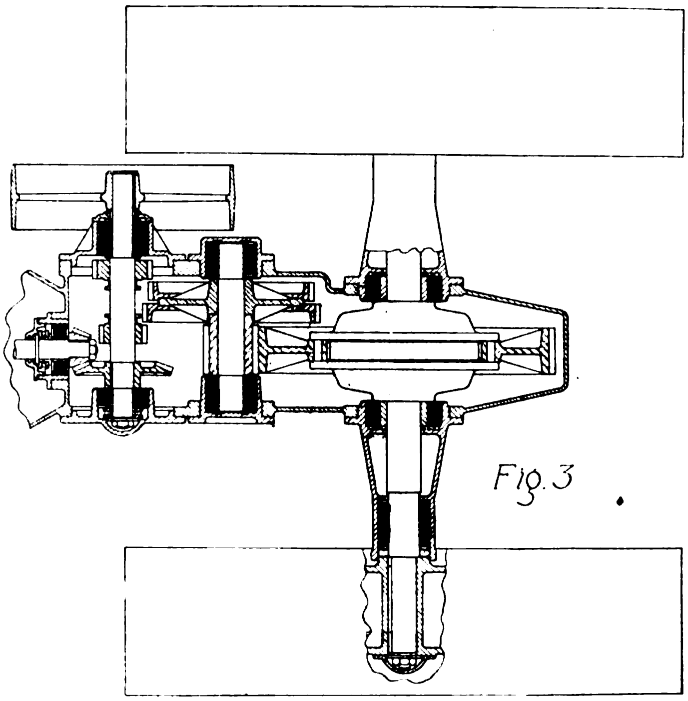


Fig. 3

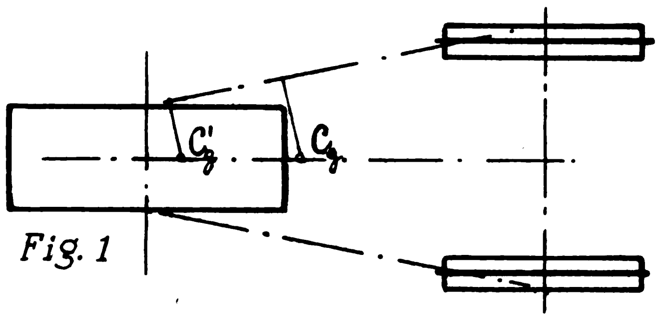


Fig. 1

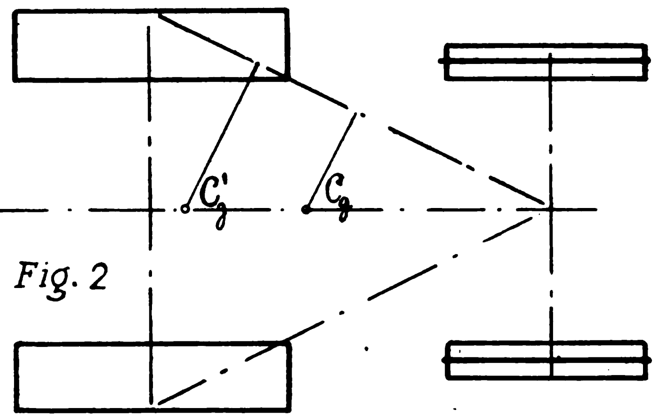


Fig. 2

Fig. 4

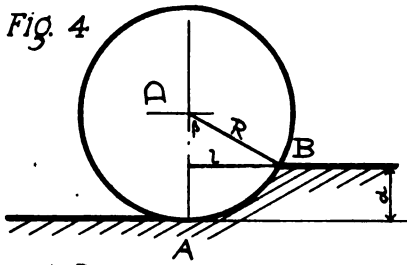
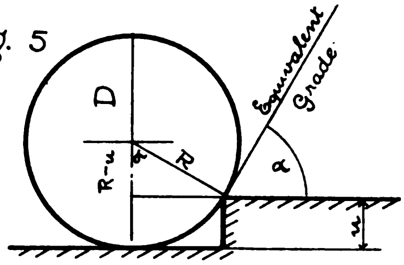


Fig. 5



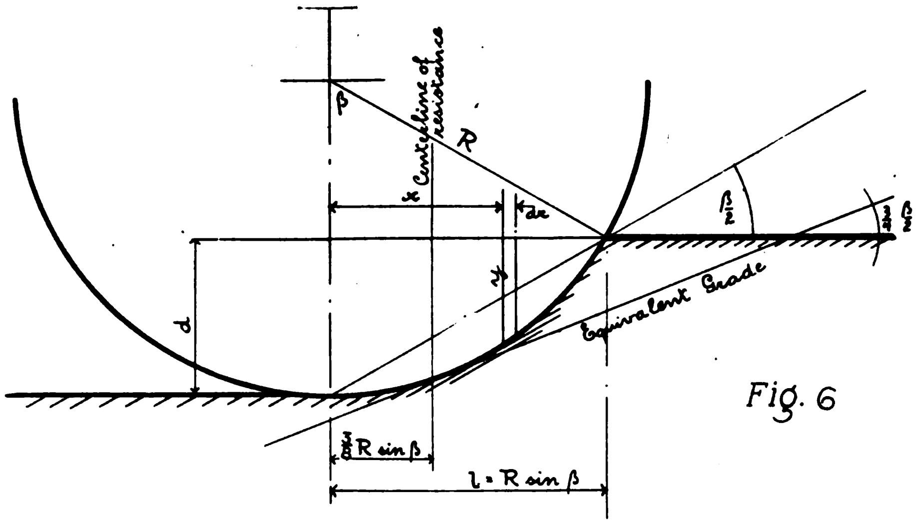


Fig. 6

familiarize himself with the latest trends in tractor design.

We may divide motor propelled farm vehicles into three distinct classes:

1. Motor plows, i.e., tractors carrying plows under them. This type of tractor is not very popular, because placing the plows under the machine makes the latter very high, heavy and clumsy, and the plows are not readily accessible for cleaning and other purposes.

2. Plain tractors, which can be used for plowing, harvesting, planting, belt work, road hauling, etc. This is the most popular and within certain size limits the most economical machine for use on the farm at present; it is also the best manufacturing proposition in the tractor field.

3. Motor cultivator and garden tractor. These machines are the youngest members of the tractor family, and, at present, in their first stage of development. However, there are great possibilities for the future along these lines.

Having decided what kind of machine to build, we must next determine its capacity or size.

In the plain tractor class the most useful machine for the average farmer is a three-plow outfit, though it seems that the two-plow tractor is destined to be the favorite and the biggest seller. Practical tests have proved that a three-plow machine is superior to a two-plow, because it can run also a small grain separator and is more economical as to fuel consumption. With a three-plow machine one man can accomplish 50 per cent more work than with a two-plow outfit of the same speed. In brief, a three-plow tractor works more economically. For large farms, of course, a four-plow tractor is still more suitable than the three-plow, and there will always be a reasonable demand for machines of the larger sizes.

The weight of the tractor should be reduced as much as practical to prevent miring in soft ground and packing of the soil. At the same time we must, however, provide for sufficient strength of parts to prevent breakage and keep the unit stresses below those of automobile and motor truck practice.

All working parts must be enclosed so as to be protected against dust and weather, yet readily accessible for repairs and adjustments. They must be constructed so as to be capable of working at full load for long periods and under all weather conditions, and require minimum attention. The lubrication should be automatic, and an effective cooling system should be provided. The material and workmanship must be first class throughout. Wherever the designer has a choice between two or more equally good constructions he should use the one which will require the least attention from the farmer.

What kind of driving members shall we select? Wheels seem to be the most logical, and the wheeled tractor will always have the widest market, because of the simplicity, reliability, endurance, small weight and low price of the wheels. Where, however, the tractor is intended for softer grounds we have to choose the crawler. A drum is not nearly as practical as wheels or as the crawler and therefore will not be considered here.

The four-wheel-drive tractor is naturally superior to a two-wheel-driven one when regarded solely from the traction point of view, yet, 90 per cent of the farmers can secure a sufficient amount of traction from a two-wheel-drive machine, and it would, therefore, be only an unnecessary outlay of money for them to buy the more

Fig. 7

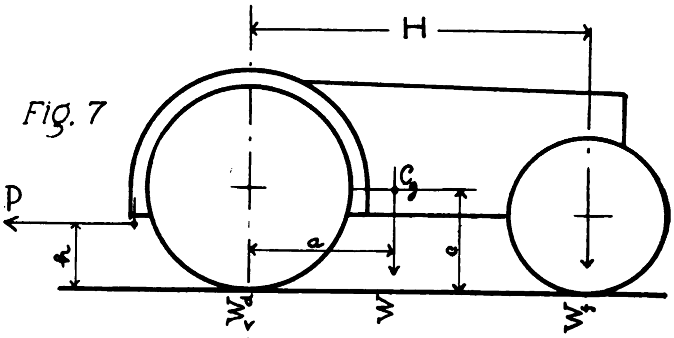
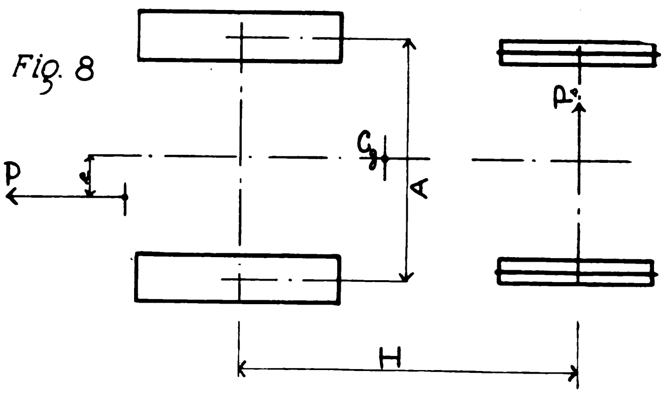


Fig. 8



costly four-wheel-drive tractor. Of course, when the territory is very hilly the four-wheel-drive tractor or the tracklayer type can be recommended, even if the original cost be higher. The two-wheel-drive tractor should have its two driving members located at the rear. This type possesses the greatest stability and the highest weight economy. When there is only one wheel in the rear, the machine is apt to tip over when pulling heavily, especially rounding corners or on side hills, because the more this machine pulls the lower is its stability. (See Fig. 1.) On the contrary, with two wheels in the rear, the more the machine pulls the greater is its stability (see Fig. 2). The driving members should be located at the rear because with that arrangement the heavier the pull the greater the weight resting on the drivers.

The front-wheel-drive type does not have as good weight efficiency as the rear-wheel drive; still, it may be considered for machines of smaller capacity. For certain special kinds of tractor, front-wheel drive is even of advantage, as, for instance, two-wheel tractors so designed that the operator may sit on the implement; also machines intended for crossing ditches, mudholes, etc.

A single driving member in the rear is a recognized failure because of its poor stability (see Fig. 1) and is rapidly disappearing from the market.

Two front wheels for steering are unquestionably better than one, because a single front wheel located on one side introduces difficulties in steering in soft ground or on side hills. When placed in the center, the forward end of the tractor must stand also all the bumps and shocks of a worn-out country road. Therefore, three-wheel tractors are constantly loosing ground and in the future will probably be discarded entirely.

Transmission Should Be Straight Gear Drive

The transmission of a modern tractor should be a straight gear drive, all enclosed and running in a bath of oil, and a responsible tractor designer endeavoring to turn out a quality product will not decide for anything else. Not a single gear must be left exposed, no friction drive or open chain drive can be considered. Spur gears are to be used wherever the construction permits, because they are the most reliable and can stand the most abuse. Bevel gears are entirely satisfactory when correctly proportioned, though they are more sensitive than spur gears and require more attention. Worm gears cannot stand much abuse and require good and positive lubrication. How far this type of gearing will be practical for farm tractors remains to be decided. The use of the worm gear directly on a live rear axle does not seem to be very reliable, on account of the enormous tooth pressure resulting from the great gear reduction used on tractors. Consequently, the worm gears heat highly even when careful lubrication is provided. Nevertheless, some tractor makers are giving this type of gearing a trial and, for small and low powered machines, it may prove satisfactory.

Anti-Friction Bearings

As to bearings, the anti-friction types are the only ones to be considered, as they are most efficient, require little attention and, if well proportioned, run almost indefinitely without appreciable wear. The accompanying illustration (Fig. 3) represents a typical anti-friction transmission.

The longitudinal weight distribution is of paramount importance in the design of a tractor and will receive due attention in another part of this article. For the present it will suffice to point out that the more powerful the engine, the larger the gear reduction, the greater the height of drawbar and the greater the rolling resistance, the greater should be the proportion of the weight on the front wheels, in order to prevent tipping over of the machine when pulling heavily or while on steep hills. The center of gravity should be as low as possible so as to insure perfect lateral stability, while still leaving enough clearance.

Preliminary Calculations

After we have decided on the type and size of the machine to be built, the next thing is to find the necessary amount of pull and power.

The required drawbar pull is usually determined from the number of plows the tractor has to pull. It is usually considered that 700 lb. of drawbar pull is sufficient to pull one 14-in. plow in Middle West soils; but we must allow one-third more as a reserve for hard and tough places, which makes a total of 935 lbs. In other words, we need in the Midle West about 1000 lb. and in Eastern States about 1200 lb. of drawbar pull for every 14 in. bottom at plowing speed, provided that the tractor is equipped with a low speed for emergency, which low speed should be about two-thirds of the plowing speed in order to develop 50 per cent more pull. In case the plowing speed is at the same time the lowest speed, the necessary maximum drawbar pull should amount to 50 per cent more, i. e., up to 1500-1600 lb. for every plow to be guaranteed at this speed. This means the actual maximum pull and not the rated maximum pull, which should be only 80 per cent of the maximum pull. The average pull in lb. required in different soils for one 14-in. bottom, plowing 6 in. deep, is about as follows:

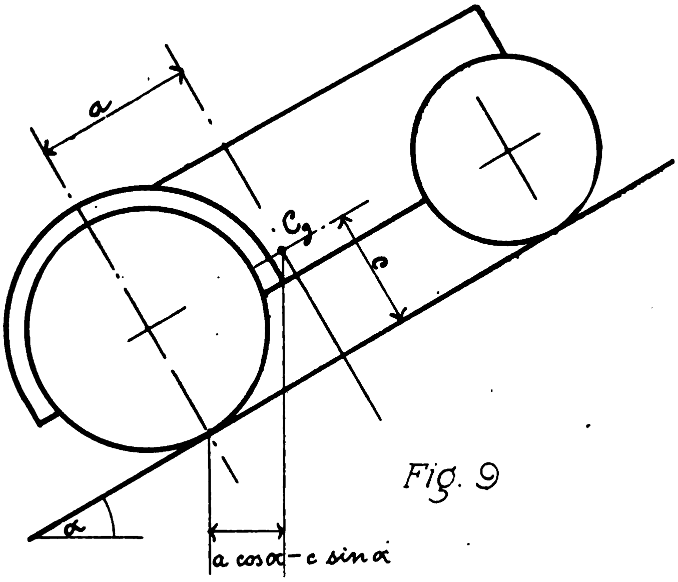


Fig. 9

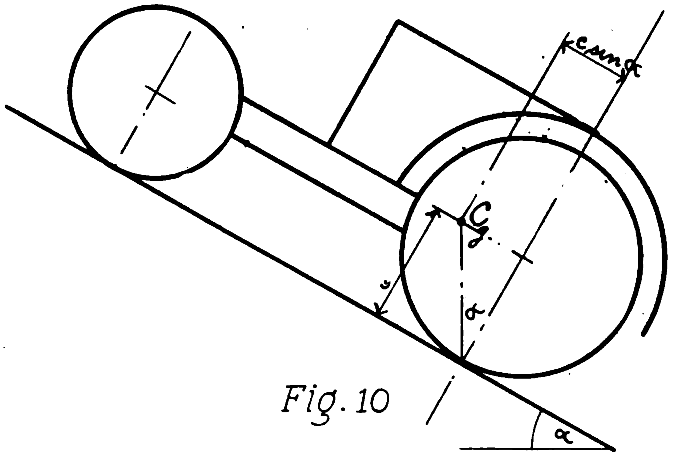


Fig. 10

Stubble	400-500 lb.	Sod	1000-1500 lb.
Clay	600-700 lb.	Gumbo	1500-1800 lb.

The drawbar pull needed for other implements runs about as given in the table below:

Binder, 6-8 ft.	800-1000 lb.
Grain drill, 7 ft.	400- 800 lb.
Disk harrow, 6-8 ft.	800- 900 lb.
Lister set	800 lb.
Double row cultivator	600 lb.
One-row cultivator	400 lb.
Corn planter	400 lb.

Weight

The total weight of a tractor should be in a definite proportion to the drawbar pull. We may say that under average soil and weather conditions the machine will pull about 80 per cent of its total weight. But since the rated maximum pull should be only 80 per cent of the actual maximum pull, the actual maximum pull at plowing speed may be equal to the total weight of the machine. The emergency pull at low speed may be up to 50 per cent greater. This maximum pull is available only for momentary use, as it would result in great slippage and loss of power when used for continuous operation. The above may be put into formulæ as follows:

$P_p = W$ lb. (on level soil for rear wheel drive) ..... (1)

$P_l = 1.5\ W$ lb. ..... (2)

where P_p = Max. pull at plowing speed.
P_l = Max. pull at low speed.
W = Total weight of tractor.

In taking the total weight of the tractor for W in our calculations we are making a slight error, as it is only the weight on the drivers at the heaviest pull that really counts. This is permissible, however, as with the rear wheel drive the weight left on the front wheels at maximum pull does not amount to much.

Rolling Resistance

The pull required to propel a vehicle on the level is equal to about 15 per cent of its weight in stubble plowing and up to about 25 per cent on soft soils. For light two-plow outfits with comparatively long and sharp spade lugs it amounts to about 20 per cent, while with track-layers it is only about 12 per cent.

t = 0.15 lb. per lb. for stubble fields ..... (3)
t = 0.25 lb. per lb. for soft or recently plowed soils. (4)
t = is the traction effort or ground resistance in lb. per lb. of total tractor weight.

To simplify matters, in the following calculation t will be assumed to be a constant, while actually it varies with the size of wheels.

For grade resistance, i. e., the amount of pull necessary to propel a vehicle up a hill of a certain grade, it seems safe to take:
g = 0.10 to 0.15 lb. per pound of weight ..... (5)
provided the tractor is designed for fairly level countries.

Speed

The proper emergency speed is about 1¾ to 2½ m.p.h. The plowing speed can range from 2½ up to 3½ m.p.h. The tendency to-day is naturally toward higher speed in plowing, which is proving successful in districts with light soils, but is impracticable in stony fields. The proposed standard plowing speed of 2 1-3 m.p.h. is altogether too low for a modern machine. The actual speed is from 5 to 15 per cent lower on account of the constant slippage of the driving members. The high speed or road speed can be taken at from 3½ to 8 m.p.h. according to the weight, size and spring mounting of the tractor. There is no demand for more than three forward speeds; however, less than three speeds results in cutting down the efficiency of the tractor.

Horsepower

After we have decided on the speed and drawbar pull of our machine we can calculate the drawbar horsepower. Then, estimating the ground and grade resistance and transmission efficiency, we obtain the brake horsepower of the tractor. The formulæ for these calculations are:

$$\text{DHP} = \frac{P_p}{375} S_p \text{ drawbar horsepower} \quad (6)$$

$$\text{BHP} = \frac{P_p + (t+g)\,W}{375\ E_t} Sp \text{ brake horsepowers} \quad (7)$$

where E_t = Mechanical efficiency of transmission.
S_p = plowing speed in m.p.h.
$(t+g)$ = ground and grade resistance in lb. per 1 lb. of weight.

For a quick calculation of the available drawbar horsepower we can develop an easy formula by substituting in equation (7) as follows:

$W = P_p$ for light and high-powered tractors
$t + g = 0.25$
$E_t = 0.84$

$$\text{BHP} = \frac{P_p\ S_p}{375}\left(\frac{1+0.25}{0.84}\right) \text{ (3 gearsets)}$$

$$\text{BHP} = 1.5 \text{ DHP} \quad (8)$$

$$\text{DHP} = \frac{2}{3} \text{ BHP (for light, high-grade machine)} \quad (9)$$

We can still further simplify the calculation of the pull P at 2½ m.p.h. since one horsepower is equal to 150 lb. pull at this speed; hence,

$$\text{DHP} = \frac{P}{150} = \frac{2}{3} \text{ BHP},$$

and, finally,

$$P = 100 \text{ BHP at } 2\tfrac{1}{2} \text{ m.p.h.} \quad (10)$$

That is, each brake horsepower is developing about 100 lb. of pull at 2½ m.p.h., on modern, light high-grade tractors.

Piston Speed

Tractor engines work about 80 per cent of the time at full load. Therefore, the unit stresses and pressures must be kept lower and the piston speed mustn't be as high as on automobiles or motor trucks, in order to prevent too rapid wear and other troubles. Also, the cooling system must be very effective. A normal piston speed of 900 ft.p.m. has proved very practical and is widely used, and it is not advisable to go much above this, especially not with the present four-cylinder engines. The formulæ for determining piston speed or r.p.m. are:

$$N = 6\frac{V_p}{L} \text{ r.p.m.} \quad (11)$$

$$V_p = \frac{LN}{6} \text{ ft.p.m.} \quad (12)$$

and that the ratio between stroke and bore is:

$$L = 1.25 \text{ up to } 1.4 \text{ B} \quad (13)$$

in which N = r.p.m.
V_p = piston speed in ft.p.m.
L = length of stroke in in.

In the table below are indicated the r.p.m. corresponding to a piston speed of 900 ft.p.m. for different lengths of stroke:

Stroke, in.	Speed, r.p.m.	Stroke, in.	Speed, r.p.m.	Stroke, in.	Speed, r.p.m.
4	1350	5¼	1029	6½	831
4¼	1271	5½	982	6¾	800
4½	1200	5¾	940	7	771
4¾	1137	6	900	7¼	745
5	1080	6¼	864	7½	720

When determining the necessary BHP of a tractor we have to take the belt work into consideration:

$$\text{Belt HP} = E_b \text{ BHP} \quad \ldots\ldots (14)$$

Where E_b is the efficiency of the gearset between the pulley and engine, if any.

The most important belt work is threshing, which at the same time is very hard on the engine. The horsepowers needed for threshing vary a good deal with the quality of the grain to be threshed. There is no general formula, but we can use the following table for determining the belt horsepowers required for different sizes of grain separators:

Width of cylinder	Required belt horsepower
18 in.	22 hp.
20 in.	24 hp.
24 in.	30 hp.
26 in.	34 hp.
28 in.	36 hp.
32 in.	45 hp.
36 in.	60 hp.

From the above table it will be seen that a tractor equipped with an engine under 30 hp. has only a limited belt work capacity and can be used only on small size farms or where there is another, larger source of power available for threshing.

Other machines, such as corn shellers, hay presses, feed grinders, ensilage cutters, etc., require usually from 8 up to 30 belt horsepower.

Assuming the standard belt speed of 2600 ft.p.m., we obtain for the diameter of pulleys

$$d = \frac{10{,}000}{n_p} \text{ in. (appr.)} \quad \ldots\ldots (15)$$

where n_p is the r.p.m. of the pulley.

Widths of pulleys may be made as follows:

6½ in. for machines of 16-20 BHP
7½ in. for machines of 20-30 BHP
8½ in. for machines of 30-40 BHP
9½ in. for machines of 40-60 BHP

For calculating the horsepower of belts and pulleys we can use the following formulæ:

$$\text{Belt HP} = \frac{d\ w\ n_p}{2860} \text{ for a pulley with a single belt}$$

$$\text{Belt HP} = \frac{d\ w\ n_p}{1720} \text{ for a pulley with double belt}$$

$$\text{Belt HP} = \frac{w\ s}{900} \text{ for single belt}$$

$$\text{Belt HP} = \frac{w\ s}{630} \text{ for double belt}$$

where w is the width of the belt in in. and s the belt speed in feet per minute.

Engine Dimensions

Assuming that the mean effective brake pressure with modern four-cycle gasoline engines equals 80 lb. per sq. in., we obtain for the calculation of the brake horsepower

$$\text{BHP} = \frac{B^2\ L\ N}{12600}\ 4 \quad \ldots\ldots (20)$$

$$\text{BHP} = \frac{N\ C}{\pi\ 12600}\ 4 \quad \ldots\ldots (21)$$

$$\text{BHP} = \frac{.7854\ B^2\ p\ V_p}{33000} \quad \ldots\ldots (22)$$

in which B is the cylinder bore in in.; p, the brake mean effective pressure in lb. per sq. in., and C the piston displacement in cu. in.

If we want to be more conservative and take the brake mean effective pressure at 72 lb., we have the well-known formula:

$$\text{BHP} = \frac{B^2\ L\ N}{14000}\ 4 \quad \ldots\ldots (23)$$

for 4-cylinder 4-cycle gasoline engines.

For determining the torque we can use

$$T = \frac{B^2\ L\ p}{4} \text{ in.-lb.} \quad \ldots\ldots (24)$$

or

$$T = \frac{C\ p}{4\pi} \text{ in lb.} \quad \ldots\ldots (25)$$

Substituting 900 ft.p.m. for V_p and 80 lb. for p in equation (22) we obtain for the brake horsepower

$$\text{BHP} = 1.71\ B^2 \quad \ldots\ldots (26)$$

and for the diameter of the bore we get

$$B = 0.765\sqrt{\text{BHP}} \quad \ldots\ldots (27)$$

In the following table are given brake horsepowers of 4-cylinder engines of different bores when the mean effective brake pressure equals 80 lb. per sq. in. and the piston speed 900 ft.p.m.

B in in.	BHP	B in in.	BHP
3½	21.0	4½	34.6
3¾	24.0	4¾	38.6
4	27.3	5	42.6
4½	31.0	5¼	47.0

If we assume that when kerosene is used as fuel there is a loss of 15 per cent in the horsepower of the engine, the above formulæ (26) and (27) become

$$\text{BHP} = 1.45\ B^2 \quad \ldots\ldots (28)$$

$$B = 0.83\sqrt{\text{BHP}} \quad \ldots\ldots (29)$$

for 4-cylinder 4-cycle kerosene engines.

As to the kerosene burning problem, it is the writer's opinion that any attempt to solve it by designing kerosene carbureters, manifolds, etc., is absolutely hopeless, because there are too many undeterminable factors regulating the vaporization of the fuel and the combustion of the mixture, viz., the quality of the kerosene used, temperature, heat conductivity, horsepower capacity, r.p.m., volume and velocity of mixture, shape of cylinder head and manifold, time, compression, etc. The only simple solution is to atomize the fuel positively by injecting it into the cylinder at the moment of combustion, so that there can be no recondensation. In this way all the spark plug, magneto and carbureter trouble would be eliminated. From my personal observation and experience with motors of the injection type, I can say that the Diesel engine is the most perfect and most reliable. However, being too complicated and too heavy, it does not seem suitable—at least, not in its present form—for propelling vehicles. The Brons motor (very similar to the Hvid) is reliable and very simple, though not as clean working and not as economical as the Diesel. As an engine for vehicle propulsion the Brons motor has, however, also a drawback. There is a slight irregularity in the timing of the explosion and it is impossible to regulate same. Direct liquid injection would be ideal provided that we could insure sufficiently fine spraying of the fuel. With all injection type engines the main problem is to regulate the minute amount of fuel necessary for each explosion.

Gear Ratio

The gear ratio of a tractor is

$$G = \frac{N}{n} \quad \ldots\ldots (30)$$

where n is the r.p m. of the driving wheels, which can be determined as follows:

Peripheral speed of wheel $= \dfrac{\pi\ D\ n \times 60}{12 \times 5280}$ miles p. h.,

and this is equal to the tractor speed S; hence

$$S = \frac{D\ n}{336} \text{ miles p. h.} \quad \ldots\ldots (31)$$

$$n = \frac{S}{D} 336 \text{ r.p.m.} \quad \ldots\ldots (32)$$

where D is the diameter of the driving wheels in in.

Substituting in equation (30) for n the value found in equation (32) and for N the value of equation (11) we obtain:

$$G = 16.1 \frac{D}{SL} \quad \ldots\ldots (33)$$

This is the gear ratio required for a tractor if the piston speed is 900 ft.p.m. For a tractor speed of 2½ m.p.h. (a good speed for hard plowing) this simplifies to

$$G = 6.44 \frac{D}{L} \quad \ldots\ldots (34)$$

Sometimes the r.p.m. of an engine are determined without taking piston speed into consideration. Usually, 900 r.p.m. is the speed selected, and in that case we have

$$G = 2.68 \frac{D}{S} \quad \ldots\ldots (35)$$

Further, for a tractor speed of 2½ m.p.h. and 900 r.p.m. of the engine we get the following very useful formula for quickly calculating of gear ratio:

$$G = 1.07\ D \quad \ldots\ldots (36)$$

Drawbar Pull and Horsepower

When the engine dimensions are given we can determine the available drawbar pull in the following way:

Torque on rear axle $= E_t GT$ in.-lb.

The corresponding tangential force is $2\,\dfrac{GTE_t}{D}$ lb., and this is equal to the drawbar pull P plus the rolling resistance $(t + g)\ W$, hence,

$$P + (t + g) W = 2\ \frac{GTE_t}{D} \text{ lb.}$$

$$P = \frac{2\ E_t\ GT}{D} - (t + g)\ W \text{ lb.} \quad \ldots\ldots (37)$$

Substituting for T from equation (25) we obtain

$$P = \frac{2\ E_t\ G}{D} \times \frac{Cp}{4\pi} - (t + g)\ W \text{ lb.} \quad \ldots\ldots (38)$$

The drawbar horsepower DHP can be calculated from the dimensions of the engine as follows:

$$\text{DHP} = \text{BHP}\ E_t - (t + g) W\ \frac{S}{375} \quad \ldots\ldots (39)$$

Equations (38) and the following equation are being used by the writer for comparing tractors of different makes:

$$\text{DHP} = \frac{N\ C\ 4}{\pi\ 12600} E_t - (t - g)\ W\ \frac{S}{375} \quad \ldots\ldots (40)$$

Wheel Sizes

When a wheel is rolling over soft ground it is supported only on a part of its periphery (*AB*, Fig. 4) ahead of the axle, because the soil is not elastic. The projected bearing surface equals lF, and since it is known from geometry that $l = \sqrt{(D - d)\ d}$ we obtain

$$\text{Area} = F\sqrt{(D - d)\ d} = F\sqrt{(D\ d - d^2)}$$

where d is the depth the wheel may be allowed to sink into the ground and F the face width of the rear wheels, both in inches.

Because d is very small in proportion to D we can safely omit the member d^2, which gives

$$\text{Area} = F\sqrt{D\ d} \text{ sq. in.}$$

For $d = 1$ in. we get:

$$\text{Area} = F\sqrt{D}$$

Allowing a mean pressure i in lb. per sq. in. of ground contact and making $d = 1$ in. we get the weight which can be safely supported by two rear wheels, or, in other words, practically the total weight of the tractor, as at heavy pulls almost all the weight is carried on the two rear wheels.

$$W = 2\ i\ F\sqrt{D} \text{ lb.} \quad \ldots\ldots (41)$$

Assuming i = 17 lb. per sq. in. we obtain

$$W = 34\ F\sqrt{D} \text{ lb.} \quad \ldots\ldots (42)$$

for the 2 rear wheels of width of face F in. each and

$$F = \frac{W}{34\sqrt{D}} \text{ in.} \quad \ldots\ldots (43)$$

When the tractor is standing still and not pulling, the weight resting on the front wheels is at its maximum and amounts to about $\dfrac{W}{3}$; therefore, for the 2 front wheels equations (41), (42) and (43) become

$$W_f = 2\ i\ f\sqrt{D_f} \quad \ldots\ldots (44)$$

where $W_f = \dfrac{W}{3}$ (approx.)

$$W = 100\ f\sqrt{D_f} \text{ lb.} \quad \ldots\ldots (45)$$

$$f = \frac{W}{100\ \sqrt{D_f}} \quad \ldots\ldots (46)$$

From the following table we can readily determine the supporting area in sq. in. of a wheel as well as the mean pressure i in lb. per 1000 lb. supported by a wheel of definite diameter and width, assuming the depth d that the wheel sinks into the soil to be 1 inch:

SUPPORTING AREA AND SOIL PRESSURE OF TRACTOR WHEELS

Supporting area $= F\ \sqrt{D}$ sq. in. mean soil pressure $= \dfrac{1000}{F\sqrt{D}}$ lb.

Wheel dia. in in.		Face of Wheel in inches 3	4	5	6	8	9	10	12	14
28	area....	15.9	21 2	26.4	31.8	42.3	47.6	52.9	...	...
	pressure	62.9	47.2	37.9	31.4	23.6	21	18.9	...	...
30		16.4	21.9	27.4	32.8	43.8	49.3	54.8	...	...
		61.0	45.7	36.5	30.5	22.8	20.3	18.2	...	...
32		17.0	22.6	28.2	33.9	45.2	51.0	56.5	...	...
		58.8	44.2	35.5	29.5	22.1	19.6	17.7	...	...
34		17.5	23.4	29.1	35.0	46.6	52.5	58.3	...	...
		57.1	42.7	34.4	28.6	21.5	19.0	17.2	...	...
36		18.0	24.0	30.0	36.0	48.0	54.0	60.0	...	...
		55.5	41.7	33.3	27.8	20.8	18.5	16.7	...	...
38		18.5	24.6	30.8	37.0	49.3	55.5	61.6	74.0	86.2
		54.1	40.7	32.5	27.0	20.3	18.0	16.2	13.5	11.6
42		19.4	25.9	32.4	38.9	51.8	58.3	64.8	77.8	90.6
		51.5	38.6	30.9	25.7	19.3	17.2	15.4	12.9	11.0
48		...	...	...	...	55.4	62.3	69.3	83.1	97.0
		...	...	...	...	18.1	16.1	14.4	12.0	10.3
54		...	...	...	...	58.8	66.1	73.5	88.2	103
		...	...	...	...	17.0	15.1	13.6	11.3	9.7
60		...	...	...	...	62.0	69.7	77.4	93.0	108
		...	...	...	...	16.1	14.3	12.9	10.8	9.3

We may use this table also for comparing mean pressures under the wheels of two different tractors; the greater the pressure under the wheels the more the soil will be packed.

Example: What is the mean pressure of ground contact with the following machines:

A—Weight 5000 lb., 2 rear wheels 60 x 10 in.
B—Weight 3500 lb., 2 rear wheels 48 x 12 in.
C—Weight 2800 lb., 2 rear wheels 42 x 12 in.

Estimating that when the machine is pulling, about 80 per cent of the total weight is carried on the rear wheels, we obtain:

Mean pressure i for A = 25.8 lb.; for B, 17.4 lb.; for C, 14.4 lb.

From the standpoint of soil packing the area grows directly with the width of face and only with the square

root of the wheel diameter. Wheels of large diameter have more area of contact, are more efficient and give more traction. Their main advantage, however, is that they bridge over obstructions better.

In Fig. 5 is shown a wheel in a hole u in. deep. In order to pull out, the engine must exert as much power as when pulling the weight carried on that particular wheel up a certain grade g. This grade can be determined as follows:

$$R - u = R \cos x$$

from which

$$R = \frac{u}{1 - \cos x} \quad (47)$$

$$\cos x = \frac{R - u}{R}$$

where x is the angle of equivalent grade $g = tgx$.

Provided the tractor is equipped with a power plant calculated to develop at plowing speed on the level a net drawbar pull equal to the weight of the machine, the tractor can climb up a grade of 45 deg. with small load. In this case equation (47) becomes

$$D = 6.83u \quad (48)$$

The table below gives the minimum diameters of wheels with which tractors having a drawbar pull equal to their weight could pull out of holes in the ground of a depth u provided both rear wheels were climbing at the same time, with all weight resting on the rear wheels at that moment:

D, in.	u, in.	D, in.	u, in.
20	2.9	42	6.1
25	3.7	48	7
30	4.4	54	7.9
36	5.2	60	8.8

In case the machine is equipped with an emergency gear reduction giving 50 per cent more pull than the plowing gear, the operator can shift into low and in this way make the tractor climb out of a hole corresponding to a 100 per cent grade and still be able to develop 50 per cent of its maximum drawbar pull P_p.

Thus it will be readily seen how important it is to select driving wheels of the proper diameter, and it is not advisable to go under 48 in., as otherwise the machine might not climb up even a shallow ditch.

As regards the size of front wheels, they must not be too small in proportion to the rear wheels.

Influence of Wheel Dimensions on Ground Resistance

It is no doubt of value to the tractor designer to have an idea regarding the relation between the wheel dimensions (diameter and face of wheel) and the rolling resistance, and, therefore, the following mathematical derivations were made.

Let us assume that there is no cohesion, no mud and no dust on the surface; that the pressure of the soil against the tire increases in direct proportion with the depth of depression; that the pressure is nil at the surface and q lb. when the soil is depressed 1 in. deep; we than have (Fig. 6) and

$$dW = qydxF$$

$$W = qF\int_0^l ydx$$

where the integral is equal to the area of the half segment which was displaced by the wheel. The value of q is in effect the carrying capacity coefficient of soil in lb. per cu. in. The area of the half segment (see Fig. 6) is $\frac{1}{2}R^2S - \frac{1}{4}R^2 \sin 2S$, where S is given in radians. The angle S is comparatively small, hence we can substitute for it $\sin 2S = 2S - \frac{(2S)^3}{6}$, and we then get

$$W_1 = \frac{1}{12} qFD^2S^3 \quad (49)$$

in which W_1 is the weight on that particular wheel only.

When q is determined by experiment for a certain soil the value of S can be determined for any size of wheel, for

$$S = \left[\frac{12W_1}{qFD^2}\right]^{1/3} (S \text{ in radians}) \quad (50)$$

After the angle S is determined we can calculate the depth of sinking—

$$d = R(1 - \cos S);$$

the maximum pressure under the tire

$$\text{i max.} = qd$$

and the area of contact $= FR \sin S$.

Substituting in Fig. 6 a parabolic segment for the circular one we can say that the center of soil resistance is $\frac{3}{8}TR \sin S$ ahead of the axle. Consequently,

$$tW_1 \times R = W_1 \tfrac{3}{8} R \sin S$$

hence

$$t = \tfrac{3}{8} S \quad (51)$$

or

$$t = \tfrac{3}{4}\left(\frac{S}{2}\right),$$

in which $S/2$ is the slope of the chord.

Finally we get

$$t = \tfrac{3}{8}\left[\frac{12W_1}{qFD^2}\right]^{1/3} \text{ lb.} \quad (52)$$

The above equation does not take into account the action of the lugs, which, of course, increases the ground resistance considerably.

We thus arrive at the conclusion that a wider face of wheel gives less ground resistance. This conclusion, however, does not hold when the soil is muddy, sloppy and sticky on the surface but firm underneath; when deep mud is adhering to the wheels; when the soil surface is covered with deep, loose dust. The rolling resistance decreases more rapidly with increasing diameter than with increasing face of wheel.

Lug Dimensions

When determining the face of the driving wheels we must take due account of the necessary face dimensions of lugs or spurs. The action of lugs on the ground is similar to that of a pinion and rack. We may assume that only one lug is in mesh at a time, because setting the lugs too close would prevent self-cleaning in the softer soils. The pressure against the face of the lugs at a definite drawbar pull (for 2 driving wheels) can be calculated by means of the equation

$$P = 2F_l \times m \times j \quad (53)$$

where P is the drawbar pull for the two driving wheels; F_l, the length of the lug in in.; m, the depth of the lug and j the mean pressure against the face of the lug. Transposed this gives:

$$j = \frac{P}{2F_l m} \text{ lb. per sq. in.} \quad (54),$$

This pressure should not exceed 60 lb. per sq. in., as otherwise an enormous slippage and a large proportional loss of power must be expected. At the same time, however, the depth m of the lugs is limited, because the efficiency of the driving wheels is greatly lessened when m is too great. For wheels of 48-in. diameter it would not exceed 3 in.

Example: What is the pressure against the face of the lugs when $P = 3000$ lb. and $F_l = 12$ in.

Solution:

$$j = \frac{3000}{2 \times 12 \times 3} = 42 \text{ lb.}$$

The amount of traction obtainable depends upon the weight carried on the driving wheels, the size, shape, sharpness and number of lugs, the diameter and width of the driving wheels, the weather conditions and the cohesion of the soil.

Generally speaking, the greater the required traction the more weight there must be on the drivers in order to force the lugs into the ground. When the pull becomes excessive in proportion to the weight, the driving wheels start to slip considerably, the efficiency of the machine becomes very low and there is danger that the machine will stall.

When a wheel equipped with lugs rolls over the ground, the lugs being driven into the soil, the maximum resistance against the face of the lugs depends on the shearing resistance of the soil. The force of cohesion holds the particles of earth together so they resist separation. This cohesion force varies with the quality of soil, being greater in clay and smaller in ordinary soil. When the ground is plowed or otherwise cultivated its cohesion is entirely destroyed and can be regained only after a certain time and when the ground has been wetted.

Resistance

The resistance also depends on the friction of the earth. The cohesive force of the soil should be considered as active only when the ground has not been cultivated within a certain length of time, whereas the force of friction exists always. The friction between the steel tire of a drive wheel and the ground would not amount to much if the wheel were not equipped with lugs. But when the drive wheel is provided with lugs we have to consider friction of earth on earth and not friction of the wheel tire on earth. According to Rankine the coefficients of friction and angles of repose are:

Kind of Soil	Angle of Repose	Friction Coefficient
Earth on earth	14-45 deg.	0.25-1.00
Earth on earth, dry sand, clay and mixed earth	21-37 deg.	0.38-0.75
Earth on earth, damp clay	45 deg.	1.00
Earth on earth, wet clay	17 deg.	0.31
Earth on earth, shingle and gravel	39-48 deg.	0.81

From the above we may derive the following approximate values:

For vegetable soils, angle of repose, 40-41 deg., and coefficient of friction 0.83-0.87; for clay soils, angle of repose, 42-44 deg., coefficient of friction 0.90-0.97, the average being about 0.9.

The combined friction and shearing resistance might result in obtaining a greater traction or pull than the weight of the tractor. But in order to keep on the safe side the maximum drawbar pull according to the foregoing computations ought to be $P = 0.9W$ at the plowing speed.

Road Work

There are not many data available which would indicate how much drawbar pull can be safely expected from a tractor of a certain weight on different kinds of roads and under various conditions. We may say, however, that about two-thirds of the total weight can be obtained on country road if the tractor is equipped with proper lugs. This naturally varies with the weather, road conditions etc.

$$P_r = \tfrac{2}{3}W \text{ lb.} \quad (55)$$

where P_r is the available drawbar pull on the road.

The tractive effort or ground resistance of country roads varies from 7 per cent to 12 per cent, the average being 10 per cent. Allowing another 10 per cent as a reserve for grades, we can estimate the available drawbar pull of any given tractor on the road.

$$P_r = (t + g)W_h \quad (56)$$

Taking the ground resistance at 0.10 and the grade resistance at 0.10, we have for the necessary tractive effort to pull the total load W_h on the road:

$$P_r = 0.20W_h \quad (57)$$

or

$$W_h = 5P_r \quad (58)$$

and, as we estimated the maximum of pull to be two thirds of the total weight of the tractor, by substituting for P_r its value in equation (55) we obtain:

$$W_h = 5 \times \tfrac{2}{3}W_t$$

$$W_h = 3.33W_t \quad (59)$$

In other words, on country roads with grades up to 10 per cent the tractor is capable of hauling 3.33 times its own weight.

Longitudinal Weight Distribution

As already mentioned, the greater part of the traction or grip is obtained by friction of the soil particles. Hence we may say that the traction depends on the amount of pressure developed by the driving wheels, or, in other words, on the amount of weight carried on the driving wheels. To obtain the maximum amount of traction the designer will naturally endeavor to have as much weight on the drivers as possible, leaving on the steering wheels only enough weight to secure proper steering. In Figs. 7 and 8, A represents the tread; H, the wheelbase; C_g, the center of gravity; a, the distance of C_g from the rear axle in in.; c, the height of C_g from the ground in in.; e, the eccentricity of the drawbar in in.; h, the height of the drawbar in in.; W_d, the weight on the drivers at rest, and W_f, the weight on the steering wheels at rest.

The total weight W of the machine is supported by the front and rear wheels, and the value of W_f and W_d while standing still on the level depend on the distances a and H and can be determined by the following equation:

$$W_f H = Wa \quad (60)$$

$$W_d H = W(H - a) \quad (61)$$

Vice versa, we can calculate the necessary distance of C_g so that there will be a weight W_f on the front wheels:

$$a = \frac{W_f}{W} H \quad (62)$$

When plowing, it is usually not possible to hook the load exactly in the center between the rear wheels, because of differences in treads and in the width being plowed. Consequently, the center line of draft and that of the power do not coincide. This results in a moment Pe (see Fig. 8) tending to swing the tractor to one side. This moment Pe must be counteracted by a resistance P_s of the front wheels, which resistance depends on the weight carried on the front wheels. This counteracting moment must be at least equal to P_e, i.e.,

$$Pe = P_s H$$

Assuming that in order to obtain this resistance P_s an equal amount of weight on the front wheels is needed ($P_s = W_s$), we get,

$$Pe = W_s H \quad (63)$$

Further, from equation (62)

$$a_s = \frac{W_s}{W} H \quad (64)$$

or by substituting from equation (63) we have,

$$a_s = \frac{P}{W} e \text{ in.} \quad (65)$$

This value a_s represents the distance the center of gravity C_g must be ahead of the rear axle in order to

balance the effect of eccentricity e of the drawbar pull P alone.

Besides causing side draft, the drawbar pull has a tendency to tip the tractor over, on account of the moment Ph. From Fig. 7 we get,

$$Ph = W_pH, \qquad (66)$$

and, further, from equation (62),

$$a_p = \frac{Ph}{W} \text{ in.}, \qquad (67)$$

where a_p is the distance of C_g necessary to balance the moment Ph alone, representing the influence of the height of drawbar pull.

When the tractor is ascending a grade of angle x, the horizontal distance of C_g from the rear support is smaller than when it is on the level. This is illustrated in Fig. 9. The horizontal distance in the inclined position is $a \cos x - c \sin x$, while on the level it was equal to a. This diminution is equal to $a_g = a - (a \cos x + c \sin x)$. But since the angle x is small we may write $a_g = c \sin x$ or

$$a_g = cg \qquad (68)$$

In Fig. 6 it is shown that if a wheel is rolling over soft ground it has to overcome a resistance equivalent to that of a three-fourths slope of chord $= \frac{3}{4}(S/2)$ and is not supported exactly under the rear axle but $\frac{3}{8}R \sin S$ ahead of it. According to Fig. 6 this decrease in distance C_g to the rear wheel support amounts to

$$\tfrac{3}{8}R \sin S = Rt \ (S \text{ small})$$

and this also must be counterbalanced by placing C_g ahead by

$$a_t = Rt \qquad (69)$$

In order to be safe that the tractor will not tip over when the drawbar pull is applied at a certain height h above the ground, the tractor ascending a certain grade and overcoming the ground resistance t, but still will have weight enough on the front wheels to ensure proper steering when there is a certain side draft e, we must advance the center of gravity C_g such a distance as to completely counterbalance all of the above mentioned moments:

$$a = a_s + a_p + a_g + a_t$$

$$a = \frac{P}{W}e + \frac{P}{W}h + cg + Rt \qquad (70)$$

Equation (70) shows that:

1. The emergency or low speed must not be too low nor the drawbar pull P_l too high, otherwise the machine is apt to tip over and endanger the life of the operator.

2. The height of drawbar must be adjustable so the load can be hitched very low when the pull is very heavy. Otherwise the machine would either tip over or have too much weight on the front wheels when doing lighter work.

3. The center of gravity must be low to insure good weight economy on the level as well as on grades (height c small).

4. The percentage of weight carried on the front wheels, as sometimes given in catalogs, does not at all give sufficient guarantee that the machine will not tip over; the only safeguard is a definite minimum distance a between the center of gravity and the rear axle.

5. This distance a, or the location of the center of gravity, does not at all depend on the wheelbase. The longer the wheelbase the more weight there may be on the rear wheels (a being constant) and the better the weight economy.

When we are designing a new tractor we do not know the height c of C_g correctly and have to estimate same. For a preliminary calculation we can put it about equal to R; then equation (70) becomes:

$$a = \frac{P}{W}(e + h) + R(t + g) \text{ in.} \qquad (71)$$

Example: What is the minimum value of a for the following two tractors:

A has max. $P = 1.5W$
B has max. $P = W$

Other conditions are the same for both tractors, namely, $C = 6$ in., $h = 15$ in., $R = 24$ in., $t + g = 0.25$.

Solution:

A: $a = 1.5 \times 21 + 0.25 \times 24 = 37.5$ in.
B: $a = 1 \times 21 + 0.25 \times 24 = 27$ in.

The same machine which is perfectly safe with a definite pull-to-weight ratio (corresponding to a certain gear ratio) may become unstable and dangerous if the pull-to-weight ratio is increased (gear ratio too low).

What is the relative importance of the different influences on the location of the center of gravity in the case of tractor B of the above example?

Side draft a_s	= 6 in.	= 21.3%
Drawbar height a_p	= 15 in.	= 53.2%
Ground resistance a_t	= 3.6 in.	= 12.75%
Grade resistance a_g	= 3.6 in.	= 12.75%
		100%

If we consider only the influence of drawbar height, without paying attention to the other factors, as is the usual practice, the minimum safe value of a for tractor B of the above example would be 15 in., but this is only 53.2 per cent of what it should be. Thus we can see that we would make a very considerable error if we took only the drawbar height into account, instead of the sum of all the factors influencing the value of a.

Let us now discuss briefly the weight distribution in a front wheel driven tractor. It is characteristic of the front wheel drive that the more the machine pulls the less the weight resting on the front driving members. Inasmuch as most of the total weight is concentrated on the drivers (in front in this case) the machine is safe even at the heaviest pulls; but when the tractor is descending a steep hill and not pulling there is a tendency to tip over to the front. Therefore, the weight must be properly distributed with view to this condition. Consequently, for front drive (see Fig. 10)

$$a = cg \text{ in.}, \qquad (72)$$

in which a is the distance of C_g behind the front axle and g the steepest gradient which can be descended with safety.

For instance, let $c = 24$ in. and $g = 0.50$ (50% grade). Then $a = 12$ in.

When we have determined the center of gravity we can estimate the wheelbase approximately—

$$H = 2\tfrac{1}{2} \text{ to } 3a \qquad (73)$$

The tread A should be equal to about $2\frac{1}{4}c$ to insure the necessary lateral stability

$$A = 2\tfrac{1}{4}c \qquad (74)$$

(To be continued)

THE influence of turbulence on the explosibility of gas mixtures and on the working of gas engines was, though not overlooked, not sufficiently heeded until recent years. Experimenting on behalf of the British Association Committee on Gaseous Explosions (Dundee, 1912), Dr. Dugald Clerk observed that the rate of explosion rise increased with the number of rotations and decreased when the turbulence was damped down. An engine working normally with ignition at the end of the first compression stroke attained maximum gas pressure in 0.037 second; when ignition was effected at the end of the third compression stroke, i.e., after turbulence had subsided, maximum pressure was not attained in less than 0.092 second. Agitating the gas mixture contained in a closed cylinder by means of a fan, the late Professor Bertram Hopkinson found that with the fan at rest and at 2000 r.p.m. or 4500 r.p.m. maximum pressure was reached in 0.13 second, 0.03 second and 0.02 second.

Belgian Industry Has Big Task In Its "Comeback" Effort

Troubles of the Germans in Keeping Their Army Motor Equipment Running in Latter Days of War Show How Country Was Stripped—Labor Problems

By W. F. Bradley

IN his two previous articles Mr. Bradley, special European correspondent of AUTOMOTIVE INDUSTRIES, told in detail of the destruction of the automotive industry in Belgium by the German army, aided by civilians. In this article he tells something of the incidental motor troubles of the invading army and of the failure of the much talked of substitutes. He also tells briefly the problems that confront the Belgian manufacturers in resuming production. As in the previous articles, the pictures taken especially for AUTOMOTIVE INDUSTRIES at the Belgian factories comprise a vital part of this story.

In this series Mr. Bradley, who went to Belgium especially for AUTOMOTIVE INDUSTRIES, draws a convincing indictment that the Germans combined war and business. There can be little doubt that much of the destruction of the Belgian plants was due to a desire to remove an after the war business competitor. This is best shown by the continued removal and destruction of machinery after the signing of the armistice was known. If you have not read the previous articles, you should get them.

—EDITOR.

WHEN the German forces first entered Belgium they made very extensive use of automobiles. Naturally, one of their first acts was to prevent any civilian traveling by automobile. This automatically shut down the factories. Many other industries, however, continued to work for a considerable time to supply civilian needs.

Large numbers of Belgian automobile owners fled in 1914, using their cars as the best means of getting away. For a number of weeks, 2000 to 3000 Belgian automobiles were parked in the public squares of the Port of Havre. Contrary to expectations, however, the Germans did not seize many private automobiles in Belgium. Where stocks existed in the factories, they took them, but the military had an objection to taking individual cars of varied makes, and the German automobile manufacturers protested against Belgian machines being used while they were in a position to produce.

As early as 1915 the effect of the blockade showed itself in a reduction in the number of German touring cars in service. While in 1914 every officer appeared to be able to get the use of a car, in 1918 the restrictions were so great that in the whole of Brussels, which was the center of the German army organization, there were not more than 50 military automobiles in service. The trolley cars were kept running, and officers used these for getting about Brussels.

The loss of rubber was a serious blow. While the Allies ran all their trucks on rubber tires, and even had automobile-hauled gun carriages rubber shod, the tire dimensions going as high as 60 by 9 in., it was a rare occurrence to see a German truck with rubber tires. Of the hundreds of abandoned or captured German trucks I examined in Belgium, not more than a dozen had rubber tires.

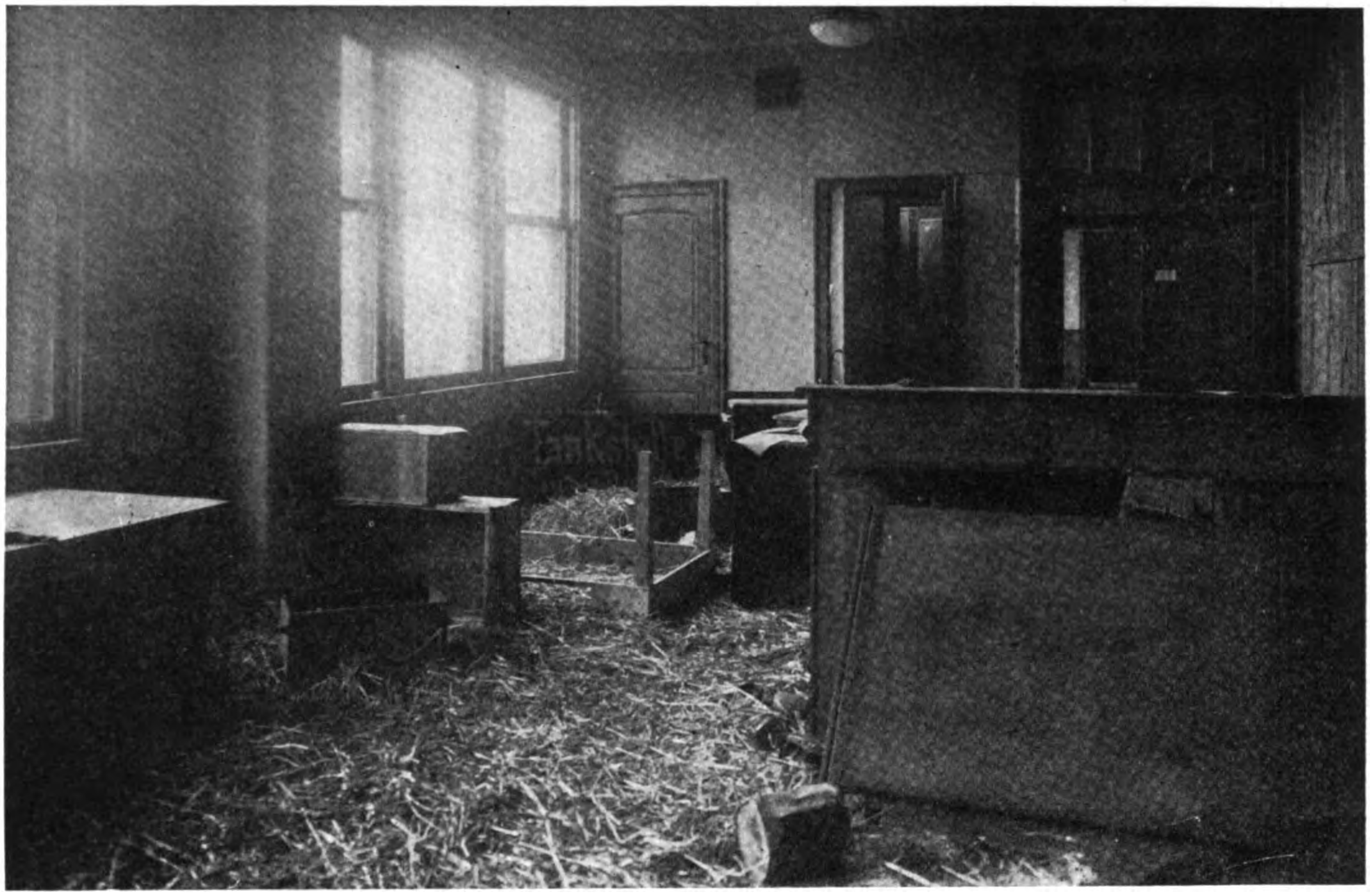
The stories of artificial rubber appear to be a myth. The majority of these trucks had very thick wood rims; mounted on the rim of the wheel around this was a light steel rim which made contact with the road. Another equally common method was a series of rubber blocks, each of which was set in a pair of cups mounted respectively on an inner and an outer rim. The inner rim was fixed and the rim had a certain amount of elasticity. In this case, as in the first instance, a steel rim was in contact with the road, the rubber giving a cushioning effect without being subject to friction with the road surface.

In some instances this system of rubber blocks between two steel rims was applied to touring cars. The result, however, was not at all satisfactory; speed had to be kept down to 12 miles an hour, the vibration was tremendous, and there was a decided tendency to skid.

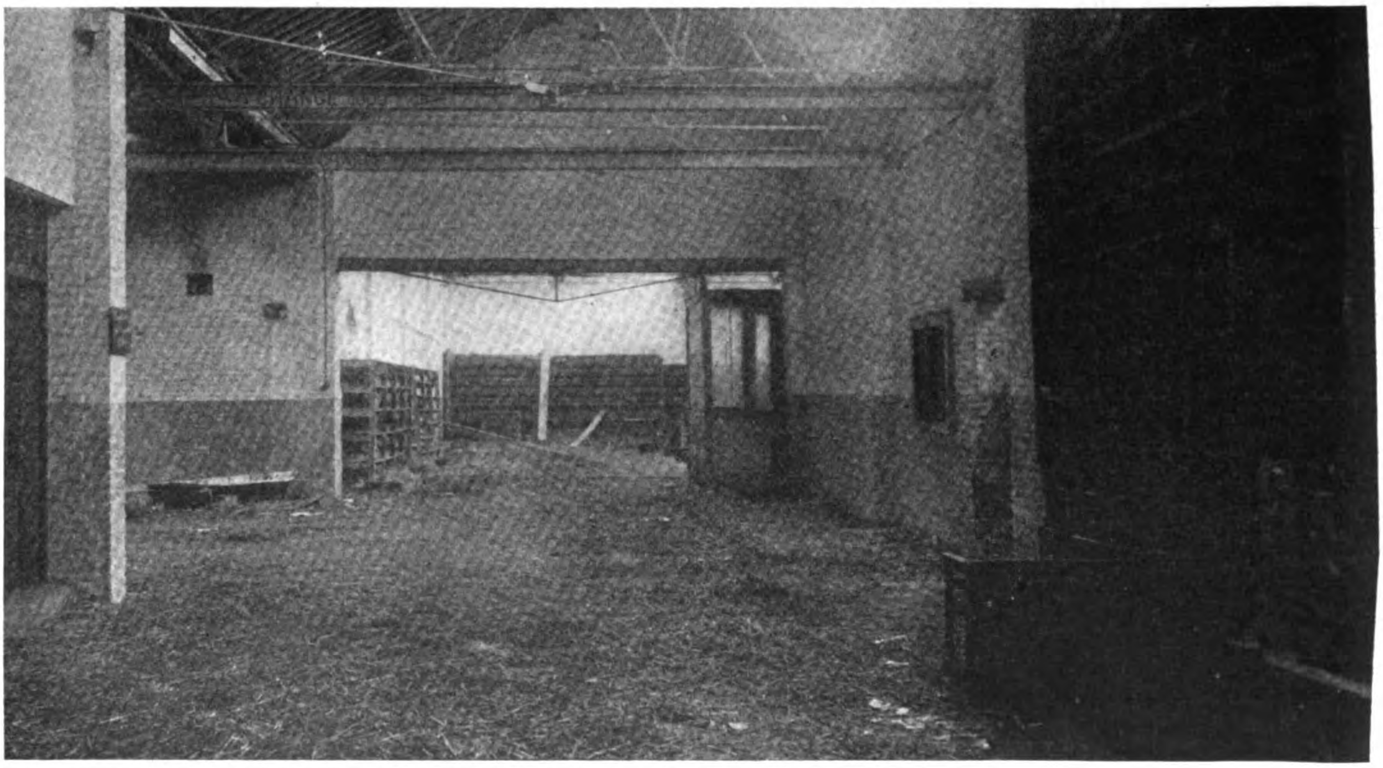
Trucks with steel tires in contact with the road were very difficult to handle on the granite-paved roads of Belgium, and on ice or snow-covered macadam roads. As a precautionary measure, every German truck carried two large sand boxes just behind the rear wheels and under the body overhang.

Sufficient pneumatic tires were obtainable to supply the cars used by the higher staff officers at the front, but the scarcity of rubber and the impossibility of find-

Armistice Day Photographs in the Derihon Factory



The office furniture was smashed, apparently without cause



This stockroom was used as a stable after everything but a weighing machine was removed

ing a substitute for pneumatic tires restricted the use of touring cars to officers in the field.

The truck was maintained by reducing the average speed, but even with this precaution the results were so unsatisfactory that light railroads were preferred. Fortunately for the enemy, Belgium and northern France were well provided with these roads.

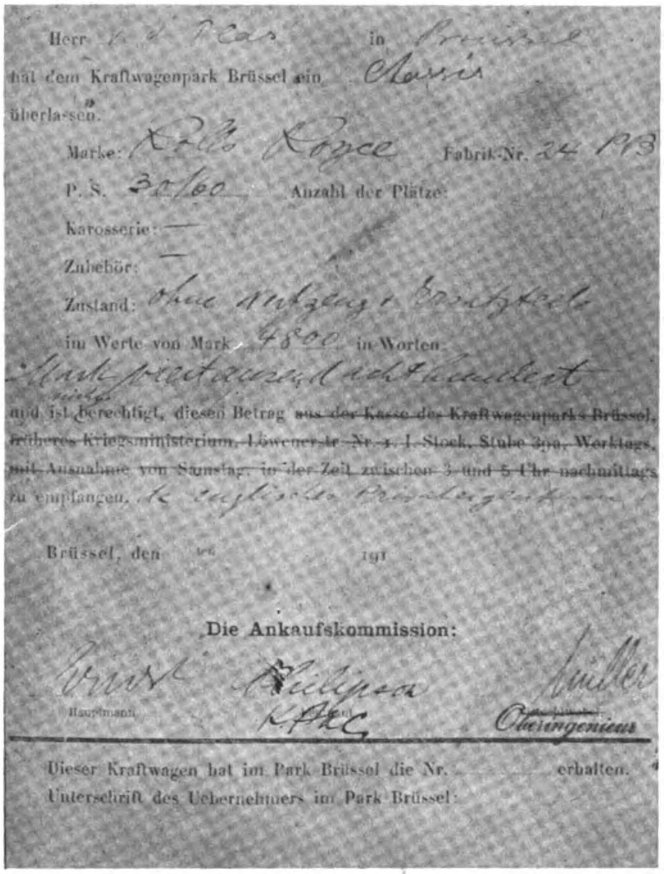
The impression has prevailed that Germany was well provided with gasoline. This is not borne out by automobile engineers who remained in Belgium during the occupation. The Galician and Roumanian oil fields appear to have supplied the enemy little of this fuel. At a comparatively early period restrictions were placed on automobile travel, as much with a view to economizing gasoline and oil as to save rubber.

All gasoline appears to have been reserved for the air service, leaving a peculiar kind of benzol for trucks and touring cars. Although this was officially known as benzol, one engineer, who had an opportunity of using it within a few days of the departure of the Germans, stated that it was a very heavy fuel, of a yellowish tint, having a strong smell of unwholesome eggs. The consumption of this fuel was high. On the dashboard of certain 2-ton trucks the following direction was painted: "Gasoline consumption 80 liters per 100 kilometers," which is equivalent to 3 miles per American gallon.

One of the results of the war has been a serious deterioration of Belgian roads. All the macadam roads have broken down under the strain, for the German armies did as little road repair work as possible. The main roads, paved with granite blocks, were not seriously damaged during the occupation. Since the German armies left Belgium, the civilian authorities have attacked the road problem, and are widening and repairing the main roads to meet the increased traffic which is anticipated with the return to normal conditions.

The Germans made considerable use of trailers for cargo-carrying purposes, for ambulances and for kitchens. All of these were shod with steel tires. While the automobile service was reduced to the lowest possible limits, the railroads were operated to maximum capacity. At certain times there passed over the main lines a train every 5 minutes in each direction, this continuing day and night for two weeks.

When troops were being moved at this rate it was impossible to understand anything of the German plans. When fresh troops were brought from the east the trains appeared to carry an almost equal number of tired troops to the rear. In other words, the movement was so intense in each direction that nothing of the German plan could be ascertained. It was different, however, when a big offensive was in preparation, for when shells were carried to the western front the trains always returned empty.


Herr in
hat dem Kraftwagenpark Brüssel ein Chassis
überlassen.
Marke: Rolls Royce Fabrik-Nr.
P.S. 30/60 Anzahl der Plätze:
Karosserie: —
Zubehör: —
Zustand:
im Werte von Mark 4800 in Worten:
und ist berechtigt, diesen Betrag ~~aus der Kasse des Kraftwagenparks Brüssel, früheres Kriegsministerium, Löwenerstr. Nr. 1, I. Stock, Stube 300, Werktags, mit Ausnahme von Samstag, in der Zeit zwischen 3 und 5 Uhr nachmittags~~ zu empfangen.
Brüssel, den 191
Die Ankaufskommission:
Hauptmann
Oberingenieur
Dieser Kraftwagen hat im Park Brüssel die Nr. erhalten.
Unterschrift des Uebernehmers im Park Brüssel:

Receipt given by the Germans for a new Rolls-Royce chassis requisitioned by them at the Van den Plass body works. They allowed 4800 *marks (approximately* $1,200*). The pre-war value was* $6,000 *and during the war rose to* $9,000

Gasoline tractors were used for hauling big guns. These were mostly manufactured by the German Daimler, Benz, and Horsch companies. In all cases they were of the rear-wheel-drive type, with very large diameter wheels, shod with steel tires. Use was also made of big two-wheel trailers carrying a Mercedes four-cylinder engine of about 5 in. bore, which operated a winding drum, and appeared to be used exclusively for placing the big guns in position. A large number of these, in good condition, were left at the Cockerill Engineering Works.

The Belgian manufacturers have before them a big problem, which they are pluckily undertaking. The destroyed plants are only a part of this task.

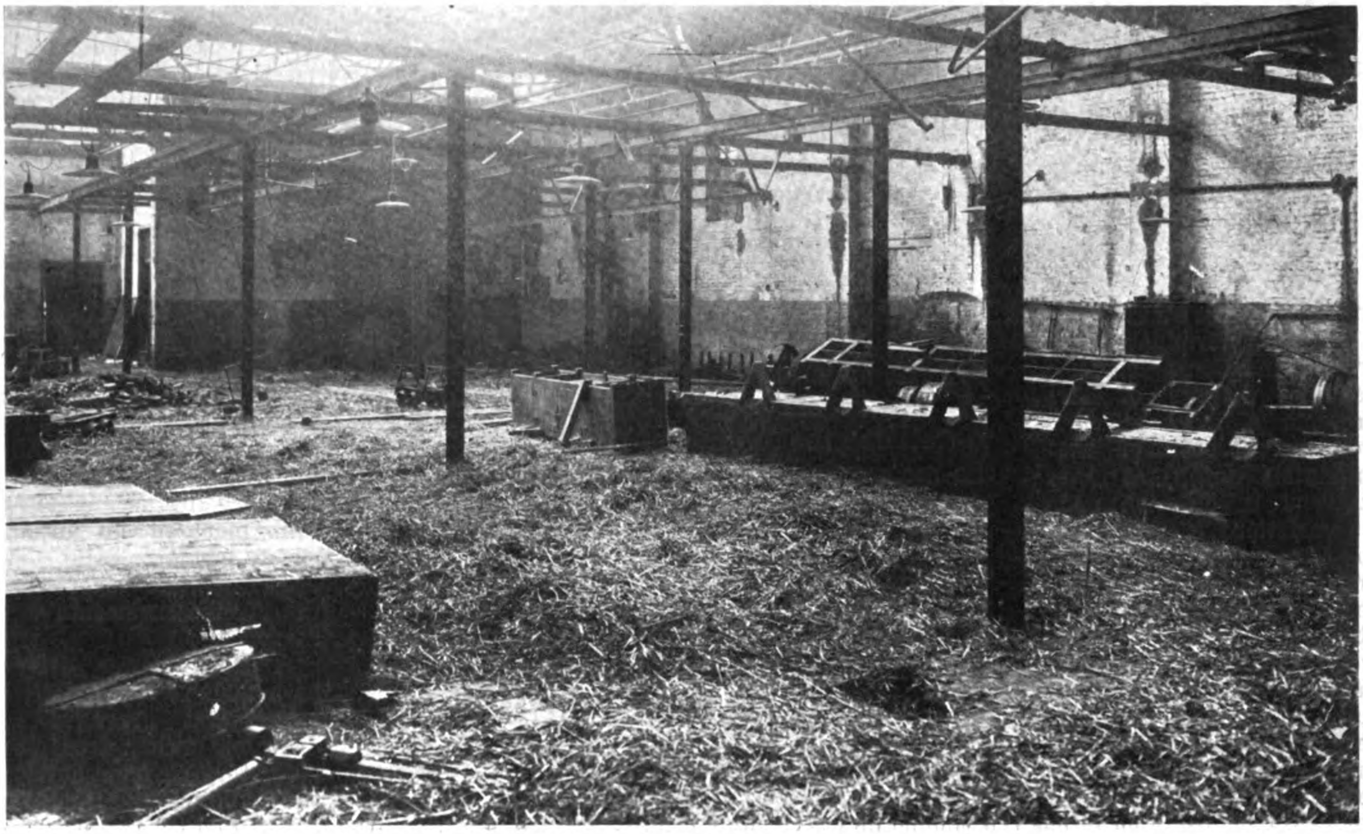
Labor conditions in Belgium are in a complex condition as the result of the war. Idleness is always demoralizing, even if adopted to hinder or injure an enemy. Belgian workpeople who have been living on 40 cents a day for 4 years, paying no rent, drawing free soup and rations, stealing from the Germans whenever possible and glorying in the action, are obviously not better for these practices. On the other hand, numbers escaped to England, where they earned high wages and enjoyed better working conditions than ever before in their lives.

These form the two extremes: the men who have been spoiled by prosperity in England and those who have been demoralized by German severity. Between them are the more intelligent and patriotic workers who realize that it is necessary to put forth enormous efforts to return Belgium to her former position.

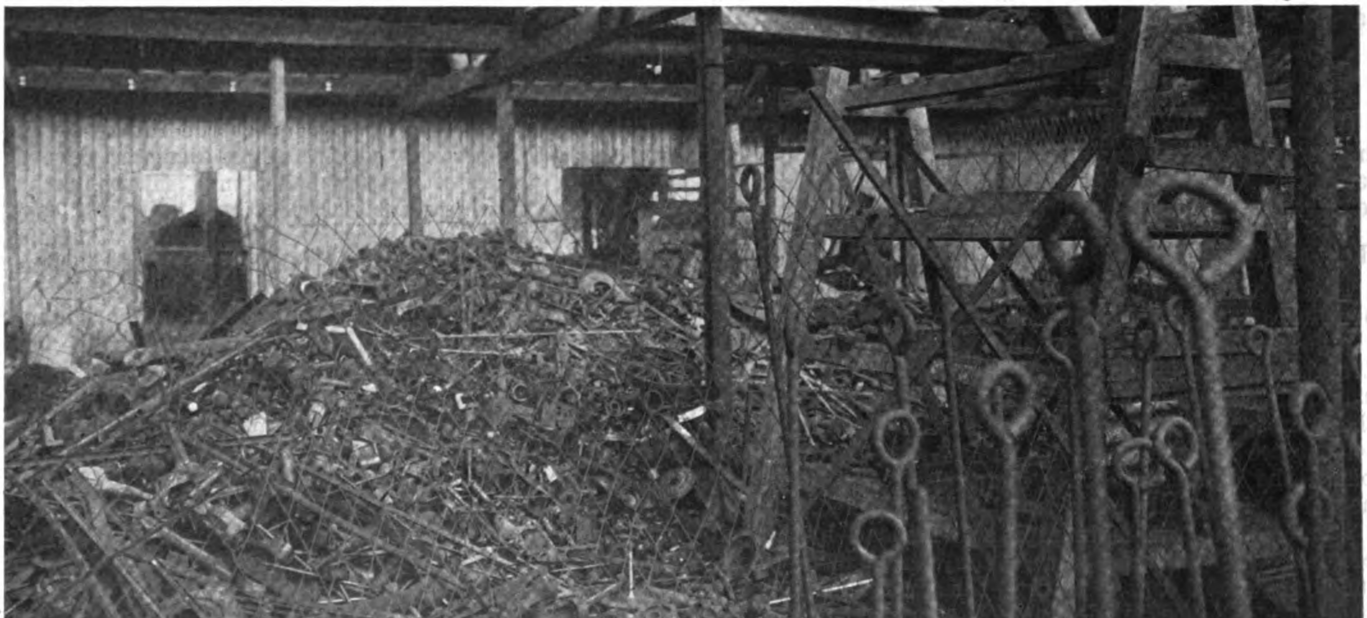
As in France and England, the claim has been made for an 8-hour working day or less. Even in France it is recognized that the reduction in the number of hours can only be effected by the use of labor-saving machinery and better shop methods. Directors of small French industries, in which the proportion of labor to machinery is necessarily high, claim that they are seriously handicapped in comparison with the big industries in which labor is small in proportion to machine work. Until machinery can be obtained for the Belgian factories, hand work will predominate, and because of this condition the manufacturers have opposed the demand for the 8-hour day.

A compromise has been arrived at whereby the 9-hour day will be established for 1 year.

Types of Wanton Destruction by the Germans



This was a high class machine shop. The Germans left only electric light fixtures



The Germans worked until the armistice became effective adding to this pile of scrap. Most of it was made from machinery

Air Weight and Volume Measurement

Practical Use of Venturi Meter for Quantitative Determination — Graphic Methods Shorten Process of Obtaining Results and Permit of Rapid Checking During Tests

By Don T. Hastings

THE apparatus and methods described in this article greatly facilitate the making of tests and the solution of problems in which the measurement of weight or volume of air is involved. Such problems include the determination of mixture ratios delivered by carbureters, division of total air entering a carbureter between the various intakes, volumetric efficiency of engines and the influence of changes in design in valves, valve timing, gas passages, etc., on the volumetric efficiency.

THE accurate and rapid determination of volumes and corresponding weights of air presents a most difficult problem, because of the intangible nature of the material in question and its variations with respect to temperature, pressure and humidity. The effects of these three variables on the density, or weight per cubic foot of dry air, have been carefully determined, and the results are embodied in the Smithsonian Tables; consequently, if a means is found for determining either the volume or weight of a given amount of air the other quantity can be readily computed.

There are three principal methods used commercially or in the laboratory for the measurement of air volume, namely:

A—The gasometer.
B—Orifices in thin plates.
C—The venturi meter.

Of the three the venturi meter is the most accurate—the readings given by either of the other two devices being based on an initial calibration, while those of the venturi meter depend solely on its size and proportions.

The Venturi Meter

The venturi meter is an instrument for the measurement of the quantity of liquid or gas which flows through a pipe and consists essentially of a piece of round straight pipe which is contracted for a short distance to a diameter smaller than the main part of the pipe. The decreased diameter is known as the throat, and for convenience is usually made one-half, one-third or one-fourth the diameter of the main pipe; the length of the throat is usually made equal to its diameter and it is connected to the main pipe at each end by conical sections, which for the best results should have an included angle of 5 deg. to 11 deg., the smaller angle being the best. All the inside surface should be machined smooth so that there are no shoulders to interfere with the flow. Connections for manometers or gages for determining the pressure in the pipe are made at the throat and at both up and down stream ends a short distance from the ends of the tapered sections.

About 2 yr. ago it became necessary for the writer to determine the mixture proportions furnished by a number of carbureters. Being familiar with the work done by Prof. Charles E. Lucke along similar lines in the laboratory of Columbia University, his advice was followed in designing and constructing a multiple venturi meter to measure the weight of air, while the weight of fuel was determined by means of a tank mounted on an accurate platform scale.

The general layout for the air measurements was as follows:

A Root blower driven by a variable speed electric motor was arranged to draw air either from the laboratory or from outside the building and force it into a header into which the five venturi tubes were connected. From a duplicate header at the other end of the venturi tubes the air was conducted to a large air-tight box in which the pressure was maintained within one-tenth of an inch of water of atmospheric. In addition to varying the speed of the electric motor to secure this pressure relation, the blower was provided with a by-pass and automatic regulating valve.

Arrangements were made either to place the box around the carbureter or to connect the intake of the carbureter to the box by pipe of ample diameter, depending on the nature of the test being run. Every precaution was taken to prevent leakage at any point, although as the pressure in the box was maintained at atmospheric, there was practically no chance of leakage around the box affecting the results. To insure air entering the carbureter under normal conditions, that is, from a state of rest, several baffles were provided inside the box.

The construction of the multiple venturi meter is shown in Fig. 1. Five venturi tubes, each having a ratio of throat diameter to upstream diameter of one to two, were arranged between two headers of large diameter pipe. The throat diameters from top to bottom were ¼ in., ⅜ in., ½ in., ¾ in., and 1 in. Each end of each venturi tube was connected to a piece of iron pipe whose inside diameter was approximately the same as the upstream diameter of the venturi, in order to insure smooth flow and avoid eddy currents in the instruments. Between each of these pipes and the header were inserted a tee and a quick-acting shut-off valve. In addition, the three center venturis were provided with expansion joints to facilitate the assembling and avoid strains which might possibly result in air leaks.

The purpose of the shut-off valves at the upstream ends of the pipes was to permit the use of one or more venturis at a time, as required by the amount of air to be measured. The valves at the discharge ends of the

pipes, in connection with the adjacent tees, permitted two or more measurements to be made at the same time, as, for instance, the amounts of air entering a carbureter at the main and auxiliary intakes. In this case a second large box was provided to which the auxiliary intake was connected. The pressure in the second box was regulated to atmospheric by partially closing the valve at the entrance to the venturi thus used.

The venturi tubes proper were made of non-corrosive bronze and most carefully machined, so that the sizes were exact to less than 0.001 in. The workmanship was excellent, as no difficulty was experienced in maintaining the metal to metal joints airtight. Each venturi consisted of the following: 1 throat; 2 duplicate tapered sections; 2 duplicate upstream (and downstream) sections, and 2 duplicate pipe flanges. As the result of this design the throat for the ½-in.-1-in. venturi was the same as the upstream section for the ¼-in.-½-in. venturi, and the same relation existed between other sizes. The tapered sections also were made in such lengths that two or more could be joined together in case ratios other than one to two were desired between throat and upstream sections. This made a number of duplicate units so that the parts were readily manufactured, and the resulting outfit was quite flexible.

Each throat (or upstream section) consisted of two pieces. The throat proper, which was simply a ring of the proper inside diameter and length, had a groove turned around the outside at about the center of the length. From this groove four small holes were drilled through to the inside at 90-deg. intervals. The outer piece was also a ring which was a shrink fit on the throat proper. This outer ring was provided with four tapped holes for manometer connections. In assembling the two rings the tapped holes were carefully lined up with the drilled holes, so that the latter could be readily cleaned out if necessary. This construction gave an annular chamber around the throat connected at four points to the inside of the throat, thus insuring the pressure delivered to the manometer being as truly representative of the actual average pressure in the throat as possible.

The tapered sections and pipe connections were each provided with heavy flanges drilled for four bolts. The throat and upstream sections were thus clamped solidly between the two adjacent flanged pieces, making the construction very rigid and yet easily demountable when required. The clamp bolts (or their center lines) are shown in Fig. 1 only on next to the bottom venturi for the sake of clearness.

The Manometers

Previous experience with the ordinary U-tube water manometer for determining pressures led to the decision to design and construct special single-tube manometers. Special, heavy-wall, uniform-bore glass tubing was obtained, and connected top and bottom to specially designed castings, all being mounted on suitable boards for handling. The lower casting had a horizontal internal area of about 4 sq. in., while the bore of the tube was about ⅛ in. This gave a ratio of areas of about 1 to 340, and, consequently, a drop of level in the reservoir of this fraction of the height to which the column rose in the tube. By calibrating the manometer scale to allow for this drop, direct readings of height were made possible, in place of the customary two readings to be added, as in the case of the ordinary U tube.

A screw plunger for adjusting the level to zero of the scale was provided in the lower casting, similar to that found on barometers. The lower casting was also provided with a suitable drain cock, and a needle valve connection between the reservoir and the water column. Partially closing this valve assisted materially in steadying the height of the water column in case the pressure fluctuated slightly. At the same time it did not restrict the passage sufficiently to render the readings inaccurate.

The pressure connection to the reservoir was made by a special nipple and a tube carried up to the level of the top of the instruments to prevent spilling when the instrument was inclined and also to facilitate the making of connections.

The upper casting had a capacity in excess of the total volume of liquid used in the instrument to prevent over-

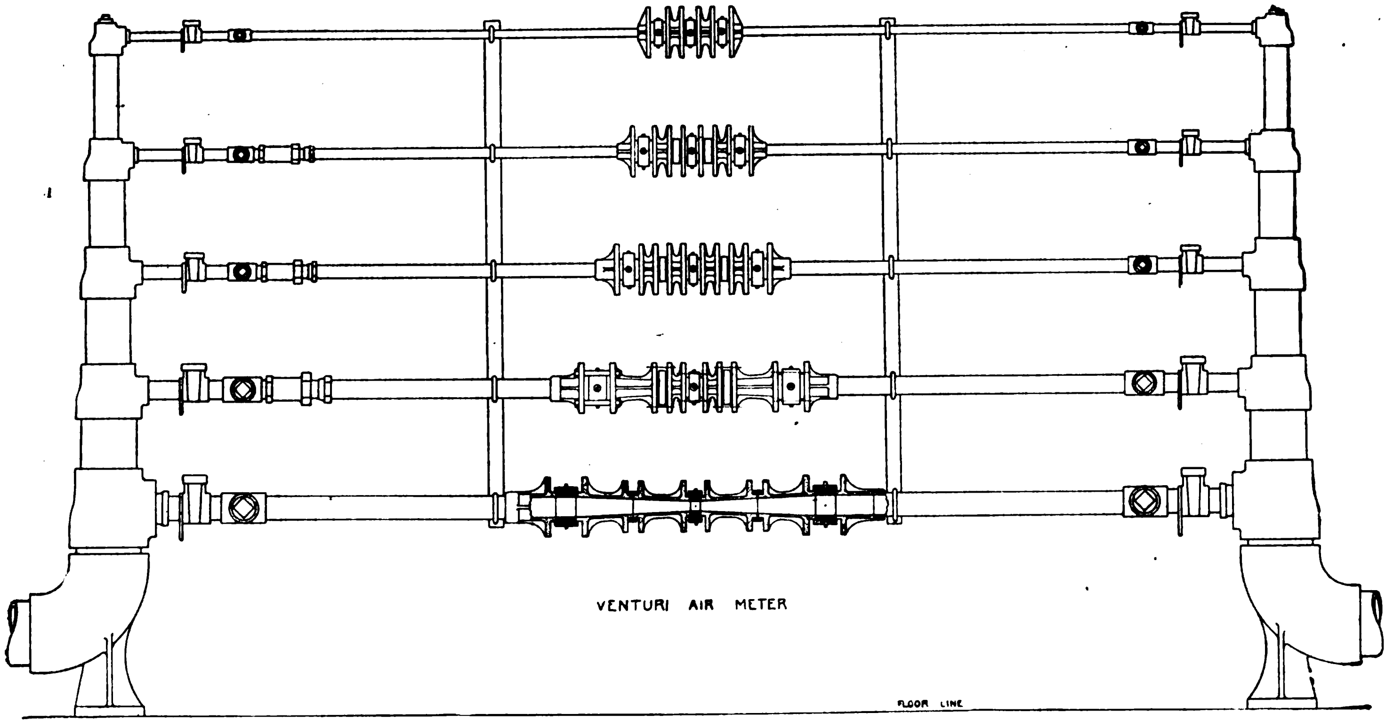


Fig. 1

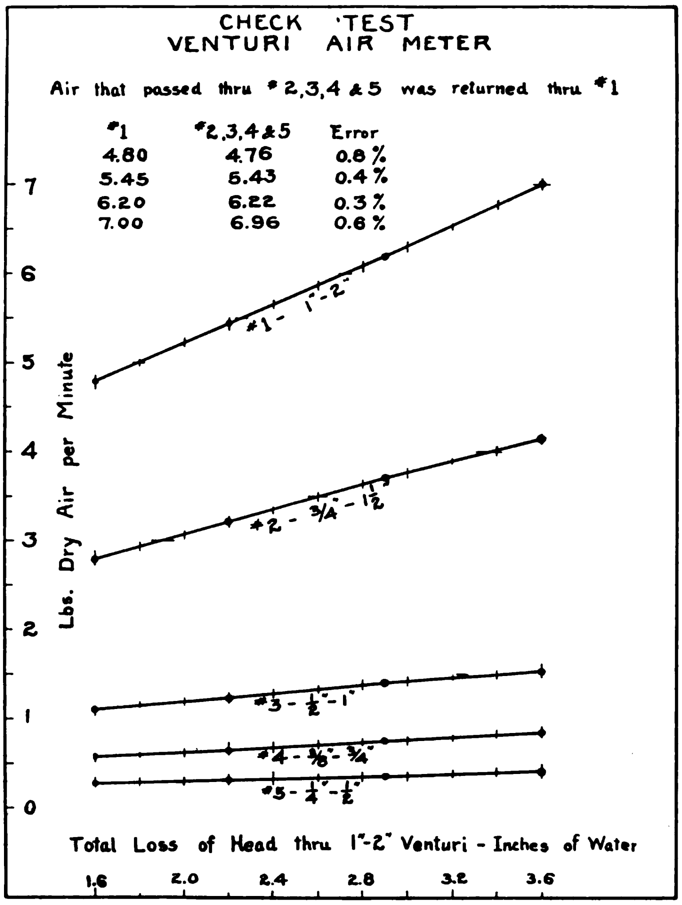


Fig. 2

flow in case excessive pressure was unexpectedly encountered. It was provided with a large filling plug and a suitable vent arranged to prevent the entrance of dirt. The shape of the upper casting and its connection to the top of the tube were so made that no liquid could be trapped and eventually work down to interfere with the accuracy of the readings. The vent could be readily replaced by a nipple for connection to a second source of pressure, in case it was desired to determine the difference of two pressures directly, instead of merely a pressure above atmosphere. This connection was also used if the instrument was needed as a suction gage, the vent then being through the tube leading down to the top of the lower casting.

Iron castings were used in the manometers, as they were sometimes used with mercury instead of water as the liquid. Brass would ordinarily be the better material where water only was to be used, but is impossible with mercury, due to the alloying action. No trouble was experienced with the cast iron in the water manometers, it merely being necessary to drain and rinse the instruments occasionally as the water became fouled with rust.

To insure the maintenance of atmospheric pressure in the box surrounding the carbureter a differential or inclined tube manometer was used. This is an ordinary manometer with the tube set at an acute angle with the horizontal instead of vertical. The result is to increase the movement of the liquid for a given vertical rise, permitting more accurate readings of small pressure differences. If the tube is set at 30 deg. with the horizontal the travel of the liquid along the tube is twice the vertical rise, while smaller angles give proportionately greater ratios.

As soon as the meter and blower were installed and all air leaks at pipe joints, valves, etc., eliminated, a check was made of the instrument by closing the end of the discharge header and the inlet valve to the largest venturi and removing the plug from the tee close to this valve. Air was then forced through the four smaller venturi tubes, all this air, of course, being obliged to return through the largest venturi. The results obtained are shown in Fig. 2. It will be noted that the difference for each set of readings was less than 1 per cent, indicating that the instrument is sufficiently accurate for all ordinary purposes.

The test described above is, of course, not an absolute check. An accurate check of this instrument could only be made by determining the actual weight of air, which is an extremely slow and expensive process. It was considered entirely unnecessary, however, as tests made at various places in the past have shown accuracies in the neighborhood of 99.8 per cent to 99.9 per cent. Some of these tests are described in Prof. Lucke's book, "Thermo-Dynamics."

To determine the loss of head through the instrument, a test was run whose results are shown in Fig. 3. Pressure readings were taken at the downstream end as well as at the upstream end and throat. It will be noted that the pressure loss is very small, indeed, considering the amount of air and the absolute pressures involved.

Use of the Meter

In actual use the meter permitted results to be obtained very rapidly. A few sample charts of tests made are reproduced herewith. Fig. 4 shows the mixture ratios delivered by a commercial carbureter under five different conditions of throttle opening. The wide variation as the quantity of mixture increases is, of course, very objectionable. This particular carbureter had an auxiliary spring-controlled valve. Adjustment of the

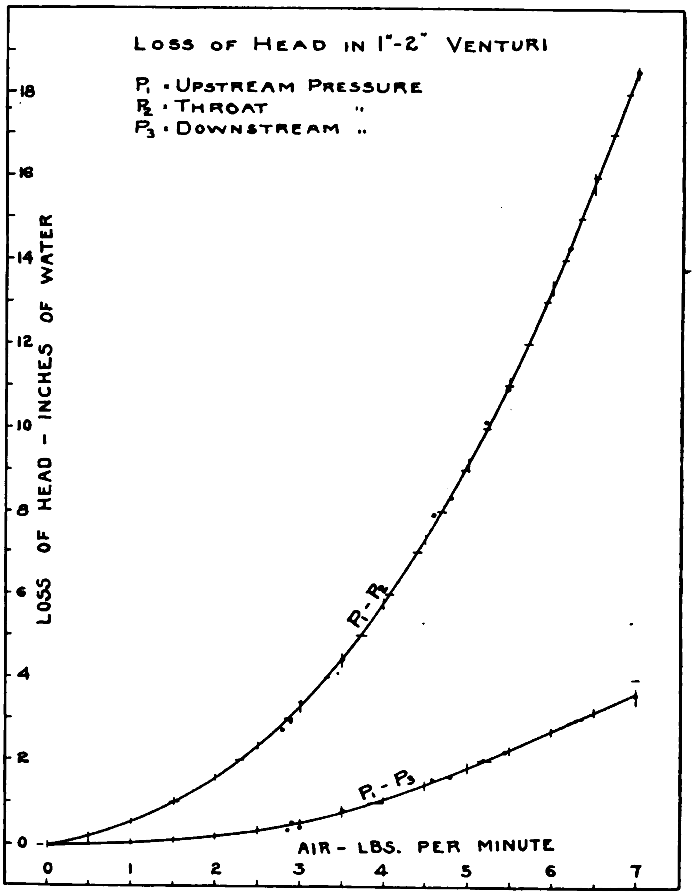


Fig. 3

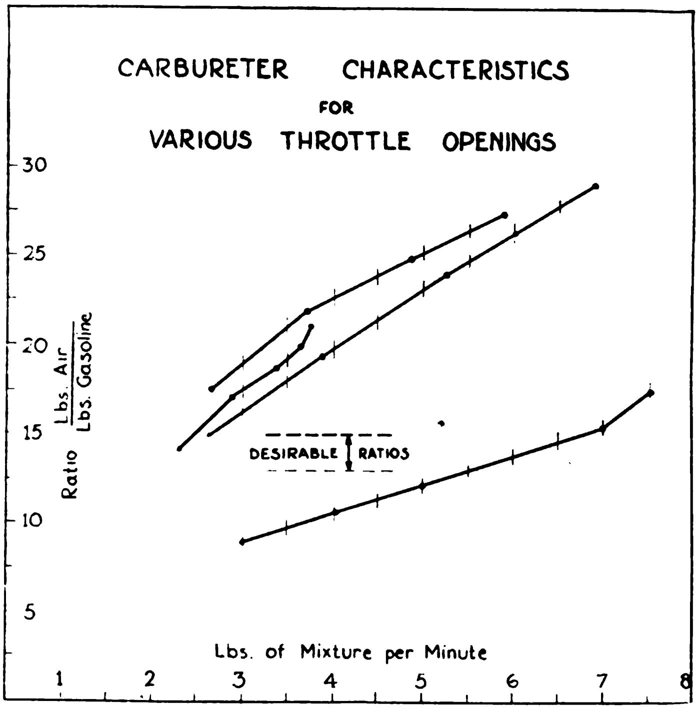


Fig. 4

spring would undoubtedly reduce the variation somewhat—the chart was selected merely to show the striking results obtained.

The test reported in Fig. 5 was made with the two pressure boxes as described above. The carbureter was of the type in which the fuel is atomized by the primary air, the quantity of fuel used being determined by the suction in the primary air passage. This chart, in connection with one like Fig. 4, furnishes an excellent guide to the changes or adjustments required to secure uniform mixture proportions throughout the speed and load range above idling. It seems to be generally accepted that a slightly richer mixture is desirable for idling, due probably to the greater dilution of the incoming mixture by the gases remaining in the cylinder.

Another very interesting test to which the venturi meter lends itself readily is the determination of volumetric efficiency of internal combustion engines, that is, the percentage of the piston displacement filled by air at atmospheric pressure under various working conditions. The amount of air is compared directly to the piston displacement, neglecting the volume of the fuel, as our present-day fuels generally enter the engine cylinders in a liquid state, even though finally subdivided by the spraying or heating in the carbureter or manifold. The volume occupied by the fuel under these conditions is relatively so small that no serious error is caused by this assumption.

The results of a test of this nature are shown in Fig. 6. A well-known truck engine, which gives general satisfaction, was tested with wide open carbureter throttle and again with the carbureter removed, the intake manifold being connected directly to the pressure box of the venturi meter. A surprising difference in the percentage of cylinder volume filled is at once apparent. It is evident that up to about 1200 r.p.m. the size and timing of the engine valves, shape and size of gas passages, etc., are about as good as it is possible to get. The one reading taken above 1200 indicates a fairly rapid falling off in efficiency at higher speeds. This is entirely immaterial, however, as the governed speed of this engine is in the neighborhood of 1050 r.p.m.

The striking thing about this test was the serious drop in volumetric efficiency when the carbureter was in place. The indications are, of course, that a larger carbureter is desirable. Before such a conclusion is accepted, however, the fuel consumption per brake horsepower hour with both carbureters should be checked up, as it is probable that the larger carbureter would give increased fuel consumption. Another factor to be carefully considered is whether the increased power is really desired. The engine is, of course, a heavy-duty one, and the power produced may be ample for the truck in which it is mounted. In any case, the increased power would undoubtedly mean shorter life and, consequently, greater repair expense and depreciation. All these factors must be taken into consideration before a change is made. Tests of this nature, however, are of considerable value in comparing different carbureters and in studying the effect of different size valves, changed valve timing, etc.

Data Required

The data which must be obtained whenever the air meter is used are shown in Fig. 7 in tabular form. This includes only the air meter data for a simple test, such as that charted in Fig. 4. The data sheet must be amplified in any particular case to include the other variables, such, for instance for Fig. 4, as fuel consumption and r.p.m.

The two temperatures and the barometer reading are used in determining the density of the air, and the barometer equivalent in inches of water, the two pressures and the two areas in determining the weight flowing per minute.

The data in connection with the density must be obtained to correspond with the air used; that is, if the air is drawn from outside the building the readings

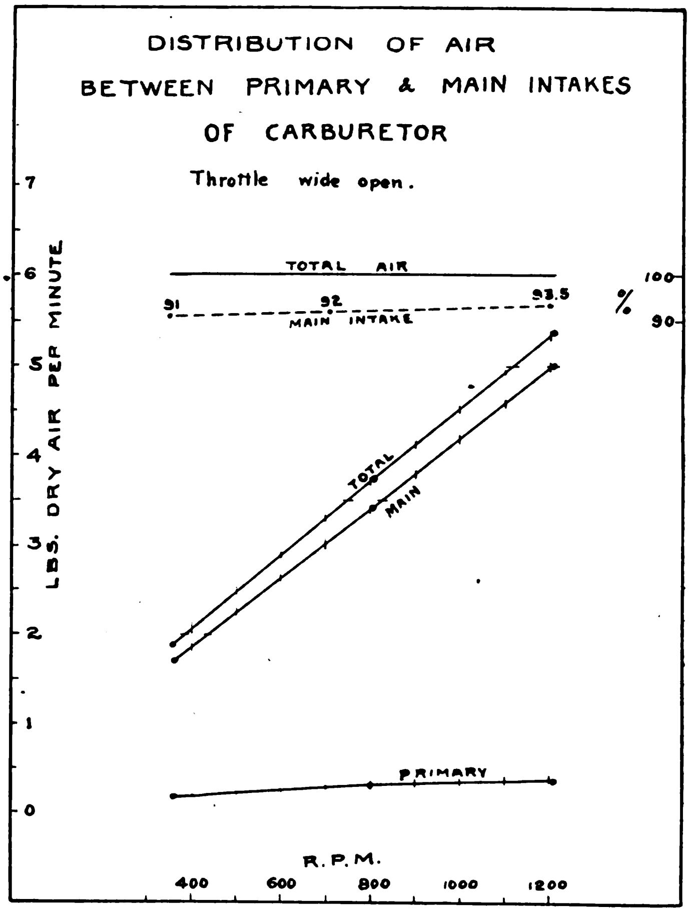


Fig. 5

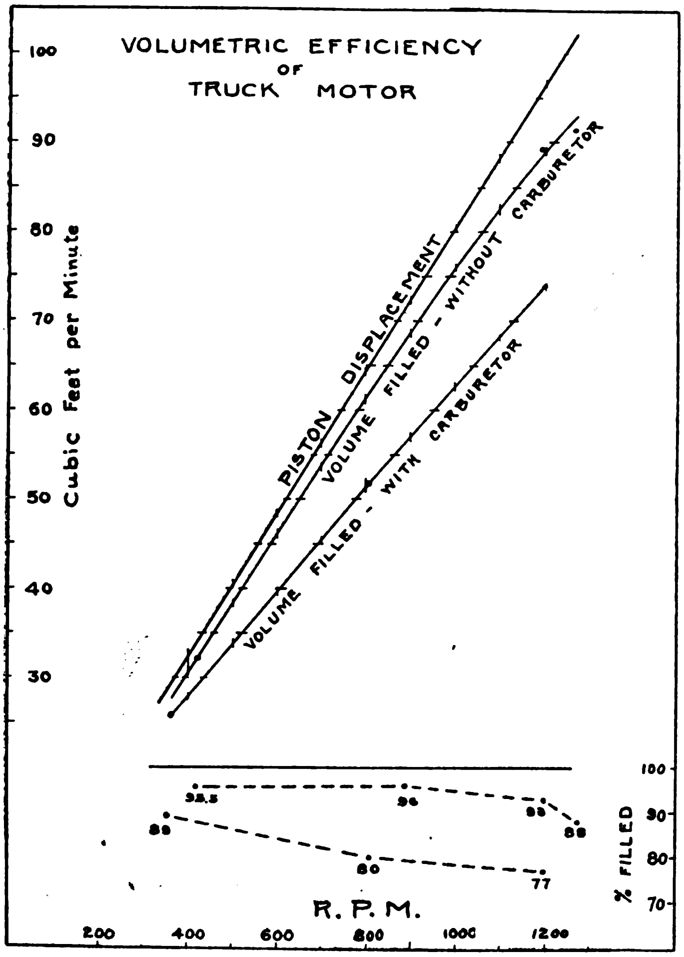


Fig. 6

should be made outside, while if air is drawn from the laboratory the readings must be made there.

The air temperature can be determined by means of any accurate Fahrenheit thermometer, readings being taken to the nearest ½ deg. The web-bulb thermometer readings are best obtained by means of a whirled sychrometer, which consists essentially of a Fahrenheit thermometer so mounted in a case that its bulb is surrounded by a cloth whose lower end is immersed in a vessel of water. This keeps the cloth around the bulb moist. The instrument is used by being swung around or to and fro at a velocity at the bulb of at least 10 ft. per second. This is the minimum velocity for accurate results—greater velocities make no appreciable difference in the readings. The temperature should be noted before starting to swing the instrument and then at short intervals until it has ceased to drop, the final temperature being recorded as t_1 in the tabular form.

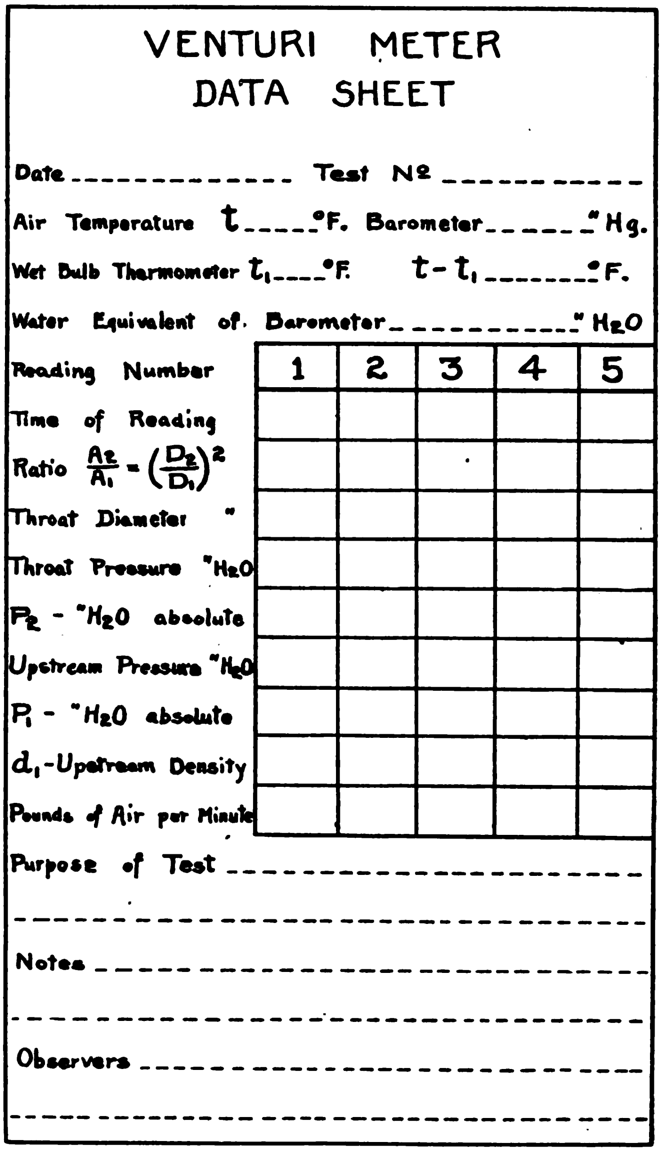
Data for determining density should be obtained about each half hour at the start of a series of tests, particularly if made in a room whose temperature rises during the test, as, for instance, when an engine is being run under its own power. After three or four readings have been taken, the frequency may be decreased if conditions are found to remain substantially constant.

Computations and Charts

The computation of results, even though use is made of logarithms, is an extremely slow and laborious process, due to the complexity of the formulæ, and presents constant opportunities for errors in calculations. It has the additional disadvantage of postponing the comparison and interpretation of results until a test is completed. If one set of readings is then found to give a result widely at variance with the others, either this result must be discarded or the whole test repeated. Obviously, then, it is of great importance to be able to obtain the results immediately after a set of readings is taken. To permit this being done, the charts shown in Figs. 8, 9 and 10 were prepared. While at first glance these charts seem quite complicated, with a little practice it is possible to obtain the result of a set of readings from them in 20 to 30 sec. as compared to about ½ hr. for the straight computation.

The charts are believed to be quite accurate. In Fig. 8 the lines carrying Roman numerals correspond to the data $b = 29.5$, $t = 82$ deg. Fahr., $t = 71$ deg. Fahr. The value of d from the chart is 0.0707 lb. per cu. ft., which agrees almost exactly with the computed value 0.07066. In Fig. 9 the data being $d = 0.0795$, $P = 380$ and $P = 390$, the chart gives $d = 0.081$ as against a computed value of 0.08099, a difference of less than 0.02 per cent. Also, in Fig. 9, V from $W = 0.7$ and $d = 0.070$ shows 10 cu. ft., which is obviously correct.

The data shown in Fig. 10 by the circles is $P_1 = 396$, $P_2 = 389$, $\frac{A_2}{A_1} = 200$, $d = 0.089$ and $A_2 =$ the area of a circle 1 in. in diameter. The chart gives a weight of 4.75 lb. per min., while the computed weight is 4.767, an error of less than 0.4 per cent.



VENTURI METER
DATA SHEET

Date .... Test No ....

Air Temperature t .... °F. Barometer ...... " Hg.

Wet Bulb Thermometer t_1 .... °F. $t - t_1$ ...... °F.

Water Equivalent of Barometer .... " H_2O

Reading Number	1	2	3	4	5
Time of Reading					
Ratio $\frac{A_2}{A_1} = \left(\frac{D_2}{D_1}\right)^2$					
Throat Diameter "					
Throat Pressure " H_2O					
P_2 - " H_2O absolute					
Upstream Pressure " H_2O					
P_1 - " H_2O absolute					
d_1 - Upstream Density					
Pounds of Air per Minute					

Purpose of Test ....

Notes ....

Observers ....

Fig. 7

DENSITY OF DRY AIR.

$$d = 62.4283\left(\frac{0.00129305}{1+0.0020388(t-32)}\right)\frac{1}{29.921}\left[b-\left\{f_1-0.000367\,b(t-t_1)\left(1+\frac{t-t_1}{1571}\right)\right\}\right]$$

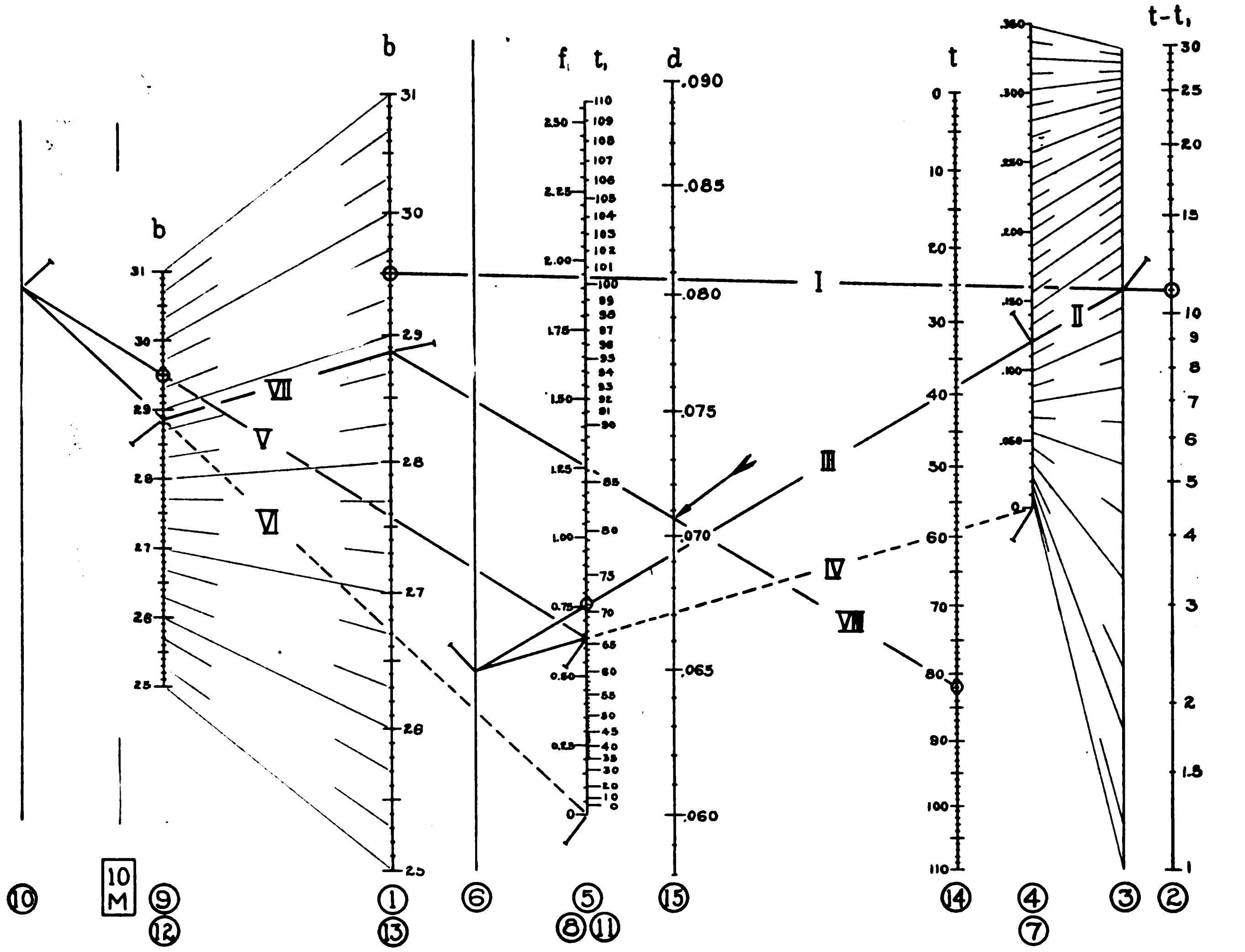


Fig. 8

SYMBOLS

d = density of dry air in pounds per cubic foot.
t = temperature of air in degrees Fahrenheit.
t_1 = temperature of wet bulb thermometer in degrees Fahrenheit.
b = height of mercury barometer in inches.
f_1 = vapor pressure in inches of mercury of saturated air at temperature t_1.

TO USE CHART

Vertical lines are numbered 1-15 in order of use.
Locate from data points on lines 1, 2, 5, 9 and 14.
Locate points on other lines by construction lines I-VIII as follows:

I through 1 and 2 locates 3.
II transfers 3 to 4.
III through 4 and 5 locates 6.
IV through 6 and zero of 7 locates 8.
V through 8 and 9 locates 10.
VI through 10 and zero of 11 locates 12.
VII transfers 12 to 13.
VIII through 13 and 14 locates 15.

NOTES

Significance of lines is as follows: 4—Smithsonian Table 41; 5—Smithsonian Table 40.
Intersection of IV and 5 shows vapor pressure on left and corresponding dew point on right.
Calibration of 14 is from Smithsonian Table 81.

MOIST AIR

To obtain density of moist air use line 10 M instead of line 10.

The density of the air where the sychrometer readings were taken is readily determined by reference to Fig. 8, complete directions for the detail use of the chart being given thereon. It may be of interest to note the significance of the several lines and their correspondence to some of the Smithsonian Tables. It must be clearly understood that the density obtained from this chart is that corresponding to atmospheric pressure. It is not the density of the air in the upstream section of the venturi which is required for use in Fig. 10.

This upstream density can be readily determined by reference to the right-hand chart of Fig. 9 and to the barometer conversion chart extending through the center of Fig. 9. The latter gives directly the height in inches absolute of a water column equivalent to the height of the mercury column of the barometer. As will be shown later, extreme accuracy in this conversion is relatively unimportant, and readings of the water column height to the nearest inch are entirely satisfactory. This quantity is P for the calculation of d_1, and is to be added to the upstream and throat manometer readings to get P_1 and P_2 for use in the right-hand chart of Fig. 9 and in Fig. 10. The value of d_1 must, of course, be greater than that of d, as the air in the venturi meter is under pressure.

After d_1 has been thus obtained it may be used in connection with the other data required in Fig. 10 to obtain the weight of air flowing per minute, complete directions being given on the chart for its use. It is perhaps advis-

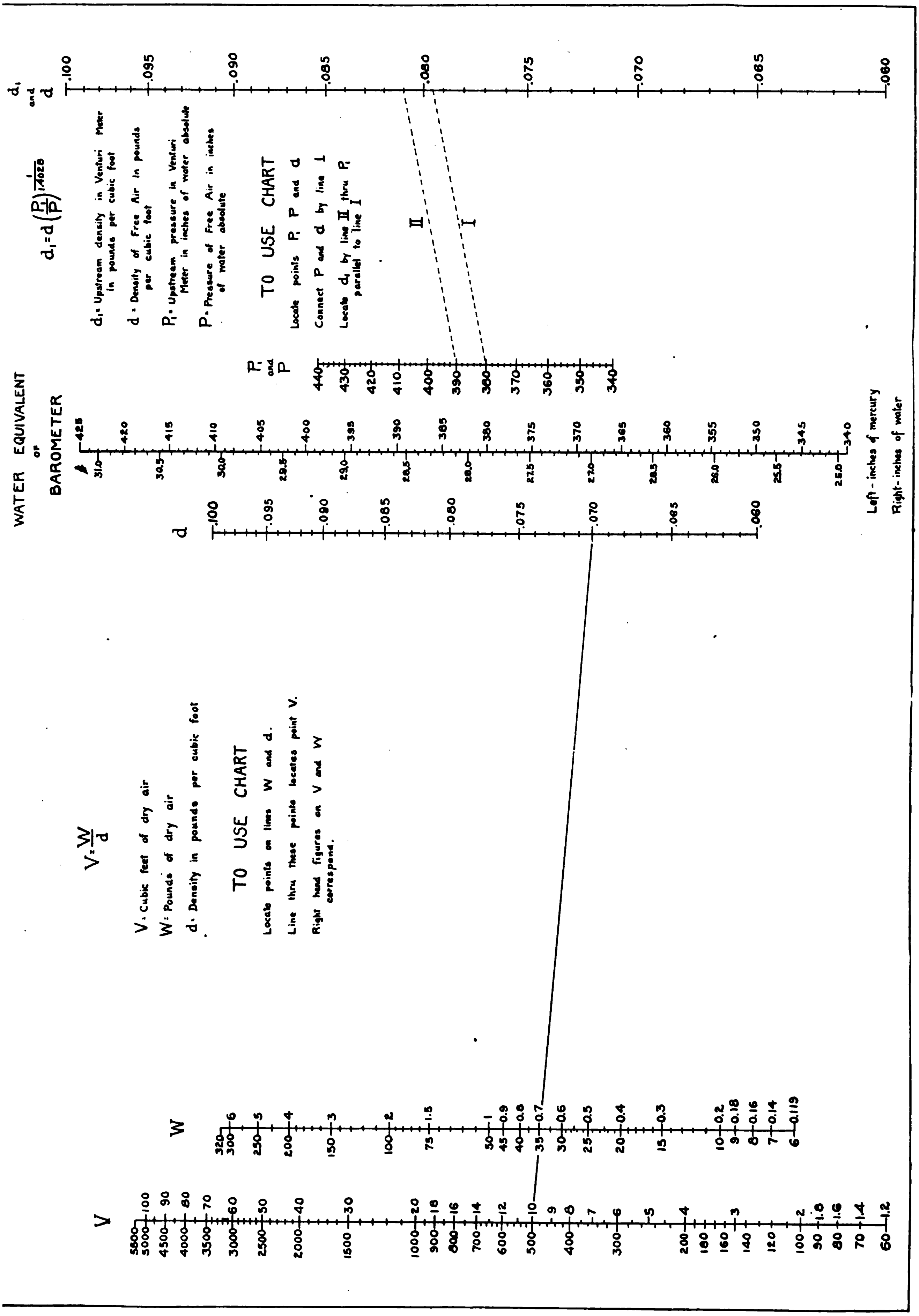

$d_1 = d\left(\frac{P_1}{P}\right)^{\frac{1}{1.4028}}$
d_1 = Upstream density in Venturi Meter in pounds per cubic foot
d = Density of Free Air in pounds per cubic foot
P_1 = Upstream pressure in Venturi Meter in inches of water absolute
P = Pressure of Free Air in inches of water absolute
TO USE CHART
Locate points P_1 P and d
Connect P and d by line I
Locate d_1 by line II thru P_1 parallel to line I
WATER EQUIVALENT OF BAROMETER
Left - inches of mercury
Right - inches of water
$V = \frac{W}{d}$
V = Cubic feet of dry air
W = Pounds of dry air
d = Density in pounds per cubic foot
TO USE CHART
Locate points on lines W and d.
Line thru these points locates point V.
Right hand figures on V and W correspond.

Fig. 9

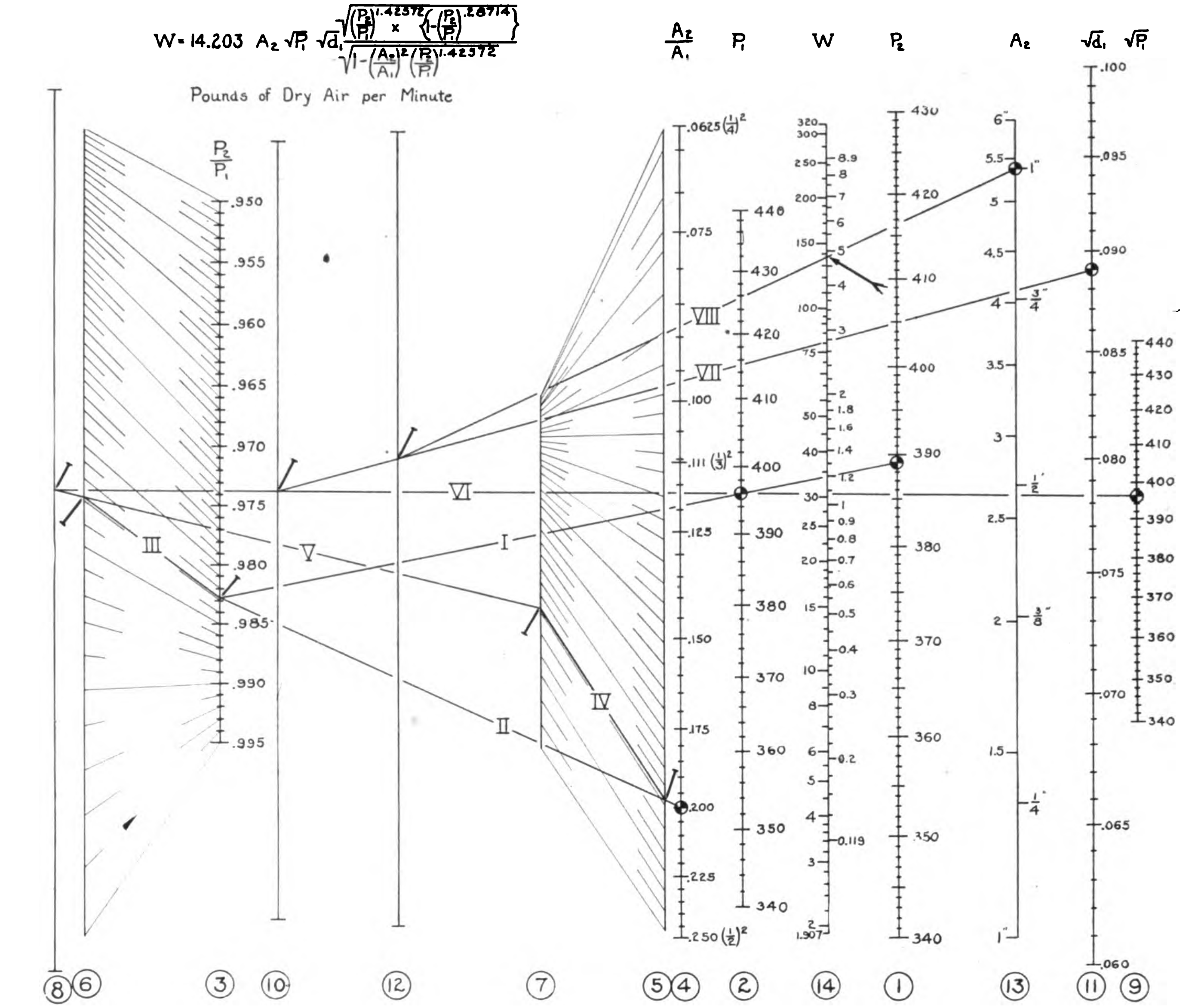


Fig. 10

SYMBOLS

W = pounds of dry air per minute.
A_1 = upstream area in square inches.
A_2 = throat area in square inches.
d_1 = upstream density in pounds per cubic foot.
P_1 = upstream pressure in inches of water absolute.
P_2 = throat pressure in inches of water absolute.
Fractions on line 4 show ratios of diameters; decimals, ratios of areas.
Figures on line 11 show densities.
Figures on line 13 show diameters.

TO USE CHART

Vertical lines are numbered 1-14 in order of use.
Locate from data points on lines 1, 2, 4, 9, 11 and 13.
Locate points on other lines by construction lines I-VIII as follows:

I through 1 and 2 locates 3.	V through 6 and 7 locates 8.
II through 3 and 4 locates 5.	VI through 8 and 9 locates 10.
III transfers 3 to 6	VII through 10 and 11 locates 12.
IV transfers 5 to 7.	VIII through 12 and 13 locates 14.

Right hand figures on 13 and 14 correspond.

able to call particular attention to the figures given on lines 4, 11 and 13. The decimals on line 4 show the ratios of the areas, while the fractions in parentheses show the ratios of diameters, the three commonest ratios only being thus expressed. Ratios nearer unity than (1/2) are inadvisable, owing to the slight pressure difference and consequent probability of error in readings, while ratios greater than (1/4) make no difference in the figure for the weight, and, consequently, the point on line 4 corresponding to the ratio (1/4) may be used for all greater ratios. It is not actually necessary to compute the areas A_1 and A_2 as the ratio only is required.

$$\frac{A_2}{A_1} = \frac{\frac{\pi}{4}D_2^2}{\frac{\pi}{4}D_1^2} = \frac{D_2^2}{D_1^2} = \left(\frac{D_2}{D_1}\right)^2$$

The square of the ratio of the diameters is much more easily computed and is the same ratio as shown above.

Line 11 is graduated proportional to the square root of d_1, but the figures given represent d_1 directly instead of its root. Line 13 is graduated in proportion to the areas of the throats, but the figures given read in inches of diameter, as this saves the labor of computing the area.

Attention is also called to the limits of the ratio $\frac{P_2}{P_1}$

These are 0.995 and 0.950, as shown by line 3. If the values obtained for P_1 and P_2 give a ratio outside of these limits, a larger or smaller venturi should be used. This illustrates again the extreme importance of obtaining the results at once after the data are recorded, to avoid the recording of unsuitable figures and permit

immediate repetition of a test, if for any reason the results are doubtful.

The left-hand chart of Fig. 9 was added to afford easy means of figuring the volume corresponding to any weight of air. It is required in case, for instance, the volumetric efficiency of an engine is being checked. Care must, of course, be exercised to select the proper value of d. In the case just mentioned it would be the value corresponding to atmospheric pressure and the temperatures t and t_1; that is, the value obtained from the chart in Fig. 8.

The Density Formula

The formula for the density of air in pounds per cubic foot given at the top of Fig. 8 is quite involved. It is based, however, on a few simple facts and its derivation is rather interesting.

The weight of a cubic centimeter of dry air at sea level in latitude 45 deg. and 32 deg. Fahr. is 0.00129305 gram. This value has been determined with great care, and is one of the accepted international standards. Under these conditions the height of the mercury barometer is 29.921 in.

Very carefully conducted experiments have proven that air expands about one-five-hundredth (0.0020389) of its volume at 32 deg. Fahr. for each degree Fahrenheit that its temperature is raised; that is, at a temperature of t deg. Fahr., its volume becomes $1 + 0.0020389\ (t - 32)$ times the volume at 32 deg. Fahr. The weight of a cubic centimeter under these conditions is decreased proportionately and becomes

$$d_t = \frac{0.00129305}{1 + 0.0020389\ (t - 32)}$$

The weight of a cubic centimeter, or, in other words, the density, also varies in direct proportion to the pressure, so that for any pressure H we have the proportion

$$\frac{d}{d_t} = \frac{H}{29.921}$$

from which

$$d = d_t \times \frac{H}{29.921}$$

and substituting our value for d_t

$$d = \frac{0.00129305}{1 + 0.0020389\ (t - 32)} \times \frac{H}{29.921}$$

For our purpose we desire the density expressed in pounds per cubic foot. There are 28,317 cu. cm. to the cubic foot and 0.0022046 lb. makes one gram. The product of these two factors is 62.4283, which, introduced in our formula, gives

$$d\ (\text{cu. ft.}) = 62.4283 \times \left[\frac{0.00129305}{1 + 0.0020389\ (t - 32)}\right] \times \frac{H}{29.921}$$

The factors 62.4283, 0.00129305 and 29.921 could, of course, be combined into a single number (0.00269787), but they are left separate in order to keep the various parts of the formula in the form used in the Smithsonian Tables. The values of the fraction in the brackets above are given for all values of t from -45 deg. Fahr. to $+140$ deg. Fahr. in Table 81. By following this arrangement the checking of values given by the chart is rendered comparatively easy.

This formula is really only a variation of the familiar gas formula

$$PV = WRt$$

in which

P = absolute pressure
V = volume
W = weight
R = a constant depending on the particular gas and the units in which P, V, W and t are expressed
t = absolute temperature

From this, $\frac{PV}{Wt} = R = \frac{P_1V_1}{W_1t_1}$ and $\frac{Wt}{PV} = \frac{W_1t_1}{P_1V_1}$

Substituting the quantities d and d_1 for their equals $\frac{W}{V}$ and $\frac{W_1}{V_1}$ we get

$$\frac{dt}{P} = \frac{d_1t_1}{P_1} \text{ and } d = d_1 \times \frac{t_1}{t} \times \frac{P}{P_1}$$

Substituting our standard condition values for d_1, t_1 and P_1, dividing both numerator and denominator of the second half of the equation by t_1 we get the same result as before.

The pressure H in our formula is that due to dry air only. The actual pressure of the atmosphere as registered by the barometer is greater than the quantity H due to the presence of water vapor in the air. This aqueous vapor exerts a certain pressure e and we have the relation

$$b = H + e$$

in which b = height of barometer.

From this

$$H = b - e$$

which can be inserted in the formula for d for dry air, giving us

$$d = 62.4283 \left[\frac{0.00129305}{1 + 0.0020389\ (t - 32)}\right] \frac{b - e}{29.921}$$

The pressure e exerted by the aqueous vapor in the air has been determined to bear a relation to the barometric pressure and the temperatures as shown by the wet and dry bulb thermometers in accordance with the formula

$$e = f_1 - 0.000367b\,(t - t_1)\left(1 + \frac{t - t_1}{1571}\right)$$

in which

e = vapor pressure in inches of mercury
f_1 = vapor pressure in saturated air at temperature t_1 in inches of mercury.
b = barometric pressure in inches of mercury
t = air temperature in deg. Fahr.
t_1 = temperature by wet bulb thermometer in deg. Fahr.

The values of f_1 are tabulated for all ordinary temperatures in Smithsonian Table No. 40, and it was from this table that line 5 in Fig. 8 was plotted. The values of the quantity to be subtracted from f_1 are tabulated in Smithsonian Table No. 41—values found on line 4 of the chart correspond to this table.

Substituting the above value of e in the formula for d of dry air, we get

$$d = 62.4283 \left[\frac{0.00129305}{1 + 0.0020389\ (t - 32)}\right] \frac{1}{29.921} \left[b - \left\{f_1 - 0.000367\ (t - t_1)\left(1 + \frac{t - t_1}{1571}\right)\right\}\right]$$

This formula for the density of dry air should not be confused with that for the density of moist atmospheric air in which the weight of the moisture is included. The latter formula is very similar, differing only in that the factor 0.378 e is subtracted from b instead of the full value of e being used. This results from the fact that the density of aqueous vapor is expressed by the formula

$$d_{a.v.} = 0.622\left[\frac{0.00129305}{1 + 0.0020389\ (t-32)}\right]\frac{e}{29.921}$$

the factor 0.622 being the specific weight of the aqueous vapor relative to air. It will be seen that the formulas contain several duplicate terms, so that on adding the densities to get the density of the moist air we have

$$be + 0.622e = b - 0.378e$$

in the numerator of the last fraction.

It is, of course, the density of the dry air only with which we are concerned in determining the mixture ratio delivered by a carbureter, as the moisture in the air does not enter into the combustion. On the other hand, in determining the volumetric efficiency of an engine, the density of the moist air should theoretically be used. Practically, however, the error caused by using the density of the dry air is so slight as to be negligible, consequently the chart was prepared for the density of dry air only. The change necessary to obtain moist air density consists in substituting the line 10*M* for the line 10 in locating the point of intersection of lines *V* and *VI* and the chart can be so used if desired.

Densities in Venturi Meter

The density obtained from Fig. 8 is that of air at atmospheric pressure. This quantity cannot be used in connection with the chart of Fig. 10, as the density in any one of the venturi tubes is greater than this amount, owing to the greater pressure in the tube. The compression is assumed to be adiabatic; that is, such that the air does not give up heat to or receive heat from the blower or venturi tube walls, due to the extreme rapidity of flow, and consequently the volumes are related to the pressures as follows:

$$PV^s = \text{a constant}$$

$$\text{Since } d = \frac{1}{V} \text{ we have}$$

$$\frac{P}{d^s} = \text{a constant} = \frac{P_1}{d_1^s}$$

From this,

$$\left(\frac{d_1}{d}\right)^s = \frac{P_1}{P} \text{ and } \frac{d_1}{d} = \left(\frac{P_1}{P}\right)^{\frac{1}{s}}$$

Consequently,

$$d_1 = d\left(\frac{P_1}{P}\right)^{\frac{1}{1.4028}}$$

The right-hand chart of Fig. 9 affords an easy means of determining d_1 ready for use in the chart of Fig. 10. Care must be exercised in case more than one venturi tube is used at the same time to determine the density d_1 for each tube in accordance with its upstream pressure P_1.

Water Equivalent of Barometer

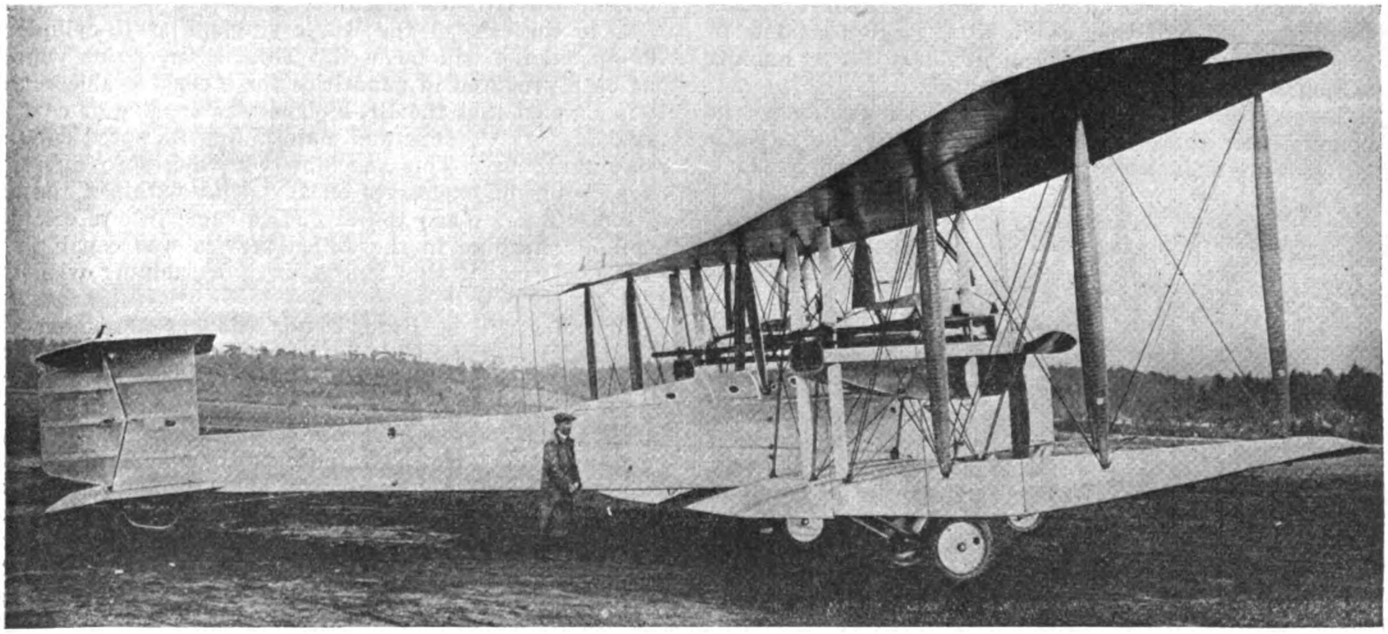
It was stated above that the exact determination of the height of a column of water equivalent in pressure to that of the barometric mercury column was relatively unimportant. This is true only because the factors into which this enters are all expressed as ratios, and, consequently, even a relatively large error affects the result by less than 0.1 per cent. For example, suppose that the equivalent of 29 in. by barometer is read as 395 in. water or as 397 in. water. Assume $P_1 = 20$ in. and $P_2 =$ 10 as read on the manometers. Our ratio of $\frac{P_2}{P_1}$ absolute becomes $\frac{405}{415}$ or $\frac{407}{417}$

These are equal respectively to 0.97590 and 0.97602, which values differ only slightly over 0.01 per cent.

The conversion chart on Fig. 9 is about correct for ordinary room temperatures. As shown above, however, no serious error will be made if the chart is used for any temperature likely to encountered.

(To be continued)

Vickers-Vimy Ready for the Transatlantic Flight

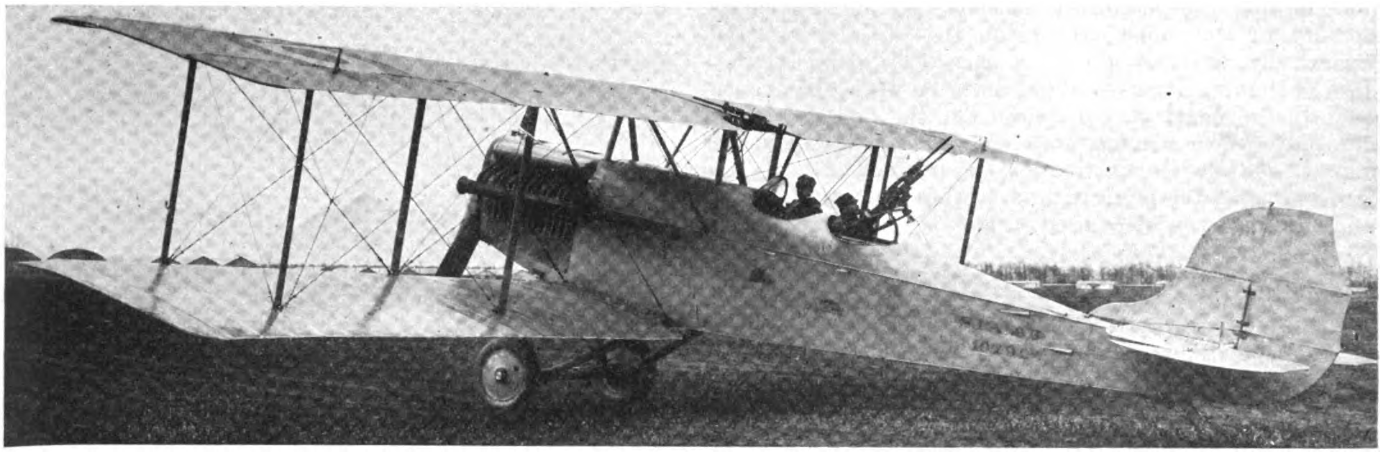


THE required 4-day notice of a probable Transatlantic flight was filed with the British Admiralty on Sunday by Captain Alcock, pilot of the Vickers-Vimy airplane at St. John's, N. F. This airplane was assembled on the starting grounds. A. W. Brown is the navigator. The plane is equipped with two standard 350-hp. Rolls-Royce engines and has a fuel capacity of 865 gal. and 50 gal. of lubricating oil. It is estimated to have a flight range of 2810 miles. The maximum speed is 100 m.p.h., but the speed for the long flight probably will be 90 m.p.h.

Fiat Plane for Transatlantic Flight

A High-Speed Machine with Single 700-Hp. Engine Designed to Make the 2000-Mile Trip in 14 Hours

By W. F. Bradley

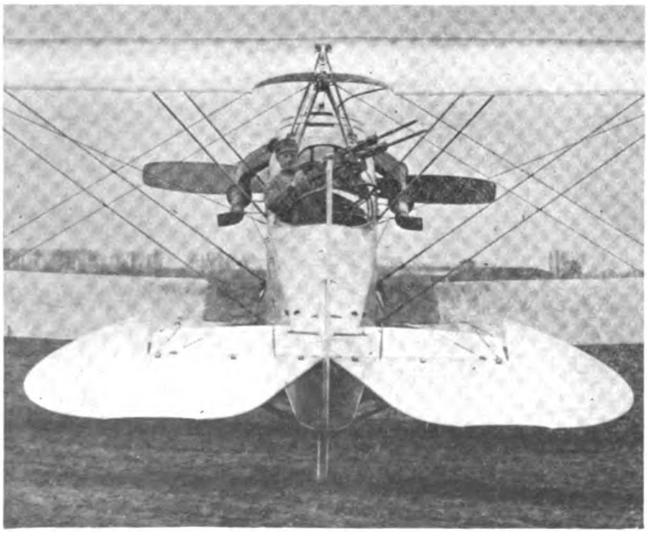


Fiat bombing and reconnoissance plane which is to make a transatlantic flight

TURIN, ITALY, May 15—Fiat is building a special airplane which will be capable of crossing the Atlantic in 14 hours, without the assistance of steamers along the line of flight, according to officials of the concern.

The Fiat machine is a biplane having an all-metal fuselage, divided into watertight compartments which will contain 660 gal. of gasoline, this being more than sufficient for the flight across the Atlantic. In case of an accident, which obliges the pilot to come down on the water, this fuselage can be emptied almost instantaneously and will then serve as a lighter capable of keeping the pilot and passengers afloat for a number of hours.

The machine is the work of Engineer Rosatelli, who believes that the only method of crossing the Atlantic is by means of a very fast, big, load-carrying airplane.



Rear view of the fuselage

As the route selected is 2000 miles in length, the Fiat machine will have to average 145 miles an hour. It is claimed that the plane will have a higher speed than this, for just before the war came to a close Fiat had produced what is officially known as the BR-biplane, which had attained a speed of 158 miles an hour with a net load of 1 ton. This speed is higher than that attained by any of the chaser planes used on the front when the war came to a close. The experience gained in the construction of the BR is being made use of in building the Atlantic machine.

As in the case of the BR, a single Fiat 12-cylinder, 700-hp. engine will be used. This is an engine which has been produced in quantities for a considerable time. It is claimed that the BR-biplane was capable of carrying a load of 1½ tons and maintaining its speed of 158 miles an hour. This machine was therefore able to drop ½ ton of explosives on any point within a radius of 300 miles. When the armistice came into effect, no bombing machine in the Allied service was capable of making a trip of this length, even if running without a load of bombs.

The pilot will be Brack-Papa, who has a number of important records to his credit, among them being the passenger-carrying height record of 23,050 ft. in 1 hr. 3 min. It is stated that the pilot and those assisting him in this undertaking have developed a scheme whereby position may be plotted while over the water and while flying at a speed of 150 miles an hour. This system has been given a practical test in several long-distance flights, notably in the 1000 miles non-stop trip from Turin to Naples and back, which was accomplished in 10 hr. 30 min.

THE Bergie National Spark Plug Co., Rockford, Ill., has brought out a special spark plug for tractor and stationary engines with stone insulator. The insulator is claimed to be practically unbreakable, heat-proof, oil-proof and compression-tight.

The Kessler Super-Charge Engine Developed for Automobile Purposes

Uses Four-Stroke Cycle With Ramming Charge of Excess Air—Crankcase Compression Employed

FOR several years engineers have realized that one method of increasing the mean effective pressure of engines would be by increasing the volumetric efficiency. Naturally, with this in mind, the first thought is the utilization of some outside pressure to ram an excess charge into the combustion chamber. This idea has been dormant up to the time of the war, when the necessity for securing high compression pressures at extreme altitudes brought it into prominence again.

One of the super-charge engines which received attention from the Government at that time is the product of the Kessler Motor Co. of Detroit. This engine, which has been in a state of gradual development for nearly a decade, was under test by the navy aircraft authorities and was just about to be manufactured when hostilities ceased. The engine was then developed for automobile work, and, largely owing to the impetus given to improved engine design by aviation engineers during the war, it is now receiving a great amount of consideration.

The Kessler super-charge engine operates on the ordinary four-stroke cycle. At the bottom of the intake stroke, however, the piston uncovers ports through which is forced a quantity of air, constituting the super-charge. Thus, when the piston starts to rise on the compression stroke the pressure is already above atmospheric, and it is not necessary for the crank to travel through 20 or more degrees before compression actually starts. With this added volume of air it is necessary that the ratio of the total volume to the volume of the compression chamber be considerably less in the Kessler engine than it is in the normal engine. This is readily explained by the diagram shown in Fig. 4. The figures show a normal engine with a compression ratio of 5 to 1, and the lower two diagrams show a compression ratio with a Kessler super-charge engine of 3 2/3 to 1. Both of these engines would have approximately the same initial compression of 100 lb. per sq. in. Thus, although the compression space is larger in the Kessler engine, the compression is the same, owing to the excess of air admitted.

Crankcase compression is relied upon to furnish the super charge of air. The quantity of air admitted is governed by some form of valve between the crankcase and the cylinder intake ports. The form of valve used in the latest engines is a rotary, connected with the throttle so as to automatically govern the amount of air admitted by throttle conditions. On the intake stroke the regular poppet intake valve is employed, but it closes at bottom center or very nearly at bottom center, so that there is no chance for the incoming air to blow back through the poppet intake. In fact, it is important, as will be seen, to close the intake valve early enough so that there is no disturbance of the incoming charge through the poppet valve.

The operation of the engine is readily understood from the foregoing explanation of the cycle. As the piston descends on the intake stroke it draws in what would be the normal amount of charge, and just before the bottom of the stroke the incoming charge of air from the crankcase has passed through the rotary valve. As soon as the piston uncovers the ports the pure air from the crankcase rushes in, sweeping across the head of the piston and filling the bottom of the displacement space with air. This is compressed along with the charge which came in through the poppet valve, at about the same compression as is used in the ordinary high-speed gasoline engine. Firing occurs in the usual manner and exhaust is taken care of through the usual form of poppet exhaust valve.

Referring again to Fig. 4, it is readily apparent where the gain in mean effective pressure comes in. At the bottom of Fig. 4 are shown two typical cards, one from a standard gasoline engine and the other from the Kessler. It will be seen that the expansion curve is slower to drop in the Kessler engine than it is in the standard type. Thus, the higher pressures are available through the working stroke, and particularly at points where the

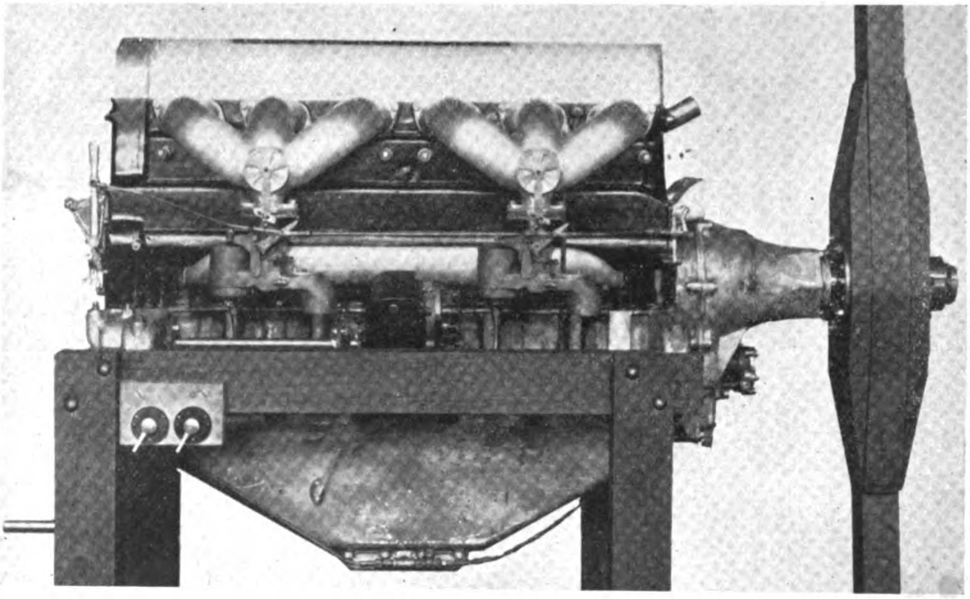
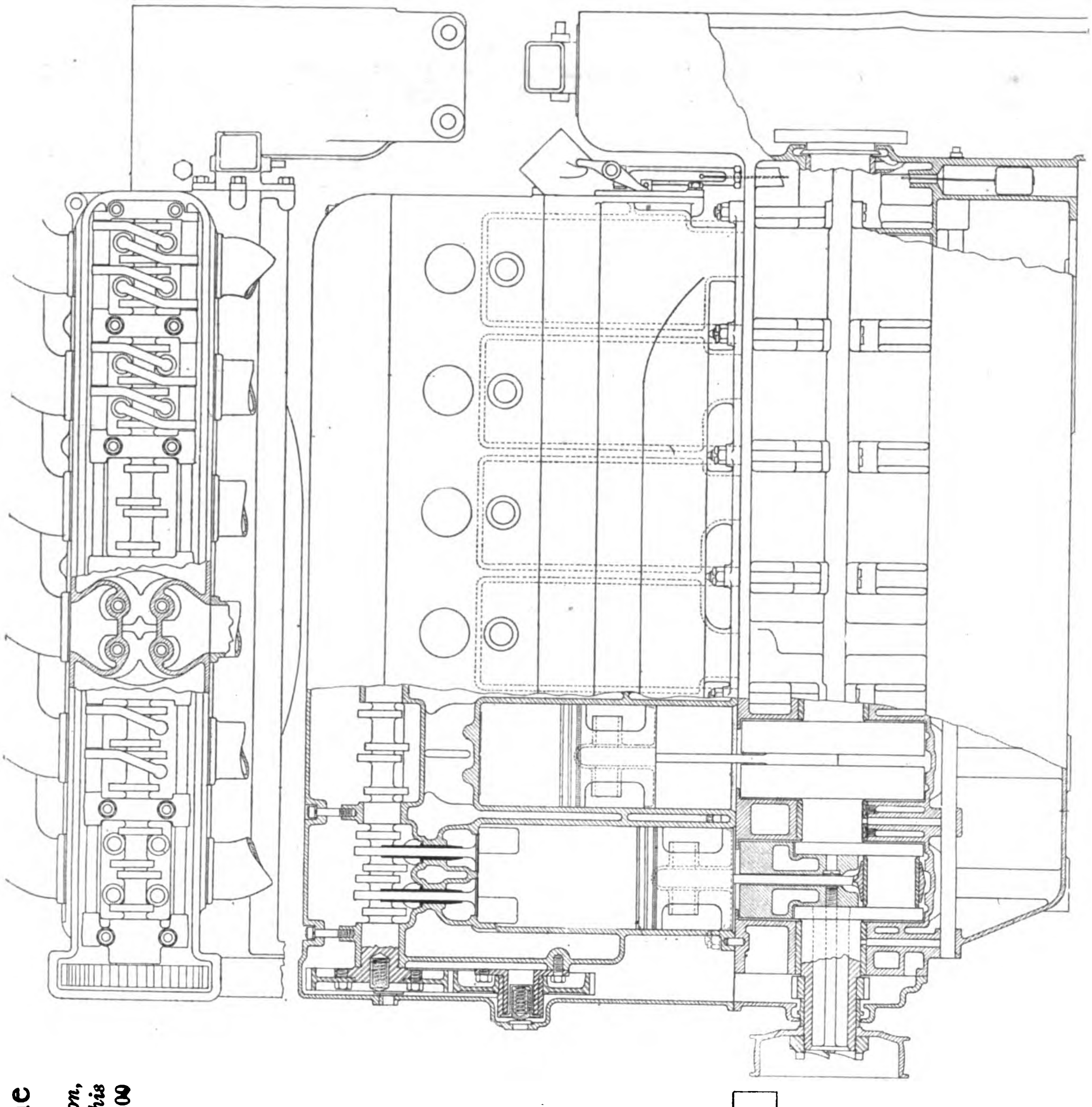


Fig. 2—Kessler aviation engine developed for the United States Navy, developing 200 hp. at 2400 r.p.m.



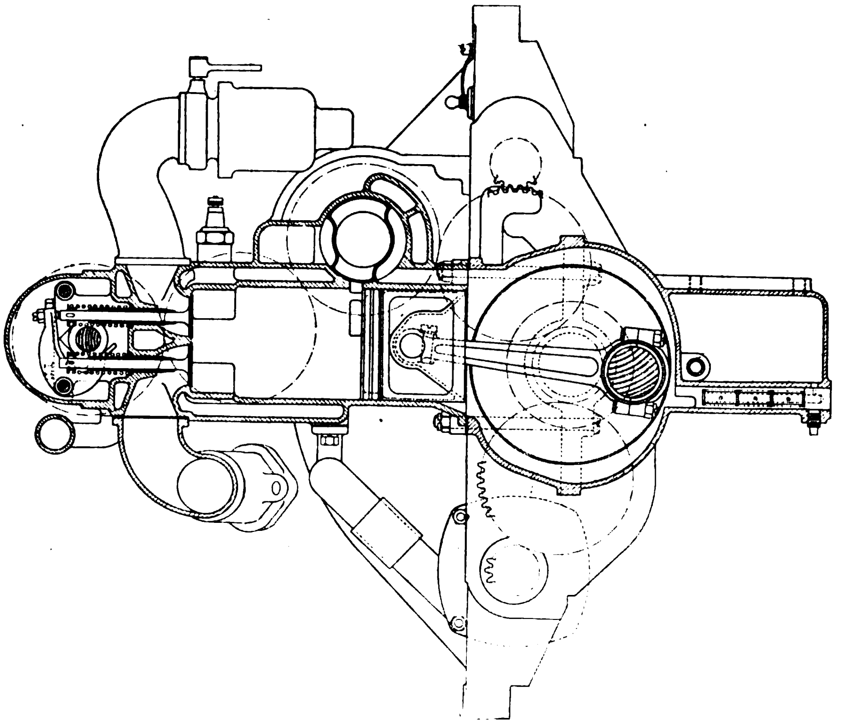


Fig. 1—Kessler Super-Charge Engine

Transverse section, longitudinal elevation partly in section, and top view of six-cylinder automobile type engine. This engine is of the overhead camshaft type and runs at 2600 r.p.m. The cylinder dimensions are 3¾ by 3¾ in.

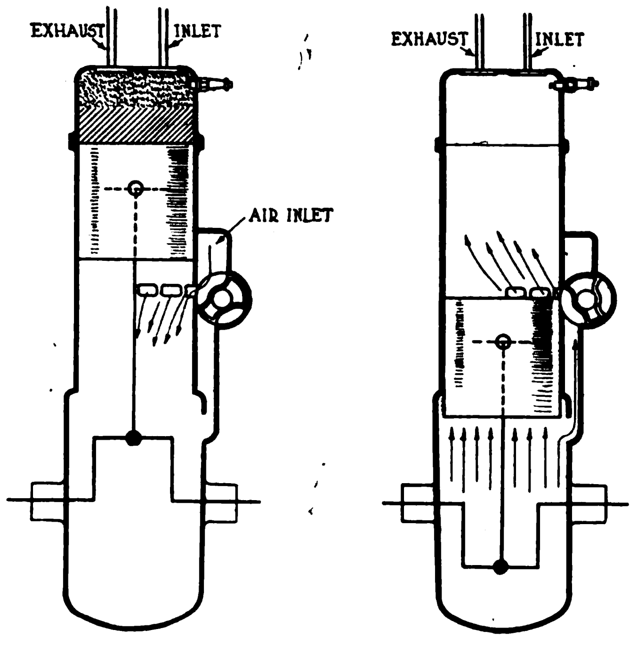


Fig. 3—Sketch showing cycle of Kessler super-charging engine and also stratification charge and cushioning effect under piston

maximum torque effort is being placed upon the cranks, due to their approach to the 90-deg. position.

In the upper part of Fig. 4 are illustrated three stages in the expansion of the charge in a typical gasoline engine with 5 to 1 compression ratio. The first expansion, to the point where the volume swept through by the piston is equal to the compression chamber volume, corresponds to a crank travel of 55 deg. After the second expansion, or when the volume swept through by the piston is equal to twice the combustion chamber volume, the crank has passed through 83 deg., and after the third expansion (three times compression chamber volume) it has passed through 113 deg. In the Kessler engine, owing to the greater volume of the compression chamber, the crank has passed through 70 deg. after the first expansion stage and 113 deg. after the second. Thus, with a greater volume of gas available on each working stroke, the expansion curve is bound to be higher throughout, and this accounts for the increased mean effective pressure.

Naturally, the first inquiry likely to be made regarding a cycle of this sort is whether or not the air dilution does not simply tend to thin out the mixture, but to this the inventors reply that they have evidence of marked stratification in the compression space; that this can be clearly shown by varying the location of the spark plugs. If the plugs are high, near the inlet stream from the poppet valves, perfect ignition results. On the other hand, if they are placed low where they would be in the path of the incoming air from the super-charging ports, either no ignition or very faulty ignition results, indicating that conditions of the charge are different in different parts of the cylinder. It is the claim of the Kessler company that this air drawn in through the ports at the bottom of the stroke lies on top of the piston and is carried up with it.

The explosion takes place in the upper part of the compression chamber and the air in the lower part absorbs heat from the explosion and then gives this heat up again during expansion. The resulting terminal pressure is somewhat higher than in the conventional engine, owing to the fact that it is not possible to get back all of the heat energy imparted to the excess air. A marked cushioning effect of the explosion is claimed, due to the presence of the excess air on top of the piston, which tends to retard the pressure peak. The cushioning effect is also claimed to reduce to a marked extent any tendency for a high compression engine to pound, as the blow on top of the piston is stated to be remarkably softened due to this volume of air.* A cushioning effect is also claimed for the crankcase compression, and it is said that at certain speeds the bearings automatically float, due to the relieving cushion of the air in the crankcase.

A staff representative of AUTOMOTIVE INDUSTRIES has

*This statement hardly agrees with the two indicator diagrams shown, of the standard and Kessler engines respectively, which show equal explosion pressures.—EDITOR.

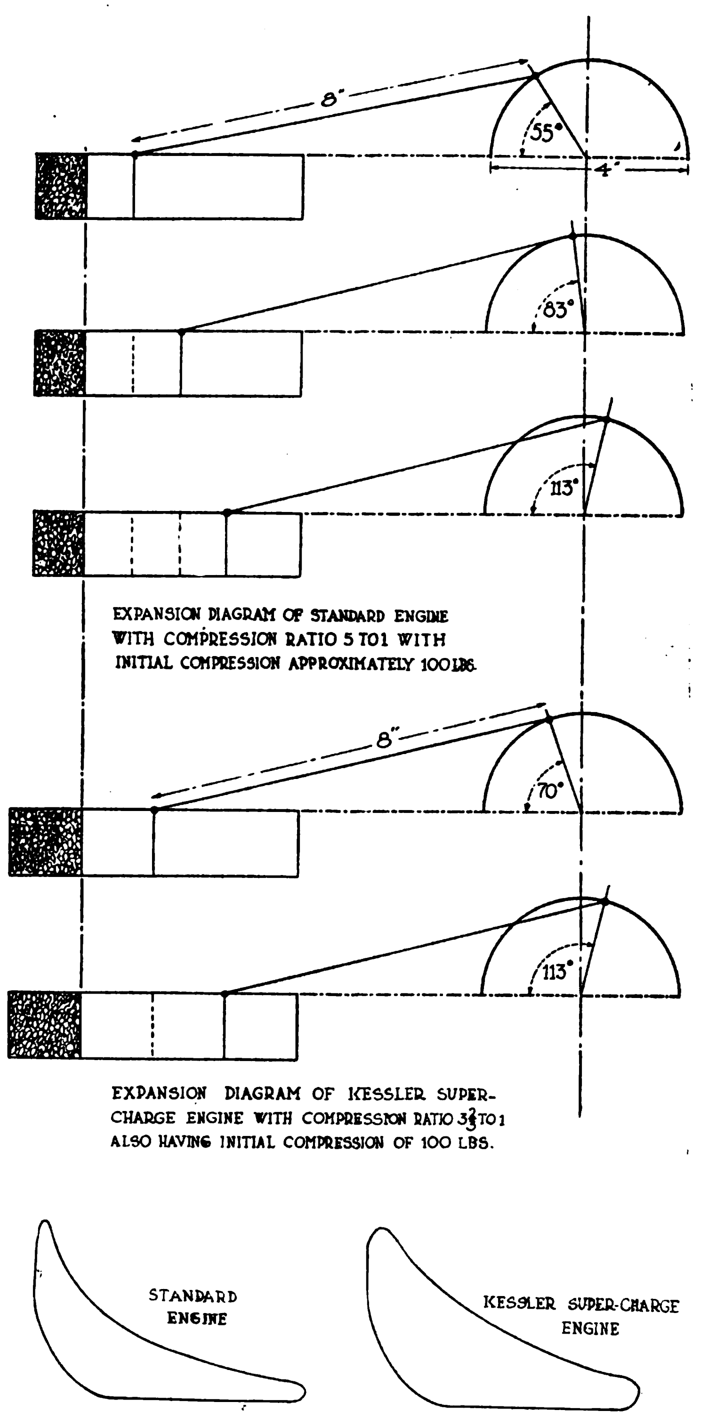


Fig. 4—Charts showing comparison of expansion diagrams of Kessler and standard engines

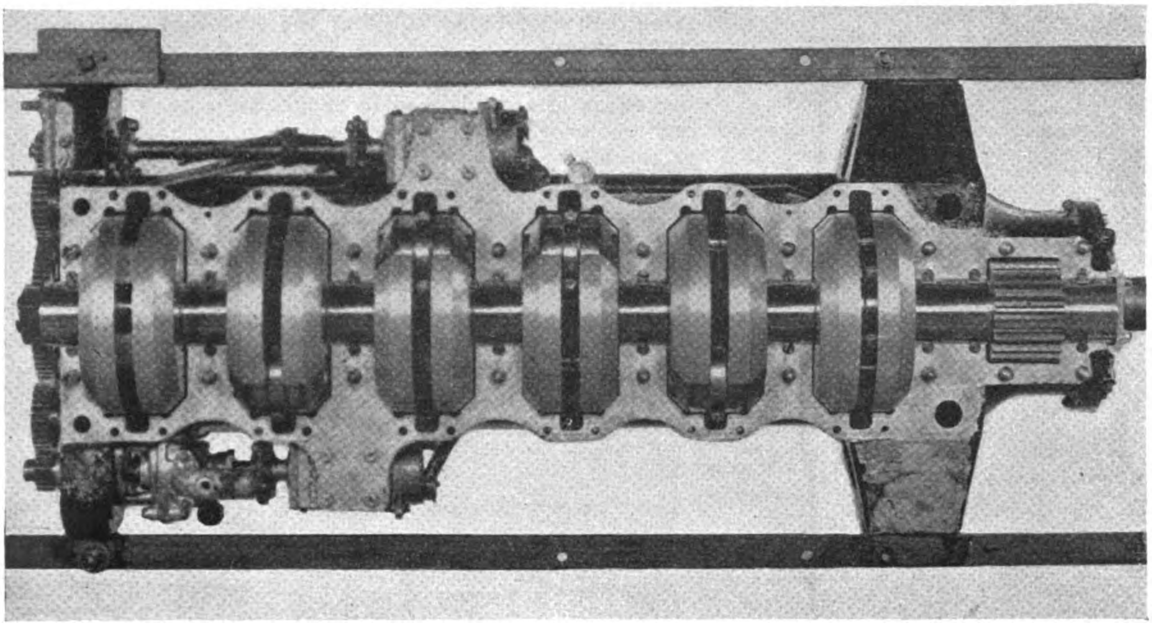


Fig. 5—Left—Counter-balanced crankshaft mounted in crankcase. Fig. 6—Right—Piston and connecting rod

seen at the Kessler plant a car with a four-cylinder Kessler engine mounted in it, this engine having made over 60,000 miles without having been taken down. The engine is in bad condition, and inasmuch as the supercharged air was drawn through an opening in the front end of the engine and the front of the engine itself is caked with the gritty accumulation of 5 years, it is safe to imagine that the inside of the engine is in extremely bad condition. The air intake for the super-charging air is controlled by a butterfly in this particular engine, and there is no screening or other device in front of it. Yet, in spite of this, the acceleration of the engine is remarkable, and, although the engine is a four, it compares favorably with multi-cylinder engines in this respect.

Claim Carbon Knocks Impossible

This engine is used by the Kessler company as evidence to support the claim that bearing loads are exceptionally light due to the balance secured by the air cushion in the crankcase and the air cushion above the piston at the time of explosion. The excess of air tends to act as a carbon cleaner also, so that carbon knocks are said to be impossible with this type of engine.

There are a great many structural designs possible with this cycle. It is nothing more than an ordinary type of engine plus the excess air charge admitted at the bottom of the suction stroke. It is quite apparent that the amount of air admitted must depend to some extent on the amount of charge drawn in, and consequently at reduced throttle openings the amount of air would be less than at full throttle opening. This is taken care of by the inter-connection of the valve controlling the air and the throttle. In the case of the rotary valve, the throttle does not control the opening and closing of the valve, but simply times it by means of a spiral guide, advancing or retarding the functions of the valve.

15-Pound Pressure Found Best

When idling only a very moderate amount of excess air is admitted, or none at all, but as soon as the load is increased the amount of air admitted is materially augmented, until at full open throttle the full period during which the ports are open is utilized in forcing in the air under a pressure of some 15 lb. This pressure has been experimented with and it has been found that best results are obtained with about that amount. A simple experiment with an ordinary engine will readily show what effect this has.

For instance, if a man were to blow into the petcock on top of the cylinder during the intake stroke or immediately after the intake were closed, and while the pressure was still at atmospheric in the cylinder, he would find an enormous increase in the final compression pressure. For this reason, with this amount of pressure put in the combustion chamber of the Kessler engine, it is possible to use a much greater volume of compression chamber and still have the same initial compression. Furthermore, as experiment with the old engine in the car has shown, slight leaks around the piston or past the valves do not reduce the power output to the same extent as in an ordinary engine.

The net result of this gain in mean effective pressure is the production of a much higher power output per

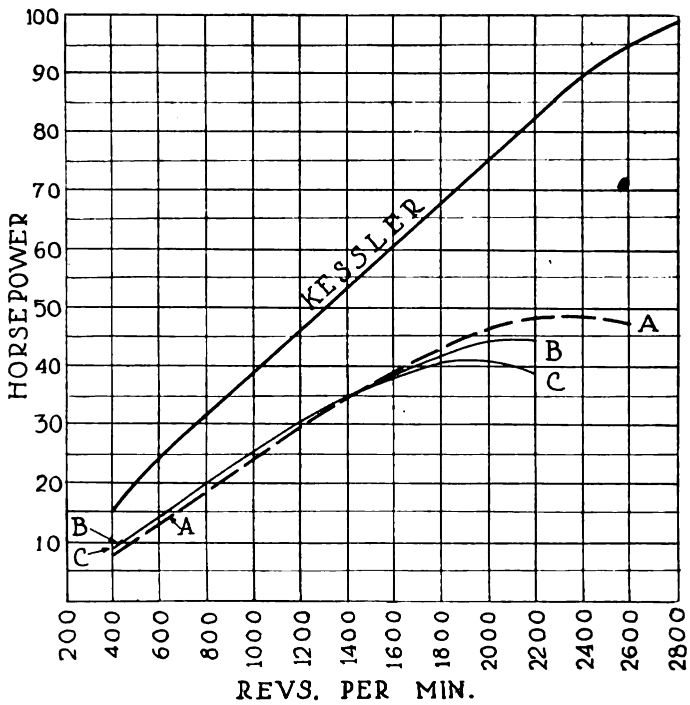


Fig. 7—Horsepower curves of Kessler and other standard engines, reduced to 247 cu. in. piston displacement

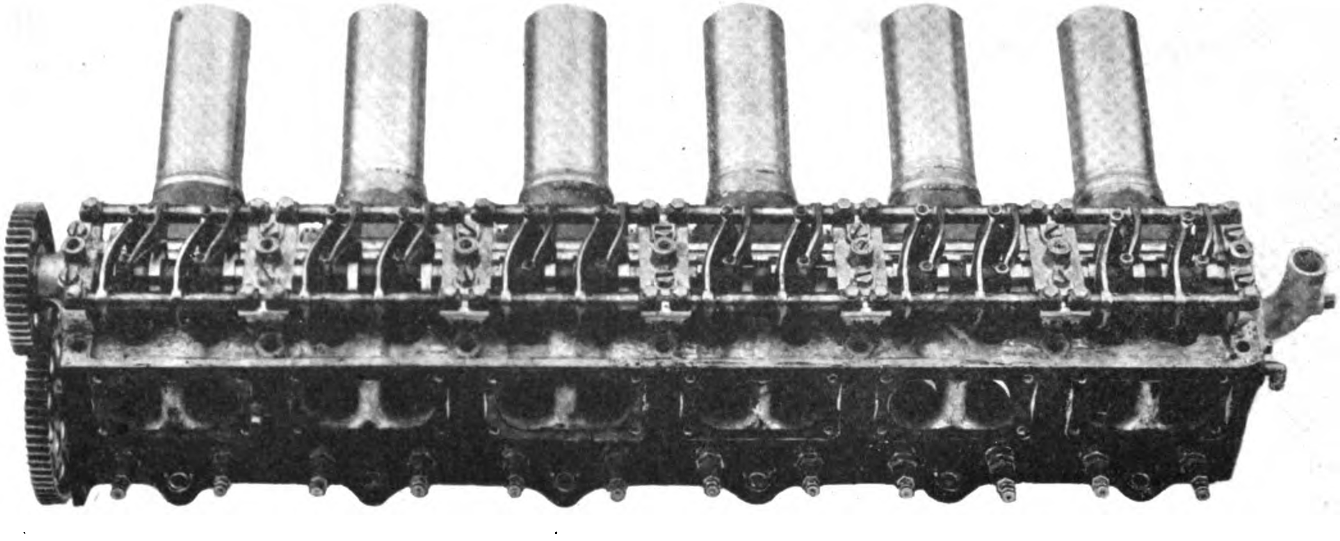


Fig. 8—Cylinder head assembly of Kessler super-charge engine for aviation purposes

unit of displacement. The curves given in Fig. 7 show three typical engines as compared with a Kessler engine, from a power output standpoint, according to claims made by the manufacturer. Curves A, B and C were made from test data of standard stock engines reduced to the basis of a 247 cu. in. piston displacement. Curve A was made by a $3\frac{1}{8}$ by 5-in., six-cylinder engine; B was made by a $3\frac{7}{8}$ by $4\frac{1}{2}$-in. four; and C, a $3\frac{1}{2}$ by $5\frac{1}{4}$-in. six. The curves all show marked drops at from 1600 r.p.m. up, the peak of the curve depending upon the valve timing.

The Kessler is a $3\frac{3}{4}$ by $3\frac{3}{4}$-in. six, with practically a straight line power curve between 800 and 2400 r.p.m. This curve is not a direct record of an actual engine run, but is based on test runs of similar engines, the data of which were compared and reduced to the displacement volume of a $3\frac{3}{4}$ by $3\frac{3}{4}$-in., six-cylinder engine with valve characteristics, etc., the same as in a sample Kessler engine just about to be constructed.

This curve indicates that by the use of a super charge the Kessler engine works in a much higher speed field than the ordinary types of engine and consequently would probably employ a much greater gear reduction than is utilized at the present time. As a matter of fact, the manufacturers believe that a ratio in the neighborhood of $5\frac{3}{4}$ to 1 or more would secure the greatest advantage from the engine. The claim of 100 hp. at 2900 r.p.m. from a $3\frac{3}{4}$ by $3\frac{3}{4}$-in. six appears radical at first sight, but the Kessler company states that in view of the results obtained in tests made on Government engines, this is considered a conservative estimate.

Engineers from motor car companies who have gone over the designs and have seen aviation engines built in accordance with this cycle have expressed their opinion that results of the kind denoted in the horsepower curve herewith are highly probable. One large concern has placed a provisional order for several thousand engines, provided certain output conditions less severe than this can be met by the engine.

From a design standpoint it is not necessary to depart very radically from ordinary practice in the construction of an engine. A very interesting piston has, however, been worked out by Kessler and is illustrated herewith. This piston is closed across the base, with a slot and webbed housing which encloses the top of the rod, thus giving a higher crankcase compression by eliminating the volume usually contained within the piston. The pistons are made either with a flat head or slightly domed. It has been found on aviation engines that were taken down and examined after long runs that this head is kept remarkably cool and free from carbon by the air blast from the super-charging air.

Furthermore, it is part of the theory of Kessler that the cushioning air lying on top of the piston also has the effect of preventing the extreme heat from reaching the head of the piston in the way that it does in the case of the ordinary type of engine at the point of maximum pressure, or at the peak of combustion.

As will be noted in the illustration herewith, Kessler

(*Continued on page* 1308)

Fig. 9—Six valve per cylinder Kessler aviation engine on testing stand during experimental work. This is a six-cylinder $5\frac{1}{2}$ *x* 6 *in. engine* (855 *cu. in. displacement*) *weighing* 578 *lb.*

Ignition Work at the Bureau of Standards*

Effects of Various Types of Spark on Engine Power—Spark Plug Faults and Their Remedies—Standard Tests, Methods and Specifications of Spark Plugs—Effects of the Auxiliary Gap

By Francis B. Silsbee

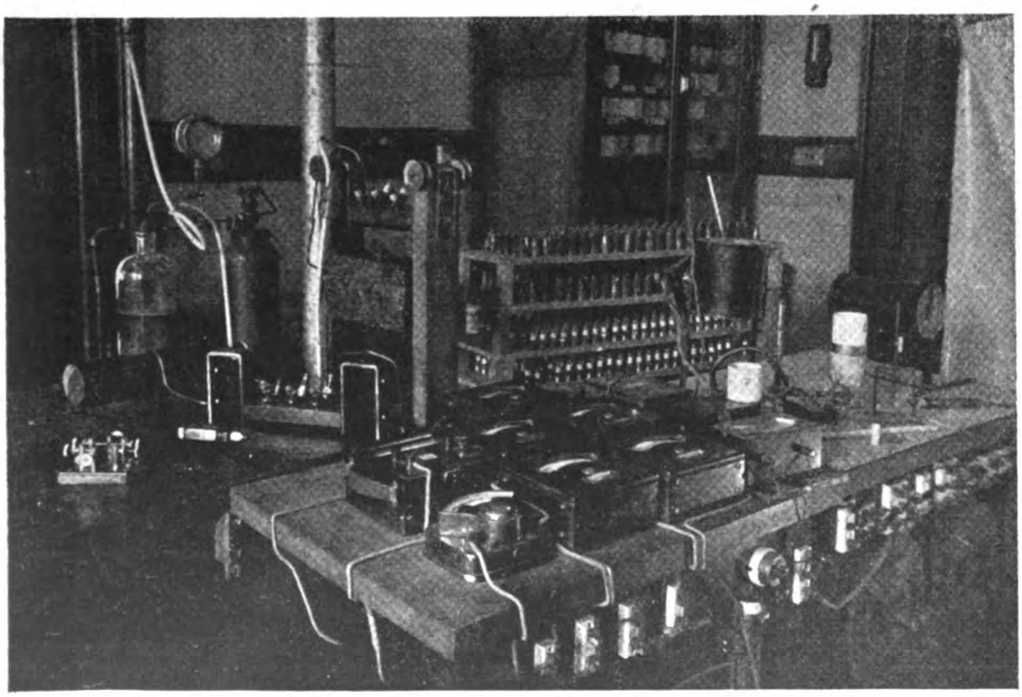
I—INTRODUCTION

DURING the past two years the Bureau of Standards has been carrying on an extensive study of various problems connected with internal-combustion engines and their accessories. While the work was intended primarily to assist in the development of prime movers for aircraft, the results are, of course, almost equally applicable to gasoline engines used for any of the myriad other purposes—trucks, tractors, tanks, motor boats, etc.—to which they are applied.

The work was undertaken at the suggestion of the National Advisory Committee for Aeronautics, and has consisted in a large measure of specific tests of various devices submitted by the different military branches of the Government, together with a systematic investigation of the more fundamental problems. Active co-operation has been maintained with the Bureau of Aircraft Production and with the Navy Department on the one hand, and with the Society of Automotive Engineers and the various manufacturers interested, on the other.

The Bureau of Standards was thus enabled to act as a connecting link between the producers and the consumers, and, being unbiased by commercial relationships, it could give to both impartial testing and consulting service. The laboratory facilities permitted the carrying out of many delicate measurements not readily undertaken by industrial concerns, and much special apparatus was constructed for the purpose. On the other hand, the difficulties attendant upon factory production were fully recognized, and care was taken not to carry the development of details so far as to trespass upon the problems more properly handled by the manufacturer.

The experiments and methods of general interest have been described in detail in a series of Aeronautic Power Plant Reports issued by the Bureau, and will be printed in full in the Fourth Annual Report of the National Advisory Committee for Aeronautics. They will be referred to below by their numbers in both the A. P. P. series and the N. A. C. series.[1]



Corner of spark plug laboratory. At the left are the pressure tank and the glass bell jar used in measuring gas leakage. At the right are the electric furnaces and in the center the instruments used in measuring the electrical resistance of the insulator. At the rear are sample plugs and porcelain cups

**During the war this work was carried on with various special military funds which are no longer available. It is to be hoped that the work already accomplished, and the problems which lie in the future, are of sufficient value to the progress of the automotive industries to justify the new Congress in supplying funds to continue the work during the reconstruction period.*—EDITOR.

[1]A limited number of these reports is available for distribution by the Bureau of Standards and will be sent upon application to parties directly interested in the results. An additional supply of reprints of the N. A. C. A. Reports will be available later. The titles and numbers of these reports are as follows: [*See foot of next page.*]

The ignition work formed one branch of this general investigation, the other divisions being studies of carburetion, radiators, fuels, lubrication, and the effects of altitude upon engine performance. It is the purpose of this article to outline the various phases of the ignition work, to show their relations to each other and to the general question of engine performance, and to point out some of the outstanding problems which should be attacked in the immediate future.

The process of ignition in an internal combustion engine is essentially a trigger effect, i. e., a very small cause produces a very large effect which bears no direct relationship to the magnitude of the cause. Thus the energy delivered to the crankshaft of a Liberty engine by a single explosion is over 100,000 times the energy of the spark which initiated that explosion.

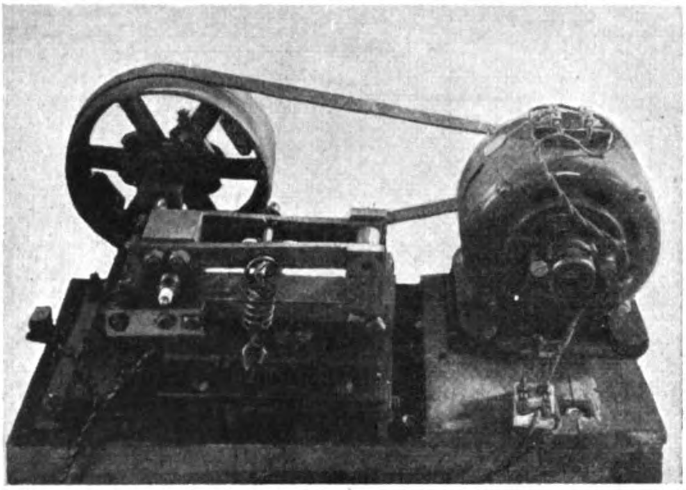
The problems met with in this work are therefore different from those usually occurring in engineering practice, and instead of studying the changes in one variable such an engine power which results from corresponding changes in another variable, such as mixture ratio or altitude, we are interested only in the effects of radical changes in the quality of the spark and particularly in the conditions which may determine the presence or absence of any spark at all.

The work therefore naturally divides itself into two parts, first, a study of the actual phenomena of the ignition of a combustible mixture by an electric spark, and, second, a study of the apparatus used to produce the spark and of the various troubles which are encountered in its operation.

II—IGNITION OF GASOLINE MIXTURES

Comparatively little work was done on the former of these problems, for two reasons. First, a complete study of the phenomena concerned would require a very long and elaborate research, and could not have been completed in time to yield results of any military value even if the war had lasted much longer than it did. Secondly, the bulk of the experimental evidence available, as well as preliminary experiments which were made at the Bureau, indicated that there was little likelihood of obtaining any marked increase in engine power by modifying the method of ignition.

A.P.P. No.	N.A.C.A. No.	Title
12	52	Temperature Measurements in Spark Plugs Having Brass and Steel Shells.
13	56-II	Measurement of Heat Energy per Spark of Various Ignition Systems.
14	54	Effect of Gas Pressure and Temperature on the Sparking Voltage of Spark Plugs.
15	56-I	A Method for Measuring the Heat Energy of Ignition Sparks.
16	58-II	A Method for Measuring Transformation Ratio and Coupling in High Tension Magnetos.
17	51-III	Methods for Tests of Spark Plugs.
18	53-I	Methods for Measuring Resistivity of Insulating Materials at High Temperatures.
19	53-II	Electrical Resistance of Various Insulating Materials at High Temperatures.
20	58-I	The Cycle of Operations of Jump-Spark Ignition Systems.
21	51-II	Gas Leakage and Its Relation to Design and Construction of Spark Plugs.
22	51-I	Causes of Failure of Spark Plugs.
23	53-III	The Production of Special Spark Plug Porcelains.
31	57	A Preliminary Report on the Use of Subsidiary Spark Gaps in Ignition Systems.
35	53-IV	Cements for Spark Plug Electrodes.
36		Causes of Cracking of Ignition Cable.



Machine for testing spark plugs for resistance to mechanical shock

The experiments performed along this line consisted in measuring the power of an engine ignited by sparks of different quality. These types of spark were: (a) the usual magneto spark which has an initial current of about 0.070 ampere and lasts 0.002 second; (b) the same system with an auxiliary spark gap in series with the plug (this has the effect of decreasing the duration and energy content of the spark to about half the former value); and (c) the same system with a condenser connected in parallel with the spark plug. This has the effect of greatly increasing the initial value of the current but produces a highly damped oscillatory discharge of very high frequency lasting only a few hundred-thousandths of a second.

Precisely the same power was obtained from the engine with each type of spark. This result, together with similar data obtained elsewhere, indicates quite strongly that the slogan "A spark's a spark" is a fairly safe guide in ignition work. While this is apparently contradictory to the widely held belief in the peculiar efficacy of "fat" or "hot" sparks, it is highly probable that all cases of trouble from so-called "weak" sparks are really caused by the entire absence or wrong timing of the spark.

The presence of a spark external to the cylinder or even at a series gap is no certain indication that a spark is produced within the cylinder if the plug is in poor condition. There are, however, many interesting questions to be settled along this line, as, for example: Is a spark of large heat content and long duration beneficial in cases where the carburetion is poor and the fuel is in the form of drops or spray? What effect do various types of spark have on the velocity of flame propagation in the cylinder? Is there an appreciable time elapsing between the passage of the spark and the beginning of the spread of the flame? A method for the measurement of the velocity of flame propagation has been developed at the Bureau and will permit a direct attack on these problems.

III—STUDY OF APPARATUS

The second class of investigations, namely, the study of various types of ignition apparatus to determine the relative merits of those then available and to indicate the possibilities for improvement, showed much more prospect of yielding results of immediate value, and the bulk of the work during the war was directly or indirectly of this nature. Since the results mentioned above indicated that the engine performance did

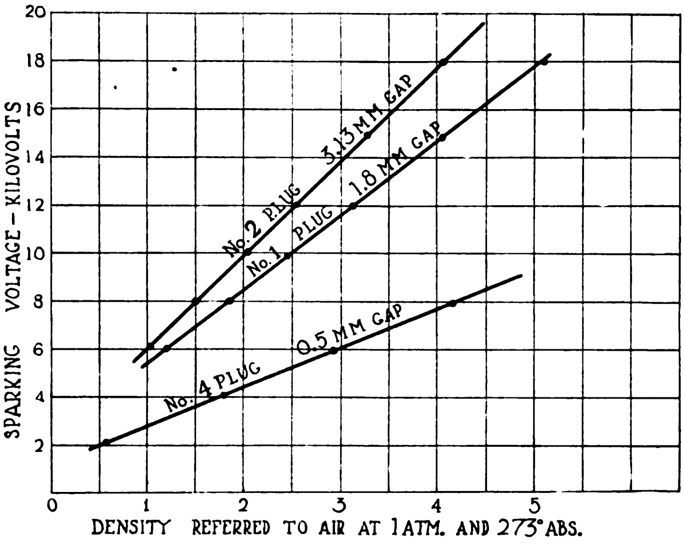


Fig. 1—Variation of spark plug voltage with length of and pressure at gap

not depend to any considerable extent upon the quality of spark produced, an estimate of the relative merits of and improvements in ignition apparatus should apparently be based primarily upon the reliability of the apparatus under service conditions and the ability of the system to function even if the conditions under which it is required to operate become unduly severe.

"The proof of the pudding is in the eating," and it is obvious that the reliability of a given make of spark plug, for instance, can ultimately be determined only from the compilation of accurate statistical data on the life and final cause of failure of several thousand such plugs in a given type of engine. The securing of such statistical data is in no sense a laboratory job and can be carried out most easily by the maker, either of the accessory in question or of the completed engine.

Even when a large number of engines are in constant use, as at a flying-field, it is no easy matter to obtain accurate statistics, and the absence of satisfactory data of this nature has been felt throughout the work, even up to the present time, as the most serious single limitation upon the progress of developmental work.

Laboratory experiments can, however, show the details of certain specific types of failure, can determine the properties of the materials concerned, and can thus indicate the magnitude of the factors of safety and lead to improvement in materials and design.

IV—CONDITIONS OF OPERATION

It became evident early in the work that more definite knowledge was needed of the conditions under which the spark plugs and ignition system were required to operate. Preliminary experiments were therefore made to measure the temperature at various points in a spark plug while operating in an aviation engine, and of the voltage which was required to pass a spark through the compressed and heated charge in the cylinder at the end of the compression stroke. These experiments are described in detail in A. P. P. Reports Nos. 12 and 14 (N. A. C. Reports Nos. 52 and 54).

The burning gases in the combustion space probably reach a temperature of 2500 deg. C., but the duration of this high temperature is so short and the frequency of repetition of the engine cycle is so rapid that the spark plug maintains a much lower and a practically steady average temperature. In the experiments the tip of the electrode was found to reach an average temperature of about 900 deg. C., while the porcelain up in the body of the shell was heated to 250 deg. C., and the metal of the shell was about 100 deg. C.

There remains much work to be done on the effect on spark plug temperatures of variations in the speed and mean effective pressure of the engine and also of the temperature distribution in plugs of various types. The rate of heat transfer from the hot gases to the material of the plug is still unknown and the degree to which the plug temperatures can be reduced by increasing the thermal conductivity of the insulator is consequently undetermined.

A study of the conditions of temperature, mixture ratio, turbulence, etc., under which the deposition of carbon on the insulator will occur and of the effect of various shielding devices on the rate of deposition is also of very immediate practical value, but is as yet a virgin field.

The voltage required to produce a spark in air at various pressures and temperatures was found to depend upon only the density of the air and to be nearly proportional to the density as shown in Fig. 1. From this plot and the known compression ratio of any engine, it is possible to estimate the increase in sparking voltage resulting from the compression. Measurements with a special crest voltmeter of the voltage actually applied to the plugs in a Hall-Scott engine while running at full power indicated a value of 6000 volts, which is in good agreement with the above data.

V—OUTLINE OF OPERATION OF IGNITION SYSTEM

A second essential preliminary to an investigation of the performance of ignition systems is to have a clear and definite understanding of the theory of their operation. The high-tension magneto and the induction coil are exceedingly complex electrical systems, and while the general principles of their operation are well known, there exists among both manufacturers and users much confusion of thought as to the precise functions of the various parts.

This condition is due in part to the fact that the industry originated with the German Bosch Co. and has grown in considerable measure, though with notable exceptions, by imitating their designs. Moreover, with the exception of several very excellent articles which have been published recently by Biffi[1] in Italy, Armagnat[2] in France, and Young[3] in England, and the highly mathematical papers of Jones[4] and of Campbell[5] there is

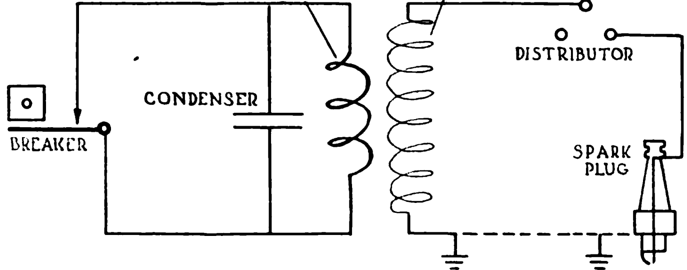


Fig. 2—Diagram of high tension ignition circuits

---

[1]Biffi, E. L'Elettrotecnica 5, pp. 302, 326, 386, 407, 1918.

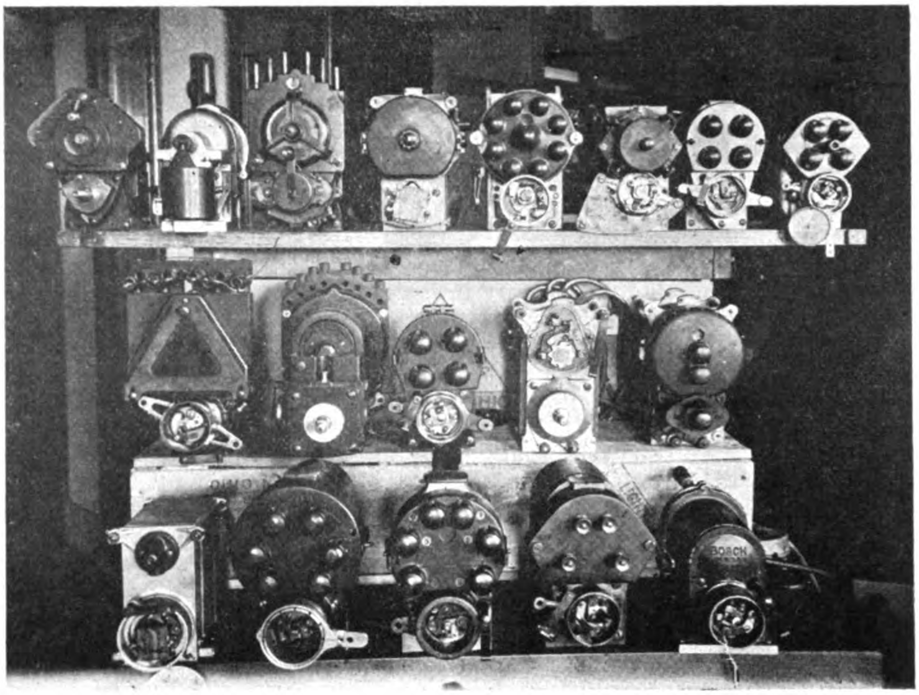
[2]Armagnat, H. Rev. Electrique 23, pp. 321-333, 1915; Electrician 76, pp. 865-899.

[3]Young, A. P. Aeronautical Journal, pp. 142-252, 1817; Automobile Engineer, March, 1915.

[4]Jones, E. T. Phil. Mag., Vol. 36, p. 145, August, 1918.

[5]Campbell, N. Phil. Mag., Vol. 37, p. 284 and p. 372, March and April, 1919.

no published data dealing at all deeply with the subject. As an attempt to clarify the situation A. P. P. Report No. 20 (N. A. C. No. 58-I) was prepared which discusses in detail the cycle of operations of the jump-spark ignition system and gives data showing the order of magnitude of the various quantities involved.



Group of magnetos submitted for test

The usual type of ignition system as indicated in Fig. 2 consists essentially of an induction coil which comprises an iron core surrounded by a primary winding of a few turns (about 150) of coarse wire and a secondary winding of many turns (about 10,000) of fine wire. The secondary is connected through the distributor to the central electrode of the spark plug in the proper cylinder of the engine. The primary is supplied with a current (3 to 5 amperes) either from a storage battery or in the case of a magneto by induction from the relative motion of the core and a permanent magnet. When a spark is desired in the engine, the primary current is suddenly interrupted by the breaker and the resultant rapid decrease in the magnetic flux through the secondary winding generates in it a sufficient voltage to produce a spark at the terminals of the spark plug. There are two essential characteristics of any apparatus of this type which must be borne in mind in considering its behavior under adverse conditions:

First, with the secondary circuit open, and with no safety gap present, the voltage will build up to a certain maximum value (10,000 to 20,000 volts) which is determined principally by the inductance and capacity of the circuits, and no spark will be produced unless the breakdown voltage of the gap between the spark plug electrodes is less than this value. A safety gap may, of course, limit the voltage to some lower value.

Second, if the spark plug is shunted by a resistance, the maximum voltage obtained across its terminals is very considerably reduced, the reduction being greater the smaller the shunting resistance. With most of the ignition systems studied, the voltage reached was found to become less than 6000 volts required to produce a spark if the shunting resistance was much less than 100,000 ohms.

It may therefore be said that present practice divides the burden of supplying satisfactory ignition between the spark plugs on the one hand and the magneto or coil on the other at the limits just mentioned. The spark plug is thus called upon to perform three functions: First, to maintain a gap between its electrodes which shall have a breakdown voltage of approximately 6000 volts; second, to maintain an insulation resistance between its terminals of not less than 100,000 ohms; and, third, to be substantially gas-tight in order that the leakage of heated gas through the plug may not raise it to such a high temperature as to cause pre-ignition of the engine and destruction of the plug. Conversely, the magneto is required to deliver at the plug terminals at least 6000 volts, at the proper time in the cycle, even if the plug resistance is as low as 100,000 ohms.

In case of trouble with the plug, the magneto or coil is required to supply either a very high voltage in cases when the spark plug gap has become fouled with oil and consequently has a high breakdown strength, or else to supply an unusually large current in cases where the plug is fouled with carbon. In this latter case, the magneto must send such a current through the carbon deposit that the product of this current multiplied by the electrical resistance of the deposit is at least equal to the sparking voltage of the gap.

VI—EXPERIMENTAL WORK ON SPARK PLUGS

The possible ways in which a spark plug may fail to fulfill its requirements may be enumerated as follows:

1. Fouling with carbon deposit causing short circuit.
2. Fouling with oil causing open circuit.
3. Cracking or breaking of the insulator.
4. Pre-ignition.
5. Conduction through the insulator.
6. Electrical puncture of the insulator.
7. Minor troubles, such as warping and corrosion of electrodes, etc.

The relative importance of these troubles depends upon the type of engine, and the statistical data available is too meagre to admit of a very definite conclusion on this point. The experience in the engine testing work at the Bureau and performance data obtained from France indicate that the order in which they are listed above is approximately that of decreasing importance.

A general discussion of these various types of failure will be found in A. P. P. Report No. 22 (N. A. C. No. 51-I) in which the origin and identification of each type of failure is described and possible remedies for some of them are suggested.

It appeared early in the work that there were no generally recognized standard tests to determine the ability of a spark plug to resist these various types of failure, and the first work undertaken was the devising of such tests and the embodying of them in specifications for the use of the Bureau of Aircraft Production.

A large number of plugs of different types were tested in various ways and the results of the laboratory tests were correlated as well as possible with their service performance in aviation engines at the Bureau and elsewhere. The results are incorporated in specifications

Nos. 28004 and 28017 of the Air Service and the methods finally adopted are described in detail in A. P. P. Report No. 17 (N. A. C. No. 51-III).

The tests cover the electrical resistance of the insulating material while hot, its resistance to cracking from sudden temperature changes, its resistance to breaking from mechanical shock, and its dielectric strength while cold, and also the gas tightness of the assembled plug.

More detailed studies have been made of several of the specific types of failure listed above, which were particularly susceptible to laboratory investigation. The first of these was the conduction of electricity through the material of the insulator.

It had long been known that ceramic materials when heated lost their insulating properties and became to a certain extent conducting. In 1916 reports came to the attention of the Bureau that spark plug failures were setting a serious limit to the design of aircraft engines abroad, and that the trouble seemed to be due to the conducting properties of the insulators at the high temperatures encountered in the most modern engines. This trouble is frequently spoken of as "cutout."

Measurements were made of the electrical conductivity over a wide range of temperature of over 100 materials from different sources. This included spark plug insulators of porcelain, mica, glass, quartz, etc., as well as a number of porcelains prepared by the Ceramic Laboratory of the Bureau.

The method used in this work is described in A. P. P. Report No. 18 (N. A. C. No. 53-I), and the results in A. P. P. Report No. 19 (N. A. C. No. 53-II). By combining the data thus obtained with the measurements mentioned above of the temperatures in spark plugs while operating in an engine, one can estimate the resistance which a plug made of any of these materials would have in operation On making this comparison it appears that except for the poorest materials tested the resistance of the plug would be well on the safe side of the limiting value of 100,000 ohms.

Consequently this trouble can occur only with very poor materials, with very weak ignition systems, or with engines which are very much hotter than those experimented with at the Bureau. Later reports from abroad make no mention of this trouble, and its importance was apparently much exaggerated.

The testing of sample plugs submitted by the Bureau of Aircraft Production enabled the laboratory to accumulate data on the gas tightness of plugs of a variety of designs. This data has been analyzed and tabulated in A. P. P. Report No. 21 (N. A. C. No. 51-II).

It appears from this work that except in plugs where the insulator is moulded between the metal parts there is little connection between the design of the plug and its gas tightness, the latter depending much more on workmanship than on design. Observations at different pressures and temperatures show that the apertures through which the leakage occurs are in general opened up by high pressure and by heating. For this reason the routine tests are made while the plug is heated to 150 deg. C.

Two specific cases of electrode troubles were also investigated by the Bureau. In the first of these the electrodes in service broke off flush with the tip of the insulator. It was found that the cementing material became chemically active at the temperature of operation and attacked the metal electrode, rapidly eating it away. This trouble was remedied by substituting a different and inert filling material in the cement.

The second investigation was on the breaking of the side electrode in plugs where it was fastened at both ends. Microphotographs showed that prolonged heating of the nickel wire caused the formation of films of oxide in the cracks between the crystal grains of the metal. If the wire is subject to even a very slight tension, the cracks sink in deeply and the wire breaks in a short time.

If the tension is absent the cracks extend less rapidly and the life of the electrode is prolonged. It is probable that the well known slow corrosion of the electrodes by the spark is due to this effect, which causes the individual crystals to drop out of the wire as each becomes completely surrounded by its oxide film. These investigations are treated more fully in A. P. P. Reports No. 35 and No. 54 (N. A. C. No. 53-IV) respectively.

The most important part of the spark plug work was the development by the Ceramic Laboratory of the Bureau of a new porcelain body for use as a spark plug insulator. This work, which is described in A. P. P. Report No. 23 (N. A. C. No. 53-III), was begun while "cutout" was believed to be an important factor and the composition of the porcelain was chosen so as to give a high insulation resistance even at high temperatures. The various experimental porcelains mentioned above were made up with a view to determining the effect of various constituents upon the conductivity.

Measurements were also made of the thermal expansion over a wide range of temperature, and of resistance to sudden temperature changes, in the case of many of the bodies. By a careful balancing of the various components and the substitution of stable compounds like sillimanite ($Al_2O_3SiO_2$) in place of the free quartz, which tends to change its crystal form and dimensions at high temperatures, a porcelain-like body was finally obtained which could be prepared commercially and which was very definitely superior mechanically, thermally and electrically to any of the materials previously on the market. This composition has been made available to the public and is now being produced, with certain slight modifications, on a large scale by one of the largest spark plug manufacturers in the country.

VII—MAGNETO INVESTIGATIONS

The work on magnetos and induction coils has been much less complete than that on spark plugs, because of the much greater complexity of the subject and the less acute need for results. One of the early tests requested by the Signal Corps was the measurement of the energy output of a number of magnetos of different types.

The measurement of power electrically at the high voltages occurring in ignition systems is a rather difficult and delicate operation, but it is fortunately very simple to measure the same energy in the form of heat after it has been dissipated in the spark. Accordingly, as a preliminary to a more complete study of the subject a number of calorimetric measurements were made of the heat energy of the spark delivered at various speeds by the ignition system submitted.

The method used in this work is described in A. P. P. Report No. 15 (N. A. C. No. 56-I), and the results obtained are given in A. P. P. Report No. 13 (N. A. C. No. 56-II). The apparatus consists essentially of a hollow block of copper containing the spark gap. The rise of temperature of the copper which results from the passage of a known number of sparks is noted and compared with the rise produced by dissipating a known amount of energy in a heating coil, which is also enclosed in the block.

From this comparison the actual heat per spark can be computed in absolute measure. In considering these results it must be carefully borne in mind that the heat content of a spark is by no means a direct measure

of its igniting power and that it is only one of many items to be considered in judging the relative merits of different ignition systems.

Extensive oscillographic tests have been made on a number of magnetos to determine the instantaneous values of current, voltage, etc. during the operation of the machine. The wave forms obtained include the primary current on short circuit and the voltage on open circuit, together with the instants of opening and closing of the breaker. Also the primary and secondary currents and the primary voltage while operating normally have been recorded.

The oscillograph vibrator is not quick enough to indicate accurately the exceedingly rapid building up of voltage just after the primary "break," but the other features of the operation are brought out very clearly in the photographs.

Owing to the expense of reproducing the photographic records, copies of these oscillograms, which constitute A. P. P. Report No. 28, are being sent only to the manufacturers of the particular machines tested and to a few officials of the War Department. The results of measurements of the films are, however, being incorporated in other reports such as A. P. P. Report No. 20 (N. A. C. No. 58-I) dealing with various phases of the subject.

In interpreting the oscillograms, it was found desirable to know the ratio of secondary to primary turns in the particular coils tested and the combination of circuits described in A. P. P. Report No. 16 (N. A. C. No. 58-II) was devised to measure this ratio.

A considerable amount of work has also been done to develop methods for measuring the intrinsic constants of ignition apparatus, such as the electrostatic capacity of the secondary winding and the eddy currents in the core. It is hoped that the combination of quantitative data on these effects with a fairly simple mathematical theory of the electrical oscillations involved will enable the design of ignition apparatus to be put on a more scientific basis.

A comparison of the present empirical practice in this industry with the high degree of refinement attained in other branches of electrical engineering, as for example the design of power transformers in which the performance can be determined to a fraction of 1 per cent, indicates a wide field for advancement.

The various phases of this subject are so closely interlocked that the entire field must be worked out as a unit and consequently no partial reports have as yet been issued covering this part of the work.

The insulated cables used to connect the spark plugs with the distributor occasionally give trouble after considerable service by cracking of the insulation. This trouble usually occurs where the cable has been bent at a sharp angle.

At the request of the Bureau of Aircraft Production, this effect was investigated and the results were reported in A. P. P. Report No. 36. It was found to be due to a chemical attack on the rubber by ozone, which is in turn produced by the silent electrical discharge which occurs at the surface of the cable.

This chemical action is normally uniformly distributed and very slow, but, if the rubber is under tension as at the outside of a bend, the layer of oxide is pulled apart, continually exposing a fresh surface. This causes the cracks to sink rapidly into the material, until the insulating wall becomes so thin that it is punctured by the igniting voltage. The remedies for this trouble are the use of rubber compounds which are least susceptible to oxidation, the use of an impregnated air-tight braid and the avoidance of sharp bends in the wiring.

The problem of satisfying the requirements of ignition systems may be attacked, not only by the direct method of using an efficient and powerful source of energy, but also by the use of certain auxiliary devices which tend to produce the desired qualities of high voltage or large current.

The simplest of these for firing short circuited plugs is an auxiliary spark gap connected in series with the spark plug but external to the cylinder so that it will maintain a perfect insulation and definite breakdown voltage. Such a gap prevents the leakage of current across a fouled spark plug and permits the secondary voltage of the coil to build up in a normal manner. When this voltage becomes equal to the sparking voltage of the auxiliary gap, the gap breaks down and this full voltage is suddenly impressed on the spark plug, producing a spark at its gap also.

It has been found possible with this device to produce regular firing in an engine with a plug shunted by a resistance as low as 5,000 ohms, which is a very material reduction of the limit of 100,000 ohms specified above. Unfortunately, manufacturers of this type of device have brought it into unmerited disfavor by making impossibly extravagant claims for it in their advertising. A. P. P. Report No. 31 (N. A. C. No. 57) contains a discussion of the theory of this type of circuit and the results of trials of it in the laboratory and on engines.

The Lodge high frequency system is closely analogous to this series gap circuit, although the auxiliary gap is in parallel with the coil rather than in series, but is equally effective in firing a heavily shunted plug. The Dean high frequency system on the other hand is intended to supply a high voltage to overcome trouble from coating of the plug terminals with oil. The use of high frequencies permits the generation of very high voltages with a moderate number of turns, and it seems probable that further developments in ignition apparatus may be expected along this line.

VIII—SUMMARY

The foregoing outline of the ignition work at the Bureau of Standards has indicated the scope and purpose of the work. It has included a brief study of the effects of various types of spark discharge upon the power developed by a gasoline engine, and has indicated the conditions of temperature and voltage at which a spark plug is required to operate.

The cycle of operations of the jump spark ignition system has been discussed in some detail, and typical values of the various quantities of importance are stated. Standard methods of tests and specifications have been developed for spark plugs and a new porcelain body has been developed which is superior to those previously available for use in spark plug insulators.

Certain specific troubles, such as cracking and corrosion of electrodes, have been studied. Calorimetric measurements have been made of the power delivered by various typs of magnetos and extensive oscillographic tests have shown in detail various phases of operation.

A peculiar type of failure of the insulated cables connecting the spark plugs to the distributors has been studied, and tests have been made of the feasibility of the use of series spark gaps in firing fouled plugs.

It appears that from the above discussion the usefulness of the laboratory lies principally in studying specific difficulties, which experience has shown to be serious, in testing the properties of materials, in developing satisfactory standard methods of measurement, and in advancing the more theoretical side of the subject by fundamental research.

Specifications of Stock Engines fo[r]

In the following table are given the specifications of 96 models of automobile, truck and tractor engines now on the American market, the product of 34 different makers. The piston displacement ranges from 86.6 cu. in., which is only little beyond the motorcycle size, to 1344 cu. in., which is about the limit of size used for heavy tractors. This table should prove handy to manufacturers and engineers in search of an engine of a given output and certain characteristics.

The table also is instructive as regards trends in design. In view of the fact that some people have been inclined to regard the 4-cylinder engine as obsolete, on account of its limited use in passenger car models, the very strong representation of the four-cylinder type in the table is certainly interesting. Of the 96 engines listed 77 are of the four-cylinder type, while the remaining 19 are divided between 2, 6, 8 and 12-cylinder types.

It will be noticed that block casting of cylinders is becoming a very common practice, except for the largest bores. Although the practice of making cylinder heads detachable is rapidly gaining ground, there is still a goodly number of engines with integral heads. Some of the engines listed have been on the market for a number of years, and a change from integral to detachable head not only involves a complete redesign of the cylinder block but the making of complete new patterns and core boxes and extensive changes in manufacturing equipment.

The L-head type of cylinder predominates, but the valve-in-head construction is well represented and is preferred by many designers of kerosene-burning tractor engines. Mushroom cam followers are much more numerous than roller type cam followers, the two types being represented in about the proportion of 2:1.

The table shows that although there are more engines in which the cylinder axis intersects the crankshaft axis, the practice of offsetting the cylinders is pretty well established. In this connection it must be remembered that off-setting is of greatest advantage in a low-speed engine and a rather large proportion of the engines covered by the table is of this type.

As regards intake manifolds, the majority of them are separate from the cylinder block and head casting, but the integral manifold is not greatly in the minority.

Most engines are designed for pump circulation of the cooling water and a centrifugal pump for the purpose comes with the engine.

MAKE AND MODEL OF ENGINE	Designed for: (Cars, Trucks, Tractors)	Number of Cylinders	Bore and Stroke	Piston Displacement (Cu. In.)	Cylinders Cast	Is Cylinder Head Detachable?	Valves Placed	Valve Port Diameter (In.)	Valve Lift, In.	Type of Cam Follower	Volume of Compression Space, Cubic Inches	Piston Length, In.	Number of Piston Rings	Is Scraper Ring Used?	Weight of Piston with Wrist Pin and Rings (Lb.)	Weight of Connecting Rod (Lb.)	Length of Connecting Rod (C. to C.)	Width of Wrist Pin Bearing (In.)	Diameter of Wrist Pin Bearing (In.)	Width of Connecting Rod Lower End Bearing (In.)	Diameter of Connecting Rod Lower End Bearing (In.)	Diameter of Crankshaft	Number of Crankshaft Bearings	LENGTH OF CRANKSHAFT BEARINGS Front	1st Int.	Rear
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Beaver JA	T., Tr.	4	4 1/2x6	381.7	B.	Yes.	I.	2	3/8	R.			4	Yes.			12 1/2	2 5/8	2 1/2	2 3/4	2 1/4	2 3/8	3	3 1/2	3 1/2	4 1/…
Beaver JA	T. Tr.	4	4 3/4x6	425.[illegible]	B.	Yes	I.	2	3/8	R.			4	Yes			12 1/2	2 7/8	2 1/2	2 3/4	2 1/4	2 3/8	3	3 1/2	3 1/2	4 1/…
Bradley A1	C.	4	4 1/8x5 1/2	294.0	B.	No.	L.R.	2x1 3/4			19.2	5 1/2	3	No.	4.38	6.20	12	2	1 1/16	2 1/4	1 3/4	2	3	2 3/4	2 3/4	4
Buda RU	T.	4	3 1/2x5 1/4	197.[illegible]	B.	No.	R.	1 1/2	3/8	M.	15.1	5	3	No.	2.80	4.06	11 1/4	1 7/8	1 1/16	2	1 7/8	*	3	2 7/8	2 1/4	3 1/4
Buda WU	T., Tr.	4	3 3/4x5 1/4	223.4	B.	No.	R.	1 1/2	3/8	M.	17.4	5	3	No.	3.22	4.06	11 1/4	1 7/8	1 1/16	2	1 7/8	*	3	2 7/8	2 1/4	3 1/4
Buda IU	T., Tr.	4	4 x5 1/2	276.[illegible]	B.	No.	R.	1 7/8	I. 5/16, E. 3/8	M.	23.0	5 3/8	3	No.	4.05	6.25	12 1/4	2 1/8	1 1/8	2 1/2	2 1/8	*	3	3 1/8	2 3/4	4
Buda HU	T., Tr.	4	4 1/4x5 1/2	312.[illegible]	B.	No.	R.	1 7/8	I. 3/16, E. 3/8	M.	26.0	5 3/8	3	No.	4.62	6.25	12 1/4	2 1/8	1 1/8	2 1/2	2 1/8	*	3	3 1/8	2 3/4	4
Buda OU	T., Tr.	4	3 3/4x5 1/2	242.[illegible]	B.	No.	R.	1 7/8	I. 5/16, E. 3/8	M.	26.0	5	3	No.	3.48	5.96	11 7/8	2	1 1/16	2 3/8	1 7/8	*	3	3 1/8	2 1/8	4
Buda OU	T. Tr.	4	4 1/8x5 1/2	294.[illegible]	B.	No.	R.	1 7/8	I. 5/16, E. 3/8	M.	20.2	5 3/8	3	No.	4.88	6.14	11 7/8	2 1/8	1 1/16	2 3/8	1 7/8	*	3	3 1/8	2 1/8	4
Buda TU	T., Tr.	4	4 1/4x5 1/2	312.[illegible]	B.	No.	R.	1 7/8	I. 5/16, E. 3/8	M.	24.5	5 3/8	3	No.	5.16	6.14	11 7/8	2 1/8	1 1/16	2 3/8	1 7/8	*	3	3 1/8	2 1/8	4
Buda YTU	T., Tr	4	4 1/2x6	381.7	B.	Yes	R.	2 1/8	I. 5/16, E. 3/8	M.	25.4	6 1/4	3	No.	5.16	7.13	13 1/4	2 1/4	1 1/4	3	2 1/4	*	3	3 15/32	3 1/4	4 1/2
Buda ATU	T., Tr.	4	4 3/4x5 1/2	389.[illegible]	B.	Yes	R.	2 1/4	I. 5/16, E. 3/8	M.	30.7	6 3/4	3	No.			14 3/8	2 3/4	1 3/8	3 1/8	2 1/2	*	3	4 1/8	3 7/8	4 3/4
Buda BTU	T., Tr.	4	5 x6	471.[illegible]	B.	Yes.	R.	2 1/4	I. 5/16, E. 3/8	M.	29.4	6 3/4	3	No.			14 3/8	2 3/4	1 3/8	3 1/8	2 1/2	*	3	4 1/8	3 7/8	4 3/4
Chief F	Tr.	4	4 1/2x6	381.7	B.	Yes.	H	2 1/8	3/8	R.	28.7	5 5/8	3	No.	5.50	5.12	12 1/16	2 1/4	1 1/2	2 3/4	2 1/2	2 1/2	3	3 9/16	3 1/8	4 1/16
Chief B	Tr.	4	4 3/4x6	425.[illegible]	B.	Yes	H	2 1/8	3/8	R.	31.8	5 1/2	3	No.	5.62	5.12	12 1/16	2 1/4	1 1/2	2 3/4	2 1/2	2 1/2	3	3 9/16	3 1/8	4 1/16
Climax K	Tr.	4	5 x6 1/2	510.5	P.	Yes	R.	2 1/4	5/16	M.	55.3	5 3/4	3	No.	7.13	8.50	13	2 7/16	1 23/64	3	2 1/4	2 1/4	3	3 3/4	3 1/2	4 3/…
Climax KU	Tr.	4	5 x6 1/2	510.5	P.	Yes	R.	2 1/4	5/16	M.	55.3	5 3/4	3	No.	7.13	8.50	13	2 7/16	1 23/64	3	2 1/4	2 1/4	3	3 3/4	3 1/2	4 3/…
Continental N	C., T	4	3 1/2x5	192.4	B.	No.	R.	1 7/32	I. 9/32, E. 11/32	M.	14.1	3 3/4	3	No.	2.84	3.75	10 1/4	1 1/2	1 3/32	2 3/16	1 7/8	2 1/…	3	3 1/8	2 1/2	3 9/32
Continental N	C., T	4	3 3/4x5	220.[illegible]	B.	No.	R.	1 21/64	I. 9/32, E. 11/32	M.	16.7	3 3/4	3	No.	2.98	4.00	10 1/4	1 1/2	1 3/32	2 3/16	1 7/8	2 1/…	3	3 1/8	2 1/2	3 9/32
Continental C2	T.	4	4 1/8x5 1/4	280.[illegible]	B.	No.	R.	1 13/16	5/16	M.	22.0	5 1/4	3	No.	3.98	4.90	11	1 3/4	1 7/32	2 1/4	2	2 1/…	3	2 3/16	2 7/32	2 1/…
Continental C4	T.	4	4 1/8x5 1/4	280.6	B.	No.	L.	1 13/16	9/32	M.	22.0	5 1/4	3	No.	2.85	4.90	10 1/2	1 3/4	1 7/32	2 1/2	2 3/16	2 1/4	3	2 13/16	3	4 7/16
Continental E4	T.	4	4 1/2x5 1/2	349.[illegible]	P.	No.	L.	2 1/64	I. 5/16, E. 11/32	M.	27.6	5 5/8	3	No.	5.34	6.50	11	2 1/4	1 7/16	3	2 1/4	2 1/4	3	3 3/4	3 3/4	4 1/…
Continental E7	T.	4	4 1/2x5 1/2	349.9	P.	No.	L.	2 1/64	I. 5/16, E. 11/32	M.	27.6	5 5/8	3	No.	5.34	6.50	11	2 1/4	1 7/16	3	2 1/4	2 1/4	3	3	3 3/4	4 1/…
Continental B7	T., Tr.	4	4 3/4x6	425.3	P.	Yes	R.	2 1/…	11/32	R.	35.9	6 1/8	3	No.	7.32	8.50	13 1/4	2 1/8	1 3/8	3	2 3/8	2 1/2	3	3	4	4
Continental 7W	C.	6	3 1/4x4 1/2	224.0	B.	Yes	R.	1 13/32	9/32	M	10.8	3 1/2	3	No.	2.00	2.44	8 1/…	1 1/…	7/8	2	1 23/32	2 1/…	3	2 9/16	3	3 3/…
Continental 9N	C.	6	3 1/2x5 1/4	303.1	B.	No.	R.	1 5/32	I. 9/32, E. 11/32	M	15.7	4 1/2	3	No.	3.10	3.44	10 1/4	1 1/2	1 5/32	1 13/16	2 3/8	2 3/8	3	2 3/4	2 1/4	3 3/…
Doman	T., Tr.	4	4 3/4x6	425.3	P.	Yes	Opt.	2 3/8	3/8	M		6 5/8	3	No.	7.50	6.50	12 1/2	2 7/8	2 1/4	2 1/4	2 1/4	2 1/4	3	3 7/8	3 7/8	4 1/…
Doman	Tr.	4	6 x7	791.6	S.	Yes	Opt.	2 3/4	7/16	M		7 1/4	3	No.	12.25	11.25	14	4	1 1/2	3 1/8	2 3/4	2 3/4	5	5	*†2 7/8	6
Elbridge	C., T., Tr.	4	3 3/4x4	176.7	B.	Yes	-H					3 3/4	3	No.				1 1/8	1 5/16	1 1/2	1 1/2	1 1/2	3	1 15/16	2 1/8	3 1/…
Erd T-TU	Tr	4	4 x6	301.[illegible]	B.	Yes	I	1 3/4	5/16	M	25.0	4 1/2	3	No.	3.88	5.62	11 1/2	2 1/8	1 7/32	2 3/8	2	2	3	2 29/32	2 3/8	4
Erd CA	Tr.	4	4 1/2x6	381.7	B.	Yes	H	2 1/8	3/8	M	30.5	6	3	No.	6.00	10.00	12 1/2	2 1/8	1 1/2	3 1/4	2 3/8	2 1/2	3	3 1/2	3 1/2	4 1/…
Erd CA	Tr	4	4 3/4x6	425.[illegible]	B.	Yes	H	2 1/8	3/8	M	34.0	6	3	No.	6.00	10.00	12 1/2	2 1/8	1 1/2	3 1/4	2 3/8	2 1/2	3	3 1/2	3 1/2	4 1/…
Falls N	C.	6	3 x4 1/2	180.2	B.	Yes	H	1 1/4	9/32		7.9	3 1/2	3	No.	1.94	1.75	8 1/8	3/4	3/4	1 5/8	1 7/8	1 7/8	3	2 19/32	2	3
Falls R	C.	6	3 1/8x4 1/2	195.6	B.	Yes	H	1 1/4	9/32		8.6	3 1/2	3	No.	1.94	1.75	8 1/8	3/4	3/4	1 5/8	1 7/8	1 7/8	3	2 19/32	2	3
Falls R1	C.	6	3 1/8x4 1/2	195.6	B.	Yes	H	1 1/4	9/32		8.6	3 1/2	3	No.	1.94	1.75	8 1/8	3/4	3/4	1 5/8	1 7/8	1 7/8	3	2 19/32	2	3

Explanation of abbreviations: Numbers in brackets indicate the column to which reference is made.

(1) **C** = Car; **T** = Truck; **Tr** = Tractor.
(5) **B** = Block; **P** = Pairs; **S** = Singly.
(7) **H** = Head; **R** = Right; **L** = Left; **Op** = Opposite; **Sl** = Sleeve.
(10) **R** = Roller; **M** = Mushroom.
(29) **I** = Integral; **S** = Separate.
(30) **C-P** = Centrifugal Pump; **Th** = Thermo-Syphon; **G-P** = Gear Pump; **Opt** = Optional.
N-C = Non-Circulating Splash.
(31) **S-P** = Splash-Pressure; **C-S** = Circulating-Splash; **Pr** = Pressure.
(32-35) **A** = Aluminum; **I** = Iron; **S-S** = Semi-Steel; **P-S** = Pressed Steel.

Passenger Cars, Trucks and Tractors

Pressure lubrication has greatly increased in popularity of late years, mainly in connection with the use of engines for tractor work and similar heavy duty. Non-circulating systems, which some people consider essential with kerosene-burning tractor engines, are still very rarely found on engines of this type.

A certain number of engine cylinders are cast of semi-steel, which, as is generally known, consists of gray iron to which a certain amount of steel scrap has been added. This addition of steel no doubt will change the physical properties of the metal in certain ways, notably by rendering it tougher, but it is a question in the mind of many engineers whether it will increase the resistance of the metal to abrasion; in other words, whether it will increase the life of a cylinder used as cylinders are used in tractor service.

It is noteworthy that no aluminum pistons are used in stock engines. Wherever the material of the cylinders is semi-steel, that of the pistons is the same.

Governors are fitted to practically all engines used in tractor work, but some manufacturers of these engines leave it optional with the purchaser what type of governor he should use.

More than half of all the engines are adapted for 3-point support, and the great majority are of the unit powerplant type.

With very few exceptions, the manufacturers of engines were quite frank about the weights of their machines, and this tabulation for the first time affords the opportunity of deriving the average weight of engine per N. A. C. C. horsepower, or per cubic inch piston displacement. There would be absolutely no use in taking averages for all of the engines, as the relative weights of passenger-car and tractor engines are quite different.

Chain drives for the camshaft and accessories drive shaft are not numerous. Their advantage being greater silence, and this having to be purchased at the price of greater manufacturing cost, one would expect to see the chain only on engines designed for passenger-car use. As regards designs of bell housing, it is interesting to note that while the S. A. E. standard housings are not universal, they are the next thing to it.

It will be noticed that the term "optional" occurs rather frequently in the table. This shows that the engine builders are willing to meet the desires of assemblers where this can be done without too much trouble.

Is Cylinder Offset?	If Offset—How Much?	Intake Manifold (Separate or Integral)	Water Circulated by	Lubrication System	Material of Crankcase	Material of Lower Half of Crankcase	Material of Cylinders	Material of Pistons	R.P.M. at which Maximum H.P. is Developed	R.P.M. at which Maximum Torque is Developed	Is Governor Fitted?	If so, what Type?	Governed Speed	Maximum Brake H.P. of Average Product	Weight of Engine Without Ignition or Carbureter (Lb.)	Overall Width of Engine (In.)	Overall Height of Engine (In.)	Overall Length of Engine (In.)	Type of Front End Drive	If Chain, what Type?	Adjustable or Non-adjustable	Points of Engine Support	Adapted for Heavy Fuel	Is Bell Housing Provided?	If so, what No. or Type?	MAKE AND MODEL OF ENGINE
27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	
Yes.	1/2	I	C-P	S-P	S-S	I	S-S	S-S	1200	800	Yes	Own		35	1000	20-17 3/4	38 11/16	36 13/16	G			3-4	Yes.	Yes.	2, S.A.E.	Beaver JA
Yes.	1/2	I	C-P	S-P	S-S	I	S-S	S-S	1200	800	Yes	Own		40 1/2	1000	20-17 3/4	38 11/16	36 13/16	G			3-4	Yes.	Yes.	2, S.A.E.	Beaver JA
Yes.	3/8	S	C-P	C-S	A.	A.	I	I	1400	900	No			30	580	25	36	38	C	S		4	No.	No.		Bradley A1
No.		I	Th	C-S	I	I	I	I			Opt.				640	26	31 3/16	32 15/16	G			3	No.	Yes.	3, S.A.E.	Buda RU
No.		I	Th	C-S	I	I	I	I			Opt.		Opt.		640	26	31 3/16	32 15/16	G			3	No.	Yes.	3, S.A.E.	Buda WU
No.		I	C-P	Pr	I	I	I	I			Opt.		Opt.		725	25 3/4	33 11/16	38 7/16	G			3	No.	Yes.	3, S.AE.	Buda IU
No.		I	C-P	Pr	I	I	I	I			Opt.		Opt.		725	25 3/4	33 11/16	38 7/16	G			3	No.	Yes.	3 ,S.AE.	Buda HU
Yes.	3/16	S	C-P	C-S	I	I	S-S	I			Opt.		Opt.		745	26	34 1/4	38 7/16	G			3	No.	Yes.	3, S.A.E.	Buda QU
Yes.	3/16	S	C-P	C-S	I	I	S-S	I			Opt.		Opt.		730	26	34 1/4	38 7/16	G			3	No.	Yes.	3, S.A.E.	Buda OU
Yes.	3/16	S	C-P	C-S	I	I	S-S	I			Opt.		Opt.		715	26	34 1/4	38 7/16	G			3	No.	Yes.	3, S.A.E.	Buda TU
No.		S	C-P	Pr	I	I	I	I			Opt.		Opt.			25 3/4	36 7/16	55 1/8	G			3		Yes.	3, S.A.E.	Buda YTU
No.		S	C-P	Pr	I	I	I	I			Opt.		Opt.			28 3/4	40 1/2	62 1/4	G			3		Yes.	1, S.A.E.	Buda ATU
No.		S	C-P	Pr	I	I	I	I			Opt.		Opt.			28 3/4	40 1/2	62 1/4	G			3		Yes.	1, S.A.E.	Buda BTU
No.		I	C-P	Pr	I	I	S-S	S-S	1400	1000	Yes	F-B	600-1000	40	900	21	35	41 3/4				3-4	Yes.	Yes.	2-3, S.A.E.	Chief F
No.		I	C-P	Pr	I	I	S-S	S-S	1400	1000	Yes	F-B	600-1000	45	925	21	35	41 3/4				3-4	Yes.	Yes.	2-3, S.A.E.	Chief B
No.		S	C-P	Pr	I	I	S-S	I	900	600	Yes	F-B	Opt.	40	1150	24	39 3/4	47 1/2	G			4	Yes.	No.		Climax K
No.		S	C-P	Pr	I	I	S-S	I	900	600	Yes	F-B	Opt.	40	1150	24	39 3/4	47 1/2	G			4	Yes.	Yes.	2, S.A.E.	Climax KU
No.		I	Opt.	S-P	A.	P-S	I	I	1800	900	No.			28 1/2	450	24 1/2	30 3/8	35	G			3	No.	Yes.	Own	Continental N
No.		I	Opt.	S-P	A.	P-S	I	I	2200	900	No.			38	475	24 1/2	30 3/8	35	G			3	No.	Yes.	Own	Continental N
No.		I	C-P	S-P	A.	P-S	I	I	1400	950	No.			35 1/2	580	24 1/2	30 3/8	35	G			3	No.	Yes.	Own	Continental C2
No.		I	C-P	S-P	A.	A.	I	I	1600	950	No.			37 1/2	560	24 1/2	30 3/8	35	G			3	No.	Yes.	2, S.A.E.	Continental C4
No.		S	C-P	S-P	A.	A.	I	I	1300	900	No			44	650	27	32 7/8	41 1/8	G			3	No.	Yes.	2, S.A.E.	Continental E4
No.		S	C-P	S-P	A.	A.	I	I	1300	900	No			44	660	27	32 7/8	41 1/8	G			3	No.	Yes.	2, S.A.E.	Continental E7
No.		S	C-P	Pr	A.	A.	I	I	1300	900	Yes	Cent.		55 1/2	1016	27	34 13/16	46 7/16	G			3	No.	Yes.	1, S.A.E.	Continental B2
No.		I	C-P	S-P	I	P-S	I	I	2100	800	No			42	575	24 1/2	27 3/4	39 9/16	G			3	No.	Yes.	3, S.A.E.	Continental 7W
No.		I	C-P	S-P	A.	P-S	I	I	2000	800	No			55	600	25 3/4	29 22/32	41 25/32	G			3	No.	Yes.	3, S.A.E.	Continental 9N
No.		S	C-P	S-P	S-S	I	I	I	900	800	Yes	F-B		35	950	26	33 1/4	45	G			3-4	Yes.	Opt.	Opt.	Doman
No.		S	G-P	S-P	S-S	I	I	I	700	700	Yes	F-B		50	1450	32	42	56 1/4	G			3-4	Yes.	Opt.	Opt.	Doman
No.		S	Opt.	C-S	I	I	I	I			Yes	Suct.	1000		323	17	22 1/2	33 3/4	G			3-4	Yes.	Yes.	4, S.A.E.	Elbridge
No.		I	C-P	C-S	S-S	I	S-S	S-S	1000	600	Yes	Cent.		35	755-827	23 1/2	35 1/4	40 1/16	G			4	Yes.	Yes.	3, S.A.	Erd T-TU
No.		S	C-P	Pr	S-S	I	S-S	S-S	950		Yes	F-B.	900			24	43 1/8	46 1/2	G			3-4	Yes.	Yes.	1-2, S.A.E.	Erd CA
No.		S	C-P	Pr	S.S	I	S.S	S.S	950		Yes	F-B	900			24	43 1/8	46 1/2	G			3-4	Yes.	Yes.	1-2, S.A.E.	Erd CA
No.		I	Th	S-P	I	I	I	I	2100	2000	No			24 1/5	430	27 9/16	28 15/16	38 9/16	G			3	No.	Yes.	4, S.A.E.	Falls N
No.		I	Th	Pr	I	I	I	I	2100	2000	No			25	425	26 1/4	28 15/16	38 9/16	G			3	No.	Yes.	4, S.A.E.	Falls R
No.		I	Th	Pr	I	I	I	I	2100	2000	No			25	425	26 1/4	28 15/16	38 9/16	G			3	No.	Yes.	4, S.A.E.	Falls R1

(46) **G** = Gear; **C** = Chain.
(47) **S** = Silent.
(48) **A** = Adjustable; **N** = Non-Adjustable.
*Buda crankshafts are of the following diameters:
Models **RU, WU, TU, QU, OU**—Front, 1 3/4 in.; center, 2 in.; rear, 2 1/8 in.
IU, HU, YTU—Front, 2 1/8 in.; center, 2 1/4 in.; rear, 2 3/8 in.
ATU, BTU—Front, 2 1/4 in.; center, 2 1/2 in.; rear, 2 3/8 in.
†Wisconsin model RBU crankshaft diameter: Front, 2 1/4 in.; center, 2 5/16 in.; rear, 3 3/8 in.
**Other intermediate crankshaft bearings are of similar length to first intermediate.

Specifications of Stock Engines for Passen

MAKE AND MODEL OF ENGINE	Designed for: (Cars, Trucks, Tractors)	Number of Cylinders	Bore and Stroke	Piston Displacement (Cu. In.)	Cylinders Cast	Is Cylinder Head Detachable?	Valves Placed	Valve Port Diameter (In.)	Valve Lift (In.)	Type of Cam Follower	Volume of Compression Space (Cubic Inches)	Piston Length, In.	Number of Piston Rings	Is Scraper Ring Used?	Weight of Piston with Wrist Pin and Rings (Lb.)	Weight of Connecting Rod (Lb.)	Length of Connecting Rod (C. to C.)	Width of Wrist Pin Bearing (In.)	Diameter of Wrist Pin Bearing (In.)	Width of Connecting Rod Lower End Bearing (In.)	Diameter of Connecting Rod Lower End Bearing (In.)	Diameter of Crankshaft	Number of Crankshaft Bearings	LENGTH OF CRANKSHAFT BEARINGS Front	1st Int.	Rear
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Field C	Tr.	4	4½x6	381.7	B.	Yes.	H.	2⅛	5/16	R.	41.4	10	3	No.	4.00	5.00	12	2	1¼	2	3	2	3	5	3	5
G. B. & S. S	C., T., Tr.	4	3¾x4¼	187.7	B.	Yes.	R.	1⅝	7/32	....	11.7	3 13/16	3	Yes.	2.81	1.69	7	1½	⅞	2	1½	1⅝	3	3⅞	2¼	4
G. B. & S. AA	C., T., Tr.	4	3¾x5	220.9	B.	No.	R.	1 11/16	23/64	M.	12.7	3¾	3	Yes.	3.06	2.25	10¼	1½	1	2 3/16	1⅞	2¼	3	3	2½	3
Gray X	T.	4	3½x5	192.4	B.	Yes.	H.	1 21/32	5/16	M.	14.3	4 3/32	3	No.	2.64	2.84	9¼	1⅝	⅞	2	1¾	2	3	2¾	2	3⅜
Herschell-Spillman 2700	C., T., Tr.	4	3¼x5	165.9	B.	Yes.	R.	1 7/16	5/16	M.	9.1	3½	3	No.	2.08	3.00	11	1½	⅞	2	2	2	2	4	...	4
Herschell-Spillman 6500	C., T., Tr.	8	3¼x5	331.8	B.	No.	R.	1 7/16	11/32	....	9.1	3½	3	No.	2.08	3.16	11	1½	⅞	1 9/16	1⅞	2	3	3	3	3¾
Hercules C2	T., Tr.	4	3¾x5⅛	226.4	B.	Yes.	R.	I. 1⅜, E. 1 11/16	11/32	M.	13.4	4 13/16	4	Yes.	3.75	5.00	11	1¾	1⅛	2¼	2	2	5	2¼	**1¾	3½
Hercules CU3	T., Tr.	4	4 x5⅛	257.6	B.	Yes.	R.	1¾	11/32	M.	14.3	4 13/16	4	Yes.	3.75	5.00	11	1⅞	1⅛	2 3/16	2	2	5	2⅜	**1¾	3⅝
Hercules M2	T., Tr.	4	4¼x5½	312.0	B.	Yes.	R.	1 11/16	11/32	M.	19.0	5⅛	5	Yes.	5.25	6.50	12	1 13/16	1¼	2½	2	2	5	3	**2	4⅜
Hercules T	T., Tr.	4	4¾x6	425.3	P.	Yes.	R.	2⅛	11/32	R.	25.8	6¼	3	No.	6.50	7.50	13¼	2⅛	1⅜	3	2⅜	5	5	2½	**2½	4
Hinkley HAA	T., Tr.	4	3¾x5¼	231.9	B.	Yes.	R.	1¾	5/16	R.	......	4¾	3	No.	6.44	5.75	11½	1¾	1⅛	2¼	2⅛	2¼	3	2¼	3	3
Hinkley HAA	T., Tr.	4	4 x5¼	263.9	B.	Yes.	R.	1¾	5/16	R.	....	4¾	3	No.	6.44	5.75	11½	1¾	1⅛	2¼	2⅛	2¼	3	2¼	3	3
Hinkley HA	T., Tr.	4	4½x5½	349.9	B.	Yes.	R.	2	11/32	R.	....	5¼	3	No.	7.25	7.50	12	1⅞	1¼	2½	2¼	2⅜	3	2½	3½	3½
Hinkley B	T., Tr.	4	4¾x6	425.3	P.	Yes.	R.	2⅛	11/32	R.	....	6⅛	3	No.	8.00	8.38	13¼	2⅛	1⅜	3	2⅜	2½	3	3	4	4
Lewis AAG	C.	6	3¼x5	248.9	B.	Yes.	R.	1⅝	5/16	M.	....	4	3	No.	....	....	9½	...	...	...	...	...	..	...	...	..
Light H	T., Tr.	4	3¼x4½	149.3	B.	Yes.	R.	1⅜	7/32	M.	12.7	4½	3	No.	2.00	2.68	9	1½	¾	2	1¾	1⅞	2	2⅜	...	2⅞
Lycoming K	C., T.	4	3½x5	192.4	B.	Yes.	R.	1½	19/64	M.	14.37	4	3	No.	2.31	3.12	9½	1 9/16	⅞	2⅛	2	2⅛	2	3 3/16	...	3 9/16
Matthews F	C., T., Tr.	4	3½x5	192.4	B.	Yes.	H.	1⅜	I. .254, E. .285	M.	15.8	3¾	3	No.	....	....	9¼	1¾	⅞	2	1¾	2	3	2¾	2	3⅜
North American C	T., Tr.	4	3¾x4½	198.8	P.	No.	L.	1½	9/32	M.	14.5	4½	3	No.	4.25	2.87	8½	2¼	1	2¼	1½	1⅝	3	2¾	2½	3½
North American CX	T., Tr.	4	4 x4½	226.2	P.	No.	L.	1⅝	9/32	M.	16.2	4½	3	No.	4.25	2.87	8½	2¼	1	2¼	1½	1⅝	3	2¾	2½	3½
North American D	T., Tr.	4	4⅜x6	360.8	P.	No.	L.	2⅛	11/32	M.	30.0	6	4	No.	5.81	5.25	11½	2½	1¼	2½	1⅞	2	3	3	3	4
Moline-Knight G	C.	4	4 x6	301.6	B.	Yes.	Sl.	....	....	....	20.1	5	3	Yes.	3.12	5.03	13⅜	2⅛	1¼	2½	2¼	3	3	2½	2½	4
Moline-Knight W	T.	4	4 x6	301.6	B.	Yes.	Sl.	....	....	....	20.1	5	3	Yes.	3.12	5.03	13⅜	2⅛	1¼	2½	2¼	3	3	2½	2½	4
Moline-Knight E	T.	4	4 x6	301.6	B.	Yes.	Sl.	....	....	....	20.1	5	3	Yes.	3.12	5.03	13⅜	2⅛	1¼	2½	2¼	2¼	3	2½	2½	4
Pittsburgh 84	T.	4	3 x4½	127.2	B.	Yes.	R.	1⅛	¼	M.	11.7	4½	3	No.	2.12	2.68	11	1½	55/64	1 57/64	1¼	1 15/16	3	3	2	2 15/16
Red Wing AA	Tr.	4	3¾x4¾	209.9	P.	No.	L.	1 7/16	.281	....	11.9	4⅛	3	No.	3.50	2.62	8½	1⅛	1 1/10	2⅛	1½	1½	3	3	2¾	3
Red Wing F	Tr.	4	4 1/16x5	259.2	B.	No.	L.	1¾	3/10	....	19.9	4¾	4	Yes.	4.75	3.62	10½	1¼	1 1/10	2¼	1¾	1¾	3	3½	2¼	4 3/16
Red Wing B	Tr.	4	4½x5	318.1	B.	No.	L.	1 15/16	3/10	....	27.0	4¾	4	Yes.	5.31	4.12	10⅜	1 15/32	1 1/10	2¼	2	2	3	3½	2¼	4 3/16
Reliable EE	Tr.	2	5 x5	196.3	S.	Yes.	H.	1¾	7/16	R.	23.0	6 3/32	3	No.	12.00	10.50	12½	2	1⅜	2	2	2	2	3¾	...	4½
Reliable OO	Tr.	2	6 x6	339.2	B.	Yes.	H.	2⅛	7/16	R.	21.0	7⅛	3	No.	12.00	10.00	12½	2	1⅜	2⅜	2⅜	2⅜	2	4½	...	4½
Reliable MM	Tr.	2	9¼x10	1344.0	S.	Yes.	H.	3	13/16	R.	......	12⅛	5	Yes.	80.00	64.00	21¾	4	2¼	4	4	4	2	6¾	...	8
Rutenber 38	T., Tr.	4	4⅛x5½	294.0	P.	No.	R.	1⅞	11/32	M.	24.5	5	3	No.	4.18	4.18	12	2	1	2½	2⅛	2⅛	3	3½	3	4½
Rutenber 40	T., Tr.	4	4⅜x5½	330.7	P.	No.	R.	1⅞	11/32	M.	27.5	5	3	No.	4.37	4.18	12	2	1	2½	2⅛	2⅛	3	3½	3	4½
R & V N	Tr.	4	3½x5	192.4	B.	Yes.	R-H.	1⅝	⅜	M.	14.8	4	3	No.	3.50	4.50	10	1 13/16	1	1¾	2½	2½	2	2½	...	3 3/16
R & V D	C.	6	3¼x4½	224.0	B.	Yes.	L-H.	1⅝	⅜	M.	10.6	3⅝	3	No.	3.00	3.50	8½	1 11/16	1	1½	2¼	2¼	3	2	3⅛	3
Supreme 4C	C., T., Tr.	4	3¼x5	165.9	B.	Yes.	L.	1¾	9/32	M.	....	4	3	No.	2.00	1.87	10	1⅝	⅞	2	1⅞	1⅞	3	2½	2⅛	3½
Supreme 12A	C.	12	2½x5	294.5	B.	Yes.	In V.	1½	9/32	R.	....	3	3	No.	1.17	1.75	11	1¼	¾	1¼	1⅞	1⅞	3	2¾	2⅞	3¼
Supreme 12A	C.	12	2¾x5	356.4	B.	Yes.	In V.	1½	9/32	R.	....	3	3	No.	1.17	1.75	11	1¼	¾	1¼	1⅞	1⅞	3	2¾	2⅞	3¼
Teetor 19H	C.	6	3⅛x5	230.1	B.	Yes.	R.	1⅗	.343	R.	10.6	3 5/16	3	Yes.	1.93	2.97	9½	1⅝	1	1 15/16	1⅞	2	3	2⅞	2⅜	3¼
Teetor 19T	C.	6	4½x6	572.5	B.	No.	Opt.	2	5/16	....	28.6	5 1/16	5	Yes	.3.00	3.75	12	3	1	2¼	1⅞	2	4	4¼	**1 11/16	4
Trego 100	C.	6	3½x5	288.6	B.	Yes.	R.	1 9/16	I. 5/16, E. ⅜	M.	16.0	4	3	No.	....	....	10	2 1/16	1 3/32	1⅞	2¼	2¼	3	2½	2½	3¼
Trego 101	C.	6	3½x5	288.6	B.	Yes.	H.	1 9/16	I. 5/16, E. ⅜	M.	16.0	4	3	No.	....	....	10	2 1/16	1 3/32	1⅞	2¼	2¼	3	2½	2½	3¼
Universal	C.	4	2⅝x4	86.6	B.	Yes.	L.	1⅛	3/16	M.	7.0	3¼	3	Yes.	....	....	7½	1	⅝	1¾	1½	1½	2	2	...	2½
Waukesha BX	T., Tr.	4	3¾x5¼	231.9	B.	Yes.	R.	1¾	5/16	M.	22.7	3⅞	4	Yes.	2.75	5.62	10⅝	2	1	2¼	2	2	3	2¼	2½	3
Waukesha R	T., Tr.	4	4¼x5¾	326.3	P.	No.	L.	2	5/16	R.	26.5	5¼	3	No.	5.00	4.75	11½	2⅛	1¼	2½	2	2	3	2 7/16	3¼	3½
Waukesha PU7	T., Tr.	4	4¾x6¾	478.4	P.	No.	L.	2⅛	11/32	R.	38.5	5¾	3	No.	6.62	5.87	12¼	2¾	1½	3	2	2	3	3½	4¼	4½
Weide'y MA	T.	4	3¾x5½	242.9	B.	Yes.	H.	1⅞	5/16	M.	20.3	4 9/16	3	No.	2.90	4.68	12	3½	1	2¼	2	2⅛	3	2⅜	2½	4
Weidely M	Tr.	4	3¾x5½	242.9	B.	Yes.	H.	1⅞	5/16	M.	20.3	4 9/16	3	No.	2.90	4.68	12	3½	1	2¼	2	2⅛	3	2⅜	2½	4
Wisconsin QU	T., Tr.	4	3¼x5	165.9	B.	Yes.	L.	1½	5/16	M.	....	3¾	2	No.	2.22	2.75	10	...	⅞	2	2	2	2	3	...	3½
Wisconsin CAU	T., Tr.	4	3¾x5	220.9	B.	No.	L.	1½	5/16	M.	18.0	5⅜	3	No.	....	....	10½	1¾	1 3/16	2¾	1¾	1¾	3	2¾	2¾	4
Wisconsin EAU	T., Tr.	4	4 x5	251.3	B.	No.	L.	1½	.313	M.	....	5	3	No.	3.93	4.00	10½	1¾	1 3/16	2¼	1¾	1¾	3	2¾	2¾	4
Wisconsin TAU	T., Tr.	4	4 x6	301.6	B.	Yes.	R.	2 1/32	I. 5/16, E. ⅜	M.	22.9	5⅜	3	No.	....	....	12	2	1 3/16	3	2	2	4	2½	**2½	3½
Wisconsin UAU	T., Tr.	4	4¼x6	340.4	B.		R.	2 1/32	I. 5/16, E. ⅜	M.	....	5⅛	3	No.	4.75	5.81	12	2	1 3/16	3	2	2	4	2½	**2½	3½
Wisconsin VAU	T., Tr.	4	4½x6	381.7	B.	Yes.	R.	2 1/32	I. 5/16, E. ⅜	M.	....	5⅛	3	No.	5.18	5.81	12	2	1 3/16	3	2	2	4	2½	**2½	3½
Wisconsin G	T., Tr.	4	4¾x5½	389.9	P.	No.	Opt.	2 9/32	.383	R.	....	6¼	3	No.	6.12	6.87	12	2⅝	1 3/16	3½	2⅜	2⅜	4	3½	**3½	4
Wisconsin RAU	T., Tr.	4	4¾x6	425.3	P.	Yes.	R.	2⅛	⅜	R.	26.2	6	3	No.	....	....	12½	2⅛	1⅜	3	2¼	2¼	3	3	3⅞	4
Wisconsin RBU	T., Tr.	4	5 x6	471.2	P.	Yes.	R.	2⅛	I. .373, E. .379	R.	40.3	5 11/32	3	No.	....	....	12½	2⅛	1⅜	3	2¼	†	3	3	3¾	4
Wisconsin D	T., Tr.	4	5¼x7	606.1	P.	No.	Opt.	2 13/32	.383	R.	....	7	4	No.	8.00	10.68	14	3 7/16	1 7/16	3½	2⅜	2⅜	3	4	4	6
Wisconsin M	T., Tr.	4	5¾x7	727.1	P.	No.	Opt.	2 13/32	.383	R.	....	6½	4	No.	8.68	10.68	14	3⅝	1 7/16	3½	2⅜	2⅜	3	4	4	6
Wisconsin K	T., Tr.	6	5¼x7	909.1	P.	No.	Opt.	2 13/32	.383	R.	....	7	4	No.	8.12	10.68	14	3 7/16	1 7/16	3½	2⅜	2⅜	4	4	4	6
Wisconsin P	T., Tr.	6	5¾x7	1090.6	P.	No.	Opt.	2 13/32	.383	R.	....	6½	4	No.	8.68	10.68	14	3⅝	1 7/16	3½	2⅜	2⅜	4	4	4	6

Explanation of abbreviations: Numbers in brackets indicate the column to which reference is made.

(1) C = Car; T = Truck; Tr = Tractor.
(5) B = Block; P = Pairs; S = Singly.
(7) H = Head; R = Right; L = Left; Op = Opposite; Sl = Sleeve.
(10) R = Roller; M = Mushroom.
(29) I = Integral; S = Separate.
(30) C-P = Centrifugal Pump; Th = Thermo-Syphon; G-P = Gear Pump; Opt = Optional.
(31) S-P = Splash-Pressure; C-S = Circulating-Splash; Pr = Pressure; N-C = Non-Circulating Splash.
(32-35) A = Aluminum; I = Iron; S-S = Semi-Steel; P-S = Pressed Steel.

ger Cars, Trucks and Tractors (Continued)

Is Cylinder Offset?	If Offset—How Much?	Intake Manifold (Separate or Integral)	Water Circulated by	Lubrication System	Material of Crankcase	Material of Lower Half of Crankcase	Material of Cylinders	Material of Pistons	R.P.M. at which Maximum H.P. is Developed	R.P.M. at which Maximum Torque is Developed	Is Governor Fitted?	If so, what Type?	Governed Speed	Maximum Brake H.P. of Average Product	Weight of Engine Without Ignition or Carbureter (Lb.)	Overall Width of Engine (In.)	Overall Height of Engine (In.)	Overall Length of Engine (In.)	Type of Front End Drive	If Chain, what Type?	Adjustable or Non-adjustable	Points of Engine Support	Adapted for Heavy Fuel	Is Bell Housing Provided?	If so, what No. or Type?	MAKE AND MODEL OF ENGINE
27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	
No.	..	I	C-P	S-P	S-S	I	S-S	S-S	1000	1000	Yes	F-B	750	....	1000	21 15/16	35 7/8	38 3/8	G			4	Yes	No		Field C
Yes	5/8	S	Th	C-S	I	P-S	S-S	S-S	1600	800	Yes	Suct	1000	30	450	23 1/2	25	34	G			3	No	Yes	3-5, S.A.E.	G. B. & S S
No.	..	S	C-P	Pr	A	A	S-S	S-S	1700	800	Yes	Cent	1400	35	410	23 1/8	31	34 1/16	G			3	No	Yes	3, S.A.E.	G. B. & S AA
Yes	3/8		Th	S-P	I	Opt	I		1900	950			....	34	495	28	30 5/8	37 1/4	G			3	Yes	Yse	3, S.A.E.	Gray X
No.	..	S	Th	S-P	I	P-S	I	I	2200	2100	No		....	43	525	25 3/4	30 1/2	42 7/8	G			3	No	Yes	3-5, S.A.E.	Herschell-Spillman 2700
Yes	15/32	S	C-P	Pr	A	A	I	I	2100	2000	No		....	70	550	27	31	52 5/16	G			3	No	Yes	3, S.A.E.	Herschell-Spillman 6500
No.	..	I	G-P	Pr	I	I	I	I	1800	1000	Yes	Cent	1400	34	650	26 3/4	34 9/16	38 9/16	G			3-4	Opt.	Opt.	2-3, S.A.E.	Hercules C2
No.	..	S	C-P	Pr	I	I	I	I	1800	950	Yes	Cent	1400	37	675	24 1/2	30 1/2	41 3/4	G			3	Opt.	Opt.	S2, .A.E.	Hercules CU3
No.	..	I	C-P	Pr	I	I	I	I	1600	800	Yes	Cent	1250	41	875	26 3/4	36 1/2	43 7/8	G			3-4	Opt.	Opt.	2-3, S.A.E.	Hercules M2
Yes	3/8	S	C-P	Pr	I	I	I	I	1400	800	Yes	F-B	1000	62	1200	25 3/4	41	46	G			3	Opt.	Opt.	1-2, S.A.E.	Hercules T
No.	..	S	C-P	Pr	S-S	P-S	S-S	S-S	2000	900	Yes	Cent	1300	35	600	25 1/2	34	36 1/2	G			3	No	Yes	3, S.A.E.	Hinkley HAA
No.	..	S	C-P	Pr	S-S	P-S	S-S	S-S	1800	900	Yes	Cent	1300	40	600	25 1/2	34	36 1/2	G			3	No	Yes	3, S.A.E.	Hinkley HAA
No.	..	S	C-P	Pr	S-S	P-S	S-S	S-S	1500	900	Yes	Cent	1200	45	800	25 1/2	38	43	G			3	No	Yes	2, S.A.E.	Hinkley HA
No.	..	S	C-P	Pr	A	A	S-S	S-S	1400	900	Yes	Cent	1050	55	1042	28 3/4	40 3/4	46 3/8	G			3	No	Yes	1, S.A.E.	Hinkley B
No.	..	S	Opt	S-P	I	A	I	I	2650	....	No		....	55	490	.....	....	....	G			3	No	Yes	3-4, S.A.E.	Lewis AAG
No.	..	S	Opt	C-S	I	Opt	S-S	Opt	2600	800	Opt		....	31	365	21 1/8	30	37 1/2	G			3	Yes	Yes	S.A.E.	Light H
No.	..	I	Th	C-S	I	P-S	I	I	2100	950	No		....	35	470	21 15/16	26 7/8	38 1/16	G			3	No	Yes		Lycoming K
Yes	3/8	S	Opt	C-S	I	Opt	I	I	2000	1200	Opt		....	25	450	24 1/4	29 3/8	32 9/16	G			3-4	No	Opt.	3, S.A.E.	Matthews F
Yes	3/8	S	Opt	C-S	I	I	I	I	1800	800	No		....	27	480	26	30	36	G			3	....	Yes	3, S.A.E.	North American C
Yes	3/8	S	Opt	C-S	I	I	I	I	1800	800	No		....	30	480	26	30	36	G			3	....	Yes	3, S.A.E.	North American CX
Yes	1/2	S	C-P	C-S	I	I	I	I	2200	800	No		....	57	800	26	34	41	C	S	A	3	Yes	Yes	2, S.A.E.	North American D
Yes	5/16	I	Th	Pr	A	A	I	I	1700	1000	No		....	53	656	.....	....	....	C	S	N	4	No	No		Moline-Knight G
Yes	5/16	I	Th	Pr	A	A	I	I	1700	1000	No		....	53	695	.....	....	....	C	S	N	3	No	No		Moline-Knight W
Yes	5/16	I	Th	Pr	A	A	I	I	1700	1000	No		....	53	725	.....	....	....	C	S	N	4	No	No		Moline-Knight E
No.	..	S	Th	N-C	I	P-S	I	I	1800	1100	No		....	18	375	22 1/2	29	32	G			3	No	Yes	Opt.	Pittsburgh 84
Yes	3/8	S	C-P	C-S	I	I	I	I	....	....	Yes	Cent	1000	19	490	19 1/8	30 5/8	33 3/4	G			4				Red Wing AA
No.	..	I	C-P	C-S	I	I	I	I	....	....	Yes	Cent	950	22	560	20 3/8	28 1/8	36 1/4	G			4				Red Wing F
Yes	1/8	I	C-P	C-S	I	I	I	I	....	....	Yes	Cent	900	26	600	20 7/16	28 3/8	36 1/4	G			4				Red Wing B
Yes	3/32	S	Opt	Pr	I	I	S-S	S-S	600	....	Yes	F-B	600	13	650	24 5/8	21 3/8	50 7/8				..	Yes			Reliable EE
No.	..	S	C-P	Pr	I	I	I	I	600	....	Yes	F-B	600	22 1/2	785	26 3/4	24 5/8	54					Yes			Reliable OO
Yes	3/32	S	Opt	Pr	I	I	S-S	S-S	350	....	Yes	F-B	380	51	3650	44 7/8	39 7/8	99 1/2					Yes			Reliable MM
No.	..	S	C-P	Pr	I	I	I	I	2000	1000	Opt		1000	31	800	27	35	43 1/4	G			3	Yes	Opt.	3, S.A.E.	Rutenber 38
No.	..	S	C-P	Pr	I	I	I	I	2000	1000	Opt		1000	34	800	27	35	43 1/2	G			3	Yes	Opt.	3, S.A.E.	Rutenber 40
No.	..	I	Th	Pr	I	I	I	I	2000	1000	No		....	34	691	19	39	38	G				No	No		R & V N
No.	..	I	Th	Pr	I	P-S	I	I	2670	1100	No		....	57	727	28 1/4	33 5/8	49 11/16	G			3	No	Yes	3, S.A.E.	R & V D
Yes	5/8	I	Opt	S-P	Int	P-S	I	I	2150	1600	No		....	42	360	18 1/2	28	33 1/8	G			3	No	Opt.		Supreme 4C
No.	..	S	C-P	S-P	A	A	Opt	Opt	....	....			....	....	.....	21	31	43 7/8	C	S	A	3	No	Yes	3, S.A.E.	Supreme 12A
No.	..	S	C-P	S-P	A	A	Opt	Opt	....	....			....	....	.....	21	31	43 7/8	C	S	A	3	No	Yes	3, S.A.E.	Supreme 12A
No.	..	I	C-P	S-P	Int	I	I	I	2300	1300	No		....	43 1/2	524	17 3/4	24 13/16	38 11/16	G			3	No	Yes	3, S.A.E.	Teetor 19H
No.	..	I	C-P	S-P	A	A	I	A	1900	1050	No		....	85	.....	24	28	45	G			4	No	No		Teetor 19T
No.	..	I	C-P	Pr	A	A	I	I	2400	1300	No		....	65	.....	25 3/4	30	52	G			3	No	Yes	3, S.A.E.	Trego 100
No.	..	I	C-P	Pr	A	A	I	I	2400	1300	No		....	65	.....	25 3/4	33 1/2	52	G			3	No	Yes	3, S.A.E.	Trego 101
No.	..	I	Th	N-C	I	I	I	I	1500	1200	Yes	Cent	Opt.	10	300	12	16	22	G			3	Yes	No		Universal
No.	..	I	C-P	C-S	A	I	S-S	S-S	1800	900	Yes	Own	1150	28	500	20 3/8	29	36 3/4	G			3	Yes	Opt	3, S.A.E.	Waukesha BX
Yes	1/2	S	C-P	C-S	A	I	S-S	S-S	1200	800	Yes	Own	900	32	600	20 3/8	33 1/2	37 1/4	G			4	Yes	Opt.	2, S.A.E.	Waukesha R
Yes	1/2	S	C-P	C-S	A	A	S-S	S-S	1200	500	Yes	Own	800	45	850	23 3/4	34	44	G			3	Yes	Yes	1, S.A.E.	Waukesha PU7
No.	..	I	C-P	S-P	S-S	I	S-S	S-S	1600	....	Opt		....	32	.....	25 3/4	32	40	G			3	Yes	Yes	3, S.A.E.	Weidely MA
No.	..	I	C-P	S-P	S-S	I	S-S	S-S	1600	....	Yes	Cent	Opt.	32	750	24 3/16	32	39 7/16	G			4	Yes	No		Weidely M
No.	..	S	C-P	C-S	I	A	I	I	1700	1000	No		....	25	435	17 3/8	27 1/2	33 5/16	G			3	Yes	Yes	3, S.A.E.	Wisconsin QU
No.	..	S	C-P	Pr	A	A	I	I	1650	900	Opt		1000	31	450	20 3/4	31 13/16	40 13/16	G			3	Yes	.Yes	.3S.A.E.	Wisconsin CAU
No.	..	S	C-P	Pr	A	A	I	I	1600	1000	Opt		1000	37	460	20 3/4	31 7/8	40 13/16	G			3	Yes	Yes	3, S.A.E.	Wisconsin EAU
No.	..	S	C-P	Pr	A	A	I	I	1600	900	Opt		1000	45	650	21 7/16	34	46 3/16	G			3	Yes	Yes	3, S.A.E.	Wisconsin TAU
No.	..	S	C-P	Pr	A	A	I	I	1600	900	Opt		1000	50	660	21 9/16	34	46 3/16			3	3	Yes	Yes	3, S.A.E.	Wisconsin UAU
No.	..	S	C-P	Pr	A	A	I	I	1600	900	Opt		1000	55	670	21 9/16	34	46 3/16	G			3	Yes	Yes	3, S.A.E.	Wisconsin VAU
Yes	3/4	S	C-P	Pr	A	A	I	I	1700	900	Opt		1000	75	1000	23 3/8	33 1/2	56 3/4	G			4	....	No		Wisconsin G
No.	..	S	C-P	Pr	A	A	I	I	1600	900	Opt		1000	60	790	23 7/8	37 1/8	48 3/4	G			3	Yes	Yes	3, S.A.E.	Wisconsin RAU
No.	..	S	C-P	Pr	A	A	I	I	1600	900	Opt		1000	65	800	23 7/8	37 1/8	48 3/4	G			3	Yes	Yes	3, S.A.E.	Wisconsin RBU
No.	..	S	C-P	Pr	A	A	I	I	1400	900	Opt		Opt.	75	890	24 1/8	36 15/16	48 3/4	G			4	Yes	No		Wisconsin D
No.	..	S	C-P	Pr	A	A	I	I	1400	900	Opt		Opt.	90	900	24 1/8	37	48 3/4	G			4	Yes	No		Wisconsin M
No.	..	S	C-P	Pr	A	A	I	I	1400	800	Opt		900	105	1200	26	37 3/8	68 7/8	G			4	Yes	No		Wisconsin K
No.	..	S	C-P	Pr	A	A	I	I	1400	800	Opt		900	125	1275	26	37 3/8	68 7/8	G			4	Yes	No		Wisconsin P

(46) G = Gear; C = Chain.
(47) S = Silent.
(48) A = Adjustable; N = Non-Adjustable.
*Buda crankshafts are of the following diameters:
Models RU, WU, TU, QU, OU—Front, 1 3/4 in.; center, 2 in.; rear, 2 1/8 in.
IU, HU, YTU—Front, 2 1/8 in.; center, 2 1/4 in.; rear, 2 3/8 in.
ATU, BTU—Front, 2 1/4 in.; center, 2 1/2 in.; rear, 2 3/8 in.
†Wisconsin model RBU crankshaft diameter: Front, 2 1/4 in.; center, 2 5/16 in.; rear, 2 3/8 in.
**Other intermediate crankshaft bearings are of similar length to first intermediate.

Two-Stroke Engines for Motorcycles*

An Outline of Their Advantages and Disadvantages and a Description of a Design Due to the Author

By E. Tilston

UP to the present time the two-stroke type of engine has been used only for lightweight motorcycles and small motor boats—except in the case of engines of the Diesel and hot-bulb types. The present type of three-port two-stroke engine gives about one-third more power than the four-stroke engine for the same size of cylinder with the engine revolving at normal speeds, although the power curve falls away more rapidly than with the four-stroke engine at abnormal speeds.

Seeing that the two-stroke engine gives more power than the four-stroke, the former can be made smaller for the same horsepower, and consequently the piston is reduced in size, and the connecting rod made shorter on account of the difference in length of stroke. With two cylinders the superiority of the two-stroke engine is more pronounced in torque, balance and absence of vibration. No one has yet been foolish enough to adopt a twin-cylinder vertical four-stroke engine for motorcycles (although its torque is far superior to the Vee type), for the reason that the balance is inferior. The only two-cylinder four-stroke engine with good torque and balance is the horizontal twin-cylinder, but even this cannot be placed alongside the two-cylinder two-stroke engine with the power stroke taking place simultaneously at the two opposite ends, which not only balances the thrust on the bearings, but considerably reduces wear and tear. Although the horizontal twin-cylinder type is admirable in balance and torque in both engines, the author does not consider either a good proposition in a motorcycle on account of frame design.

This question of torque, balance and vibration brought about the demise of the one- and two-cylinder vertical four-stroke engine in motor cars, and the author is of the opinion that history will repeat itself in the motorcycle. If it is necessary to adopt an engine in a motor car which gives a propelling force every stroke, how much more necessary is it in the motorcycle where there is so little room for springing to minimize vibration? With regard to torque, the two-cylinder vertical two-stroke engine is in every way equal to the four-cylinder four-stroke engine, although the balance may not be so good, but as one piston is descending while the other is ascending, what little difference there is in balance through the couple is offset by halving the number of cylinders and reducing the reciprocating parts.

Simplicity and Lower Cost Excellent Advantages

The greater simplicity and lower cost of the two-stroke engine are excellent advantages from a production point of view. Providing that carburetion is the same in both types of engine, the double-firing stroke will give the best result in starting, especially if this is coupled with half the weight of reciprocating parts.

Much attention has been given of late to improving the carburetion in connection with the four-stroke engine by exhaust jacketing the inlet pipe. This is obtained in the two-stroke engine without any inaccessible pipes, as the charge entering the crankcase is heated, which has a further tendency to keep the engine cool.

Accessibility—another point in which the two-stroke engine excels—not only adds to the cleanliness of the machine, but also to its appearance, which is a desirable feature when selling. If accompanied by simplicity it is a great inducement to the novice who is about to purchase a motorcycle, and there can be no doubt that it is a very big factor in increasing the army of motorcyclists.

*From a paper presented to the Institution of Automobile Engineers, London.

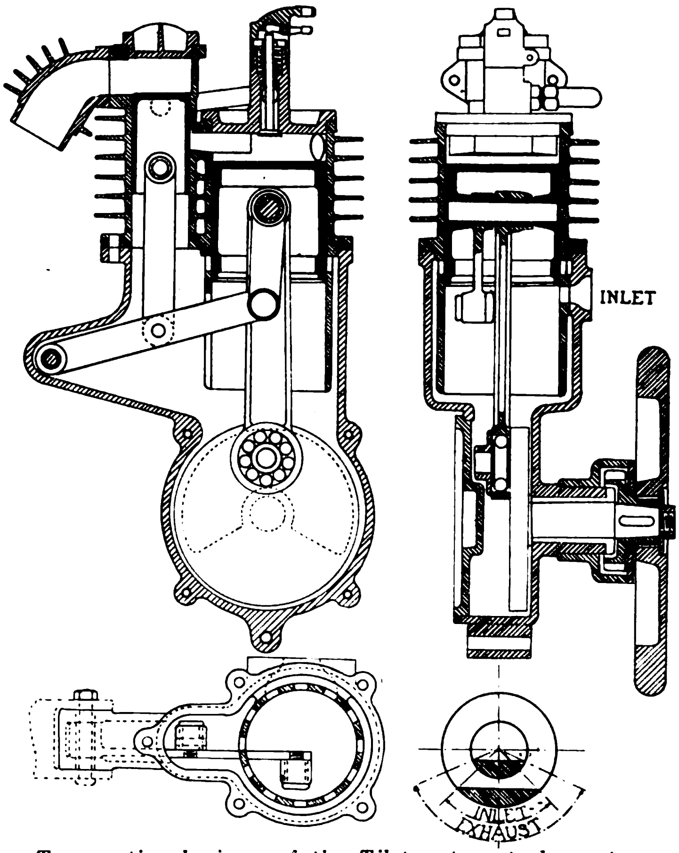
It is only necessary to consider the simplicity of the two-stroke engine with its absence of valves, and then to turn to the timing case of the four-stroke engine, which needs constant adjustment, to realize what scope a designer has in making the two-stroke engine accessible.

Best Type of Engine for Frame Design

The two-stroke engine appears to be the best type for frame design, inasmuch as character of torque and balance (which minimize vibration), total weight, and weight of reciprocating parts are in its favor.

Just as one- and two-cylinder engines in motor cars were discarded on account of inferior torque, so there will be a tendency towards multiple cylinders in motorcycle design. It appears impossible to make a two-cylinder four-stroke engine of even torque and good balance unless the cylinders are placed at 180 deg. The horizontal twin-cylinder arrangement in either type of engine—as previously mentioned—does not lend itself to frame design, while there are other disadvantages in cooling, if the engine is placed with the flywheel revolving in the direction of the road wheels.

Frame design is a most important matter, and the public —especially those who are familiar with frame breakages during the war—will look with suspicion in future on the machine that lets them down. The author admits that bad springing is responsible for a good many frame breakages, but there is also the question of best type of engine in designing a good frame without adding unnecessary length.



Two sectional views of the Tilston two-stroke motorcycle engine, with piston type exhaust valve

In regard to weight the advantage lies with the two-stroke engine. A saving in weight is a saving in cost, and is of enormous benefit in case of an accident which necessitates the machine being pushed home. There is also a considerable saving in the wear and tear on tires.

Reliability

There can be no doubt that the present-day two-stroke engine is very unreliable for large horsepowers. In the first instance it is necessary to bear in mind that there are two power impulses against one in the four-stroke engine, consequently the moving parts, especially the piston and small end of the connecting rod, are more likely to get overheated. This is counterbalanced to a certain extent by the fact that a new cool carbureted charge is drawn into the crankcase every revolution, which lies inside the piston, and tends to keep these parts cool. In the present-day two-stroke engine there are other reasons for overheating, namely, the exhaust port is arranged at the lower end of the cylinder, and the hot burnt gases do not tend to escape, consequently the piston in ascending is subject to the heat from the exhaust. It must be admitted that even in small two-stroke engines of 250 c.c. it frequently happens that the engine peters out on a fast run of 50 miles or so. For further proof of the evil effect of exhausting at the lower end of the cylinder, it is only necessary to examine the top piston rings on the exhaust side of any two-stroke engine, and they will be found caked up with carbon, and often require cutting out after a few hundred miles' run. To sum up, the disadvantages of exhausting at the lower end of the cylinder are as follows:

Loss of incoming charge through the exhaust, imperfect scavenging, overheating of the piston, which is increased by the deflector, and caking of piston rings with carbon on the exhaust side, all of which add considerably to unreliability and waste.

Economy

The small difference in economy of fuel between the present-day two-stroke engine and the four-stroke engine is no doubt due to the loss of incoming charge through the exhaust, combined with the large amount of burnt gases in the cylinder. Remove these two evils, and there is no reason why the two-stroke engine should not equal the four-stroke engine as regards economy.

It would naturally be imagined that the two-stroke engine would be more flexible than the four-stroke engine, seeing that a single-cylinder two-stroke engine is equal in power impulses to a two-cylinder four-stroke engine, and there can be no question but that by increasing the number of cylinders flexibility is improved. In the author's opinion, the reason why the two-stroke engine is actually not more flexible than the four-stroke engine is that there is a greater amount of exhaust gas left in the cylinder on the compression stroke than is found in the four-stroke engine. If all the exhaust gases can be ejected from the cylinder, at every position of throttle opening, the flexibility would increase in proportion to its superior torque.

In the two-stroke engine there are no valves, which are generally the source of heating troubles in the four-stroke engine. If the cylinder is scavenged from end to end, and the exhaust removed to the top end of the cylinder, with a flat-topped piston, the author is of opinion that the two-stroke engine will give less trouble in overheating than the four-stroke engine, provided that the means for controlling the exhaust are as efficient from a cooling point of view as the other parts of the engine.

Desirable and Undesirable Features

Undesirable

The deflector on the top of the piston.

The exhaust at the lower end of the cylinder.

Valves—they must not give trouble through overheating.

The waste of the incoming charge through the exhaust.

Desirable

The cylinder scavenged from end to end through a ring of ports and an annulus.

A light flat-topped piston.

The incoming charge must fill the cylinder completely with the throttle full open.

No exhaust left in the cylinder at any position of the throttle.

Both inlet and outlet must be unobstructed to allow free passage, otherwise back pressure of the outgoing exhaust prevents the new charge entering, and diffusion of the two results in escape of the new charge through the exhaust. If these ideals are accomplished, it is possible to more than double the power as compared with the four-stroke engine for the same c.c.

The combustion space represents roughly 20 per cent of the cylinder volume, and if this could be filled with a new charge and fired twice, as compared with the combustion space in the four-stroke engine, which is filled with burnt gases and fired once, then the possibility of increasing the power of the two-stroke engine may be more than doubled.

The two-stroke engine that the author is responsible for is the result of very careful consideration of the merits and demerits of both types of engines on the lines laid down.

When the first experimental engine was demonstrated at Stonebridge several criticized it on account of its cost and extra moving parts as compared with the ordinary two-stroke engine. However, it is impossible to control an exhaust port at the top end of the cylinder and provide an extra pump for displacement without additional moving parts and expense. It will be noticed that the means to control the exhaust port (the piston valve) also gives additional displacement to induce sufficient charge into the crankcase from the carbureter, which the movement of the piston alone fails to accomplish.

The lower end of the piston and piston valve are both open to the crankcase and, as they move upwardly together, their combined displacement is available to fill the cylinder at the end of the next downward stroke of the piston. On the explosion stroke, the closing of the port from the carbureter to the crankcase first occurs, followed by compression of the charge in the crankcase. The opening of the exhaust at the top end of the cylinder follows, and shortly afterward the inlet ports from the crankcase to the cylinder are opened by the main piston.

An exhaust poppet valve overheats, but with a piston valve as shown this type of engine does not get nearly so hot as the three-port two-stroke engine without valves.

When the explosion takes place the piston valve is at the top of its stroke and is considerably above the combustion space. The cool carbureted charge, introduced into the crankcase every revolution, lies not only inside and around the main piston, but also inside the piston valve, and as there is only a thin wall of metal separating the hot explosion from the newly introduced cool charge, the excessive heat from the former is absorbed by the charge, which is afterward passed into the cylinder, thus cooling the piston valve and preventing dissipation of heat from the outside. This helps the fuel consumption and aids in an easy start.

There are no rings on the piston valve, which is of the same metal as the cylinder. A clearance of 0.001 in. is allowed between the bore and the valve, and the short stroke of the valve, in conjunction with the cooling effect of the charge lying inside, allows the temperature from end to end of the valve to be maintained practically constant, thereby permitting free movement without fear of seizing.

The top rings of the main piston maintain their elasticity under severe loads and constant running because the piston is cooled internally every revolution. The piston valve is operated by link motion from the piston pin, with about half the stroke of the main piston. There are several ways in which the piston valve can be reciprocated, but the design shown allows the crankcase volume to be cut down with a view to increasing the compression.

It will be noticed that the compression release valve in the cylinder head is so arranged that the passage from the cylinder is in communication with the upper end of the piston valve cylinder. Just before the explosion occurs, the piston valve has moved up and prevented an explosion occurring in the exhaust pipe and muffler, and a very simple and effective method of lowering the compression is obtained, which facilitates easy starting.

The Economics of Flight

Effect of Altitude of Flight on the Energy Expenditure Necessary to Cover a Given Distance—Problem Involves a Consideration of Many Factors

By H. B. Irving

DURING the war the economics of flying was of no importance as far as fighting in the air was concerned. It had to be considered seriously in connection with long-distance air raids, when it was of great importance to cover the longest possible distance on the minimum of gasoline, and for reconnaissance also the economics of flying deserved attention.

But with the end of the war this subject appears in a quite different light. Now the question of cost of transport enters in largely, whereas, during the war the question of cost was scarcely considered. The problem in commercial aviation is to transport goods or passengers at the cheapest rate at which it is possible to run a service which will offer sufficient advantages over existing services to be able to compete with or replace them.

It is the object of the present article to give a brief consideration of the aerodynamic principles which govern the economics of flying without entering into the multitude of other considerations which affect the question. The aerodynamic principles are perfectly general, while the other considerations are usually of a particular nature and need special application to each case.

Aerodynamically the economics of flight is concerned with the effect of the various conditions of flight on the energy required to carry a given weight a given distance. Take first of all the case of a given body whose resistance is $P\rho V^2$, where K is a constant, ρ is the density of the air, and V is the speed through the air. The fact that K is constant of course implies that the resistance of the given body varies as the density of the air and as the square of the speed. The former assumption is always true, while the latter is generally very nearly true. The energy required to move the body through distance S at speed V varies as RS or $K\rho V^2S$.

Two very important general principles are at once apparent from the above reasoning. First, the energy required to transport a body a given distance varies as the square of the speed at which it is moved. This is true in spite of the fact that the greater the speed the less the time required. So that the lower the speed of flight the more economical is the flight. This conclusion shows the fundamental disability under which high-speed flight labors in comparison with other means of transport, and it is only modified in practice by the fact that "time is money."

The second conclusion depends upon the common knowledge that the density of the air decreases with increasing altitude. At 10,000 ft., for instance, the density is 0.722 that at ground level, and at 20,000 ft. it is only 0.520 the density at ground level. It would appear to follow, therefore, that on general grounds, for economic flight the altitude of flight should be as great as possible. In practice the limit imposed on the altitude of flight is due to the reduction in power of the engine caused by the rarefaction of the air at altitudes and (or) the personal physical disabilities caused by the atmospheric conditions at high altitudes. To some extent the former limitation can be overcome by designing the engine specially for performance at altitudes, and the latter may also be partially overcome by suitable provision being made, but it would hardly appear at present that any provision for the physical needs, due to very high altitudes, of either pilot or passengers could form part of any commercial flying enterprise, and that there is, therefore, practically speaking, a limit to the altitude at which commercial flight can take place.

Proceeding now from the case of a plain body whose resistance varies as V^2—the case of the airship—to the case of the airplane it must be remembered that, in general, the altitude at which the airplane flies varies according to the speed of flight and that the foregoing reasoning only applies to flight at a given altitude. With the alterations in attitude which take place in practice the resistance coefficients of the body, struts, wires, etc., of the airplane generally alter very little, while the lift and drag coefficients of the wings both alter greatly. The

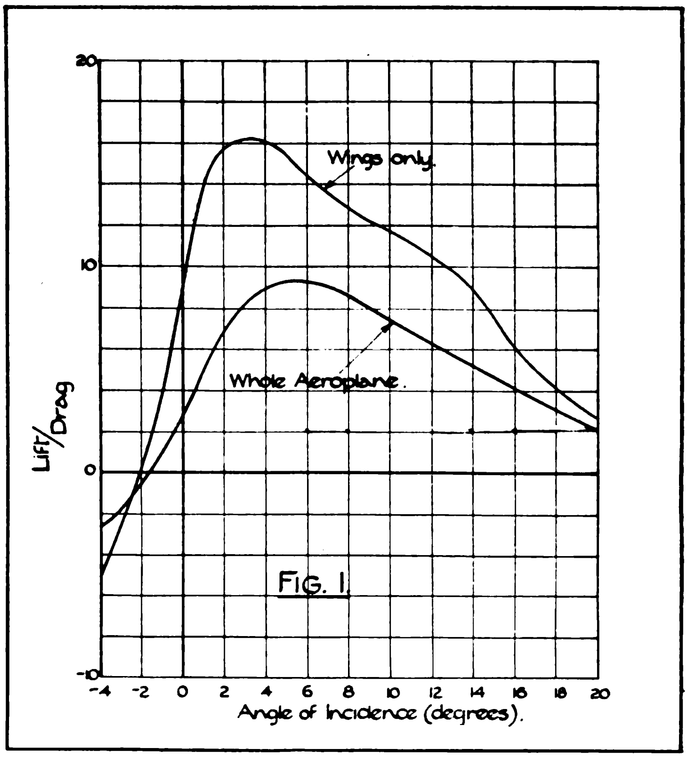


Fig. 1—Diagram showing variation of lift drag ratio with angle of incidence

total lift must, of course, remain equal to the total weight throughout the flight, so that as the attitude alters the speed must alter, an increase in the lifting power of the wings caused by increasing their angle of attack being accompanied by a decrease in the speed of the machine.

The ratio of the lift to the drag of a machine is one of its most important characteristics. Other things being equal, the greater this ratio the greater the aerodynamic efficiency of the airplane. For a given airplane the ratio has a definite value for each attitude of flight. Fig. 1 shows the general nature of the curve of lift-drag ratio plotted against angle of incidence of wings for a biplane. Two curves are given, one for the wings only and one for the whole machine. Such curves are generally derived from the results of experiments on models placed in a wind tunnel.

It will now be shown that the most economical speed of flight for any given airplane is that for which the attitude is the one corresponding to maximum lift-drag ratio for the whole machine. The work done in moving an airplane a distance S (relative to the air) when the resistance is D is equal to DS. If $W = L =$ weight of airplane, we have

$$DS = \frac{W}{L/D} \times S$$

and for a given distance S this is a minimum when L/D is a maximum. So that the most economical attitude for flight is that corresponding to maximum lift-drag ratio of the airplane, which attitude is generally not much different from that for maximum lift-drag ratio of the wings.

The above conclusion is true for any altitude, a fact which means that, aerodynamically, that there is nothing to be gained by flight at high altitudes with a given airplane. Other considerations, however, have to be taken into account in this connection. Suppose an airplane to be flying at its most economical altitude. In order that the lift of the wings may at all altitudes be equal to the weight of the machine the forward speed must vary inversely as the square root of the density of the air. Since lift and lift-drag ratio are constant the drag must be constant, and therefore the horsepower must vary with density in the same way as the forward speed; that is, the horsepower varies inversely as the square root of the density. From this reasoning two points emerge, each indirectly bearing on the economy of flight and showing why flight at the higher altitudes is preferable to flight just above ground, although aerodynamically the economy of flight is the same at all altitudes. Firstly, since the forward speed increases with altitude, there will be a saving of time by flying at the higher altitude, a very important consideration. And secondly, since the power required increases with altitude, as shown above, it will pay to fly at an altitude which utilizes or nearly utilizes the full power of the motor, since motors generally run most economically at about their full power.

Another method of considering the question of the best speed for economic flight of a given airplane is as follows:

Work done in moving airplane through distance

$$S = DS = \frac{DV}{V} \times S$$

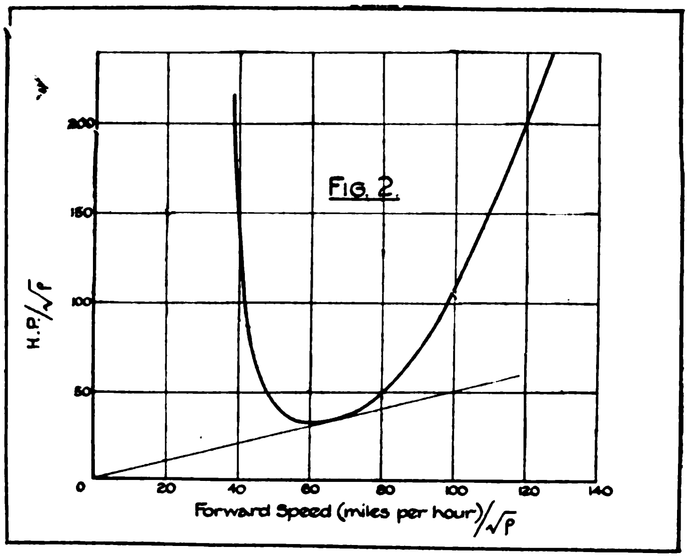


Fig. 2—Diagram for determining most economical speed of flight

That is, the work done varies as $\frac{\text{H.P.}}{V} \times S$ and is a minimum for a given distance when the ratio H.P./V is a minimum. This condition is illustrated by Fig. 2, in which H.P./$\sqrt{\rho}$ is plotted against $V/\sqrt{\rho}$, where ρ is the density of the air relative to the density at ground level. The figure thus applies to any altitude, change in density being allowed for by change in the scales of the coordinates of the curve. The most economical speed is found by drawing a tangent from the origin to the curve, and it will be seen that the most economical speed is only slightly greater than the speed for minimum horsepower. Thus, an airplane flying at its "ceiling" is flying at very nearly its most economical altitude.

It has now been shown that for a given airplane aerodynamically the maximum economy of flight is the same at all altitudes, but that this involves flight at speed varying according to the altitude. If the economy of flight of a machine of given weight is considered—as it should be—*for a given speed*—the problem as to the effect of altitude on economy becomes rather different. For economical flight the altitude must be always the same, namely that of maximum lift-drag ratio; therefore, if the speed is to be constant, the area of the wings must vary inversely as the density. But in spite of this fact, the resistance of the wings remains the same at all altitudes, since

$$D_w = \frac{W}{L/D_w}$$

where L/D_w is the lift-drag ratio for the wings. The size of the body remaining the same, its resistance will vary as the density and hence there will be a saving of power in the machine specially designed to fly at high altitudes.

To some extent this conclusion is modified by the fact that the machine which flies at the higher altitude has larger and therefore heavier wings, struts, etc., so that the *useful load* carried by this machine will be rather less than that carried by the machine flying at the lesser altitude; and, further, the larger wings mean more re-

Table Showing Economy of Power Due to Flight at High Altitude

Height in feet	0	2000	4000	6000	8000	10000	12000	14000	16000	18000	20000
Relative density ρ	1	.940	.870	.825	.772	.722	.678	.636	.596	.556	.520
Resistance of Body, etc. R = 200 × ρ	200	188	174	165	154	144	135	127	119	111	104
Total resistance = R + 200	400	388	374	365	351	344	335	327	319	311	304
Percentage Reduction on resistance at ground level	0	3	6.5	8.75	11.4	13.9	16.1	18.2	20.2	22.2	24.0

sistance other than wing and body resistance. But the weight of the wings and the resistance of parts other than wings which varies with wing area are each only a small proportion of the total weight and resistance, and the economy to be gained by designing for high altitude at a given speed is nevertheless considerable.

It is not possible in the present article to give any exact figures as to the magnitude of the saving which could be effected by designing for high altitudes. This would depend—among other things—on the type of airplane and the forward speed desired. In fact, in order to arrive at accurate figures in any particular cases would practically mean roughing out weights and resistances for each special design. A rough idea as to the order of magnitude of the saving may, however, be arrived at by some very simple calculations for a particular case. Take, for example, an airplane of weight 3200 lb., say, whose lift-drag ratio at ground level is 16 for the wings only and 8 for the complete machine. The resistance at ground level will then be 200 lb. for the wings and 400 lb. for the complete machine, thus making the resistance of the body, etc., 200 lb. The accompanying table shows the percentage saving in resistance (and consequently horsepower, since the forward speed is supposed constant) over that at ground level at altitudes up to 20,000 ft. In this particular case, in which at ground level the resistance of the body, etc., is equal to half the total resistance of the airplane, the percentage reduction in total resistance at any particular altitude is equal to half the percentage reduction in the density at that altitude. The condition that the resistance of the body, etc., is equal to half the total resistance will in general not be very far from being realized in practice, and so the figures of the table give an indication of the order of magnitude of the saving which may be effected by designing specially for altitude. It will be noticed that the figures of the table are independent of the forward speed, and in this connection there are two points which should be remembered. They are the questions of landing speed and rate of climb. The airplane designed to fly at its most economical altitude and to use its full power at ground level would, as Fig. 2 shows, require only very slightly less horsepower at the altitude for minimum horsepower. There would thus be only a very small reserve of power for climbing and the ratio of climb would be very slow indeed. Again, with the machine designed for flight at ground level the forward speed is strictly limited to values which are not very high in order to keep the landing speed down. The maximum lift coefficient of wing section is generally about double its value at the altitude for maximum lift-drag ratio; which means that the landing speed is about equal to the economical speed divided by $\sqrt{2}$. Thus, if the chosen speed of flight is 100 miles per hour the landing speed is equal to 71 m.p.h., a value which is considerably on the high side.

But consider now the airplane which is designed for the same forward speed at an altitude of 8000 ft., say. Its landing speed will now be reduced from 71 m.p.h. to 71×0.772, or nearly 54.5 m.p.h., and the rate of climb at ground level will now be of fair magnitude. For the horsepower required for the 8000-ft. machine when at ground level will be $\sqrt{\rho}$ times that required at 8000 ft., that is, 5.7 per cent of the power will be available for climb. In the case of the particular airplane chosen as example, this would give a rate of climb of 111 ft.-min.

Obviously, then, machines designed for economical flight at low altitudes are not practical machines, and the effect of altitude on economy of flight should be considered by comparing the performances of machines at high altitudes with those for altitudes of perhaps 6000 to 8000 ft.

Kessler Super-Charge Engine Developed for Automobile Purposes

(*Continued from page* 1293)

uses a counter-balanced crankshaft, and this same type of counter-balancing will be used on the 3¾ by 3¾-in., six-cylinder automobile engine, of which sample engines are now being made up. Air by-passages are so arranged that every down stroke of the piston is utilized for producing crankcase compression. As compared with the normal form of engine, it will be slightly higher, due to the increased combustion chamber volume. The weight per unit of displacement will probably run about the same as that of the ordinary type of engine, and in general appearance there will be no marked difference. The automobile type should weigh approximately 5.3 lb. per hp.

A representative of AUTOMOTIVE INDUSTRIES saw an aviation type Kessler engine on the block, operating first as a normal poppet valve type and then with the super charge admitted. The difference was remarkable, for, although the valve timing was a little early in the intake cut-off for the ordinary poppet type engine, yet it gave a very creditable performance. As soon as the supercharge was admitted, however, the speed of the engine rose remarkably, and it was possible to carry a much higher load on the engine. While it is impossible for the representative of AUTOMOTIVE INDUSTRIES who witnessed the test on the engine to accurately state the results of the cushioning effect on the bearings due to crankcase compression, it is positive that on the old automobile type engine employed in the experimental car the vibration is remarkably low for a four-cylinder engine of any type. Claims made by the inventors of this engine and taken seriously by car makers who have examined it, state that bearing life is materially increased by the effect of the cushion.

The engine now being developed for car work will have a proportional valve capacity which is probably the largest ever used in automobile practice. It will have two intakes and two exhaust valves per cylinder, each valve having 1½ in. clear diameter, although the bore of the engine is only 3¾ in.

Glued Part Failures Not Always Due to Glue

GLUES are often blamed for failures for which they are not responsible. Tests made at the Forest Products Laboratory of the U. S. Forest Service at Madison, Wisconsin, show that properly handled commercial glue develops a shearing strength greater than that of most woods.

The average glue user prepares his glue with reasonable intelligence but commits atrocities in preparing surfaces to be glued and in handling pieces after gluing. To get full strength from any glue, proper surface contact is imperative. Good glue will adhere fairly well even with poor surface contact. Joints of this kind possess, however, inherent weakness and the added disadvantage that they are more liable to ruin through bacterial action than tight joints, since the glue in them is more exposed.

The proper application of pressure is important in all glued work, but doubly so in the manufacture of plywood. Securing proper pressure involves keeping cauls and press in first-class condition and using them skillfully.

Tractor Design from the Operator's Viewpoint

Criticism and Suggestions Based on Extensive Tractor Experience on Large Western Ranches

By Arthur B. Domonoske

IN the following article I am giving the side of the design as the operator looks at the result and not as the designer must necessarily do in laying out the machine. Shop practice must guide the designer to a large extent, while to the operator the necessity of keeping the machine running is the paramount consideration. My experience has been mostly in the Far West and with the track-laying type of machine, so I shall confine my attention to that locality and to that type of machine.

As a foreword it might be well to mention that on the western ranches the tractor has been adopted not for any inherent love for machinery on the part of the rancher, nor because of the glib talk of the salesman, but of dire necessity. With the increase of wages and the shortening of hours in the cities, the better men of agricultural communities drifted into city trades and occupations.

The hours on the ranches were long, the sleeping accommodations were poor, no provision was made for personal cleanliness, and while the meals were generally of good quality there was no variety of menu. No amusements were possible except occasional drinking and gambling, and added to these were the great difficulties in the way of a hired man starting in business for himself. Therefore, it became increasingly harder to obtain good teamsters for "eight-mule" teams at $1.50 and $2 per day, but tractioneers or "caterpillar skinners," as they are called in ranch parlance, could be obtained for $4 per day, and found.

A 75 or 80 b.-hp. tractor is supposed to do the work of four eight-mule teams, so an engineer at $4 and a plow tender at $2 would replace four teamsters at $1.50 each. The labor costs would therefore be alike for teams and tractor.

Fuel Costs

As far as fuel and oil costs are concerned on most ranches, it seems from the meagre figures available that it is immaterial whether you raise a certain amount of feed for the teams or whether you raise the same amount of grain and sell it to buy fuel and oil.

The first cost of the tractor and that of the four eight-mule teams were not far different, so the deciding feature was the ability to keep the outfit going. Had there been plenty of drivers the tractor would have been greatly delayed in getting a foothold, for it has been my experience that four *well-driven* eight-mule teams will out-plow the 75-hp. tractor in average plowing. The reason is that, in the case of the teams, there are four separate units and a temporary accident to one rig does not delay all of them, and, in addition, the rigs are more flexible and can get in and out of sharp corners better. In harvesting, the four teams are combined in one unit and have no such advantage over the tractor, but, on the other hand, the motion of the tractor is steadier, it makes turns quicker, and gets closer to ditches.

From this you may see that the essential thing for the operator is to keep going. The tractor, having been forced upon the rancher, is looked upon as a necessary evil and undeserving of sympathy, while the tractioneer is a man too lazy to drive a team and who is continually breaking into the bank account for salary and repair bills.

It must be further remembered that the tractor operator may be miles from a well-equipped machine shop and must rely on his collection of hand tools. His equipment for lifting consists of two 2-in. jack screws, whatever blocking there is lying around loose, and man power. Chain falls are rarely found on the ranches.

We will now take up some of the points of design that concern the operator in his task of "keeping her going" and will somewhat subdivide them.

The Motor

The carbureter has been advertised as the "heart of the motor," and likewise the motor may be considered the heart of the tractor. The tractor operator tries above all things to have a sweet-running engine; it is his source of power and it is vital that it shall run, and run well.

If time permits, the rest of the outfit is given some share of the attention, but the engine is first, last, and all the time the center of attention. One bugbear is that of heating, for, while the majority of automobiles are overcooled, the tractor is not. Here we have no letup of the load but a constant, steady drag. There is no chance to stop and let your engine cool off, nor to change the cooling water; therefore your radiator must be ample to care for the worst conditions possible.

It is not an uncommon thing to run when the thermometer registers from 90 to 120 deg. Fahr. in the shade and your tractor is in the sun. With the incoming air at 120 deg. Fahr. you have no great difference in temperature between the air and the water and must therefore rely on plenty of radiating surface and on the fan sending a steady volume of air through the radiator. The rate at which the water flows through the radiator tubes and the water jackets also greatly affects the cooling. A slipping fan or pump belt plays havoc with the cooling; therefore, these two should be run by extra wide belting or be positively connected to the engine.

The fan, if not belt-driven, should have a slip clutch to prevent blade damage. The pump must be located where it is under sufficient head on the suction side

to insure pumping even with very hot water. Also, most operators would appreciate a location where the pump may be packed without either standing on your head or else lying on your back under the machine and receiving the accumulated mud and grease from the frame and the hot water from the pump in your eye. Where the fan and the pump are belt-driven it might be well to remember that the belt pull may be considerable and that bearings should be ample and well lubricated.

Cooling is also made harder by the presence of scale-forming salts in the water which deposit in the water jackets and in the radiator spaces. At times the water must be taken from irrigation ditches and organic matter is introduced into the system, which blocks up the water passages, and therefore some means should be provided for cleaning these. The dust settling on the fins of the radiator tubes will cut down the transmission of heat through the tubes, and allowance should be made in the area allowed for cooling.

Care should be taken that the pump delivers water equally to all the cylinders, so some may not be heated while others run cool. Some companies use a tank in connection with the radiating system, and here it should be remembered that, while it is a nice thing to place it out of sight, there should be some way to remove it without taking off most of the decking and nearly all of the main drive shafting. The constant jar and bad water will make any tank leak in time.

Soldered Joints

Soldered joints in the radiator should be reduced to a minimum and allowance should be made for the expansion of the tubes. One western company uses packed joints with threaded glands, similar to those used in steam engine condenser practice, and from the operator's viewpoint it is an excellent system. The radiator should also be spring-mounted, to take off jars, which are considerably larger than most people imagine. A sight feed glass and a petcock should be located in the system so that the operator can tell whether the water is circulating properly.

The injection of water through the intake manifold has a tendency to keep the engine cool, but the proper regulation of the amount to be fed may give difficulty.

Another point that might be considered is that the heated air from the radiator, which is usually blown over the motor, is not very effective in cooling the cylinders. It might be better for the engine, and would be much better for the operator, if this were diverted from the motor. A blast of air at the outside temperature would help in keeping the cylinders cool.

Although it would add to the complication, some means of keeping the crankcase oil cooled would help wonderfully in keeping the motor temperature down.

A tractioneer hates to shut down a hot engine, because of the difficulty in starting it again. Sometimes a little oil poured in the air intake to the carbureter will aid greatly in cooling a hot engine, but care must be taken not to choke it with too much. The final method of cooling is to shut down and open up the crankcase and allow the air to circulate through the case freely. This is bad, owing to the dust that may be blown in. Starting the motor will be hard, due to the hot walls reducing the weight of charge entering the cylinders and also to the lubricating oil running down off the piston and the cylinder walls, thus making poor compression.

Aside from the foregoing considerations there is heating due to improper mixture, air leakage, etc., which are due to the engineer's negligence and must be charged up to the human element. The other extreme of overcooling in winter can be regulated by shutter control on the fan housing or by bypassing the water from the pump, either by thermostatic or manual control.

Next to heating, lubrication may be said to be the operator's worst trouble, although he is often unaware of the real cause. Most operators do not change their oil often enough, either because of lack of knowledge or of the owner's objection on the score of cost. The tractor manufacturer is largely to blame for this in not impressing on the owner the necessity for changing oil. The crankcase oil receives considerable carbon from deposits that form on the lower side of the piston head, due to the heat charring the oil, and which in time jar loose and fall into the oil pits. Dust also gets in during filling up with oil at night and in testing bearings. It is somewhat of a question as to whether a filler cap should be provided or whether a man should take off a side plate to put in oil. By taking off the side plate the bearings are more closely watched, and all tests for bearing looseness should be made on warm engine. In either case there should be no projecting ledges to catch dirt and allow it to fall into the oil when either the cap or door is removed. Of course, the operator should wipe this dust off, but when a man draws up alongside of a tank wagon just as the sun is going down, with an hour's work ahead of him in filling up and greasing, he is apt to let this slide.

A combination of splash and force feed lubrication seems to me to be the best solution of the lubrication problem. I doubt if the main bearings get all the oil they need with the constant level splash, while with a full force system failure of the pump would lead to speedy damage unless noticed by the operator. Either a gage or a sight feed glass should be provided, so that the operator may know whether the pump is working or not.

Crankcases

Crankcases which do not have sufficient drain plugs or have pockets that must be baled out and finally cleaned with rags or waste take up a needless lot of time in changing oil. As the oil pump periodically gets clogged with foreign substances, it would be well if it were so shaped and located as to be easily accessible. The oil pump should be at the lowest point in the system, so that the oil may get started immediately and so that the pump will deliver oil as long as there is any left.

Where overhead rockers are used with "valve-in-the-head" motors a cover should be provided to keep dirt from settling on the stems of the inlet valves and by its abrasive action soon cause trouble from air leakage into the inlet ports. Provision must be made for rocker-arm and valve-stem lubrication. If possible, this cover should be easily removable to allow turning the valves about a quarter turn each day to prevent uneven seating and thus making the valves run longer between grindings.

The governor working parts should by all means be dustproof and well lubricated. Also, the governor spring should be worked within a range of stresses where it will not be continually changing in value. A surging governor is extremely bad in pulling a ground driven harvester, which requires a steady gait to keep an even motion on the cylinder and fans. In exposed governors this surging is often caused by the gumming up of the moving parts with dirt and oil.

As many parts as possible should be oiled without the use of compression grease cups, to save time in filling up.

One make of tractor has over forty grease cups of various sizes. However, it should be remembered that there are places where the compression grease cup must be used, as a very effective way of keeping dirt out is to have plenty of grease on the inside of a bearing.

All gears should be enclosed and should be amply supplied with lubrication. Much grease is thrown off by exposed gears, and dirt collects in the grease that does stay on. Aside from the wearing of the gearing it is hard to keep your tractor clean with a grease-slinging device operating all the time, and a dirty tractor is the beginning of trouble.

Some of the tractor makers are fitting dust strainers on the intake air to the carbureter, and all of them should. Most people do not realize the amount of dirt that gets into the cylinders through the carbureter.

Control

A simple hydraulic clutch and speed control or a correspondingly simple magnetic control would be a welcome thing for the tractor operator. At present a man is between the two fires of starting with a jerk or burning out the clutch by slipping. In crossing ridges and ditches the clutch must be released to prevent the front end from rising and dropping suddenly. All of this causes wear on the lining. A more liberal design would be better than the present, and most tractors are designed for too great a pull on the levers. Exercising a pull at frequent intervals and only once or twice an hour are entirely different propositions.

Another fault is that there is too much spring in the levers. Rim or band clutches in which two opposing toggles must be equally adjusted for correct action should have some equalizing device independent of the clutch adjustment. Since clutches in the neighborhood of gears are apt to be covered with oil, in spite of the operator, they should be designed to carry the load on the assumption that they are to run in oil.

Steering should be made as easy as possible and power steering gear should be fitted to the larger tractors, especially if there is much weight on the front end. However, it is possible to steer 75-hp. tractors by hand without excessive exertion if the steering gear is built correctly.

Tracks

Means must be provided to allow the operator to keep his sprockets and tracks in correct alignment. A round-head track bolt, even if fitted with a square shoulder fitting in the track shoe, is mean to handle, as it is only a short time until the shoulder wears enough to turn. Either a solid link and shoe or some means of bolting on so that the bolts will stay tight must be developed, especially for road work.

Starting

For the average tractor operator, starting either by bar or by turning the flywheel by hand is not a serious thing under ordinary circumstances. However, it is not an easy thing for a light-weight man, and on a cold morning or with a hot motor it is hard work for the best of them.

As there is no housing of the tractor at night, everything is thoroughly cold on the tractor in the morning. The oil is thick and the motor turns over hard, while the gasoline and distillate are in poor shape for vaporizing. Engineers use various methods for starting on cold mornings, some of them dangerous.

1—Prime each cylinder with *gasoline*, either through priming cocks or through spark plug holes. Turn engine over several times with ignition off and allow to stand a while. This allows some of the gasoline to vaporize and diffuse through the mixture. Then prime engine again through priming cock and turn over with ignition on. Under ordinary conditions the engine will start the first time, but on cold mornings more severe methods must be used.

2—Put the gasoline priming can in hot water. I have seen engineers put the can in a fire or hold it over a blowtorch until the vapor begins to distill off. Prime with this warm gasoline.

3—Warm up intake manifold and inside of cylinders through spark-plug holes with blowtorch; but care must be taken to stand clear of any possible flame from cylinders. Heat spark plugs.

4—Pour gasoline or distillate over the heads and manifolds and set fire to it. Care must be taken that there are no pipe line or tank leaks near the flame.

5—Prime with a mixture of gasoline and ether. Too much ether will lift the heads.

6—Above all do not prime too much, as the raw gasoline will wash the oil away from the rings and spoil the compression. Sometimes priming with a mixture of oil and gasoline or a little oil alone helps greatly.

The fact that these severe and more or less dangerous methods are in common use shows the necessity for some good starting system combined with a method of getting an explosive mixture into the cylinder independent of the regular carbureter.

Fire Hazards

Although many fires were started before tractors were used and many are blamed on tractors where something else is responsible, the fact remains that a tractor in a grain field, dry as tinder, is a source of danger. Fires may be started by pieces of carbon thrown out of the exhaust, by pieces of hot wire blown off the spark arrester, by chaff or straw falling on the hot exhaust manifold and dropping off into the stubble, or by a pop back in the carbureter in starting, and especially if the operator squirts gasoline into the air intake, as most of them do.

Some owners place a 30-gal. stove boiler, with the top head removed, on the front end of the tractor and bring the exhaust pipe of the engine down into the tank, so the exhaust gases must make a 180 deg. turn to get out. The lower portion of the tank up to about 6 or 8 in. of the end of the exhaust pipe is filled with water which quenches the hot particles of carbon, which are too heavy to turn with the gases. This tank, while very effective in catching carbon, increases the back pressure on the engine and thus adds to the heating troubles.

In addition a fire extinguisher is carried on the engine and one on the harvester. A can of water filled with wet sacks is also carried on the tractor, and on windy days a man follows the outfit on a saddle horse to watch for fires. For quick action he carries a wet sack on the saddle strings. On very windy days the outfit stops.

General Operation

A gas tractor is excessively cold in winter and very hot to work on in summer. In the colder climates provision should be made for a cab, but care must be taken to keep out exhaust gas from this cab. If the hot air from the fan were not driven back on the operator it would be cooler in summer.

A clear view ahead of the tractor should be provided, as it helps wonderfully in coming up to ditches and corners.

Clutch brakes should be provided to keep the master clutch from spinning if the gears happen to be in the neutral position.

(*Continued on page* 1359)

Matthews Full Automatic Lighting Plants

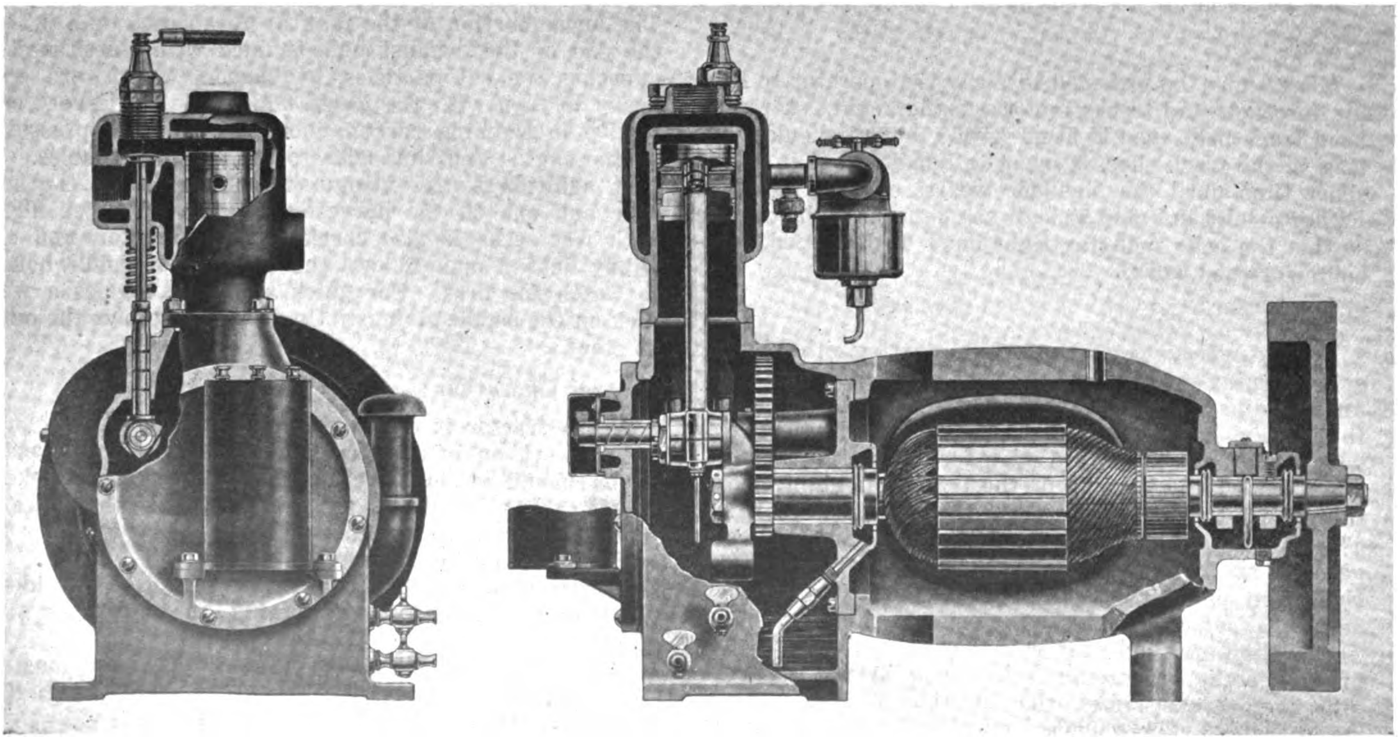
Made in Capacities Ranging from 300 Watts to 6 Kilowatts—Start and Stop Automatically, as Required by State of Battery Charge or the Amount of Load on the Line — Plain Generator Set Also Furnished

By P. M. Heldt

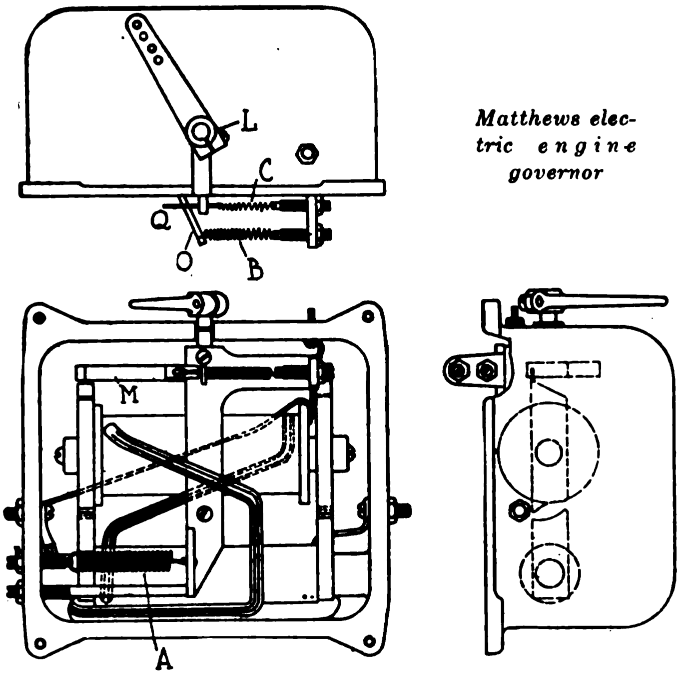
THE Matthews Engineering Co. of Sandusky, O., manufactures electric lighting plants in sizes ranging from 0.3 K.W. to 15 K.W. The line comprises automatic plants in 0.3, 1, 2, and 6 K.W. sizes and non-automatic plants of 1, 5, 10 and 15 K.W. In addition to these, a 12 K.W. plant is made, which comprises two 6 K.W. automatic generators connected in parallel. The smaller plants are used largely for lighting farms and private country houses, while the larger units find application in lighting and furnishing motor power for large estates, ranches, stores, dairies, churches, small towns, moving picture theatres, etc. It will be be noted that the automatic feature is used mainly in connection with the smaller plants. The reason for this is that with large plants there is usually some one who is looking after the installation all the time, and automatic control is not then essential.

All of the automatic plants are, naturally, very much alike in design, so far as their electrical features are concerned. We have selected the 1 K.W. and the 300 watt plants for description. The former comprises a single cylinder, water cooled, upright engine, having cylinder dimensions of 3 x 3 in. The cylinder is of the "L" head type, with integral cylinder heads, the crankcase being cast separately. There is a large hand hole with cover plate on the side of the crankcase through which access can be obtained to the crankshaft and connecting rod bearings. The plant is of the 3 bearing type, that is, there are two bearings in the engine and one in the generator. The engine bearings are made of S. A. E. specification babbitt, and are extra large. The armature shaft is piloted in the end of the engine crankshaft, and is driven from the latter through a sort of jaw coupling. The crankcase is cast with two large openings on the end, over which are bolted the bearing plates. In order to insure absolute alignment of the engine bearings, these are line-reamed. The generator is held in alignment with the engine by means of a connector flange to which the former is bolted.

Owing to restrictions on the amount of gasoline which can be kept within a building, the gasoline tank



Sectional views of 300-watt generator



Matthews electric engine governor

from which the fuel is drawn is located outside the building, and a 5 ft. length of copper tubing is furnished with the plant, by means of which connection can be made from the storage tank to a Stewart vacuum tank, which is secured to the cooling tank. The latter is an electrically welded steel barrel, 19 in. in diameter by 34 in. in height. A Schebler Type B carbureter is fitted, which is controlled by an electric governor. This governor has both a shunt and a series winding. It is so designed that when the generator is carrying only battery load, the generator voltage is maintained to give the proper charging rate; that when there is a lighting load in addition to the battery load, the throttle will be opened wider and more current will be generated to take care of this additional load. Battery charging is continued until the charge is complete, when the plant will be automatically shut down.

The governor consists of an electro-magnet with rotating or rocking armature to the shaft of which the governor lever is connected. The governor has both a shunt and a series winding, each winding being on a separate spool. There are three adjusting springs on which adjustments are made under the following conditions: If the governor fails to open the throttle sufficiently as the load is thrown on, and in consequence the battery begins to discharge, spring A should be slightly weakened: if when the plant is started the armature M does not assume its normal running position, that is, if the lever O does not come up against the far end of clip Q, then the adjusting spring B should be weakened; if, under normal running conditions with the battery connected to the plant, clip Q should not be up against the stop, then the adjusting spring C is too weak and should be strengthened.

It will be noted that the governor lever is provided with a number of holes so that its effective length can be varied, and the lever can also be adjusted on its shaft by means of the clamp screw at the hub.

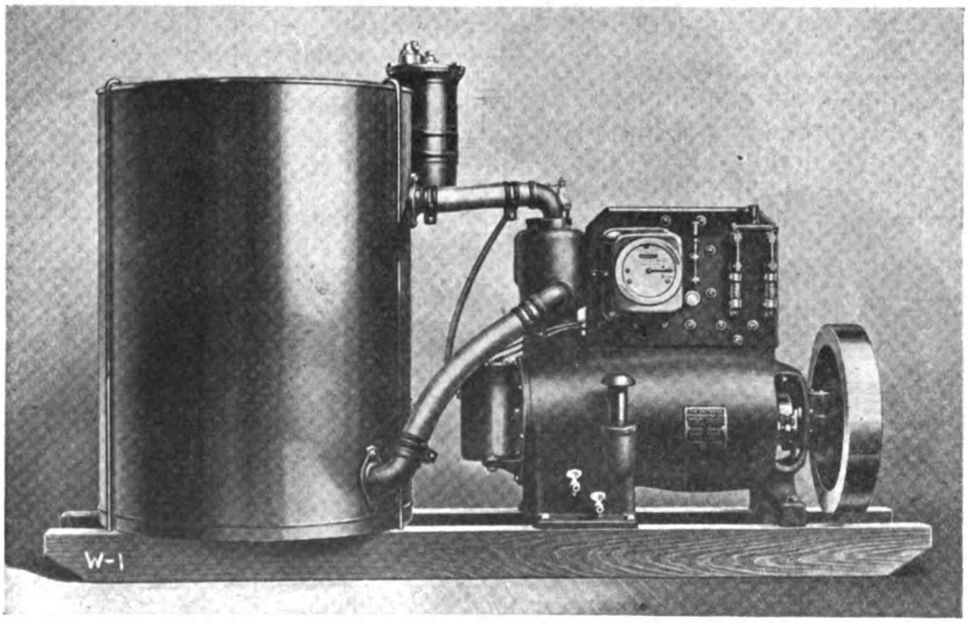
Ignition is by a 32-volt vibrating coil in conjunction with a timer. The spark plug is screwed into the valve cap. Lubrication of the engine is by splash. A large crankcase oil reservoir is provided and there are hand holes in the crankcase on both sides. Four feet are cast on the crank chamber by means of which the engine is supported upon a channel iron frame.

Ordinarily, starting is effected electrically, but for emergency cases a starting crank is provided, the shaft of which passes underneath the cooling tank to the end of the supporting frame. Cooling water is circulated by thermo-siphon action, the connections between the jacket and tank being of ample dimensions.

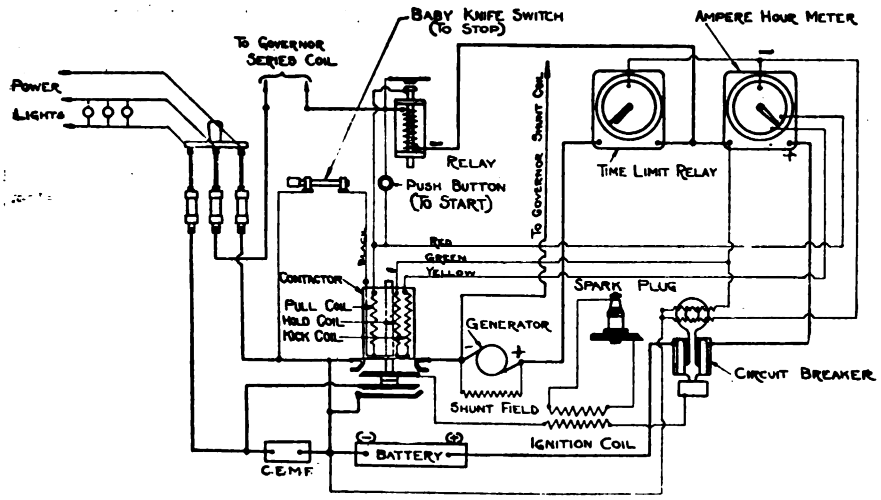
The generator is of General Electric make, and is a 4 pole type with laminated fields. Wave armature winding is used, and there are four brushes on the commutator. The outer end plate of the generator is cast with feet which rest on a cross member of the frame. The generator is wound for 32 volts, supplying current to a 16-cell Willard battery.

The battery consists of 16 cells and 1 counter-cell, and has a capacity of 72 ampere-hours. The generator set occupies 60 x 21 in. floor space, is 42 in. high and weighs complete 480 lb., while the battery occupies 39 x 18 in. floor space, is 21½ in. high and weighs 271 lb.

The 300 watt outfit is probably the smallest commercial electric lighting plant ever manufactured, and its design has been reduced to the simplest form. Thus, the generator field frame and the engine crankcase are a single casting; likewise, the engine crankshaft and the armature shaft are one and the same piece. The set comprises a single cylinder, vertical, water cooled engine of 2 in. bore by 3 in. stroke, with integral cylinder head. An overhanging crankshaft is used, which is hardened and ground, and held on by taper, key and nut. The plant is a two bearing job, having one bearing between generator and engine, and one generator outboard bearing. Non-Gran bronze bearings are used with a ring oiler on the generator bearing. The connecting rod is made of bronze with



Three-hundred-watt plant complete



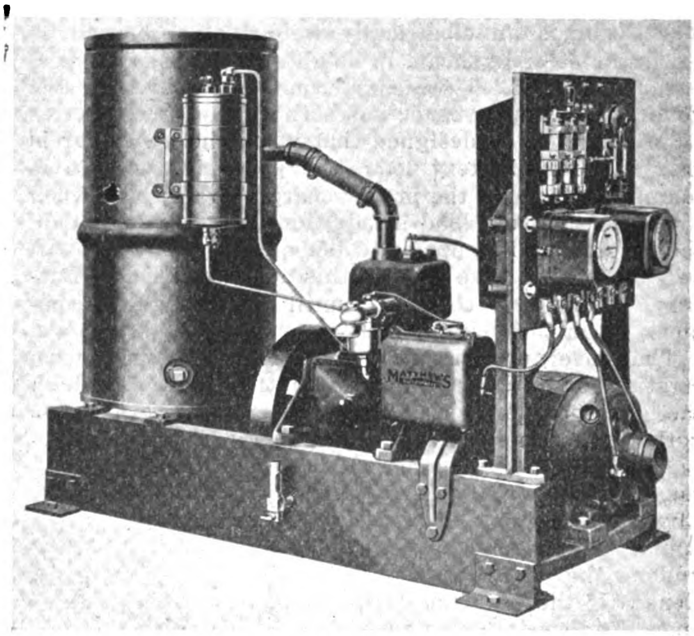
Circuit diagram 1 *K. W. set*

adjustable bearing, and has an oil thrower secured to it. The crank is counterbalanced so as to insure smooth running. On the cam-shaft bearing there is a spiral groove which has a tendency to pull the oil in and keep the engine clean. Spur gears are used for the cam-shaft drive, the large gear being made of cast iron, and the pinion of steel. A mushroom type cam follower is used, and an adjustable tappet. The clear diameter of the valves is 15/16 in. The valves have cast iron heads and steel stems. The piston has 3 rings and is fitted with a tubular piston pin which is hardened and ground.

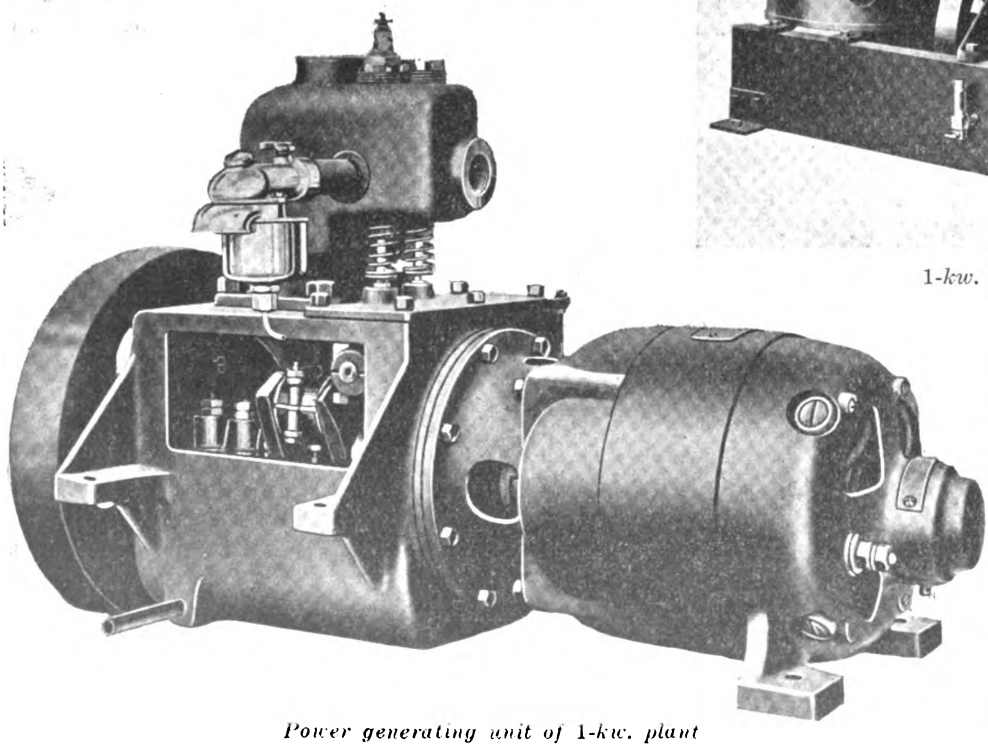
A Stewart vacuum feed system is supplied and thermo-siphon circulation of cooling water is used. The cooling tank measures 16 in. in diameter by 24 in. in height. The carbureter is the Schebler model B, and is provided with a throttle lock device so the generator output cannot exceed 300 watts. Otherwise, if the engine were run under full throttle, it would be possible to get an output of 425 watts.

Ignition is by a 32 volt, single spark, non-vibrating coil, the interrupter being mounted on the end of the camshaft. The flywheel is held on by a taper and key. Oiling is by splash. There is a check valve in the oil return pipe from the main bearing so that the crankcase compression cannot force oil up this pipe and cause excess lubrication. A vacuum type of breather is used, that is, a breather with a valve which opens when there is an excess of pressure in the crankcase and closes when there is a partial vacuum.

The generator is of the two pole shunt-wound type, and has an extra large armature shaft. The field frame and the engine crankcase being one casting the boring of the armature tunnel and of the two main bearings can be effected in one setting. There are two main brushes on the commutator which are in the regular position, 180 deg. apart, and in addition there is a third brush slightly behind one of the main brushes. A voltage of 36 is obtained between the main brushes, and these are connected across the storage battery, while a voltage of 32 is obtained between one main brush and the auxiliary brush, and the lighting load is connected between these two brushes. The flywheel is located outside the generator and has a weight of 22 lb. There is no flicker of the light with the engine running at 1250 r.p.m.



1-*kw. plant complete*



Power generating unit of 1-*kw. plant*

The switchboard and instruments are much the same as on the other system. Lugs are cast on the field frame for holding the switchboard. The ignition coil is mounted on the end of the engine crankcase and is therefore close to the interrupter and the spark plug.

In the foregoing description the term "automatic" has been used repeatedly, and it may be well to explain exactly what this term covers as applied to this plant. In the

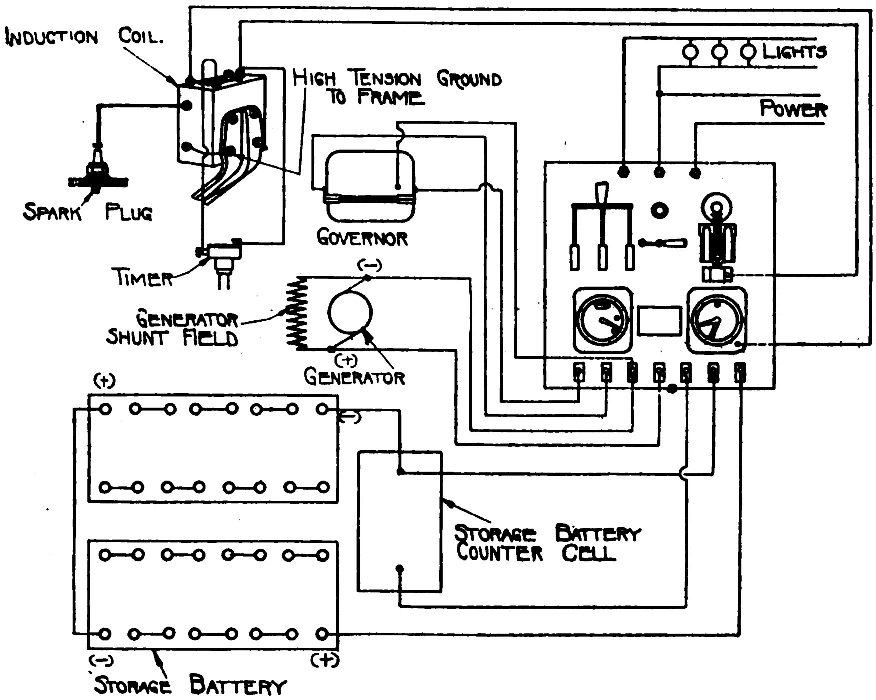


Diagram of connections 1-kw. set

first place, as soon as approximately 15 per cent of the battery charge has been withdrawn, the engine will start automatically and begin to recharge. If only a few lights, say 10 or 12, are turned on they will be supplied with current directly from the battery and the plant will be idle until 15 per cent is taken from the battery. If a larger number of lights are turned on, say from 15 to 20, the generator will recharge the battery in the usual way, but when a state of full charge is reached it will not stop unless some of the lights are turned off. If an electric motor is switched on to the circuit the engine will immediately be started, and the entire load will be carried by the generator, irrespective of the state of charge of the battery. Once started, the engine will not stop until the batteries are completely charged, and as the generator carries all the heavier loads, even if the batteries are entirely full, a slow overcharge is obtained which keeps the battery in good condition.

The automatic features of the Matthews lighting system are based on the Sangamo ampere-hour meter and an overload relay. All current passing into and out of the battery flows through this meter and causes the indicator hand of the instrument to turn on its dial. The complete discharge would move the indicator hand about one-third around the dial. Contact points are secured to the dial plate in the positions corresponding to an empty battery, to a full charge, and to an 85 per cent charge. When the battery is being charged, the hand of the meter turns in a clockwise direction.

On discharge as soon as the meter hand reaches the "start" point the engine is started and begins to charge. Of course, not as much current can be taken out of a battery as has to be put into it during the charge, and in order to make up for the difference, the ampere-hour meter is so designed that its hand moves from 20 to 25 per cent slower on charge than on discharge, for a given rate of current flow. As already explained, if there is only a very small lighting load on the circuit when the battery is fully charged, the plant will be shut down. However, if a lighting load on the circuit is 17 amperes or over the plant will continue to run, and in consequence some additional current will flow into the battery. When the charging operation is over, the meter hand is always at "full," corresponding to the condition of the battery. It takes approximately one hour to charge the battery from the time the engine is started until the meter hand reaches the "full" stop.

There is another condition which must be provided for in a mechanism of this kind, in order that the charge of the battery may always be maintained. It is well known that when a battery is standing idle for a considerable period there is always a slow leakage of current. This leakage current, of course, does not flow through the ampere-hour meter, which consequently does not show the discharge of the battery. To take account of this discharge by leakage, the ampere-hour meter is provided with a thermocouple, which causes the disc of the meter to slowly revolve in the discharge direction, so that every 4 or 5 days the plant will automatically start and recharge the battery, even though no lights are ever turned on and no current is consumed.

One of the illustrations herewith shows a complete wiring diagram of the plant, in which are indicated not only the connections between the generator, battery and load, but also the connections of the ignition system and the electric governor. All of the instruments are mounted on a switchboard which has an elonite asbestos base. These instruments include a contactor, an overload relay and a circuit breaker. the ampere-hour meter and a device of the same class known as a time limit relay. The contactor is in the form of a solenoid switch with three coils. One of these is referred to as a pull coil, the second as a hold coil, and the third as a kick coil. The engine can be started in several different ways, one way being by means of a push button on the switchboard. Normally, the engine is started by the ampere-hour meter. When the hand of this meter comes around to the starting contact the circuit is closed through the pull coil of the contactor, and the battery is thereby thrown into circuit with the generator, starting the latter as a motor. The ignition circuit of the engine is also closed through the starting contactor, so that the "spark" is on the moment the engine begins to turn over.

As above pointed out, when sufficient current is being used in the consuming circuit the engine will start, irrespective of the position of the hand on the ampere-hour meter. This is effected by a device called an overload relay—an electro-magnetic switch through which flows all of the current supplied by the plant. When the plunger of the relay is strong enough it pulls it up, thereby closing the circuit through the pull coil of the contactor, which starts the engine.

In addition to the apparatus described above, the switchboard contains a time limit relay, the function of which is to open the battery circuit in case the engine for any reason should fail to pick up its cycle while it is being cranked by the generator. This would happen, for instance, if there was no fuel in the tank. When the battery is discharging the hand of the time limit relay turns clockwise, and vice versa. However, when the battery is being charged the hand can only

(*Continued on page* 1359)

Four-Year Range of Wages in the Automotive Industry

Influence of the War Upsets the Basis of Comparisons Previously Employed—Seasonal Fluctuations Still Obtained

WASHINGTON, June 7.—Wages in the automobile industry were increased from $2.50 a day average in 1915 to $4.65 a day average in 1918. These figures are obtained from reports made to the Department of Labor monthly by automobile manufacturers. The number of companies reporting range from 36 to 52.

The accompanying charts were compiled from these reports and present the wages, numbers employed, production and selling prices in the automobile industry, the average daily wage and the average daily number employed, the prices of basic commodities, and the wages and number employed in other similar industries.

The tables show the wages and number employed in the automobile industry only. For the sake of comparison, where months of different years are used to obtain percentages, reports from the same factories only were used, regardless of the number filed.

In accounting for increase of wages in the industry many factors must be taken into consideration. The first cause undoubtedly was the effort to meet the demand for quick production of war materials for our allies, much of which was made in automobile factories. After the declaration of war by this country, the withdrawal of men for military purposes became a serious factor. The

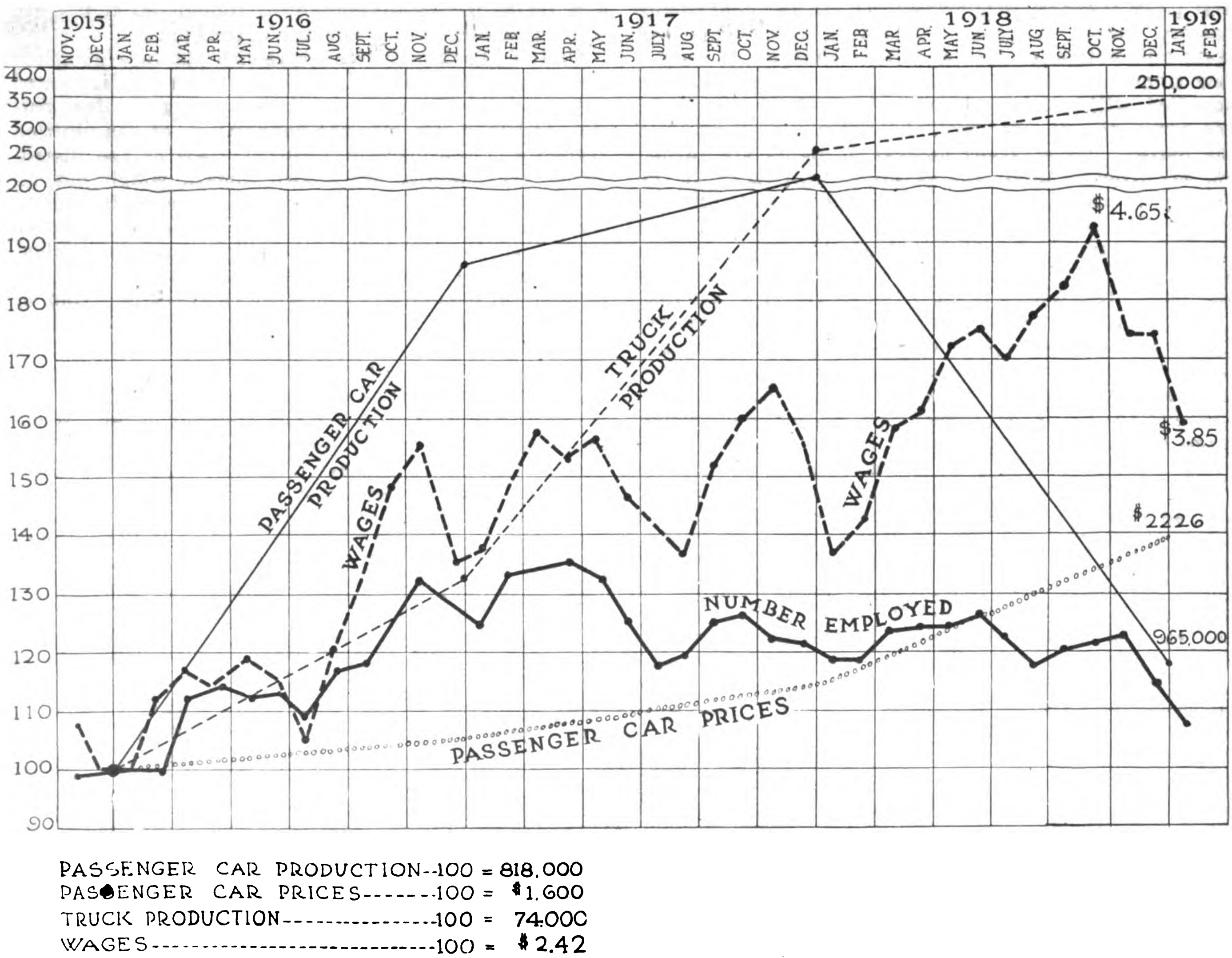


Chart 1—Showing the number employed, daily wage in the automobile industry and production and average selling prices of passenger cars and trucks

Wages and Numbers Employed in Automobile Industry

Mo.	Establishments reporting	Number on weekly payroll in 1916	Number on weekly payroll in 1917*	Per cent of increase or decrease	Amount of weekly pay roll in 1916	Amount of weekly pay roll in 1917*	Per cent of increase or decrease	Daily average number employed per factory 1916	Daily average number employed per factory 1917	Average daily wage 1916	Average daily wage 1917*
July	36	90,942	92,354	1.6	$1,615,257	$2,154,737	33.4	2526	2565	$2.54	$3.55
Aug.	42	104,001	107,024	2.9	2,028,049	2,305,983	13.7	2476	2548	3.08	3.61
Sept.	38	89,926	91,742	2.0	1,861,768	2,158,537	15.9	2366	2414	3.45	3.92
Oct.	43	115,549	110,427	—4.4	2,409,981	2,610,926	8.3	2687	2568	3.49	3.60
Nov	40	107,479	101,365	—5.7	2,375,177	2,529,603	6.5	2686	2534	3.84	4.16
Dec.	47	104,638	101,415	—3.1	2,165,965	2,496,948	15.3	2226	2153	3.45	4.10
		1917	1918		1917	1918		1917	1918		
Jan.	45	110,256	98,816	—10.4	2,183,095	2,122,457	—2.8	2450	2190	3.28	3.53
Feb.	48	134,387	119,882	—10.8	2,840,688	2,668,866	—6.0	2799	2497	3.52	4.08
March	50	137,093	125,277	—8.6	3,073,893	2,981,061	—3.0	2741	2505	3.73	3.96
April	50	125,407	117,352	—6.4	2,761,526	2,846,438	3.1	2508	2347	3.67	3.87
May	47	120,112	114,745	—4.5	2,773,654	3,011,044	8.6	2555	2441	3.85	4.37
June	47	104,024	109,669	5.4	2,337,951	2,858,794	22.3	2213	2333	3.74	4.34
July	48	127,962	128,473	0.4	2,810,608	3,243,692	15.4	2665	2676	3.51	4.13
Aug.	48	118,477	119,004	0.4	2,553,961	3,208,572	25.6	2575	2587	3.59	4.50
Sept.	48	113,889	117,290	3.0	2,614,888	3,215,836	23.0	2372	2443	3.84	4.57
Oct.	52	136,589	135,313	—0.9	3,241,109	3,776,737	16.5	2626	2602	3.95	4.65
Nov.	51	79,831	87,536	9.7	1,721,481	2,155,906	25.2	1565	1718	3.59	4.08
Dec.	48	108,498	114,427	5.5	2,608,839	3,058,385	17.2	2261	2383	4.00	4.45
		1918	1919		1916	1919		1918	1919	1918	1919
Jan.	49	106,993	112,984	5.6	2,277,082	2,979,959	30.9	2181	2305	3.56	4.39
Feb.	47	109,583	110,472	0.8	2,445,176	3,240,057	32.5	2331	2350	3.72	4.96

*Where monthly figures are used for the sake of comparison with the previous year they are reduced to the same basis as the reports of the previous year. Viz., the report of the number employed in July, 1917, when used for comparison with 1916, is that reported by the same 36 factories as reported in 1916.

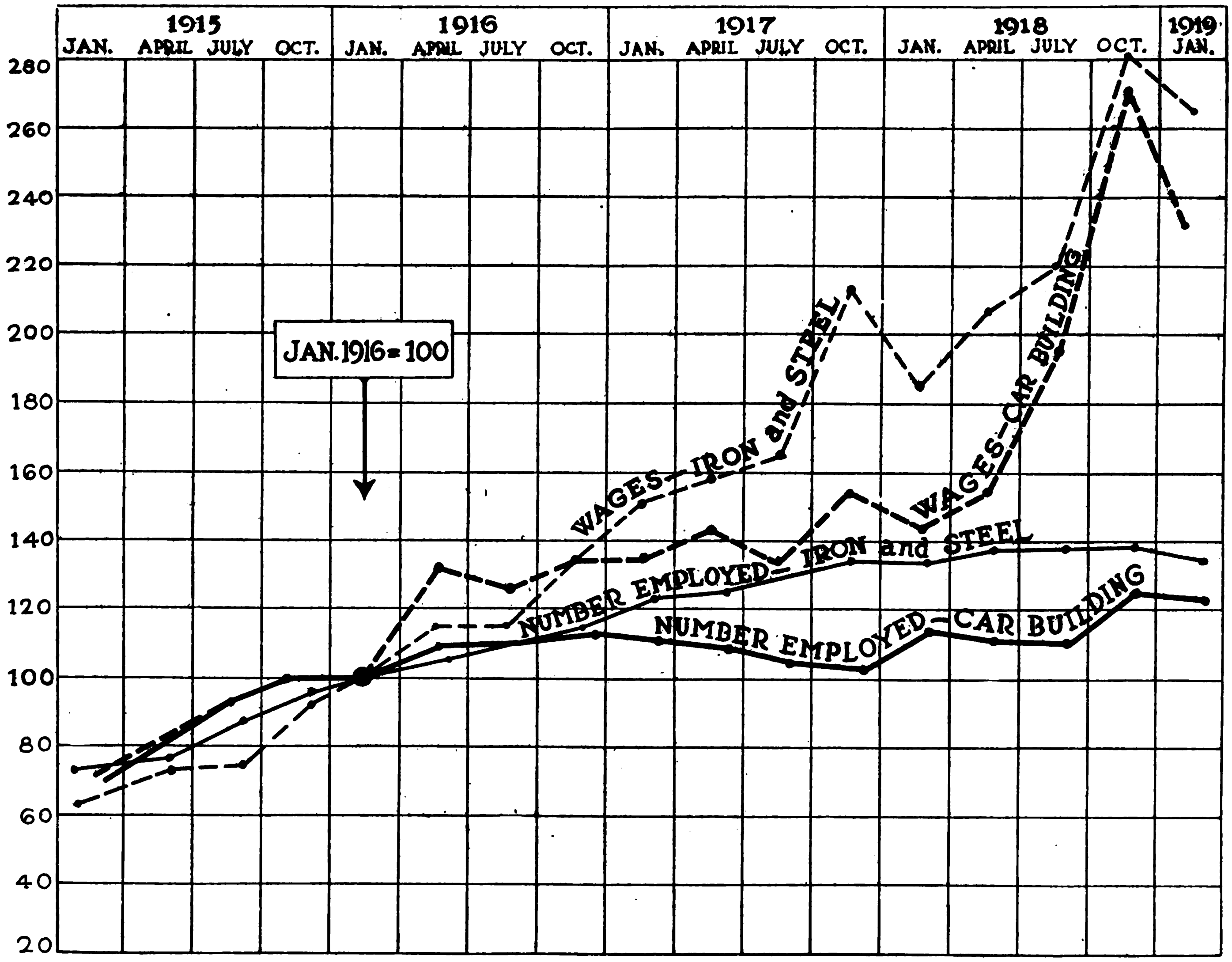


Chart 2—Relative number employed and wages paid in other large industries, based on figures for January, 1916, as 100 per cent

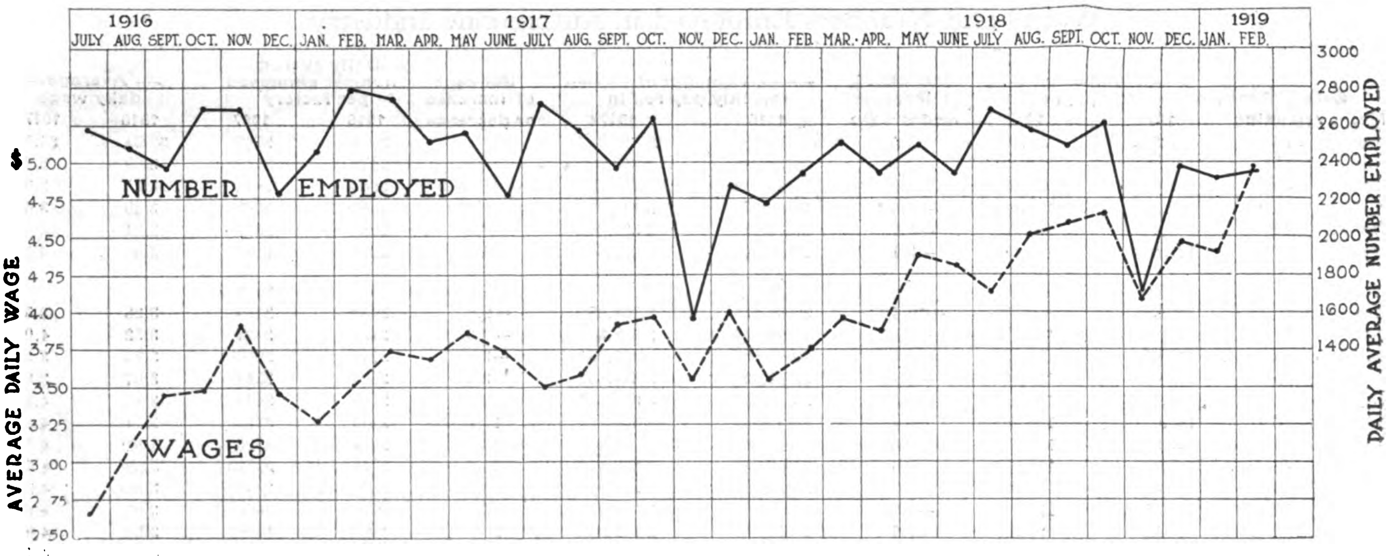


Chart 3—Showing the average daily number employed and wages in the automobile industry

high cost of living later became a contributory factor, but usually the demand for men in the automobile factories kept the wage increase in the industry ahead of the cost of living increase.

There is a close relation between the numbers employed in the automobile industry and in the kindred iron and steel and car building industries, as shown in Chart 2. In all of these industries the wage scale increased considerably more than the number employed, which usually is an indication of the wage increase.

Increased prices for passenger cars have apparently had no serious effect upon the sales, as production increased constantly and in even greater degree than the selling prices up to 1918 when government control limited the output.

Seasons Maintained

That the numbers employed and the wage scales rise and fall simultaneously in normal times is indicated by the curves from November, 1915, until November, 1917, following which time the effect of the war became noticeable and the wage scale of the automobile industry increased while the numbers employed decreased (see Chart 1). Shortly after, in January, 1918, the influence of the war on production and working organizations was marked with a decline.

Prices of steel and iron rose to unprecedented heights in 1917, increasing more than 300 per cent. A reduction to an increase of 150 per cent above pre-war prices was effected in 1918 when the government exercised its price control. Crude rubber, although fluctuating during the past four years, has maintained a fairly stable price level.

It is particularly interesting to note (Chart 3) that the wages from July, 1916, to February, 1918, rise and fall in practically the same months as the wages from July, 1917, to February, 1919, although the latter scale is approximately 50 per cent higher, indicating that some such influences as inventory or selling seasons or production seasons have a slight effect. Similarly the size of the working organizations rises and falls in similar months for different years. Apparently the war had very little influence on those factors which caused the slight increases and decreases that mark the different months on the chart as it will be noted, the number employed from July, 1916, to February, 1918, had decreases in December, 1916; June, 1917, and November, 1917, which were again displayed in the curve for the period July, 1917, to February, 1919.

The increased price of passenger cars is apparently due equally to the increased prices of steel and iron and the growing wage scale.

In the table showing the wages and numbers employed in the automobile industry it will be noted that wage increases have been as high as 33.4 per cent for one year while decreases have never totaled more than 6 per cent. Working organizations have increased as much as 9.7 per cent when in November, 1918, they increased to 87,536 from 79,831 employed in the same month of the preceding year. The greatest wage increase was recorded in July, 1917, when the pay roll of thirty-six manufacturers totaled $2,154,737 as compared with $1,615,257 in the same factories for July, 1916. A considerable increase was also noted in February, 1919, when the pay roll totaled $3,240,057 as compared with $2,445,176 for February, 1918, an increase of 32.5 per cent.

Relative Wage and Number Employed in Automobile Factories

FROM NOVEMBER, 1915, TO JANUARY, 1919, IN WHICH JANUARY, 1916, EQUALS 100 PER CENT

Month and Year	Number on Pay Roll	Amount of Pay Roll
1915—November	99	108
December	100	100
1916—January	100	100
February	112	111
March	114	117
April	112	114
May	113	119
June	109	115
July	116	105
August	117	119
September	123	132
October	132	148
November	129	155
December	125	135
1917—January	133	137
February	134	149
March	135	158
April	133	153
May	130	156
June	125	146
July	118	141
August	120	136
September	125	153
October	126	160
November	122	165
December	121	156
1918—January	119	137
February	119	142
March	123	158
April	124	161
May	124	172
June	126	175
July	122	170
August	118	177
September	120	182
October	121	192
November	123	174
December	114	174
1919—January	108	159

A Review of the Motor-Fuel Situation

Limitations and Possibilities of Different Fuel Sources—Interrelations of Engine and Fuel Development—Comments on the Essentials of a Research Organization

By Joseph E. Pogue*

THE rapid growth of the automotive industry has so increased the demand for motor-fuel that the ability of the fuel supply to keep pace has come into question. As a stringency in fuel supply will prove a retarding factor in the expansion of the automotive industry, the subject is a vital one not only to automotive manufacturers, but to the general public as well. A review of the motor-fuel situation as it stands in 1919 is, therefore, timely, for only by widespread appreciation of the nature of the fuel problem and especially of the steps that may be taken in solution can the most favorable outcome be assured.

THE PETROLEUM SITUATION

Crude petroleum to the extent of approximately a third of a billion barrels is mined annually in the United States. Most of this quantity is refined to produce gasoline, kerosene, fuel oil, lubricating oil, and various by-products. The relative production of these products in 1918 is shown in Fig. 1.

Gasoline, of course, is the predominant motor-fuel in use in this country; kerosene is coming into prominence as a motor-fuel, although a small part only of the output as yet finds such application; fuel oil, which bulks larger than gasoline and kerosene combined, is mostly employed for firing boilers, although a trifling quantity is used in Diesel engines and a small fraction is converted into gasoline through processes of pressure distillation known as "cracking."

The Joint-Product Character of Gasoline.—Gasoline is not an independent product, free to respond singly to motor-fuel demands, but is intimately tied up with the production of other constituents of crude petroleum, especially kerosene and fuel oil. In consequence, the price and supply of gasoline are influenced by market conditions holding for kerosene and fuel oil.

Before the vogue of the internal combustion engine, gasoline was a by-product of little value turned out in connection with the manufacture of kerosene, but the rapid upgrowth of the light motor has brought gasoline into more urgent demand than either kerosene or fuel oil, with a resultant price discrepancy between the three (see Fig. 2). Means, however, are now developing for converting kerosene and fuel oil into gasoline, as well as for using them directly in motors, and in proportion as the motor-fuel demand encroaches upon these cheaper products their price advantages over gasoline will tend to disappear.

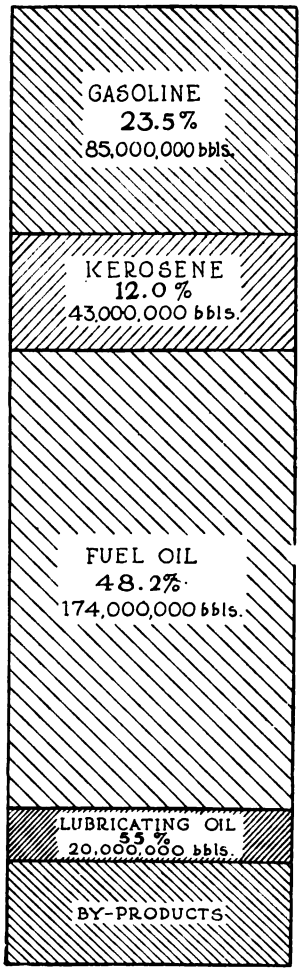


Fig. 1—The production of petroleum products in the United States during 1918

The close interplay between gasoline, kerosene, and fuel oil, arising from their production in common from a single raw material and their (as yet limited) interchangeability, is a factor of great significance which should be held clearly in mind in viewing the motor-fuel situation.

Era of Surplus Gasoline.—Until recently, crude petroleum was mined in gross excess of the quantity necessary to provide an ample supply of gasoline. Much gasoline in consequence was unrecovered from the crude petroleum brought into use. This gasoline represented "slack" in the situation (see Fig. 3). During this period, expansion in gasoline output was readily effected merely by subjecting a growing share of the crude output to refining.

Even though the rate of increase in gasoline production has for some ten years exceeded the rate of increase in production of crude petroleum, no stress was felt until the gasoline "slack" began to run out around 1917. Then the burden shifted to more rigorous means for sustaining the supply.

The Era of Tightening Gasoline Supply.—At present practically all the easy-to-extract gasoline is removed from the crude petroleum mined, and the motor-fuel demand is not filled by the quantity obtained. A growing discrepancy is covered by cracking fuel oil into gasoline, by lowering the volatility of gasoline which permits a larger percentage (at the expense of kerosene) to be extracted, and by gathering the gasoline suspended in natural gas. These economic expedients are recent developments, and are being called more and more into play by the rapidly expanding demand for gasoline. In the absence of conspicuous gasoline "slack" within the crude supply, the expansion in output of crude petroleum has ceased to be adequate to accommodate the situation.

Supply of Crude Petroleum Limited.—Not only is the production of crude petroleum failing to keep pace with the demand for motor-fuel, thus already forcing into play other expedients for expanding the supply, but also the unmined supply of petroleum has a physical limit which is rap-

*Division of Mineral Technology, U. S. National Museum. Formerly of the Oil Division, U. S. Fuel Administration.

idly being approached. The U. S. Geological Survey in early 1919 estimated, on the basis of extensive engineering data, that the available petroleum still underground in the United States approximates 7,000,000,000 barrels.

In view of the large and rapidly increasing annual draft upon this reserve, the supply seems startlingly inadequate to sustain the motor-fuel situation for any satisfactory period of time. Moreover, it is well known, because of the greater extent of drilling necessary, that petroleum may be mined only at increasing cost and with increasing difficulty as the resource is depleted. It is already a common belief among petroleum engineers that the oil output of the United States has practically reached its maximum.

The recent interest on the part of the oil industry in acquiring reserves of petroleum in Mexico and South America is but the business reflex to this point of view. But even with the most optimistic assumptions on behalf of contributions from foreign countries, it can scarcely be hoped that the petroleum reserve available to the automotive industry of this country will be found to exceed twice the quantity now in sight.

Supplementary Gasoline from Natural Gas.—At present a highly volatile gasoline is extracted from natural gas in many parts of the country and blended with petroleum distillates too heavy alone to be marketed as gasoline. In this way, commercial gasoline in quantity aggregating about 10 per cent of the total supply is manufactured. The production cost of such gasoline is low and the growth of this industry has been rapid in the past few years. The contribution of this by-product source, however, is limited as to the future, since natural gas is a waning industry and gasoline is already being extracted from roughly half of the supply.

Cracked Gasoline from Fuel Oil.—Fuel oil, the petroleum product turned out in greatest bulk and selling around a quarter to a fifth the price of gasoline (see Fig. 2), is the source of a growing quantity of gasoline. By special methods of distillation, certain qualities of fuel oil are transformed or "cracked" into a grade of gasoline that is mixed with straight refinery gasoline

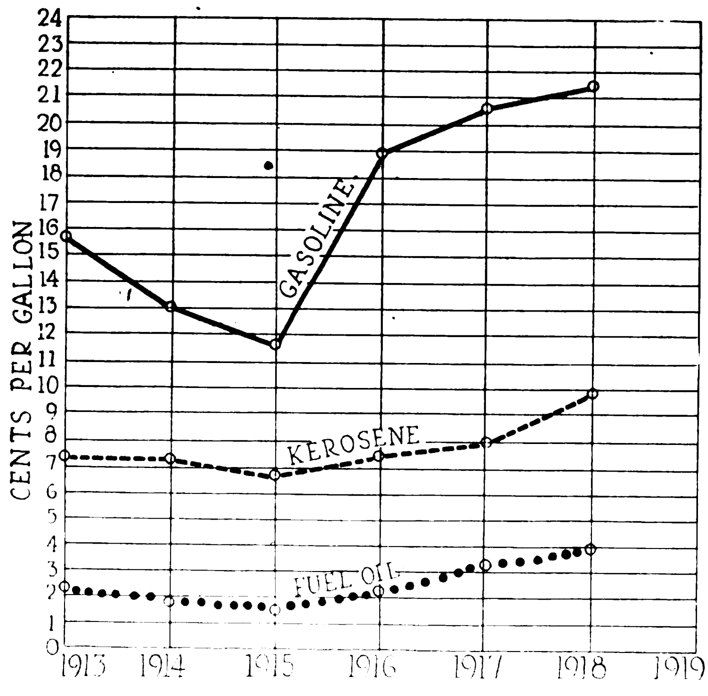


Fig. 2—The average wholesale price of gasoline, kerosene and fuel oil in 1913-1918. Data from Oil Division, U. S. Fuel Administration and Price Section, Bureau of Planning and Statistics, War Industries Board

and contributes by so much to the total supply. Information is wanting as to the exact contribution made by cracked gasoline, as the cracking operation is often an integral part of the ordinary refining process, and the records are not separately available.

Theoretically, the supply of gasoline can be doubled, or even trebled, from the same quantity of crude; but practically, the development and expansion of cracking processes are slow and it is estimated that it would require something like ten years for cracking to double the percentage of gasoline obtainable from crude over the average of 23 per cent now extracted.

In the meantime, other insistent demands bearing down upon fuel oil may be expected to lessen the price interval between fuel oil and gasoline, which is now the chief economic motive for the process. With engines adopted only to volatile gasoline, the automotive industry is now almost wholly dependent upon the competency of cracking to expand the fuel supply. Whether cracking can meet the issue fully without an undue increase in the price of gasoline (which, in fact, would not be meeting the issue) is open to question.

Additional Motor-Fuel by Lowering the Volatility of Gasoline.—It is common notoriety that gasoline during the past few years, especially during the past twelve months, has been becoming heavier and less volatile in quality. In this way, the total supply of gasoline has been increased at the expense of the lighter fractions of "kerosene" which went the way of motor-fuel instead of illuminating oil. This outcome is thought to be the normal economic response to a growing demand that the increases in crude production and the increments from natural gas and cracked fuel oils were unable to meet unaided. At any rate, lowering volatility is in actual progress and thus far the tide has not been stemmed, although the tendency has been widely frowned upon and excoriated.

Kerosene as Motor-Fuel.—Kerosene which sells now for about half the price of gasoline (see Fig. 2) is available for use as a motor-fuel (a) either directly as such, (b) after cracking into gasoline, or (c) through addition to the gasoline supply, which is thereby decreased in volatility.

There is a growing tendency, especially in the tractor industry, to use kerosene directly as a motor-fuel, but thus far its use in the gasoline engine cannot be said to have given generally satisfactory results. Cracking processes are under development which employ kerosene as their raw material, but the commercial practicability of such processes remain largely to be established; up to the present certain grades of fuel oil represent the dominant raw material from which cracked gasoline is produced.

The indirect use of kerosene through incorporation into the gasoline supply has already been adverted to; this use has already appreciably reduced the output of kerosene proper, but the engine in current use interposes a barrier to a practical extension of this expedient to embrace the entire kerosene cut.

Kerosene commands a lower price than gasoline merely because it cannot be so readily used for motor-fuel purposes. As soon as it assumes a parity in use, it may be expected to attain an equality in price.

Fuel Oil as Motor-Fuel.—Fuel oil is available as motor-fuel (a) directly in the heavy-oil engine of the Diesel or semi-Diesel types, (b) indirectly through the avenue of cracking into gasoline, and (c) directly in the current type of engine through the medium of gasification by means of heat.

As fuel oil is now almost exclusively used for steam-raising and gas manufacture—purposes for which coal would suffice—virtually the entire supply can be eco-

nomically captured by the automotive demand. Fuel oil is due for a rapid diversion to transportation purposes, and competition will rapidly develop between cracking, on the one hand, and a direct use, either in heavy-oil engines or upon gasification in light motors, on the other.

It remains to be seen whether this competition will result in a retardation in the development of cracking technique, the direct uses winning out; or whether cracking will prove competent to augment progressively the gasoline supply, the field of direct uses being accordingly narrowed by this counter demand. Upon the outcome will depend the course that engine development in the truck and tractor industries should take—whether the goal should be the heavy-oil engine, gasification apparatus, or a continuation of the present type of motor.

The whole matter, from the automotive standpoint, is complicated by the tremendous prospective upgrowth in the use of the marine motor burning fuel oil—a development that will encroach more and more upon the fuel oil supply at the same time that fuel oil is coming to be needed by automotive agencies on land.

SUPPLEMENTARY RESOURCES OF NON-PETROLEUM ORIGIN

With the tightening up of the gasoline situation, with its attendant problems as to the competency of cracking to maintain adequate increases in supply versus engine adaptation in the direction of accommodating the heavy fractions of petroleum distillation, there come into view a number of supplementary fuel resources such as benzol, alcohol, and shale-oil distillate, seeking a motor-fuel rôle. These fuels, or at least the first two, are now beginning to come upon the market, and although they were unable to compete with gasoline during the era of gasoline surplus, they now have possibilities of development as opposed to supplemental resources of petroleum origin, such as kerosene, fuel oil, and cracked gasoline. Whether these supplements can edge into use before crude petroleum is yielding up its full quota of motor-fuel values is an important question, the answer to which is contingent, in part, upon the fuel policy of the automotive industry.

Benzol as a Motor-Fuel.—Benzol is a light oil produced in commercial quantities along with coke, gas, ammonia, and tar, when bituminous coal is subjected to distillation in the by-product coke oven. The average yield is about 2½ gallons of benzol per ton of coal and roughly 1-12 of the bituminous coal mined in the United States is treated in this way.

The country's output of benzol has increased materially during the war, owing to the demand for this product in connection with the manufacture of explosives, resulting in a surplus of benzol now which must find an outlet in the form of motor-fuel. Increases over the present supply of benzol, however, are contingent upon the rate of progress in the by-product utilization of coal, which in turn is dependent upon the rapidity with which the beehive coke oven is replaced by the by-product oven in the coke industry, and the course of progress in the gas industry in the direction of supplying the fuel needs of communities under by-product practice.

At best, the benzol available for motor-fuel use must represent only a small fraction of the motor-fuel demand; but at the same time the quantity available must be reckoned with.

Benzol is a satisfactory fuel in the present type of engine, after a slight carburetor adjustment which is readily made. Fortunately it is miscible with gasoline, so that it may be used alone, mixed with gasoline, or alternating with gasoline. This feature greatly simplifies the problem of distribution.

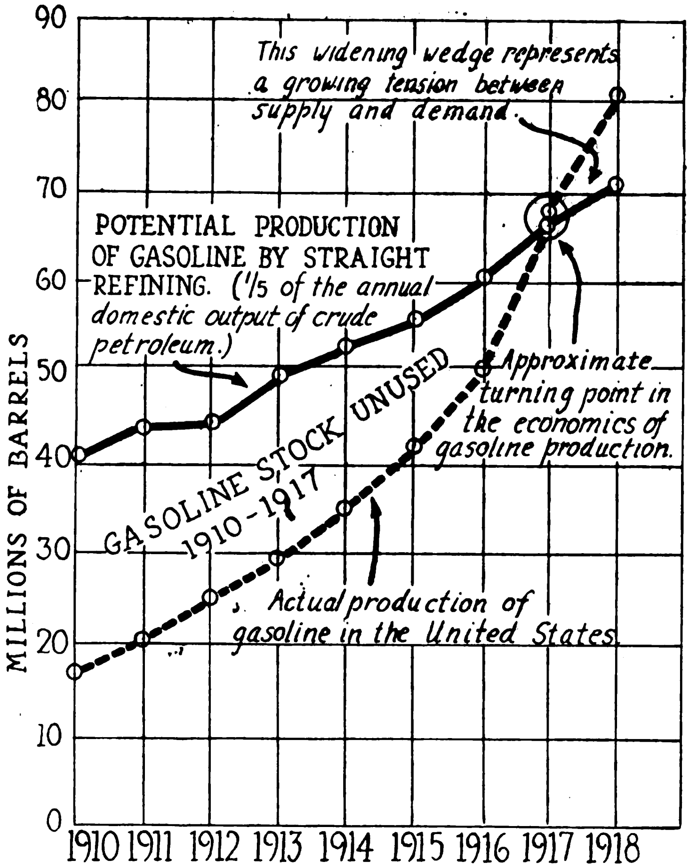


Fig. 3—Chart showing the tightening up of the gasoline supply in the United States. Data from Oil Division, U. S. Fuel Administration

Benzol is already coming on the market in small quantities in the eastern part of the country, selling at the same price as gasoline.

Alcohol as Motor-Fuel.—Alcohol stands apart from the fuels previously reviewed in the fact that it can be made from products of vegetable origin which are reproducable from year to year and therefore makes no drain on resources limited in quantity. As it constitutes a satisfactory fuel even in the present type of engine, and so far as raw materials are concerned can be manufactured in practically unlimited quantities, it offers a reassuring prospect in the face of a rapidly waning petroleum reserve.

Alcohol in composite form, mixed with benzol, kerosene, and other materials, has already come on the eastern market in small quantities; and manufacturers of industrial alcohol are making efforts to build up a motor-fuel demand for this substance.

The future of industrial alcohol as a motor-fuel remains to be seen. Thus far it has been unable to compete with gasoline, which was to be expected during the era of "easy" gasoline, especially as the cost of production, in the United States at least, has prevented a selling price in competition with gasoline.

With increasing facility in production, especially if the price of gasoline goes up a few cents, alcohol may be expected to assume increasing prominence; and it is an open question as to whether alcohol may not come into widespread use more rapidly than shale-oil distillate, its rival supplementary resource.

The legal difficulties in the way of widespread alcohol utilization, however, are to be taken into account as a retarding factor; although the coming in of Prohibition will free capacious manufactories for the production of industrial distillation products in the place of beverages

and give further incentive for the development of industrial alcohol.

Alcohol, therefore, must presumably sooner or later be reckoned with as a motor-fuel. The progress of alcohol, however, will depend not so much upon its own merits as upon its status in regard to the range of motor-fuels likewise undergoing development and the extent to which its upgrowth will fit into the general situation. These relationships have scarcely as yet been sufficiently investigated to permit of more definite statement in advance.

Shale-Oil Distillate as Motor-Fuel.—The occurrence in many parts of the country, especially in Colorado, Utah, and Wyoming, of immense areas of black shales, capable of yielding upon distillation appreciable quantities of an oil analogous to petroleum, has attracted considerable attention of late and offers a prospective source of motor-fuel. Oil-shale, indeed, is generally looked upon as the logical successor to petroleum, which will come into commercial development as soon as the richer petroleum resource needs a supplement.

Shale-oil cannot be produced as cheaply as petroleum at the present price level of the latter, although it is expected by many that moderate price advances over the present scale may bring shale-oil on a parity.

Considerable preliminary developments have already taken place over the past few years in Colorado and Utah particularly, but the progress of the new industry has been slow. At best, even granted a distinct need for output, the development of a large production of shale-oil must be a matter of many years, because of the extensive mining operations and large distillation plants that must come into existence as a preliminary.

Shale-oil will probably be able to yield a range of products roughly analogous to those extracted from petroleum, which is a very fortunate circumstance for the automotive industry, since engines developed for petroleum products will presumably prove suitable for shale-oil products. On the other hand, there is danger of a hiatus in supply, should petroleum output fall off more rapidly than shale-oil output develops; although a rapid development of fuel alcohol may stand ready to fill in the gap.

All these uncertainties, however, make it the more imperative that the automotive industry should adopt a fuel policy broad enough to care for all contingencies.

Composite Fuels.—Heretofore, automotive transportation has employed single fuels, chiefly gasoline. With the approach of supplementary fuels, and with progress in fuel research, the matter of mixed or composite fuels is assuming considerable interest. If it becomes necessary for the motor-fuel demand to be met by two or more fuels of diverse sources, the question of distribution will assume added importance, as to whether those fuels may be more advantageously marketed separately or as a blend.

It may turn out that a virtue can be made of a necessity, so to speak; for initial researches on mixed fuels have already gone to show that certain admixture may yield more favorable results than the components in severalty. Indeed, it is thought by some that results of almost revolutionary significance may be attained by intensive research in this direction following the trend of the economic situation in respect to motor-fuel production.

Up to the present, the field of composite fuels has been beclouded by a number of fakes and half-baked developments, to which an undue amount of publicity has been given. The industry will have to continue to be on its guard against falsifications in a field so little known and with possibilities so unsounded.

Significance of New Fuels Relative.—Since automotive transportation has developed and become standardized on the basis of gasoline, the significance of the various fuels coming into sight to supplement the gasoline supply does not depend upon the individual merits of the fuels so much as upon their capacity to enmesh with the existing situation.

A study of individual fuels, therefore, will prove misleading if not accompanied by an appraisal of the relationship that each bears not only to gasoline but to all other fuels that have potential motor use. This is one of the features which renders the motor-fuel problem

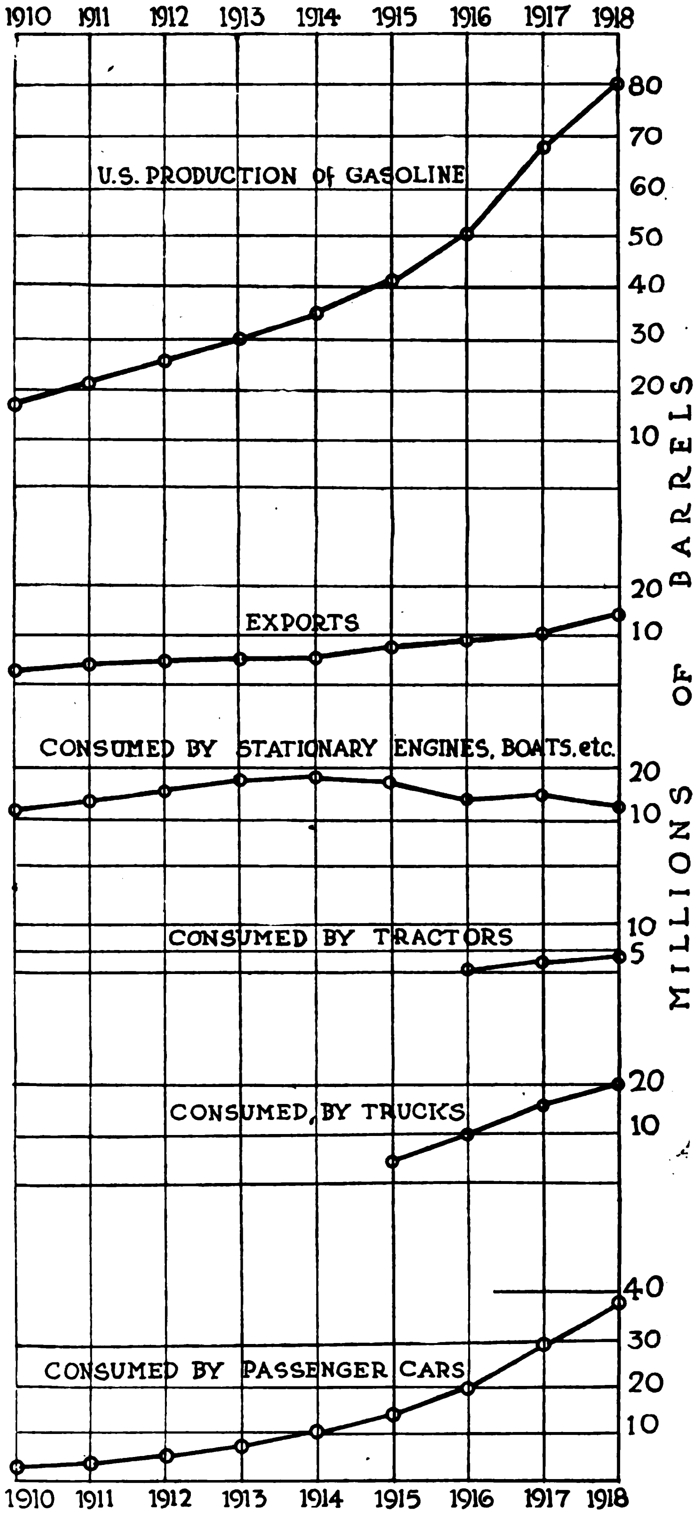


Fig. 4—Chart showing the rate of increase and character of the motor-fuel demand during 1910-1918. Data from Bureau of Oil Conservation, Oil Division, U. S. Fuel Administration

so intricate and so elusive if viewed with its various parts dissociated. It cannot be too strongly emphasized that the merits of any single factor in the situation, whether it be a process such as cracking, a new fuel undergoing development such as benzol or alcohol, a fuel in the offing such as shale-oil distillate or new types of mixed fuels, cannot be evalued unless cross-referenced with respect to all counter developments falling under its sphere of influence.

Such a condition renders a discussion of the situation peculiarly difficult, since the exigencies of language require that each topic be discussed separately, and all the due qualifications and cross-currents cannot be introduced without a fatal sacrifice of clearness and brevity. In visualizing the trend of the motor-fuel situation, therefore, the reader must hold in mind that the advance is not comprised of elements developing in parallel manner, but is more like a jostling crowd of components, each affected by the recurring impacts of all the others.

EVOLUTION OF THE MOTOR-FUEL SITUATION

If we view broadly the development of the automotive apparatus from a fuel standpoint, there appears to be an evolutionary trend behind the matter, with a bearing of considerable significance upon the issue under consideration.

Era of Engine Independence.—The era of gasoline surplus, when gasoline remained unextracted from a significant share of the output of crude petroleum, may also be termed the era of engine independence. The expansion in motor-fuel demand was then met by running a larger share of the crude petroleum through refineries, and the gasoline supply was maintained without sufficient change in quality to dictate adaptations in engine design. During that time, engine progress lay largely in the direction of refinements of quality—flexibility, power, convenience, etc. Fuel was standardized—a volatile gasoline—and the engine was independent of other fuel considerations.

Era of Superficial Concessions to Fuel.—During the past few years, a tightening up in the gasoline supply has become apparent, and in spite of various expedients for maintaining the gasoline of earlier days, a notable change in quality has come into evidence.

Gasoline has been getting heavier, less volatile, embracing an increasing quantity of material formerly produced as kerosene. This progressive change in gasoline quality is especially noticeable in winter, because of difficulties in starting engines, and during the past two winters in particular troubles on this score have passed the stage of inconvenience. So long as both fuel and engine remained standardized, all was well.

Now the fuel is undergoing de-standardization, so to speak, and the engine, built to use high-volatile gasoline, is forced to use low-volatile gasoline. Already, the engine has recognized this maladjustment, as indicated by superficial concessions to this state of affairs, as by preheaters, hot-spots, and the like, and by the upgrowth of a host of so-called fuel economy devices. The engine is now passing through an era of superficial concessions to the fuel situation.

Future Relation of Engine and Fuel.—Unless the present trend of motor-fuel reverses itself, the automotive industry will have to cope with a fuel growing progressively less specialized, or else with a diverging range of fuels, which comes to the same effect. The automotive industry, theoretically, can stop the change now taking place in fuel by holding fast to the present engine in detail, but this procedure will so limit the supply and increase the price of fuel that in practice the engine will have to give way.

It is concluded, therefore, that an era is arriving when the engine will have to make rather radical concessions to fuel, as a relief to a strained situation; and the problem before the automotive industry is: First, to recognize this situation; and second, to establish means for making these concessions with the maximum easement to the supply and price of fuel. Anything short of this will mean just so much of a detriment to the growth of automotive transportation.

A view of the rapidly increasing demand for motor-fuel, as shown graphically in Fig. 4, with reference to the limitating factors in supply as already noted, will emphasize the likelihood of conditions arising that will influence engine design.

Realization of a Motor-Fuel Problem.—The inevitable concern of the automotive industry in the motor-fuel situation is just coming to be appreciated. A year ago it was quite generally felt that fuel was a thing apart from automotive manufacture. Now the fuel situation is a live issue in the automotive industry.

The rise of a fuel problem, however, was not entirely unanticipated. For years the U. S. Geological Survey and the U. S. Bureau of Mines have pointed out the limited size of the petroleum resource and the need for its conservation.

In 1918, the Bureau of Oil Conservation of the Oil Division of the Fuel Administration made a special study of the motor-fuel situation and urged both upon the National Automobile Chamber of Commerce and the Society of Automotive Engineers that the matter be brought effectively to the attention of the automotive industry.

At the winter meeting of the Society of Automotive Engineers on Feb. 5, 1919, a morning was devoted to a fuel session, at which time a number of authoritative papers were presented, which served to outline the situation and call attention to the issue.[1] Following this meeting there has been a general agitation of the matter, and the topic of motor-fuel is now prominently before the automotive interests.

As a specific outcome of the meeting, a fuel research committee was appointed by the Society of Automotive Engineers, and this committee is now formulating plans for the establishment of a research organization charged with the duty of handling the fuel problem in behalf of the automotive industry.

SOLUTION OF THE MOTOR-FUEL ISSUE

Although the existence of a fuel problem is already generally appreciated, and preliminary steps have already been taken toward attacking the issue, there is danger that the true nature of the problem will not be apprehended and consequently a false start may be made.

While the problem is exceedingly complex when all its details are taken into consideration, the fundamentals appear to be sufficiently clear if the matter is logically analyzed. For example: Accepting the existence of a tightening-up tendency in the fuel supply as an obvious fact, there are two avenues of relief—increasing the efficiency of fuel utilization and enlarging the fuel supply itself. The first issue is a more direct matter than the second and may be more concretely handled, if concerted

[1]These papers were planned to give an authoritative expression of each important phase of the fuel problem, as follows:
1. The Unmined Supply of Petroleum in the United States, by David White, U. S. Geological Survey.
2. Mexico as a Source of Petroleum and Its Products, by E. DeGolyer, Consulting Geologist.
3. The Status of Refinery Practice in the United States, by E. W. Dean, U. S. Bureau of Mines.
4. The Status of Engine Efficiency in the United States, by H. C. Dickinson, U. S. Bureau of Standards.
5. An Interpretation of the Engine-fuel Situation, by J. E. Pogue, U. S. Fuel Administration.
6. More Efficient Utilization of Fuel, by C. F. Kettering, President of the S. A. E.

engineering effort and business policy is brought to bear intensively upon it.

In regard to increasing the fuel supply directly, however, the issue takes on a more intangible and elusive aspect. The curve of oil production is lagging behind the curve of motor-fuel demand, and consequently improved technology and supplementary resources must come into action if an unbroken advance is to be maintained.

But inadequate study has yet been brought to bear upon the relationship that the various fuels undergoing development hold to the fuel (gasoline) in current use, and therefore, to put the matter bluntly, relatively nothing is known of the real situation as it is shaping up. In other words, the problem has transgressed the bounds of the conventional methods of study and research heretofore employed; and unless new means are brought to bear upon the problem, no hope of a solution should be entertained.

Need for Scientific Control.—What is needed is an agency, representative of the automotive industry, competent to bring engine development into harmonious adjustment with fuel developments. This adjustment, of course, will ultimately be attained under the give and take of competition, but such an adjustment will prove slow and wasteful, and the industry, in the meantime, will be subject to retardation in event of fuel shortage. Instead of awaiting such an outcome, with its attendant vicissitudes, the automotive industry can take the matter in hand now and, by applying scientific method to the issue, insure itself against the evil effects of a period of fuel stress.

Means for Administering Scientific Control.—The fuel research organization now (June, 1919) undergoing formation is the obvious agency upon which the industry must depend for a solution of the fuel problem. Upon the vision and ability of this organization the success of the whole matter turns. It is of the utmost importance, therefore, that this organization be projected commensurate with the character and importance of the problem it is designed to solve.

The Functions of a Fuel Research Organization.—The fuel problem is not one which laboratory research alone can solve. The fuel situation must be explored and harmonious fuel policies must be developed, in addition to the work of research upon fuels and engines.

A fuel research organization, therefore, to be adequate, must accommodate three functions: economic analysis, to determine the course of fuel developments in relation to engine design; research, to build up the technology requisite to advance in fuel efficiency and fuel production; and industrial co-ordination, to insure an aggregate of fuel policies in adjustment with the needs of the fuel situation.[1] Only through an adequate organization, functioning in this three-fold manner, can the requisite efforts toward increasing thermal efficiency and enlarging the fuel supply be put forward by the automotive industry.

It cannot be emphasized too strongly that an ample supply of fuel depends not only upon the efficiency obtained in the engine from the fuel actually used, but also upon the efficiency attained in the realm of fuel production, which is contingent, in part, upon the requirements of the engine-type. It is the peculiar nature of the fuel problem to embrace the possibility of contributing to an easement of fuel supply in these two directions.

Difficulties in the Way of Progress.—There is a grave danger, at the present stage of affairs, that the true nature of the fuel problem will not be generally enough apprehended, and that a research organization too narrowly conceived to meet the issue will be established. This danger arises from the fact that a limited and narrow conception of the term "research" prevails, as being a matter entirely of material, laboratory investigations; while at the same time there exists a general tendency to overlook the fact that the fuel problem is primarily an *economic issue*, of which technology is only one factor.

Impossibility of Finding a Ready-Made Solution.—There seems to be a general feeling on the part of many in the automotive industry that a definite program for meeting the motor-fuel issue ought to be forthcoming. The point of view of the industry may perhaps be summarized in four questions.[2]

1. Are the gasoline producing companies doing all they can to produce the maximum motor-fuel from the available crude?
2. What must the automotive manufacturers do to obtain a greater percentage of efficiency from the fuel utilized?
3. What contemplated changes in fuel characteristics do the fuel producers expect will have to be made within the next five years?
4. What changes may this necessitate in the design of automotive apparatus?

It is felt by many that if answers to these questions could only be provided, the industry would then have a basis for action and could make definite progress.

In this light, however, it appears that an essential step in the problem—scientific exploration of the problem itself—is being quite universally overlooked. In the writer's opinion, no individual or organization in the country knows the answers to these questions. The answers have not been worked out. There has, indeed, been no agency engaged in working them out. If answers are necessary as a preliminary to action, the step immediately ahead is to establish an agency competent to bring adequate and rigorous scientific study to bear on the matter and to work out the answers.

In short, there appear to be three stages in the issue: First, the recognition that there is a fuel problem of concern to the automotive industry; second, the establishment of an organization for handling this problem under a true perception of the peculiar nature of the issue; and third, action. The first stage has been passed through; the danger now is that stage 2 will be too hastily attended to and that either the matter will lag for want of a convincing plan, or else lines of action will be followed leading off into impractical directions. The practical outcome, in fine, depends upon the type of motor-fuel research organization shortly to be established. This organization will either be equal to the occasion, or not; and if not, the immediate opportunity for progress will have been lost.

Confidence and Backing of the Automotive Industry Necessary.—It therefore behooves the automotive industry in its entirety to take the utmost interest and concern in the plans now under consideration for motor-fuel research. Without the financial support, confidence, and co-operation of the industry, a motor-fuel research organization cannot hope to go far. And conversely, without the existence of a central organization, built along broad lines and adequately equipped as to funds, personnel, and a true perception of the issue, the automotive industry will remain lacking in means for insuring its prosperity in the years immediately ahead.

[1] These three functions are elaborated in a paper, by the present writer, entitled "The motor-fuel problem," to be presented before the June Meeting of the Society of Automotive Engineers at Ottawa Beach and subsequently to be published in the Journal.

[2] This summary view was supplied the writer by David Beecroft in a letter of May 27, 1919

Automotive Export Problems During Post-War Period

The American Manufacturer Must Cultivate the Fields Opened to Him During Struggle to Offset Trade Lost by Allied Restriction — Figures of 1913 and 1918 Tell a Graphic Story

By Allen Sinsheimer

AMERICAN automotive manufacturers must completely readjust the world map of exports. There is little prospect of immediate renewal of the prewar trade with the Allies. There is every possibility that the Allies will constitute formidable competition for export automotive business. Consequently, American manufacturers will find it particularly important to work closely those fields they have cultivated since 1914; guard against loss of business by meeting competition, and develop all possible new fields in the Orient and elsewhere before England, France, Germany and Italy are able to expand.

These conclusions come as a result of a study of the automobile exports of the various nations in 1913, and the recent disclosures, by Allied officials at the Foreign Trade and U. S. Chamber of Commerce conventions. Statements by these officials show that the United States cannot expect a resumption of pre-war automobile business with the large European nations for several years.

England, France and Italy, it was asserted, must control their imports until they re-establish their exports. They find themselves, to-day, after four years of war, exporting in April, 1919, $28,423,563 worth of products to the United States in return for $336,848,859 worth

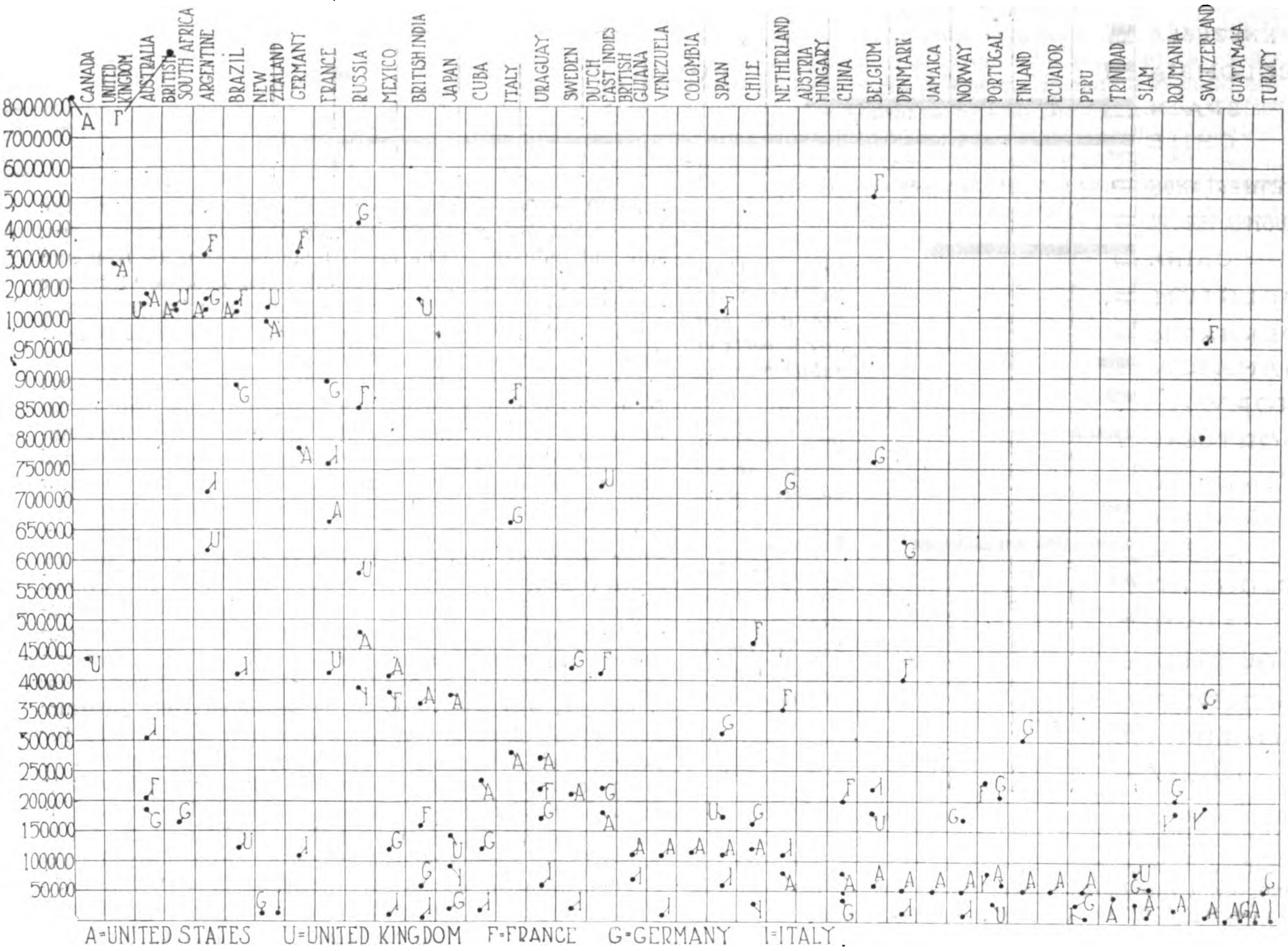


Chart 1—Showing the pre-war status of automobile shipments to the forty principal countries. France, Germany and the United Kingdom were very frequently larger exporters to certain countries than was the United States

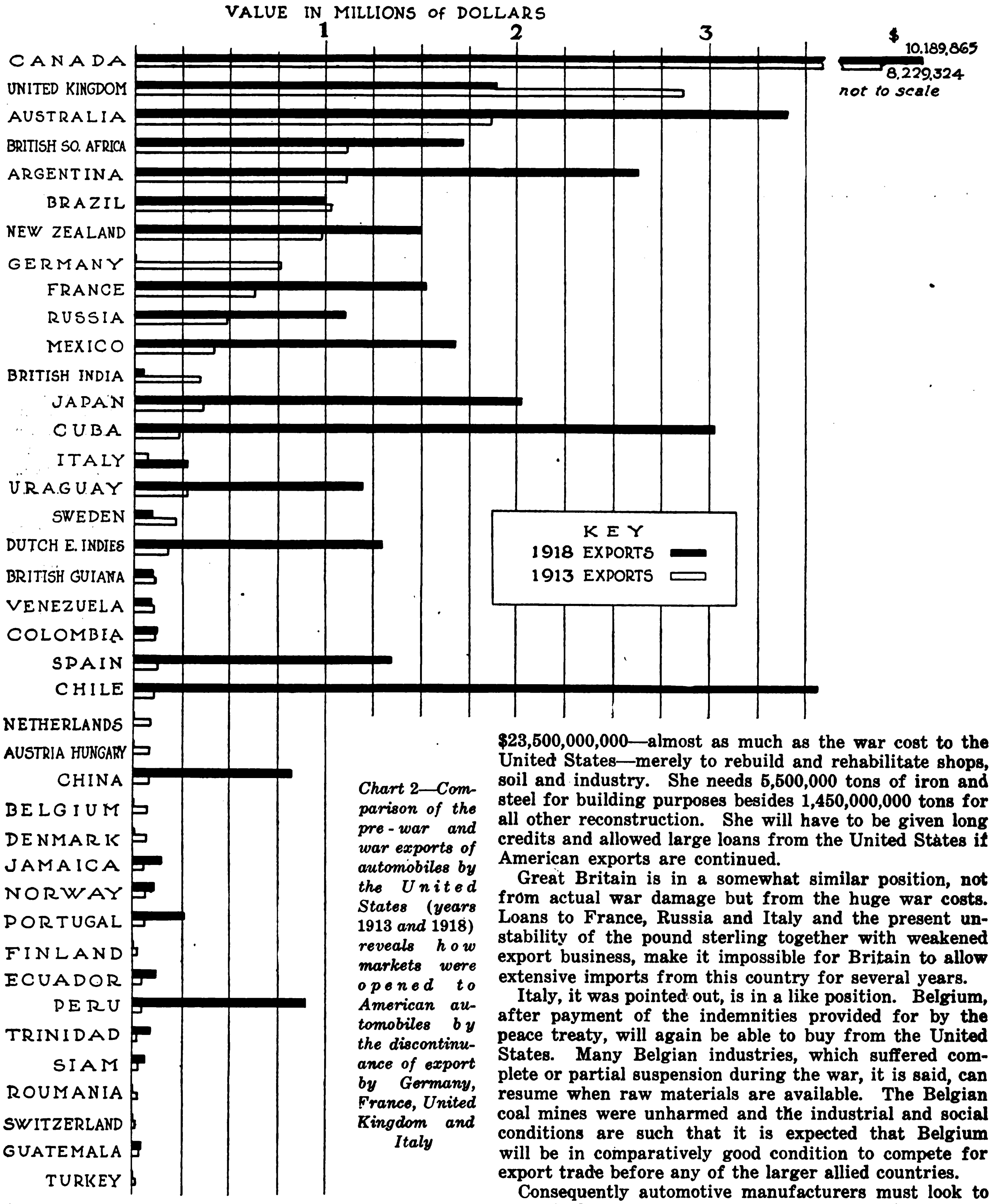


Chart 2—Comparison of the pre-war and war exports of automobiles by the United States (years 1913 and 1918) reveals how markets were opened to American automobiles by the discontinuance of export by Germany, France, United Kingdom and Italy

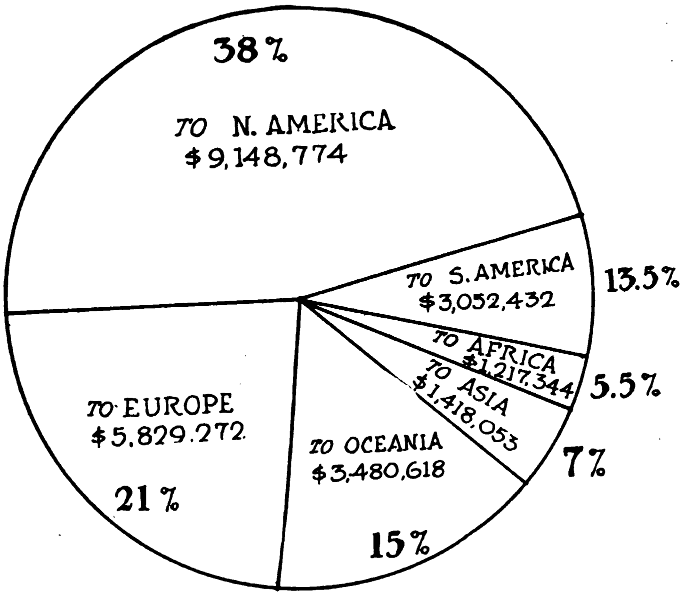
shipped from this country. This creates an unnatural trade balance and an unhealthy financial situation.

France, it was stated, is in such condition that it cannot even intelligently plan its future at present. It is short 222,000,000 tons of coal, has 250,000 miles of road to be repaired, needs 2500 locomotives and 35,000 freight cars, has $5,000,000,000 circulating in paper money against $772,000,000 gold deposit, will require $23,500,000,000—almost as much as the war cost to the United States—merely to rebuild and rehabilitate shops, soil and industry. She needs 5,500,000 tons of iron and steel for building purposes besides 1,450,000,000 tons for all other reconstruction. She will have to be given long credits and allowed large loans from the United States if American exports are continued.

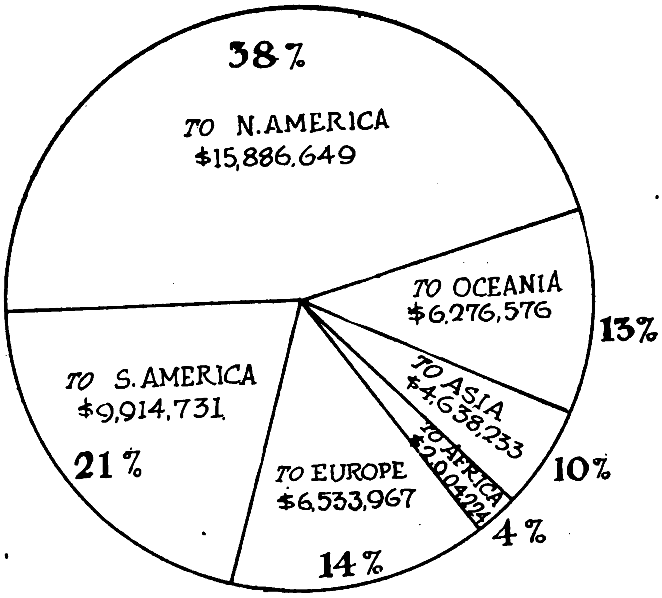
Great Britain is in a somewhat similar position, not from actual war damage but from the huge war costs. Loans to France, Russia and Italy and the present unstability of the pound sterling together with weakened export business, make it impossible for Britain to allow extensive imports from this country for several years.

Italy, it was pointed out, is in a like position. Belgium, after payment of the indemnities provided for by the peace treaty, will again be able to buy from the United States. Many Belgian industries, which suffered complete or partial suspension during the war, it is said, can resume when raw materials are available. The Belgian coal mines were unharmed and the industrial and social conditions are such that it is expected that Belgium will be in comparatively good condition to compete for export trade before any of the larger allied countries.

Consequently automotive manufacturers must look to other fields than the Allies for automotive business. The war completely upset the conditions of 1913. In Chart No. 2 it is shown that the export of automobiles by the United States increased from $24,275,793 in 1913 to $45,331,360 in 1918. The gain represents chiefly trade with countries which could no longer be supplied by Great Britain, Italy, France or Germany. As an example, our exports to Argentina increased from $1,181,735 in 1913



1913



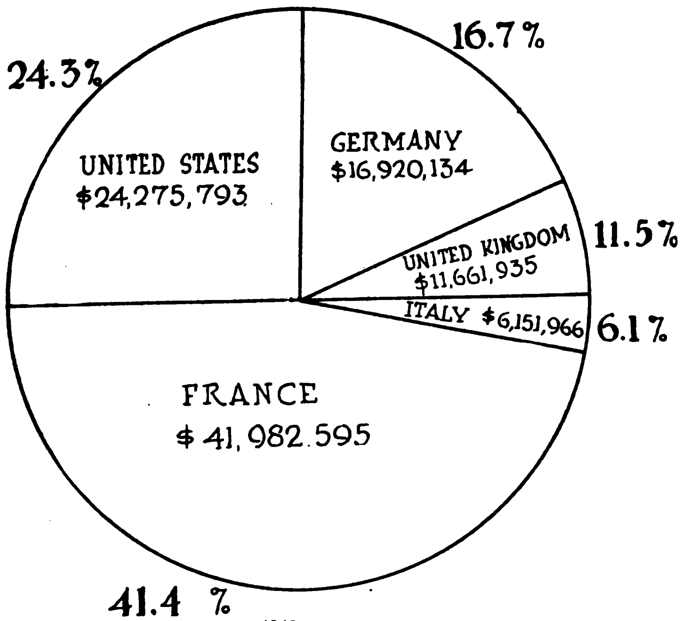
1918

Chart 3—Shipments of automobiles to North American countries were not affected by the war: South America assumed the position in 1918 that had been held by Europe in 1913, taking 21 per cent of the total exports, while Europe took but 14 per cent

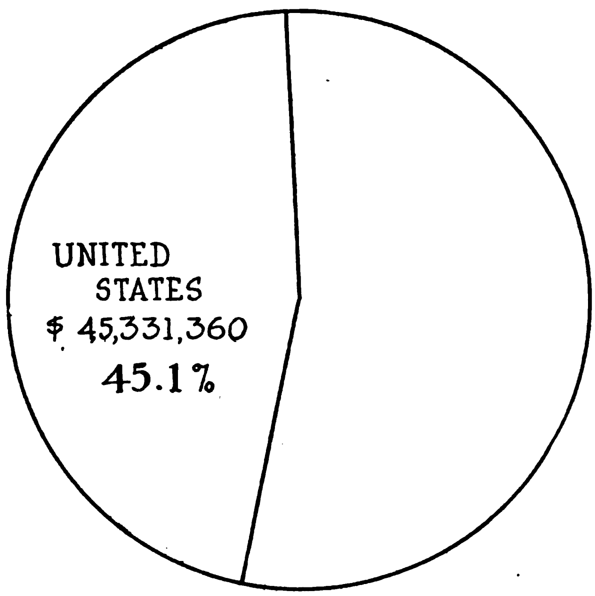
to $2,666,898 in 1918; to Uruguay from $273,253 to $1,-177,463; to Cuba from $242,686 to $3,029,813; to Chile from $109,982 to $3,576,511; to China from $90,459 to $830,997; to Spain from $127,621 to $1,346,826; to Dutch East Indies from $198,378 to $1,302,800, and to Peru from $55,646 to $913,669.

Prior to the war, as is shown by Chart No. 1, Chile purchased its automobiles chiefly from France, which shipped $606,926 worth of vehicles there in 1913; secondly from Germany, and thirdly from the United States. China made its greatest purchases from France; the Dutch East Indies from the United Kingdom, France second, Germany third, and the United States fourth. Argentina purchased chiefly from France, next from Germany and thirdly from the United States. The United Kingdom obtained its greatest imports from France and next from the United States.

By continents (chart 3) the exports of 1913, compared with 1918, show a steady increase of exports from the United States to North American countries. Exports to South America increased from 13.5 per cent to 21 per cent, while the exports to Europe decreased from 21 per cent to 14 per cent, indicating that the war had so shifted the exports to South America as to recompense American manufacturers for their losses in Europe. Africa, although increasing its exports, did not maintain a proportionate growth. Oceania, including Australia, the Philippine Islands and New Zealand, increased its purchases



1913



1918

Chart 4—The positions of the various automobile exporting nations in 1913 are clearly indicated in the above chart, which shows that France exported 41 per cent of the total as compared with 24.3 per cent shipped by the United States. With the entire world markets open, the United States shipped only $4,000,000 more of automobiles in 1918 than France exported in 1913

both in value and percentage, due to its inability to buy from Europe.

The problem consequently for the manufacturer is to develop export business among these countries to make up for losses caused by restrictions imposed by the Allies. Great Britain has temporarily allowed the American manufacturers to ship to that country 50 per cent of the number of cars sent there during the first seven months of 1913. This permission ends Sept. 1. It means that comparatively few automobiles will be exported, and those most likely will be used as demonstration and sales cars.

What will happen after Sept. 1 is problematical. It is not yet known whether Great Britain relaxed restrictions to meet the demand for passenger cars from this country temporarily, until the British manufacturers can get into production, or whether the relaxations will continue, but the wise manufacturers will base export plans on nations other than the United Kingdom. There is no prospect of business with France, which is maintaining a strict embargo, or Italy which cannot afford to buy automobiles abroad.

The most fertile fields appear to lie in South America,

Value of Germany's Car and Truck Exports

To	Passenger Cars		Trucks	
	1908	1913	1908	1913
Argentina	$50,456	$1,228,080	$20,701	$56,614
Australia	13,566	159,460	......	67,144
Austro-Hungary	421,022	1,720,026	53,074	281,316
Belgium	35,700	768,978	31,178	2,856
Brasil	35,224	857,038	......	493,850
British India	....	76,398	......	33,082
British Malacca	....	6,188	......	....
British South Africa	....	159,460	......	....
Bulgaria	....	75,446	......	29,512
Ceylon	....	34,986	......	....
Chile	....	152,558	19,990	19,516
China	....	49,504	......	....
Cuba	....	138,516	......	19,040
Denmark	39,270	625,226	13,094	28,084
Dutch East Africa	....	....	30,702	18,088
Dutch East Indies	40,698	218,960	......	27,846
Egypt	....	11,424	......	....
Finland	....	305,830	......	99,960
France	499,800	868,93[illegible]	12,614	15,232
Greece	....	29,036	......	32,368
Guatemala	....	12,138	......	....
Italy	48,076	655,448	32,368	88,964
Japan	....	42 602	......	....
Kamaroon	....	....	......	13,566
Kiao-Chau	....	17,136	......	....
Mexico	....	142,324	......	33,558
Morocco	....	....	......	138,040
Netherlands	36,652	723,758	......	71,368
New Zealand	....	12,852	......	....
Norway	22,134	167,790	......	42,364
Peru	....	17,374	......	....
Portugal	15,946	215,390	......	2,380
Roumania	78,064	214,200	......	231,098
Russia	415,548	4,232,116	151,130	778,736
Serbia	....	24,276	......	116,144
Siam	....	51,884	......	7,616
Spain	43,078	347,480	......	....
Sweden	33,558	435,540	13,566	....
Switzerland	73,780	369,614	......	37,128
Turkey	....	51,408	......	101,864
United Kingdom	429,590	1,214,752	18,564	104,720
United States	64,974	245,616	......	50,456
Uruguay	....	172,312	......	....
All other countries	98,294	58,072	43,316	71,638
Total	$2,495,430	$16,920,134	$440,300	$3,316,126

Cars and Trucks Exported by United Kingdom

	1908		1913		1917	
	No.	Value	No.	Value	No.	Value
Argentina	....	....	304	$622,333	1	$1,460
Australia	....	....	1055	1,693,625	30	43,988
Belgium	15	$30,464	154	194,908	....	......
Brasil	....	....	77	136,739	8	5,042
British India	....	....	1223	1,845,352	124	337,273
Ceylon and dependencies	....	....	178	277,887	3	8,010
Straits Settlements	....	....	285	423,79[illegible]	55	69,592
British Possessions, N. E. S.	297	458,468	381	587,464	160	150,750
British South Africa	....	....	934	1,399,255	26	34,230
Canada	....	....	169	445,338	3	5,596
Denmark	....	....	......	....	27	68,369
France	52	113,638	419	426,685	113	187,900
Germany	7	25,082	......	....	......	....
Italy	....	....	......	....	......	....
Japan	....	....	69	128,992	1	4,287
Java	....	....	77	148,574	5	6,472
New Zealand	....	....	829	1,192,760	30	39,949
Portugal	....	....	27	56,286	......	....
Russia	2	4,137	499	558,703	658	2,081,408
Siam	....	....	42	59,912	......	....
Spain	....	....	120	164,142	23	58,967
United States	23	66,871	76	290,013	31	180,762
Others	38	87,597	747	1,009,106	260	346,685
Total	434	$786,237	7595	$11,661,935	1588	$3,610,758

the Orient, neutral countries of Europe and in British South Africa. The problem rests completely on whether or not American manufacturers will be able to hold the trade gained during the war. For instance, can the American exporter hold the business of Argentina, formerly held by France and Germany; or in Mexico which originally divided purchases between the United States, France, Germany and Italy; or Spain, which, prior to the war, purchased automobiles chiefly from France?

Spain, Portugal and the Scandinavian countries are prosperous and likely fields for American sales. The Scandinavian countries favor the United States. They disliked the strict censorship of Great Britain and the hardships imposed upon them by Germany during the war. Spain and Portugal, after four years' dealing with the United States, recognize and appreciate American merchandise, and the American manufacturer has an opening in these fields to-day, with a slight advantage over the Allies, who enjoy a better location, with more prompt supply facilities.

British South Africa, which prior to the war purchased its automobiles chiefly from Great Britain, and secondly from the United States, imported $1,706,136 worth of cars from this country last year, more automobiles than it purchased in any one year from Great Britain. To hold and increase this business will demand intensive effort from American manufacturers. Great Britain will make an earnest attempt to recover her export trade in British South Africa. It is a British colony, and has the advantage of cheap parcel-post rates from Great Britain.

The Latin-American countries demand special concentration and attention from Americans. It is in this field that the losses of exports to Europe can be balanced. Argentina, Brazil, Uruguay, Venezuela, Colombia, Chile, Ecuador and Peru are buying all of their automotive products from the United States. American manufacturers and Latin-American dealers and consumers have come

France's Car and Truck Exports

French automotive exports are recorded in pound weight instead of by units or values for individual countries. The following table thus permits of comparison by weights only. The year's total value in dollars is also given.

	Passenger Cars (Lb.)			Trucks (Lb)	
	1908	1913	1915	1913	1915
Algeria	1,191,185	5,484,604	344,799	155,865	6,393
Argentina	956,444	4,079,171	173,061	208,776	......
Australia	....	301,589	....	....	......
Austria-Hungary	74,079	300,928	....	....	......
Belgium	2,545,667	9,665,407	....	535,056	......
Brasil	471,165	1,858,257	56,438	410,496	.....
British India	....	221,562	250,663	....	40,565
Canada	....	....	....	65,697	24,471
Chile	....	606,926	73,193	....	......
Colombia	....	....	....	75,177	......
Denmark	133,720	541,891	67,681	254,852	......
Dutch East Indies	....	576,503	90,609	....	......
Egypt	208,694	354,720	74,075	....	.....
Germany	2,395,178	4,685,436	....	546,961	......
Greece	....	....	140,213	59,304	91,490
Indo-China	258,855	297,401	197,973	30,203	3,307
Italy	480,667	1,315,705	1,132,723	169,754	39,021
Japan	....	....	8,598	....	......
Madagascar	....	106,041	....	....	......
Mexico	503,014	489,421	....	77,662	......
Morocco	....	677,033	162,920	214,728	91,050
Netherlands	2 8,965	456,132	204,807	....	......
Norway	....	....	46,958	....	......
Portugal	87,765	690,922	207,894	69,445	......
Russia	733,528	1,550,275	4,688,302	80,688	......
Spain	626,699	1,583,328	874,785	129,190	3,086
Switzerland	425,439	1,143,967	77,602	....	27,337
Tunis	326,087	694,670	103,616	71,870	......
Turkey	143,780	....	....	....	41,003
United Kingdom	13,460,441	13,319,532	3,179,254	147,488	......
United States	2,425,702	749,123	663,144	45,856	......
Uruguay	......	324,738	....	....	......
All other countries	467,186	1,207,018	204,366	233,026	44,974
Total lb	28,064,278	53,284,300	13,023,674	3,708,578	457,763
Value in dollars	$24,568,654	$41,982,595	$13,111,696	$1,914,753	$353,149

to a closer co-operation and understanding. South America is now so completely accustomed to American cars, so thoroughly prepared to make and adjust repairs and maintain American cars, that this business, which increased from $3,052,432, in 1913, to $9,914,731 in 1918, should be easily maintained and extended. There is little likelihood that Argentina, for example, will again turn to France or Germany for automobiles in preference to the United States product, if American manufacturers will study the habits and customs of the Argentine folk, and meet them with honest, fair, and intelligent business.

It is likely that Australia, which, prior to the war, purchased its automobiles in slightly greater quantities from the United States than from Great Britain, and which increased its purchases from $1,896,990, in 1913, to $3,410,557 in 1918, will continue to buy chiefly from this country unless the trend of the trade is changed by restrictions.

Similarly with New Zealand, which increased its purchases from the United States 50 per cent during the war. Before the war this was chiefly British trade. It is possible for American manufacturers to hold this gain.

Briefly, therefore, the problem confronting the American automobile exporter is to develop further those countries which turned to the United States during the war, to head off European competition, and particularly to study each individual market exhaustively, to learn its requirements so thoroughly that the foothold that Ameri-

Value of Italy's Car and Truck Exports

To	Passenger Cars			Trucks		
	1908	1913	1915	1908	1913	1915
Albania	......	....	$229,863	.....	....	....
Algeria	......	$19,204	....	.....	....	....
Argentina	$571,087	725,131	77,779	.....	$30,969	....
Australia	105,185	320,959	329,787	.....	3,474	$52,110
Austria-Hungary	342,548	247,600	11,387	.....	386	38,600
Belgium	12,738	207,475	211,528	.....	....	124,785
Brasil	44,583	398,510	28,564	.....	49,309	....
British India	1,544	9,650	146,574	.....	1,544	100,360
British South Africa	......	....	....	.....	772	....
Bulgaria	......	27,599	11,580	.....	....	....
Central America	16,019	5,115	....	.....	....	....
Chile	5,394	41,665	15,633	.....	3,860	3,860
Cuba	......	26,634	17,756	.....	....	....
Denmark	......	3,860	9,650	.....	....	....
Dutch East Indies	14,475	86,946	151,601	.....	....	13,124
Ecuador	......	1,448	....	.....	....	....
Egypt	14,089	2,316	1,544	.....	....	....
Eutrea	3,474	1,544	....	.....	....	....
France	598,676	748,454	1,023,189	$5,465	14,282	4,792,865
French Asiatic Colonies	......	3,474	....	.....	....	....
Germany	555,587	118,058	199,562	.....	1,737	45,838
Greece	2,316	15,857	65,967	.....	42,267	77,200
Italian Somaliland	......	1,930	386	.....	....	3,474
Japan	4,825	79,806	19,493	.....	....	....
Malta	6,755	2,895	....	.....	....	....
Mexico	......	13,317	....	.....	....	....
Montenegro	......	15,054	....	.....	....	....
Morocco	......	4,632	4,632	.....	....	....
Netherlands	66,585	117,344	33,582	.....	1,158	....
New Zealand	......	2,895	....	.....	....	....
Norway	......	15,054	43,040	.....	....	....
Peru	......	5,790	....	.....	....	....
Portugal	3,800	79,516	16,453	.....	....	215,967
Portuguese Africa	......	1,075	....	.....	....	....
Roumania	2,895	184,508	75,849	.....	....	188,175
Russia	55,102	385,923	822,277	.....	216,160	523,416
Salvador	......	....	2,316	.....	....	....
Serbia	......	18,528	4,246	.....	....	....
Siam	......	1,930	6,948	.....	5,970	3,474
Spain	23,259	71,796	89,601	.....	....	127,573
Spanish Africa	......	13,124	....	.....	....	....
Straits Settlements	......	21,230	25,832	.....	....	....
Sweden	......	17,352	12,352	.....	....	....
Switzerland	1,030,458	219,523	65,331	63,304	10,914	16,984
Tripoli	......	20,643	2,895	.....	44,236	....
Tunis	2,895	....	....	.....	....	....
Turkey in Asia	3,860	....	....	.....	....	....
Turkey in Europe	42,508	33,601	....	.....	15,722	....
United Kingdom	1,296,670	1,396,207	1,184,909	.....	....	587,492
United States	663,534	182,983	44,766	3,860	....	....
Uruguay	3,860	53,804	30,108	.....	2,316	....
Total	$5,449,692	$6,151,966	$5,310,000	$72,629	$444,956	$6,915,267

Italy's Exports Are Classified as Follows:

Weight (Kilograms*)	Value		
	1908	1913	1915
Passenger cars:			
Under 500	$104,317	$10,461	$7,262
500-1,000	1,812,193	2,282,225	1,204,687
Over 1,000	3,533,182	3,859,280	4,165,313
Trucks:			
Under 1,000	1,544	28,477	334,865
1,000-3,000	44,030	369,927	5,765,180
Over 3,000	26,055	46,552	815,222

*Kilogram = 2.2406 lb.

can manufacturers have gained will be extended. If the American manufacturers ignore the requirements of the individual countries they may take it for granted that England, Germany, Italy and France will quickly recover their losses.

The automobile business formerly held by Europe is not to be despised. In 1913 Germany exported $16,920,134 worth of automobiles and $3,316,126 worth of trucks; France, $41,982,595 worth of passenger cars and $1,914,753 worth of trucks; Italy, $6,151,968 worth of passenger cars and $414,956 worth of trucks, and the United Kingdom, $11,661,935 worth of passenger cars and trucks, a total of $82,362,465, as compared with $24,275,793 worth of passenger cars and $1,737,141 worth of trucks which were exported by the United States. These huge exports were made before Europe learned the massed production that has come out of the war, and it is a certainty that unless the American manufacturer employs all his skill, not only in production but also in engineering and merchandising, he will find the export automobile business going back into old channels.

ITALIAN TRACTOR DEMAND

WASHINGTON, June 10.—Italian demand for tractors will be slight in the immediate future, according to a report by Commercial Attaché A. P. Dennis. The government purchased a heavy stock in the country during the war and there are now 6000 American tractors in Italy, while outstanding contractors with domestic concerns call for 1500 more. The sales to individual farmers are negligible. The government purchases the tractors and sends them out in squadrons of ten in charge of a non-commissioned military officer, who plows for farmers in the vicinity at so much per acre.

The plowing is quite unlike the customary American methods. The conventional plow in the plains of Lombardy is a heavy implement, ordinarily of German manufacture, with a moldboard from 18 to 21 in. deep and a superimposed jointer for the better spreading of the deep upturn of land. The combined effort of 8 to 12 oxen is required to operate this plow, and when a heavy type is used the services of two men are also required.

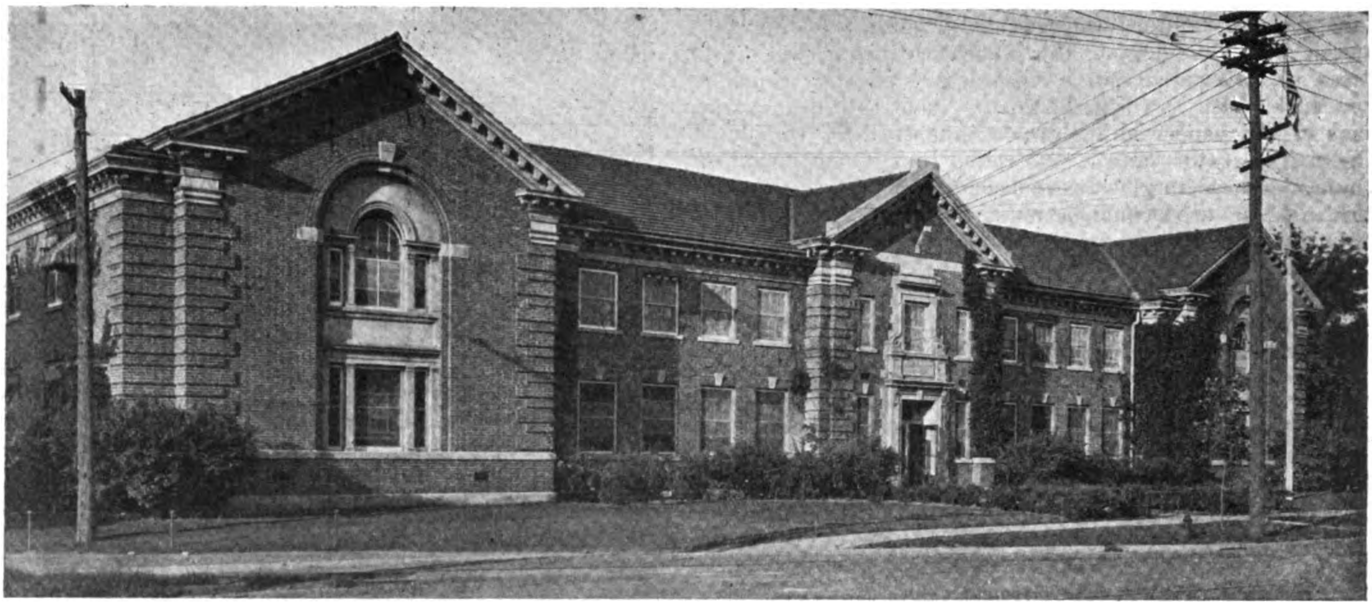
The weighty army tractors, which have been tried out for this service, are not adapted to the work, as two of the wheels must run either in the furrow or on the turned earth, whereas all the heavy-bearing wheels should track on the unturned soil. The reason for plowing to the depth of 20 in. is to conserve moisture.

United States Exports of Passenger Cars

	1908	1913	1918
Europe:			
Austria-Hungary	*4* $3,218	*134* $91,781	....
Azores & Madeira Is.	....	*16* $10,549	....
Belgium	*14* $36,900	*94* $85,679	....
Bulgaria	....	*17* $11,457	....
Denmark	*10* $9,045	*81* $77,149	*2* $4,100
Finland	....	*51* $53,568	....
France	*191* $669,405	*818* $615,086	*1,169* $1,518,858
Germany	*68* $171,293	*845* $764,389	....
Gibraltar	....	*7* $6,576	....
Greece	....	*5* $4,080	*4* $6,580
Iceland and Faroe Is.	....	*2* $1,016	*15* $11,396
Italy	*73* $243,744	*331* $280,961	*129* $78,228
Malta, Gozo & Cyprus Islands	....	....	....
Netherlands	*19* $43,699	*111* $94,163	....
Norway	*3* $5,751	*78* $66,689	*97* $115,810
Portugal	*1* $1,226	*73* $58,931	*223* $270,987
Roumania	*3* $4,941	*38* $30,337	....
Russia in Europe	*32* $37,243	*580* $484,913	*492* $1,136,400
Serbia, Montenegro & Albania	....	*2* $1,160	....
Spain	*5* $3,855	*186* $127,621	*1,205* $1,346,826
Sweden	*16* $20,409	*256* $235,918	*95* $111,377
Switzerland	*1* $608	*22* $24,965	*3* $1,533
Turkey in Europe	*1* $807	*13* $9,814	....
England		*3,783* $2,893,785	*742* $1,712,672
Scotland	*757* $1,621,516	*6* $8,104	*150* $217,000
Ireland		*6* $5,538	....
North America:			
Bermuda	*1* $1,800	....	....
British Honduras	....	*1* $1,800	*8* $6,858
Canada	*385* $700,504	*6,723* $8,229,324	*12,985* $10,189,865
Central American States:			
Costa Rica	*2* $1,336	*13* $14,955	*199* $85,070
Guatemala	*6* $11,550	*10* $14,892	*34* $46,657
Honduras	....	*4* $8,100	*16* $12,292
Nicaragaua	....	....	*49* $32,031
Panama	*7* $4,926	*39* $43,432	*129* $93,329
Salvador	*1* $1,700	*11* $13,212	*54* $68,297
Greenland	....	....	....
Mexico	*244* $354,338	*235* $423,123	*2,578* $1,653,545
Miquelon, Langley & St. Pierre Islands	....	....	....
Newfoundland & Labrador	*2* $6,500	*9* $10,353	*27* $34,676
West Indies, British:			
Barbados	....	*7* $5,793	*58* $33,198
Jamaica	....	*62* $59,131	*236* $149,673
Trinidad & Tobago	*28* $45,866	*43* $39,902	*161* $100,571
Other British	....	*7* $6,716	*80* $50,009
Cuba	*105* $157,081	*223* $242,686	*2,846* $3,029,813
Danish (Virgin Is. of U. S.)	....	*4* $2,131	*152* $12,313
Dominican Republic	*1* $2,000	*7* $5,382	*248* $157,607
Dutch	....	*19* $14,590	*12* $7,435
French	....	*5* $3,877	*248* $146,698
Haiti	....	*38* $24,499	*102* $54,613

	1908	1913	1918
South America:			
Argentina	*70* $72,396	*1,062* $1,181,735	*3,525* $2,666,898
Bolivia	....	*2* $1,493	*152* $105,408
Brazil	*55* $97,363	*987* $1,035,247	*1,575* $1,000,011
Chile	*15* $20,045	*78* $109,982	*3,399* $3,576,51
Colombia	*1* $500	*110* $113,334	*164* $121,422
Ecuador	*4* $2,453	*74* $55,372	*142* $130,086
Falkland Is.	....	....	....
Guiana, British	*1* $765	*18* $114,313	*180* $100,546
Dutch	....	....	*16* $17,775
French	....	*1* $558	*8* $3,632
Paraguay	*1* $557	....	*13* $5,025
Peru	*8* $6,790	*70* $55,646	*784* $913,669
Uruguay	*8* $13,142	*209* $273,253	*2,232* $1,177,463
Venezuela	....	*104* $109,499	*160* $97,485
Asia:			
Aden	....	*15* $7,998	*8* $6,879
China	*7* $7,471	*89* $90,459	*833* $818,659
China, British	....	....	*6* $3,000
China, French	....	....	*2* $2,017
China, Japanese	....	....	*10* $7,321
Chosen (Korea)	....	*7* $6,095	*2* $1,300
East Indies, British:			
British India	*11* $9,970	*439* $355,573	*73* $53,428
Straits Settlements	*16* $12,625	*387* $319,247	*287* $202,221
Other British	*2* $1,375	*39* $31,245	*11* $17,749
Dutch	*117* $79,989	*278* $198,378	*1,272* $1,302,800
French	....	....	*18* $21,175
Hongkong	*3* $2,308	*7* $6,673	*117* $9,122
Japan	*7* $17,230	*312* $364,507	*2,149* $2,040,897
Persia	....	....	*2* $1,048
Russia in Asia	....	*1* $1,160	*5* $8,425
Siam	*5* $2,959	*56* $35,934	*65* $60,220
Turkey in Asia	....	*1* $824	....
Oceania, British:			
Australia	*87* $74,175	*2,085* $1,896,990	*4,307* $3,410,557
New Zealand	*59* $72,647	*958* $990,837	*1,818* $1,453,311
Other British	....	*3* $2,396	*30* $20,863
French	....	*11* $14,005	*12* $7,612
German	....	*1* $350	*12* $11,029
Philippine Islands	*16* $14,897	*517* $577,040	*1,714* $1,373,204
British Africa, West	....	*4* $2,688	*202* $115,772
South	*2* $1,147	*1,279* $1,157,895	*2,142* $1,706,136
East	....	*14* $12,802	*112* $75,778
Canary Islands	*1* $1,426	*10* $6,426	*15* $5,378
Egypt	*1* $3,500	*16* $10,156	*21* $17,300
French Africa	....	*10* $7,297	*121* $50,550
German Africa	....	*5* $3,175	....
Italian Africa	....	....	....
Liberia	....	*1* $805	*12* $4,220
Madagascar	....	....	*2* $1,659
Morocco	....	....	*35* $17,718
Portuguese Africa	....	*20* $16,102	*9* $9,673
Totals	*2,477* $4,656,991	*24,293* $24,275,793	*52,312* $45,331,360

The figures in *italics* denote the number of passenger cars exported to each country.



Main building, Forest Products Laboratory, Madison, Wis.

Waterproof Plywood for Airplanes

Decision to Build DH-4 Machine in This Country Created Large Demand for Plywood—Waterproof Glue the Chief Technical Problem Involved—Strength Tests Made

WHEN plywood was recognized as a structural material for use in aircraft early in 1917, it became necessary immediately to insure its production in quantity and to improve the quality of the commercial product. Before the war plywood was made up with vegetable or cheap animal glues, neither of which was water resistant. Attempts had been made in a small way both in this country and abroad to introduce waterproof plywood made with blood albumin glue, but its use was not general and the methods of manufacture were more or less trade secrets. The first investigations of the U. S. Forest Products Laboratory at Madison, Wis., had shown that the commercial water resistant glues in this country were scarce and unsatisfactory. In fact, only four or five of those submitted by various manufacturers were even promising.

Late in 1917 the decision to build the DH-4 model in this country created a demand for large quantities of waterproof plywood, and it appeared that the supply of waterproof glue would be the controlling factor in the production of this material. Accordingly at the request of the Army and Navy Aircraft bureaus, the Forest Products Laboratory attacked the problem from the following angles:

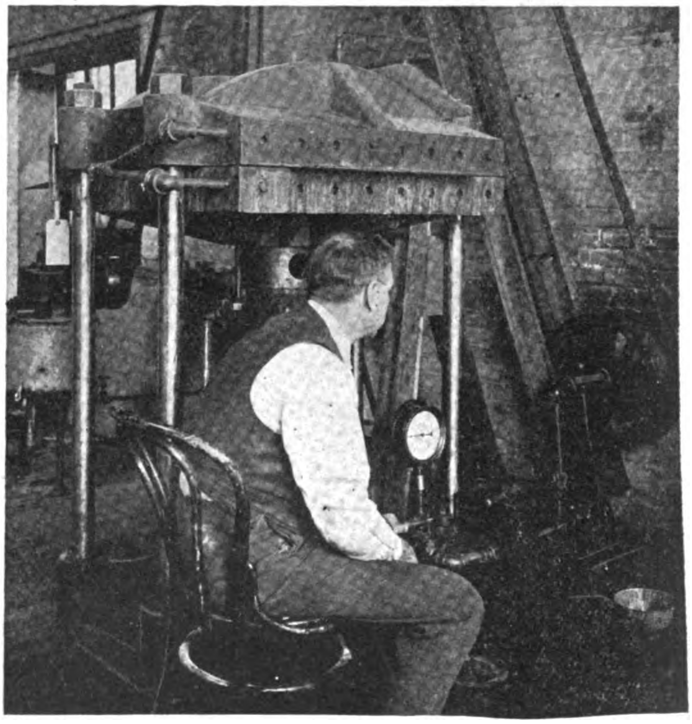
(1) Development of water resistant glues and assistance in securing their manufacture in quantity.

(2) Development of testing methods for water resistance and strength of glues and performance of routine tests on samples sent in by inspectors and manufacturers.

(3) Recommendation of glue and plywood specifications.

(4) Study of the properties of plywood as a material.

Investigation of the quantity production possibilities of water resistant glue made it very soon apparent that the supply of blood albumin would be inadequate and that if blood albumin glue only were used, the cost of the plywood would be extremely high. Meanwhile, having found



Gluing an experimental plywood panel with blood albumin glue. The press is steam heated and hydraulically operated

one company which was producing water resistant plywood with casein glue, the laboratory began work and soon demonstrated that a satisfactory plywood could be produced with this type of glue. About this time a census of the veneer and plywood industry was completed by the laboratory and it was found that if both blood albumin and casein glues were used, almost unlimited quantities of plywood could be made. The general situation was therefore relieved and the price of plywood steadily reduced.

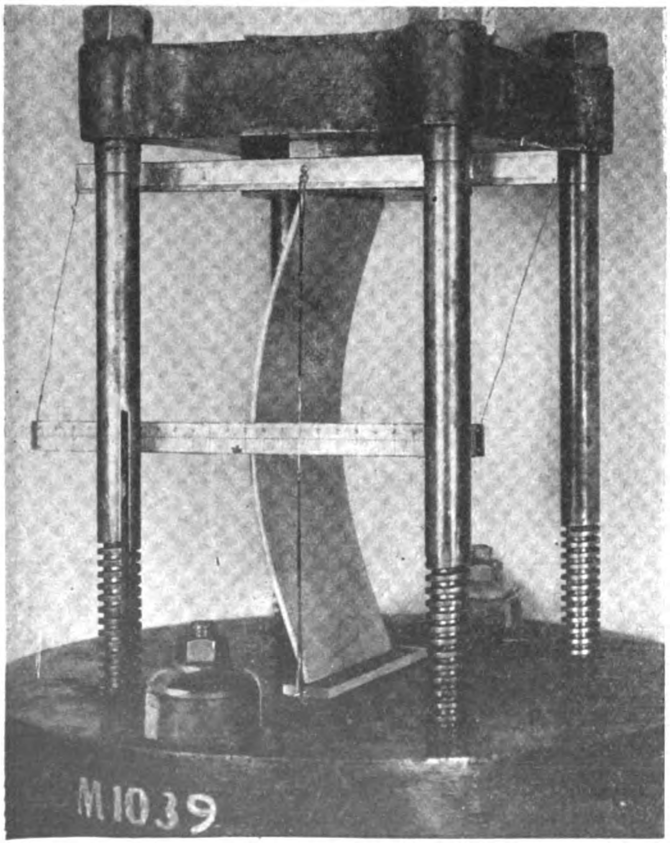
Aircraft manufacturers at this time showed a decided preference for non-waterproof plywood and it was only because the Forest Products Laboratory could supply information on the possible production of the waterproof product, together with data upon its advantages here and abroad, that waterproof specifications were adopted. It appears probable that the adoption of the non-waterproof specifications would have resulted in very few of the machines constructed from plywood reaching Europe intact.

By this time the Signal Corps had completed the organization of a plywood inspection section, and the laboratory was receiving samples of plywood almost daily from new manufacturers who desired their product tested.

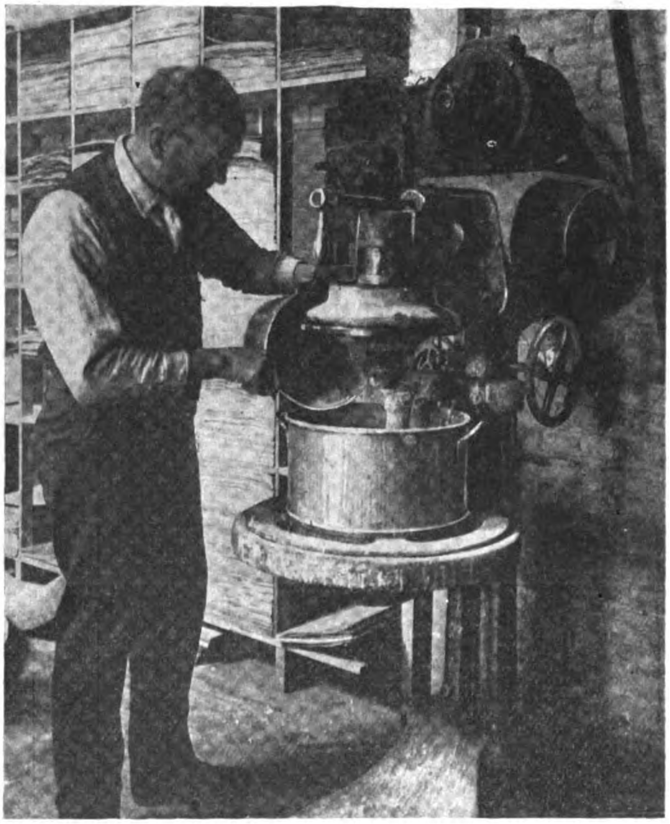
A glue inspection organization had also been started and headquarters established at the Forest Products Laboratory with a senior inspector from the Signal Corps in charge. The glue inspection force worked in close cooperation with the laboratory in the matter of glue specifications and procedure for inspection and certification of aircraft glues.

Work was under way on the development of casein glues and contact with casein producing companies and glue manufacturing companies had become well established.

During April, 1918, two commercial water-resistant casein glues were tested for shear strength in joint work



Strength test of veneer panels



Mixing a full-sized batch of casein waterproof glue

and they both developed strength equivalent to that of high grade non-waterproof hide glue. Two water-resistant glue formulas developed by the laboratory had also been supplied to certain manufacturers of glue and plywood and numerous companies were becoming interested in waterproof plywood manufacture.

During the summer of 1918 a method of gluing very thin plywood was developed and demonstrated on a commercial scale at two plants by representatives of the laboratory. The process involved the coating of tissue paper with blood glue, drying this sheet and using it with the veneer instead of a wet glue. This material was not found as suitable a substitute for linen as it first gave promise of being and but little of it was manufactured. A similar process was developed for gluing the linen fabric on propellers and satisfactory blood albumin tapes were also developed for use in taping plywood.

While the work which has been described was under way at the laboratory, additional activities of a less spectacular nature were also having their effect upon the improvement of quality and increase in production of water resistant plywood. Methods of manufacturing casein and blood albumin were investigated and specifications prepared for these and other glue constituents. Improvements were also suggested for glue manufacture and use, especially along the lines of mixing and applying glues, testing samples of plywood for strength and water resistance when sent in by manufacturers and Bureau of Aircraft inspectors, training of these inspectors in glue and plywood manufacture and solving specific problems submitted by various departments of the army and navy aircraft bureaus.

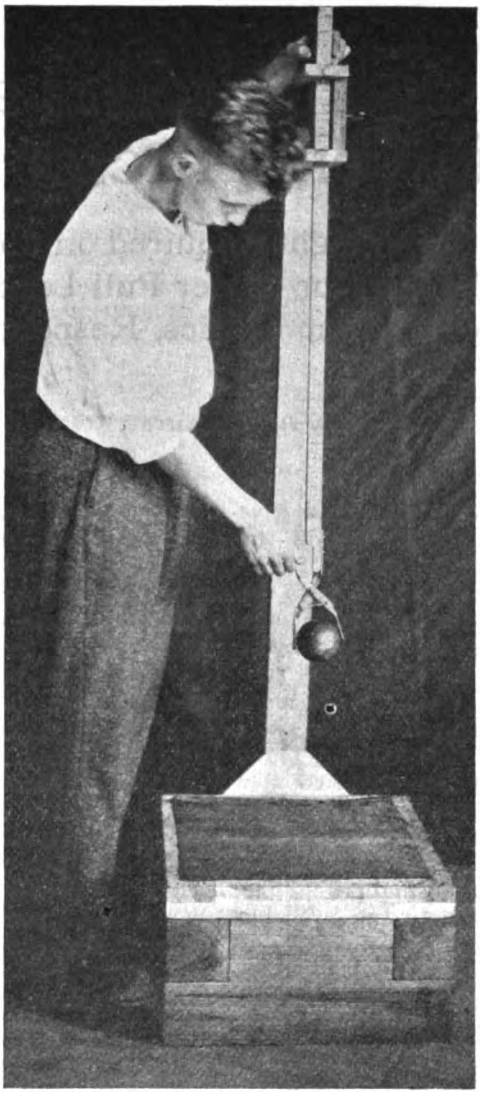
The wide distribution of the results of this work was especially helpful to manufacturers. Experts from the laboratory also made trips into the field and on numerous occasions "trouble men" were sent out to panel factories for periods ranging from a few days to one month. Their work ranged from correcting the practice of mix-

ing a glue or adjusting a press to a complete analysis of all factors of production to locate some small but important trouble.

The total result of the work of the laboratory on water-resistant glues and plywood may be summarized by saying that it practically meant the developing of a new industry, the improvement of its product to the essential degree and the saving of more than $6,000,000 to the Government by removing scarcity of plywood as a controlling factor in aircraft production.

Plans for an extensive series of tests to determine the physical and mechanical properties of plywood were drawn up in September, 1917, and the testing was begun early in October of the same year.

In outlining a series of tests for plywood, the attempt was made to test for those properties of plywood that make it a unique material of construction for airplanes. Inasmuch as the strength of plywood depends upon the direction in which the forces act, tests were made to determine the bending and tensile strength, parallel and perpendicular to the face of the panel. A piece of apparatus was devised for determining the relative resistances to splitting of plywood made of various combinations of veneer. Tests were also made to determine the relative resistances of various plywoods with conditions that tend to warp the plywood, as, for example, wetting on one face. In a series of tests to determine the physical and mechanical properties of plywood made of various species of veneer panels of eight thicknesses were tested, ranging in thickness from 3/30 of an inch to 3/6 of an inch. Moisture and density determinations were made on all test specimens. One series consisted of about fifty (50) tests and to date more than one hundred (100) series of tests have been made, which covered about thirty (30) species.



Toughness test on thin plywood

In addition to the extensive series of tests on various species of plywood, tests were also made on plywood consisting of combinations of several species of veneer; also on plywood consisting of five, seven and nine plies. Reports were issued from time to time embodying the results of the strength tests. On the basis of the tests made a specification for plywood was drawn up and submitted to the Specification Section of the Bureau of Aircraft Production. The list of species recommended included several species that had not previously been used and that the tests showed to be satisfactory, and omitted other species that were not as satisfactory.

A classification of species into four (4) groups was also drawn up. This classification gives a brief description of the mechanical properties of the species grouped and points out specific uses for airplane parts for which particular species would be satisfactory.

Detailed recommendations were made from time to time governing the species to use for particular airplane parts made of plywood. A plywood table was drawn up, giving the species, thicknesses, position of plies and number of plies to use for each plywood panel in the USD-9 airplane. Similar tables were prepared for the DeHaviland-4 and the Lepere planes.

The tests initially made to determine the relative resistances of plywood to weathering made of various species of veneer proved to be unsatisfactory, so another test was devised. In the latter test the panels were subjected to high humidities to change their moisture content and subsequently they were exposed to brilliant sunshine to lower their moisture content. Warping measurements were made at various stages. These tests showed that as a rule the species of low density were inclined to warp less than the species of high density. The tests also showed that a high ratio of core to total plywood thickness is also favorable to a reduction of warping. Panels in which the center ply is of low density veneer also warp less than panels in which the center ply is of high density veneer of the same weight.

A series of tests to determine the relative strength of screw and nail fastenings of plywood was inaugurated. The tests completed to date show that screw fastenings were generally superior to nail fastenings even when the nail used is twice as long as the screw. The tests also show that the strength of fastenings increase with the density of the plywood.

A series of tests to determine the shear strength of plywood was started. Tests have been completed on plywood in which the distance between the shear forces and width of the member was varied. The shear strength of plywood parallel to the grain of face, while not very much higher than the shear strength of the wood parallel to the grain, is nevertheless superior to the latter, inasmuch as sudden failure does not occur. A lower factor of safety may consequently be used when designing plywood parts that are subject to shear. Shearing strength of plywood when the force is exerted at 45 deg. to the direction of grain of face is stronger than wood parallel to grain of face and advantage has been taken of this fact in designing plywood members. Tests are still in progress to determine the shear strength of plywood made of various species of veneer and to determine the relative shear strength of plywood made of various numbers of plies. An extensive series of tests to determine the bearing strength of plywood made of various species of veneer and various numbers of plies is now in progress.

The effect of varying the sizes of the bolt, the thickness of the plywood and the direction in which the force is applied are being investigated.

A series of tests to determine the effect of the method of cutting veneer on the strength of plywood was completed. These tests were made on five species in which veneer was cut from the same log by each of three processes. They show that in general the method of cut-

(*Continued on page* 1359)

The Influence of Hitches and Drawbar Location on Tractor Design

A Method of Calculating the Weight Required on the Front Wheels to Prevent Rearing of the Tractor Under Full Load, on the Level and on Steep Grades, Respectively

By A. W. Scarratt*

SEVERAL articles have appeared in the automotive magazines in the past few months which show the importance of proper drawbar implement hitches and how to make them, but nothing has appeared, to the writer's knowledge, which explains clearly the influence of hitches and drawbar location as related to tractor design. The purpose of this article is to cover this subject, as related to the four-wheel-type of tractor or modern design, in simple language and figures.

Let us consider first the case of a tractor doing plowing on tough, level land, equipped with an engine capable of delivering 30 hp. maximum at the flywheel, and weighing, completely equipped, 4500 lb., or 150 lb. per brake horsepower.

In order to determine the required weight distribution, we must first endeavor to compute the probable maximum drawbar pull and to establish its point of application. Two factors enter here, namely, speed or rate of travel, and efficiency. Two hundred feet per minute or 2.27 miles per hour is a good lively plowing speed for heavy work, and the efficiency or drawbar power consists of what is left after we deduct the rolling resistance of the tractor, the transmission losses, and the slippage at the drive wheels.

These three items can be approximated as follows:

1. Rolling resistance about 15 per cent of engine power.
2. Transmission losses—about 12 per cent of engine power.
3. Slippage—about 8 per cent of engine power.

Slippage is one thing often lost sight of and it is easy to lose sight of 8 per cent. That is just a nominal slippage. You can hardly notice it.

Adding up these three losses, we find that 35 per cent of the engine power has disappeared and that we have 65 per cent left to work with, which if converted into drawbar pull means 3200 lb. at a speed of 200 ft. per minute. This, therefore, is a three- to four-plow tractor, depending on the ground conditions, and being of compact, enclosed, modern design it will operate with the right-hand drive wheel in the furrow.

On a tractor designed to operate as stated, the drawbar should be located at least 14 in. above the bottom of the drive wheels—for two reasons:

First, to attach to the plow at a proper height.

Second, to have a reasonable ground clearance beneath the drawbar.

We now have the information necessary to proceed with the design of the tractor, namely, the weight of the tractor, the drawbar pull, the height of the drawbar, and the speed.

*Editor's Note.—A. W. Scarratt is tractor engineer for the Minneapolis Steel & Machinery Co., and as such has given special attention to the subject of tractor hitches.

By referring to Fig. 1 we find that there are a number of forces both active and reactive to be considered, and our object is to determine the magnitude and position of these forces in order that the system will balance, for in order to obtain equilibrium the moments of the active and reactive forces must be equal.

The one active force with which we are concerned is the tangential load applied at the rim of the main drive gear which tends to raise the front end of the tractor; this is indicated by F_1. In order to overcome the opposing loads the moment of this force must be greater than the moments of the forces acting against it.

We have assumed that the transmission loss is 12 per cent., or 4 per cent for each of three gear reductions. Then the power delivered at the rim of the main gear would be 92 per cent of the engine power, or 27.6 hp. As we are considering a slippage of 8 per cent, the speed of 200 ft. per minute is only 92 per cent of the rim speed of the drive wheels, which we will assume to be of 26 in. radius. In other words, the actual rim speed is 217 ft. per minute. Since in this case the radius of the main gear is 13 in., or one-half of the wheel radius, the pitch line velocity of the gear is 108.5 ft. per minute.

Therefore the force at the pitch line of the main drive gear—

$$F_1 = \frac{\text{Hp.} \times \text{constant}}{\text{velocity}} = \frac{27.6 \times 33{,}000}{108.5} = 8400 \text{ lb.}$$

This force naturally tends to lift the front end of the tractor and is only prevented from doing so by two reactive forces, namely, the drawbar pull W_1 and the front end weight W_2.

We know the position, direction and magnitude of W_1, and we also know the position and direction of W_2. What we want to know is the required magnitude of W_2.

It will be well to notice here that these forces all center about the rear axle, that all tendency to rotate is about the rear axle, and not the point of contact between the drive wheels and the earth. Therefore all moments must be computed, using the rear axle as the fulcrum point.

Then since the active and reactive forces are equal and opposite,

$$F_1 \times 13 = (W_1 \times 12) + (W_2 \times 84)$$
$$\text{or } 8400 \times 13 = (3200 \times 12) + (W_2 \times 84)$$
$$\text{or } 109{,}200 = 38{,}400 + (W_2 \times 84)$$
$$\text{or } 70{,}800 = (W_2 \times 84)$$
$$\text{from which } W_2 = 850 \text{ approximately.}$$

That is, W_2 must be 850 lb. in order to keep the tractor from overturning on level ground. This, however, provides no necessary weight for steering the tractor, and makes no allowance for the increased weight which is necessary when operating on heavy grades.

In a three-plow tractor there should be a surplus of about 400 lb. weight at the front end to permit of proper guidance at all times and also as an extra safeguard against overturning.

It may be well to mention here the fact that when the load is picked up very suddenly by engaging the clutch too rapidly, the power transmitted momentarily is far in excess of the maximum engine power. It is equal to maximum engine power plus the power derived from the stored-up energy in the flywheel. This condition, due to careless operation, has tipped many tractors over which would be safe if properly handled. But careless operation will be encountered and tractors must be made foolproof as far as possible.

From the foregoing it will be seen that the location and intensity of the drawbar pull have a very definite influence on tractor design.

But the example just covered is not the one which governs, so let us consider the operation of the tractor on a heavy grade of say 30 per cent, as other conditions are met with here.

Now, maybe you think 30 per cent is not a heavy grade. Well, the next time you are out plowing up and down a hill that you guess is about 50 per cent, just get a long timber and a spirit level and find out what it is; chances are that it will be about 25 or 30 per cent.

To start with, the efficiency of the tractor will not be as high; that is, you will not have 65 per cent of the engine power available at the implement, for the following reasons: More power will be required to roll the tractor up hill against the force of gravity, the footing will most likely not be as good, causing increased slippage, and the heavy implement itself must be dragged up hill against the force of gravity, thereby absorbing a great portion of the power which was available at the drawbar on the level.

We assumed previously that the rolling resistance of the tractor itself would be 750 lb. on level ground. The rolling resistance on a 30 per cent grade will be just 1350 lb. more, making the total draft 2100 lb. for this 4500 lb. tractor, provided the ground surface is just as good. With an increase in wheel slippage to 12 per cent we find that the drawbar pull has dropped to 34 per cent of the engine power, or 1700 lb., the losses being as follows:

Rolling resistance	= 42 per cent
Transmission losses	= 12 per cent
Slippage	= 12 per cent
Total	66 per cent

By referring to Fig. 2 you will note that we still have force F_1 = 8400 lb., and we also have force W_1, but it is now only 1700 lb., hence we are going to need more front end weight.

We must now endeavor to determine this weight, but we shall have to first assume what we think would have been a correct front end weight in Fig. 1. Let us take this to be 1700 lb. Then the center of gravity (fore and aft) would be 32 in. ahead of the rear axle. However, when standing on a 30 per cent grade this dimension is reduced to 27.8 in.

Now we will assume that W_2 acts downward 27.8 in. ahead of the rear axle.

$$\begin{aligned} \text{Then } F_1 \times 13 &= (W_1 \times 12) + (W_2 \times 27.8) \\ \text{or } 8400 \times 13 &= (1700 \times 12) + (W_2 \times 27.8) \\ \text{or } 109{,}200 &= 20{,}400 + (W_2 \times 27.8) \\ \text{or } 88{,}800 &= (W_2 \times 27.8) \end{aligned}$$

From which W_2 = 3200 lb., or the weight required to prevent the tractor from overturning on a 30 per cent grade. Since the center of gravity is 32 in. ahead of the rear axle when the tractor is on a horizontal plane, the resulting weight at the front wheels would be 1220 lb., which leaves a balance of 480 lb. overweight for steering when we have a total of 1700 lb. at the front end.

It is, therefore, very clear that the later case governs the design, and it should also be clear that to arrive at a correct tractor design the drawbar and its location must be carefully and primarily considered.

Incidentally, this also shows clearly the marked advantage which a light-weight, powerful tractor has when operating in hilly country, as compared to the average tractor which weighs about 300 lb. per brake horsepower of the engine. If the tractor considered in this article weighed 300 lb. per brake horsepower, or 9000 lb., it could barely propel itself up the grade considered.

As plowing is the heaviest work which a tractor is called upon to perform, the drawbar location for this class of work should be most favorable. A vertical adjustment at the tractor will hardly be required, but a sideways adjustment should be provided by all means in order that the plow may be hitched to the best advantage regardless of the number of bottoms, and right here it will be well to remember that what may be a four-plow tractor in some places is a two-plow tractor in others.

For discing, harrowing and seeding it would probably be advantageous to be able to hitch at a higher level than for plowing. There are many implements of this type in use intended to be horse-drawn which could easily

(Continued on page 1359)

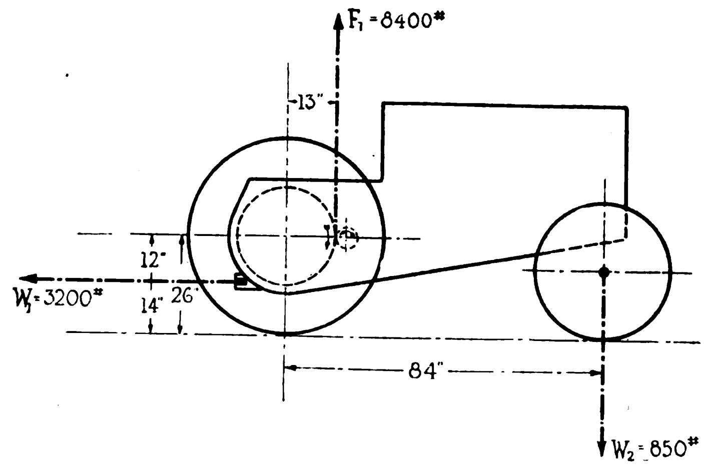


Fig. 1—Diagram of forces on tractor when operated on level ground

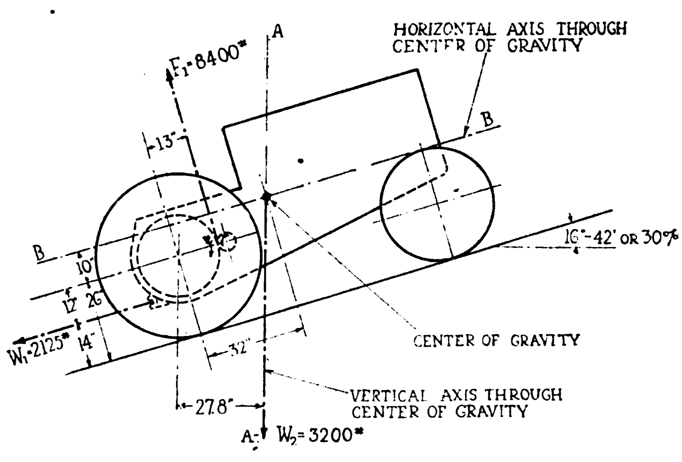


Fig. 2—Diagram of forces when tractor is on 30 per cent grade

Humanity Becomes Important Factor in British Labor Settlements

Review of Developments of Conferences Representative of Workers, Capital and Government in Post-War Period Indicates a Political Growth Not Yet Achieved in This Country

By Harry Tipper

THE developments in Great Britain between the signing of the armistice and the present time have emphasized the predominance of the economic problem and particularly the industrial problem in the political life of the country. They have indicated the development of additional strength in the labor power and at the same time an increasing division between the radical element in the labor organization and the more experienced conservative majority.

The most important points to be considered in connection with the development are:

1. **The demands of the manufacturer in respect of labor.**
2. **Findings of appointed commissions representing government, labor and capital.**
3. **The growth in power of the shop stewards.**
4. **The organization of the radical division of labor in favor of industrial unions instead of occupational unions.**
5. **The promotion of the Whitley plan by the Government.**
6. **The definite tendency to shorter hours.**
7. **Lack of any considerable wage reductions.**
8. **Continuance of a large proportion of unemployed.**
9. **Difficulty in industrial readjustment and the consequent partial activity in industry.**
10. **Large developments in housing**
11. **Strong definition and consolidation of labor aims.**

The labor organizations in Great Britain have been sufficiently developed industrially and were sufficiently powerful politically to necessitate the careful consideration of their position during the war in order to provide the necessary unity for industrial war activity. The occupational unions, in the most important industries, have been recognized as the necessary machinery for effective bargaining, for a great many years, and they represented a sufficient majority of the workers in many of the industrial lines, particularly in the skilled trades required for war work, so that the Government was obliged to call them in in order to secure the orderly progress and production to the point necessary for war development.

As a consequence of this, the older organizations were directly concerned in the methods and operation of labor dilution by the introduction of women employees, in the release of essential workers, in the elimination of the usual labor privileges accorded by shop practice in England, and it became necessary in the Government controlled industries to appoint committees of labor and capital to go over the war operations of these industries.

In return for this co-operation, the labor organizations demanded from the Government an agreement that all trade union privileges would be restored upon the termination of the war and that no attempt would be made to hold the workers to the concessions which had been secured from them for war necessities. In the agreements these privileges were specifically mentioned and the Government was committed to the practical enforcement of the return of these privileges at the termination of the war.

Combined Committees of Labor and Capital

In addition to these specific agreements, the Government had been obliged to develop combined committees of labor and capital in the controlled industries and had been obliged to concede additional power to the labor organizations in several ways. It had further promised, more or less vaguely, to consider the living conditions, the housing necessities and other matters in which labor organizations were interested, when the termination of the war would permit these developments. Part of the present confusion in Great Britain is due to the difficulty which the Government is having in redeeming its pledges to the labor party and the labor organizations.

In the endeavor to fulfill some of its promises and to bring about an orderly adjustment to peace conditions the Government appointed, after the armistice, the commission to investigate the coal miners' demands and the national council, as recommended in the Whitley plan, to consider the whole industrial question. These two commissions are the first examples of triangular conferences of labor, capital and Government which have had their beginning in the political demands and practical necessities of the worker, and which have recommended definite, and in some cases drastic, changes, carrying the recommendations of the commissions much further than settlement of the immediate question.

The action of the Sankey commission was the direct result of the coal strike which started in the Welsh coal field and extended to various other coal fields in Great Britain, involving nearly 140,000 miners. The strike did not involve the Scottish miners, this union standing at one side to await the result of the negotiations of the English and Welsh unions with the Government.

Coal Miners' Demands

The coal miners' strike involved more important demands than had been placed before the British public heretofore. These demands were for a 6-hour workday, nationalization of the coal mines, increase of wages, partnership of the employees in the management of the mines, and improvement of housing and living conditions.

The employing coal operators refused all these demands absolutely, stating that any increase in the cost of production would so increase the price of coal as to make it impossible for the English industry to meet foreign competition. The threat and the coal shortage resulting from the strike were of such a serious character as to bring the Premier himself back home from the Paris Peace Conference in an effort to settle the matter.

First Miners' Movement

The first movement of the miners commenced as far back as Jan. 1, when the Miners' Federation of Great Britain adopted their new program, which included demands for a state grant equal to full trade union wages to be paid unemployed miners until work was found for them; the administration of mining conditions by joint district committees of mine owners and workers, and also for the 6-hour day and the nationalization of the mines. On Jan. 7 the Miners' Federation demanded a 30 per cent advance in wages. As there are a million men employed in the coal mines, the acceptance of these demands would have meant an increase of wages amounting to $1,000,000 per day.

On Feb. 13 the Government submitted to the miners its plan for settlement of the strike, formulated by the Premier. This offer included a shilling per day wage advance and a proposal that all the questions should be submitted to a general conference in which the employees should have equal representation with the employers.

The miners absolutely refused this Government offer, but, despite their refusal, the Prime Minister went ahead with his plan and a commission was appointed to make a full inquiry into conditions in the coal industry. Both the investigations of this commission and the strike continued until March 17, when the miners agreed to withhold their strike for a short period, pending a preliminary report of the commission. This preliminary report, when returned, practically conceded all the miners' demands.

The recommendations of the report were agreed to by the Government, and although the investigations of the commission still continue, the entire trend of the investigation is favorable to the miners and it is practically settled that the following conditions will be put in force:

1. **A 7-hour work day (with a 6-hour day after July, 1921).**
2. **Two shillings per day wage increase.**
3. **Voice of the employees in the direction of the mines.**
4. **Either nationalization of the coal mines or unification of same under some joint control of private ownership.**

While the testimony of the employing coal operators and of many manufacturers before the commission was to the effect that, conceding that the miners' demands would so increase the cost of coal as to offer a serious handicap to British industry, particularly in competition with America, nevertheless the condition of the miners was so bad that on humanitarian grounds alone their demands should be in the main conceded.

While, in a way, the result is a victory for labor, yet it is more than that a victory for humanitarian progress and an acknowledgment as to the right of the worker to a higher standard of living. The great coal mine strike was not the result of any new conditions or evidence of any new phase of social unrest. The condition of the coal miners has long been a subject of public sympathy in Great Britain and public opinion had much to do with the final granting of the miners' demand.

One outcome of the investigation was to show that the profits of the mine owners ran from 1 to 2 shillings per ton prior to the war and as high as 4 and 5 shillings during the war.

The action of the Government in relation to the coal strike was based upon three reports submitted by the Coal Industry Commission. One of these, made by the more radical members, recommended allowing of the full claims of the miners. Another of the interim reports dwelt more on the actual statistics of coal mining operations, and the third interim report, called the Sankey report, offered a definite recommendation which the government finally decided to adopt. This report states that the increased wages proposed will mean the distribution of an additional sum of $150,000,000 per annum in wages among the colliery workers.

The interesting part of this report and its adoption by the Government lies in the fact that the commission included eminent men of various shades of opinion, with representatives of the miners and the manufacturers and also public men of a legal and general training. The report is generally referred to as the Sankey report because of the fact that Judge Sankey was the chairman of the commission. The condemnation of the present conditions of the workers in the coal mines is very definite and inclusive in this report.

The Whitley Plan

The national council, which was authorized by the Government to consider the whole question of industrial development, labor conditions and the things which should be done to produce industrial peace, was called in connection with the Government's promotion of the Whitley plan. The Whitley plan has been mentioned a number of times in this country and the general purpose of the plan and its acceptance indicate the recognition by government and by general public opinion in Great Britain of the necessity for equal representation of the workers in control and management of industry, in so far as that control and management concerns matters directly relating to the workers.

This recognition of rights is acknowledged in the acceptance of the Government of the so-called Whitley scheme. The adoption of this plan is the direct result of the unusual conditions existing during the war which compelled the government to require full co-operation between employers and employees, with state authorities, in the control and conduct of industry to permit the securing of the greatest possible plant efficiency and the largest possible production of materials.

National Council of 400 Recommended

The recommendations of the Whitley report submitted to the Government during the war as a plan for future labor policy were put into partial effect, or at least the first step taken, in March of this year, when a National Conference was held, being, in fact, a joint committee meeting of employees and employers similar to that recommended in the Whitley plan. At this conference it was proposed that a National Council of 400 should be formed to be composed of half capital and half labor. It is intended to use this national body as a consultative authority of the government on all industrial matters. Its members are to be elected by the trade unions and by the associations of employers. It is not clear, however, as to whether this proposed National Council is to be joined up with the Works and Districts Committees called for by the Whitley plan.

There appears to be little open opposition to the Whitley plan, as set forth in the report to the Minister of Labor, which he, representing the government, has formally announced will be put into effect. In a way, the

plan is based on participation of employees in the management of each separate industry in a manner similar to the "employees' representation plan" adopted by many industrial concerns in the United States. The plan differs essentially in providing joint district organizations and a joint national council. This plan briefly calls for the following organization:

1. **The establishment for each industry of an organized body, representative of both employers and work people, to be called the Works Committee, to consider and act upon all matters relating to local labor and industrial conditions.**
2. **The formation of District Councils representative of the trade unions and of the employers' association in each industry.**
3. **The formation of Joint Standing Industrial Councils to be equally representative of the employers and of such industries as are not already represented by trade union organizations, the purpose of this being to secure a representation for the masses of unskilled labor not included in the regular union organizations.**

It is the purpose of the plan to have the Works Committee and District Councils act upon matters of a local nature which can be decided by them, including the conditions of employment, the methods of fixing, paying and adjustment of wages, and the establishment of regular methods of negotiations for differences arising between employers and work people and means for preventing unemployment.

It is intended that the National Council should only take up matters of general or national importance, such as legislation, state control, etc.

The difficulty of succeeding with a general employer-employee co-operative plan with the unskilled workers, not included in the regularly organized trade unions, is fully recognized by labor leaders and industrial economists and the subject is quite fully covered in a recent "second" report of the Committee on Industrial Relations of Great Britain which originally outlined the so-called Whitley plan.

Report Does Not Favor Compulsory Arbitration

This committee recommends that the existing Trade Boards Act, enacted because of the needs of the war, shall be continued. The original purpose of this act was to provide means for establishing a minimum standard of wages, but in addition to such purpose, it is now proposed to use this medium for the organization of "Industrial Councils" for unorganized industries.

It is noteworthy that this second report of the Industrial Relations Committee does not favor compulsory arbitration, stating that both employers and employees are opposed and that imposition of forced arbitration would lead to further unrest. Neither does this committee favor compulsory methods to prevent strikes, pending negotiations.

In promoting the Whitley scheme, the government does not intend to abandon for the present the other existing government agencies provided for industrial reconstruction and for promoting better industrial relations. One idea is to link up the National Industrial Council, to be organized under the Whitley plan, with the work of the present Trade Boards and other joint representative industrial organizations organized during the war. The government is also maintaining trade union advisory committees at the headquarters of the government departments, as well as local labor advisory committees in various localities.

It is noteworthy that the Department of Labor continues to use its Trade Board organization for the adjustment of conditions relating to the employment of unskilled labor not organized by any of the established unions. Only as recently as February, the government took action regarding wages in the trades devoted to the manufacture of garments, knitted articles, embroidery and various needle trades, which have no representative unions.

While the Whitley plan was worked out by a committee representative of both employer and employee interests, and while there is no open opposition to the plan expressed by the union workers, yet there has been some evidence of suspicion on the part of union labor interests against the idea of works committees. Doubtless this position is based on ideas which prevailed to some extent in the United States, that by the building up of works committee or employees' representatives, to deal with the employers in conference, the result will be to weaken the strength and importance of the local trade unions.

"Triple Alliance" Stands Aloof

Although the National Industrial Conference continues to function and at its meetings subjects of the greatest importance to labor are considered, even such questions as giving to workers a direct share in the control of industry, yet it is notable that the "Triple Alliance," the most powerful of all trade union combinations, stands aloof from this government effort to solve the industrial problem by co-operation and conferences. No delegates or representatives of this union organization officially took part in the proceedings of the recent National Industrial Conference.

Leaders of this union organization do not admit that they are opposed to the National Conference or the Whitley plan or that they will refuse to enter into them, excusing themselves on the ground that other important affairs have prevented them from participating. It is not certain that this large trade union element will eventually co-operate in the National Conference or the Whitley plan. The Whitley plan is supported strongly by the National Labor Party leaders and is part of the policy of the present government administration headed by Lloyd George.

Great Britain's Relation to Labor

The important position which the government of Great Britain holds in relation to all labor and industrial questions is shown by the history of recent events. The great coal strike would have resulted in serious disaster to British industry if Premier Lloyd George had failed to secure a compromise agreement.

The government is working hand in hand with the organized trade unions, and that it recognizes the trade union power fully is evidenced by the refusal of the government to intervene in any way in the recent strikes on the Clyde and elsewhere, basing its opposition on the wishes of the trade union executives. In the case of Glasgow, although the Lord Provost asked for intervention by the government, the administration officials refused, stating that such action would undermine the authority of the national trade union representatives.

Although the Whitley plan of the government is not yet fully in operation it has been applied in several of the separate industries, notably in the manufacture of pottery, rubber and watches. These have a full system of shop committees, district councils and national councils organized and operating.

These developments indicate the extent to which the labor situation in Great Britain has become a political matter and the extent to which the labor organizations can enforce the political consideration of their demands. They illustrate the extent to which the Government has recognized the necessity for change in the general organization of industry in order to preserve harmony and to insure a reasonable, peaceful development.

It is not possible, as yet, to determine the ultimate success of the Whitley plan, or the other methods of governmental consideration of the labor situation, because labor opinion itself is divided as to the improvements to be secured and the methods to be adopted in securing those improvements. Probably 65 per cent or 70 per cent of the workers would be very glad to return to pre-war conditions if pre-war prices could be returned.

Leaders Recognize Value of Slow Development

The older and more experienced leaders in the labor ranks see the necessity for slow and careful methods of development, and even the aims of the labor political party itself, as shown by their reconstruction platform and the statements of the party leaders, specifically indicate that there is no expectation of accomplishing these things in any short time; and that the main object before the party is to see that each development builds toward the final platform which they propose to support. The great danger in the situation arises from the division of opinion within the ranks of the labor organizations as such, both as to the aims which can be immediately fought for and the methods which can be used in endeavoring to secure them.

The growth of the shop steward system in Great Britain has had a very distinct tendency to remove the power from the leaders of the national unions, or at least to take away a sufficient amount of that power to make it difficult for such leaders to control the whole body of workers under any agreement. This is evidenced by the history of the strikes which occurred between the signing of the armistice and the present time.

Strikes Reaction from Wartime Production

Unquestionably, a number of these strikes were made possible because of the general reaction from the war production necessities, the restrictions imposed during the war, and the strain which the country suffered for several years during that period. These strikes were called for demands which varied considerably. They were sufficiently widespread to indicate a spirit of general unrest, but more particularly they were based upon the local demands of the workers in some part of the country led by the District Allied Trades Council, which is the shop stewards body. They were frequently called in direct opposition to the national organization, of which the strikers were members and conducted without the approval of such organization.

In a number of cases the union leaders made common cause with the Government, and it is interesting to note that the strength of the labor organizations, in their power over their own ranks, was still sufficient to enable the employers to refuse any dealings with their own employees except through the recognized union leaders. The shipbuilding strikes, which were particularly bad in Belfast, where they developed almost along the lines of a completely socialistic government, were broken because of the division in the labor ranks and the regular union organizations were greatly strengthened by the defeat of this movement.

The great strike of the Triple Alliance, which is a co-operative organization of the three great industrial unions, railway workers, miners, and the transport workers, was one of the most difficult to settle, and it is not certain even now that this matter has been sufficiently settled to eliminate the possibility of further strikes in the near future.

Strikes have crept into the cotton district in Lancaster, in the engineering and shipbuilding trades, in the electrical trades, all of which strikes finally collapsed without any material change in the situation except agreement to reduce the hours to 47. Almost all the strikes were unofficial strikes. They were conducted by the local shop stewards, and were not recognized by the older leaders. Their breaking down is evidence that the radical element, which favors the direct action through the shop-steward system, is not yet sufficiently strong to endanger the recognized union organizations, although the number of men who became involved in the strikes indicates that there is a very large movement among the labor bodies to demand clearer and more direct action in connection with their local disputes than is provided through the regular organization.

This is partly due, of course, to the reaction from the war and partly due to the growth of radical opinion in the ranks of labor, which threatens to disrupt the labor organizations themselves.

Industrial Unions

A feature of this radical development, which has grown out of the formation of the shop-steward movement within the Allied Districts Trades Council, has been the movement in favor of industrial unions instead of occupational unions which form the machinery of the recognized labor organizations. This development arises more out of the political labor party and its growth than it does out of the actual union organization; but the ability of the Allied District Trades Council to enforce its demands, where the old craft unions have been unable to enforce them, has developed a strong opinion in the labor ranks in some cities in favor of industrial unions all through.

This has attracted to its side a number of social reformers and a considerable body of opinion which lies outside the labor ranks, but which is affiliated with the labor party as a political organization. So far, the tendency toward industrial unionism is not of importance in Great Britain, and it is not likely to become so if the tendency of the present developments continues. It is probable that further economic troubles of a more or less serious character will occur in Great Britain, due to the conflict between the industrial unionism as represented by the shop-steward system and the craft unionism as represented by the older organizations, and that the radical element will find sufficient following to induce them to make excessive demands and attempt to enforce these.

There is no indication, however, that these movements will assume sufficient importance to materially affect the developments which are taking place or to interfere with the orderly progress which is being made in the settlement of these important questions.

In all the actions which have occurred in meeting the strikes in Great Britain since the armistice, in all discussions of the labor questions in the triangular conference between government, capital and labor, there has been a distinct and definite tendency toward shorter hours and work. In connection with this matter, of course, it must be remembered that in Great Britain the hours of work have been longer in the past than those usually obtaining in this country, and the historical background suggests an importance in connection with this demand which it does not possess in the United States.

The 48-hour week is practically admitted in all types of industry to-day in Great Britain. In the case of the shipbuilding trades strikes, engineering trades strikes in Belfast, Glasgow, and other points in the British Isles, the demands for working hours range all the way from a 47-hour week to a 30-hour week. The decisions were made upon a 47-hour week in London. While the same organization in Belfast was demanding 44 hours there was a strike in Glasgow for a 40-hour week. Most of these strikes were unofficial, and the engineers' and shipbuilders' strikes were first broken by the decision of the Liverpool Federation to continue work.

The Liverpool Federation stood 10,000 in favor of 44 hours and 8000 in favor of a 40-hour week. These strikes failed, but the 47-hour week was adopted and it is probable that further development will necessitate a reconsideration of this and the elimination of three hours, making it a 44-hour week. In the report of the commission appointed to deal with the coal mining industry the recommendation, on account of the peculiar conditions in this industry, starts with a seven-hour day until July, 1921, after which time a six-hour day shall be considered.

At the last annual meeting of the Lever Bros., Ltd., of Port Sunlight, near Liverpool, the directors of this company reported that they had adopted a 36-hour week.

In practically all of the strikes there has been a tendency to reduction of hours, and the demands of the unions lie about half way between the 48-hour week and the 40-hour week. In some few cases local organizations have demanded smaller working days than that, but there is a very large opinion, as indicated by the votes and the actions of the different unions in the trades, for a week ranging between 40 and 47, with a majority of the workers in favor of a 44-hour week.

If the votes and strikes of the scheduled trades involved indicate anything in respect of the future probability, they suggest a very definite, powerful demand in the organized unions of Great Britain for a shortening of the traditional hours of labor and it does not look as though the present 48-hour week would last very long without further attempts to reduce it.

Up to the present there has not been any great tendency toward wage reduction in any of the large industries, although in some of the smaller branches of trades there have been reductions. In fact, in some of the large industries, particularly in the railroads, which are under government control, and the cotton and engineering trades, there were demands for increased pay. In the settlement of the railroad strike there was a considerable increase allowed the workers. In the settlement of the cotton strike, which occurred just after the armistice, because the cotton mill owners repudiated their promise for increase made during the war, a 50 per cent increase was decided upon with an arbitration settlement to finally determine the matter. The coal miners were allowed a 30 per cent increase.

These advances are evidence that there is no tendency for wages to come down, although the unemployment continues at a very high rate.

Reports from Great Britain show unemployment in the United Kingdom on April 14 of a total of 246 unemployed per 10.000, and about one million pounds per week was being paid out as unemployment wage. The unemployment as reported at the beginning of May was slightly less and the last reports indicate a very slight decrease. It is evident from the conditions in the very important industries in Great Britain that the question of readjustment is a very difficult one and that it will be some time before the unemployment rate decreases to a reasonable percentage.

Unemployment Insurance

The obligations of the government for unemployment insurance must continue to be high for a considerable time and will probably amount to about two hundred million dollars this year. The extent to which factories were increased in Great Britain for war purposes has not been understood in this country, and it can hardly be measured without a knowledge of the preceding circumstances. The conversion of Gretna Green, which before the war was a village of one street and probably 30 or 40 houses, into a city with ammunition plants aggregating approximately 9 miles long by 3 miles wide, with the necessary housing and other accompaniments, is a little indication of the way in which manufacturing facilities grew during the war. The difficulties entailed in turning these facilities over to peaceful occupations so as to maintain the employment which was built up during that period.

The demobilization of the soldiers has not occurred in Great Britain at the rate at which it is proceeding in this country, and this has kept down the unemployment to some extent; but it is to be expected that there will be a great deal of unemployment in Great Britain for some time to come on account of the enormous difficulties in the way of adjusting all manufacturing facilities to the necessities of peaceful work and reviving the trade which was lost in the concentration upon the war requirements.

One of the demands made by the labor party in connection with its reconstruction platform was the demand for better housing. This has been a subject of political controversy for many years in Great Britain and there is no question but what the housing conditions in many parts of the country were poor before the war and these housing conditions were not improved with the consolidation of manufacturing demanded by the war necessities.

Millions to Be Expended for Homes

In the United States we have some housing problems, but we have no such problems as those confronting the people in Great Britain, where their population has been shifted to a very much greater degree and where the percentage of men going into service was so much higher a proportion of the population. The development in building is going ahead in a good many districts at the present time, and it is expected that millions of pounds will be expended by the government and the local government bodies for the erection of workingmen's houses throughout England, Scotland and Wales.

It is not expected by any of the parties, or by any section of public opinion, that the housing problem can be settled through private means, and it is probable that the government will be obliged to assist in this program for a number of years in order to introduce the conditions which should prevail. It is not only that the number of houses required are not available, but the character of the houses for workers in Great Britain is inferior to those in the United States, and the facilities for sanitation, etc., are not nearly so complete. Bills have been introduced in the House of Parliament offering various solutions. The programs are not finally settled, but it is probable that the government will aid in the financing of local housing operations.

At present the government is financially helping the public utilities associations for the building of houses, and some of the local trade union organizations are contemplating qualifying themselves, legally, to act as building associations to enable them to secure this government financial aid. Our reports on the resumption of building activities in Great Britain indicate that in several of the districts this resumption shows an increase of 300 per cent or 400 per cent in the last two months.

War Has Helped Define Aims of Labor Party

The general situation in Great Britain shows that the war has developed a definition of the aims of the labor party as a political party and the labor organization as a craft union which consolidates the demands of labor to a much greater degree than was visible before the war. The aims of the labor party are summed up effectively in the platform for reconstruction which has been closely adhered to in the later speeches of the labor party leaders. This platform is very radical in many of its ideas and would be called a socialistic platform in many respects.

It should be noted, however, that the labor party in speaking of workers includes all workers, brain and hand workers, in the term workers, and in this respect its definition is entirely different from those of the craft unions. The definition it makes between labor and capital is the definition of those whose toil enriches the community and those who make no production effort.

The consolidation of these demands in the political aspect of the labor question, as well as the definition of the demands of the draft unions, has resulted in the general admission of some points which are still in controversy in many other countries.

Public opinion in Great Britain, including the opinion of employers, acknowledges the right of the worker to representation in the management, at least in respect of the things which concern his working surroundings and employment. The general statements by important manufacturers, by prominent public men of all types and by those whose words would count in Great Britain, indicate that the employers themselves and the general public recognize the obligation of industry and society to provide the worker with certain stable conditions of living and with certain opportunities for development, as well as a measure of partnership in the decision of the governing principles under which matters shall be arranged.

During the past six months a group of employers representing the principal plants in one of the most important British industries met in London and prepared a set of guiding principles relating to the management of their business, which outlined their duties as regards wages, the place of the worker in the management, security of employment, disposition of the profits and other subjects.

In the matter of wages, their conclusion was:

"These should always be sufficient to enable a man to marry, live in a decent house, provide means for the upkeep of the physical efficiency of the family with a margin for contingencies and recreation."

This declaration was in effect in favor of the naming of a minimum wage based on a cost of living. Continuing, the declaration of principles says:

"The worker asks to-day for more than an improvement in his economic conditions. We admit the justice of this claim and we must co-operate with him and treat him as we should wish to be treated ourselves. We propose to create suitable machinery for this purpose but believe that the more essential thing is the living desire to give full expression in a belief in right relations. Experience on shop or works committees trains the members in participation. We shall promote the formation of such committees."

It is this admission of the points of agreement between the public, capital and labor which gives rise to the hope that the adjustment of the situation in Great Britain will be made with orderly development, although it cannot be made without some economic disturbances. Unless the radical element in the older organizations becomes much stronger than it is, the control of the situation by the craft unions and the statement of the leaders of the older organizations "that progress must be made a little at a time" indicate the general feeling that there is sufficient groundwork of common opinion upon the necessary developments to provide progress which will be satisfactory.

Peace Will Offset Radical Demands

The conclusion of peace and the concentration of governmental activities upon domestic political issues will hasten the orderly development and offset the radical demands that have a tendency to accumulate during times of unemployment and industrial depression.

It is clear, however, that in Great Britain the position of capital, worker and government will be determined from a viewpoint which we would consider more radical than anything at present on the horizon in this country and the conclusions arrived at will tend to admittance of principles which we are not prepared to admit as axiomatic in the United States.

There is no doubt that Great Britain of pre-war days as a political government, has gone and that the labor party power will be felt in all the political developments of the next few years. The radical opinion may force political consideration of matters which should not be considered from that standpoint, and for a time labor power, forced by the radical demand in its own ranks, may go beyond wise development.

There is some tendency of this kind to be observed, but it is admitted that the position of the worker, politically and industrially, has been entirely changed and that it is necessary that recognition be given to him in a different way, so far as Great Britain is concerned.

NEXT WEEK Mr. Tipper will discuss the developments in labor conditions in the United States since the signing of the armistice. This will be a comprehensive study of the situation, especially applicable to the automotive field and will be a document of great importance to every employer of labor. The development of the labor organization situation and the attitude of employers are traced through this period of surprises.

The Experimental Car

An Outline of the Methods Used in Developing New Models for Quantity Production—Experimental Department Organization and Routine

By C. Roy Watson

TO make automobiles that sell like hot cakes on their inherent merits is no chance nor haphazard business. Every firm desires to have its product held in high esteem by the buying public and to enjoy the privilege of selling cars when the mediocre firms are feeling slow times.

Granted a good manufacturing organization, all that remains to make a success is a well developed car, and that means good engineering, checked by able experimental testing. The writer's purpose in this paper is to give the methods of experimental car testing developed in several years of his experience with a leading manufacturer. Like most things in these days of highly detailed design and efficiency, a great deal of method or system has to be used in the experimental work to get good results. I am not going into the planning nor designing phases of engineering work, except as it borders on the experimental.

How Not to Do It

Many automobile makers to-day do not fully realize the importance of thoroughness and high standards in the experimental work. The usual procedure when a new model is brought out is to build a single experimental car composed of the first guesses of the engineers. The motor is perhaps given some kind of a block test and the car goes to the road where it is driven irregularly by an ordinary tester, and on week ends by more or less biased and theoretical engineers. Replacements and new devices are put on from time to time and the developments disturbed by tightening ups and "babying." Time on the road is wasted in making advance demonstrations to dealers and trifling in general. The result is that little progress is actually made in developing the model, and that when the cars go into production a ferocious scramble ensues to patch last hour discoveries, loose odds and ends and unforeseen manufacturing difficulties. This means expensive delay in production, an increased scrap pile, profit killing replacements and negative advertising by consumers.

Method or System

The time necessary to develop a new model to the point of production varies according to the amount of newly designed detail. An old model that has successfully stood the acid test in the public's hands, on which there have been made a few minor detail refinements, requires little time, although a standard of, say, 30,000 miles of methodical road testing is always a good precaution. Such a test represents an average of five years' use in the average owner's hands. Naturally, hot and cold weather, wet and dusty roads, etc., should be covered by the test in order that it may be thorough.

In the case of an entirely new design the drawings must have been completed and the commercial arrangements for stock assured. The experimental car parts must then be built and prepared and the component units pass through the laboratory tests, leaving a period of from four to six months' time for tests of the complete car on the road. If extremely radical designs are to be incorporated in the model, much more time has to be given to the doubtful features, as many an engineering organization has had to make a right-about face with some features that could not be made practical in time.

After the experimental cars have developed all the bugs and the machine is a success, the manufacture of parts for the new model should be sandwiched between the production of the current model, and the development of tools, material specifications and the shop organization of means and method be completed. In this way the new product can be smoothly dove-tailed into the end of the old season's product and the common losses and delays in starting the new season avoided.

In order to run the whole gamut of service that the motor public will expect the car to stand up to creditably, and to systematically handle the complex details of development, three experimental cars had best be built. With one car alone all the eggs would be in one basket, and in case of a road or shop accident all the work done might be lost. In the section on the system of testing out it will be seen why the third car is advisable.

Outline of the Work

The experimental staff should be a highly trained and talented force, with such equipment as is necessary to do the work efficiently. They should work in an atmosphere favorable to keen observation and originality. With a live firm it seems that there is ten times as much work to do as the Experimental Department can handle. In the automobile business resting on the oars is permissible only to the few firms who are greatly in the lead. Some have taken a hard back slide due to relaxing the aggressive policy. A leader must work hard to retain his position. I will outline the experimental work advisable to all firms in a season's program:

A—Developing the new model.
- 1—Building the experimental car and parts.
- 2—Laboratory tests and developments.
- 3—Road tests and developments.
- 4—Acceptance and commercial co-operation.

B—Super-testing the factory product.
- 1—Acting upon agents' complaints and suggestions.
- 2—Experiments on employees' cars.
- 3—Replacements under commercial exigencies.

C—Research.
- 1—New designs and accessories submitted.
- 2—Commercial material substitution.
- 3—Competitors' car study.

Super-Testing the Factory Product

From the outline it would seem that there is a good deal to do after the car is put into production. When the factory starts to build the car a certain amount of co-

operation is needed from the experimental force to straighten out difficulties in manufacturing and to closely inspect the new production to see that it is fully up to the highest standards of quality. One of the first cars of the production should be taken out by the experimental testers and driven 10,000 miles under all conditions to be sure that all is going well with the new product. The factory test is generally a short affair and only serves to show the most superficial defects. In the "super factory test" defects in workmanship, materials, heat treatments, accessories, etc., are found without waiting for the agents to get a number of cars into the public's hands and in time figure the trouble out and then give the alarm. This test always saves many times over what it costs, and should be repeated two or three times during the season. These cars, with the other experimental cars, can be taken into the shop, standardized and refinished somewhat and sold at cost to the employees, who will eagerly bid for them. In selling such cars a resale limit can be imposed reasonably and perhaps some minor experimenting carried on, on condition that the owner supplies the experimental department with his views and findings. There is nothing like getting an expert to personally get the tools in his hands and minister to perhaps some of his own deficient contributions in the model. He soon sees the point or helps chafe the guilty parties.

Refinement and Substitution

During the season the agents and others make criticisms or suggestions for minor refinements. With judgment, these minor changes can be thrashed out on any car under test, where they will not interfere with more essential things. In the case of the failure of supply during the season, of any material or part, due to some commercial reason, experiments can likewise be made for substitution.

Research

Innovations come along from time to time for study and development. These are the things that add selling attractiveness to the product or cut manufacturing cost. They have to be sandwiched into the current experimental work, or, if important enough, a car may be provided specially for them. As a rule, an intricate device should be installed by the parties submitting the same, and with prudence a certain amount of collaboration can sometimes be permitted. Often only the germ of an idea is brought in and nine-tenths of the adaptation and development has to be done by the car maker to get the device into practical form.

Study of Competitors' Cars

Some makers study competitors' cars and get many ideas, both of operation and construction. Like the foregoing work, this is best done by the trained talent and the comment of various experts of various viewpoints. The engineers should first look the car over in turn and drive it on week ends and evenings, then have a clever tester measure the performance in every way, run up the mileage for developments, disassemble for inspection and then have an expert draw up an analytical comparison to facilitate the study.

Equipment

A set of rooms, or, better, an efficiently arranged building, should be provided exclusively for the experimental work. A good arrangement is to have one large and one small door near together. A guard must be posted at the doors and the place not allowed to become a curiosity shop for prying individuals. People on business should be received by the guard in an ante-room which is surrounded by the necessary offices. Following in order grouped around a common stock room should be the machine shop, laboratory, and garage with large communications and doors. The shop and garage should have partitions or small rooms on the side for special work, and the laboratory should have a muffled wall testing block; a special corner can be used for dead stock. The machine shop should contain mainly tool maker's machinery, and the size should depend on the quantity of work it is expedient to do in the factory, in keeping with the required degree of secrecy. The laboratory contains motor testing equipment and apparatus of all kinds to make quantitative and chemical tests. The garage contains plenty of parking space, facilities for building, filling, cleaning and repairing cars, etc. The location of this department should be such as to be hidden from public and factory view and it should contain the usual conveniences for the men so as to keep them within their own sphere.

Personnel

The men doing experimental work must be trained experts in their specialties and not ordinary mechanics and drivers. They must be deeply experienced, practical, critical, and ingenious. Ordinary wrench slinging dubs have no place in the work except to demonstrate perhaps at a later stage how the car may be abused by careless owners and poor garage talent. The organization of the staff is as follows:

The experimental engineer in charge has a general routine supervision over the whole work, sits in the conference of engineers and must be able to keep a smooth, alert frame of mind among his assistants, some of whom might be of more vital value in the work than himself. Three foremen of the machine shop, laboratory and garage look after their respective divisions and make reports in writing and suggestions directly to the forum of engineers. Lastly, the chief experimental tester is like the home guard in a football game—the last man to stop bad design and mistakes. He must be very thorough.

All must work in a friendly, unbiased, and critical atmosphere and be encouraged to churn up data and ideas without any fear or favor. All should be assured that they are under the direct protection of the head of the company and should be cautioned to secrecy outside the department.

Constructing the Experimental Cars

It is necessary at times to get special work done in the factory on the highly specialized production machinery. In fact, it is desirable that it should be done for training as far as is consistent with workmanship, expediency and secrecy. The latter factor need not be much worried about ordinarily, at least not in the case of conventional designs and where the volume of such work obscures the identity. A general policy throughout the conduct of the work, of not allowing doubtful characters to get more of the plan than is helpful in their detail of the work, serves to keep them from getting all the links in the chain and having enough to do any harm.

In the process of making the experimental parts—and in assembling them together, expert study must be given to every detail in order that data may be secured at every stage of the work for checking developments in the tests, that they will be identical in material, heat treatment, limits, etc., to what they will be in the manufactured product, that conflicts and inaccessibilities are eliminated and that manufacturing facility is incor-

porated. Every piece should be analyzed for material, and heat treatment where important, in order to insure that everything is up to specification and that no parts materially weaker or stronger or more or less durable than the normal get in to ruin the conclusions at a later stage of the testing-out work. Likewise, the parts should be carefully checked for alignment, dimensions, finish, etc., and in some cases both extremes of the limits provided for trial in parallel tests. Axial lines, bench and description marks should be inscribed on all new and doubtful parts and assemblies, in order to later study any bending, twisting or undue wear that may occur.

The careful stamping of parts not standard should be looked to, and anything needing special identification should be stamped where the mark is most visible at all times. Parts with rough and indefinite limits should be carefully measured, and data kept in a tabulated diagram. Likewise, diagrams of dimensions should be kept of all parts that wear. A ten thousandth part of an inch in such data is a good limit of measurement. There is nothing more exasperating than to get a break, bend, twist, reduction or wear effect and not have reliable data to go back to in drawing a conclusion. Workmanship in experimental work is a bugbear, and too much cannot be said on the subject. Neglect in this matter wastes time and money.

The valuable detail judgment and co-operation of manufacturing specialists will add value to the work, provided it is diligently collected and tactfully handled. Remember these things mean savings in money, and the car is composed of almost millions of little details. This is a little sermon on the way.

A skeleton chassis, such as some firms employ in testing out, is only a small part of the car. It is a waste of time to stop here. The scientist's assertion that every atom in the universe has a relation to and an effect on every other atom applies especially strongly here. All the superimposed and attached parts and the equipment have their mutual fits, their co-operative functions, their clearance relations, their stiffening and weakening influences, their weight effects and must be in position when making the test. The complete car should go to the road fully equipped with no ifs or ands.

The body, top, curtains, shields, fenders, control mechanism, piping, wiring, etc., are portions generally designed by different hands, and the complex locations in different planes make many things a matter of individual fitting and adaptation, and templates must be made and allowances fixed early. Often very embarrassing and ridiculous conflicts are found in the finishing up stage where the work is improvidently conducted. The sooner such defects are found and eliminated the better, as elaborate body and sheet metal dies and forging tools take long periods to alter.

Laboratory Tests

Many of the parts, accessories and sub-assemblies need laboratory testing before going together. This is a very important work, and volumes can be written on the equipment and procedure necessary to do this basic work thoroughly. Things are in general more accessible in the laboratory than on the car.

The complete car on the road should be regarded as the final elimination test or the last checking out of things overlooked and unforeseen. Every defect found is something of a debit mark on the thoroughness of all concerned in preparing the experimental car. The more closely the laboratory can calculate and judge to road performance the more effectively their work will be done.

The standards of efficiency in laboratory work are rising fast. Things are more accessible for fine detail study in the laboratory than in the car. With the tendency toward light weight construction, cleverly arranged physical tests eliminate the clumsy method of risking the tester's life in the road test. Material and heat treatment inspections are conducted here. The motor is tested here for internal friction, power, flexibility, lubrication, balance, cooling, ignition and carburetion and its shortcomings are eliminated. The clutch and transmission are tested for inertia effects, holding, slipping, shifting, lubrication, etc. The rear axle and universal joints are tested for lubrication, heating, etc. Accessories like tire pumps, horns, speedometers, fuel feeders, primers, etc., are also gone through in a suitable way. When the car is completed the spring action is studied by weighting and jacking up and down, and interferences are studied. The limitations of the bumpers and rebound straps are noted and the arcs of axle movement all compared to the angles and sliding of universal joints, brake rods, torque bars, etc. Many incalculable and unforeseen details operating through several planes like control rods, under pans, and accessory connections, etc., must be corrected here. Weighting of the parts and sub-assemblies should be done also for comparison and future reform at least. Tabulated measurements of the operation of sylphons, metering and control mechanism, spring travel, etc., must be taken for future reference.

Testing on the Road

At least two experimental cars should be provided for the testing of each new model, no matter how few new features are brought out, as it would be an exceptional new model that did not contain at least a number of refinements in details. Ordinarily three cars had best be built, and two of them driven on the road by experienced professional experimental testers who are equipped in their specialty to adequately put the cars under every possible service and abuse the owners will likely give them; to report defects intelligently, and to suggest remedies and improvements from their intimate viewpoint.

The first car can be driven continuously, or twenty-four hours per day, by two or three shifts of two men each. During the pre-production period some of the drivers can be commercial testers studying the new model and getting prepared for testing it. The purpose of the two men on each shift is to expedite any work done on the car on the road, to divide up the driving work, help in heavy road difficulties, expedite caretaking work and that one may serve as a rescuer if he escapes injury in case of an accident. It is needless to say that poor or careless drivers will not be a good investment in experimental work. One of the two drivers in each shift serves as the captain of his shift and makes reports directly to the chief experimental tester, keeps up the data collected during his shift and opportunely co-operates with the engineering and experimental forces.

One of the results gained on the 24-hour car will be the effect of great distance, as 30,000 miles can be turned up normally in three months; another will be plenty of abuse administered, as the men get on a fine driving edge and can "slam her over the road" in good shape. Figuring an average driving season as 6,000 miles, the distance traveled will represent five years of service and the maximum of road abuse the car can receive. A car tested to this degree and found "all there," can hardly be compared to the one and two-season repairshop wrecks which are due to the low engineering standards of the makers.

At this stage the car should be completely taken down and inspected. It should have gone through the test without adjustments of motor bearings, cleaning of carbon, valve grinding, replacements and adjustments, and still be in fairly good running shape. With a few slight adjustments and cheap replacements, *i.e.*, a light overhauling, it should give a creditable performance and be ready for another long period of use.

The result of frequent warming and cooling, cold, garages, slow and irregular driving resulting possibly in rust, condensation, corrosion, freezing and the fine detail study cannot be got on the 24-hour or big mileage car, so the second car should be driven by a crew of two during the usual day of work and at times a little in the evenings. The sharpest talent should observe this car, and it should be tested all around the country and subjected to all possible conditions.

The third car should be kept about the shop to use for a model in fitting and measuring, etc., without holding up the active cars for that time-consuming work. This can be loaned to the engineers for their driving and study and also possibly used at times for some advance demonstrations to dealers. Side issues should not be allowed to conflict with experimental work. Using the experimental cars for personal and commercial services should not be tolerated. These things always consume more time than anticipated, distract from the work, destroy observation and spontaneous thought and interfere with road and weather opportunities. Routine matters should not be allowed to intrude on the work at any stage, as they spoil keenness of thought and originality.

After the rawest defects have been eliminated and the cars found safe to go out of the vicinity of the shops, every kind of roads and climate should be visited. The extremes of hot and cold weather should be experienced to see if the carbureting, cooling and other temperature-affected factors are right. Winter work in the north can be supplemented with warm weather driving in the south. Sand, gravel, dust, mud and snow roads should be sought to see if any kind of dirt gets in anywhere and does damage by clogging, chemical action or wear. To see if the clearances are good, the pulling is smooth, the brakes are adequate and all suspension, torque and running gear parts strong under abuse. Mountainous roads, rough and smooth roads, wet and dry roads should all be tried out in various combinations. A volume could be written on the fine details and abuses and the money that motor car companies have lost by lack of thoroughness in their testing-out work.

The Car's Initial Run

When the new car is first started out it should be run easily, well lubricated, and kept in good adjustment for a little while; then the severity of the work should be gradually increased in every way to a reasonable point, and finally the maximum of reasonable abuse and overload should be given. In this way the whole story of the weak features is obtained, whereas if the model was roughly handled from the start, and smashed, only one thing would be learned, and that is that it would not stand the maximum. As an abstract deductive method of analysis of the qualities of a car the practical maximum and minimum of everything must be considered. Two qualifying conditions creep in here: One is practical experimental judgment based on broad knowledge and experience and the ideal of the "Old One Horse Chaise" mechanical principle. Not that the climax in this ideal is looked for exactly, but that the standards in lubrication, adjusting, repairing, or the caretaking requirements are not such that a little neglect on the motorist's part is going to result in stalling him in the middle of a California desert or call on him to buy half of his car over again. For instance, if a ball or roller bearing is used in a part of the car likely to be neglected in some way, the chances of trouble to the motorist (which is always trouble to the manufacturer as well) will be much less perhaps than with a plain bearing that might seize and twist off a shaft, rip up a set of gears, or smash up a big casting. Such deep considerations make the fine automobile that connoisseurs speak of with admiration. The lack stamps the improvidential institutions that can hardly get their product to the shipping dock and be sure that something is not going to happen the next minute.

After the crudest of weak points have been remedied, the experimental work simmers down to the long-distance, long-time durability tests and the fine detail study under various climatic and road conditions and the unforeseen combinations of circumstances that are stumbled onto by accident.

About every 15,000 miles the car should be taken down and inspected thoroughly. When doing work upon parts that have fallen down in the test everything opened to view should be inspected, but it should always be kept in mind that frequent adjustments, tightening ups and minute attentions such as the average owner neglects should not be made, as valuable developments are apt to be lost. If the car is going to be a rattle trap, keeping the experimental and demonstrating cars tight is not going to help the motoring public's opinion in the least. It is better to find these things out at the factory and remedy them than to wait for the public to advertise the outfit as a junk pile.

Paper Work

An important aid in the work is the compiling of data and reports. These things are indispensable. On the cars, log books are kept of fuel, oil, water and tire consumption. Odometer readings, gage readings, acceleration readings, climatic and road conditions, are kept, tabulated for reference and comparison. Likewise, impressions of speed, power, noise and vibration are recorded. Thorough reports of the experimental work and data collected, as well as remedies and suggestions, must be promptly prepared and sent to the engineers and those helpfully concerned in the work. The reports are typewritten on a form handy for filing, and their delivery is carefully checked. An index is kept, which is compiled from the reports and data, and is available to all. The system compiles the story from the standpoint of problems under development, sub-assemblies and functions in the car. In this way the history of any development can be found quickly and without searching through a mountain of papers for little details. Insufficiently checked details and guesses should not be sent in unless time presses, and then they should be labeled as such.

In all experimental work the keynote must be thoroughness and adherence to actual operating results, and not pure deduction and theory. Some engineers are like the woman who dropped four cents on the street car floor and left the conductor to look for five. An engineer with a salesman's graces is a danger to the community. The work is impersonal. The experimental men must consider themselves as the company's and the purchasers' friend jointly, and not allow anything to be "put over" that is not up to the highest standards of the art. It is the duty of the management to see that the critics are not molested in any way by offended persons. Politics in the shop and underground bickerings caused by a neglect of the management to thoroughly supervise are very demoralizing to results in engineering work.

Truck Loading Devices Reduce Lost Time

Installation of Apparatus for Handling Loose or Bulky Material Cuts Labor and Increases Profits

By J. Edward Schipper

WHEREVER quantities of loose materials, or materials of tremendous bulk, have to be loaded into trucks the problem arises how this can be done so that the loading time and the expense of loading will be reduced to a minimum.

Every time an analysis is made of truck transportation cost, the length of time required for loading is found to be an important factor. Therefore, truck manufacturers, contractors and fleet owners are constantly endeavoring to cut down the time required to load or unload the vehicle and are giving every encouragement to the design and invention of devices which make this possible.

Loose material such as dirt, gravel, coal, ashes, etc., is most difficult to deal with. Solids, such as stone, bales of hay, bales of cotton, furniture, crates, etc., do not present as hard a problem, because they can be lifted on the loading platform and generally packed very easily by the driver and helper into the desired position. Where the articles handled are of miscellaneous size and shape, as in moving van service, manual labor has to be depended upon entirely, and for this reason a different basis of charge is generally used in this class of work. For handling the loose materials mentioned, however, a variety of devices are in use, and many of these are of exceptional value.

Dumping is the most common method of unloading loose material. Dumping bodies were employed to a considerable extent on horse-drawn vehicles before the motor truck came into common use. These early dumping bodies generally were manipulated by the driver, who inserted a crank on the squared end of the shaft and cranked the wagon body up to a dumping position. A train of gears gave the reduction necessary to enable one man to readily lift a loaded 2 or 3-ton wagon. This type of body was extensively employed for retail delivery of coal and is still in common use.

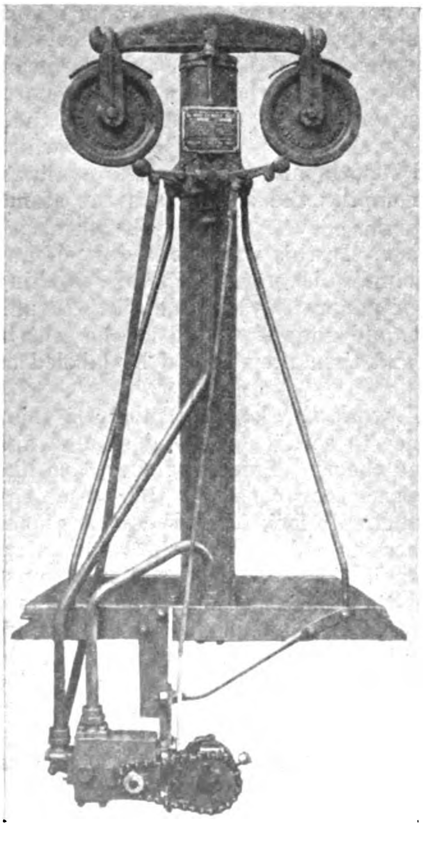
Hydraulic Hoists on Motor Trucks

In the case of the motor trucks the dump body is generally hoisted hydraulically. Owing to the presence of a gasoline engine on the truck, mechanical power is available for the hoist, and generally a take-off from the gearbox permits of the engine power to be used in operating the pump for a hydraulic hoist or in running any other unloading device which can be mounted upon the truck itself.

Hydraulic hoists are made in either vertical or slanting installations. With an hydraulic hoist it is important that the load be properly distributed so that when the outfit is installed on the chassis, the chassis is not called upon to take care of any undue strain; there must also be no undue strain on the hoist.

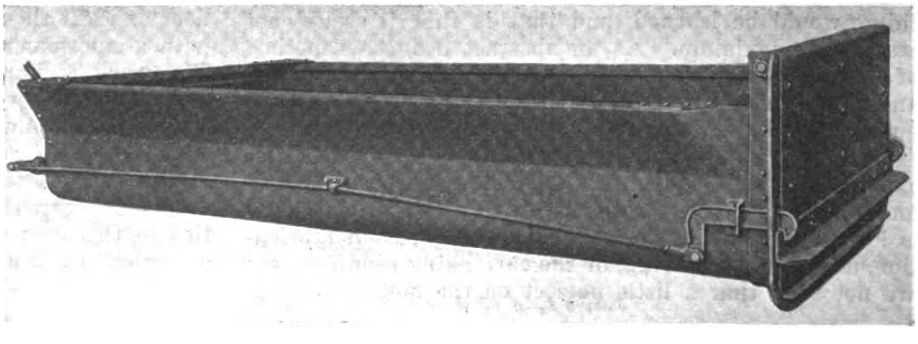
With a recent type of hydraulic hoist it is possible to dump a capacity load in about 15 sec. After the commodity is dumped it is not necessary to keep the truck at rest. The driver can start on his return trip and the body will of itself come back into position. This may appear on the surface to be a small item, but when figuring cost on a job, is is a saving of time such as this that makes the job profitable.

As compared with manual unloading or hand-operated gear trains for raising the dumping body, the hydraulic hoist is so far superior that it requires only a relatively

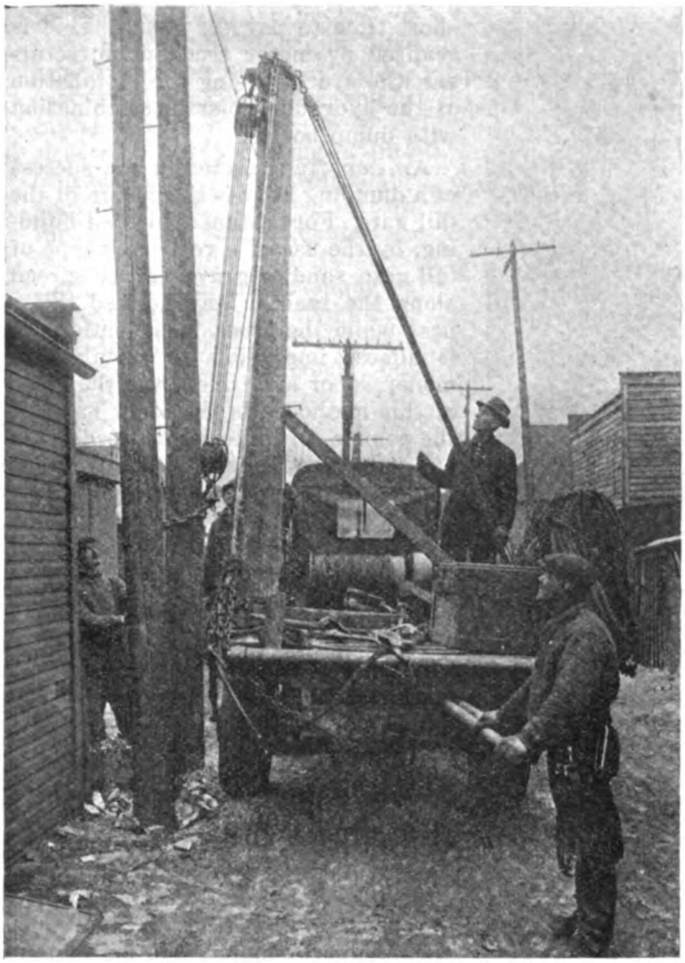


Left — Wood hydraulic hoist. Weight, 325 lb.; capacity, 3 tons.

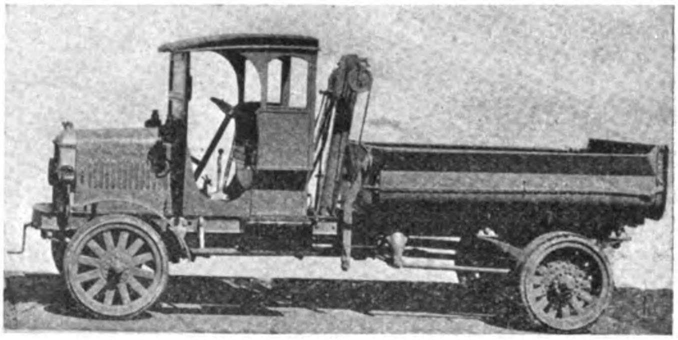
Below — All-steel dumping body with driver-operated tail gate latch



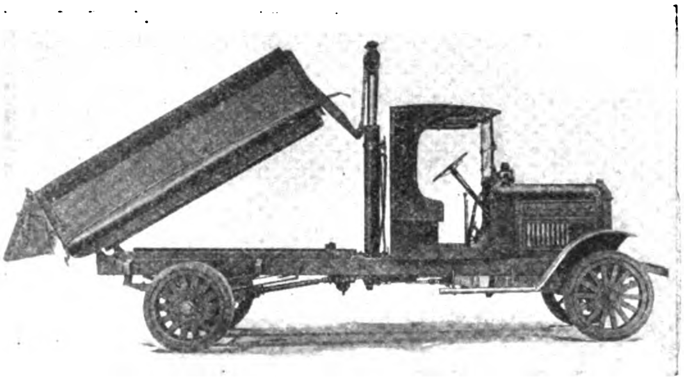
Variety of Hoists Used to Economize Time



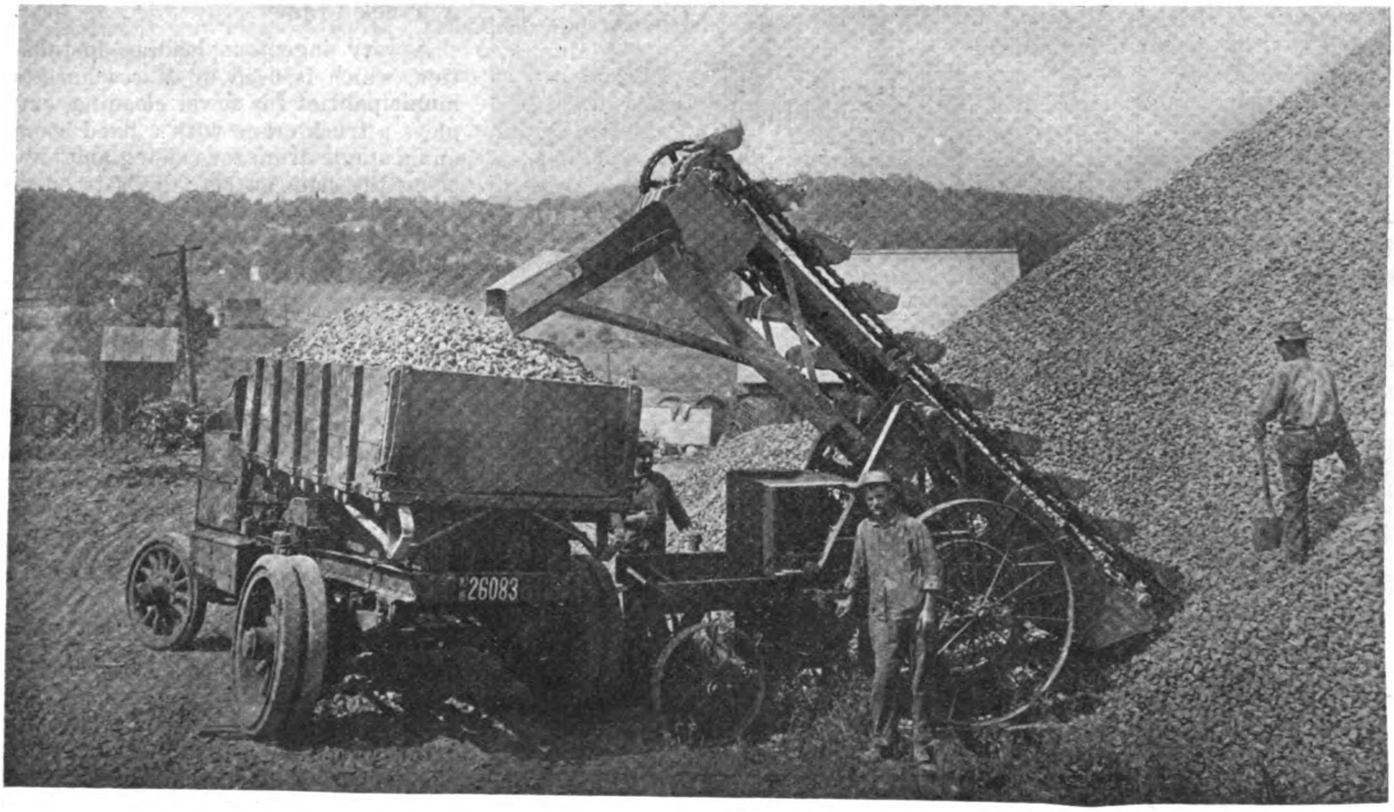
Winch-equipped truck for telegraph pole installation



Slanting type of hydraulic hoist installation

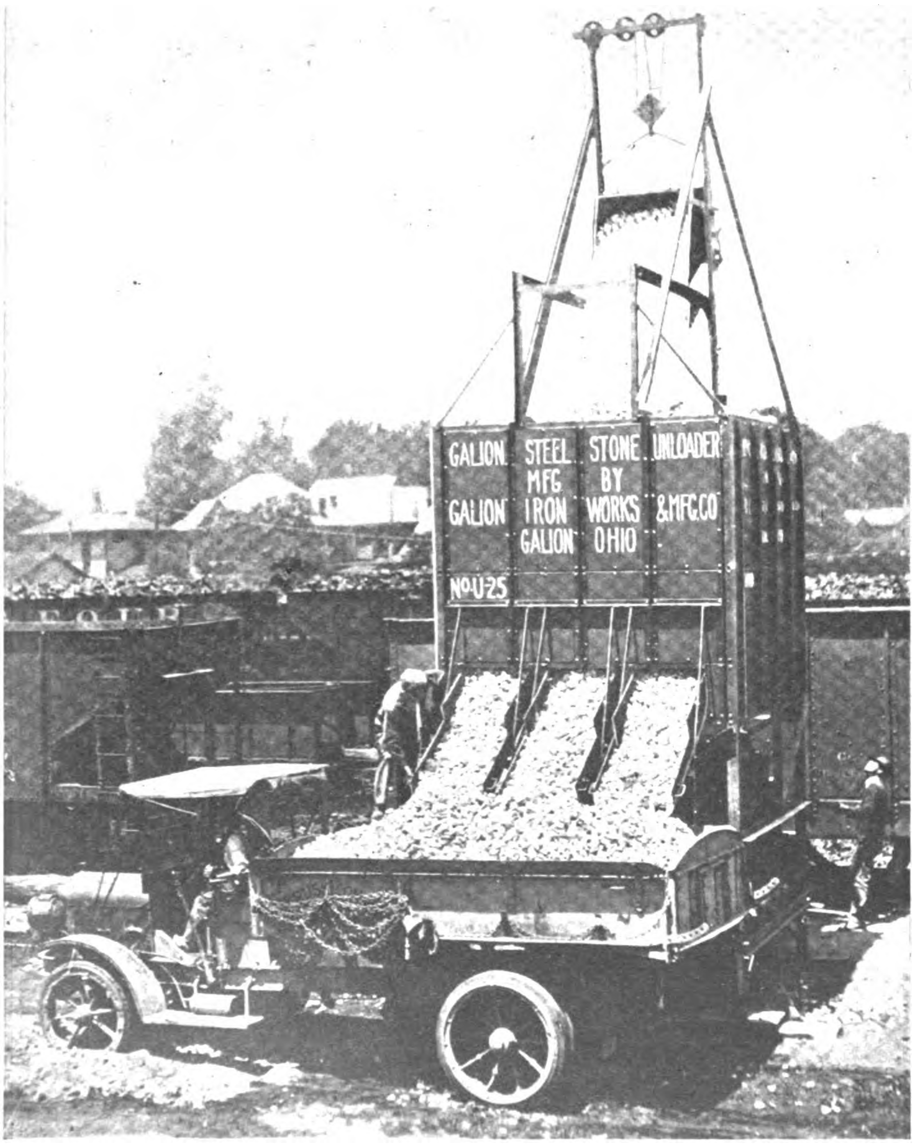


Vertical type of hydraulic hoist installation



Haiss type of digging wagon loader, eliminating practically all hand shoveling

Dump body raised by power take-off on transmission system



Galion device for unloading hopper type freight cars into wagon by means of hoisting device, reservoir and chute

short time to pay for itself. This is realized by motor truck manufacturers who are indorsing the installation of the hydraulic hoist in combination with dump bodies.

An important factor in the success of a dumping body is the design of the tail gate. For instance, in road building, by the use of a restricted type of tail gate, sand or gravel can be spread along the road in any desired thickness while the truck is in motion. It is almost impossible to calculate in money, labor and time saved the value of this method. On the other hand, if the commodity is to be dumped all in one spot, it can be placed just where it is needed, and by the use of the vertical hoist the body can be quickly raised to the proper height. The angle to which the body must be raised has been worked out for various materials.

The hydraulic hoist for a 5-ton truck weighs approximately 500 lb. in the heavy-duty type; that is, a 500-lb. hydraulic hoist will have a capacity up to 7 tons. Such a hoist requires a space of about 15 in. between the body and the seat, if installed vertically, or from 18 to 20 in. if slanting. The lightest type of hydraulic hoist, designed for trucks up to 2-ton capacity, but capable of lifting up to 3 tons, weighs approximately 325 lb., and requires a space of $13\frac{1}{2}$ in. between the body and seat. On this type the body arms are outside the chasis frame.

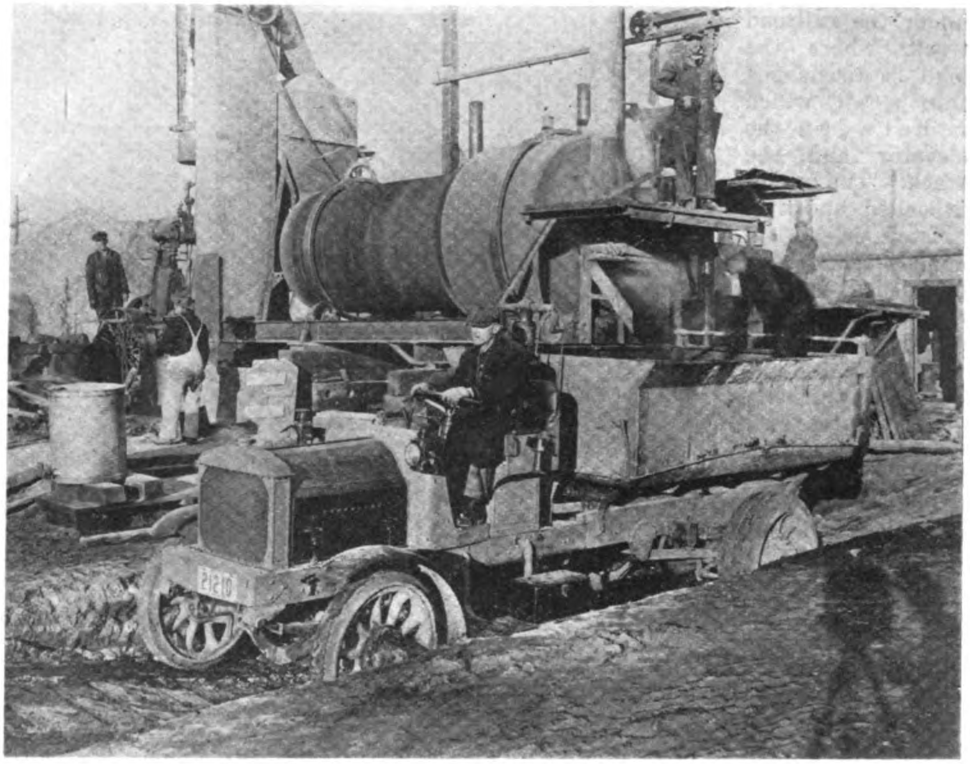
A Truck Crane

A very ingenious loading installation, which is used by Massachusetts municipalities for sewer cleaning, employs a truck crane with a fixed boom and a single drum for raising and lowering the clam bucket. This is operated by a direct take-off from the transmission gearset, and is mounted on an extension on the side of the truck frame, as illustrated. The clam bucket itself is opened and closed by compressed air, the air compressor which the installation comprises being driven from the transmission shaft. This arrangement can be made either automatic so that the clam bucket opens after it has been lowered, and closes when the hoist starts, or it can be made manually operated so that the opening and closing can be timed at the will of the operator. The crane swings the loaded bucket over the body of the truck, and it is dumped by the compressed-air system, which opens the clam bucket. Formerly the weighted tails were simply lowered and the cleaning operation performed by manual labor entirely.

In all loading of loose materials, particularly those which are delivered

to the loading point by freight car, it is highly desirable that gravity loading be used. Wherever it is feasible, the freight car should be brought up to an elevated track and dumped into overhead bins, from which the material can be withdrawn through some form of chute into the truck.

This method can be employed to advantage even in small-scale operations, because it not only eliminates manual labor, but after the material has been once delivered to the highest point by means of the rolling stock it requires no further power expenditure in handling it, except that required for opening and closing the chute doors.


Feeding from concrete mixer directly into truck, with ground dug away to permit clearance

The use of winches mounted on trucks for heavy work is practically a necessity. For instance, in telegraph and telephone pole installations, where the heavy pole has to be hauled into position and then lifted and lowered, the use of a winch effects a very material saving as compared with the old pike-pole method. Furthermore, the use of winches tends to obviate physical injury. Statistics show that truckmen compelled to lift heavy crates or other unwieldy bulks are more subject to hernia than any other class of men. For this reason alone the extensive use of lifting devices should be urged. A winch mounted on the truck platform will be found to give a wider range of utility to the truck body, particularly for contractors, who are apt to handle practically any class of work. Telephone and telegraph companies have found it necessary to maintain several trucks so equipped.

Sewer cleaning installation with power take-off from transmission and clam bucket, operated by compressed air

For handling such materials as coal, coke, stone, sand, fertilizer, and similar loose materials, from storage or cars, various types of portable loaders external to the truck itself can be employed to advantage. For instance, the continuous chain type, with closely spaced buckets, is very useful. The buckets pick up the load as the loader is pushed into the material, and are kept full by manual shoveling, if this is necessary. The buckets then deposit the load into a chute or hopper, from which it is fed into the truck. By the use of mechanical loaders of this type it is possible to cut the loading time from 15 to 20 min. down to 2 min. These figures are reported by the manufacturers of a device for unloading stone, sand, gravel, or other similar material, from a hopper-bottom car, carrying it to a bin, and loading it into a truck or wagon without the employment of any shovelers. It is figured that the cost for labor alone, loading stone out of a car into a wagon or truck, comes to about 15 cents per cubic yard when the work is done manually. With this type of loader it is claimed it will do this same work for about 2½ cents a cubic yard.

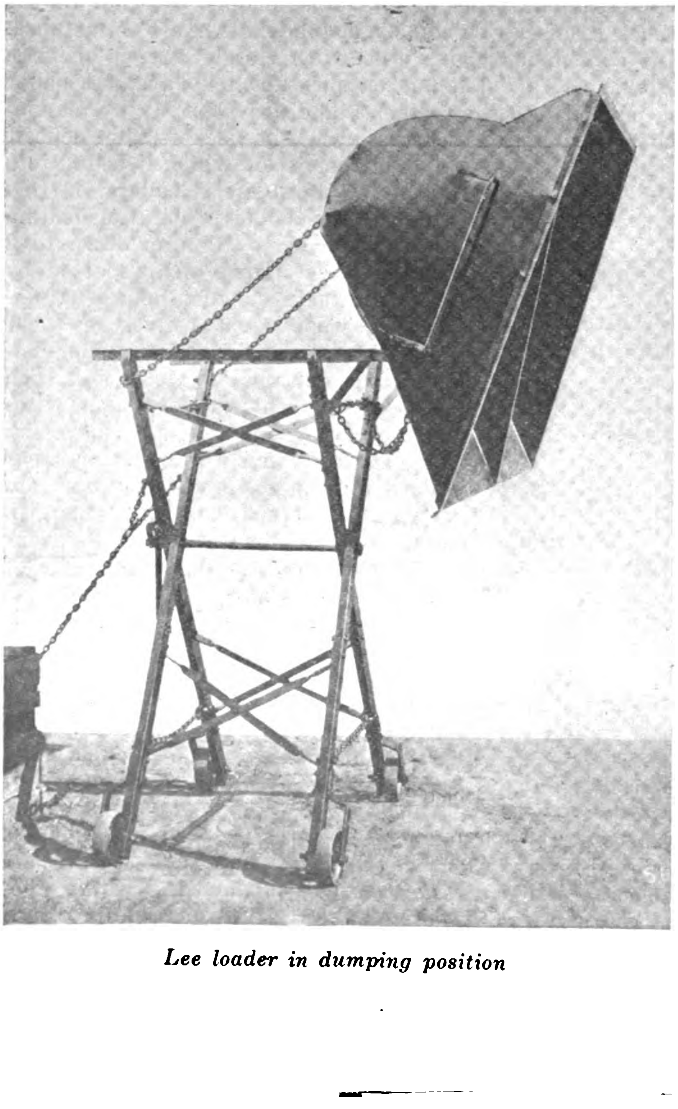
Machines of this kind are operated by one man, and as many as ten cars of a total weight of 500 tons can be moved in one day. The chief units in the construction of the loader are: frame, hoisting apparatus, bin, chute and pit, and the powerplant. The unloader is first located at a siding, and the cars are so moved that the hoppers or slides are over a chute placed

under the railroad track, where the load is discharged into a pit which is between the elevator and the track. The bucket is loaded, and then hoisted on an inclined track and emptied at the top of the track, into a hopper bin, from which it is discharged by gravity truck chutes into wagons, trucks or hauling cars. The drivers operate the chutes and load their wagons without delay or assistance.

Useful type of road body which can be loaded or dumped from the side

The elimination of hand shoveling is of supreme importance in saving time and money on work of this kind. As a matter of fact, it is almost impossible to get hand shovelers, because in summer there is so much other work to be had that men will not do this sort of work, and in winter conditions of frost make it practically impossible.

The manufacturer of a type of loader widely used compiled figures for comparison of costs in loading 5 cu. yd. of broken stone, coke, gravel, sand, and similar material, by hand and by a loader. His conclusion, based on cost of labor, time of use of truck, etc., was that the loading of a truck by hand cost \$1.94½ and by machine 45½c. The use of the loader almost exactly doubled the number of trips that could be made by the truck.



Lee loader in dumping position

British Standard Accumulator Rating

NO value for the capacity of an accumulator is of practical use unless it is also stated at what rate the current is generally assumed to be taken from the cells.

The following rating rule for accumulators used on automobiles for starting, lighting and ignition has been adopted by the Society of Motor Manufacturers and Traders (England):

"Accumulators shall have printed on their labels their actual capacity when discharged at a definite rate continuously, this rate being one twentieth of the capacity claimed. An interval of rest to be allowed, such interval not to take place until half the period of discharge has expired.

"In every case the discharge test is considered as being completed when the pressure in volts per cell has fallen to some pre-determined value, usually 1.8 volts per cell for the 10-hr. discharge and 1.85 volts for a 20-hr. discharge as an accumulator discharged at a very low and easy rate should not be allowed to fall to as low a point as would be safe at a higher rate of discharge."

During the past year this important subject of accumulator capacity has also been fully considered by the Portable Battery Makers' Section of the British Electrical and Allied Manufacturers' Association who have considered the matter from the point of view of electrical engineers dealing with accumulators used for every purpose, including automobiles.

A standard curve has been issued by them in which the percentage values for capacity at discharge rates varying from 1 to 20 hr. have been agreed upon and accepted by the principal manufacturers of portable accumulators.

This standard capacity curve having been considered by the Society of Motor Manufacturers and Traders through the Accessories and Components Committee, they fully appreciate the value of the work done in this connection, and agree that all figures for capacity based upon the 20-hr. figures in this B. E. A. M. A. curve are acceptable to them as true values for capacity at 20 hr. rate under rating.

THE Russell Mfg. Co., Middletown, Conn., has issued a booklet giving complete data of brake lining and clutch facing sizes used on different models of cars and trucks. The publication should be of particular use to garages and repair-shops.

Effects of Wrapping on the Strength of Struts

Found to Be of No Value When Additional Weight of Wrapping Is Considered—Bakelized Canvas Slightly Increases the Strength of Strut, But Cotton Tape Does Not

By T. R. C. Wilson*

THE wrapping, partial or entire, of certain airplane members such as struts or wing beams has been more or less commonly practised under the supposition that such wrapping aided in (1) increasing the strength at critical points, (2) holding the members together in case of partial failure, thus preventing sudden failures, and (3) keeping out moisture.

Wrapping has been advocated especially for cross-grained material in order to make available for airplane construction spiral-grained stock which would otherwise be rejected.

Extensive tests conducted by the Forest Products Laboratory of the Forest Service for the Air Service of the Army and the Bureau of Construction and Repair of the Navy on cross-grained, untapered spruce struts of the same outside dimensions covered with bakelized canvas gave the following results:

	(1) 2-Ply canvas covering (12 struts)		(2) 4-Ply canvas covering (12 struts)	
	Q	Q/W	Q	Q/W
Average	2922	619	2672	480
Maximum	3500	750	3200	580
Minimum	2425	532	2100	361

Q=Maximum or crippling load in pounds.
W=Weight of strut in pounds.

The deflections in inches of the struts which were tested to destruction were as follows:

	(3) 2-Ply canvas covering (3 struts)			(4) 4-Ply canvas covering (5 struts)		
	E.L.	T.	F.	E.L.	T.	F.
Average	2.0	4.9	6.3	1.7	6.1	7.8
Maximum	2.3	5.0	7.1	2.5	6.5	9.8
Minimum	1.7	4.8	5.0	2.1	5.5	6.3

E.L., T., and F. mean deflections at elastic limit, at first audible cracking of wood and at final failure of strut (rupture of canvas), respectively.

Four struts were tested to maximum load with the canvas on; the canvas was then removed and the struts again tested to maximum load. The average results and relative efficiency of different coverings follow:

	With canvas covering X			Canvas covering removed			Solid wooden struts of same dimensions as in X computed values		
Plies	Q	W	Q/W	Q	W	Q/W	Q	W	Q/W
2	3362	4.59	732	3012	3.53	852	3885	3.89	998
Per cent	100	100	100	90	77	116	115	85	136
4	2587	5.59	465	2145	3.43	636	3460	4.12	855
Per cent	100	100	100	83	61	137	134	74	184

Four struts were tested to maximum load with canvas full length after which the canvas was removed from the outer thirds of the length and the struts were again tested to maximum load.

The average results follow:

	Entire length canvas covered			All canvas removed from outer thirds of length		
Plies	Q	W	Q/W	Q	W	Q/W
2	2800	5.02	558	2590	4.30	603
Per cent	100	100	100	92	86	108
4	2300	5.58	414	2003	4.17	484
Per cent	100	100	100	87	74	117

Average results of tests of cross-grained Sitka spruce and Douglas fir struts (taped and untaped) follow:

Struts Wrapped with Cotton Tape and Given Three Coats of Dope.
10 *Pairs Sitka Spruce.*

	Weight (W) Lbs.	Maximum Load (Q) Lbs.	Q/W	Deflections At E.L. Ins.	Deflections At T. Ins.	Load at T. Lbs.
Taped	3.49	1262	362	2.1	6.2	934
Untaped	3.24	1276	394	2.0	6.4	910

Struts Given Two Coats of Wood Filler, Wrapped with Cotton Tape and Given Four Coats of Dope.
10 *Pairs Sitka Spruce*

	Weight (W) Lbs.	Maximum Load (Q) Lbs.	Q/W	Deflections At E.L. Ins.	Deflections At T. Ins.	Load at T. Lbs.
Taped	3.37	1197	355	2.5	3.9	993
Untaped	3.25	1285	395	2.1	5.2	1046

10 *Pairs Douglas Fir.*

	Weight (W) Lbs.	Maximum Load (Q) Lbs.	Q/W	Deflections At E.L. Ins.	Deflections At T. Ins.	Load at T. Lbs.
Taped	3.94	1480	375	2.8	5.0	1262
Untaped	3.63	1406	387	2.2	5.4	1121

E.L.= Elastic limit. T.= Tension failure.

These struts were of the tapered type used in the J-I training plane. All had cross grain of greater or less degree. Each taped strut was cut from alongside an untaped one. Before taping all struts were the same size.

The conclusions from all tests are as follows:

The addition of bakelized canvas to cross-grained struts, (1) increases the load somewhat but decreases the load per unit weight, and (2) increases the deflection and work to final failure and hence the shock-resisting capacity.

Wrapping cross-grained struts with cotton tape according to standard methods has no appreciable effect on their strength properties. It is doubtful if any other methods of wrapping such as cording would increase the strength properties very greatly. There is also the probability that any wrapping or covering will be loosened by weather changes.

It is believed that wrapping is of less value than the same *volume* of wood, and since the wrapping is likely to be heavier than wood it is of still less value compared to the same *weight* of wood.

*Engineer in Forest Products.

Landing Fields for Commercial Aviation

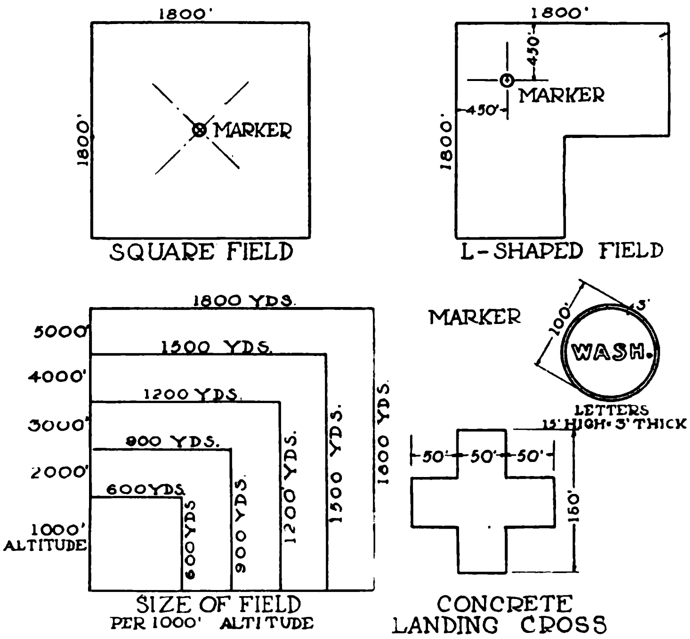
Some Considerations Entering Into Their Location and Design, as Determined by Army Aircraft Officials

According to army and other Government officials, landing fields are of the highest importance when it is attempted to establish commercial aviation routes, and the many elements that enter into their construction must be fully considered. Although no complete and comprehensive analysis has yet been made of all the factors that should be taken into account, some reports have been made on the subject and rules and regulations established by the War Department.

Because of the thinner atmosphere in districts located at a relatively high altitude, it is necessary to make the fields in such districts of greater length, to make it possible for the machine to attain a greater speed within the length of the field and thus insure the same rising power. For determining the necessary length of the field the War Department has developed a formula by which the length of the field necessary at sea level is multiplied by the ratio of the average weight of dry air (in pounds per cubic foot) at sea level to the average weight of dry air at the altitude considered. This gives the required length of the field at the altitude in question. The accompanying chart and table illustrate this method.

The height of surrounding country, the accessibility of the field from the port of call, the character of the soil and the prevailing winds are other important considerations. A landing field properly constructed according to the War Department specifications published herewith must have the point of landing at least 1200 ft. from the nearest obstacle 100 ft. high, 500 ft. from the nearest obstacle 60 ft. high, etc., including as obstacles trees, buildings or other construction, and hills.

To mark the fields so they can be distinctly located from great heights the army uses either a concrete landing cross measuring 150 ft. in each direction, or a circle 100 ft. in diameter with an outer ring 3 ft. wide and with letters 15 ft. long and 3 ft. thick.



Landing field length factor plotted against altitude

Where fields are built in sections that suffer from considerable wet weather or frost, sand foundations should be used to prevent either mud or rough frozen ground.

Data for Use in Calculating Necessary Length of Landing Fields

Altitude in Feet	ρ	l_0/l	$\sqrt{\frac{l_0}{l}}$
0	.0768	1.00	1.00
2,000	.0730	1.052	1.026
4,000	.0685	1.121	1.058
6,000	.0639	1.201	1.094
8,000	.0601	1.278	1.131
10,000	.0565	1.359	1.165
12,000	.0531	1.446	1.203
14,000	.0497	1.546	1.243
16,000	.0467	1.543	1.283
18,000	.0439	1.748	
20,000	.0412	1.863	

ρ = average weight of dry air in lb. per cu. ft

ρ_0 = weight of dry air in lb. per cu. ft. at sea level.

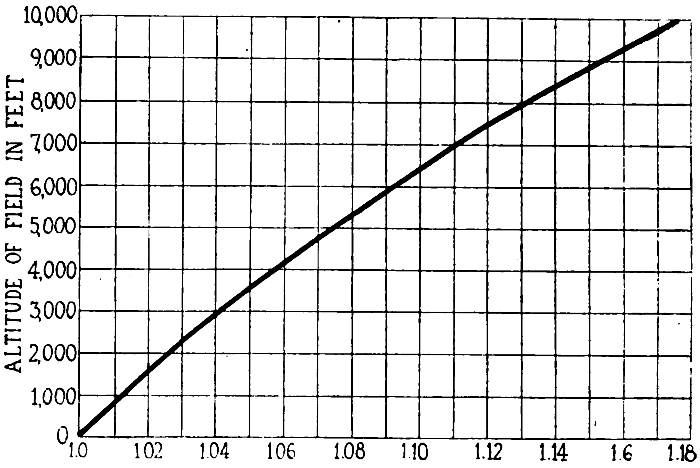
From formula.

$$L = K_y A v^2 = C \frac{1}{g} A v^2$$

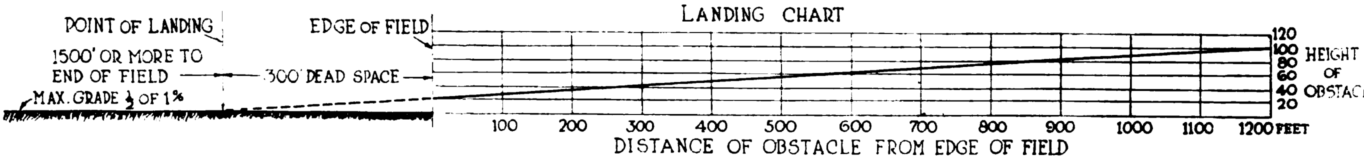
$$V = \sqrt{\frac{g W}{C \rho A}} = \sqrt{\frac{\text{const.}}{l}}$$

L = lift = W = weight

Since l is the only variable the velocity varies as $\sqrt{\frac{l_0}{l}}$



$\sqrt{\frac{l_0}{l}}$



Specifications for landing fields

Emergency fields, which do not have to be so complete as the permanent landing fields, should be particularly numerous in hilly country where it would be difficult to effect a landing. To insure absolute safety, the fields should not be further apart than twelve times the service ceiling of the airplane used. It is generally estimated that an airplane can make a forced descent six times as long as its service ceiling. For example, the Curtiss planes used in the air mail service have a ceiling of 1 mile. In case of trouble they can glide down over a distance equal to six times their ceiling, or 6 miles, and consequently if emergency fields are located 12 miles apart, the planes, when forced to land, are always able to reach a field.

Fields of this character, being used only in emergencies, need not be given the attention of permanent fields and can be considerably smaller. An airplane can land on a field 500 ft. long, although it might not be able to rise from it.

In deciding upon the location of a hangar on a field, the direction of the prevailing high winds must be studied. Properly arranged, a hangar will serve to take the brunt of the usual prevailing winds and act as a protection to the field and to the airplanes landing on it. At the same time the hangar cannot be built so that the winds will blow across the entrance.

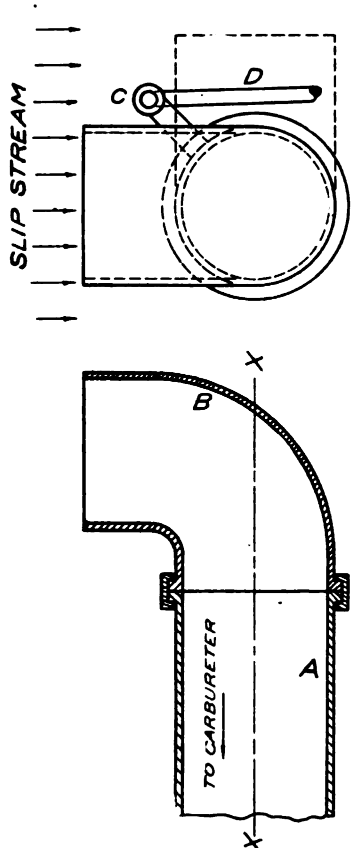
There is considerable danger of injury to planes leaving or entering a hangar if the entrance is not shielded and so built that the winds strike the back of the building instead of across the doors.

A Suggested Modification for Liberty Carbureter Air Intake

By C. V. Elliott

In the March, 20, 1919, issue of AUTOMOTIVE INDUSTRIES two views were shown of the air intake used on the Liberty aircraft engine. The article states that the intake pipe is cut off at an angle so that pressure may be produced by the propeller slip stream.

Some time ago the writer experimented upon the effects of a stream of air passing the end of a small tube when the tube axis was at different angles with the direction of the air current. The tube was connected to a U tube manometer containing water which indicated any suction or pressure that was produced at the end of the tube. If these experiments of mine are comparable with the conditions existing at the carbureter intake, it would seem that the angle at which the air intake for the Liberty aircraft engine is cut off is about the proper angle to reduce the effect of the propeller slip stream to zero.



Proposed modification of Liberty carbureter air intake.

This at once suggests a modification of the design by which it might be possible to increase the power of the engine at high altitudes and at the same time partly compensate for the increased richness of the carbureter mixture at high altitudes. Some of your readers who may have the facilities might be interested in trying the design here illustrated and explained.

In the illustration, *A* represents the vertical carbureter intake pipe to the top of which is attached the elbow *B*. *B* is fastened to *A* in such a manner that it may be rotated about the vertical axis *X-X*. *B* has a lever arm *C* attached to it so it can be rotated by a rod *D* running to the dash.

When the opening of the elbow squarely faces the slip stream, the total air pressure in the intake would be the sum of the atmospheric pressure plus the pressure equivalent of the slip stream velocity. With the elbow turned 90 deg. from facing the stream, a suction instead of an impact would be produced in the intake, the value of which varies with the velocity. At some position intermediate between these two, the slip stream velocity would have no effect upon the pressure in the intake.

The probable effect upon the mixture would be to make it leaner when the elbow faces the slip stream and richer when at a right angle. If the carbureter were adjusted to give the correct mixture with the elbow at a right angle with the slip stream and then turned facing it, it should partly compensate for the effect of decreased air pressure at high altitude. With the elbow facing the stream, it should also be possible to get an increased weight of mixture into the cylinders, hence, more power.

If anyone should try this or has already tried it, the writer would be pleased to learn of the results.—C. V. ELLIOTT, *Instructor in Mechanical Engineering, Louisiana State University.*

Carburetion of Low Grade Fuels

(*Continued from page* 1259)

changed a number of manifolds along these lines, and in every case there has been a decided increase in power and fuel economy; in some cases both were increased as much as 25 per cent.

On large engines, where the manifolds are of considerable length, and especially on heavy duty marine engines, the distance the fuel has to travel becomes a serious factor, and it is well to consider the advisability of using a carbureter for each cylinder or for each pair of cylinders. In such cases a side outlet carbureter, where the fuel passes from the mixing chamber to the engine cylinders by the shortest possible path, is the most effective.

It is also essential to make a close study of the mixture velocity in the mixture passages. No doubt there are designers with plenty of experience who can estimate very closely the necessary velocity, but for truck, tractor or marine engines, in which most of the low grade fuel is used, it is advisable to make up several manifolds giving different velocities, and thus develop the correct size experimentally. This applies also to a certain extent to automobile types. It is the writer's opinion that for most of the work above mentioned, a limited full load speed is desired, and after all other parts of the design have been settled, it is well to reduce the manifold area until it just begins to affect the maximum power. This will unquestionably produce the best results.

ONE of the noteworthy consequences of the war, according to *Metall und Erz*, is the great increase in the output of wolfram (tungsten). Before the war the whole world production did not exceed 10,000 tons annually. The present output is at least double that quantity. An approximate estimate gives: Portugal, Spain, France and Great Britain, 2500 to 2800 tons; North America, 6000 tons; South America, 3000 to 3500 tons; India, Siam, the Malay States and Australia, 5500 to 6000 tons; China and Japan, with Indo-China, 800 to 120 tons.

The FORVM

Ensign Heavy Fuel Apparatus

By O. H. Ensign

A CARBURETOR with an inherent correct-mixture characteristic dependent upon the principle of design (rather than on experimental or scientific development by combining certain compensating elements) is especially valuable with low-grade fuels. The carburetors described herein fulfill these conditions. The basic design of these carburetors is shown in Fig. 1. Fig. 2 shows a horizontal section through this vortex mixing chamber. The air enters the metering chamber X tangentially and flows downward to the outlet K of the chamber, following a helical path. The air inlet is of the same size as the engine manifold (the nominal carburetor size) and the velocity is nowhere higher than in the manifold. The pressure drop at the center of the vortex mixing chamber X is the result of centrifugal action, plus the small entering velocity head. With air only, this pressure drop at all speeds is directly proportional to the velocity head in the air horn or manifold, averaging about five and a half times that head.

When operating normally, the fuel drawn in at the center of X is thrown by centrifugal force through the revolving air and attains its maximum velocity near the rim of X. In so doing it absorbs from the air the energy necessary to attain this velocity, thereby causing a drop in the whirling speed of the air, which in turn acts to reduce the suction on the fuel applied through the suction outlet D. In other words, we have a centrifugal pump with an air impeller operating under suction lift only, against a restricted orifice, but this pump is flexibly impelled and slows down with the added load of fuel with each increment of added motor load, so that there is an inherent tendency to thin the mixture as the load increases, instead of a tendency to enrich it. The mixture characteristic can be changed by the operator only with reference to the general fuel-to-air ratio, but not for any particular speeds and loads.

Vaporization of the lighter constituents of the fuel also causes an added drop of suction at D, as their expansion partially eliminates the vacuum, so that the more volatile the fuel, the less will be used. The more you heat the mixture by means of hot air and increase the vaporization, the less fuel will be used. In other words, the better adapted the fuel is for economical use in the motor, the less of it the carburetor will deliver, and this applies throughout a wide range of temperature. There is no need of adjustment for temperature changes, but adjustment will be required when changing from one fuel to another of far different volatility. This characteristic makes hot air the most effective method of heating. The rate of revolutions about the center of the mixing chamber X reaches 15,000 per minute in some installations. The heavy particles of fuel will be thrown to the outer wall and brought into the fresh air stream repeatedly, thus "aerating" the fuel to the maximum, if such a term can be used, and those heaviest fractions which reach the holes J at full load will pass through them under an atomizing pressure of about one-fourth of the total pressure drop through the mixing chamber, which may reach 30 in. of water when the proper size carburetor is used. Hot air in this mixing chamber aids materially, because the reduction of viscosity allows better breaking up of the fuel. At low throttle, all the heavy particles will be carried through the by-pass tube Z and ejected above the throttle at O. The natural mixture characteristic of this carburetor on modern gasoline is from 16 to 1 by weight at no load to about 17 to 1 at full load, with a straight line mixture inherently produced between these two points under all conditions of operation. The unbalanced butterfly E is used only for automobile work, when manifold conditions make it difficult to get extremely low idling. However, on an ordinarily geared machine at 7 to 10 m.p.h., this unbalanced butterfly lies horizontally and offers no resistance. It is not in any sense a choke and does not affect the pressure on the mixture at any time more than ⅛ in. of water. With this metering characteristic and this tremendous aeration of the fuel, it is naturally a low grade fuel instrument, and 90 per cent of the factory output of the Ensign Carburetor Co. has been for other fuels than gasoline—mostly kerosene.

Fig. 3 illustrates the side outlet carburetor in this type, for use with block motors with or without integral manifold.

With this straight line mixture and the manifold construction outlined above, combined with the proper application of hot air, there is not as much risk from pre-ignition as there would be where there is a possibility of a stratified mixture and poor distribution.

To still further eliminate the difficulties arising from starting and handling of low grade fuels, especially kerosene and similar products, the Ensign fuel converter, shown in Fig. 4, has been developed and it is believed to have reached a stage of perfection. This instrument uses the same metering system but adds a gas producer, a priming chamber and a thermostat.

Under all conditions of operation the heavy fractions pass through the fire screen U by gravity, over the distributer C into the combustion chamber Q and are there ignited by the spark plug which is in series with one of the cylinder spark plugs, or may be supplied from a special distributer. There is formed a continuous downward flame, and partial combustion takes place, because the suction through the gas flue Z puts the flame out before combustion is complete, delivering a fixed inflammable gas above the throttle. The heat developed by the gasification of the heavy particles of fuel causes a rise in temperature of the floor of the mixture passage L, the walls of the gas flue Z and adjacent parts, vaporizing the lighter particles of fuel, so that the resulting mixture is composed of vaporized fuel, free carbon, fixed gas, a certain percentage of inert gases and steam. The throttle is provided with a notch O, into which a square plug M, operated by the thermostat capsule N, is projected by action of the heated mixture, which is forced to flow about the capsule N, thereby regulating the opening of the notch O to control the draft through the flue Z when the motor is idling, and thus regulate the idling temperature.

With the throttle wide open the draft through the flue Z is an induced draft, brought about by the elbow of the main mixture passage, the obstruction offered by Z, etc. The idling temperature is limited to something under 235 deg.; the load temperature varies according to the motor and other conditions, from 235 deg. down to 160 deg. In other words, the temperature is

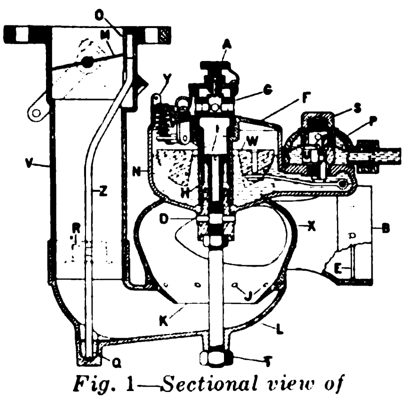


Fig. 1—Sectional view of Ensign carburetor

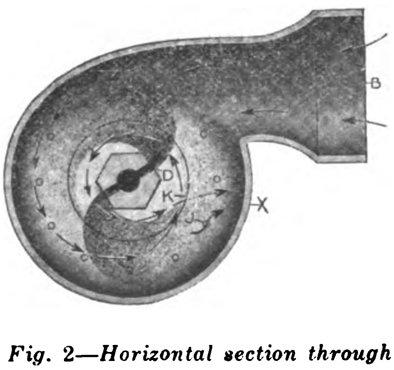


Fig. 2—Horizontal section through vortex mixing chamber

highest with the lightest load and lowest with the heaviest load. The by-pass V takes air relatively free from the heavy fuel mixture, out of the upper part of the mixture passage L, and compensates for the tendency of a large portion of the fuel to flow into the fire box when starting cold or in cold weather. Also, it furnishes relatively clean air to maintain a higher rate of combustion under those conditions, while in warm weather the heat travels up into the mixing chamber X, and some of the lighter particles of the fuel will be vaporized and pass through V, smothering the fire. Thus the apparatus inherently compensates, to a great degree, for changes in temperature and changes in the end points of the fuel.

It is started by means of a gasoline primer in the chamber E. At the top of this chamber is a large hole which overflows when priming cold, and a puddle of gasoline will form under Z. With the throttle closed and the plug M withdrawn, the engine is sure to get a good mixture for starting. Gasoline continues to feed, at a reduced rate, for a short time, until the cup E is empty. However, the instant a spark occurs in the combustion chamber, there are formed a fixed gas and heated vapors that will operate the motor in the coldest weather. Starts have been made at 16 deg. below zero, which permitted of putting the motor to work immediately, and within the short distance of a city block full power on kerosene was obtained. It starts on a kerosene prime from D when hot and a few drops of gasoline from F when warm. The inverted cone B is of a refractory cement, practically indestructible. The small threaded rod standing in the flue Z has a vertical movement of about 1/16 in. and under the suction and the jar of the road, moves around in the flue Z, removing any carbon which may collect in the flue.

This offers an instrument for handling any water white fuel from gasoline through to kerosene, with no change in the instrument other than adjustments of sleeve G, with a change in the viscosity of the fuel, except that in warm weather when running on gasoline the spark plug in the combustion chamber should be short circuited. The instrument then becomes a gasoline carburetor.

With this instrument ideal manifolds are not necessary, but are an advantage. It can be started to work immediately, which is more than can be said of present gasoline equipments, when cold weather conditions are considered.

The pressure of a certain percentage of inert gases (carbon dioxide, carbon monoxide and methane) in the mixture will obviate pre-ignition under compressions which with any other method of heating kerosene would cause serious trouble.

When operating at extremely low speeds under small throttle, the thermal value of the mixture is lowered, because a very large percentage of all the fuel is drawn through the fire box and converted into fixed gases, but as the throttle is opened up, the thermal value of the mixture increases. The all-around average result on many commercial installations indicates an average of one-third less kerosene used than with gasoline. This, of course, is due to better distribution to all cylinders and a uniform performance on a thin mixture, as well as to a slightly increased thermal value of the fuel used. Some block tests have been made in which the horsepower exceeded that obtained on cold gasoline, under the same conditions. This was undoubtedly due to the fact that the distribution to the cylinders was very materially improved.

An entire change of the character of the mixture occurs with extreme changes of atmospheric temperature, for in extremely cold weather, no doubt, a very large portion of the fuel passes through the fire box all the time, because it simply is metered by the chamber X and not broken up to any extent, and probably this fuel, passing through the fire box, is cracked to a certain degree to some lighter fractions, as it has to pass through the flame zone. Also, during cold weather a very persistent fog is created by these vapors of fuel, which pass through the flame zone and are delivered above the throttle, by contact with the colder mixture, going around the outside of the flue Z.

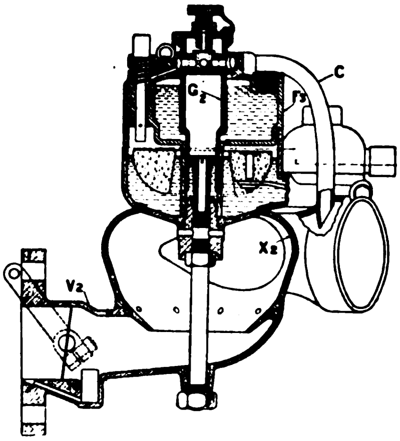


Fig. 3—Side outlet carburetor for use with block motors

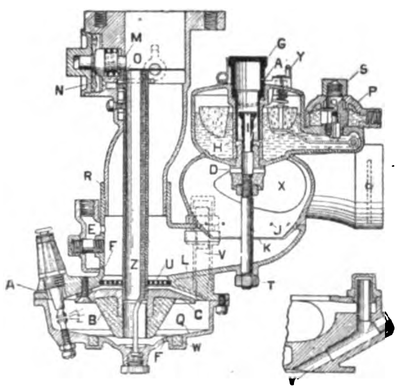


Fig. 4—Ensign fuel converter

The apparatus has been in continuous operation for over two years. Throughout this period the motor was in better condition, with less repairs than with any other method of carburetion, and within the last six months it has been possible to operate without unusual attention being given the converter.

—

Odd Ways of Starting Gas Engines

By Jack Hiscock

NOT every motorist as he presses his starter pedal, stops to think how fortunate he is that the process of cranking the engine has been so simplified for him. Electric starters were developed because the old method of cranking by hand proved intolerable. Yet, hand starting of an automobile engine is child's play compared with the methods necessary to start some other types of engines.

When a tractioneer starts the engine of his big caterpillar, he fits a bar into one of a series of sockets in the engine's flywheel and rocks the engine up to compression. No one can spin these monsters. Rarely can they be rocked past compression, but are usually rocked backward up to compression, where, thanks to generous priming and a hot spark, they usually fire and the wielder of the pinch-bar pulls it from the darting socket hastily.

The petty officer on a submarine chaser relies upon compressed air to start his unwieldy engines. He, too, must prime copiously and has the additional responsibility of an auxiliary engine, hand-started to pump the air.

A most picturesque but risky method is ordinarily used to start airplane engines. The mechanic shouts "Off" as he approaches the propeller and is answered in kind by the pilot at the switch. He then spins the great wooden blades by hand to charge the cylinders with gas. Having worked up a warm perspiration, even on the frostiest mornings, he springs clear and shouts "Contact!" The pilot indicates that he has closed the switch by repeating the signal and the mechanic once more approaches the propeller. Gingerly this time, however. With a single swift motion he twirls the blade through an arc of more than 90 deg. and steps quickly away from and to the side of the murderous whirling stick.

A 150-hp. engine is about all anyone but a Samson can swing. When heavier engines, culminating in the 400-hp. Liberty, made their appearance, new methods had to be devised. At first the blade was pulled over compression by running past it and giving it a smart pull in passing. Sometimes two men with hands joined were required. As many as three were required to do the preliminary "winding up" or charging. Owing to the weight and complication, electric starters were not considered seriously, but an auxiliary magneto was made use of to produce a shower of sparks in the cylinder under compression.—JACK HISCOCK, *Splitdorf Electrical Co.*

Engineering Comment on Pertinent Questions of Design

(*Continued from page* 1255)

close as possible to the cylinder walls and have arranged the gas passages as free from bends as possible. This has given very gratifying results, even in the lower speed range.

I am not in favor of a piston speed above 1500 to 1600 ft. per minute on account of the lack of time necessary to vaporize the fuel at higher speeds. With low-grade fuel the time available for vaporizing, compressing, and exploding it is too limited to permit combustion of the full charge, and necessarily part of the gas stays in the cylinders in the raw state and filters into the crankcase by the piston rings, thereby cutting the quality of the oil and causing bearing troubles.

The Pistons

I think the hour-glass type of piston and the broken wall piston will have a restricted use, as, for instance, in flying machine motors or racing motors, but I cannot see how anything but the full cylindrical type can be used in the everyday motor. Everyone must realize that in the gas motor, the piston is not quite as well guided as in the steam engine and, therefore, the bearing of the piston into the cylinders must be made long enough to insure a perfect joint and a compression chamber absolutely tight. As the film of oil, which is between the wall of the pistons and the cylinder, plays a great part in gaining that object, it must not be broken in the length of the piston in order to have the greatest efficiency. There is also the trouble known as piston slap, and this can be avoided only with a piston bearing as long as possible and unbroken. In fact, I think that we could have better motors to-day if we would lengthen our pistons slightly instead of trying to shorten them. At least, it would give the motors a great deal longer life.

My experiments with the different types of aluminum pistons have not convinced me yet that it is the proper piston to use in a motor. Neither the heavy type nor the die cast aluminum piston has been proved satisfactory, and especially since, with the fuel we are using, we must prevent, by all possible means, the passing of the raw gas by the pistons into the crankcase, the aluminum piston is certainly at a great disadvantage as compared with the cast-iron piston. For limited service in specially built motors for racing cars and flying machines, I consider the aluminum piston a necessity, but for continuous and heavy service, nothing has yet appeared to take the place of a well-designed cast-iron piston.

I cannot see any chance for a radical change in the transmission. I think that a great deal of the noise caused by the meshing of the first and second speed gears could be avoided if the transmissions were designed with wider and heavier bearings, also with heavier shafts, avoiding the deflection of the shafts under load. The practice of making secondary shaft gears and their shaft revolve together on two outer bearings should be abandoned, because the load is applied only on one point and has a tendency to bend the shaft and, of course, makes the gears run out of true, thus causing some noise. The best plan is to have the countershaft gears in one unit revolving on a fixed heavy shaft. This tends to eliminate any chance of deflection and to distribute the load evenly along the full length of the shaft. The gears will run smoothly and noise will be eliminated.

Rear Axles

I do not think that the rear axles are too strong on any car. Some of them might be too heavy and some better design, no doubt, can be evolved which would reduce the weight and make a better axle. But in my opinion the rear axle of the average car could be made stronger and better by using larger bearings, also a higher grade of steel for the shafts, and a special heat treatment of the steel tubing, permitting the use of a lighter section with a high elastic limit. An electrical treatment of steel tubing has been devised recently which increases the elastic limit of the tubing by 100 per cent and, no doubt, this could be used in making a rear axle stronger and lighter at the same time.

In my opinion the great majority of cars on the market have very poor brakes. The reason, I believe, is that we apply the braking power on the slowly revolving rear wheels with less effect than if we applied the power to the transmission shaft revolving at a high speed. No doubt the reason for putting the brakes on the rear wheels has been that most of the automobile plants of this country are located in flat country, where designers do not have the opportunity of trying the cars on mountain grades. If some of the automobile factories were located near the Rocky Mountains, no doubt we would have better brakes because, in testing the cars, the engineers would find that the present brakes would not take a car down a grade seven or eight miles long without burning the motor and having to brake with the motor. Foreign cars are better than ours in this respect, for most of them are used on mountain roads, and as far back as 15 years ago their designers had studied the brake question and had transmissions with the brake drum flanged to permit the cooling of the drum by water. —E. Planche, Chief Engineer Dort Motor Car Co.

By John Wilkinson

Super-induction charge for the purpose of ramming an excess charge in the combustion chamber is utterly futile. It makes the car heavier, it consumes more gasoline per mile, it increases the cost and the complication. The economy is less because super-induction, on account of the increased mean temperature, cannot be used with as high compression as is used in the ordinary four-cycle engine. It, therefore, follows that the thermal efficiency will be lower. Also, on account of the higher mean temperature, more radiator will be required, the exhaust pressure will be higher and more muffler will be required; and, too, on account of the same high mean temperature better exhaust valves will be required. Added to this will be the complication of a means for super-induction.

For a given horsepower, although the mean effective pressure is raised, there is no reason to look for more horsepower per pound of weight. Therefore, as first stated, the automobile will be heavier, more costly and less efficient.

In regard to pistons I can see no field for heavy aluminum pistons in small size cylinders, because weight limits the speed. Die-cast pistons are very successful in themselves.

The Riccardo type, with guiding and sealing elements. may find a considerable field in stationary practice, but in automobile practice, where high speed and light weight are necessary, this type would seem to be impossible.

From transmissions he has seen the writer believes it is quite possible that within a few years such improvements will be made in grinding gears that we may expect to get a commercially satisfactory transmission. I have already seen some special transmissions which are so much better than the average that they would seem to be good enough if used as a standard.

Most all rear axles are too heavy and when the designers appreciate the disadvantages of this weight, they will have no trouble in producing a reasonable weight axle.

I am a thorough believer in the transmission brake as a foot brake for general service. The advantages in having one brake on the transmission and one brake on the rear wheels, so as to remove as much weight from the rear axle as possible, should be evident. This results in better diffusion of the heat in braking under severe conditions and furnishes a foot brake for general service which, when applied quickly under high speed, will not throw the car into the ditch.—John Wilkinson, Vice-President H. H. Franklin Mfg. Co.

Tractor Design Problems

By L. L. Cass

I do not think it logical to restrict intake passages to govern the performance of a tractor engine. Why build for power that cannot be used? The logical method would be to apply to a tractor an engine with 25 per cent surplus power, which would be avaliable in extreme conditions. Make an engine as efficient as possible and so powerful that, except under extreme conditions, there is always reserve power. When this is done, engine trouble will be reduced to a minimum.

Comparative results obtained with both splash and pressure lubrication, which I have observed personally, prove conclusively to me that pressure lubrication is absolutely necessary, the most practical pressure being 25 to 30 lb. at 1000 r.p.m. of the engine. Positive application of lubricant is the only way to be sure of accomplishing the desired results.

The wise tractor owner is the one who insists upon using gasoline instead of kerosene. Many good kerosene burning equipments are on the market, but with the best of them there is found to be considerable crankcase dilution, more so than with gasoline. While kerosene is cheaper than gasoline, lubricating oil must be changed more often, bearings must be watched more closely and better performance can be obtained by the use of gasoline.—L. L. Cass, Chief Engineer, Parrett Tractor Co.

By H. L. Horning

If the passages are restricted for the purpose of eliminating the governor, I do not think it will be satisfactory. The farmer demands a tractor with a governor. All engines have restricted intake passages whether they are served by a governor or not. No doubt these restricted intake passages save many engines from untimely destruction.

I think pressure lubrication will be satisfactory when it is better understood by the manufacturer and the user. At present the splash is the most satisfactory system. Nothing can take the place of design and good workmanship in bearings, nor can lubricating oil be expected to cover the defects of a bad system of lubrication.

The common method of lubrication is splash, in which the level is established by overflow dams. Another form, and the most reliable, is the splash system in which the oil level in deep troughs is correctly maintained, irrespective of the inclination of the engine. The oil pump capacity in pumping the oil into the troughs is just equal to the capacity of the scoops to throw the oil out. Inasmuch as the oil pump capacity varies with the speed of the engine, and the rod scoop capacity the same, the level of the oil is constant.

Force feed through a hollow crankshaft is a well-known and high-class system. It has not been widely adopted because of the difficulties with leakage of oil under pressure, both past the piston and rings and at the crankshaft, and because of the unusual workmanship required for the pressure maintenance. In both the above mentioned systems old oil is pumped over and over, and this leads to bearing troubles.

Lubricating oil is little understood even by the refiners. Most tractor oil is so loaded with the heavier portions that under high pressure and temperature under the piston heads and walls it breaks into lighter oils, carbon and tars. Added to this, many engines suffer from dirt, dust and sand which enter either at the carbureter or breather. Taken together, the oil in the crankcase of an engine in use for a month, with either the splash or common force-feed systems, is usually a bad mixture and entirely unfit for lubrication uses.

With the force-feed system, unusual care must be taken to strain and settle all grit or dirt out of the oil, or it will cause unusual damage to journals and bearings. No such care is necessary with the splash system, as it seems to develop the least difficulties with dirty oils. With clean oil, well filtered and of good body, the force-feed system works exceedingly well so long as the bearings are in good adjustment. A surplus capacity of oil must be available at all times, so one or more loose bearings will not starve other bearings. Unusually good piston and cylinder fit must prevent overoiling of cylinders when rod bearings are loose.

The ideal system, if expense and care are no object, is the force, feed of fresh oil to crankshaft bearings and cylinder in exact quantities. So far as results are concerned on the surfaces, bearings lubricated by this method are not only the most economical in oil consumed, but also insure the longest life to both journals and bearing surfaces.

This brings us to the effect of heavy fuel on the bearings of tractor engines. Incomplete vaporization leaves heavy fuel unburned, incompletely burned and decomposed on the walls of the cylinder and combustion chamber. Under the action of high heat the fluid residue flows down the cylinder and past the rings, through the oil drain holes so commonly used, into the crankcase.

The products of complete and incomplete combustion found in crankcase oil range in hydrocarbons from formaldehyde to sugars. They include acetone, alcohols, sorghums, formic acid and a list of disinfectants varying in constitution according to the circumstances of combustion. This mixture, taken together with the solid contents mentioned above, constitutes about the worst lubricant a cylinder and bearings could have. The lower crankcase is the catchbasin for the by-products of imperfect combustion process. It is the main sewer for decomposing body fillers of our poorly compounded lubricating oils. It is the settling basin for steel, iron and bearing particles which slough off into the lubricants, and the crankcase with its oilpan forms the dustpan of the self-appointed air cleaner which duty every engine takes upon itself.

Taken from an unbiased standpoint, have engineers in tractor engines of to-day finally arrived at about the worst lubricating conditions possible? Is there any device which would permit more fuel to get into the lubricant than our present design of oil scraper piston?

The man was a great philosopher who said, "Tractor engines work in spite of the designers and users."

The heavy fuel and by-products of combustion appear

to have bad effects on steel journals and bearing materials. In England some practical men, and engineers as well, consider an engine "done for" if it is once thoroughly saturated with some of the fuel compositions.

Economic factors impose the splash system, in its most thoroughly worked out form, as being a good stand-by under all circumstances. Most men understand it best, or, to be frank, pay least attention to it. As an all-around system, it takes care of itself better than any other. The ideal system of fresh oil to all points is perfect, theoretically, but the complication and details, together with thickening of oil in cold weather, make it hard to introduce. The force feed through the crank will become widely used when manufacturers and users know more about it.

Bearings suffer under heavy fuel conditions due to the high pressure of detonation and preignition. Preignition can be controlled by design, as will be noted under cylinders, pistons and rings. Both preignition and detonation are limiting factors of our modern fuels.

It has been our policy to frankly state to our customers just how well we can burn kerosene, its limitations, and wherein it is not as good as gasoline. We have influenced a number of customers not to put on the kerosene equipment, convincing them that the decrease in the cost of the fuel per gallon did not make up for the loss in horsepower and less work done in a day.—H. L. Horning, General Manager, Waukesha Motor Co.

By R. O. Hendrickson

I believe in governing or limiting engine performance by a combination of three factors, as follows:

First—traction.

Second—piston area.

Third—restriction of intake passages.

In regard to splash oiling system vs. pressure, this depends principally on the size and revolutions per minute of the engine, the splash being more suitable for high-speed engines and the pressure absolutely essential for engines where the piston walls are at a greater distance from the crank. The splash system is much simpler.

I believe that where an engine is designed for the use of kerosene fuel, it is quite as satisfactory as gasoline, except for the additional attention required in starting. An internal combustion engine to use kerosene as fuel must be designed throughout with this in mind. An engine of the T or L head type, with large areas in the combustion space, is not very suitable for burning kerosene oil; on the other hand, an engine with a compact combustion space, with proper carbureting attachments and manifolds, is quite satisfactory.—R. O. Hendrickson, Chief Engineer, Wallis Tractor Co.

Duralumin for Metal Airplanes

IN a recent paper presented to the Royal Aeronautical Society of Great Britain, Dr. A. P. Thurston asserted that wood construction of airplanes would give way to metal construction on account of the all-round superiority of certain metals, notably steel and duralumin. As compared with steel, duralumin has many advantages and a few disadvantages. Weighing only one-third as much as steel, it follows that the various members may be, weight for weight, three times thicker than steel members. Hence the difficulty in overcoming local failure due to local flexure is greatly reduced. Nevertheless, the perfection of a design can only be discovered by constructing it in steel, and it is thought that duralumin designs will be improved by adopting the principles which have proved to be the only feasible ones in steel construction.

A prejudice appears to exist in certain quarters against duralumin owing to the fear of corrosion. It should be stated that duralumin, unlike aluminum, is not acted upon by sea water, or affected by atmospheric influences, and experience in connection with airship work shows that duralumin, if properly varnished, is not affected by corrosion under ordinary conditions of service. Nearly every case of corrosion so far experienced in actual practice has been traced back to incorrect heat treatment, or to cold working after heat treatment. The heat treatment of duralumin, instead of being a disadvantage, as is often supposed, is in actual point of fact of the greatest assistance in the practical working of the metal. This heat treatment is carried out by placing the members to be treated in a bath containing a mixture of potassium and sodium nitrates heated to a temperature of 480 deg. C. In practice there is a fairly wide margin of temperature so long as 500 deg. C. is not exceeded, in which case there is danger of the metal being burnt and reduced to aluminum. The parts should be left in the bath long enough to be heated uniformly to the temperature of the path, the actual time allowed being five minutes in the case of small units up to several hours in the case of 3 in. bar. There is no danger in leaving it in the bath too long, providing the actual temperature of 500 deg. is not exceeded. At the end of this time the article is removed from the bath and quenched out in water or non-acid oil. Immediately after heat treatment the metal is found to be in a very soft and plastic condition, and it may be pressed, forged, bent to the smallest radius, or in the case of drawn sections which have warped with the quenching, straightened without any fear of damaging the metal. The metal now commences of itself to harden up, and in about an hour's time has reached about 26 tons tensile strength, with an elongation of about 15 per cent.

This process of hardening continues for a very long period, the strength slightly increasing at the expense of the elongation. Heating duralumin to 300 deg. C. and then quenching out anneals the metal, and it can then be worked in any way desired. In order to give it back its strength it is necessary to heat treat it at 480 deg. C., as explained above. In practice it is usual to anneal any duralumin part if a number of operations have to be performed, and on the other hand to heat treat before final operation if this is not of too prolonged a nature, taking advantage of its abnormal condition immediately after heat treatment. An actual example of the value of this property of duralumin in slowly hardening up after heat treatment occurs when duralumin is used for rivets. If an attempt were made to rivet these up in the ordinary hard condition they would crack badly. By heat treating them, however, and using them immediately after this, a perfect job may be made while they are soft, and within a very short time afterwards they have hardened up to their full strength.

If duralumin in the ordinary hard condition is bent to a small radius there is, as would be expected, a probability of incipient cracks developing on the surface of the metal at the bend. These cracks are the places where the corrosion begins. If the metal was properly heat treated before such bending no injury would be caused to the surface of the metal, and no trouble would be experienced from corrosion. Nearly the whole of the prejudice against the use of duralumin is due to ignorance as to its properties with and without heat treatment. Sections cannot conveniently be drawn thicker than 0.2 in. Above this thickness the sections are extruded. It is advisable to use only solid drawn sections for the constructional purposes and designs should accordingly be modified to meet the limitations in the material.

ACCORDING to a French contemporary, American army motorcycles recently sold at auction in London brought prices above their catalog figures.

THIRTY-ONE of the leading British accident insurance companies have so far issued a list of premiums for flight risk insuranee.

Tractor Design from the Operator's Viewpoint

(*Continued from page* 1311)

The belt pulley should be where a man can either sight over it or set guide marks by stepping off from the belt as it lies on the ground. Also, the belt should clear the operator well so that he will not be caught or struck in tightening up on it. The belt pulley should not be located so that it may catch a man's clothes when not being used in belt work.

Seat springs are apt to break, and if there is any chance of a man dropping in front of a disk or other load, a safety basket should be provided. Considerable improvement might be made in the operating position it is necessary for the operator to assume. A padded or a cushion-back seat is too warm in summer, but saves a man from much jar.

It should be borne in mind that an operator must be at his post all the time the tractor is operating and is unable to run all over the machine to make adjustments and to oil the various parts of the tractor.

Care should be taken not to make individual parts, such as heads of a block motor, too heavy, as very often the operator has no facilities for lifting and has no helper.

These remarks are not intended as a criticism of any one design, nor of designers in general, for the problems involved in getting out a practical machine are not easy. Some of the operator's requirements are much more easily stated than solved, but the success of a tractor and its sale in any given neighborhood depend largely on the operator, and the easier it is made for him to keep going, the better he and the owner are satisfied. Some operators may like to tinker with their machines, but most of us are glad enough to leave them alone, unless some part is in need of attention, and the more easily that thing may be got at, the more likely it is to be fixed before trouble develops. In case of trouble the more accessible rig will get going the soonest; therefore, make your rig accessible.

The Influence of Hitches and Drawbar Location on Tractor Design

(*Continued from page* 1335)

be provided with suitable hitches for tractor operation, and their further use should be provided for.

I do not believe that a successful tractor will ever be a very good cultivator or vice versa, because the operating conditions and requirements, as well as the power demands are too different. Therefore, cultivating implements and their attachments need not be considered in connection with the problem of tractor hitches.

So much for the problem of tractor hitches and drawbar location as related to tractor design; doubtless there will be many to take issue with me on one point of reasoning, and that is the point about which the moments of the various forces act. I have watched dozens of tractors in operation, seen them raise up and even turn over, and the rotation is always about the rear axle and not the point of contact between the drive wheels and the earth.

In proof of the reasoning employed, make of yourself a tractor in the following way, and note the reactions in your own body.

If you stand with the body bent forward at the hips, with a wooden square representing the tractor framework hinged upon a pipe or rod strapped across your back at your hips, and attempt to drag a load hitched onto the lower end of the wooden square, you will observe that the forward end of the horizontal arm of the square presses heavily downward upon your back, and that the harder you pull the more the tendency will be for you to want to straighten up. This corresponds exactly to the forces at work in a tractor, showing that the greater the resistance (or drawbar pull) becomes, the greater the effort becomes to overcome this resistance, and, therefore, the greater the tendency to raise up at the forward end.

As the framework corresponds exactly to the wooden square, and is hinged about the rear axle, it is evident that it cannot rotate about any other point.

Some engineers claim that at the time the tractor overturns it becomes practically a locked or rigid mechanism. If this were a fact the drawbar pull would suddenly have to become an active force in place of a reactive force in order to overturn the tractor, and this, of course, cannot happen.

Waterproof Plywood for Airplanes

(*Continued from page* 1333)

ting veneer has very little effect on the strength of the plywood, but that the plywood made of sawed veneer is inclined to warp less than the plywood that is made of sliced or rudely cut veneer.

An extensive series of tests on glued and riveted joints in plywood was completed. Joints of various types were made, some of which extended through a single ply only, while others extended through the entire plywood thickness. The tests show that the tubular rivet gives the most satisfactory results in riveted joints and that there is very little difference in the strength of joints made of various sizes of rivets, provided that the most effective spacing and margin is used of each size. The scarf joint extending through the entire plywood thickness was recommended in preference to the riveted joint, because it gives a considerably higher efficiency. A scarf having a slope of from one in twenty to one in thirty was found to be very satisfactory.

Tests were made to determine the proper conditioning for plywood which is to be bent in double curvature. A special mold was prepared for this purpose, but the tests made are still too limited in scope to draw any conclusions.

Machines were devised for determining the vibrational strength of plywood and the relative toughness. The tests made to date are still too limited in number to draw conclusions.

Matthews Full Automatic Lighting Plants

(*Continued from page* 1315)

turn through a certain angle and is then held from rotation by an adjustable stop on the dial. If now the current through the relay should be reverse, as in cranking the engine, the relay hand moves slowly in a clockwise direction until it comes up against the contact point. This completes the circuit of the breaker trip coil, which latter neutralizes the hold coil, so that there is no resulting pull, and the breaker armature is released, thereby opening the circuit between the battery and the generator. Thus, after a fixed period of cranking the engine, which is generally about 2 min., if the engine fails to pick up its cycle the generator is automatically cut off from the battery and no undue amount of electric energy will be wasted.

The normal position of the breaker is the closed position with the hold coil energized. If the breaker opens, all control circuits are dead, and all coils and relays in the released position, and the lights are cut off.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, June 12, 1919 No. 24

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
Clyde Jennings, Managing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address - - - - - Autoland, New York
Long Distance Telephone - - - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - One Year, $3.00
Canada - - - - - One Year, 5.00
Foreign Countries - - - - - One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.
Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.
Member of the Audit Bureau of Circulations.
Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

European Restrictions

INSTEAD of France and Great Britain ameliorating on the question of import restrictions and the import duties to follow the removal of restrictions, the present sentiment in both countries to protect their respective industries is increasing. The reason lies in the fact that for many years America used its high tariff wall of 45 per cent against European manufacturers, and now these European makers do not especially cherish the suggestion from America that import restrictions should be removed and low import duties levied.

The probability of the removal of the British import restrictions September 1 is not so bright as it was a month ago. The 9 months of import restrictions do not seem sufficient for the British manufacturer, who has been somewhat slow in rearranging his business after the war, although perhaps not open to criticism, as the work of re-arrangement has increased as months have passed.

France has frankly stated that her manufacturers are capable of caring for the needs of the civil population in that the interests of the country must stand ahead of the interests of any particular industry. The civilian population may require more vehicles to-day than the manufacturers can furnish, but if throwing down the bars to America, because she has the vehicles at hand, would bankrupt the French industry, then the French Government is entirely rational in its view.

America is to-day paying part of the price of the high tariff duty that has always been against the European manufacturer. The 10 years when European makers had to meet the 45 per cent duty are not forgotten. As France puts it, after American makers have built up business behind a 45 per cent tariff protective wall, it is hardly good grace to tell France she should not have a high tariff protective wall to rebuild her industries after the war. If the protective wall was good for America in the early days of the industry, and up to the present, then it should be good for France to-day. Perhaps we were not so much concerned about giving our civilians cheap European cars 10 or 12 years ago as we are giving French civilians cheap American cars to-day.

The best thing for the automobile industry in America is to have a healthy automobile industry in England, France, Italy and Belgium. It would be scarcely short of a calamity to have the French automobile industry bankrupt. The same applies to the British industry. Both of these countries have played a large part in the development of the industry. The British maker played it without a protective tariff. The French maker did it with a relatively low tariff. He has been the developer. We did it with a high tariff. Because of this we should attentively listen to the requests of France and England for the protection of their industries for a given period.

As Japanese Do It

SOME American business men have expressed astonishment at the ability of the Japanese to gain and hold export trade. While the Americans knew there must be a reason, a good many of them apparently were not able to discover that reason. There are many reasons for the Japanese success, and one of them is set forth in the recent summary of foreign trade printed by the Guaranty Trust Company of New York. In the Japan report this review says:

> The Japanese merchants do not intend that their new found trade shall be lost, and with the assistance of the Government are making strenuous efforts to retain their place, and to remove any stigma of inferiority which, rightly or wrongly, may be placed upon their goods by foreign purchasers. In Australia, for instance, it is reported that the Japanese consul-general reports all complaints received direct to his Government, which in turn traces the defective product to the factory in which it was produced. In some cases, the consul actually guarantees on behalf of his Government the quality of the merchandise.

This would appear to be a very good foundation of a successful trade. Some reports have it that all American firms do not place quality first.

Tractor Rating

THOSE favoring a revision of the existing tractor rating formula for belt and drawbar should not overlook the reason for a revision which seems to lie in the present chaos in the minds of the farmer and the dealer, brought about by over-rating of tractors and misleading conclusions as the result of manufacturers' ratings. As an outcome of this, one state has legislated that its university would conduct practical tests and give ratings before tractors can be sold within its confines. Other states are taking different action.

If it is these conditions which have brought about the present agitation for a revision of the rating formula, the new rating should at least correct present abuses and clarify the situation for the farmer and the dealer. The new rating will unquestionably be used as a merchandising argument. It will carry a stamp of official recognition and, as such, it must represent the power capacity of the tractor and should take into recognition superiority of design and construction.

The old rating, known as the S. A. E. rating, which rates a tractor at 80 per cent of its drawbar performance on a 2-hour test, and 80 per cent of its belt performance on a 2-hour test, should be satisfactory. The trouble is that it has not been lived up to. There is no camouflage in it. The tractor must perform and, following this formula, there is little danger of over-rating.

A proposed formula bases the belt rating on the piston displacement of the tractor in connection with the r.p.m. and a constant 13,000. This has all of the earmarks of rating a tractor on a dimension basis. Piston displacement is merely a product of the cylinder dimensions. It has been known for years that the product of an engine in horsepower is not merely dependent upon cylinder dimensions.

The development of internal combustion engines in the last 8 years has been along the line of higher efficiency as a means of increasing power, rather than increasing dimensions and hoping for an increase in power. Many engines have had their power vary without adding to the cylinder dimensions. In an internal combustion engine, power is the commodity to be purchased and not cylinder dimensions or weight. The formula to be used as a criterion of power in merchandising a tractor should then primarily have regard for the power output rather than merely the displacement of the engine. The proposed rating gives the impression of rating on a tonnage basis rather than on a performance basis.

The possibilities for sales reception with such a rating seem dangerously broad. With three engines of the same dimensions, there will be a different performance in each. Good design, careful workmanship, accurate inspection, and good materials, will give power in one engine. In another, the lack of these will result in loss of power. All three, however, will be able to be presented to the farmer as equally efficient engines. The ratings will be the same. Here lies the merchandising danger. On the face of it, such a formula makes an imperfect rating the dominant official factor in a sale. Such a rating begins in a fallacy and ends in confusion. The fallacy is that while purporting to give a statement regarding horsepower, you do not in reality give the horsepower. The confusion is that the consumer has no assurance from the dimension argument that he is getting the horsepower he thinks he is.

With this being the case, how can such a proposed rating correct the existing evil of uncertainty in the minds of the consumer and the merchandiser? It seems to be but another example of shifting the issue. There seems a special danger at this time of establishing such a rating in that we are unquestionably on the verge of developments in internal combustion engines that will give the greater return on the fuel expenditure and a mere dimension rating would not take anything like due consideration of such. It would seem to be merely befogging the tractor confusion to change the present rating and adopt the proposed one.

There is only one way to measure horsepower, which is the commodity for sale, and that is by an engine test, as proposed in the existing S. A. E. rating. It is difficult to see any legitimate reason why any manufacturer should object to a rating based on the actual ability of the vehicle to perform. With horsepower the commodity the farmer wants, let us get a rating that will give him a criterion of horsepower.

Emigration and Machinery

MACHINERY, which will take the place of human hands in performing arduous work, must be developed to a state far beyond what it has now reached. The demand for this machinery is becoming greater every day. The increasing rate of emigration taking away from these shores thousands of the foreign-born who were willing to man the pick and shovel is going to make it necessary to use machines for operations far smaller than they would have been used upon a year ago.

The loading time of the motor truck is so important to its economical operation that contractors and fleet owners are watching this development very closely. When a machine cuts loading time from 20 minutes to 2 minutes, it may be instrumental in saving thousands of dollars on one job. In fact in the excavation in Detroit for the U. S. Base Hospital No. 36, machine loading saved $15,000 on the excavating work, and this was during wet weather. The saving of labor is even more significant.

Latest News of the

Court Limits Picketing of Overland Plant

Defines It as "Act of Aggression" in Important Opinion Granting Injunction—Plant Opens Again

TOLEDO, June 9—Aided by an important court decision against picketing the Willys-Overland Co. will attempt to operate again this week. Vice-president and general manager Clarence A. Earl said to-day the gates would open to workers Thursday and if unable to do so at that time, they would open Monday at the latest.

Federal Judge Killits has limited the number of pickets to be on duty when the plant opens to 150, not more than 50 to be on duty at one time and a maximum of six to be stationed at a gate. The judge ordered that in event of disorder, attributable to pickets, the privilege of picketing be abolished. Picketing is to be permitted from 6 a.m. to 6 p. m., and a deputy U. S. Marshal is to be on duty at each gate to superintend. All gates used by workers, excepting 12, are ordered sealed.

The pickets are required to wear large badges. Only citizens are to be used as pickets. They are not to be stationed within six feet of the gate. The injunction becomes effective at 2 p. m. Tuesday and runs until 10 a. m. June 19.

The opinion is a sweeping one and sets a precedent which other courts may follow in similar strike cases. It brands picketing as an act of aggression and takes a definite stand against it.

The Electric Auto-Lite Corp., Toledo, opened Wednesday, operating under an injunction issued by the United States Court last Friday, which limits picketing.

DUNLOP OFFICIALS HERE

NEW YORK, June 10—George du Cros, J. V. Worthington and F. C. Baisley, directors and executives of the Dunlop Rubber Co., England, are in this city. They are here to study conditions in the automotive and tire industries.

Various rumors now circulating in regard to their plans are not to be taken too seriously, they state. The results of their investigations will be made known in due course in AUTOMOTIVE INDUSTRIES.

MAXWELL-CHALMERS MERGED

NEW YORK, June 12—The completion of the consolidation of the Maxwell-Chalmers plants awaits the action of the directors of these two companies. Meanwhile the general plan of the merger has become known. The new company will issue 400,000 shares of stock of no par value, which will be distributed as follows: Maxwell first preferred, 120 per cent; Maxwell second preferred, 60 per cent; Maxwell common, 15 per cent; Chalmers preferred, 90 per cent; Chalmers common, 15 per cent.

An issue of $10,000,000 notes convertible into common stock, will provide for the expansion of the new company. Other details are the subject of negotiations. The Maxwell-Chalmers Corp. has started construction on a $10,000,000 manufacturing plant here. The plant, when in operation, will employ between 15,000 and 20,000 men and will have a capacity of approximately 500 cars a day. The capacity of the present plant is 100 cars.

A.A.A. Would Modify Federal Road Act

ATLANTIC CITY, June 9—The American Automobile Association, in annual session here to-day, indorsed the Federal Aid Road Act, now pending in Congress, with the suggestion that the act be amended to restrict the aid given from Federal funds to roads that are part of a well defined state system. It was also suggested that the Secretary of Agriculture be given authority to increase the aid given to 75 per cent in certain cases instead of the regular 50-50 plan.

Progress was noted in the plans for unifying taxation laws, anti-thievery measures, effective hand signaling and road beautification.

Mrs. Robert Lee Morrell, a New York attorney, was elected a vice-president. She is the first woman to hold office in the association. David Jameson of Pennsylvania, was re-elected president. Other officers are: Vice-presidents, Ralph W. Smith, Colorado; P. J. Walker, California; H. J. Clark, Minnesota; Clifford Ireland, Illinois; Dr. John H. Quayle, Ohio, and Dr. R. R. Elmore, Kentucky. H. A. Bonnell of New Jersey will begin his twelfth year as treasurer. John N. Brooks of Connecticut is again secretary. A. G. Batchelder holds over as executive chairman.

WILLS-LEE CANADIAN PLANT

DETROIT, June 12—John R. Lee today said that he and Mr. Wills would build a large automobile plant in Sarnia, Ont. This plant will manufacture their new car and will employ about 2000 men. Sarnia is directly across the river from Port Huron. The Canadian plant thus will be directly opposite the American plant. The Canadian plant will not be started until the American plant is completed.

Detroit Labor Back in Production

Factories Running in Spite of Labor Difficulties—Car Industry Not Affected

DETROIT, June 10.—In spite of a street car strike with all cars idle, the labor situation is improving. The 1500 Studebaker strikers at plant No. 3 are back to work. The issue here was not a matter of wages or hours but one of conditions. The strikers charged discrimination and asked for the reinstatement of certain discharged men. The men were not reinstated.

The strike at the Timken-Detroit Axle Co. is entering its fourth week without sign of adjustment. The men are holding out for increased wages, readjustment of the piece scale system and shorter hours. Production at the plant reached a low ebb but the company is now getting back into operation on a fair scale. This strike has been peaceful. The police are providing the company with plenty of protection.

Ford Workers Help Wadsworth

The Wadsworth Mfg. Co. is still running after six weeks of strike. New men have been taken into the organization to replace those who quit their jobs. During the first three weeks, production of Ford sedan bodies was cut to a minimum but during the last three weeks operation has been resumed in many departments and production is increasing. The Ford Motor Co. sent hundreds of workers into this plant when the strike was called and saved the day for the Wadsworth Co.

The Foundry workers are very restless and a number of strikes in local foundries is hampering parts production. The Detroit Forge Co. workers are on strike. They demand a wage increase and an 8-hr. day.

ORDNANCE FOR S. A. E.

NEW YORK, June 12—Word has been received from the War Department that 30 carloads of automotive war apparatus have been shipped to Ottawa Beach, Mich., for the summer meeting of the S. A. E. on June 23-28. The material sent includes tanks with and without guns, 8 trucks fitted for various forms of shop work, such as air compressors, power saw, drill press, etc. There are also various sized tractors, up to 10 tons and some French guns. This equipment will be in place for the meeting.

The number of reservations to-day was 608.

Automotive Industries

Slight Prospect of Trade with Europe is Hanch's Report

Secretary of N.A.C.C., After 4 Months Abroad, Has a Gloomy Export View

French Remind Him of Our High Tariff on Their Cars Before War and Now

NEW YORK, June 9—At present there is no indication what will be the attitude of the government of Great Britain toward removing present restrictions on the importation of automobiles after Sept. 1, 1919, is the opinion of C. C. Hanch, secretary of the National Automobile Chamber of Commerce, after his 4-months' investigation of conditions in Great Britain, France and Italy, and after his attending a meeting of the automobile interests of the Allies in Paris, March 5 and 6, 1919. Mr. Hanch's report was read to those present at the N. A. C. C. meeting here.

The automotive manufacturers of Great Britain, France and Italy are insistent upon receiving absolute protection against the United States for a considerable period, say 2 years, and substantial protection thereafter. They naturally have certain influences with their respective governments and unless public opinion intervenes, it is likely that import restrictions will be continued for a considerable period.

According to Mr. Hanch there is a serious shortage of automotive equipment in these European countries and a great demand for motor apparatus, so that the existing restrictions are working hardship on the population.

France takes issue with Mr. Hanch and asserts that the French manufacturers are well able to furnish all the automotive equipment necessary for the French population, and does not take kindly to the requests that French restrictions of importations be removed. They unqualifiedly declare that they cannot subscribe to any such plan for America selling automobiles in France as suggested, and further draw attention to the fact that for practically 10 years America had a 45 per cent ad valorem duty on French cars, while at the same time France was exacting an import duty of from 8 to 10 per cent on American machines.

In the view of France, the treatment by America was hard and unjust and, to-day, it is but natural that the French manufacturers should urge the French government to apply to each of the Allies what those Allies think proper to apply to France. In a word, this means that if America applies a 45 per cent ad valorem duty on French products, then the French government should apply a similar duty on American products.

The whole question was discussed at the conference in Paris, March 5, by representatives of the automobile industry from England, France, Belgium, Italy and the United States, reports of which have already been published in AUTOMOTIVE INDUSTRIES.

Mr. Hanch, in his report to the N. A. C. C., says that he pointed out the injustice of import restrictions in a letter to the secretary of the French organization known as the Chamber Syndicate des Constructeurs d'Automobile. Fully 20 per cent of Mr. Hanch's report is taken up with his letter and the French reply and, from the latter, it is quite evident that the French do not coincide with the views expressed by Mr. Hanch as representing the N. A. C. C.

There was another conference held after March 5 in which French manufacturers expressed a slight change in opinion and indicated that they would not advocate a continuance of the embargoes after July, 1919. It might be inserted here that since Mr. Hanch left Paris the French automobile manufacturers have recommended that, after the signing of Peace, France will adopt a duty of 45 per cent on American automobiles until January, 1920, and after that date the duty will be 15 per cent.

Favors Removal of Restrictions

Mr. Hanch, in his letter to the Chambre Syndicale des Constructeurs d'Automobile, talked in favor of France removing restrictions because of the general shortage of automobiles in France, the inability of the French manufacturer to meet the demand and the strong demand on the part of the French industry for automobiles. He summed his conclusions under the following heads:

1—There is a material shortage of transportation traction equipment for civilian use in all European allied countries.

2—The European manufacturer cannot supply the required amount of automotive equipment needed by the civilian population as soon as it should be provided to permit the economical welfare of European allied nations.

3—The manufacturers of the United States are in position to furnish a part of the automotive equipment needed by the civilian population of the European allied countries.

4—The needs of the civilian population of European allied countries will absorb the production of European manufacturers as well as equipment which can be furnished by the U. S. A.

5—Further delay in granting import licenses, or in removing embargoes, can only result in serious injustice to the European allied countries by preventing such population from securing its requirements as soon as needed and also by encouraging extortionate prices for second hand and other equipment.

6—The earlier the trade relations between all the allied and friendly nations are established the sooner will be the return to normal and economic conditions in all the countries.

7—The early removal of embargo and the granting of import and export licenses is in the best interests of all nations concerned.

That the French Chambre Syndicale des Constructeurs d'Automobile quite seriously objected to being told by Mr. Hanch what was best for the French civilian population and what were the requirements, is indicated by the letter written by H. Cezanne, general secretary of the Chambre. The latter was couched in the typical French language which has suffered considerably in translation, but still indicates how very much France resented dictation from America as to what she should do for her own people.

Undoubtedly France thought of the days when America put a 45 per cent duty against her products, and has retained it practically up to the present time, and wondered why America, who

(*Continued on page* 1371)

Rubber Imports Slow Up in May

16,348 Tons Come in, Compared With 27,948 Last Month

NEW YORK, June 11—Imports of crude rubber into the United States in May were only 60 tons ahead of the amount imported in the same month last year, a drop of 11,600 tons from last month's figures.

Comparative figures for the past four years, as compiled by the Rubber Association of America, follows:

	1919 Tons	1918 Tons	1917 Tons	1916 Tons
January	7,235	16,084	12,788	9,162
February	14,079	13,108	10,162	1,597
March	28,223	17,161	18,624	10,070
April	27,948	13,425	13,000	10,014
May	16,348	16,288	18,411	11,189

War Work Considered in Show Allotments

N.A.C.C. Permits Manufacturers to Enter Production for 1919, 1918 or 1917

NEW YORK, June 11—War work was recognized in the drawing of spaces for the coming national automobile shows by the National Automobile Chamber of Commerce at the meeting held here last week. It was decided that the spaces should be allotted on the factory production for any of the three last fiscal years ending June 30. In other words, the manufacturer may elect whether he will enter his production for the year ending June 30, 1919, 1918 or 1917.

The shows, as stated last week, will be held in New York at the Grand Central Palace, Jan. 3 to 10, and in the Coliseum in Chicago on Jan. 24 to 31. Coincident truck shows will be held in both cities. The site of the New York truck show probably will be in the Twenty-Second Engineers Armory at 168th Street and Broadway. The Chicago truck show will be held in the Drexel Pavilion in the Stock Yards district.

Two special sessions of future possibilities were held in connection with the meeting of the N. A. C. C. One was the meeting with the representatives of the oil trade on Thursday night. At this meeting it was learned that the automotive manufacturers and the oil-men have been working without the mutual understanding that would be exceedingly helpful to both. Especially was the forecast for truck production in 1919 as presented there a surprise to the oil-men.

Export Managers Hear Hanch

The second special session of interest was that of the export managers. They heard a report from C. C. Hanch, who has been studying conditions in Europe for six months past. In addition to his formal report, Mr. Hanch was kept on the floor for two hours answering questions. Preparations were made for special investigations of three developments from this discussion, which probably will have a direct bearing on the future trade. It was voted to broaden the foreign trade department of the Chamber. The showing was that the export now is $125,000,000 of the total $1,300,000,000 automotive business.

A constitutional movement to increase the number of directors of the Chamber from 15 to 18 members was originated.

The following directors were re-elected: John N. Willys (Overland), H. H. Rice (Chevrolet), Roy D. Chapin (Hudson), C. C. Hanch (Studebaker), and J. Walter Drake (Hupmobile). At the next meeting a constitutional amendment to increase the directorate from 15 to 18 members will be offered to provide for further representatives of the truck industry. At present there are five members of the truck industry on the board of directors.

THE FUEL CONFERENCE

NEW YORK CITY, June 10—A so-called cabinet for the consideration of fuel problems was a result of the meeting Thursday night of representatives of the automobile industry and the petroleum industry to consider what should be done for the general good on the fuel situation. This cabinet of ten is expected to outline the fuel problem and to guide the united efforts of the fuel people and the apparatus manufacturers in the right direction. This objective is to give a better fuel, and improvement, perhaps, in apparatus to handle the fuel, as engines and vaporizers.

There was no dissenting view expressed by either side on the subject. Both are united in their purpose to work together to this end. With many of the oil-men, there seems to be no fuel problem and some of them are apparently ignorant of the difficulties of properly handling fuels on the market.

From an oil-man's point of view the increased output of fuel is merely one of a broader use of the cracking process, which is gaining all the time, as well as the sinking of more wells. It seems impossible to produce a better fuel than we have to-day and produce it in the same quantities from a given amount of crude. If we want to increase the fuel, we will have to lower the standard. If we want to increase the quality it will be necessary to lower the volume.

At present the fuel interests are well over-stocked with fuel oil and some of the refineries are closed down temporarily on this account. The dropping off in war demand has been the cause of this.

PRICES OF ARMY TRUCKS

WASHINGTON, June 9—The Sales Division of the War Department, following its recent conference with the trade press and the industry with regard to the sale of surplus motor vehicles, is now fixing the prices and will soon catalog them and send the catalog to the various district offices of the War Department.

The trucks will be sold either by auction for cash, or to the highest bidder on sealed proposals on due public notice, or at the current market price or by negotiations under competitive conditions, providing the price obtained is not less than that fixed by appraisal or is the highest of not less than three independent competitive bids. The supply and condition will decide the methods chosen.

WINTHER EXPANSION PLANS

KENOSHA, WIS., June 9—The Winther Motor Truck Co., at a special meeting of the board of directors, June 11, will vote on the plan to issue $1,000,000 of common stock, most of which will be taken by present holders. The proceeds will be used to increase the facilities and otherwise finance expansion. The present plant was erected a few months ago at a cost of $150,000 and a second unit of equal size is proposed.

Paris Show Will Be October 9-19

Space Requirements Will Place Decided Handicap on American Exhibitors

PARIS, May 22—Oct. 9 to 19 inclusive have been fixed as the dates for the 15th French automobile show, which will be held in the Grand Palais in Paris after a lapse of 4 years. This is the first automobile show to be held in Europe since the war and will inaugurate the series that will include London and Brussels.

American exhibitors are at a disadvantage compared with European competitors. One of the rules states that allied manufacturers can be admitted on the same footing as French makers, providing they have taken part in at least three previous Paris shows, and also providing that the import duties in their own country prior to 1914 were not higher than 15 per cent ad valorem. As the United States is the only country in the world having a duty higher than 15 per cent, it is evident that this rule has been adopted entirely with the object of handicapping American exhibitors.

The regulations state that foreign exhibitors who do not comply with these requirements will be given special spots decided on by the committee. This practically means that they will have to take whatever spot may be available after everybody else has made a selection.

When the war broke out in 1914, numerous firms had made a request for space and had, in many instances, deposited the entry fees for the 1914 show. These firms will receive preferential treatment when space is allotted.

No enemy firm can exhibit at the Paris show.

Stands will be uniformly decorated and will be delivered completely equipped with signs, carpets, etc., ready for receiving the actual exhibits. As in previous years, a refund will be made to all exhibitors after expenses have been paid.

The Grand Palais, which is the biggest hall under one roof in Europe, if not in the world, has been occupied by the military during the war. It has just been released and is being repaired and equipped with the show in view. There is no doubt that every inch of space will be occupied. The president of the Show Committee is Baron Petiet, president of the French Society of Automobile Manufacturers. Henri Cézanne is the general manager of the show.

American manufacturers desiring space are recommended to apply without delay to 51 rue Pergolèse, Paris.

DETROITER CREDITORS TO MEET

DETROIT, June 9—Creditors of the Detroiter Motor Car Co. will hold a final meeting at 117 Fort Street, west, on June 25 to pass on the trustees' report showing property for distribution, etc., and offer for sale the balance of unpaid accounts receivable.

Italian Factories on 8-Hour Schedule

Experiment of No Lunch Hour Fails—Strike of Foremen Serious

TURIN, ITALY, May 20—All Italian automobile factories have been on an 8-hr. day basis since March. The attempt has been made to run a single shift of 8 hours without stop for meals. This is still being done at the Fiat factory, but it is recognized that the experiment is a failure. The seventh and eighth hours are not productive, and after working for that length of time it is impossible for the men to do overtime.

In consequence Fiat will shortly change to four hours in the morning, two hours for the mid-day meal, and four hours in the afternoon.

The Lancia factory also adopted the 8-hr. day without a break, but has changed over to 8 to 12 and 2 to 6. The reduction from 10 to 8 working hours a day has been made without any diminution in the weekly wage. On piece work an increase of 25 per cent has been granted.

A strike which affected all Italian automobile factories has just been brought to a close after one month's duration. The foremen and heads of departments, being dissatisfied with working conditions, left the shops. An attempt was made to run without these men, but it was not successful, and practically all the shops had to close.

Although an agreement was arrived at after 31 days, it is reported that the interruption has thrown the factories back at least two months.

IN FRENCH TIRE FACTORIES

PARIS, May 20—The 8-hr. day has been permanently adopted in the French factory of the Goodrich Tire and Rubber Co. at Colombes, near Paris. Owing to the shortage of coal, the work hours had been reduced on many occasions and, when the Government law was proposed, it was decided to make the 8-hr. day a regular feature.

Arthur Lumsden, the director of the French Goodrich company, has adopted the plan inaugurated a few months ago by the neighboring Gnome & Rhone Co. of having a break of only half an hour in the middle of the day for a meal. To do this it has been necessary to erect dining rooms, as the French laws forbids eating in a building where work is carried on.

While the 8-hr. day is well received by French workmen, the objection is being raised by their wives that the men have too much time on their hands and consequently spend too much money for drink.

There is no doubt that the drop in France from 60 to 48 hours a week will raise social problems in which employers of labor must take an interest. When working 60 hours a week, a man's time was fully occupied in working, sleeping and eating. The French working man had few hobbies. Now that spare time has been thrown on his hands, there is danger of his misusing it, if not educated to better ways.

ITALIAN EXPORTS

TURIN, ITALY, May 10—Italy exported 1867 trucks and 1071 passenger cars, having a nominal value of $9,068,500, during the year 1918.

This is a considerable drop on the two preceding years, for in 1917 the number was 8734 with a value of $22,995,761, and in 1916 it was 6463 trucks and passenger cars valued at $16,806,450.

The decrease is due to the cancellation of army contracts. In 1916 and 1917 Fiat alone was building from 60 to 100 trucks a day, 50 per cent of them going abroad. This was cut down by about three-quarters when the armistice was announced.

The number and value of exported passenger cars has increased, being 1071 in 1918, compared with 702 in 1917 and 824 during 1916. Although only two out of the twelve months of 1918 were under partial peace conditions, the returns indicate that Italy's greatest activity will be in passenger cars rather than in trucks.

Automobile imports were lower during 1918, only 50 trucks and 30 passenger cars, valued at $161,820, being brought into Italy.

PROGRAM FOR MECHANICAL ENGINEERS

DETROIT, June 10—The spring meeting of the American Society of Mechanical Engineers, to be held here June 16-19, will have at least 22 papers, according to the present schedule. The first session will be largely taken up by the regular society business.

Of particular interest to the automotive industry is the gas power session, which will consider the internal combustion field, including the Deisel and other types of oil engines, and the kerosene engine. Carburetion will also be taken up during this session. Another session will be on fuel economy, which includes papers on pulverized coal and fuel oil.

Industrial relations will be treated by at least three speakers and probably others will be announced. This session will be on Tuesday afternoon.

The production of Liberty engine parts at the Ford plant will be treated by W. F. Verner on Wednesday morning.

A paper, "Crude-Oil Motors vs. Steam Engines in Marine Practice," by J. W. Morton, one by D. L. Arnold, entitled "A Suggested Formula for Rating Kerosene Engines," and "Standards of Carbureter Performance," by O. C. Berry will be presented.

Airplane subjects will be given attention on Thursday, when there will be a paper entitled "Elements of a General Theory on Wing Design," by Walter C. Durfee, also "Air Fans for Driving Electric Generators on Airplanes," by Captain G. Francis Gray, Lieut. John W. Reed and P. N. Elderkin.

Used Cars at Premium in Italy

Manufacturers There Putting Export Trade First, While Imports are Barred

TURIN, ITALY, May 20—There is a very strong demand throughout Italy for both trucks and touring cars. The factories are unable to meet local requirements, with the result that used cars are bringing fancy prices. The army has not offered any of its cars for sale, thus tending to maintain the artificial price of used cars.

The home manufacturers have nothing to fear, for automobile imports are prohibited. Indeed, in many cases Italian manufacturers are more interested in exporting, in an effort to establish foreign markets, than in meeting the requirements of their clients at home.

The result of this is that there is sharp competition for any used cars which may be put on the market, and in most cases used cars are sold considerably in excess of the prices asked by the factories for new models. As an example, a used Fiat 3½-ton truck can be sold for more than the Fiat Co. price for a new truck. Four-year-old Lancia cars are bringing as high as $12,000 at nominal rate of exchange.

It is certain that the army is making a mistake in not placing its surplus trucks and cars on the market while the demand is great and the supply small. Within six months the factories will be producing in large quantities and the bottom will drop out of the second-hand car market.

Lancia has decided to continue his 4-cylinder 30-hp. model produced before the war. The only material change is the adoption of the detachable cylinder head. This change has become general in Italy, for it has been taken up by Fiat, the biggest producer, and also by Nazzaro, who is now preparing to build a high-class four with detachable head and valves in the head.

Nazzaro has abandoned his original factory at Turin and is taking over the new works at Florence.

ARMSTRONG-SIDDELEY NEW CAR

COVENTRY, ENGLAND, May 27—The Siddeley-Deasy Motor Car Co., Ltd., will soon be known as the Armstrong-Siddeley Co., Ltd., and the car to be manufactured, as the Armstrong-Siddeley.

The new Armstrong-Siddeley car will use a six-cylinder engine, with overhead valves, in which aluminum construction will figure prominently. The cylinders will be 3½ x 5¼. Features to be incorporated are spiral bevel axle drive, cantilever springs, disk wheels and electric starting and lighting. Deliveries will begin in August. The price will be $3,300. The entire manufacturing efforts of the company will be concentrated on one model.

English Manufacturer Slow in Production

Labor Troubles Blamed for Inactivity — Importers Want Duty Removed

LONDON, ENGLAND, May 28—One cannot help but be amazed at the slowness with which the British manufacturer is returning to normal business. Practically 50 per cent of the car makers have not yet delivered a single car to the public, and there are scarcely more than four firms that are producing 50 per cent of their pre-war output. The invariable excuse for the delay is labor troubles.

British importers of American cars take the view that the only hope for the British automobile industry lies in the removal of the present prohibition. If the restrictions on imports were removed, the British makers would then have to make a determined effort for the business and would put up what is described as a real sporting fight.

By Sept. 1, British manufacturers will have had 9 months in which to clean up after the war, and prepare to meet any competition, but the sentiment is growing that restriction of import may be continued after this date, and some take the view that there may be an increase in restrictions. At present it is almost impossible to get any united thought on the subject. The view is held that it will be necessary to have another general election in the near future at which time the whole subject will come up for review as a national issue.

There is beginning to be heard in England an outcry against the introduction of a tariff under the government administration without having the direct sanction of it from the voters.

LONDON, ENGLAND, May 28—The difficulty of British manufacturers to get under way with production is accentuated by the uncertainty with regard to the price of coal. This is having a serious effect upon the industry. It is difficult to secure close prices for material. While there is a great deal of restless talk among labor, manufacturers generally agree that these will smooth out as time passes.

Some factories under the 47-hour a week schedule which began Jan. 1 are turning out as much as they used to in the 53-hour week, with the same number of workers. There are others who are having considerable difficulty under the shorter week, and at certain establishments workers have refused to work on a piece basis and are working slower on the hour basis. Recently the wood working trade union forbade any piece work system in the future for its members. There are some factories in which this order is not being observed.

TRUCK DEMAND HEAVY

LONDON, ENGLAND, May 28—The demand for motor trucks is so far in excess of the supply that deliveries in 8 weeks is the best that can be had for any standard British make of trucks.

This delay in delivery is all the more important because the government is not handling the disposal of war trucks as was hoped it would. Officials in charge of selling war trucks seemed more desirous of getting high prices for individual trucks than speeding sales and getting rid of the war supply. Although there are 20,000 trucks supposed to be ready for sale, many of them new, only 500 or 600 per month are being released for public sale to consumers. Some of the dealers are endeavoring to buy from the government trucks of the make they handle, but it has not been possible to do so.

In the meantime there are many automobile parks where thousands of trucks can be seen half buried in mud without means of protection, and at the same time prospective owners cannot make purchases.

This needless delay is largely due to the fact that the government is tied up with peace negotiations, and those in charge do not seem to have the business vision that the situation calls for.

OPPOSES EUROPEAN BRANCHES

NEW YORK, June 12—C. C. Hanch, who inspected the automobile industries in Great Britain, France and Italy as a representative of the N. A. C. C., is not much in favor of American automotive manufacturers establishing branches in Europe at present.

They would have no advantage because import restrictions and high custom duties apply to parts of vehicles, as well as to completed vehicles.

It would be some time before American manufacturers could install the necessary manufacturing equipment in Europe to go on a production basis, and by the time such factories were established, import restrictions would be removed and custom duties modified, so that exporting of the completed vehicle from America would be more desirable than the assembly of it in Europe. At present labor conditions in Europe are also unsatisfactory.

War Department Surplus Vehicles Transferred

WASHINGTON, June 12—The Director of Sales of the War Department this morning approved the transfer of the entire surplus of serviceable motor vehicles held by that Department to other Government departments, a total of 39,100 vehicles. This action leaves fewer than 1000 vehicles to be sold at public auctions. These are unserviceable because of design or for other reason, and will be available only for parts or junk.

FORD STEEL ORDER

NEW YORK, June 12—An order for 150,000 tons of steel, with a possibility of an increase of 200,000 tons, by the Ford Motor Co. is announced by the U. S. Steel Corp.

"Liberty Fuel" Soon to Have Real Test

One of Originators of Much Disputed Compound Says It Will Be Put on Market

CHICAGO, June 7—Liberty fuel, the special motor and airplane product developed by the Government for its war trucks and planes, and regarding which conflicting reports came from Washington early in the winter, is to be put on the market in large quantities within a short time, according to former Major Zimmerman, who was instrumental in its development. Zimmerman made this statement in enlarging upon his theory that one of the greatest developments of the future in the automotive field would be the chemical treatment of fuels to increase their volatility and reduce the heat losses through cooling and exhaust.

The announcement of the marketing of Liberty fuel came in a discussion of a paper on "The Design of Intake Manifolds for the Present Heavy Fuels" by F. C. Mock, engineer of the Stromberg Motor Devices Co., presented at the June meeting of the Midwest Section, Society of Automotive Engineers, last night. In answer to a question as to conflicting reports of the value of Liberty fuel, Zimmerman said that road tests covering thousands of miles were made and that no undesirable features were shown. The varied reports, he said, were directly due to war conditions in Washington.

In his paper on intake manifold design Mr. Mock discussed the necessities for proper carburetion, particularly the shape and heating of the manifold. He definitely advised against any attempt to heat the fuel in the float bowl of the carbureter, because in many sections of the country there are fuels which contain a percentage of very volatile elements, casing head gasoline being a sample. He gave it as his belief and hope that the time is coming when the service departments of each responsible motor car and motor truck manufacturer will develop fittings and connections of this nature to replace the equipment of cars now in service. After the patterns and tools are once made the cost of production is low, and the application could probably be made in half a day, so that the complete installation should not cost over $10 or $15.

Mr. Mock's paper will be printed in a future issue of Automotive Industries.

COMPLAINT AGAINST PREST-O-LITE

WASHINGTON, June 10—A complaint alleging that exclusive contracts made by the Prest-O-Lite Co., Indianapolis, are in violation of the Clayton anti-trust act has been issued by the Federal Trade Commission. Deposits required for the use of steel gas containers are the basis of the complaint. The company is cited to appear July 24.

Ships, Investments, Parcel Post at Pan-American Conference

Latin American Countries Anxious for Better Shipping Facilities with U. S.—Protection of Trademarks Necessary—Press Relations

WASHINGTON, June 9—The immediate establishment of ample freight, mail, and passenger steamship facilities between North and South America, the necessity of investing American capital in South America, the elimination of unnecessary restrictions on parcel post shipments and the need for a well-defined program for the protection of patents, trademarks and copyrights in Latin America were the principal developments of the Pan American Convention which closed here last Friday following a 5-day meeting attended by more than 700 delegates.

The Latin American representatives were particularly pleased with the announcement by Edward N. Hurley of the U. S. Shipping Board, which told of the proposed establishment of great fleets of vessels between the U. S. and the southern continent. They stated that this is the most important requirement of the Latin American countries, and that the development of better shipping and mail carrying facilities will insure an expansion of the trade between the two continents.

Parcel Post

The need of new treaties between the U. S. and the Latin American countries providing for removal of restrictions and regulations on parcel post was mentioned by several speakers, including Frutos Plaza of Montgomery Ward & Co., who praised the increasing efficiency of the parcel post between the U. S. and Latin America, but decried the regulations existing in Brazil and Argentine, which prescribed the use of customs brokers whose fees make the employment of the parcel post practically impossible.

Mr. Plaza told also that the delivery by parcel post in South America had improved remarkably in the past few years, and cited as an instance a shipment made by his company of 300 parcels to Bolivia, each under 11 lb. in weight to conform to the legal limits, and each of which arrived safely and promptly to its destination in the interior of the country.

The necessity for protecting trademarks was illustrated by the examples of the Hupmobile, Renault, Pierce-Arrow, Fordson, and other well-known American trademarks, which have been registered or applied for by natives or European concerns, and which are consequently lost to the American owners. The countries of Latin America, it was said, have furnished a particularly profitable field for the registration of trademarks by others than their originators for speculative purposes, and nearly every issue of the official bulletins of these countries contains applications for trademark registration that are fraudulent or at least unauthorized.

Manufacturers were urged to register their trademarks promptly. The cost of registration was stated to be about \$6 per country, per year. There have been no lawsuits conducted in any of the Latin American countries, they were warned, to recover a mark that has been stolen in which the cost has been less than the cost of registration in all of the countries in the southern continent combined.

Press Relations

The establishment of better press relations was predicted by Frank B. Noyes, president of the Associated Press, who told of recent arrangements just completed whereby the largest South American newspapers will for the first time in history take the Associated Press service. This, he stated, should insure a better understanding of the habits and businesses between the two countries. More than 18,000 miles of cables have been installed between New York and Latin America, according to John L. Merrill, president of the All America Cables, who cited this as another connecting link between the continents.

South American papers, it was stated, have been subscribing to the European press for news service and for this reason have been influenced against American products and in favor of European commodities. Robert Barrett of the Bureau of Foreign and Domestic Commerce described the operation of the new press service between the U. S. and South America, stating that 3500 words a day are being sent over the cables, and also praised the branch of the Committee on Public Information, which was established in Buenos Aires during the war, and which he stated contributed three or four columns daily to the local newspapers, doing more than any other agency to acquaint the people with the progress of the U. S.

In answer to the question, "Will the U. S. hold its export trade gained in Argentine during the war?" Mr. Barrett said that it will hold a great part of the business, but that we can not expect much business from Argentine for the balance of this year.

Immediately after the armistice, he said, American manufacturers, who had been holding up orders to Argentine for many months, began to ship commodities to that country, with the result that a surplus of supplies has been received there. He praised the establishment of the two American branch banks in Buenos Aires which now allow American manufacturers to extend credits as freely as European competitors. He described the banks as being very successful with deposits over \$60,000,000.

Eighty-eight American firms, he said, are carrying stock in Buenos Aires and are consequently in a position to meet any and all European competition. His statement that the Argentine Republic now regards the U. S. in a more friendly light than any other nation was repeated by a number of Argentinian representatives, all of whom attributed this feeling to the motion picture business, which they stated has shown the American progress and ideals to Argentine.

The aid being given to industry by the business press of the U. S. was discussed by A. C. Pearson, president of the Associated Business Papers, who stated that the Webb-Pomerene bill, which "promises so much for foreign trade in the United States," was made possible largely by the co-operation of the business papers.

The business publications, he said, inform their readers of possible markets, of all trade news, of new designs, of the progress of the industries, and extend important advice and criticism, besides also functioning as important encyclopedias of knowledge through their advertising columns.

Capital Investments

Other discussions, including those by Charles M. Schwab, Frank A. Vanderlip, Senor Augusto Villaneuva of Santiago, and Senor Julio Zamora, Financial Agent of the Bolivian Government, told of the need for re-organization of Pan American business and of the duty of the U. S. to invest capital in Latin America to further the industrial and commercial relations between the two nations and to provide funds whereby the Latin American countries can pay for their exports from this country.

Other subjects discussed included the necessity of teaching Spanish in the schools of the U. S., the development of transportation in Latin America, the extension of better credit facilities to Latin American buyers, the improvement of the administration of consular offices and the revision of tariffs.

The next meeting of the Pan American Conference will be held in January, 1920, according to notice received from President Wilson during the last Convention.

CURTISS BUYS SERVICE PLANES

WASHINGTON, June 6—The Air Service has sold to the Curtiss Aeroplane & Motor Corp. 1615 JN-4D airplanes without engines, and 1100 Standard J1 planes without engines, for \$2,272,000, which is 12 per cent of the original value, which was estimated at \$22,500,000. The Air Service discontinued the use of the SJ-1 plane last summer.

TILTON BELT REPRESENTED BY CASSIDY

NEW YORK, June 11—Edward A. Cassidy Co., Inc., has been appointed manufacturer's representative and will act as the sales department for Tilton endless woven belt.

Air Service Seeks Inventions

Gasoline Gages and Tanks, Portable Hangars Among Devices Needed

WASHINGTON, June 7—The War Department Air Service is in need of certain devices and appliances and asks the assistance of inventors and engineers with regard to development of the following:

Gasoline tanks that will withstand a salvo of 15 shots fired at a range of 30 yd., the ammunition consisting of calibre 30, equally mixed, service, tracer, incendiary and armor piercing bullets, fired through the tank at the most vulnerable angle with fire occurring in 10 consecutive tests on as many tanks. The weight should be kept low and be not more than 75 per cent more than the usual standard weight tank. Information about previous experiments will be furnished if wanted. Air bag floats, landing skids, etc., are wanted to prevent a machine from capsizing when landing in water.

Portable hangars for field service as the present hangars made of canvas are unsatisfactory and leak and blow down. Hangars are wanted to hold at least four De Haviland planes with enough room in addition for mechanical work, and should incorporate necessary wiring for electric lighting and extension lamps.

Gasoline supply gages are wanted that are responsive, serviceable and accurate to the last half-gallon, with mounting on the tank.

Central electric power plant, a single generator and battery is sought that will furnish required power for the radio installation, heating and lighting, electric starter, ignition and the motor driven camera. This is also to include necessary transformers to supply these various apparati with the electrical energy needed in proportion and kind.

Some sort of engine driven plant is wanted so that the head resistance of the wind driven generators now used will be eliminated. A saving in weight is expected from the new type suggested. The plant is wanted for use on Liberty 12 and Hispano Suiza 300 engines.

Mobile cranking device to be mounted on a motor truck to be electrically driven and for use on planes not equipped with self starters, is desired, so it may be used at an aerodrome by being backed up on to the front end of any airplane and built with a flexible arm attached to the propeller. The electrical energy is then to be used to crank the engine and start it. When the engine picks up, the arrangement should be such that the device will be automatically thrown out of connection with the propeller.

FORSCHLER UNDER NEW COMPANY

NEW ORLEANS, May 19—Philip Forschler Wagon & Mfg. Co. has been bought by the Forschler Motor Truck Mfg. Co., Inc., with headquarters at 120 North Claiborne Avenue.

34 PER CENT OF AIR ENGINES AMERICAN BUILT

WASHINGTON, June 6—The A. E. F. Air Service received 10,464 airplane engines during the war and up to Nov. 30, 1918, of which 4153 were Liberty 12's. The Allies produced 6944 or 66 per cent of the total number, and the United States 3520 or 34 per cent.

Of the 2698 planes received at the front by the A. E. F. the Allies produced 75 per cent, France turning out 1825, England 206 and the United States 667.

Five hundred and nine American fliers lost their lives in action including training and accident casualties, as compared with 2680 British and 1945 French. Following is the table:

	Killed	*Wounded*	*Missing*	*Per Cent* *Killed*	*Per Cent* *Wounded*	*Per Cent* *Missing*
American	509	241	277	50	23	27
British	2,680	2,988	1,837	36	40	24
French	1,945	2,922	1,461	31	46	23
Total	5,134	6,151	3,575	35	41	24

From the beginning of the war to April 30, 1919, the Air Service condemned 1105 planes and 853 engines of all types as follows:

Primary training		*Advanced training*		*Service*	
Planes	861	Planes	211	Planes	33
Engines	713	Engines	129	Engines	11

Ten thousand five hundred and ninety-four service engines and 2457 service planes are included in the "active" class by the Air Service, which has inventoried its equipment, as against 10,636 obsolescent training engines and 2955 training planes, and 2540 obsolete engines and 2031 planes. Following is the complete inventory showing the active engines and planes which are considered worthy of use, the obsolescent which are used but will not be rebuilt or repaired when worn, and the obsolete which are no longer used:

	New	Used, but in flying condition	Out of commission	Total	Per Cent New	Per Cent Used, in commission	Per Cent Out of commission
Active							
Service engines	10,081	288	225	10,594	95	3	2
Service planes	2,127	167	163	2,457	86	7	7
Training engines	2,007	608	122	2,737	73	22	5
Training planes	773	980	488	2,241	35	44	22
Obsolescent							
Training engines	4,480	3,942	2,214	10,636	42	37	21
Training planes	539	1,804	612	2,955	18	61	21
Obsolete							
Engines	1,419	158	963	2,540	56	6	38
Planes	1,026	65	940	2,031	51	3	46

	Killed	Wounded	Missing	Per Cent Killed	Per Cent Wounded	Per Cent Missing
American	509	241	277	50	23	27
British	2,680	2,988	1,837	36	40	24
French	1,945	2,922	1 461	31	46	23
Total	5.134	6.151	3.575	35	41	22

Primary training		Advanced training		Service	
Planes	861	Planes	211	Planes	33
Engines	713	Engines	129	Engines	11

75 PER CENT SAVED ON CANCELLED AIR CONTRACTS

WASHINGTON, June 9—Contracts have been cancelled and suspended for the Air Service since the date of the armistice representing an original value of $130,000,000, liquidated at a saving of $95,000,000 or 75 per cent. The following table gives details of how the various items have been dealt with.

	Value of contracts liquidated	Per cent of suspensions liquidated	Amount saved on liquidation	Per cent saved on liquidation
Balloons and supplies	$4,067,558	42	$3,418,830	84
Airplanes and spares	7,707,455	5	6,152,083	80
Fabrics, lumber and metals	3,984,143	51	3,127,143	78
Engines and parts	102,501,838	38	76,119,701	74
Instruments and accessories	1,149,995	14	1,021,131	70
Chemicals and chemical plants	8,983,419	66	6,242,331	69
Miscellaneous	1,548,547	14	1,281,735	83
Total	$130,242,955	27	$97 361,955	75

PROJECTS FOR 11,350 MILES

WASHINGTON, June 6—Projects for improving highways totaling 11,350 miles to cost $108,295,329, and on which Federal aid amounting to $43,076,176 was requested, have been approved by the Bureau of Public Roads to date. This includes 1188 projects, of which 813 miles have been completed at a cost of $6,870,451, of which $2,692,491 was paid in the form of Federal aid by the Government.

AERIAL SERVICE IN ITALY

WASHINGTON, June 9—A regular air mail service has been started between Rome and Naples, Italy, with two trips daily from each city. An aerial line will be started between Rome and Palermo in the near future. The trip will take about 4 hours. This is one of the first international air routes that will complete a route between Rome and Constantinople.

NEW CONSTITUTION ADOPTED BY GAS ENGINE ASSOCIATION

CHICAGO, June 7—A new constitution for the National Gas Engine Association, which provided for subsidiary groups and for greater specialization in associational work, was adopted this week at its annual meeting here. Sections already formed are the following: Farm Engine Section, T. C. Menges, Associated Manufacturers Co., Waterloo, Ia., chairman; Oil and Stationary Engine Section, O. G. Deane, Muncie Oil Engine Co., Muncie, Ind., chairman; Tractor Engine Section, R. K. Schriber, H. C. Doman Co., Oshkosh, Wis., chairman; Accessory Section, Walter Brown, Webster Electric Co., Racine, Wis., chairman; Farm Light Plant Section, L. S. Kilholtz, Domestic Engineering Co., Dayton, Ohio, chairman.

About 20 farm light concerns were present at the convention and it was decided that instead of forming a separate organization it would affiliate with the Gas Engine association.

Lynn W. Meekins, of the Bureau of Foreign and Domestic Commerce, addressed the last general session on the possibilities of foreign trade. He considers China, Australasia and Siberia as the sections of the world offering the greatest opportunities. He gave the following figures on the shipment of internal combustion engines during the war to June 30, 1918:

Engines for military tractors, 23,500; kerosene engines, 15,000, principally to Canada, England, Australia and New Zealand; gas automobile engines, 35,800, principally to Canada, England and Argentina; korosene stationary engines, 27,000, principally to Canada, Australia England, Cuba and France; gas marine engines, 7,200, principally to Canada, England, British India and New Foundland; gas stationary engines, 3,300, principally to France, Japan, England and Australia.

LOCOMOBILE SUIT MOTION

NEW YORK, June 10—Attorneys for the National Automobile Chamber of Commerce to-day filed a formal motion that the suit against the Chamber brought by the Locomobile Co. be dismissed because the plaintiff had not stated a sufficient cause of action. This is the friendly suit filed by Locomobile Co. attacking the validity of the patent pooling department conducted through the Chamber. The pleadings allege that this arrangement is detrimental to the trade.

Andrew L. Riker, president of the Locomobile Co., has held several offices in the Chamber. The filing of this motion leaves the suit open to argument at the request of either side.

N. A. D. A. AGAINST CAR SEIZURE

ST. LOUIS, June 9—At the quarterly meeting of the directors of the N. A. D. A. here Saturday it was decided that the association should lend financial and moral aid in the fight the Georgia State Dealers' Association is making against the law which permits the seizure of a motor car carrying liquor, regardless of mortgage rights of the seller.

The test case has recently been decided adversely to the dealer in the Georgia Court of Appeals. It is planned to carry this case to the United States Supreme Court. The seriousness of this situation is in the fact that the entire country probably will be on a prohibition basis in the near future. A telegram received from the National Automobile Chamber of Commerce assured the N. A. D. A. of full co-operation by that body.

The seizure of these cars, when sold on partial payments, is becoming a considerable factor in the dealers' banking arrangements.

AFRICAN AGRICULTURAL SHOW

JOHANNESBURG, SO. AFRICA, April 23—The Johannesburg Agricultural Show, which is an annual event, closed yesterday with an automobile exhibit disappointing in many respects. The absence of European cars made quite a difference, and the show was not up to its usual standard.

Studebaker's new models were shown for the first time. The Essex made its debut. There were only two tractors at the exhibit, Fordson and the Austin of Birmingham, England. There was no plowing ground satisfactory for the demonstration close at hand but the Fordson gave plowing exhibits nearby.

United States Exports of Cars, Trucks and Parts, by Countries, During April, 1919

Countries	Commercial Number	Commercial Value	Passenger Number	Passenger Value	Parts, Value
Belgium	20	$85,122	30	$46,339	$5,194
Denmark	46	79,976	115	169,514	12,924
France	251	1,062,593	4	18,900	290,061
Gibraltar	......	......	12	17,718	40
Greece	......	......	5	7,890	1,324
Netherlands	8	18,000	42	54,064	120,613
Norway	67	178,611	93	161,483	16,437
Portugal	......	......	9	8,590	25,205
Russia in Europe	......	......	......	......	510
Serbia, Montenegro, etc	1	1,200	......	......	......
Spain	5	10,162	114	90,450	20,213
Sweden	2	3,800	86	102,974	1,000
England	......	......	120	158,392	527,087
Ireland	......	......	......	......	212
British Honduras	......	......	2	1,617	719
Canada	168	247,045	1,401	1,224,294	1,582,323
Costa Rica	......	......	1	1,436	739
Guatemala	......	......	5	7,249	2,163
Honduras	1	800	2	1,052	2,296
Nicaragua	......	......	2	2,419	3,644
Panama	20	11,326	15	9,184	15,810
Salvador	......	......	10	15,853	2,630
Mexico	72	70,106	304	225,574	61,066
Newfoundland and Labrador	2	2,711	7	10,502	2,530
Barbados	......	......	2	1,500	1,096
Jamaica	3	1,521	14	10,405	4,849
Trinidad and Tobago	8	5,160	24	13,383	11,868
Other British West Indies	2	1,100	4	2,450	3,856
Cuba	87	170,169	224	279,538	137,128
Virgin Islands of United States	......	......	2	2,425	282
Dutch West Indies	1	600	3	1,450	197
French West Indies	......	......	11	7,023	8,078
Haiti	......	......	22	25,840	3,230
Dominican Republic	1	3,000	15	9,905	14,253
Argentina	......	......	57	61,135	190,823
Bolivia	......	......	......	......	1,179
Brazil	6	3,765	216	163,095	32,098
Chile	17	28,318	81	157,725	121,388
Colombia	4	4,815	11	8,857	3,591
Ecuador	......	......	7	8,922	2,866
British Guiana	6	5,457	5	6,295	3,566
Dutch Guiana	......	......	5	2,712	375
French Guiana	1	550	......	......	......
Peru	34	23,990	88	106,329	17,278
Uruguay	18	24,731	293	298,664	72,259
Venezuela	9	4,989	50	40,670	13,765
China	......	......	116	120,062	883
Japanese China	......	......	......	......	15,090
Chosen	......	......	......	......	88
British India	12	27,886	140	168,464	37,044
Straits Settlements	1	3,250	......	......	7,340
Other British East Indies	......	......	......	......	936
Dutch East Indies	66	129,930	528	659,999	109,020
French East Indies	......	......	3	5,490	1,521
Hongkong	1	1,905	1	3,500	1,124
Japan	60	93,974	147	209,295	35,523
Russia in Asia	1	3,800	......	......	49,113
Siam	......	......	2	2,880	88
Turkey in Asia	......	......	1	5,000	......
Australia	11	18,810	134	133,911	148,552
New Zealand	8	14,516	298	330,223	53,174
Other British Oceania	......	......	......	......	1,595
French Oceania	......	......	......	......	767
German Oceania	2	1,335	4	2,365	1,229
Philippine Islands	2	2,492	215	225,615	48,451
British West Africa	3	3,688	19	17,787	3,155
British South Africa	1	844	19	16,883	5,175
British East Africa	......	......	13	10,576	1,652
French Africa	1	600	34	28,244	243
Portuguese Africa	......	......	......	......	66
Egypt	......	......	39	19,812	5,644
Total	1,029	$2,352,647	5,226	$5,503,923	$3,866,237
Shipments to:					
Alaska	4	$4,667	2	$1,600	$4,408
Hawaii	10	25,120	136	177,968	29,988
Porto Rico	10	26,126	50	45,520	27,566

This table supplements the one which appeared in the May 29 issue of AUTOMOTIVE INDUSTRIES, *and gives figures for all the individual countries, including those generally grouped under the collective heading of "Other Countries."*

75 Per Cent Detroit Business Improving

In May 69.6 Per Cent Business Normal and Above—31 Per Cent Below

DETROIT, June 10—Approximately 75 per cent of all Detroit business is improving rapidly in volume and earnings. Approximately 19 per cent is stationary while only 6 per cent is on the decline. Figures obtained from representatives of every line of business during May show that 25 per cent of business is above normal; 44 per cent normal, while 31 per cent is below normal but slowly climbing.

Price uncertainty is the greatest obstacle facing manufacturing lines. This is especially noticeable in the metal industries due entirely to the steel situation. Continued advance in the price of all commodities is due to wage increases and is halting development and readjustment more than any other single influence.

Detroit's prosperity is reflected in her banking institutions, 23 of which gained $43,394,906 in total resources between March 4 and May 12. On May 12, banking resources here totaled $517,510,360, as compared with $474,115,454 on May 4. The prediction is that the next statement of Detroit banks will show a total gain in resources of at least $200,000,000. This opinion is based upon the belief that millions of dollars involved in war orders will be settled by that time and that considerbale foreign business is coming.

—

BRITISH IMPORT RESTRICTIONS

LONDON, June 9—Recent announcements from the Board of Trade on further relaxation of import restrictions contains some interesting information for American exporters.

Rubber tires are to be admitted at the rate of 50 per cent of the 1913 importations. This is more liberal than the admission of cars, which is based on 50 per cent of 7 months of 1913.

The restrictions on the importation of the following articles are to be removed: Motor car jacks and track jacks, files, bronze castings, (machine or phosphor bronze), foundry flasks, springs for the upholstery trade, friction clutches, flexible metallic tubing, rubber manufactures other than tires, boots and shoes and stationery articles.

The importation of the following articles is to be licensed only exceptionally as and when required: Portable shop cranes, electric hoists and steel pulley blocks, except Yale triplex electric hoists, which are to be rationed to regular pre-war importers at the rate of 100 per cent of 1913 importations, steel tanks, trolleys and trucks for warehouse and wharf, shaft bearings, shaft bearing boxes, blocks for shafting, shaft collars, shaft couplings, shaft hangers, shaft hanger frames, metal baths and fittings thereof, iron and steel welded tubes up to 2 inches in diameter.

The importation of the following articles will be licensed exceptionally as and when required: fire extinguishers, electrical measuring instruments of all kinds, excepting those with 4-in. dials and under.

It is also reported that bulbs for electric lamps will be admitted into Great Britain at the rate of 50 per cent of the 1913 imports, and dry cells and primary batteries, except those for pocket lamps will be admitted at the rate of 20 per cent of the 1916 imports, according to information just received by the War Trade Board.

—

Expansion Plans Reflect on Machinery Trade

DETROIT, June 10—Expansion plans of the automotive industry are flooding the Detroit machinery makers and dealers with new business. A situation rather slow and gloomy in February and March has given way to one of optimism in May and June, and every indication now points to more business than many firms will be able to handle.

During the month of May, many automotive concerns announced expansion plans, the results of which reflect directly upon the machinery trade. Some of the companies announcing their plans last month are: Detroit Seamless Steel Tubes Co., new plant, $3,000,000; Saginaw Malleable Co., plant additions, $275,000; Standard Parts Co., Flint, new plant, $350,000; Jordan Motor Car Co., Cleveland, new plant, $250,000; Kenosha Wheel & Axle Co., Kenosha, Wis., new plant, $500,000; General Motors Corp., new plants, equipment, etc., in Michigan alone, $30,000,000; Henry Ford & Son, Dearborn, and in other states, plants and equipment in Michigan and other states, $2,500,000; General Motors Corp., outside of Michigan but within the United States, $12,000,000; in Canada, $6,000,000; Goodyear Tire & Rubber Co., Akron, plant addition, $500,000; Studebaker Corp., South Bend, new appropriation, $4,000,000; Maxwell Motors Corp., for Canadian plant, $1,000,000. In addition at least $2,500,000 has been scheduled for plant additions and new equipment by the firms in Michigan.

—

ELCAR INCREASES PRICES

CHICAGO, June 9—The price of the 6-cylinder Elcar has been raised from $1,375 to $1,475. The 4-cylinder remains the same, $1,175.

	New Price	Old Price
6-cylinder	$1,475	$1,375
4-cylinder	1,175	1,175

—

CONTINENTAL MOTORS ADDS

MUSKEGON, MICH., June 7—Continental Motors Corp. will spend about half a million or more in making building additions to its local plant and in adding new machinery.

Profit Tax Encourages Building Operations

Money Going into Plant Additions and Improvements to Avoid Heavy Taxes

DETROIT, June 9—The excess profit tax, which is taking from 40 per cent to 75 per cent of the profits of local manufacturers, is the cause of the greatest industrial expansion in the history of the city. Profits spent in expansion, plant improvements, new equipment, etc., are non-taxable, and scores of manufacturers are putting the major portion of their money back into their business. In other words, the government is paying for 60 per cent of expansion projects, here and elsewhere, for if the money was not invested in improvements, etc., most of it would go to the government in taxes.

Increased Capitalization

Dozens of companies have increased their capitalization and have erected new plants. New factories are springing up everywhere. The investment in new plant units, improvements, equipment, etc., will run high into the millions. Many concerns are building homes for their workers. Since Jan. 1 approximately $1,500,000 has been invested monthly in new buildings, not to mention the establishments which have changed hands, involving an equal, if not greater, amount.

The automotive industry has not been slow in grasping every expansion opportunity. In fact, the industry has set the pace for the rest of the manufacturing field. This is shown by the remarkable expansion projects of General Motors and Studebaker corporations.

Since the government fixed the price of steel and that market became more or less steady, as far as the building trades were concerned, construction plans held in leash by scores of big companies were released. Steel prices are in no way checking building work here.

—

PACKARD WINS GEAR SUIT

WASHINGTON, June 11—The Packard Motor Car Co. is decleared to be originator of the spiral bevel gear axle in a decision handed down by the Court of Appeals of the District of Columbia, a court of last resort in such actions. The Gleason Works of Rochester, N. Y., was the contender in the suit. The decision rules that a Packard employee was the inventor of the machine and process of making the gears in 1912 and that in 1913 the Gleason works devised a faster machine than that used by the Packard Co.

The decision follows, by a few days, the purchase of the patent rights by the Gleason Works. There are now nearly 400 Gleason machines in operation, each having a capacity of 10,000 spiral bevel gears annually.

Slight Prospect of Trade With Europe is Hanch's Report

(*Continued from page* 1363)

had been the father of high protection, should come to France and tell her what duties she should place on American automobiles.

In defending France's present attitude with regard to automobiles Mr. Cezanne says:

"Concerning the requirements of motor vehicles I should like first of all to state that the French Chambre Syndicale des Constructeurs d'Automobile, having studied this question very seriously for some months, is firmly resolved that future necessary general interests of the country must be considered before the private interests of automobile constructors. This is the policy that has been followed during the whole war.

"I think you have been misinformed as to the extent of the requirements of the French clientele and I should like to give you correct details showing by incontestable figures these requirements are much smaller than the supplies which could be made either immediately by the French military authorities, who hold a very large stock of motor vehicles, or within a relatively short time by our French factories which are able to turn out a much greater number of motor vehicles than are required to supply the French market.

"In 1913 there were 90,959 touring cars in France, of which 48,512 were used for business or professional purposes. To these figures add 6000 trucks which, at that time, were amply sufficient for French requirements. This totals 100,000 vehicles.

France Doubles Trucks Since 1914

"During the war the Government requisitioned all the 6000 trucks and 40,000 touring cars. Due to truck purchases from foreign countries during the war, France has approximately doubled the trucks she had in 1914.

"It may be strange to you that a country like France, with good roads, should have so few touring cars in proportion to its population, one car for every 300 people, whereas the U. S. A. has one car for every 14 people. It is impossible to compare the two situations if we consider the distribution of population per square kilometer and the length of railroad lines in the two countries. The French population is much denser per square mile or kilometer and the railroad mileage per population is greater in France than in the U. S. A.

"From 70 to 75 per cent of the French population belongs to the peasantry living on the land and have not been owners of motor cars.

"Again, in America a motor car lasts 2 or 3 years, whereas in France a car is kept as long as possible by the owner.

"In France the tax is very high and there is little chance for reduction. The luxury tax is 10 per cent for the value of the car and applies to used cars as well. The annual tax on the 15 hp. car ranges from 170 to 500 francs, according to the locality. Gasoline is 5 to 6 times as expensive as in the U. S. A.

"For these reasons, circulation of cars in France cannot develop as rapidly as in the U. S. A. Further handicap exists in consequence of the reduction of private fortunes in France, due to the war, and the great increases that must be made in taxes and, as a result of these conditions, an estimated maximum of 25,000 to 30,000 cars will meet the immediate requirements and that the total number cannot exceed 135,000 cars.

"In 1913 the French factories produced 45,000 to 50,000 car chassis, 25,000 of which were exported. Since then French factories have developed in the manufacture of car material and within a relatively short time will be able to produce 120,000 cars per year in addition to trucks. This is the presumed requirements of the French clientele, which are not all equally urgent and could be made within a year if the French factories were main masters of the French market.

"In addition the French factories are supplemented by 25,000 vehicles which can be immediately released from the army in good condition, and 25,000 others which can be released after undergoing repairs. These alone would meet the most pressing requirements of the French people.

French Factories in Production

"French factories are already beginning to produce cars and production will increase during the next few months so that the French market will reach the saturation point before the end of 1919.

"From the moment the possibilities of French production will have, exceeded the requirements of the French market, and if the makers require export trade, will the automobile makers of the U. S. A. be disposed to open the doors of their own market to French cars, which doors they have kept so tightly closed for more than 10 years?

"I, therefore, come to the conclusion that French automobile constructors cannot subscribe to the proposition which you formulate. The manufacturers of the U. S. A. must know that if they were permitted to send large numbers of cars into France, simply because they have been more favored than their French colleagues during the war and are able to make deliveries, that would be dealing a mortal blow to the French manufacturers. This, I feel, is not their intention."

Writing on the subject of future duties on automobiles, Mr. Cezanne continues:

"I quite understand that you find the course even unjust that an American car coming into France to pay a duty of 45 per cent ad valorem, while an Italian car pays only 10 to 15 per cent. Permit me to say with all free candor, that for many years French cars going into the U. S. paid 45 per cent ad valorem while American cars coming into France were only taxed on a basis of 8 to 10 per cent. France found this treatment hard and unjust, the more so because French production could not be a danger for American production, the latter being so much greater.

"At one of the meetings you gave us to understand that there was not much chance of this duty being materially modified and yet, because you have fought beside us, you ask all of the Allies shall be treated on the same footing. It seems to me, and I feel sure that all my countrymen will agree with me, that if any steps are to be taken towards an equitable solution, the government of the United States should take the first step.

"The American automobile industry would be honored in our eyes by bringing the matter to the notice of their government, but it is not surprising that if we cannot have the same tariff for all the Allies, we urge upon the French government at least to apply to each of our Allies the same treatment they think proper to apply to us."

Exports of Automobile Tires from United States During April, 1919

Countries	Value
Belgium	$5,405
Denmark	33,746
France	1,968,453
Greece	3,945
Italy	242
Netherlands	19,120
Norway	30,445
Portugal	3,217
Serbia, Montenegro, etc.	100
Spain	47,392
Sweden	130,942
England	129,623
Bermuda	12
British Honduras	156
Canada	104,658
Costa Rica	503
Guatemala	3,194
Honduras	7.119
Nicaragua	1,415
Panama	16,896
Salvador	18,626
Mexico	75,732
Newfoundland and Labrador	6,352
Barbados	4,003
Jamaica	9,271
Trinidad and Tobago	10,823
Other British West Indies	7,413
Cuba	298,343
Danish West Indies	401
Dutch West Indies	1,652
French West Indies	25,353
Haiti	2,021
Dominican Republic	19,091
Argentina	35,207
Bolivia	448
Brazil	82,187
Chile	149,476
Colombia	6,939
Ecuador	26,996
British Guiana	2,601
Dutch Guiana	390
Peru	25,549
Uruguay	62,373
Venezuela	29,510
China	42,141
Chosen	1,767
British India	101,788
Straits Settlements	63,161
Other British East Indies	4,268
Dutch East Indies	58,339
French East Indies	1,766
Hongkong	5,696
Japan	20,851
Siam	9,766
Turkey in Asia	36
Australia	66,194
New Zealand	59,584
Other British Oceania	4,495
French Oceania	248
German Oceania	464
Philippine Islands	58,667
British West Africa	4,971
British East Africa	7,188
Canary Islands	220
French Africa	285
Egypt	4,701
Total	$3,923,936

McGUIRE CARLISLE SALES HEAD

STAMFORD, CONN., June 10—Clarence V. McGuire has been appointed general sales manager and advertising director of the Carlisle Cord Tire Co. Until now he has been vice-president of Van Patten, Inc., advertising agency. In entering the company he becomes a director of the organization and a member of the executive board.

—

Harold W. Woodworth, who has been in the Boston office of the Ahlberg Bearing Co., Chicago, will be in charge of the new office of the company at 511 Westminster Street, Providence, R. I.

—

Bruce E. Anderson, formerly with the Ideal Engine Co., has become general manager of the Lansing Body Co., succeeding Frank Thoman, who retires as manager but continues as a member of the board of directors.

—

R. S. McLaughlin, president of the McLaughlin Motor Car Co. and a vice-president and director of the General Motors Corp., has been elected president of the newly organized General Motors of Canada, Ltd., which has a capital of $10,000,000.

—

L. P. Helm, for two years in charge of production of the Olympian Motors Co., Pontiac, has resigned to become production engineer of the Chief Motors Corp., Port Huron, Mich.

—

J. H. McMillan, advertising manager of the Mueller Metals Co., Port Huron, Mich., has resigned, to take effect June 15. His future plans have not been announced.

—

Otto Bruenauer, formerly director of sales and engineering of the U. S. Ball Bearing Mfg. Co., Chicago, has resigned. Otto Bruenauer and Howard L. Spohn became identified with the U. S. Ball Bearing company in January, 1917, and with Walter H. Strom had charge of the plant. As a result of reorganization and changes in policy consequent upon the death of Walter H. Strom in January, 1919, Spohn resigned as commercial manager in May, Bruenauer's rssignation following. Spohn immediately returned to the Class Journal Co. Bruenauer's future plans have not been announced.

—

CARBURETER HAS NEW MAKER

CHICAGO, June 9—The Beneke & Kropf Mfg. Co. has succeeded the Findeisen & Kropf Mfg. Co. and will make the Rayfield carbureters formerly made by the latter concern. With the reorganization of the company, plans for the material expansion of manufacturing have been formulated. Henry Beneke, formerly vice-president of Hibbard, Spencer Bartlett & Co., has purchased the entire interests of Frederick Findeisen and becomes vice-president and treasurer of the reorganized company. O. F. Kropf remains with the company as active president, and E. A. Bates continues as director of sales and advertising.

Men of the Industry

Changes in Personnel and Position

REQUA RESIGNS AS OIL HEAD

WASHINGTON, June 6—Mark L. Requa resigned to-day as director of the oil division of the U. S. Fuel Administration. Mr. Requa's departure marks the disbanding of the oil division, which controlled the production and consumption of oil, including gasoline, during the war.

—

PARKS HEADS MAXWELL

WALKERVILLE, ONT., June 6—George W. Parks has been elected president and general manager of both the Maxwell Motor Co. of Canada, Ltd., and the Chalmers Motor Co., of Canada, Ltd.

—

L. E. Lyons, who for the past several months has been acting as sales manager of the B. F. Everitt Co., has resigned to return to the Sheldon Axle & Spring Co., with headquarters in Detroit.

—

William F. Jahnke, formerly a member of the city commission of Saginaw, is now connected with the General Motors Corp. in Detroit, being one of six men working out plans for the organization of a savings and investment department of the General Motors Corp.

—

UNGER HEADS RESEARCH SOCIETY

DETROIT, June 10—J. S. Unger, with the Detroit branch of the Carnegie Steel Co., was elected president of the Steel Treating Research Society Saturday evening, and L A. Danse, Cadillac Motor Car Co. secretary and treasurer, was chosen vice-president. Dr. John A. Mathews, Syracuse, talked on metallurgical achievements of America during the war and the new alloys devised and new methods invented. He declared that the broken parts of the racing cars which failed to finish in the Indianapolis 500-mile race May 31 should be examined by experts to determine the reason for breakage in order to secure the benefit of this knowledge for future construction.

—

TRACTOR SHOWS IN OHIO

COLUMBUS, OHIO, June 10—There will be four tractor shows in Ohio this year. The first will be held here, July 28-29, the second in Piqua, Aug. 1-2, third in Fostoria, Aug. 6-7, and fourth in Akron, Aug. 12-13. The demonstrations will be in charge of Prof. H. C. Ramsower, head of the agricultural engineering department of the Ohio State University.

WHITE PLANS NEW CAR

DETROIT, June 9—D. McCall White, formerly vice-president of the Cadillac Motor Car Co., has opened a temporary office in Detroit. He is actively engaged in getting out the preliminary designs for a new car which he is going to manufacture. The location of the plant in which it will be produced has not been definitely determined.

—

DORT MEN IN SOUTH AMERICA

FLINT, June 10—F. A. Petrie, director of sales of the Dort Motor Car Co., for the South American countries, sails on June 20 for Buenos Aires to establish export connections for the Dort car in Latin America. He is taking with him Vaughn Green, engineer and service expert, and four sample cars. He expects to visit Argentina, Uruguay and Chile and will make a careful survey of that field.

—

Lynn McNaughton has been appointed general sales manager of the Cadillac Motor Car Co., succeeding Earle C. Howard, who recently resigned. Mr. McNaughton has been with the Cadillac sales organization for 14 years, and assistant under Mr. Howard since 1913.

—

B. V. Unwin, until recently connected with the Commonwealth Brass Co., Detroit, has been appointed manager of the sales promotion department of the J. C. Wilson Co., Detroit.

—

F. W. McIntyre has been appointed sales manager of the Becker Milling Machine Co., Boston. For the past 16 years he was connected with the Niles-Bement-Pond Co., Boston.

—

O. D. Conover, formerly vice-president and chief engineer of the T. W. Price Engineering Co., New York, and production manager of the Ludlum Electric Furnace Corp., has resigned to become sales and production engineer on foundries and steel plants of the Austin Co.

—

SHEEPSHEAD BAY ENTRIES

NEW YORK, June 9—A program of four events, 10, 20, 30 and 50-mile race, is scheduled for the Sheepshead speedway June 14. Professional entries include:

Dario Resta	Resta special
Joe Thomas	Mercer special
Louis Chevrolet	Frontenac special
Ira Vail	Hudson special
Denny Hickey	Stickel special
J. M. Reynolds	Frontenac special
Dave Lewis	Meteor special
Tommy Milton	Duesenberg special
Ralph DePalma	Packard special
Rene Thomas	Ballot
Albert Guyot or Louis Wagner	Ballot

The 20-mile event is to be an invitation race for non-professional drivers. The two entries for this event received by the Contest Board of the American Automobile Association so far are:

W. T. Comerford	Stutz
Eddie O'Donnell	Duesenberg

Current News of Factories

Notes of New Plants—Old Ones Enlarged

BRIGGS & STRATTON WILL ENLARGE

MILWAUKEE, WIS., June 9—The Briggs & Stratton Co. will enlarge its productive facilities aproximately 100 per cent at a cost of nearly $500,000. Ground will be broken early this week for a 5-story fireproof factory building, 60 x 185 ft., duplicating the present factory, erected about three years ago. In addition, a new office building, laboratory and engineering building, 69 x 120 ft., 4 stories high, will be built. The new facilities will be available by Oct. 1.

The company also will take over the motor-wheel department of the A. O. Smith Corp., Milwaukee. The motor-wheel is a gas-engine attachment for bicycles. The working force will be enlarged to 1,000 or 1200 in three or four months.

Stephen E. Briggs, president and general manager, left last week for Europe to investigate market conditions for export. During hostilities, the larger part of the company's facilities were devoted to the manufacture of hand and rifle grenades.

ENGLISH COLUMBIA AGENCY

DETROIT, June 6—The Columbia Motors Co., Detroit, has engaged Stanley Watson Inc., London, Eng., to take the agency for the Columbia car abroad.

PERFEX TO DISMISS BANKRUPTCY

MILWAUKEE, WIS., June 9—A petition seeking dismissal of involuntary bankruptcy proceedings filed March 28 against the Perfex Radiator Co., Racine, Wis., has been set for hearing on Wednesday, June 18, by Judge F. A. Geiger of the Federal Court at Milwaukee. The plant has been continued in operation under the direction of Julius J. Goetz, receiver, since proceedings were instituted.

DIVIDENDS DECLARED

The McCord Mfg. Co., Detroit, quarterly dividend, 75 cents, payable July 1 to stockholders of record June 25.

Pierce-Arrow Motor Car Co., Buffalo, quarterly dividend, 2 per cent, payable June 14 to stockholders of record May 31.

CLEVELAND, June 11—The Cleveland Tractor Co. will increase its capitalization $1,980,000. Stockholders will be given first opportunity to subscribe to the new stock. A stock dividend of 10 per cent was also declared, and an initial quarterly dividend of 1½ per cent beginning July 1, thus placing all the Cleveland stock on a 6 per cent basis.

Allis-Chalmers Manufacturing Co., Detroit, regular quarterly dividend, 1¾ per cent on preferred, and ¾ per cent on account of accumulated dividends on preferred, both payable July 15 to stockholders of record June 30.

Stutz Motor Car Co., Indianapolis, regular quarterly dividend, $1.25 a share, payable July 1 to stockholders of record June 23.

INTERNATIONAL HARVESTER BUYS PLOW

CHICAGO, June 9—The International Harvester Co. has purchased the Chattanooga Plow Co., maker of chilled plows. The Chattanooga Plow Co. was formed 40 years ago and is being operated by the founders. Its plant covers about 3½ acres of a 7-acre site. The line of horse and power cane mills established by the Chattanooga company will be continued by the Harvester company.

PLANS FOR 150,000 FORDSONS

DEARBORN, June 6—Henry Ford & Son plans to produce approximately 150,000 tractors during the fiscal year commencing June 1, 1919. The plant has been in operation 14 months and on May 1, the date it closed down for inventory, it had made 53,078 tractors. Inventory work was completed June 1 and the company is back in production. Approximately 100 tractors were run daily this week, and before the middle of June the daily output will be between 300 and 400 machines. Orders have been received from France, England and Belgium for 1000 tractors.

NORTHWAY MAKES 580 ENGINES DAILY

DETROIT, June 6—The Northway Motors Corp., one of the General Motors units, is averaging 580 automobile engines daily. The company is also making engines for the Sampson tractor. Approximately 400 engines are being turned out daily for the Oakland Motor Car Co., 150 for Olds Motor Works and 30 for the Cole Motor Car Co. It will be nearly one year before the building program, recently outlined for this company, goes into effect.

ONEIDA PRODUCTION DOUBLED

GREEN BAY, WIS., June 7—The Oneida Motor Truck Co. since the end of the war has more than doubled its production and increased its sales by 130 per cent. During May salesrooms were established at Baltimore, Denver and Sioux City.

FORD STREET CAR NEXT

DEARBORN, June 6—Within two weeks the first of Henry Ford's "street cars," with which he hopes to solve Detroit's transportation problem, will be in operation. The big gasoline vehicle is nearing completion at the Dearborn tractor plant. C. J. Hall of Los Angeles, Cal., is aiding Mr. Ford in designing and construction work.

MARTIN-PARRY MERGER

INDIANAPOLIS, June 9—The Martin Truck & Body Corp., York, Pa., and the Parry Manufacturing Co. of this city, both commercial car body makers, have merged as the Martin-Parry Corp. John J. Watson, Jr. is chairman of the board, and other directors are: Guy E. Tripp, Westinghouse Electric & Manufacturing Co.; James F. Shaw, Knauth, Nachod & Kuhne; F. M. Small, former president of the Martin Truck Co.; Robert I. Burr, S. C. Parry, Parry Manufacturing Co.; Walter R. Herrick, Herrick, Berg & Co., and George R. Walbridge, Bonbright Co., Inc.

COMPLAINT AGAINST PAN MOTORS

WASHINGTON, June 6—The Federal Trade Commission has issued a complaint against the Pan Motor Co., St. Cloud, Minn., and the president, Samual C. Pandolfo, charging him and the company with having sold stock worth $4,723,111 and deceiving the public by circulating false statements and unfair advertisements regarding the assets and resources of the company. They claim there were 54,000 recorded subscribers of stock of whom 39,000 have paid their subscriptions in full.

The commission complains that the Pan Motor Co. represented that they planned to manufacture passenger automobiles on a large scale but merely assembled 200 cars.

This is the first formal complaint issued by the Federal Trade Commission, and the defendants are ordered to file their answer by July 10.

REO MAKING 50 A DAY

LANSING, MICH., June 7—The Reo Motor Car Co. averaged 30 per cent more cars in May than the average production for the first quarter. The company is producing from 40 to 50 trucks daily.

800,000 KELSEY WHEEL SETS IN 1919

DETROIT, June 7—The Kelsey Wheel Co.'s 1919 output will be 800,000 sets of wheels, as against 690,000 in 1918. In addition to automobile wheels the company is now making automobile bodies and brake bands.

5 HINKLEY ENGINES A DAY

DETROIT, June 6—The Hinkley Motors Corp., after shifting from a 100 per cent war rating to a peace basis, got into production June 1 and is now running approximately 5 engines daily. The company expects to make 6000 engines this year and 15,000 in 1920. About 350 men are employed.

ACASON IN CAPACITY PRODUCTION

DETROIT, June 6—The Acason Truck Co. is producing from 20 to 23 trucks a day, which is plant capacity.

AUTO WHEEL PRODUCTION

LANSING, June 3—The Auto Wheel Co. is now approaching capacity production. The company is producing 450 sets of wheels daily.

Calendar

SHOWS

Aug. 30-Sept. 6—Minnesota. State Fair.

Sept. 1-6 — Indianapolis. Ind. State Fair, Cars and Accessories, Indianapolis Automobile Trade Assn., John B. Orman, Manager.

Sept. 13-20—Cincinnati, O. Ninth Annual, Music Hall, Cincinnati Automobile Dealers' Assn., H. K. Shockley, Manager.

*Oct. 9-19—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-16—London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December — Brussels. International Automobile Mfrs. Congress.

Jan. 3-10 — New York, N. Y. Grand Central Palace, National Automobile Chamber of Commerce, S. A. Miles, Manager.

Jan. 24-31—Chicago, Ill. Coliseum, Cars; Drexel Pavilion, Trucks; National Automobile Chamber of Commerce, S. A. Miles, Manager.

January — New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

June 9-12—Denver, Colo. Sectional Tractor Demonstrations, Denver Tractor Club.

July 14—Wichita, Kan. Automotive Committee of National Implement Assn.

July 28-29—Columbus, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 1-2 — Piqua, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 18-22—Aberdeen, S. D. Sectional Tractor Demonstrations.

October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

CONTESTS

June 12-13—Travers Isl., N. Y. Greenfield, Mass., and return. Inter-City reliability run.

†June 14—Sheepshead Bay, L. I. Speedway race.

July 4—Hohokus, N. J. Dirt Track Event.

July 4—Tacoma, Wash. Annual speedway races.

July 4—Atlantic City, N. J.—Airplane races—Aeronautic Convention.

*July 5—Cincinnati, O. Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15 — Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

*Tentative dates.
†Sanctioned.

CONVENTIONS

June 12-14—Pittsburgh. Annual convention of American Drop Forge Assn. and Drop Forge Supply Assn., William Penn Hotel.

June 16-19—Detroit. American Society of Mechanical Engineers spring meeting, Hotel Statler.

June 23-28—Ottawa Beach, Mich. S. A. E. Mid-summer Meeting.

July 9-10—Buffalo. Motor and Accessory Mfrs. Assn. Mid-summer convention.

Sept. 22-24—Philadelphia. Annual Convention, National Association of Purchasing Agents. Bellevue-Stratford.

May 12-15, 1920—San Francisco. Seventh National Foreign Trade Convention.

January — Washington. Pan-American conference.

STROMBERG FINANCIAL REPORT

NEW YORK, June 9—The Stromberg Carbureter Co. of America, Inc., holding company of the Stromberg Motor Devices Co., has just published its annual report for the fiscal year ending Dec. 31 last. Net profits of $279,097 are shown, as compared with $318,819 of the previous year. The profit per share is $5.58, as compared with $6.37 in 1917, on the 50,000 shares of no par value.

The income of the Carbureter company consisted of $350,628, the net earnings of the Motor Devices company and $21,742 other income, a total of $372,368. The deductions are $70,392 for Federal taxes and $22,879 for other taxes and sundry expenses. In this report no provision is made for the 1919 taxes because the Federal rate was not known at the time the books were closed.

The Motor Devices Co. report shows sales for the year of $2,160,373 and operating profit of $384,781. The added income was $6,817, making total income $391,598. Charges of $40,972 were deducted for taxes, etc. The Carbureter company balance sheet shows:

Assets.	
Investment Stromberg Motor Devices Co.	$1,180,761
Cash	38,211
Liberty bonds	25,000
Notes receivable and accrued interest	201,400
Furniture and fixtures	238
Total	$1,445,610
Liabilities.	
Capital stock (50 000 shares without par value)	$250,000
Surplus	1,195,610
Total	$1,445,610

CARS AND TRUCKS FOR ARGENTINA

WASHINGTON, June 10—An additional field for motor cars and trucks has been opened in a section of Argentina as a result of the construction of a macadamized highway connecting the cities of La Plata and Bahia Blanca, which traverses the distance of Lomas de Zamora, Can Vicente, Canuelas, Monte, Las Flores, Azul, Olavarria, Laprida, Pringles and Tornquist. The first section of this road has been completed. La Plata is also connected directly with Buenos Aires by a macadamized highway. The new road, nearly 500 miles long, will link all of the border section with the ports.

TRADE-MARK LAW

WASHINGTON, June 11—A new trade-mark law in Honduras, effective Aug. 1, 1919, provides for a registration fee of $50 gold for each trade-mark. This increased fee will not apply to applications filed before Aug. 1.

JAPANESE REGULATIONS

WASHINGTON, June 6—New automobile regulations have been promulgated by Japan. Chauffeurs, who are required to be 18 years old, are divided into two classes, A and B, according to their qualifications as operators.

Those in class A may operate any kind of car and their licenses are good for five years. Chauffeurs in class B can also operate for five years on the same license, but only special cars or classes of cars.

The speed limits vary according to the width of the streets. On roads between 12 and 18 ft. wide, machines may run at the rate of 8 m.p.h., between 18 and 36 ft. at 12 m.p.h., on roads above 36 ft. in width at 16 m.p.h. Within the city limits machines must not travel on streets less than 18 ft. wide. They may run at a speed of 12 m.p.h. on streets between 18 and 36 ft. wide and on those wider than 36 ft. 16 m.p.h. is the limit.

FOREIGN TRADE OPPORTUNITIES

WASHINGTON, June 10—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has received requests for automobile or parts and accessories agencies of business from individuals and companies in foreign countries. These are listed below. For further information address the Bureau of Foreign and Domestic Commerce, Room 149, Customhouse, New York, specifying each Foreign Trade Opportunity number on a separate sheet of paper.

Mexico—Cars, motor trucks and accessories. No. 29 504.

Philippines—Cars and tires. No. 29,217.

Australia—Accessories and pressed steel grease cups. No. 29,524.

Belgium—For 3 firms sale of trucks, with trailers, 1½ to 3 tons, small agricultural machinery, tires, solid and pneumatic. No. 29272.

Belgium—Small cars, trailers, trucks and motorcycles. No. 29274.

Switzerland—Engines, trucks, tractors. Correspondence may be in English. No. 29280.

Catalogs with price lists of medium and high grade cars. Correspondence may be in English. No. 29313.

Spain—Cars. No. 29331.

LITHUANIA MARKET FOR CARS

NEW YORK, June 7—Lithuania, which has been freed from all export restrictions by the War Trade Board, offers a new field for American cars. It is a rich agricultural country organized into co-operative enterprises, which make it possible for her to buy on a large scale, according to a bulletin distributed by the New York office of the Lithuanian National Council. It is in need of proper motor equipment, including trucks, tractors and cars, offering a new market to the American manufacturer.

SHIP TO GERMAN AUSTRIA

WASHINGTON, June 9—Applications will now be considered by the War Trade Board for exportation of automotive products to German Austria.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 25

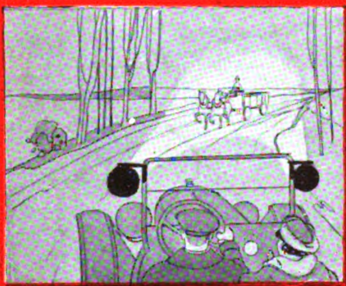
PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, JUNE 19, 1919

Fifteen cents a copy
Three dollars a year

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, N. Y., under the Act of March 3, 1879

Stewart

CUSTOM BILT NECESSITIES

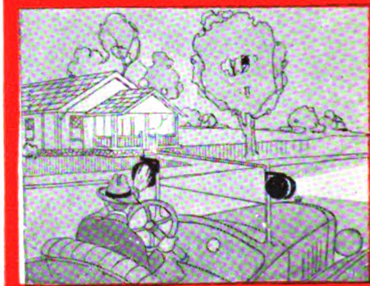


Every car should be equipped with *two* Stewart V-Ray Searchlights.

STEWART V-RAY SEARCHLIGHT LEADS THE FIELD

Only one worthy of the name **searchlight.** "Spotlights" are mere toys beside the sturdy Stewart. Projects intense beam of light 1000 feet. Is "custom-bilt" the Stewart Quality Way to outlast the car.

That's why more of them are now being sold than all "Spotlights" combined. ***Order your supply today.***

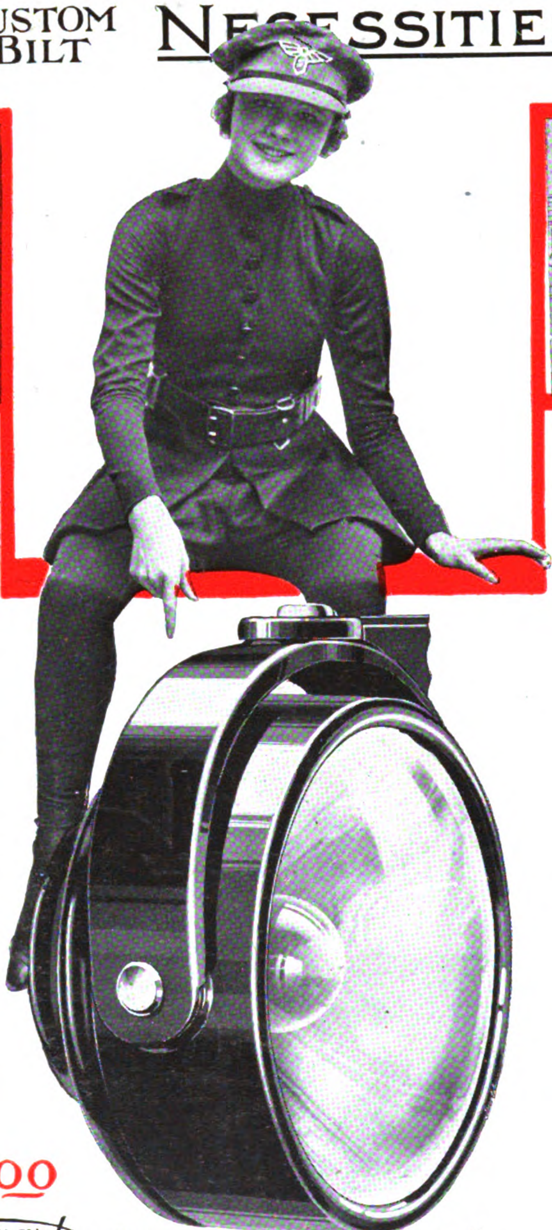


Intense beam of light is projected 1000 feet in any direction desired.

HERE'S NEW IDEA! IT WILL DOUBLE YOUR SALES

Sell every motorist **two** Stewart Searchlights instead of **one.** A new safety-first movement in vogue nationally. Motorists themselves started it. Thousands enlisting daily.

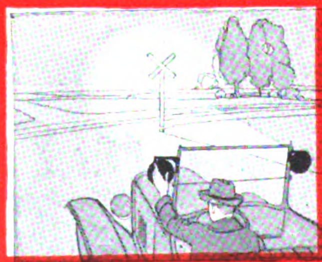
Searchlights do not blind oncomers, yet full strength, not diffused, light is always on road. Furnish safest illumination. Spread this idea. ***Double your sales. Reap the profits.***



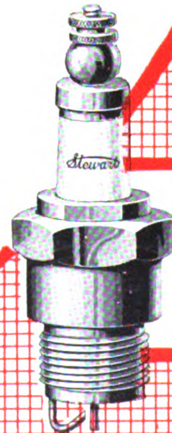
$6.00 Stewart V-Ray Searchlight

"More than a Spotlight"

Stewart Vacuum System $12.50



Picks out road signs, sharp turns, ditches and all danger spots.



Stewart Spark Plug $1.25

THE Stewart BIG TEN ARE ALL LEADERS IN THEIR CLASS

STEWART-WARNER SPEEDOMETER COR'N, Chicago, U. S. A.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

VOL. XL | NEW YORK—THURSDAY, JUNE 19, 1919—CHICAGO | No. 25

Non-Stop Transatlantic Flight Brings New Problems

Pilot of the Vickers-Vimy Voices Need of More Complete Meteorological Observations—Sextant and Compass Sufficient Guide Even in Fog

CAPT. JACK ALCOCK, who piloted the Vickers-Vimy airplane across the Atlantic in 16 hours and 20 minutes, is quoted as saying in an address at Galway, Ireland, that he expected that within a year airplanes would be carrying passengers across the Atlantic.

One of the first remarks made by Captain Alcock after his arrival in Ireland was: "We must have more complete meteorological observations. We were told in Newfoundland that the conditions were favorable. Yet within an hour we plunged into bad conditions, fog and a sleet storm."

As to the machine, Captain Alcock, who is a veteran British aviator, and Lieut. A. W. Brown, his American navigator, had little to say in the way of suggestions. Captain Alcock said that he had at no time pushed his engine and that the surprising speed was the normal engine work, aided by the winds, which were favorable throughout the trip.

The fuel supply, it appears from early reports, was sufficient to have completed a flight to London, had the aviators cared to continue to that point. Their landing at Clifden, Ireland, appears to have been due to a desire to make a good landing as soon as possible and not endanger the record of their trip by continuing. They had undertaken the flight in the London *Daily Mail* competition, which required only a landing on the Irish coast. In addition both men were greatly fatigued, due chiefly to the adverse weather conditions encountered.

Lieut. A. W. Brown *Capt. Jack Alcock*

Lord Northcliffe, owner of the *Daily Mail*, whose offer of $50,000 was directly responsible for this flight, as well as that of the ill-fated Sopwith machine piloted by Harry Hawker, sent a telegram of greetings to Captain Alcock. In this, Lord Northcliffe takes a remarkable view of the possibilities of transatlantic flying. His telegram reads:

"My Dear Alcock—A very hearty welcome to the pioneer of direct Atlantic flight. Your journey with your brave companion, Whitten Brown, is a typical exhibition of British courage and organizing efficiency.

"Just as in 1913 when I offered the prize I felt that it would soon be won, so do I surely believe your wonderful jour-

Front view

ney is the warning to the cable monopolists and others to realize that within the next few years we shall be less dependent upon them unless they increase their wires and speed up. Your voyage was made more quickly than the average press message of 1919.

"Moreover, I look forward with certainty to the time when London morning newspapers will be selling in New York in the evening, allowing for the difference between British and American time, and vice versa in regard to New York evening journals reaching London the next day.

"Then we shall no longer suffer from the danger of garbled quotations due to telegraphic compression. Then, too, the American and British peoples will understand each other better as they are brought into closer daily touch.

"Illness prevents me shaking you by the hand and personally presenting the prize, but I can assure you that your welcome will be equal to that of Hawker and his gallant American compeer, Read, whose great accomplishment has given us such valuable data for future Atlantic work.

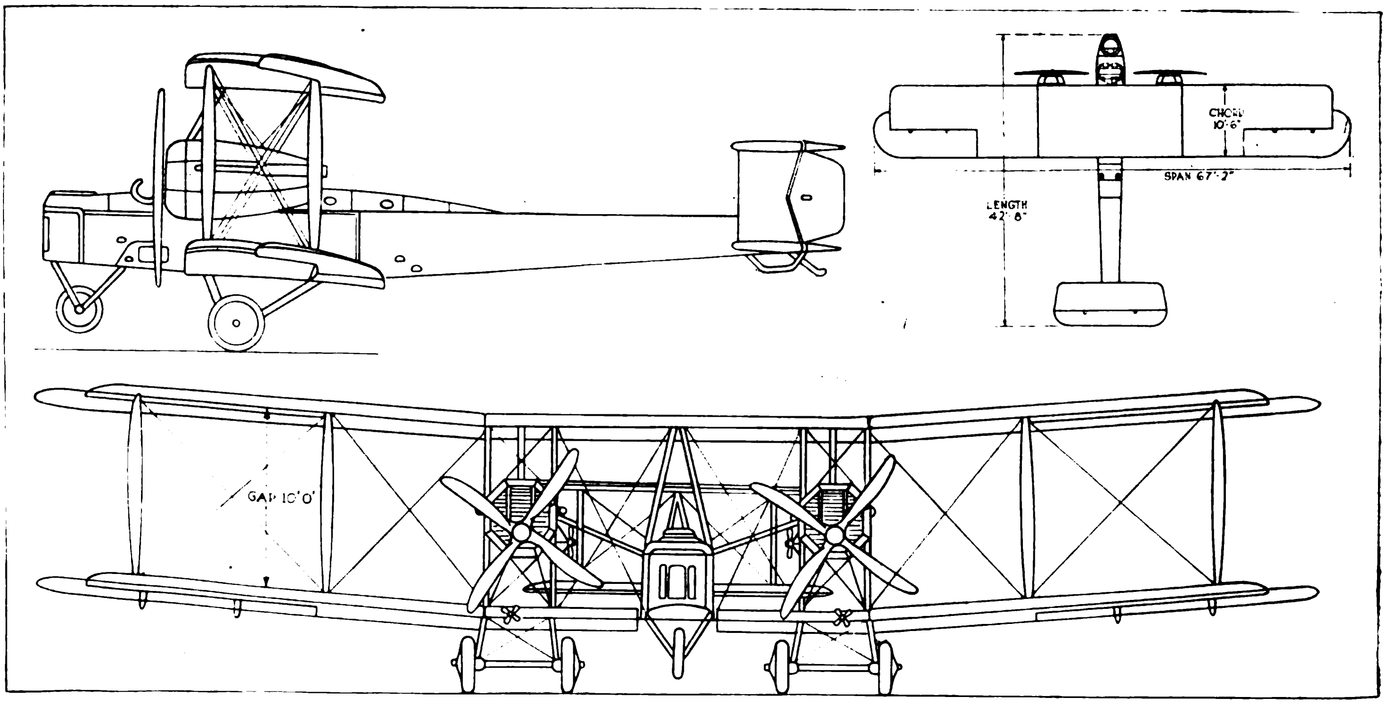
"I rejoice at the good augury that you departed from and arrived at those two portions of the British Commonwealth, the happy and prosperous Dominion of Newfoundland and the future equally happy and prosperous Dominion of Ireland.

"Yours sincerely, NORTHCLIFFE."

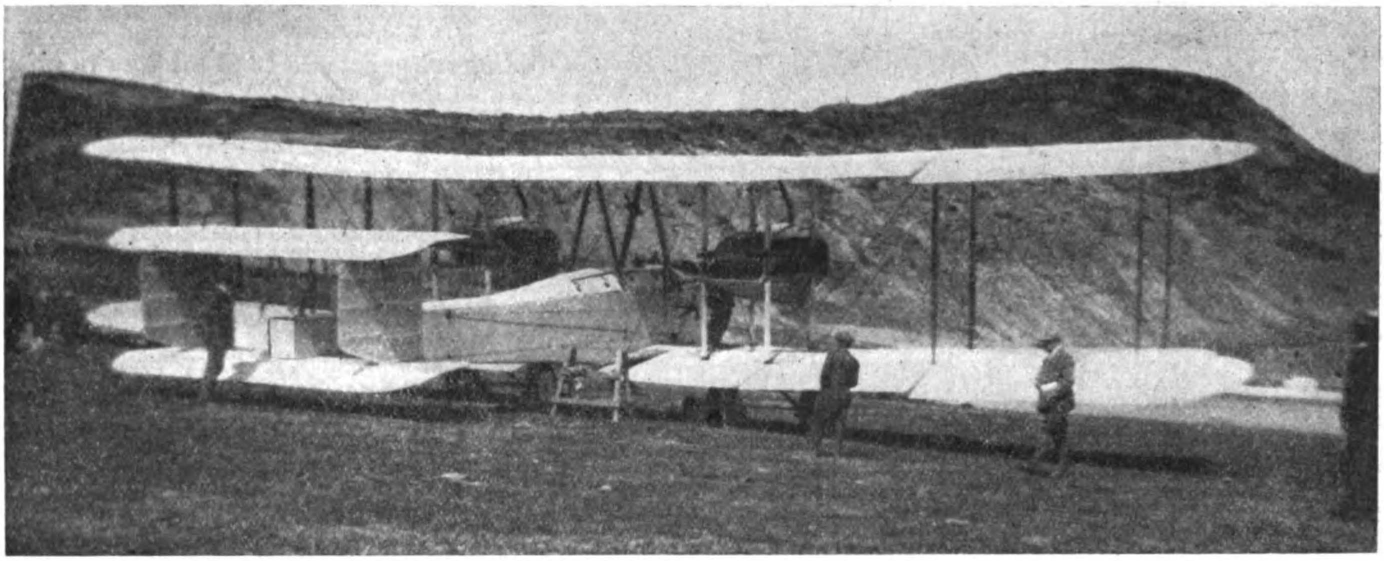
In later interviews both men spoke of the future as follows:

"The next time I cross the ocean," Captain Alcock said, "it will be in a flying boat. I foresee for the flying boat a great future, both as a passenger and commerce carrier."

On his side Lieutenant Brown remarked that the lesson gained was that marine navigation is entirely applicable to airplanes.



Side and front elevations and plan



Rear view

"There is little element of luck either in the success of the NC-4 or our flight," he declared.

"So far as weather was concerned, it could not have been worse in our case, for after the first hour we were smothered in fog until we landed in Ireland. Nevertheless, with only a sextant and compass, and a special device for determining the machine's speed and drift, we came through.

"And I am sure we could do it again."

The flight of the Vickers-Vimy was not in itself a surprise. The fact that the failure of the Sopwith machine had been due to incidental mechanical trouble—solder in the radiator—and the success of the American seaplanes in crossing the Atlantic had led the public to expect the success of this flight. The element of surprise was supplied by the speed, as apparently no one had counted upon the consistent aid of the winds for the entire journey.

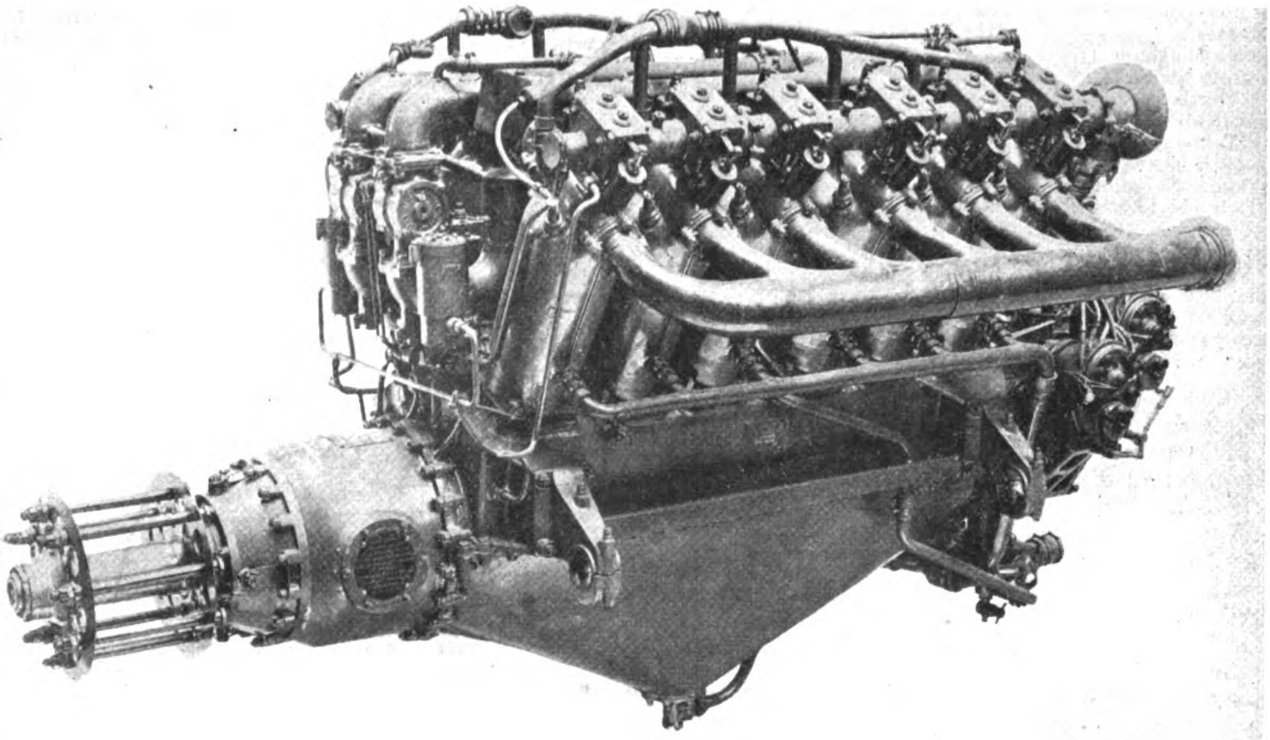
The exact record of the flight is:

Started, St. John's, N. F., June 14, 4:10 p. m., Greenwich time.

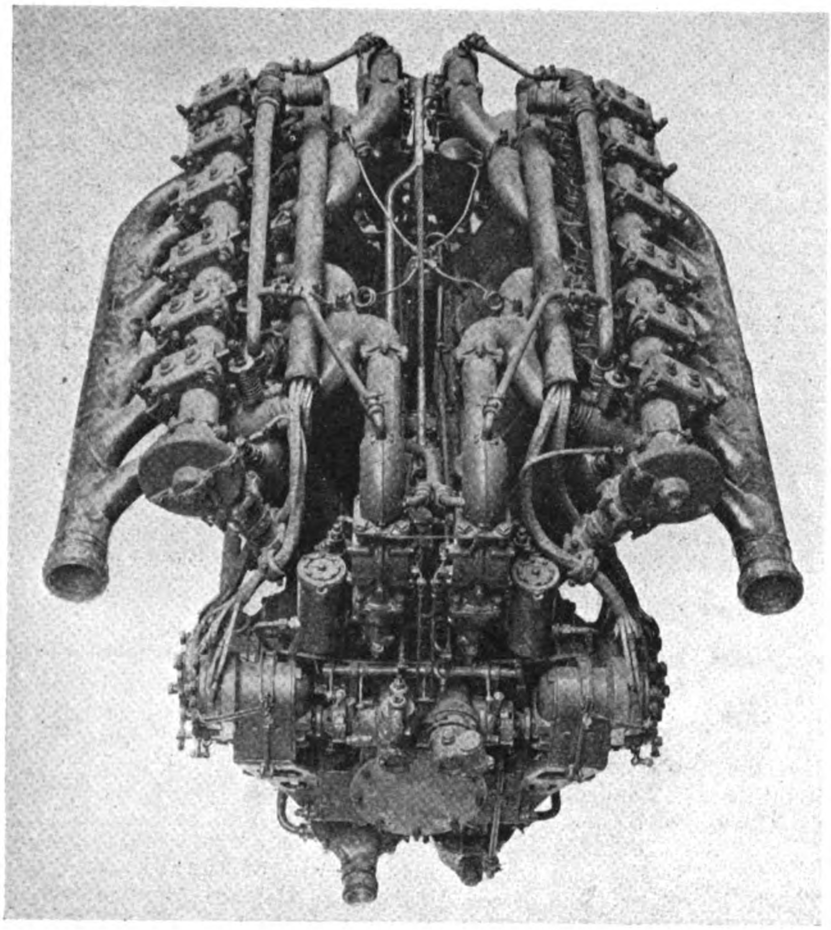
Landed, Clifden, Ireland, June 15, 8:22 a. m., Greenwich time.

Distance, 1900 miles, making an average of 120 m.p.h.

The only unfavorable feature of the Vickers-Vimy flight came at the finish, when Captain Alcock mistook a bog for a meadow and landed in it. The machine pitched forward on her nose, turned sideways, and was damaged to an extent that the plan for Captain Alcock to continue his flight to London was abandoned and the machine taken apart and removed there by freight. The two navigators made a triumphal trip to London by



Rolls-Royce 360-hp. Eagle engine with epicyclic reduction gear



Rear view of engine

boat and rail, being hailed at all stops as heroes and carried about on the shoulders of admirers.

The comparison of this flight, in a land plane built for speed, with the previous complete trip across the Atlantic by the American Naval sea planes, is:

Course	Date, May	Distance, Miles	Time, Hours	Speed, M.P.H.
Rockaway-Chatham (forced landing about 100 miles off Chatham)	8	345.45	5.45	59.87
Chatham-Halifax	14	368.42	3.51	97.87
Halifax-Trepassey	15	529.69	6.20	83.60
Trepassey-Horta	16-17	1,381.81	15.18	90.27
Horta-Ponta Delgada	20	172.72	1.45	99.83
Ponta Delgada-Lisbon	27	921.21	9.44	94.50
Lisbon-Mondego River	30	115.10	2.07	56.20
Mondego River-Ferrol	30	253.30	4.37	52.50
Ferrol-Plymouth	31	523.30	6.59	74.60
Complete Flight—				
Rockaway to Plymouth....	8-31	4,519.70	57.16	78.70
Transatlantic Flight—				
Trepassey to Lisbon.......	16-27	2,150.00	26.47	80.30

The Vickers-Vimy twin-engined plane was originally designed as a bomber. It has a wing span of 67 ft., a chord of 8 ft. 9 in., a gap of 12 ft., and an over-all length of 42 ft. 8 in. The chief modification required by the machine to fit it for the transatlantic flight consisted in replacing its bomb-racks and bomb-dropping gear with additional fuel tanks.

When "hopping off" from Newfoundland the Vimy carried 1090 U. S. gallons of gasoline weighing about 6000 lb., as well as 50 gal. of oil.

One of the outstanding features of the Vimy plane is the strength and elasticity of its construction, which are due to the use of seamless steel tubing. This type of construction extends from the nose to well behind the planes.

The Vimy has a sturdy double under carriage, with a two-wheeled chassis placed directly under each engine. Fully loaded the craft weighs a trifle more than 13,000 lb. Even distribution of eight separate tanks and a cleverly arranged feeding system whereby the fuel is consumed at the same rate from all eight not only insured a well-balanced plane but promised an "even keel" had the fliers been forced down on the surface of the ocean.

A gravity tank at the top of the fuselage was arranged to be emptied first so it could serve as a life raft any time after the first two hours of the flight, which period was necessary to exhaust the load of gasoline contained in that tank.

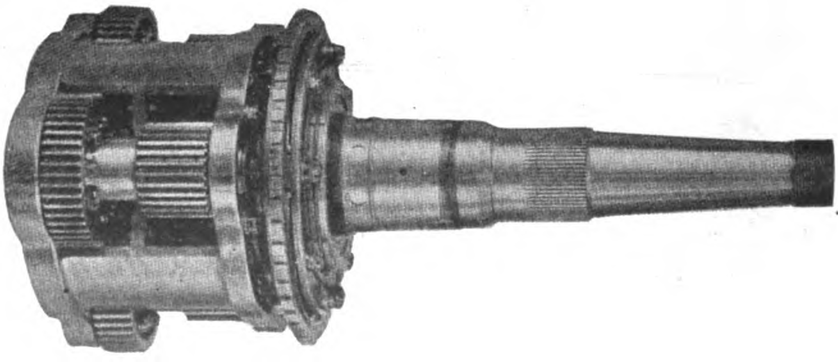
The Vimy's radio apparatus was the standard type used by the Royal Air Force, and was lent to Alcock by the British Air Ministry. It is similar to that carried by Hawker's Sopwith. The transmitting radius of this type of radio is placed at 250 miles. Messages can be received from a much greater distance.

The maximum flying speed of the machine in still air is about 100 m.p.h., but it was intended not to fly "all out," but to keep the engine throttled down to about 90 m.p.h. so as to obviate undue strains and also take advantage of the somewhat higher efficiency at this speed. Under these conditions it was figured that the Vimy had a flying range of 2440 nautical miles.

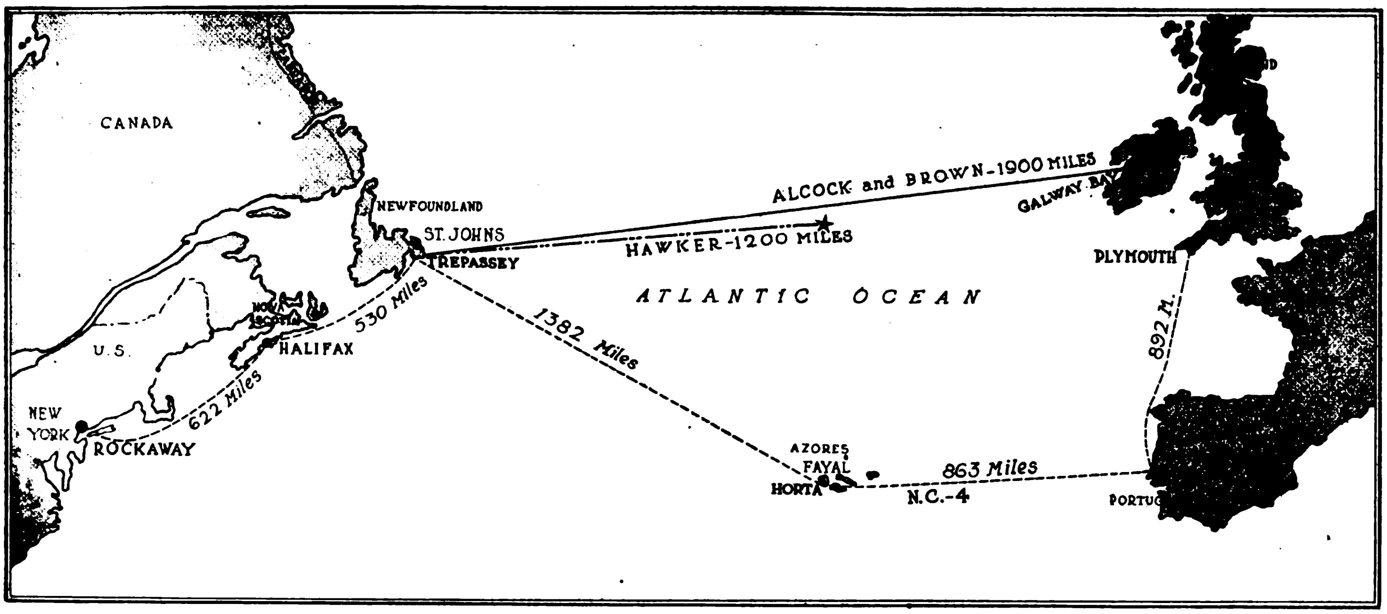
Capt. J. Alcock, D. S. C.

The pilot, Capt. J. Alcock, D.S.C., was born at Manchester, England, in 1892, and received his engineering training at the Empress Motor Works, at Manchester. He became interested in aviation in its early days and adopted it as a profession. He took the Royal Aero Club's flying certificate at Brooklands in 1912 and rapidly rose to the head of his profession, taking part in a large number of the early competition flights, among others the race from London to Manchester and return in 1913, in which he secured second place.

At the outbreak of war he immediately joined the Royal Naval Air Squadron and was assigned to Eastchurch as an instructor. Later he became the chief instructor of the Aerobatic Squadron. He did valuable work on the Turkish front, where he won the D. S. C.,



Epicyclic reduction gear



Routes followed by NC-4, Hawker and Alcock

and held the record for long-distance bombing raids. He was eventually taken prisoner by the Turks owing to an engine failure, and remained as such until the end of the war.

The navigator, Lieut. Arthur Whitten Brown, A.M. I.E.E., M.I.M.E., A.M.F.A.I.E., was born in Glasgow in 1886, and his parents were American citizens. He is an engineer by profession and received his practical training with the British Westinghouse Co., which is now allied with the Vickers Co. He received a thorough knowledge of surveying, and being interested in aviation, naturally devoted study to aerial navigation as applied to surveying. He enlisted in the University and Public Schools Corps in 1914, later receiving a commission in the Manchester Regiment, and served with the Second Battalion in France during 1915. He then transferred to the Royal Flying Corps as an observer and was wounded and taken prisoner of war in the same year. He was later interned in Switzerland, and repatriated in December, 1917, since which time he has been engaged with the Ministry of Munitions on the production of aero engines, and has put in a considerable amount of flying at home stations. He is also a pilot of some experience and has flown many types of machines.

Lieutenant Brown, after duration tests in the transatlantic "Vimy," considered he would have no difficulty in making a successful Atlantic flight. He intended to rely upon a system of navigation similar to that employed in marine navigation.

Preliminary Flights at Brooklands Airdrome

The preliminary flights were successfully carried out at Brooklands Airdrome, Surrey, by these two officers, who expressed themselves completely satisfied with the tests. The Rolls-Royce engines ran perfectly and the airplane left the ground with its load of 4 tons of gasoline and oil after running a very short distance on the ground.

The Rolls-Royce Eagle engine is a 12-cylinder machine with a bore of 4½ and a stroke of 6½ in. It is provided with a reduction gear which at a crankshaft speed of 1800 r.p.m. turns the propeller at 1080 r.p.m. At the normal speed the engine develops 360 hp., and its weight, including the reduction gear, but not including radiator, water, oil or fuel, is 877 lb.

The cylinders are machined steel forgings, fastened to the crankchamber by four bolts and having spherically shaped heads in which the valves are inserted in an inclined position. The valve ports are integral with the cylinder. Pressed steel water jackets are welded to the cylinder in two halves. It should be mentioned that a cylinder head with overhead valves is very generally regarded as the only reasonable form of cylinder-head construction for an engine working at very high mean effective pressure, to give a minimum of trouble from distortion, etc.

Articulated Pin Type Connecting Rods

The pistons are made of aluminum and are of the Zephyr type, which offers advantages from the points of view of strength, cooling, and lubrication. The connecting rods are steel forgings, machined all over, and are of the articulated pin type, that is to say, the main rod carries a pin on the big end, on which is pivoted the articulated rod, serving the other side of the engine. This type of construction makes for efficient lubrication and is an advantage from the point of view of longevity, because it permits of adjustment of the big end for wear should this become necessary.

The crankshaft is of the standard six-cylinder type, machined all over, and bored out on pins and journals to remove inactive material and to carry oil.

An interesting point associated with the crankshaft is that it forms a pipe supplying oil under pressure to all the working joints of the engine mechanism. It is fed with oil under pressure through the main bearings, and this oil is in turn fed to the connecting rod big ends, and thence up the pipes in the connecting rods to the piston pins. The oil from the crankshaft is also introduced into the epicyclic gear and completely lubricates all the parts of the gear. The oil which necessarily leaks from each end of each crankshaft bearing and connecting rod big end is flung from the cranks on to the cylinder walls, lubricating the latter freely. Oil is also fed up the connecting rods to the piston pins and articulated pins. The lubrication system of the engine is therefore what can be called a complete pressure system.

The oil is supplied under pressure from a geared pump at the rear end of the engine, which draws from an external oil tank, which is mounted in such a position that it is cooled by the air draft. An entirely separate portion of the same oil pump extracts the oil which drains into the crankchamber and returns it to the external

BLAZERS OF AIR TRAIL

1500—Jean-Baptiste Dante made flights with a glider of non-vibrant wings in Perugia, Italy.

1742—Marquis De Bacqueville used imitation flapping wings from house on Seine to garden of the Tuileries.

1842—Henson patented monoplane to be driven by steam engine. Wing span 140 ft.

1871—M. A. Penaud built toy model which flew 131 ft. in garden of the Tuileries.

1876—Penaud designed airplane with two propellers.

1896—Prof. S. P. Langley's steam-driven monoplane model flew over Potomac successfully for 3000 ft. at 20 to 25 m.p.h.

1896—Lillienthal flew biplane glider previous to fitting it with 2½-hp. engine; killed in flight.

1900—Wilbur and Orville Wright experimented with gliders with arched surfaces and adjustable rudder in front. Glided 600 ft.

1903—Dec. 17—Wright brothers fitted a biplane glider with 16-hp. engine, made first successful sustained flight in world.

1906—Sept. 13—Santos Dumont made first officially recorded European airplane flight.

1907—Oct. 26—Henry Farman, Englishman, flew Voisin 2500 ft. in 52 5/10 sec. in a straight line.

1908—Aug. 8—Orville Wright surpassed French records for duration, distance and height in flights in France.

1908—Oct. 10—Orville Wright made flight of 1 hr. duration with one passenger.

1909—July 25—Bleriot crossed the English Channel from Calais to Dover in 37 min.

1909—Sept. 29—Wilbur Wright flew around statue of Liberty.

1913—June—Brindejon flew from Paris to Warsaw stopping at Berlin, covering 933 miles in 11 hr. including stops.

1914—July—Successful trials of the "America," ordered by Rodman Wanamaker for transatlantic flight.

1914-1918—War period.

1919—Harry G. Hawker and Commander Mackenzie Grieve flew 1289 miles from St. John's, N. F., in an effort to make a non-stop flight to Ireland, when their Sopwith airplane was wrecked and the men rescued by a tramp steamer.

1919—Lieut. Commander Read and Navy crew, in the U. S. Navy airplane NC-4, made the flight from Rockaway Beach, N. Y., to Plymouth, England, 4519 land miles in 9 stages between May 8 and 31. The longest flight was from Trepassey, N. F., to Horta, Azores Islands, on May 16-17. The average speed for this entire flight was 78.70 m.p.h.

tank, after straining it to free it from dirt. In this way no oil is allowed to accumulate in the base chamber, where it would become heated up by conduction from the engine.

The crank chamber is made of aluminum castings and consists of upper and lower halves. The upper half is designed for great rigidity and its stiffness is further increased by the lower half, which is secured to it by a large number of bolts.

The drives for the camshaft, magneto and other auxiliary devices are all at the rear end of the engine. An air pump is normally mounted at the rear end and supplies air under pressure to the gasoline tank, on planes where pressure feed is used. Provision is also made for a speed indicator and for mounting a hand or electric starting gear. The water and oil pumps are also mounted on the accessories drive unit at the rear end of the engine. There is one camshaft extending across the tops of each row of cylinders, and this shaft operates both the inlet and exhaust valves through rockers. This valve operating mechanism is entirely enclosed and is fed with oil from a main lubricating system.

Ignition is by six-cylinder Watford magnetos, of which four are carried on each engine, so as to provide two entirely independent systems of ignition for each cylinder. Four carbureters are fitted, each supplying three cylinders through a branched inlet pipe. The carbureters are a special development of the Claudel-Hobson type, with adjusting means designed to take care of climatic and altitude changes.

Water is circulated by a single centrifugal pump, mounted at the rear end of the engine and delivering to the jackets at their lower ends through two pipes. Hot water is taken from the topmost point of the cylinders and conducted to the radiator through two manifolds.

During 1915 the Rolls-Royce company developed an epicyclic reduction gear which has since then been fitted to all of their engines. The question of the desirability of a reduction gear on airplane engines has been much discussed. Recent experiments have fully convinced the Rolls-Royce company that the use of a reduction gear largely increases the transmission efficiency of an engine and propeller; that is to say, much greater percentage of the available horsepower of the engine is utilized in propelling the plane. This leads to improved performance as regards both speed and rate of climb, and to an increased radius of action.

While the gain effected by reducing the propeller speed is not large on high speed airplanes in which the ratio of horsepower to total weight is comparatively high, it becomes very important in large machines which have less horsepower in proportion to weight.

The gain to be effected by the use of a reduction gear depends also upon the amount of energy lost through friction in the gearing. It is claimed by the Rolls-Royce company that with the reduction gear developed by it the frictional loss is very small and that there is, in consequence, almost invariably an appreciable increase in transmissive efficiency over an ungeared engine, even in machines of the highest flying speeds. The epicyclic type of gear adopted by the company is claimed to avoid the extremely heavy side loads on the crankshaft and crank chamber experienced with the use of ordinary spur gear sets.

This design of epicyclic gear has now been in use for four years as an aero engine reduction gear and has recently also been adopted for the Liberty engine. In the case of the Rolls-Royce Eagle engine the reduction gear adds less than 90 lb. to the weight of the engine, or less than ¼ lb. per horsepower.

Fuel and Rating Problems Discussed by Mechanical Engineers

Digest of Papers Read at Spring Meeting of American Society on Pertinent Automotive Topics

DETROIT, June 16—Papers of direct interest to automotive engineers are included in the program of the American Society of Mechanical Engineers Spring meeting, which opened here to-day. These papers deal with fuel, carburetion, airplane wings, airplane generators and engine design.

Members of the Society of Automotive Engineers were invited as guests.

The papers of principal interest to the automotive industry are: "A Suggested Formula for Rating Kerosene Engines," by D. L. Arnold, chief engineer of laboratories, International Harvester Corp.; "The Production of Liberty Motor Parts at the Ford Plant," by W. F. Verner; "Air Fans for Driving Electric Generators on Airplanes," by Captain G. Francis Gray, Lieutenant John W. Reed and P. N. Elderkin; "Standards of Carbureter Performance," by O. C. Berry. Following is a digest of these papers:

A Suggested Formula for Rating Kerosene Engines

By D. L. Arnold

A piston displacement of 13,000 cu. in. per min. is suggested as the standard for brake horsepower rating for kerosene engines by D. L. Arnold. At the present time there is no standard rating in use and as a result engines of the same bore, stroke and speed, or, in other words, the same piston displacement per minute, are given different ratings by almost all manufacturers. The conditions are such that many bills are now being introduced in the state legislatures, specifying how an engine shall be rated. If all these bills were to pass, each state might require a different rating, compelling manufacturers to furnish different name plates in each state. It is therefore suggested that the members of the Society of Automotive Engineers, co-operating with the mechanical engineers' organization, should adopt a standard rating for this type of powerplant.

The deriviation of the formulæ now in use is familiar to engineers, and it is, of course, well known that they are based on widely varying assumptions. In fact, these different formulæ give widely differing ratings for engines of the same piston displacement per minute. Reducing these formulæ to the common basis of piston displacement per minute per horsepower, the figure varies all the way from 14,000 down to 9000.

The formula suggested by Mr. Arnold is:

$$\text{Rated horsepower} = \frac{D^2LNn}{16{,}550}$$

This formula assumes that the engine is capable of developing one brake horsepower for every 13,000 cu. in. piston displacement per minute and still have a fair overload capacity, since the maximum possible output should be one brake horsepower per 11,000 cu. in. piston displacement per minute.

With a standard rating established there should also be a standard type of name plate, which includes both the horsepower and the speed at which this horsepower is developed. In other words, the plate should read: 16 hp. at 500 r.p.m., not merely 16 hp., or 16 hp. speed 1000 r.p.m., giving both rating and maximum speed of engine. In this way no doubt will be left as to what is meant.

Tractive Rating

In considering the internal combustion engine rating for tractors, the majority of manufacturers have followed the rule that draw bar horsepower should be considered as 50 per cent of the rating of the power unit. This is very conservative, but is very good considering the wide range of conditions. However, the data on the name plate should include the following:

16 Brake hp. at 500 r.p.m.
8 Drawbar hp. at 500 r.p.m. of the engine
Drawbar pull:
....lb., reverse speed at......miles per hr.
....lb., first speed at......miles per hr.
....lb., second speed at......miles per hr.
....lb., third speed at......miles per hr.
Drawbar pull and horsepower are on the average good footing.

Standards of Carbureter Performance

By O. C. Berry

Carbureter performance reports should be based more upon the actual accomplishments of the carbureter than on the engine performance alone. With this in mind it is possible to set up standards of carbureter performance which give a better knowledge of the carbureter than is obtained from the average run for this purpose.

The characteristics of the carbureter which should be known in giving expression to its performance may be

expressed as indicated in the following subdivisions:

a—The range of flow-rate capacities, or, in other words, the maximum and minimum number of cubic feet of air per minute that can be handled.

b—The richness of the mixture as affected by the rate of flow of the air through the carbureter, sudden changes in the rate of flow, and the degree of throttle opening.

c—The pressure drop through the carbureter at different rates of flow.

d—The thoroughness and uniformity with which the fuel and air are mixed.

e—The uniformity of the richness of the mixture furnished to the different cylinders.

f—The temperature and dryness of the mixture entering the cylinders.

g—The temperature of the combustion-chamber walls, particularly the piston head.

Considering these matters separately, in brief, it is found that the flow rate range is important in passenger cars, where great flexibility is desired. It is suggested that the flow-rate capacity of all carbureters should be stated definitely in cubic feet per minute, and this information should always accompany the statement of the size of the carbureter flange.

The air required by an engine may be computed by assuming that the air required per brake horsepower per minute will remain nearly constant, irrespective of the amount of gasoline used or the speed of the engine, assuming that the carbureter is adjusted so that the engine carries its full torque with wide open throttle. For the usual passenger car type of engine, with a compression ratio of about 4 to 1, this constant is about 2.1 cu. ft. per min. at full power. The air used when idling at any speed is almost exactly one-quarter of that used under full load at the same speed.

Richness of the Mixture

The richness of the mixture is expressed in pounds of gasoline per pound of dry air. With a dry mixture at half load and 1000 r.p.m., regular firing may be obtained with mixtures between 0.0575 and 0.12. The best efficiency under the same conditions accompanies a mixture of about 0.067, and the best power, 0.08.

Pressure Drop

It is impossible to obtain 100 per cent volumetric efficiency on the ordinary type engine. The drop in pressure should be measured at the throttle on the carbureter side. If designing engineers would insist on data showing the pressure drop through the carbureter necessary to give the desired rates of flow, carbureter manufacturers would soon publish guaranteed-vacuum-air-flow curves, thus making possible intelligent carbureter selection for a given service.

Thoroughness of Mixing

The best direct test of the quality of the mixing is to have the carbureter discharge into a glass-walled section between the carbureter and the manifold. The best dry mixtures appear as colorless and dry as pure air, while wet mixtures resemble a fog, and in most cases streams of liquid fuel are seen following a spiral path along the wall of the manifold.

Uniformity of Mixture

It is impossible to measure distribution accurately, but the results obtained by any given manifolds may be tested by removing the exhaust manifold and observing the flames from the exhaust opening. This can be done to best advantage in comparative darkness. By adjusting the carbureter for continuously leaner mixtures, the impoverished cylinders will be caused to miss, and then by gradually enriching the mixture the yellowish flame will indicate the cylinder with the rich mixture. Uniformity is, of course, the desired goal.

Temperature and Dryness

Often the temperature and vapor pressure are high, to maintain a dry mixture once it is established, but the time element is lacking and the mixtures are consequently quite wet. It is desirable to make the fullest use of the heat in the combustion chamber walls, piston head and compression, and to introduce the mixture into the cylinder as wet as possible, still being sure to have it dry before it is burned.

Temperature of the Combustion Chamber

When the mixture is dry as it enters the cylinders, or the fuel so well atomized that it remains suspended in the air and is entirely vaporized during the compression stroke, the heat absorbed from the combustion-chamber walls does not improve the carburetion, but decreases the power capacity of the engine without improving either its efficiency or the way it runs. These conditions, however, are rare. A considerable portion of the fuel usually enters the cylinders as a liquid which collects on the piston head. Under these conditions the temperature of the combustion-chamber walls, especially the piston head, becomes very important. The reasons for this may be explained as follows:

The piston head is usually at a temperature two or three hundred degrees above the cylinder walls. If the temperature of the walls is 200 deg. Fahr., the piston head will therefore be between 400 and 500 deg. Fahr. If the wall temperature is lowered to 100 deg. Fahr., the piston head temperature will drop to between 300 and 400 deg. Fahr. These temperatures apply to passenger car engines running under ordinary conditions. Several tests have been run at Purdue to determine the rate at which Red Crown power gasoline will evaporate from the surface of a hot iron plate. The maximum rate of evaporation seems to occur when the metal is at about 450 deg. Fahr. If the evaporation in ounces of fuel per square inch of metal per second be taken as 100 per cent at 450 deg. Fahr., then the evaporation at 400 deg. Fahr. is about 40 per cent, at 350 deg. Fahr. about 9 per cent, and at 300 deg. Fahr. about 1.8 per cent. It is therefore important that the jacket-water temperature be kept high when the piston head is depended upon to flash any considerable amount of liquid fuel into a gas. This conclusion is borne out by the engine tests. With the air entering the carbureter at 70 deg. Fahr. and the jacket water maintained at 110 deg., the engine would not fire regularly with any richness of mixture. When the jacket-water temperature was raised to 200 deg. Fahr., the engine would fire some of the richer mixtures regularly, and by raising the air temperature to 80 deg. Fahr. the engine developed full power and efficiency and would fire a wide range of mixtures.

The Production of Liberty Motor Parts at the Ford Plant

By W. F. Verner

This paper deals with the production of Liberty engine cylinders and connecting-rod crankshaft bearings as carried on at the Ford Motor Co.'s plant at Detroit. The contract made with the United States Government called

for 5000 engines, and these were to be produced at the rate of fifty per day of eight hours. To do this, important developments in the methods of manufacture were brought about by the production department.

One of these was the method of producing cylinders from tubing. Six operations were necessary, and the author describes them in detail. The methods employed to produce connecting-rod crankshaft bearings likewise resulted in a great saving of time. Twenty-one operations were found necessary for this work, and a complete description of each is given. The paper concludes with an explanation of the method of installing bearings in the upper and lower halves of the Liberty engine crankcase.

Air Fans for Driving Electric Generators on Airplanes

By Capt. G. Francis Gray, U.S.A., Lt. John W. Reed, U.S.A., and P. N. Elderkin

In this paper the authors briefly describe the method employed by the Radio Development Section of the War Department in testing air fans used for driving the electric generators usually installed on airplanes for radio communication. They also discuss at some length the various types of air fans and present numerous photographs and curves clearly illustrating the construction of the fans and their operating characteristics.

The difficulty of the problem lay in designing a fan which would turn at constant speed in the air streams of widely varying speed set up by the airplane in flight. The various types of fans tested were: Fixed blade fans of special blade shape; fixed blade fans with wind brakes centrifugally regulated; fixed blade fans using a friction clutch or a friction brake centrifugally regulated and pivoted-blade fans with pitch centrifugally regulated.

Tractor Brake and Drawbar Horsepower Rating

By R. O. Hendrickson

I ATTENDED a meeting of the Tractor Standards Division of the Society of Automotive Engineers, and, while we did not come to any conclusion in reference to satisfactory ratings, it is expected that same will be voted upon June 23, and I might tell you that the tentative suggestions in regard to this which were put forth by those present were not entirely satisfactory to me. The ratings recommended were briefly as follows:

$$\frac{0.7854\,D^2LRN}{13{,}000} = \text{Brake horsepower}$$

$$\frac{0.7854\,D^2LRN}{26{,}000} = \text{Drawbar horsepower}$$

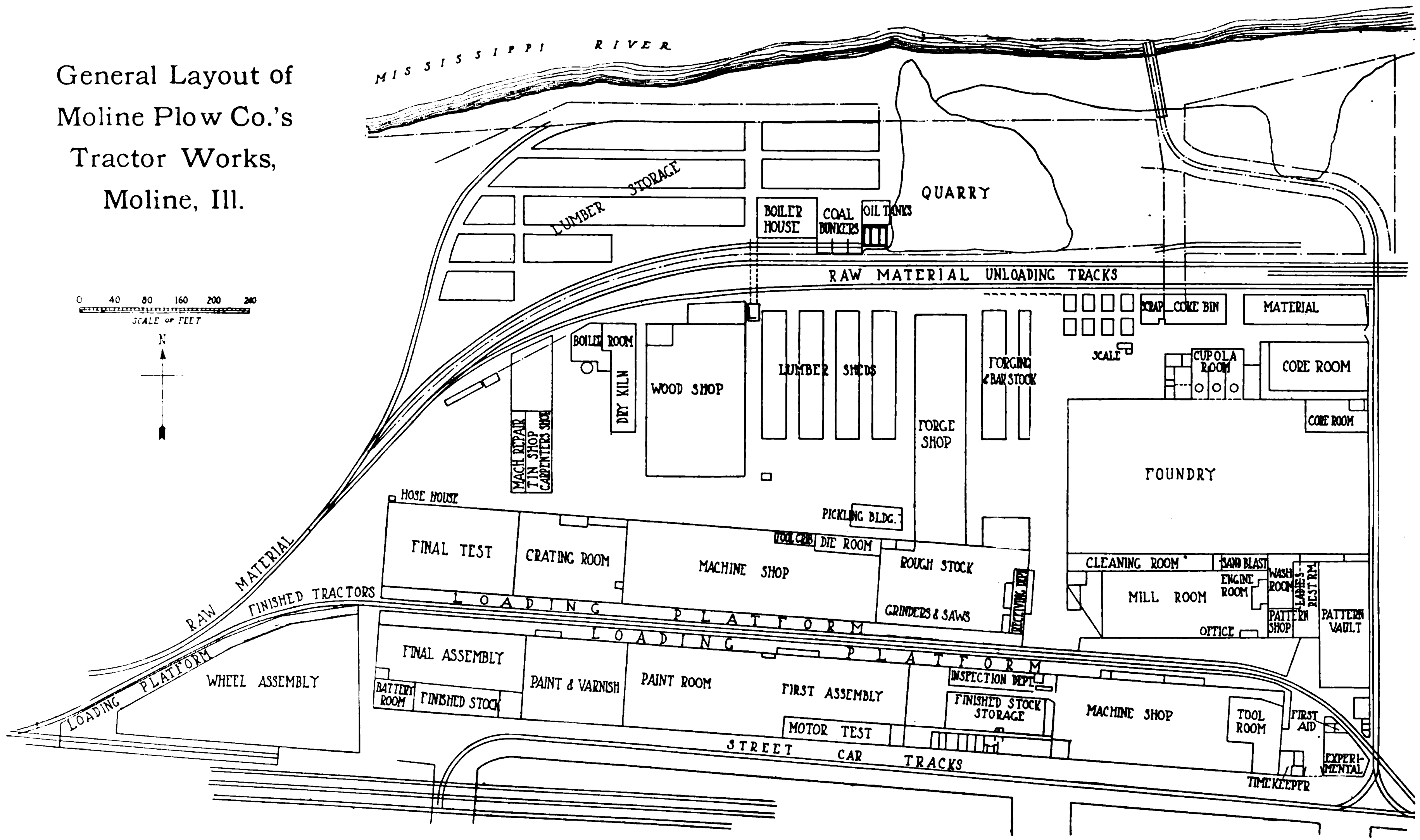
You will note that 13,000 cubic inches displacement per minute per horsepower is the constant used in figuring the brake horsepower, while the accepted A. L. A. M. formula for rating automobile engines is based on approximately 11,733 cubic inches displacement per minute per horsepower. The larger constant was thought desirable for rating tractor engines on account of the heavier work they are called upon to do and also on account of the fact that kerosene, which is largely used in tractor work, is supposed to develop less brake horsepower in a motor of a given size than is the case in the automobile where gasoline is used. Our experience, however, with kerosene is that the maximum power with a properly designed motor is almost exactly the same as when using gasoline. You will note that in calculating the drawbar horsepower they have considered merely doubling the constant, which would result in a drawbar power equal to 50 per cent of the brake horsepower.

My objection to the brake horsepower formula, as recommended, is that it does not fix a piston speed. It seems to me that, since within quite a wide range of speed the horsepower of a motor varies in almost direct proportion to the speed, and since the speed at which a motor is driven largely determines its life or endurance, a piston speed should be assumed in the formula, inasmuch as the wide variation in stroke of different motors and the fact that the arbitrary r.p.m. quoted by the manufacturer is used in the formula. In other words, the r.p.m. used in the formula should be based on a given number of piston feet traveled per minute. This would then give the formula a value which it certainly has not when the r.p.m. factor used is established according to the ideas of the engine maker. For a motor to endure and to be efficient it should not run at an excessive piston speed, nor at one too low. As the formula stands the engine maker is at liberty to state any r.p.m. he desires, which certainly would not be the case if the factor of r.p.m. were based upon 850 piston feet per minute, which we have found to be the most logical and satisfactory with our various sizes of motors for tractor work.

To make a long story short, we could use the formula outlined above and rate our motor either 25 brake horsepower or 50 brake horsepower, all depending upon what figure we decided to use for the r.p.m. If the piston speed were fixed at 800, 850 or 900 r.p.m. and the r.p.m. determined from this, then all makers of tractor engines would be rating their engines on the same basis, whereas as the formula stands it means nothing, at least that is the way it seems to me.

In regard to drawbar rating, this, it would seem to me, is almost impossible to establish, for several reasons as follows: First, the weight of the tractor in relation to the wheel diameter and width has a great deal to do with the rolling resistance of the tractor; second, the weight distribution has a great deal to do with the pulling capacity of the tractor as a whole; third, the weight of the tractor in relation to its motor horsepower has a great deal to do with the power available at the drawbar; fourth, the fact that the rolling resistance of a tractor requires all the way from 5 per cent to almost 100 per cent of the power of the tractor, due to soil conditions, is the worst of all, and it seems to me that to start off and rate a tractor motor with a formula where the piston travel is arbitrary according to the ideas of a man who rates the particular motor, and then to take 50 per cent of that as the drawbar horsepower, and in view of all the variable factors as outlined immediately above one has information of very little value when the calculation is finished. (*Continued on page* 1418)

General Layout of Moline Plow Co.'s Tractor Works, Moline, Ill.



While a certain amount of work is being done in this plant for the implement section of the Plow Works, most of it is devoted to tractor production. It is hoped to increase the daily production, which was about 55 tractors early this year, to about 150 by July 1

Production Features of the Moline Plow Tractor Works*

Two-Wheeled Tractors Produced According to Systematized Plan Similar to That in Automobile Plants—Shops Are Equipped with Modern and Exclusive Machinery, and Capacity Recently Was Tripled

By P. M. Heldt

FARM tractor plants employing production methods comparable with those in vogue in the automobile industry are very few in number. The reason is that the tractor industry is still very young, and there has been insufficient time to standardize and systematize. Tractor design, moreover, is not yet settled to any extent, and there is naturally considerable risk involved in investing heavily in tools and equipment that may be rendered obsolete by a change in design. A few manufacturers in the tractor field, however, have had the courage to go ahead and install the necessary equipment for the production of tractors on a large scale by the most up-to-date methods. One of these is the Moline Plow Co., whose tractor branch is at Rock Island, Ill.

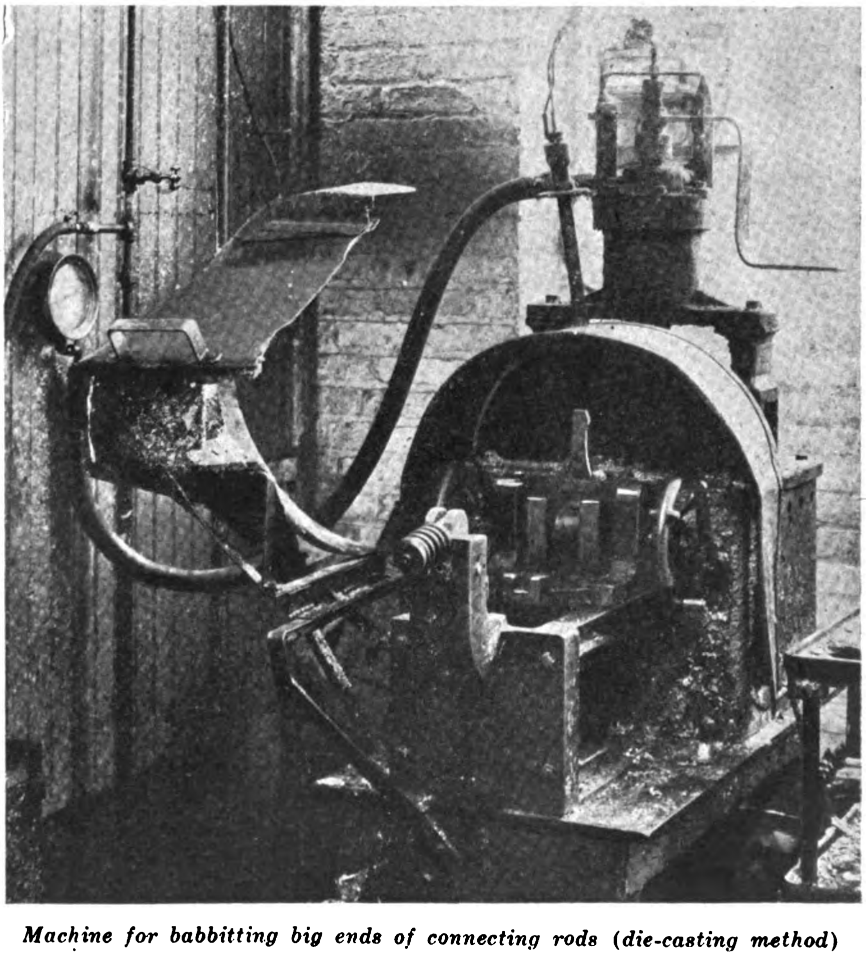
When the writer visited the Moline plant last March, the daily production was about 55 tractors. It was then planned to increase this to 150 tractors a day by July 1, without any material enlargement of the plant. This involved considerable rearrangement of departments and the installation of much new machinery.

The plant comprises a large and modernly equipped foundry, measuring 280 x 360 ft. The location of this with respect to the other departments of the works may be seen from the plan herewith. All raw material is received over a railway siding alongside of which are located a material storage shed, coke bins, scrap shed, etc. There are two rooms, one in one corner of the foundry building, the other one in a separate building. All of the simpler and lighter core work is done by girls, and this department is separated off from the main core room. There are benches extending in front of the core ovens, on which the core makers place the finished cores, whence they are transferred to the ovens. West of the main core-making room is a core storage room, and an overhead monorail extends into this room, so that heavy cores can be handled by power. A new spur from the Chicago, Milwaukee & St. Paul Railroad has just been laid down at the rear of the plant.

There are three cupolas in the foundry, and a total of 39 tons can be melted in each per day. The total number of hands in the foundry at the time of the writer's visit was 300, of which 90 were employed in the core rooms. The foundry is equipped with all the latest machinery devised for this class of work, including an electric sand cutter, moulding machines, strippers, etc. A good many castings are made in this foundry for the implement branch of the Moline Plow Co. The cast bull gears of the Moline tractor, which are one of the most important castings on the machine, are made by moulding machines developed by the concern's production experts. This is a hand ram roll over stripper for the drag. The teeth are made of dry sand and set into the mould, while for the cope an ordinary plate is used, which is lifted off with an air hoist.

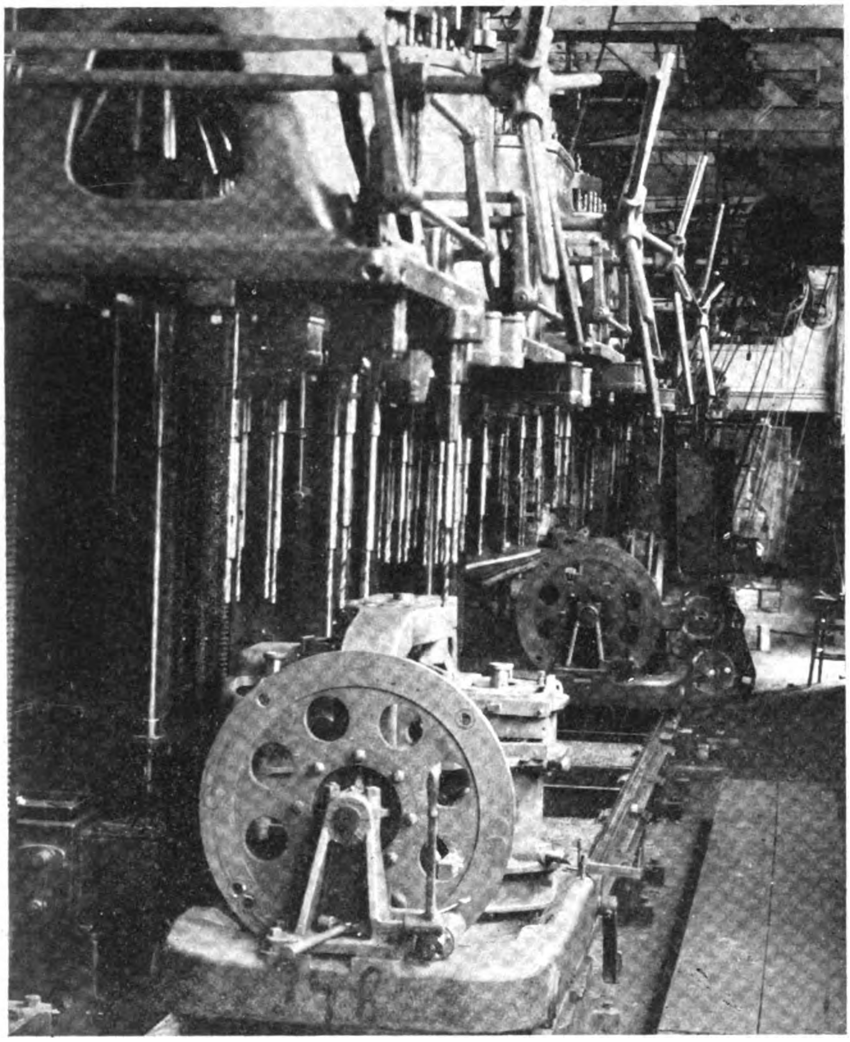
Two of the three cupolas are lined down to 68 in. in diameter, while the third is lined down to 58 in. Use is made of two No. 6½ and one No. 6 Root blowers.

A system for wetting the sand in the foundry at night has been introduced. The whole foundry is divided into floors, or sections, and over each floor there is a sign bearing the number of cubic feet of water required for

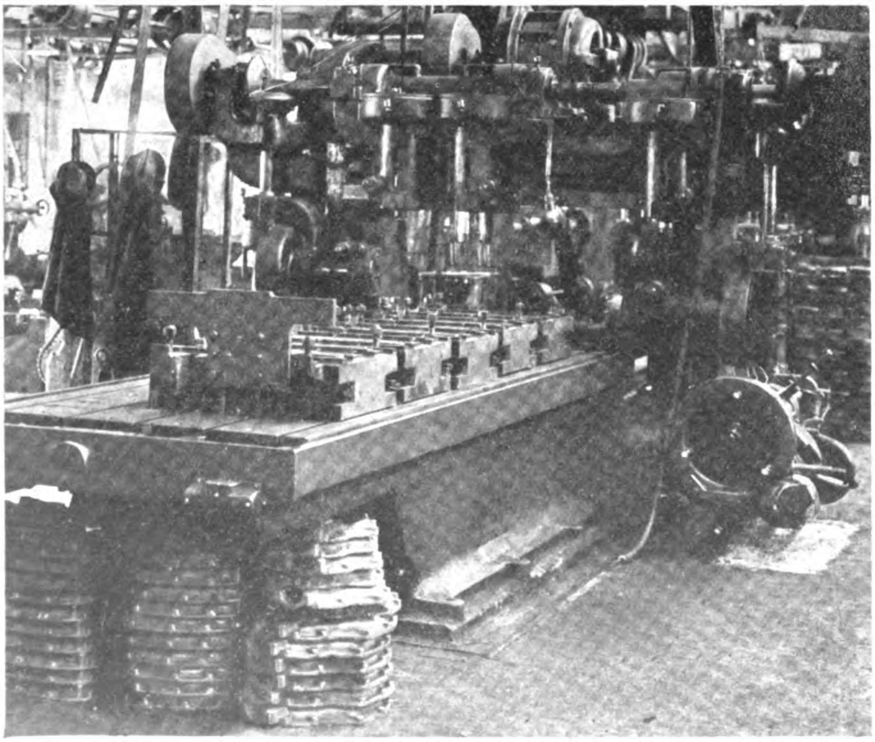


Machine for babbitting big ends of connecting rods (die-casting method)

*A continuation of this article next week will be devoted to the assembly and testing plant.



Railroad gang drill with tumbling jig in which transmission housing is handled while 100 holes are drilled in it



Ingersoll continuous milling machine in which six surfaces on the transmission housing are milled in one operation

it. One man waters the whole foundry. He carries a water meter at the end of a 50-ft. hose, on a harness, in front of him. Faucets are distributed throughout the foundry, so that this 50-ft. length of hose will enable him to reach any part. The water thus added to the sand exactly makes up for the evaporation during the day, not only for the whole foundry, but for each separate floor as well.

A Pangborne sand-blasting equipment is installed, and some of the castings are carefully cleaned, particularly the bull gears and transmission cases. The cases are first cleaned of all core sand, then tumbled, then chipped, then sand-blasted and ground, and finally they are inspected. A monorail system extends over the whole foundry, and the melted iron is handled in ladles having a capacity of 800 lb. each. Iron is melted at the rate of 15½ to 16 tons per hour. Castings are delivered to the mill room in two-wheeled handcarts.

The plant also has a small brass foundry, and at the time of the writer's visit two men were employed there. There are very few brass castings in the tractor, and most of the work done in this foundry is on patterns and aluminum plates. The foundry is of saw-tooth roof construction, and therefore has very good daylight.

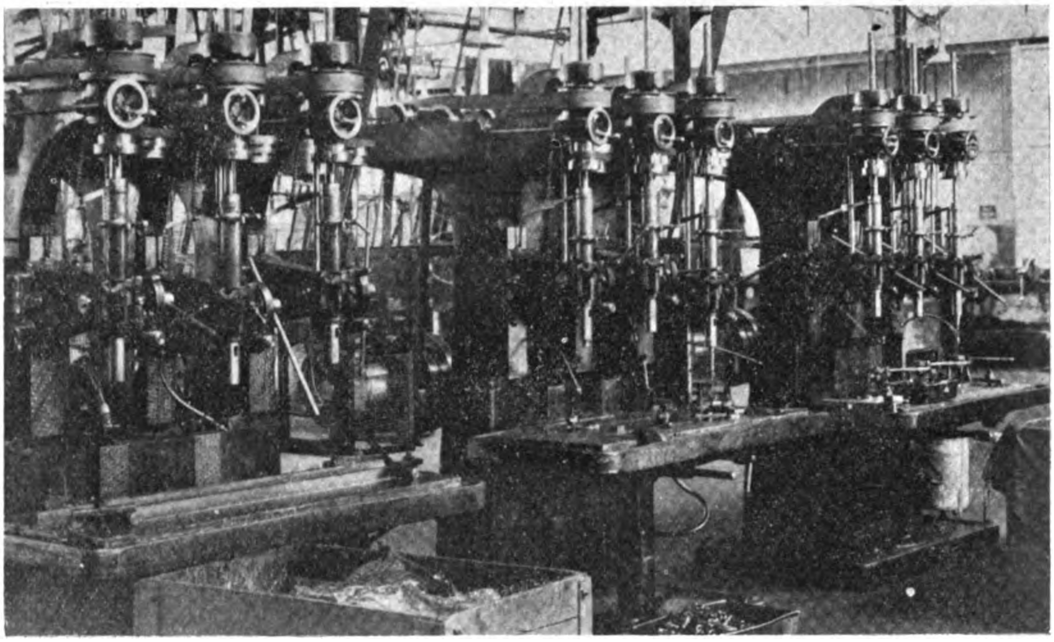
To the south of the foundry is the first cleaning room, where the cores are knocked out of the transmission cases. Next comes the mill room, where the castings are chipped and ground. At the eastern end of the mill room is the pattern shop, and over this is a girls' rest room. To the east of this is a pattern vault.

After the castings come out of the mill room they are stacked on a platform, alongside of a spur of the Chicago, Rock Island & Pacific Railroad.

There are two machine shops in the plant, referred to as shop A and shop B respectively. The most important part, in many respects, of the Moline tractor —the one on which the greatest number of machine operations are performed, and which forms the nucleus around which the whole tractor is assembled—is the transmission housing. The castings from which these transmission cases are made are received in machine shop B, and are faced on a Diamond surface grinder for the first operation. All of the machine tools in which this part is handled are naturally of the heavy type, and it is worth pointing out that there is a Richard-Wilcox crane over these heavy tools, so that the cases can be transferred from one tool to another by power. In addition, there are air hoists on swinging arms in this department.

After the first grinding operation the cases go on to an Ingersoll milling machine, which takes 9 cuts at one time. The cases are bored at the same time.

Some of the machine operations on the cases are as follows: First, the open end which bolts to the engine crank case is ground. Next, dowel holes are bored. In the next operation six plane surfaces are milled, and in the following operation four more surfaces are milled. Next, three holes are bored in Beaman & Smith horizontal boring machines. This operation comprises both rough and finished boring. Next follow two boring and facing operations, and after this the case goes to the drill presses.



Avery 3-spindle power drills for drilling and reaming (central spindle for reaming)

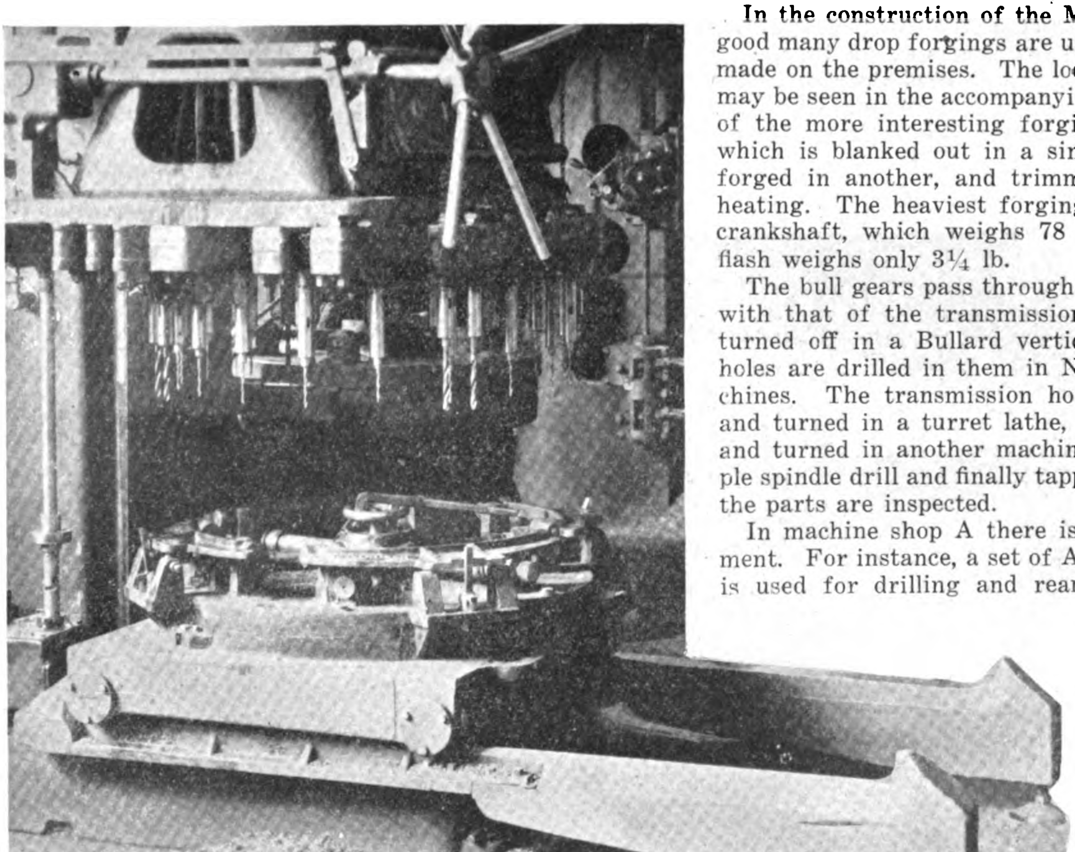
There is a total of 100 holes to be drilled in this part, ranging in size from 5/16 to 1 7/16 in. A set of four No. 30 Natco multi-spindle drills and two radial drills are used for this purpose, and the casing is handled in a tumbling jig, mounted on a truck on a track in front of the drills. It takes just 6 minutes to drill these 100 holes. All of the tapping required on the case is also done by power machines, the Hammond radial tapping machine being used. There is a gang of 6 of these machines, and the work done by them includes tapping 74 holes, reaming of one, and spot facing of two.

The drilling and tapping completes the machine operations on the cases, and they are then washed in soda solution, in which they are dipped. After drying they are painted inside by means of the spraying process. The cases are moved about the floor on electric trucks. There is an inspection of the cases between each pair of operations, and even between the drilling and tapping. After the cases have been cleaned and painted on the inside, they go to the assembling department.

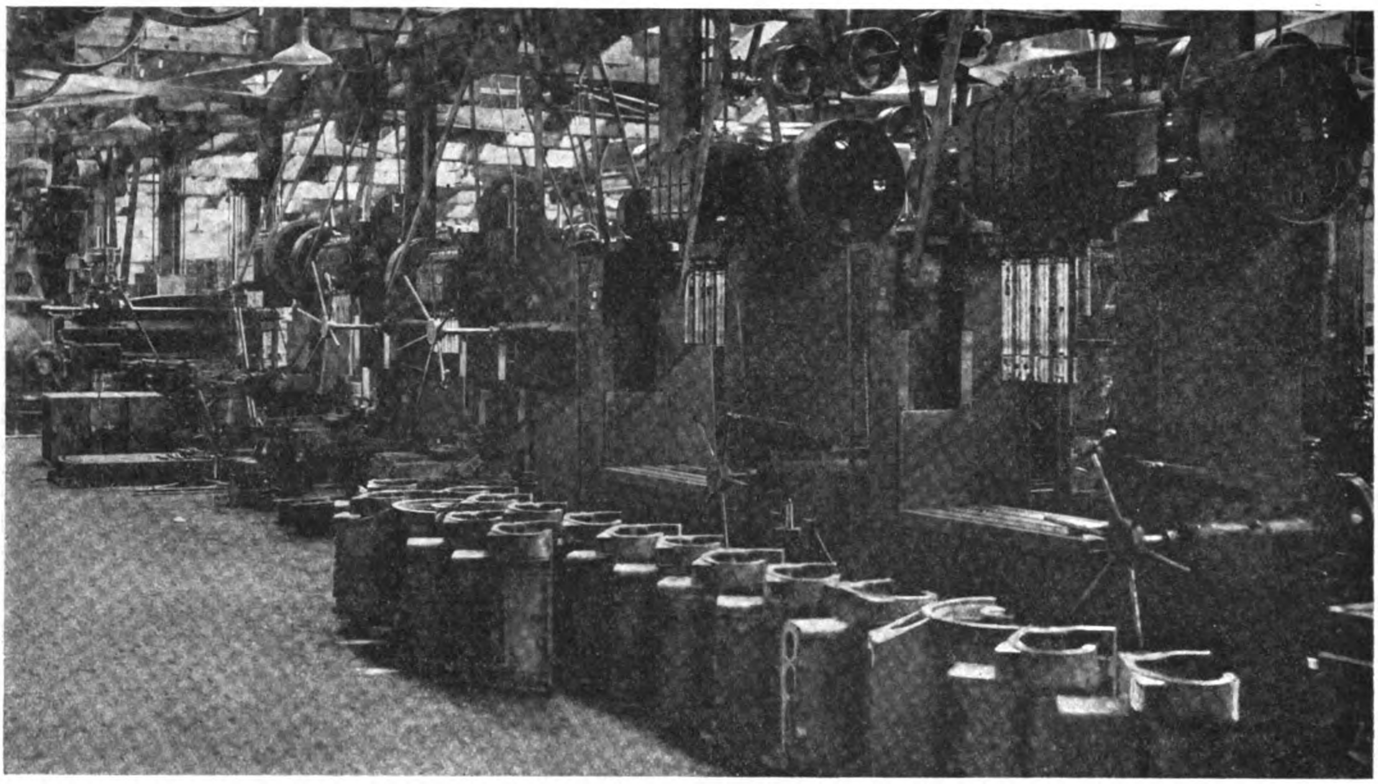
In the construction of the Moline Universal tractor, a good many drop forgings are used, and these forgings are made on the premises. The location of the forging plant may be seen in the accompanying plan of the works. One of the more interesting forgings is the clutch shifter, which is blanked out in a single piece in one hammer, forged in another, and trimmed in a third, all in one heating. The heaviest forging made in the shop is the crankshaft, which weighs 78 lb. in the rough, but the flash weighs only 3¼ lb.

The bull gears pass through the shop on a line parallel with that of the transmission cases. These gears are turned off in a Bullard vertical boring mill. Next, 26 holes are drilled in them in Natco multiple drilling machines. The transmission housing end is bored, faced and turned in a turret lathe, then bored, faced, reamed and turned in another machine, then drilled in a multiple spindle drill and finally tapped. At the end of the line the parts are inspected.

In machine shop A there is a great variety of equipment. For instance, a set of Avery 3-spindle power drills is used for drilling and reaming forgings, the center spindle being used for reaming. Next to these drills there are several Lapointe broaching machines, used for broaching key holes. One operator attends two of these broaching machines, while in the



Multiple spindle drill and jig used for drilling bull gears



Four-spindle cylinder boring machines

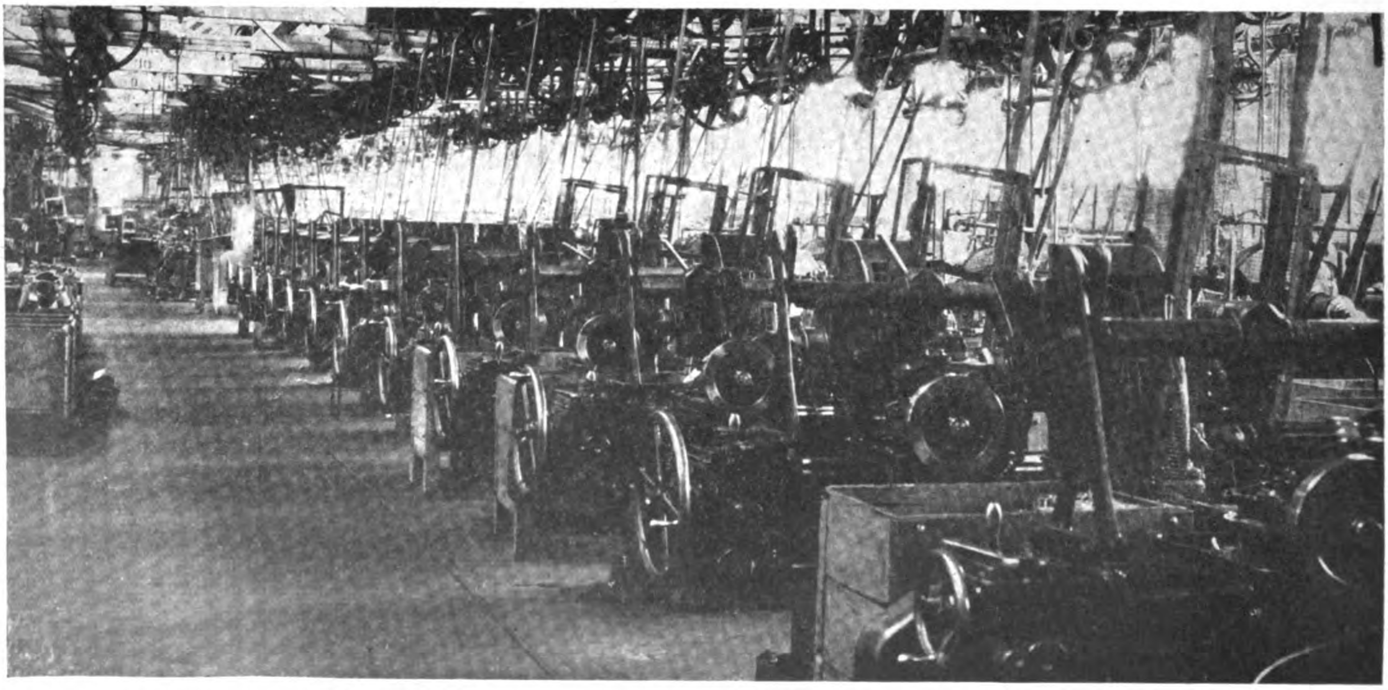
case of the automatics, one man looks after three machines.

A somewhat unusual tool for a tractor factory is a Pratt & Whitney rifle drill, which is used for drilling holes 7½ in. deep in the clutch shaft. The drill is a two-spindle machine, and drills two shafts at one time.

A uniform type of parts box is used throughout the plant, these boxes being made of 1-in. boards, which are bolted to angle-iron corner pieces, the angle iron being extended to form legs. Elevating trucks are used for carting these boxes around.

At the end of machine shop A there is a metal washing machine, in which the greasy parts, as they come from the machine tools, are cleaned in Oakite. A continuous chain conveyor operated by an electric motor draws the material through the Oakite vat. As the cleaning fluid is at a high temperature, the parts dry quickly after being removed from it.

(*To be concluded*)



Barber-Coleman gear hobbers. Note the parts boxes alongside these machines

Parcel Post Development Must Keep Up with Export Trade

EVERY person interested in export trade, whether for a large or small article of merchandise, has realized the value of an adequate parcel post service. The following article sets forth the present status of that service and indicates some of the immediate needs. It also advises that if the service does not meet with your requirements, you take up at once with the Second Assistant Postmaster General such changes as will help your business.—EDITOR.

By Allen Sinsheimer

THE rapid growth of the American export trade has served to call attention to the great advantage of an adequate parcel post service as a part of the foreign trade equipment. The quick development of the trade with the Latin-American and other countries that formerly did not buy freely from this country developed defects of the service more rapidly than they could be overcome while war conditions obtained.

Recently considerable progress has been made in overcoming these disadvantages, but trade conferences have shown that there remains a wide field for this work. In the automotive trade, the parcel post is invaluable for the shipment of small parts.

During the war many countries suspended parcel post service, but most of these have resumed, and other nations, with which the United States Post Office Department has recently negotiated, have completed parcel post conventions. A list is published herewith of the countries and the exchange post offices which dispatch and receive parcel post mails, including the countries which have resumed parcel post service interrupted by the war, those countries which have recently agreed to receive parcel post from the United States and those which have increased the weights of the parcels.

Rates Chief Obstacle to Parcel Post

The chief obstacle to extensive use of parcel post has been found in the rates and in regulations of certain nations. Maynard D. Howell, export manager of Montgomery Ward & Company, discussing this subject at the recent Foreign Trade Convention, pointed out the great advantage enjoyed by British shippers, as compared with American exporters, because of the lower rates from London as compared with those from, for example, Chicago.

Instances cited show that a 3-lb. package parcel post from London to Johannesburg costs 84 cents, a 7-lb. package $1.20 and an 11-lb. package $1.80 as compared with mail from Chicago at $1.56 for 3 lb., $3.48 for 7 lb. and $5.40 for 11 lb. Similarly, the rates to Spain, India and other countries are greatly in favor of the British shipper.

Express rates to the same points are frequently 500 per cent higher. This gives the British automotive manufacturer an important advantage. He can ship a package of spark plugs, for instance, weighing 11 lb., to Singapore for 72 cents, as compared with $5.40 from Chicago.

Furthermore, there are many of the British colonies with which the United States has no parcel post arrangement, and the only method of shipment is from the United States to England. Consequently, the automobile dealer in Nigeria, for example, can ship to this country through British parcel post, but the American manufacturer cannot ship to him except by employing an agent in London and paying postage from America to London and from London to Nigeria.

Another important obstacle is in the restrictions in certain countries, especially in Latin America, and the heavy customs duties and the complicated customs regulations in Argentina, Brazil, Cuba and other countries. Shipments to Argentina encounter a delivery fee of 30 cents, internal revenue taxes, customs duties and charges for the intervention of the customs broker, which frequently exceed the value of the contents of the parcel. Further, there are levies for storage, statistics and for return of undeliverable parcels to the point of origin.

Argentine Regulations

The parcel post administrator of Argentina insists on collecting postal charges for the return of undeliverable parcels, and, as there is no money order convention in force between the United States and Argentina, the method of payment is through postage stamps only and is cumbersome.

Venezuela charges a delivery fee equal to 30 cents for each parcel, regardless of weight, and the restriction that 44 lb. of merchandise of one sort is the most that may be imported by parcel post into Venezuela by one addressee, in the same mail, except on condition of the increase of the customs duties and other charges, causes unnecessary delays.

The chief difficulties in the Brazilian parcel post arise from the fact that the service is strictly limited to a few large cities, including Rio de Janeiro, Sao Paulo, Bello Horizonte, Bahia, Pernambuco and Para, and parcels addressed to other destinations can be delivered only when arrangements have been made by the addressee for their transmission through one of these above-mentioned post offices.

The United States Post Office can only accept parcels for delivery beyond these offices at the owner's risk. Brazilian authorities also provide that parcels must bear the amount necessary for return postage, if they are undeliverable, and the lack of a money order convention between the two countries necessitates the employment of coupons forwarded through the Post Office Department for the pre-payment of return postage.

The Bolivian parcel post was highly praised at the recent Pan-American Convention by an American ship-

per, who told of 300 parcels sent to that country, all of which had reached their destination in good condition. At the same time, there are reports from other sources that a considerable number of packages shipped to Bolivia are rifled in transit and that it is difficult to fix the responsibility for this, because the parcels are conveyed by sea to Mollendo, a Peruvian port, and require land transit through Peru.

The lack of direct communication from the Peruvian ports to eastern Peru, across the Andes, limits the service to that country. Similarly, the long transit and frequent handling of parcels to Ecuador via the Isthmus of Panama hinders successful operation of the service to that country, and this, with the fee of 24 cents for the delivery of each parcel, regardless of weight, in Ecuador, hampers the usefulness of the service.

Because of the provision in the American legislation relating to the United States and Cuba limiting shipments of cigars to parcels containing not less than 3000 cigars, Cuba feels that she would be placed at a disadvantage if she entered into a convention with the United States. Requests to Congress for a repeal of this restriction have not been complied with.

The recent conclusion of a convention with Great Britain whereby parcel post arrangements have been completed between the United States and South Africa, via the English mails, is an important step toward improvement of foreign trade relations with that country, which with Liberia forms the only section of Africa enjoying parcel post service with the United States.

Exporters favor a change in our parcel post rates so that the rate will decline with increase in weight. This is the system employed by Great Britain whereby parcel post to nearly all countries costs less per pound the heavier the package, until a minimum rate is reached. The United States has a uniform rate of 12 cents per pound, whether for 1 lb. or for 20 lb. Some of the countries with which the United States has parcel post conventions limit the parcels to 11 lb. maximum, and this has been objected to by shippers, who are requesting an increase to 22 lb.

Packing regulations in some countries, for example Italy and France, require the employment of waterproof paper for some commodities, and wooden boxes with burlap for others. These requirements are exacting and are so much more rigid than the American regulations, which merely require that every parcel must be securely and substantially packed so that it can be opened with-

Parcel Post Relations With the Following Countries Was Not Interrupted During the War. The Exchange Post Offices for These Countries Are Named:

Names of Countries	Exchange Post Offices	
*Argentina	New York, San Juan	Buenos Aires
*Australia, including Tasmania	San Francisco, Honolulu	Sydney, Melbourne, Brisbane, Adelaide, Perth, Hobart, Launceton
Bahamas	San Francisco, Honolulu	Nassau
*Barbados	San Francisco, Honolulu	Bridgetown
Bermuda	San Francisco, Honolulu	Hamilton
Bolivia	New York, San Francisco	La Paz
Brazil	New York, San Juan	Bahia, Para, Pernambuco, Rio de Janeiro, Sao Paulo
British Guiana	All offices authorized to ex	change mails between the two countries.
China	San Francisco, Seattle, Honolulu	
Colombia	All offices authorized to ex	change mails between the two countries.
Costa Rica	All offices authorized to ex	change mails between the two countries.
*Curacao (including Aruba, Bonaire, Saba, St. Eustatius and the Dutch part of St. Martins)	New York, San Juan	Willemstad
Dominican Republic	New York, San Juan	Santo Domingo
Ecuador	New York, New Orleans, San Francisco	Guayaquil
*Dutch Guiana	New York	Paramaribo
*France (excluding Algeria and Corsica)	New York	Cherbourg, Havre
*French Guiana	New York, San Juan	Cayenne
*Gibraltar	New York	Gibraltar
*Great Britain and Ireland	New York, Chicago, Boston, Philadelphia, St. Louis, Baltimore, San Francisco	London, Liverpool, Dublin
Guatemala	New York, New Orleans, San Francisco	Guatemala City, Retalhuleu, Puerto Barrios
*Guadeloupe (including Marie Galante, Deseade, Les Saints, St. Bartholomew and the French portion of St. Martins)	New York, San Juan, P. R.	Basse-Terre
Haiti	New York, San Juan	Cape Haiti, Port au Prince
Honduras (British)	New Orleans	Belize
Honduras (Republic of)	New York, New Orleans, San Francisco	Tegucigalpa, Puerto Cortez, Amapala, Trujillo
Hong-Kong. See Section 186	San Francisco, Seattle, Tacoma, Honolulu	Hong-Kong
*Italy (including Rep. of San Marino, Italian Colonies of Benadir and Erythrea, and the Italian offices at Bengazi, North Africa and Tripoli-in-Barbary and the Aegean Islands of Carpathos and Rhodes)	Philadelphia, Chicago, New York, Boston	Naples
Jamaica, including the Turks, Caicos Islands and Cayman Islands	Boston, Philadelphia, Baltimore, San Juan	Port Anton
Japan, including Formosa, Karafuto (Japanese Saghalien) and Korea. See section 186	San Francisco, Seattle, Tacoma, Honolulu	Yokohama, Kobe, Nagasaki
Leeward Islands (Antigua with Barbuda and Redonda, St. Kitts, Nevis with Anguilla, Dominica, Montserrat and the Virgin Islands, British)	New York	St. John, Antigua
*Martinique	New York, San Juan, P. R	Fort-de-France
Mexico. See section 2	All offices authorized to ex	change mails between the two countries
*Netherlands, East Indies	San Francisco	Tandjongpriok
Newfoundland	New York, Boston, Philadelphia	St. John's
New Zealand, including Fanning Island	San Francisco, Honolulu	Auckland
Nicaragua	New York, New Orleans San Francisco	Bluefields, San Juan del Norte, San Juan del Sur, Corinto
Panama. See section 2	New York, New Orleans, San Francisco	Colon, Bocas del Toro
Peru	New York, New Orleans, San Francisco	Lima
Portugal	New York	Lisbon
Salvador	New York, San Francisco	San Salvador
*Society Islands	San Francisco	Papeete
Trinidad, including Tobago	New York	Port of Spain
*Uruguay	New York, San Juan	Montevideo
Venezuela	All offices authorized to ex	change mails between the two countries.
Windward Islands (Grenada, St. Vincent, the Grenadines and St. Lucia)	All offices authorized to ex	change mails between the two countries

*Parcels cannot be registered.

out damage to its cover by postmasters and customs officials, that our shipments are frequently held up because they do not meet the foreign regulations.

The fault lies in the failure of the authorities here to negotiate conventions abroad which will recognize our methods of packing. This difficulty is also encountered in Argentina, where the American Consul General reports "because their treaty provisions are better, the parcel post service of other countries is better than ours."

The importance of extending parcel post facilities and providing for equitable service with all nations was shown recently in the instance of an automotive manufacturer who was attempting to place his literature in foreign countries. He found that the duties to the South American ports are so high that he could only ship literature in packages weighing 1 lb., as fourth class matter and not as parcel post. But custom house regulations and tax duties on these shipments caused him to give up the entire plan.

A 4-lb. package was assessed more than $5. As a result, the Department of Commerce has advised shippers that the best way to send catalogs and other literature to foreign countries is to ship them separately and obtain free admission, as single catalogs are not considered as a shipment in commercial quantities.

Catalogs and price lists sent singly are usually admitted free, excepting in South Africa, where they are free up to 8 oz. and cost 3 pence between 8 oz. and 16 oz., with an additional 1½ pence for each extra 8 oz. or fraction thereof. Advertising matter to Australia is dutiable at the rate of 10 pence per lb., or 40 per cent *ad valorem*, and the duty must be paid when the total quantity of advertising matter sent by one consignor in one mail to any one state in the commonwealth exceeds one shipping. The practice of the several countries in this regard is so varied that it is not possible to obtain a general statement which will serve as a guide, or, in fact, to obtain a complete list of the regulations of the countries of the world. Many countries have no specific provisions.

These problems are not being overlooked. The Departments of Commerce, Post Office and State are seeking to establish equitable rates and regulations, but the chief difficulties lie in the fact that in several countries, particularly in Latin America, there are no reciprocal conditions. That is, there are no inducements this country can offer for favors and no business threats which they might employ to bring about more reasonable parcel post arrangements.

The customs brokers in Argentina and Brazil are influential and have foiled every attempt to improve the regulations and, of course, reduce their fees. Furthermore, importers in some countries object to the development of parcel post service, foreseeing in it harmful competition to their own business.

In countries with which the United States now operates parcel post, parcels are allowed a maximum length of 3½ ft., length and girth combined of 6 ft., weight of 11 lb., except Ecuador, Mexico, Panama and Salvador, where the weight limit is 20 lb., and Brazil, Nicaragua, Peru, British Honduras, Columbia, Guatemala and the Republic of Honduras, where the weight is 22 lb. Parcels to China may weigh 11 lb., but must not exceed one cubic foot in volume.

The postage rate to all countries is 12 cents per pound or fraction thereof. Parcels to foreign countries cannot be sent insured or C. O. D., except to Mexico and Salvadore, where the sender of the registered parcel post package is entitled to an indemnity equal to the amount of actual loss incurred, but not exceeding 50 francs.

Parcel post relations, interrupted during the war, were resumed on the following dates:

Belgium	Jan. 27, 1919
Siam	Jan. 31, 1919
Greece	Feb. 3, 1919
Liberia	Feb. 12, 1919
Alsace and Lorraine	Feb. 20, 1919
Iceland	Feb. 21, 1919
Madeira Islands	March 11, 1919
Palestine and Mesopotamia	
Union of South Africa	April 12, 1919
Italy	April 16, 1919
Norway	April 19, 1919
Luxembourg	April 23, 1919
Paraguay	April 30, 1919
Algeria, Corsica and Tunis	April 30, 1919
Chile	May 14, 1919
Denmark, the Netherlands and Sweden	May 7, 1919
British India	May 12, 1919

It is up to the exporters to point out to the proper authorities the needs of the parcel post service to best serve the export business. While these negotiations are handled by the Departments of State, Commerce and Post Office, a letter to the Second Assistant Postmaster General will serve to notify these departments of the needs as viewed by the exporter.

Ethyl Alcohol from Waste Sulphite Liquor Using an Acclimated Yeast

RESULTS obtained from a series of investigations by the Forest Products Laboratory at Madison, Wis., upon the production of ethyl (grain) alcohol from sulphite pulp mill waste liquor are as follows:

Of the 2.0 to 2.9 per cent total sugars found in waste sulphite liquor about 55 to 62 per cent are fermentable and upon fermentation go to produce only ethyl alcohol.

Fermentations of the sulphite liquor conducted both on experimental and commercial scales showed a production of 0.7 to 1.15 per cent by volume of absolute alcohol. A plant with a capacity of 100,000 gal. of waste liquor would thus be able to produce 700 to 1150 gal. of absolute alcohol per day. Since the alcohol produced from this source contains a small quantity of methyl alcohol, but little further denaturing is necessary.

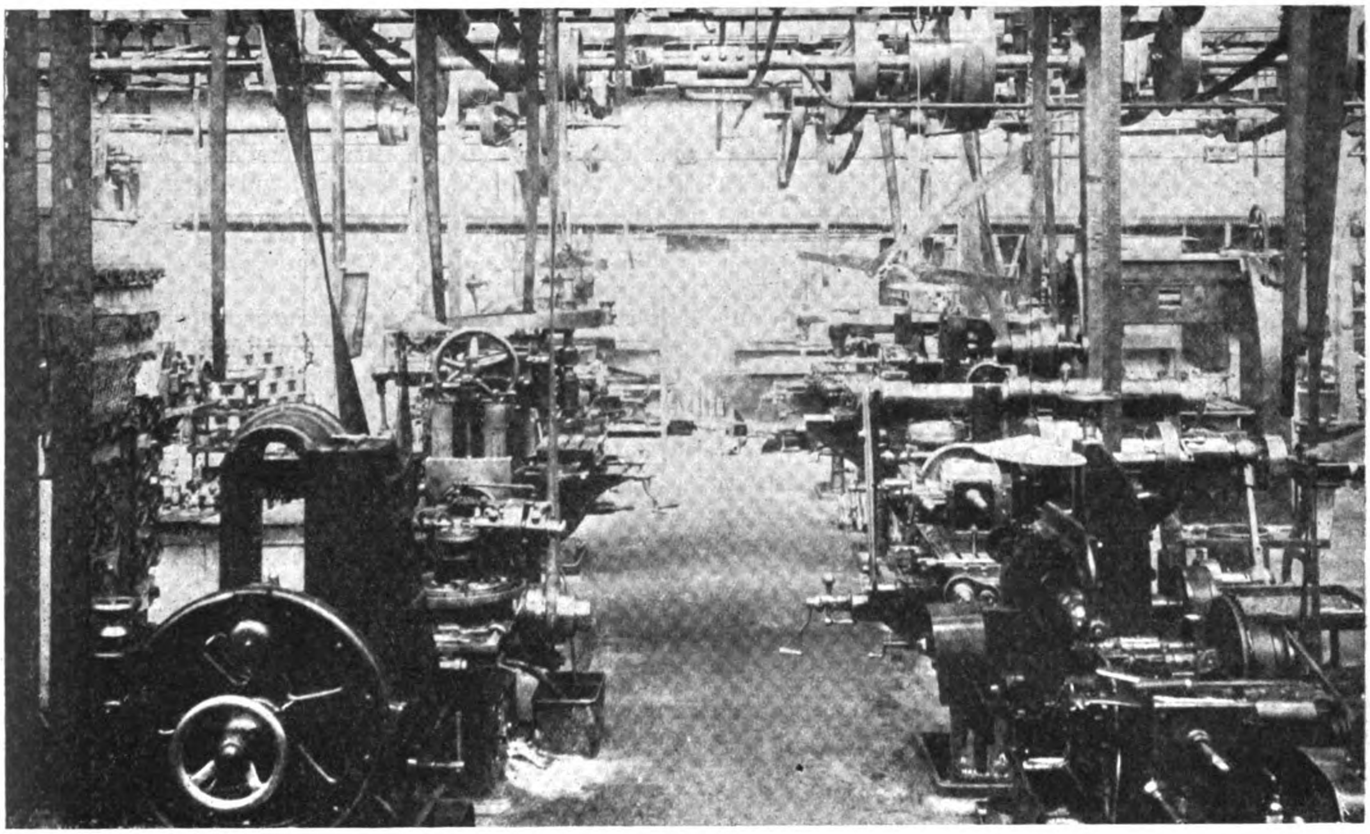
A comparison of yeasts showed that a yeast acclimated to sulphite liquor just prior to fermentation gave higher yields of alcohol than one which had been permanently acclimated to this liquor. The cost of the former process was enough greater, however, to discourage its use. This fact led the Laboratory to permanently acclimate a strain of beer yeast to this liquor and a culture was produced which gave results comparing very favorably with those obtained by the use of a freshly acclimated yeast.

A quite common custom of calculating alcohol yields from the sugar which disappears during a fermentation has been shown fallacious, since in some cases part of the sugar removed by fermentation forms substances other than alcohol.

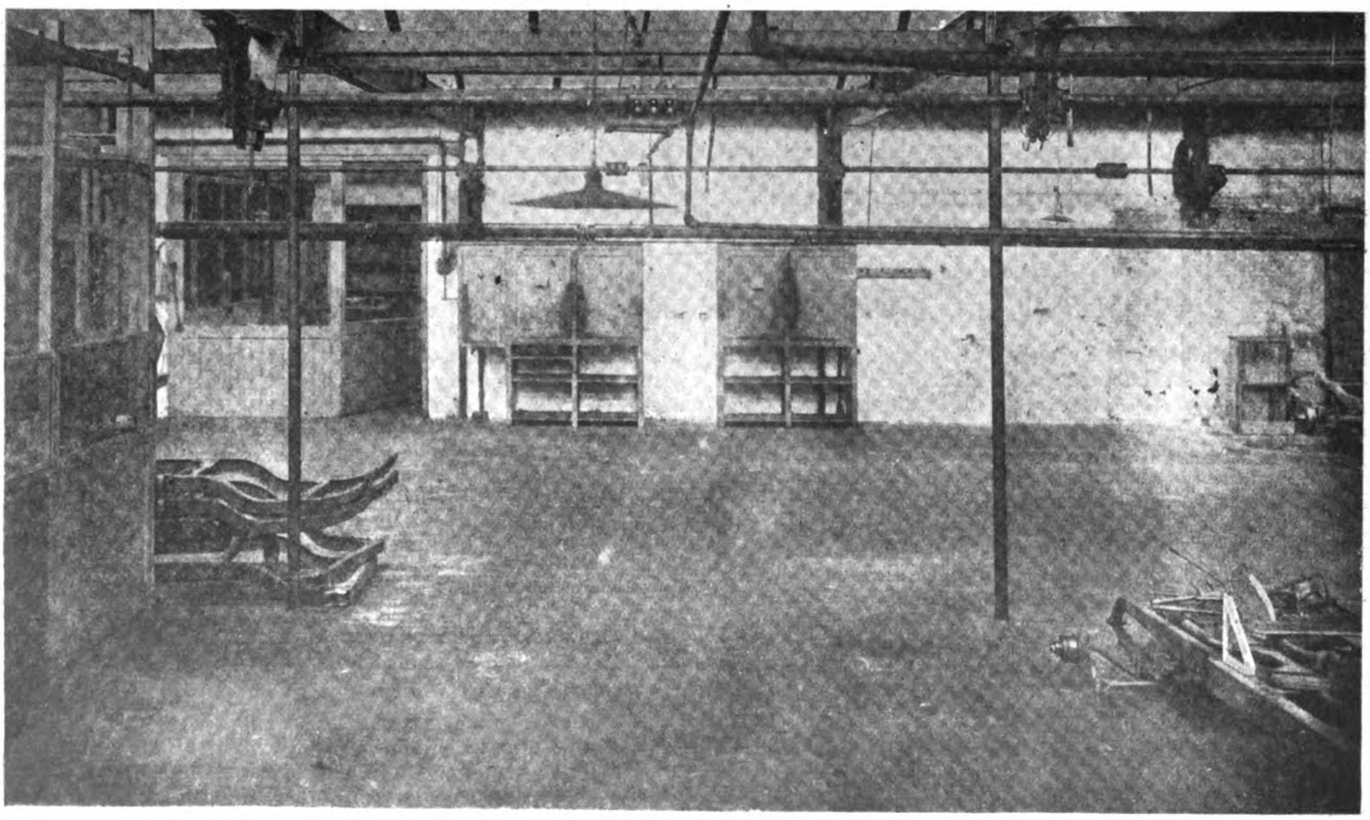
ACCORDING to an item in an English paper a steel works is to be established at Goderich, Ontario, to manufacture motor cars and parts, trucks and tractors. It is proposed to bring ore from Michigan and to manufacture high-carbon steel. The capital of the corporation is said to be £3,000,000.

AN improved shim for babbitted bearings has been developed by the Laminated Shim Co. of New York. The shim is of the laminated type but has a babbitt edge, so that the entire bearing surface is of babbitt. The manufacturers of the shim say that undoubtedly a higher engine efficiency is obtained in this way.

Before and After the German Army

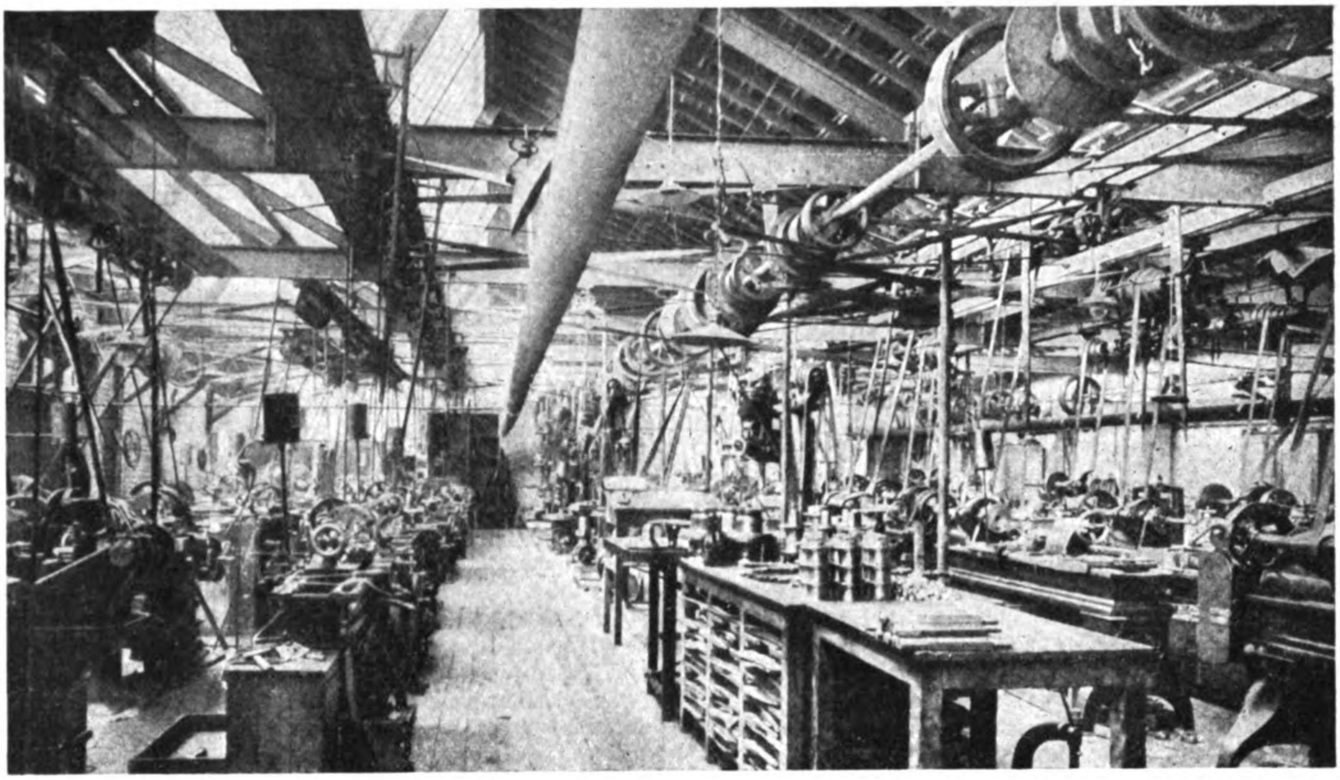


Gear cutting shop before the war

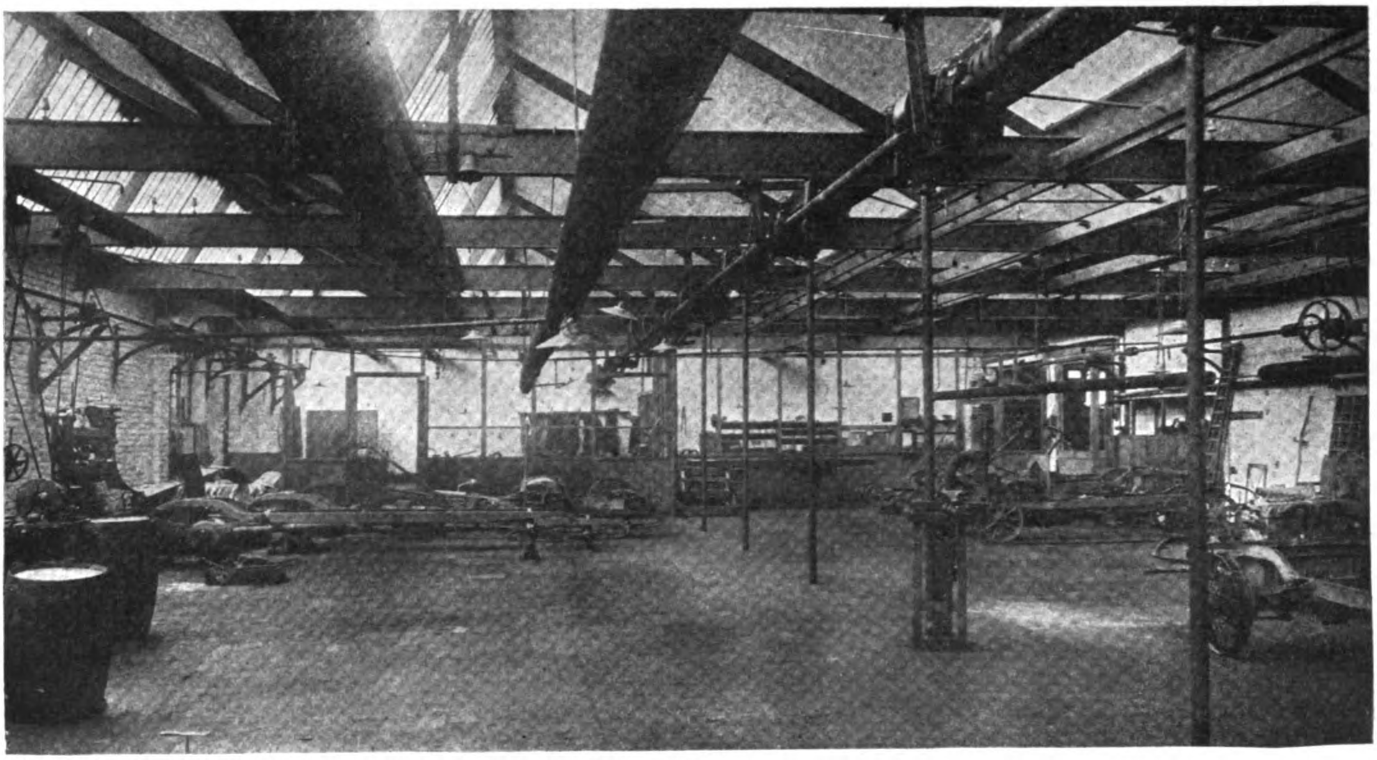


As the Germans left it

Raided the Excelsior Factory at Brussels



Main machine shop in August, 1914



Same shop on Armistice Day

Humanity and Tolerance Will Solve U. S. Labor Problems

DO you know what the recent strikes in this country mean? Have you grouped them as to cause? Do you know what steps have been taken to meet the changing conditions? Mr. Tipper has answered these questions. In this article he shows how this strike differed from that one. He shows how the radicals in labor circles have flourished through being opportunists and how they have seized, to promote their cause, strikes that were begun with an entirely different object. The following article is important to every American employer.
—EDITOR.

By Harry Tipper

IN reviewing the labor conditions and developments in the United States since the armistice, it is very important that care should be taken to distinguish between the labor unrest which has arisen out of the demands of the occupational unions affiliated with the American Federation of Labor, the unrest which has arisen out of the fight of the radical element in labor with the American Federation of Labor, the general unrest among the unskilled bodies which have been temporarily organized for some particular purpose, and the particular cases where the unrest which has occurred, through the efforts of the regularly organized unions, has been complicated by the action of the radical element after strikes had been started.

To some extent we are participating in the general spirit of unrest which follows the war as a necessary reaction from the war tension and strain. Not so much of this is due to actual strain, but a considerable part of it arises from the growth in Europe of this unrest and the suggestion which accompanies such knowledge, intelligently acted upon by the propagandists. The restrictions during the war in this country were not sufficiently severe to lead to any considerable strain and the conditions of the worker are so much better than they have been in Europe as to afford no basis of comparison in this respect.

Unemployment

The amount of unemployment is trifling in comparison with the statistics received from European countries, and the absorption of those turned out of the army and navy and from the war industries is proceeding with sufficient rapidity to indicate a lack of real surplus and a possible shortage of labor in the most important fields. There is a definite shortage of labor in a number of cities, and particularly in the automotive field.

This shortage extends into other industries where the turn-over from war production to peace necessities has not been severe and where skilled workers represent the majority of the required employees for productive purposes.

In general there is a considerable surplus of labor in various parts of the country. Although this surplus is a very small proportion of the total labor and cannot be regarded as a serious difficulty in the face of general business conditions in the United States, its position commands respect in view of world trade and the shortage of the usual immigration which has supplied a large portion of the unskilled labor in the past.

The surplus labor offers no such problem in this country as must be faced by Great Britain, and there is no reason for any alarm in respect of the totals of unemployed, particularly as from 60 to 90 per cent of those applying for jobs are placed with little difficulty.

The element of unorganized labor in this country, which is variously estimated at 5,000,000 to 7,000,000 workers, is the element which calls for the closest consideration in analyzing the question of industrial unrest. The I. W. W. organization, and similar radical bodies, claim a very large proportion of this unorganized labor as followers of their particular tenets.

There is no justification for this claim, but it is true that the I. W. W. propagandists and agitators find their greatest response from the unorganized portion of the laboring population who have no other means of voicing their grievances and have no experience with the regular machinery of the occupational union.

The total number of workers in this country who are affiliated with the American Federation of Labor is about 4,000,000 as a maximum. Before the war it was about 2,000,000. The attitude of the American Federation of Labor is conservative, and in comparison with the other organizations who are attempting to build their power on the unskilled workers, at present unorganized, their attitude is very safe and recognizes the necessity for slow development by compromise.

Labor Unrest

The reports of labor unrest in the public press as they appear from day to day make no distinction between the strikes or demands authorized by the occupational unions and those demands which have been created by the I. W. W. organization for the purpose of stimulating unrest, and those demands which have grown out of local grievances that are not recognized by the national labor leaders. The discussions in the more serious periodicals in respect of this question do not properly differentiate these various qualities of unrest and do not distinguish between the racial traditions which have some effect upon the actions taken.

With from 6 to 20 races involved in the working population of various industries, many of these races being

without any considerable knowledge of the language, the customs, the government or the political principles of the country, the possibilities of confusion in estimating the causes of industrial unrest are almost limitless.

This matter is emphasized because it has become apparent from the statements of executives of trade associations and manufacturers' bodies that the manufacturers themselves are in the dark as to the causes for much of the disturbance and are inclined to class all statements emanating from radical bodies as labor propaganda and are guilty of the mistake of confusing all unrest with the definite program of the American Federation of Labor. So long as there is no understanding of the various bodies who are engaged in promoting semi-political economic theories among the ranks of the workers of various nationalities and particularly attempting to organize those who are not organized into regular occupational unions, it will be futile to attempt to arrive at any plan which will form a basis for the solution of such difficulties.

The strikes which have occurred in this country and in Canada indicate the difference between the various demands and the difference in the origin of these strikes.

In the instance of the great sympathetic strike in Seattle, which caused such comment in this country and which was immediately defined as Bolshevism, I. W. W. and so forth, the actual history of the strike shows that it began by a demand of the workers in the government yard for an increase in pay. These workers are skilled mechanics and belong to the occupational unions. Their strike was not authorized by the unions nor approved by them but originated because of the grievance against the Emergency Fleet Corporation, which it was claimed had not kept faith with the strikers. On Feb. 7 various other union organizations went out in sympathy.

It appears from the history of this strike that the strike was originally backed by the local officials of the organized occupational unions affiliated with the American Federation of Labor, and that the control of the strike by the radical element was a later development and probably arose out of the success in bringing about sympathetic strikes and out of the prospect which was opened to the radical organization in the use of this machinery for their purpose.

The Textile Strike

The textile strike, which occurred in various centers, including Paterson, Passaic, Albany and Lawrence, Mass., was another illustration of a strike which was started by the regular occupational union and which was seized upon by the I. W. W. and other radical propagandists with the attempt to use it to their advantage and to prevent a settlement of the strike.

This strike originated with the demand of the United Textile Workers for an 8-hour day. In most parts of the country the demands were agreed to, but strikes occurred in Albany, Cohoes, Paterson, Passaic and Lawrence, Mass. In Lawrence the strike started out peacefully enough and was apparently close to a settlement when the I. W. W. and radical propagandists, who had poured into the city to foment the strike among the various nationalities, took advantage of the threatening attitude of the city officials and the mill men to organize the radical element into practical control.

This radical element succeeded in preventing a settlement of the strike for many days, by obliging the conferences to occur through them and adopting the irreconcilable attitude which is a part of their program.

The United Textile Workers branch of the American Federation of Labor not only expected a peaceful strike but withdrew its approval when the radical element succeeded in gaining control. Very few of the members who were on strike in Lawrence were members of the Textile Workers' Union, and most of them belonged to that large body of unorganized, semi-skilled and unskilled labor of various nationalities which can be swayed so easily by the promises of the more radical leaders who are interested in the extreme program of the I. W. W. This strike resulted in a general increase of wages of about 15 per cent and shortening of the hours of labor to 48 hours a week.

Another indication of the conflict which exists between the occupational unions and the I. W. W. and the importance of this conflict to the manufacturer is indicated by the copper miners' strike in Arizona, Montana and Utah. Notwithstanding the agreements of the regular occupational unions with the mine owners for conferences upon all wage questions and hours, the radical element, which claims adherence to the I. W. W., succeeded in engineering the strike and in the attempt to form a workers' government at Butte.

Other strikes which occurred on the wage question were those in the building trades, shoe trade, San Francisco shipyards, Brooklyn Rapid Transit workers, telegraphers and the expressmen and paper mill workers. Strikes which occurred in connection with hours of labor were very few, although the hours were mentioned in a good many of the strikes as a secondary and subsidiary matter.

Glass Workers' Strike

The glass workers in certain districts struck for a reduction from 12 to 8 hours. The expressmen's strike included an 8-hour day and various of the other strikes indicated that the workers were prepared to demand an 8-hour day.

One of the most important strikes which occurred in connection with the automotive field was the strike at the Willys-Overland plant in Toledo, which began on April 17 and which has not yet been settled completely. This strike assumed such great importance because it occurred in the face of the announcement of a profit sharing plan, upon which the first disbursement had just been made.

This strike was not engineered by the regular occupational unions, although a great many of the strikers were members of the unions. It was the result of the propaganda of the radicals in the labor organizations, of which Toledo has long been one of the centers of activity.

The number of alien workers in these automobile plants represents a considerable proportion of the total working population, and evidence has been accumulating for several years that it is among these alien workers the radical, semi-political, economic propagandists find their most fertile field for followers. This strike immediately took on the character of a radical socialistic movement and lost the sympathy of many of the union workers who were not in agreement with the radical program.

The strikes in Winnipeg and other sections of Canada, which are still in existence, have been advertised as Bolshevistic and I. W. W., but they are really a part of the Western Canadian unions which have been controlled by the radical element in labor circles for some years.

Many of the leaders of the Western occupational unions in Canada have come out flat-footedly in favor of one industrial union in each center, which is a part of the program of the I. W. W., and it was only by the efforts of the more conservative Eastern bodies that this program failed of adoption in the general convention of the Canadian Federated Unions.

The danger in this Canadian strike does not arise from the unorganized workers being seized by the alluring character of the radical program, but arises from the fact that the regular organizations have been controlled largely by the radical element, and this control has existed for a sufficient length of time to affect the whole policy of the local unions and their local affiliated organizations.

This disturbance, however, indicates that the idea of the industrial union and the radical program which has been a part of the policy of the Western unions in Canada has not developed such strength that it can control the whole of the labor organization. A number of unions withdrew from these strikes, and the best evidence indicates that at no time were the strikes so complete or so general as the daily reports in the newspapers would indicate.

Danger of Control by Radical Minority

At a time when there is a general unrest due to the reaction from the special strain, and also a fluidity of political opinion, there is always danger of the control of existing machinery by the radical minority temporarily, and a confusion in the minds of the outside public as to the extent of and reasons for that control.

The differences of opinion which existed in the labor ranks and the multiplicity of bodies which are attempting to deal with economic questions on the side of the worker can be illustrated in no better way than by examining the aims of labor as stated by various leaders and the resolutions adopted by various bodies. All political parties which are concerned with political propaganda under the general term of "socialism" include in their platforms economic demands, and the statements of these parties are frequently confused with the aims of occupational organizations. The general demands of occupational unions include:

1. **The 8-hour day.**
2. **The right of organization.**
3. **A tendency toward the increase of wages.**
4. **At all times an adequate wage in comparison with the cost of living.**

They also have some demands in connection with political questions, including the government ownership of public utilities and a change in the taxation methods. The various other bodies connected with labor, including the Socialist party, the I. W. W., the New York State Labor Party, fathered by the Central Federated Union of New York City, the Chicago Labor Party, and various other bodies of mixed origin, make demands running all the way from government ownership of utilities, representation in industry, 6-hour work day, the limitation of profit on invested capital, to the complete ownership of all means of production by the workers.

The American Federation of Labor to-day represents the largest general body of opinion in connection with labor conditions and similar economic questions existing among the workers in the United States. All the other bodies that claim to speak for labor and are concerned with semi-political and economic activities are so much less important, from the standpoint of their power in members and their agreement as to platform, that they should be examined and considered largely because of the value of their activities as an indication of the general tendency in certain sections of professional, semi-public and labor ranks to inject the economic developments into politics and provide a political platform of an economic character.

Any tendency for these other organizations to consolidate their aims and agree upon their demands would indicate a development of their organizations which would be of the greatest importance. So long as the number of organizations continues to multiply and the demands continue to disagree, they can be neglected for practical purposes and the situation in the labor field considered from the standpoint of the demands of the American Federation of Labor.

That these organizations become articulate and in some cases vociferous in their political propaganda, together with the evidence that most of them exist because of the complete lack of economic knowledge among a large section of the population, emphasizes the necessity for education of a better character than our present education among the workers; the importance of the right type of educators and necessity for the explanation of economic fundamentals in the curriculum.

They also emphasize the danger which exists to the industrial organizations of this country because of their neglect of all public matters, such as education, in the respective communities in which they are interested, and the important change which must take place in the business man's attitude upon all matters that he calls the politics of his community and state.

It is an unfortunate fact that most of the educators in our public secondary schools and even in our colleges have no practical working knowledge of industrial organization, its elements, its growth and its necessities, and are consequently unable to inform the students upon matters which will affect their mature lives more thoroughly than perhaps any other item.

The attitude of the employer in connection with labor questions is changing in this country, although we do not display the tolerance which is indicated by the attitude of the employers in Great Britain toward labor problems. At the same time, the developments which have occurred since the armistice was signed indicate the change which has taken place and the importance which is attached to that change by large industrial organizations. It is true that there are still a majority of manufacturers who believe the old system of organization can continue without any changes and adequately fill the bill, but many authorities in industry have indicated their vision of a change and indicated it in their utterances, not only, but in the practice in connection with their organizations.

Rockefeller's Principles

John D. Rockefeller, Jr., at the United States Chamber of Commerce Meeting, wound up a very illuminating address with a declaration of principles which is reproduced here:

1—I believe that Labor and Capital are partners, not enemies; that their interests are common interests, not opposed, and that neither can attain the fullest measure of prosperity at the expense of the other, but only in association with the other.

2—I believe that the community is an essential party to industry and that it should have adequate representation with the other parties.

3—I believe that the purpose of industry is quite as much to advance social well being as material well being and that in the pursuit of that purpose the interests of the community should be carefully considered, the well being of the employees as respects living and working conditions should be fully guarded, management should be adequately recognized and capital should be justly compensated, and that failure in any of these particulars means loss to all four.

4—I believe that every man is entitled to an oppor-

tunity to earn a living, to fair wages, to reasonable hours of work and proper working conditions; to a decent home, to the opportunity to play, to learn, to worship and to love, as well as to toil, and that the responsibility rests as heavily upon industry as upon government or society to see that these conditions and opportunities prevail.

5—I believe that industry, efficiency and initiative, wherever found, should be encouraged and adequately rewarded, and that indolence, indifference and restriction of production should be discontinued.

6—I believe that the provision of adequate means of uncovering grievances and promptly adjusting them is of fundamental importance to the successful conduct of industry.

7—I believe that the most potent measure in bringing about industrial harmony and prosperity is adequate representation of the parties in interest; that existing forms of representation should be carefully studied and availed of insofar as they may be found to have merit and are adaptable to the peculiar conditions in the various industries.

8—I believe that the most effective structure of representation is that which is built from the bottom up, which includes all employees, and, starting with the election of representatives in each industrial plant, the formation of joint works committees, of joint district councils, the annual joint conferences of all the parties in interest in a single industrial corporation, can be extended to include all plants in the same industry, all industries in a community, in a nation and in the various nations.

9—I believe that the application of right principles never fails to effect right relations; that the letter killeth and the spirit maketh alive; that forms are wholly secondary, while attitude and spirit are all important, and that only as the parties in industry are animated by the spirit of fair play, justice to all and brotherhood will any plans which they may mutually work out succeed.

10—I believe that that man renders the greatest social service who so co-operates in the organization of industry as to afford to the largest number of men the greatest opportunity for self-development and the enjoyment by every man of those benefits which his own work adds to the wealth of civilization.

This is reproduced not only because of its general declaration of principles but because the Standard Oil Co. of New Jersey, Colorado Fuel & Iron Co., Standard Oil Co. of New York, the Gilbert & Barker Co. and other companies in which Mr. Rockefeller is interested have been operating through joint councils and profit sharing developments for a year, indicating that the declaration has been capable also of a practical application in these industrial organizations.

A number of joint councils in one form or another have been adopted by the Bethlehem Steel Co., Midvale Steel Co., Lukens Steel Co., International Harvester Co., Goodyear Tire & Rubber Co., Doehler Die Casting Co., Packard Piano Co., Van Sicklen Speedometer Co. and a number of others, and this development has been growing since the armistice, so that it is unusual for a few days to pass without the record of additional business institutions who are operating under this system in one of its various forms.

Notwithstanding these facts, there is a considerable body of opinion among the manufacturers who believe that the old method of warfare between the union and the employer must go on and are not prepared to make any concessions or to consider any changes in organization. This is indicated by the suggestions made at the National Association of Manufacturers at its convention:

1—Fair dealing as the fundamental and basic principle.

2—No opposition to labor organizations — but against illegal acts of interference with the personal liberty of other employees (the open shop).

3—No discrimination regarding employment because of membership in labor organizations, but also no discrimination by employees against fellow employees who are not members of labor organizations (the open shop).

4—Right of employee to leave his employment whenever he sees fit, and equal right of the employer to discharge.

5—Freedom to adjust wages between employer and employee without interference or dictation on the part of individuals or organizations outside of the industrial enterprise concerned.

6—Freedom of employees against molestation or interference in their business and in the methods they choose to adopt or systems of pay, provided same are just and equitable.

7—No limitation upon opportunities for any person to learn any trade. (Restrictions as to apprenticeship.)

8—No strikes and lockouts, but amicable adjustment through methods that will preserve the rights of both parties.

9—Acknowledgment of the right of employees to contract for services through collective bargaining, but repudiation of stipulations that employment should be denied to men not parties to such contracts. (In other words, this is a declaration against the closed shop.)

10—A pledge of National Association of Manufacturers to oppose any and all legislation not in accord with the foregoing declarations.

However, when leaders like Frank Shove, president of the National Association of Cotton Manufacturers; Frank A. Vanderlip, banker; John N. Willys, president of the Willys-Overland Co.; Eugene M. Grace, president of the Bethlehem Steel Corp., and many more who can be quoted, admit that the worker should have some say in the government of his own conditions of work and that there should be tolerance and amicable possibilities of adjustment, the situation has developed sufficiently to merit the hope that the United States can offer a basis for the solution of its problem, which will be more advantageous in its permanent effects than the solutions which must be considered by the European countries where the conditions are entirely different.

There has been a general desire in this country to keep the labor question out of the political arena, a desire which is voiced by the president of the American Federation of Labor just as definitely as it is voiced by the manufacturer. The war made it necessary for the government to interfere in the labor situation to a considerable degree, and there is evidence that economic questions will inevitably become political questions by the very necessity for industrial peace and the recognition of the widespread demand for change in conditions.

Interference of government in the conduct of industry in respect of the hours, wages and working conditions is always to be deprecated unless the impossibility of decent agreement makes it necessary from the public standpoint. For many years the government in this country has been obliged to formulate regulations limiting the number of hours which can be worked in certain industries because of the character of these industries or

the character of the labor. It has been obliged to regulate on questions of employers' liability and similar matters, on questions of factory space per man, lighting, sanitation and other matters which concern the public health.

The Government and Industry

In its general regulation of industry from the workers' standpoint, the government, in this country, has done less than any other country. There is no general sentiment as yet for the limitation of child labor and there are many states in which there is no such regulation at this time. The sanitary regulations vary from state to state and the public necessities have not yet forced any general agreement upon the fundamental living conditions in connection with industrial work.

The difficulty of government action in connection with industrial necessity arises from the fact that standard regulation imposes as much hardship as it prevents. Taking no account of the local conditions involved, of the particular character of the work, and of the particular character of the individual organization, it cannot modify its regulations to take advantage or correct these local differences.

For this reason the smallest amount of government regulation consistent with the public welfare is the best position industrially. Notwithstanding these facts, there is a persistent demand for government action in connection with industrial matters—a demand frequently favored by the public, which has become tired of being subjected to the inconveniences arising out of the continual warfare between employers and employees and their almost total neglect of the public necessities when their own demands are at stake.

Political action upon labor matters and their economic necessities is being demanded more than ever, and the government at Washington is more sensitive to the labor development than at any other time.

Regulation of Troubles

All through the political body, with its preponderance of lawyers, there exists the idea that regulation is the general panacea for all troubles, and just as soon as we get a few bomb outrages we must immediately enact a sheaf of new laws, even though the old ones are perfectly good if they were properly enforced and operated. The number of new laws put into effect in each State reach a surprising total when they are collected, and the constant demand for regulations of this kind indicates that a large body of public opinion believes that regulation is the best way to bring about the result.

Under these circumstances it is obvious that the amount of regulation that will be put into effect depends largely upon the attitude of the manufacturer. If he will divest himself from the idea that he has *no obligation to the public*, if he will throw away his prejudices and analyze the conditions, he will appreciate that, whether he agrees with the situation or not, the tendency of the times *demands that he discuss the workers' problems with them*, that he accede to the right of the public to criticize and investigate his method of doing business and that the law of supply and demand is not a principle governing the human beings, and that the health of the body politic is more important to that body than the success of his individual enterprise.

Inasmuch as the worker, either brain or hand worker, constitutes a large majority of the voting population and his opinions and ideas are astonishingly different from those of the majority of manufacturers, it is not difficult to conceive of the present tendency toward governmental regulation continuing and enlarging its scope, unless the manufacturers realize that political power can be used to secure industrial power, just as industrial power was used in the past to secure political power.

There is no escape in Great Britain from the political decision upon labor matters because the issue has been drawn for so long, and the warfare continued so intensively, that one of the largest political bodies has been created for the purpose of enforcing economic demands, and it is not unlikely that the labor party in Great Britain may be called upon to supply the cabinet for the British Empire at the next election. There is a possibility in this country of providing a basis for the solution of the labor problem without bringing it squarely into the political arena and making the solution more difficult by that fact.

The first steps toward this solution have been taken. There is a better understanding between labor and capital, or rather between employer and employee. There is a better disposition on both sides and practical men have devised practical means of providing machinery for the solution of many of these questions. A continuance of the tendency in this direction will open up the possibility of the settlement of these matters without the necessity for a great deal of governmental intervention, and a settlement of them along what would seem to be a most orderly line. The unrest is not serious, the radical element is not unduly large, but the demand for a better understanding is widespread and the recognition that industrial organization as it was has not fulfilled its obligations to society is equally widespread. A review of the six months gives hope that industry is cognizant of the situation and operating to meet it.

Swedox Rod and Wire Filler for Welding

COINCIDENT with the development of the newer welding processes, there has been great improvement and specialization in the materials used. The Central Steel & Wire Co. of Chicago is manufacturing eight varieties of "filler," each adapted for a particular kind of ferrous metal.

Only seven years ago comparatively little autogenous welding was being done, and the attention of the officials of the Central Steel & Wire Co. was first directed to the subject when a manufacturer of steel barrels became one of their steady customers, buying an unusual amount of welding wire. The metallurgists of the company were instructed to investigate the subject of welding as a whole.

As a result of their preliminary investigation, they proposed the adoption of the present form of rods and wires. This was an important step, but what is regarded as a vastly more important step was the adoption of special treatments of welding wires for electric welding and acetylene welding, respectively.

As the investigation was carried farther, it was found that better results could be obtained by using slightly different fillers for different grades of steel to be welded. This development finally led to the adoption of eight distinct fillers which are now being offered by the company. These eight fillers are as follows:

Mannox, for acetylene welding; Lektrox, for electric welding; Castox, for cast iron; Carbox, for cast steel; Vanox, for vanadium metal; Nickox, for nickel welding; Kromox, for chrome nickel, and Railox, for use in welding railroad tracks, switches, rods, etc. All are known by the family name of Swedox.

Air Weight and Volume Measurement

PART II

Theory of the Venturi Meter as Applied to Liquids and as Applied to Gases

By Don T. Hastings

THE theory of the venturi meter is based on natural laws whose accuracy has been many times proven by the most competent investigators. Careful tests also of well-made venturi meters have repeatedly shown results well within 1 per cent of the theoretical.

Theory for Liquids

The theory of the venturi meter used to measure liquids is as follows: Liquids are practically incompressible; consequently, if the flow through the venturi meter is steady, equal volumes of the liquid must pass through all sections of the meter in a given length of time. The volume passing any section per second is equal to the area of the section multiplied by the velocity of flow. Expressing this in symbols, let

A = area in square feet of large section venturi
a = area in square feet of throat
Q = volume in cubic feet passing any section per second
V = velocity in feet per second through large section of venturi
v = velocity in feet per second through throat

Then $Q = AV = av$.

The quantities V and v are related according to the formula

$$\frac{V^2}{2g} + \frac{P}{W} + H = \frac{v^2}{2g} + \frac{p}{W}$$

in which friction in the meter is neglected and

g = acceleration of gravity = 32.16 ft. per sec. per sec.
P = absolute pressure in the pipe in pounds per sq. in. at large section
p = absolute pressure at throat
W = weight of liquid per cubic foot in pounds
H = distance of large section of meter above (or below) throat in feet

When the axis of the meter is horizontal, as is usually the case, $H = O$ and

$$\frac{V^2}{2g}\ \frac{W}{P} - \frac{V^2}{2g} + \frac{p}{W}$$

The formulae (2) and (3) are based fundamentally on the principle of the conservation of energy. The quantity $\frac{V^2}{2\,g}$ is the so-called "velocity head" and represents the height required to produce the velocity v of a body starting from rest under the influence of the acceleration of gravity g. $\frac{P}{W}$ is the "pressure head" and represents the height of a column of the liquid required to produce the pressure exerted on the liquid. It is thus seen that all the quantities in formulae (2) and (3) represent heights or "heads." The derivation of the formula can be found in any standard reference work on Hydraulics if desired.

From (1)

$$V^2 = v^2 \times \frac{a^2}{A^2}$$

and substituting in (3)

and transposing

$$\frac{v^2}{2\,g} - \left(\frac{v^2}{2\,g} \times \frac{a^2}{A^2}\right) = \frac{P}{W} - \frac{p}{W} \qquad (4)$$

$$\frac{v^2}{2\,g}\left(1 - \frac{a^2}{A^2}\right) = \frac{P - p}{W} \qquad (5)$$

$$v^2 = \frac{2\,g}{\left(1 - \frac{a^2}{A^2}\right)} \times \frac{P - p}{W} = \frac{1}{1 - \frac{a^2}{A^2}} \times 2\,g \times \frac{P - p}{W} \qquad (6)$$

$$v = \sqrt{\frac{1}{1 - \left(\frac{a^2}{A}\right)}} \times \sqrt{2\,g\,\frac{P - p}{W}} \qquad (7)$$

Substituting the value of v as computed from equation (7) in equation (1) gives the quantity.

Theory for Gases

The formulae derived above for liquids flowing through a venturi meter are applicable to gases, because gases are compressible and consequently the density of the gas varies with changes in pressure and temperature. The result is that equal *volumes* do not pass the various sections of the venturi in the same length of time. If the flow is steady, however, equal *weights* of the gas must pass all sections in equal time intervals and on this basis formulae may be derived. In the following, friction losses will be disregarded, as they have been proven entirely negligible; the discussion also is limited to venturi tubes whose axes are horizontal, thus eliminating the factor due to the difference in height or the "static head." In practice it is always possible and usually by far most convenient to set the venturi tubes in this position.

Departing for a moment from the venturi meter, consider a piston moving in a cylinder as a result of the pressure exerted on it by the gas filling the cylinder. Assume that this pressure is maintained constant as the piston moves. The work done on the piston, neglecting friction and temperature effects, is measured by the force exerted, multiplied by the distance the piston is moved, or

Work = Force × Distance
Force = Gas Pressure × Area of Piston
and Work = Pressure × Area × Distance

The area multiplied by the distance equals the volume displaced by the gas during the time the work was done, so the expression may be written

Work = Pressure × Volume
or $W = P \times V$

If the pressure does not remain uniform but varies during the movement, as is usually the case, the same formula can be applied by subdividing the distance into as many parts as may be necessary, so that the pressure during any one part of the travel is practically constant, multiplying the pressure during each part of the travel by its corresponding small volume and adding the results together, as

$$W = P_1V_1 + P_2V_2 + P_3V_3 + \ldots\ldots\ldots + P_nV_n$$

This expression shows that the work done is the sum of such terms as $P\ V$; when V is made very small to get accurate results it is usually written "dV." The formula is then written

$$W = \int_{V_1}^{V_2} P\, dV$$

In words this means that W is equal to the sum of such terms as $P\ dV$ between the limits V_1 and V_2, V_1 and V_2 being the volumes at the beginning and end of the working period.

This formula can be evaluated graphically for any particular case, as, for example, that of a steam engine indicator diagram. Whent here is a known algebraic relation between the various pressures and their corresponding volumes, the solution can be found mathematically.

Consider now a straight tube of uniform diameter through which gas is flowing steadily. Imagine that the gas is divided into discs or layers at right angles to the axis of the pipe. Each disc will press on the layer in front of it and in turn be pressed on by the layer behind it. Any disc or layer may then be compared to the piston in its cylinder, with reference to the gas immediately behind it.

If the diameter of the pipe is not uniform, but contracted, as in a venturi tube, the analogy still holds, though in this case the pressure and volume are both changing. The formula still holds, however, and we may write as the fundamental equation of the venturi tube

$$W = \int_{V_1}^{V_2} P\, dV \tag{9}$$

The next step is to determine the algebraic relation between P and V so that the formula can be put into usable shape.

Countless experiments by numerous scientists have proven that for all gases, including air, this relation is given by the general formula

$$P V^s = P_1 V_1^s = P_2 V_2^s = K$$

in which
$P\ P_1\ P_2$ = absolute pressures
$V\ V_1\ V_2$ = volumes
s = an exponent usually greater than 1 and less than 1.5
K = a constant

The values of s and K have been most carefully determined for air and many other gases under various conditions, and may be found in any standard work on Thermo-Dynamics. The particular values for use in the case of air measurement by means of the venturi meter will be given later.

From equation (9)

$$P = \frac{K}{V^s} \tag{10}$$

Substituting in equation (8)

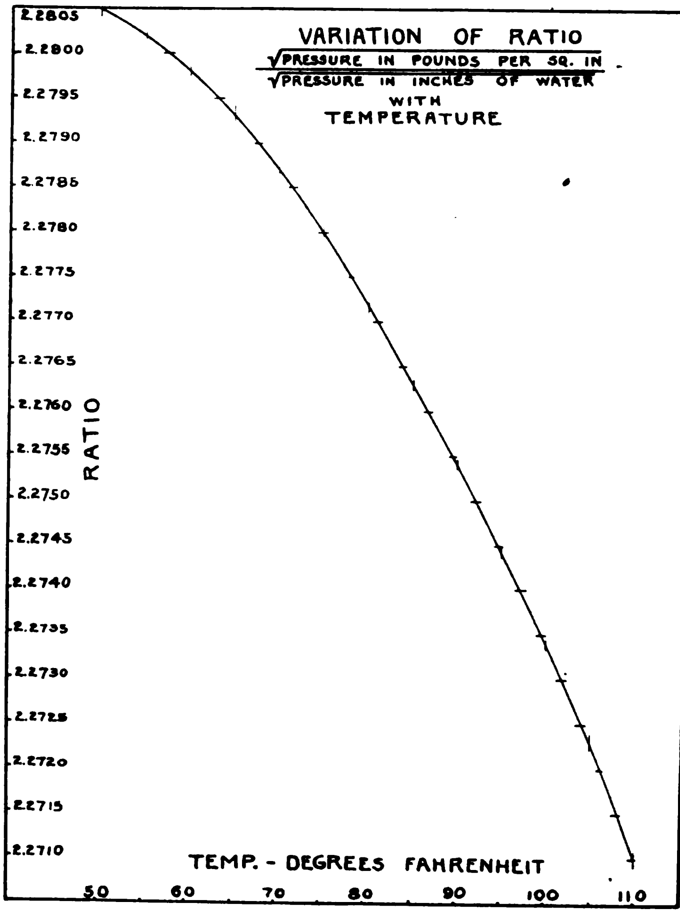


Fig. 11

$$W = \int_{V_1}^{V_2} \frac{K}{V^s}\, dV \tag{11}$$

As K is a constant it may be moved outside the summation sign, and we get

$$W = K \int_{V_1}^{V_2} \frac{dV}{V^s} \tag{12}$$

The mathematical process of integration is now applied and we get

$$W = K \int_{V_1}^{V_2} \frac{dV}{V^s} = K \int_{V_1}^{V_2} V^{-s} dV$$

$$= \frac{K}{1-s}\left[V_2^{1-s} - V_1^{1-s}\right] \tag{13}$$

As s is greater than 1 as stated above the denominator and both exponents are negative; changing form to get positive values, we have

$$W = \frac{K}{s-1}\left[\frac{1}{V_1^{s-1}} - \frac{1}{V_2^{s-1}}\right] \tag{14}$$

To get the equation in more convenient form multiply and divide by the factor $\frac{1}{V_2^{s-1}}$ or $\frac{1}{V_1^{s-1}}$

$$W = \frac{K}{s-1} \times \frac{1}{V_2^{s-1}}\left[\frac{V_2^{s-1}}{V_1^{s-1}} - 1\right] \tag{15a}$$

$$\text{or } W = \frac{K}{s-1} \times \frac{1}{V_1^{s-1}}\left[1 - \frac{V_1^{s-1}}{V_2^{s-1}}\right] \tag{15b}$$

Substituting the values of K from (9) we get

$$W = \frac{1}{s-1} \times \frac{P_2 V_2^s}{V_2^{s-1}}\left[\left(\frac{V_2}{V_1}\right)^{s-1} - 1\right] \quad (16a)$$

$$W = \frac{1}{s-1} \times \frac{P_1 V_1^s}{V_1^{s-1}}\left[1 - \left(\frac{V_1}{V_2}\right)^{s-1}\right] \quad (16b)$$

Cancelling

$$W = \frac{P_2 V_2}{s-1}\left[\left(\frac{V_2}{V_1}\right)^{s-1} - 1\right] \quad (17a)$$

$$W = \frac{P_1 V_1}{s-1}\left[1 - \left(\frac{V_1}{V_2}\right)^{s-1}\right] \quad (17b)$$

Again from equation (9) we get

$$\frac{P_2}{P_1} = \left(\frac{V_1}{V_2}\right)^s \quad \text{and} \quad \frac{P_1}{P_2} = \left(\frac{V_2}{V_1}\right)^s \quad (18)$$

Extracting the S root we get

$$\frac{P_2}{P_1}^{\frac{1}{s}} = \frac{V_1}{V_2} \quad \text{and} \quad \left(\frac{P_1}{P_2}\right)^{\frac{1}{s}} = \frac{V_2}{V_1} \quad (19)$$

Raising to the $s - 1$ power

$$\left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}} = \left(\frac{V_1}{V_2}\right)^{s-1} \quad \text{and} \quad \left(\frac{P_1}{P_2}\right)^{\frac{s-1}{s}} = \left(\frac{V_2}{V_1}\right)^{s-1} \quad (20)$$

Substituting these values in (17a) and (17b)

$$W = \frac{P_2 V_2}{s-1}\left[\left(\frac{P_1}{P_2}\right)^{\frac{s-1}{s}} - 1\right] \quad (21a)$$

$$W = \frac{P_1 V_1}{s-1}\left[1 - \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] \quad (21b)$$

Either of these equations (21a) and (21b) represents the work done during the expansion of the gas, that is, during its change from the P_1, V_1 condition to the P_2, V_2 condition. To get the total work done, however, we must add to this expression the work done at the constant initial pressure in replacing the gas which has been expanded and must subtract the work done at the constant final pressure in displacing the volume of gas necessary to permit the flow to take place. This gives us, using only equation (21b) for convenience

$$W = P_1 V_1 + \frac{P_1 V_1}{s-1}\left[1 - \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] - P_2 V_2 \quad (22)$$

Referring again to (9) we may write

$$P_1 V_1 V_1^{s-1} = P_2 V_2 V_2^{s-1} \quad (23)$$

and

$$P_2 V_2 = P_1 V_1 \left(\frac{V_1}{V_2}\right)^{s-1} \quad (24)$$

Substituting from (20)

$$P_2 V_2 = P_1 V_1 \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}} \quad (25)$$

Substituting in (22)

$$W = P_1 V_1 + \frac{P_1 V_1}{s-1}\left[1 - \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] - P_1 V_1 \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}} \quad (26)$$

$$W = P_1 V_1\left[1 - \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] + \frac{P_1 V_1}{s-1}\left[1 - \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] \quad (27)$$

$$W = P_1 V_1\left[1 + \frac{1}{s-1}\right]\left[1 - \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] \quad (28)$$

$$W = \frac{s}{s-1} P_1 V_1 \left[1 - \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] \quad (29)$$

Equation (29) represents the total work done on the gas during its change of condition; it consequently is equal to the difference in energy possessed by the gas before and after the change. The initial energy is given by the expression

$$E_1 = \tfrac{1}{2} m u_1^2$$

and the final energy by

$$E_2 = \tfrac{1}{2} m u_2^2$$

m = the mass of the gas
u_1 = velocity at large upstream section of the venturi tube
u_2 = velocity at throat of venturi

Subtracting,

$$W = E_2 - E_1 = \tfrac{1}{2} m (u_2^2 - u_1^2) \quad (30)$$

Substitute for m its equivalent $\frac{w}{g}$

w being the weight of the gas in pounds and g being the acceleration due to gravity = 32.159 ft. per second.[2]

$$W = \frac{w}{2g}(u_2^2 - u_1^2) \quad (31)$$

If w is taken as 1 pound and u_1 and u_2 are measured in feet per second, we may combine equations (29) and (31)

$$W = \frac{1}{2g}(u_2^2 - u_1^2) = \frac{s}{s-1} P_1 V_1 \left[1 - \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] \quad (32)$$

Since we have taken W = 1 pound V_1 becomes the volume of 1 pound of the gas at the pressure P_1 and consequently $\frac{1}{V_1}$ = the density d_1 at that pressure, from which,

$$V_1 = \frac{1}{d_1} \quad (33)$$

Substituting in (32) we have

$$u_2^2 - u_1^2 = 2g \frac{s}{s-1} \frac{P_1}{d_1}\left[1 - \left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] \quad (34)$$

As equal weights pass both upstream and throat sections in equal time intervals, the velocities, densities and areas must be related as follows:

$$w = w_1 = w_2 = A_1 u_1 d_1 = A_2 u_2 d_2 \quad (35)$$

But

$$\frac{d_2}{d_1} = \frac{V_1}{V_2} \quad \text{from (33)}$$

and

$$\frac{V_1}{V_2} = \left(\frac{P_2}{P_1}\right)^{\frac{1}{s}} \quad \text{from (19)}$$

$$\text{so} \quad d_2 = d_1 \left(\frac{P_2}{P_1}\right)^{\frac{1}{s}} \quad (36)$$

Substituting in (35) and dividing out d_1,

$$u_1 = \frac{A_2}{A_1} u_2 \left(\frac{P_2}{P_1}\right)^{\frac{1}{s}} \quad (37)$$

Squaring this value of u_1 and substituting in equation (34)

$$u_2^2 - \left(\frac{A_2}{A_1}\right)^2 u_2^2 \left(\frac{P_2}{P_1}\right)^{\frac{2}{s}} =$$

$$2g\,\frac{s}{s-1}\,\frac{P_1}{d_1}\left[1-\left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] \qquad (38)$$

$$u_2^2\left[1-\left(\frac{A_2}{A_1}\right)^2\left(\frac{P_2}{P_1}\right)^{\frac{2}{s}}\right]=$$

$$2g\,\frac{s}{s-1}\,\frac{P_1}{d_1}\left[1-\left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}\right] \qquad (39)$$

$$u_2 = \sqrt{2g\,\frac{s}{s-1}\,\frac{P_1}{d_1}\left[\frac{1-\left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}}{1-\left(\frac{A_2}{A_1}\right)^2\left(\frac{P_2}{P_1}\right)^{\frac{2}{s}}}\right]} \qquad (40)$$

Substituting this value of u_2 and the value of d_2 from (36) in (35)

$$w\left(\begin{matrix}\text{pounds}\\ \text{per second}\end{matrix}\right) =$$

$$A_2 d_1\left(\frac{P_2}{P_1}\right)^{\frac{1}{s}}\sqrt{2g\,\frac{s}{s-1}\,\frac{P_1}{d_1}\left[\frac{1-\left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}}{1-\left(\frac{A_2}{A_1}\right)^2\left(\frac{P_2}{P_1}\right)^{\frac{2}{s}}}\right]}$$

from which

$$w = A_2\left(\frac{P_2}{P_1}\right)^{\frac{1}{s}}\sqrt{2g\,\frac{s}{s-1}\,P_1\,d_1\left[\frac{1-\left(\frac{P_2}{P_1}\right)^{\frac{s-1}{s}}}{1-\left(\frac{A_2}{A_1}\right)^2\left(\frac{P_2}{P_1}\right)^{\frac{2}{s}}}\right]} \qquad (41)$$

In this formula the various quantities must be measured in the proper units; they are consequently recapitulated below for convenience:

- w = weight of air flowing in pounds per second
- A_2 = area of throat of Venturi tube in square feet
- P_1 = pressure in upstream part of Venturi tube in pounds per square foot absolute.
- P_2 = pressure in throat in pounds per square foot absolute
- g = acceleration of gravity = 32.159 ft. per second^2
- s = an exponent whose value in this case is 1.4028—this is the value which has been determined for air when its expansion is adiabatic; that is, when no heat is given up by the air to the walls of its containing vessel nor any received by the air from the walls. This is assumed to be the case in flow through Venturi tubes due to the high velocities employed and seems to be justified, as many extremely careful tests have been made to check the instrument with results of errors of less than 1 per cent in all cases
- d_1 = density in pounds per cubic foot of air in upstream section of Venturi tube—the determination of this factor will be discussed later
- A_1 = area of upstream section of Venturi tube in square feet

Substitution of the numerical values of g and s simplifies formula (41) somewhat

$$w = A_2\left(\frac{P_2}{P_1}\right)^{0.71286}\sqrt{64.318\times 3.48262\;P_1\,d_1} \times\sqrt{\frac{1-\left(\frac{P_2}{P_1}\right)^{0.28714}}{1-\left(\frac{A_2}{A_1}\right)^2\left(\frac{P_2}{P_1}\right)^{1.42573}}} \qquad (42)$$

Extracting the numerical root and squaring $\left(\frac{P_2}{P_1}\right)^{0.71286}$ in order to place it under the radical sign

$$w = 14.96647\;A_2\sqrt{P_1}\sqrt{d_1}\;\sqrt{\times\frac{\left(\frac{P_2}{P_1}\right)^{1.42572}\left[1-\left(\frac{P_2}{P_1}\right)^{0.28714}\right]}{\left[1-\left(\frac{A_2}{A_1}\right)^2\left(\frac{P_2}{P_1}\right)^{1.42572}\right]}} \qquad (43)$$

It will be more convenient to read the weight as pounds per minute instead of per second, so we multiply by 60. It is also desirable to express the area in square inches instead of square feet, so we divide by 144.

$$w\ (\text{lb. p. m.}) = 6.23603\,A_2\ (\text{sq. in.})\ \sqrt{P_1}\sqrt{d_1}\sqrt{\text{—}} \qquad (44)$$

For convenience in reading pressures, water manometers will be used. The readings of a water manometer will vary with the temperature; at 78 deg. F. a 1-in. column of water represents a pressure per square foot of 5.1875 lb. At 50 deg. F. this value is 5.2075 lb., and at 110 deg. F. 5.1575 lb. As we are concerned only with the square roots of these quantities, we get the following relations:

At 50 deg. F., 2.2805
At 78 deg. F., 2.2776
At 110 deg. F., 2.2710

The values of this conversion factor are shown in Fig. 11; between the limits given, which are the extremes usually met in practice, the variation either way from the value corresponding to 78 deg. F. is less than 0.3 per cent. This variation may be taken into account when extreme accuracy is desired, but for all ordinary purposes we may use the factor 2.2776. The temperature of 78 deg. F. is chosen as this is about the average temperature encountered in ordinary work.

Introducing this factor (by multiplication) and reading P_1, in inches of water absolute, the formula becomes

$$w = 14.203\;A_2\sqrt{P_1}\sqrt{d_1}\;\frac{\sqrt{\left(\frac{P_2}{P_1}\right)^{1.42572}\times\left[1-\left(\frac{P_2}{P_1}\right)^{.28714}\right]}}{\sqrt{1-\left(\frac{A_2}{A_1}\right)^2\left(\frac{P_2}{P_1}\right)^{1.42572}}} \qquad (45)$$

in which

- w = pounds per minute
- A_2 = area in square inches of throat
- P_1 = pressure in inches of water absolute
- d_1 = density in pounds per cubic foot of dry air at pressure P_1
- $\frac{P_2}{P_1}$ = ratio of absolute pressures at throat and upstream. This ratio must be kept between the limits .950 and .995 to secure the best results.
- $\frac{A_2}{A_1}$ = ratio of *areas* of throat and upstream section. This ratio should be ¼ to 1/16.

The FORVM

Status of Lorraine-Dietrich Aircraft Engine When Examined by U. S. Engineers

By M. Barbarou

AS a member of the Society of Automotive Engineers and Technical Director of the Lorraine-Dietrich Co. (Route de Bezons, Argenteuil, France), I take the liberty of drawing your attention to a paragraph of an article by J. G. Vincent headed "Lorraine-Dietrich Held Up as a Model," which appeared in your magazine dated February 6. This article contains inaccuracies, and I shall feel much obliged if you will kindly correct same. I wish to most emphatically contradict the statement that the "Lorraine-Dietrich" eight-cylinder motor was in the "experimental state" when the officers delegated by the United States Government came to examine it.

I am glad to learn that the engineers who came to examine the Lorraine engine were Captain Clark and Capt. Howard Marmon, for they never introduced themselves to any of the managers of the firm, which latter had given instructions that all persons delegated by the United States Government should have free access to all parts of the works.

These officers came to see the Lorraine-Dietrich Co. in July and August, 1917, and this type of engine, perfectly tuned up for quantity production, underwent a successful official test of 50 hr. Dec. 26-30, 1916, as you will see by the detailed test performance I am enclosing herewith, certified correct by the inspection officer of the Lorraine-Dietrich Works. The details of this engine were quite settled for manufacturing in series.

I must add that the Lorraine-Dietrich Co. made a series of high altitude tests (Lautaret pass) with this engine, beginning July 30, 1917. I consider that it is stretching the truth when the author says in the article that the Lorraine-Dietrich engine was in the "experimental state" and that this applied more to the Liberty engine.

The Lorraine-Dietrich Co. received numerous calls from different United States officers for the supply of inlet manifolds and carbureter parts to improve the carburetion of the engine. I proposed to tune up the engine (carburetion, etc.).

I am sending you in this connection photographs and a translation of a letter sent by the French War Office to the Lorraine-Dietrich Co. on July 6, 1918, and a confirmation of a telephonic message sent by the French Technical Section for Aviation on June 19, 1918. You will notice from these documents that the Lorraine-Dietrich Co. offered the United States Government a free manufacturing license for its aviation engines.

With regard to the 370-hp. twelve-cylinder engine, the Lorraine-Dietrich Co. was asked for a sample engine toward the end of 1918, and I refused to have it delivered, not seeing the necessity of supplying a model in view of the manufacture of the Liberty engine.

I shall feel obliged if you will kindly publish this letter in your magazine, so that your readers may know that when the United States Government sent a delegation of engineers to France to study the Lorraine motors, this company had several types which were absolutely ready, from every point of view, for quantity production.—M. BARBAROU, *Technical Director, Lorraine-Dietrich Co.*

Letter of the Director of Military Aviation (France) to the Administrator of the Lorraine-Dietrich Co.

(Translation)

DEAR SIR: I have the honor to inform you that the Aircraft Manufacturing Department has received the necessary instructions to deliver to your works as soon as possible, in agreement with the Aviation Technical Department, a Liberty engine, in order that your specialists may try to improve its carburetion.

In your letter of June 17, you also offered to the French Government, for the American Aviation, a free manufacturing license for your 500 hp. and 1000 hp. motors.

I beg to express my best thanks for this suggestion, as also for the first one, and wish to congratulate you for having so thoroughly and with so broad minded a spirit understood the role of collaboration which firms such as yours cannot fail to play with regard to our American allies.

I am advising of your offer General Patrick, Director of the American Aviation Expeditionary Force, 45 Avenue Montaigne.

Yours faithfully,

(Signed) PAUL DHE, Director of Military Aviation.

Confirmation of Telephone Message No. 3284/Mo. D Sent June 19, 1918, at 17.50 o'clock

(Translation)

COMMANDER CAQUOT.

Director of Aviation Technical Section to the Under-Secretary of State for Aeronautics.

TUNING UP OF LIBERTY MOTOR

In agreement with the Lorraine-Dietrich Co., which is willing to help us, I suggest that you should deliver to the Lorraine works the Liberty motor now at Chalais, in order to improve the carburetion. I am advising the American Aviation.

(Signed) CAQUOT.

—

An Appreciation

Editor AUTOMOTIVE INDUSTRIES:

I want to thank you for the space given in the current issue of AUTOMOTIVE INDUSTRIES to the Class B rules for tractor tests adopted by the American Society of Agricultural Engineers, and also for the editorial comment on these rules.

This publicity co-operation will be greatly appreciated by all the members of the American Society of Agricultural Engineers.

Thanking you for the courtesy, we are,

Yours very truly,

(Signed) RAYMOND OLNEY,

President American Society of Agricultural Engineers.

St. Joseph, Mo., June 10, 1919.

—

Berling Magneto on Bender Special

WE are informed of a mistake in the table in AUTOMOTIVE INDUSTRIES in which the equipment of the cars in the Indianapolis Speedway race was described. The table specified the Bosch magneto as a part of the equipment of the Bender Special. It appears that two weeks before the race this car was equipped with two Berling type 5-41 magnetos. This was the first use of Berlings in racing and reports to the company are that the operation was faultless.

—

Air Measurement—Errata

A NUMBER of typographical errors occurred in the article on Air Weight and Volume Measurement by Don T. Hastings in our June 12 issue, as follows:

P. 1282—col. 2—line 13—second t should be $t_1 = 71$ deg. Fahr.

P. 1282—col. 2—line 17—P should be P_1 and d should be d_1.

P. 1282—col. 2—line 22—$\frac{A_2}{A_1} = 0.200$ instead of 200.

P. 1287—col. 1—line 6 should read

$$b - e + 0.622e = b - 0.378e$$

the minus sign having been omitted.

—

THE annual meeting of the International Aeronautic Federation will be held in Brussels, the date to be fixed. Next year's meeting will be in Geneva. Aero Clubs of Japan and Brazil have been admitted.

Details of the Still Hydrocarbon-Steam Engine

British Product, Which Uses in Main Cylinder Any Form of Liquid or Gaseous Fuel Hitherto Employed, Ranked Above Diesel in Announcement

A GREAT deal of interest has developed in England in a new design of engine announced by W. J. Still, which he claims is more efficient than the Diesel engine. From a correspondent we learn that Mr. Still spent about half a million dollars in experimental work before announcing his engine. Following are some particulars of the Still engine taken from a paper read before the Royal Society of Arts by Frank D. Acland.

The Still engine is an engine capable of using in its main working cylinder any form of liquid or gaseous fuel hitherto employed; it makes use of the recoverable heat which passes through the surfaces of the combustion cylinder, as well as into the exhaust gases, for the evaporation of steam, which steam is expanded in the combustion cylinder itself on one side of the main piston, the combustion stroke acting on the other side. It increases the power of the engine and reduces the consumption of the fuel per horsepower developed.

Its primary object is not to use the waste heat for raising steam, but first to use it in improving the thermal conditions of the working cylinder, and so insure the maximum efficiency from the fuel burnt within it, diminishing, as a consequence, the heat lost in that operation. Since the maximum efficiency is obtained by combustion of the fuel in the cylinder, and the minimum by the evaporation of the water in the steam generator, it is evident that the larger the quantity of steam which can be generated per horsepower developed by the combustion cycle, the lower must be the heat efficiency of the whole machine.

In the Still engine—see diagram—the jacket and cooling water form part of the circulating system of a steam generator, which may be an integral part of the engine, or external to it. The cooling water therefore enters and leaves the jacket at a constant temperature, regulated by the pressure of the steam, the cooling being effected by converting the water into steam without raising its temperature. Excluding the radiation losses, which are kept low by lagging, all the heat which passes through the walls is thus usefully recovered in the water as steam. The temperature of the cylinder wall is uniform over the whole of its exterior surface, and the heat lost to the cooling water at each stage of the cycle—compression, combustion and expansion—is diminished.

During compression, owing to the walls being at steam temperature, the incoming charge picks up heat instead of losing it during the greater part of the stroke, an advantage of the greatest value to the heavy oil types of Still engines, where an air charge is taken in at the full out-stroke, and is compressed to a pressure where its increased temperature insures the certain ignition and combustion of the fuel which is injected into it.

During combustion and expansion the uniform and higher mean temperature of the walls reduces the heat lost to the jacket water. Some of the heat thus economized adds to the useful work on the piston, the balance passing out in the exhaust gases for recovery.

The cylinder of a Still engine consists of an inner liner, which is approximately one-third to one-fourth of the usual thickness; it is ribbed externally so as to add to its conducting surface and provide suitable passage for the cooling water, and it is reinforced by an outer hoop capable of withstanding the highest pressures to be met with in working. No failure of a cylinder of any kind has occurred, even under most severe, even abnormal test conditions, *e.g.*, with mean combustion pressures of 180 lb. per square inch in a two-stroke engine, to which was added overload steam mean pressures of 70 lb., *i.e.*, a total mean effective pressure per revolution of 250 lb. per square inch.

The Still engine may be of the constant volume or constant pressure type, or a combination of both; its losses to the cooling water are not the same as in a normal engine of either type, except in so far that they vary with the type, with the cycle, with the efficiency of the com-

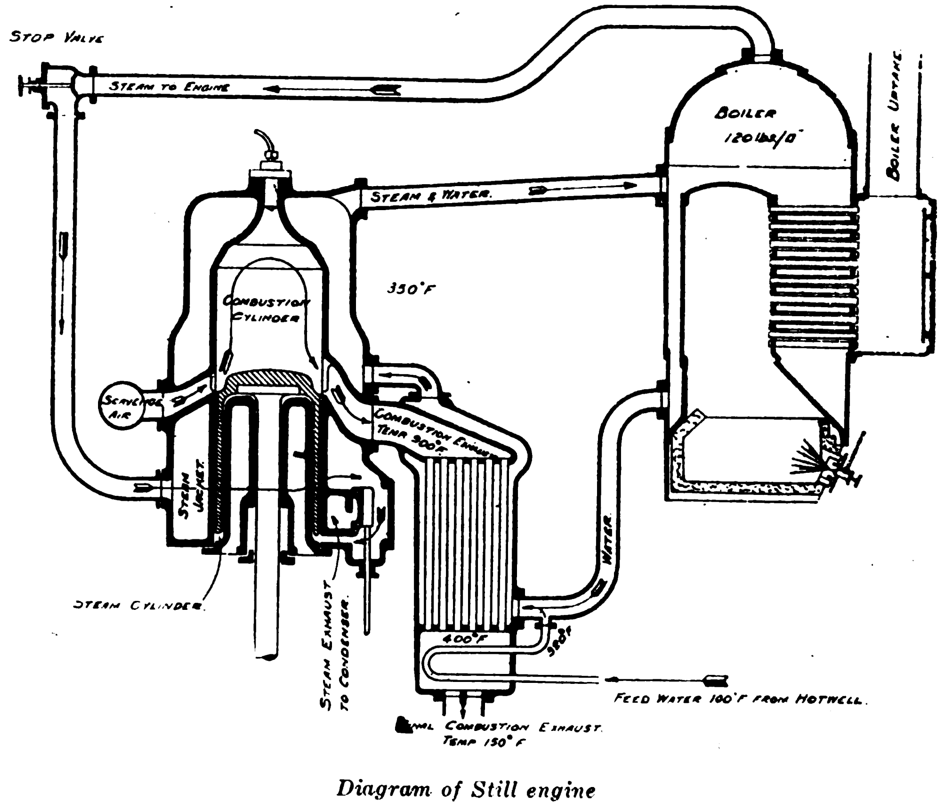


Diagram of Still engine

bustion stroke, and with the load. At normal and full loads, such heat units, in a Still engine, as pass into the jacket water, which is at steam temperature and pressure, are lessened and are wholly recovered without loss—radiation excluded—in overcoming the latent heat of the water and give off their steam in the steam space in proportion to the heat flow at those loads. At lower loads less steam is produced, until at still lower loads no steam at all is measurable. In other words, the jacket losses are practically eliminated.

Exhaust Gases

The exhaust gases take a subsidiary, but important, part in the cycle; their usefulness in ordinary combustion engines, in raising steam, is limited to the amount of heat recoverable between the initial temperature of the exhaust and that of, say, 50 deg. Fahr. above the steam temperature, after which the whole volume passes away to atmosphere at a still useful temperature, less a small percentage available for feed-water heating. But in the Still engine the exhaust gases, after raising their quantum of steam, are employed in preheating all the water required for the steam generated in the jacket water and in the generator. Trials at full efficiency over long periods and steady loads show terminal stack temperatures as low as 150 deg. Fahr. The heat efficiency of the combined cycles is therefore exceedingly good, with an initial temperature of over 2000 deg. Fahr. and a final exhaust to atmosphere at 150 deg. Fahr.

The quantity of steam capable of being generated from "waste heat" depends upon the efficiency of the combustion cycle, and on the load. Some years of experimental work prove that the weight of steam recovered may vary from a maximum of about 7 lb. per brake horsepower hour developed by the combustion cycle of a four-stroke constant volume engine at full load to a minimum at light loads which is hardly measurable, and which only balances the loss due to radiation.

The engine used for this research was of constant volume type, four-stroke. It first underwent a series of tests, so as to arrive at its "initial horsepower" as an explosion engine, *i.e.*, without any power added by the steam cycle, and was carefully checked in this connection by comparison with well-known and authenticated trials carried out by the late Prof. Bertram Hopkinson, F.R.S., and others. Though it was a single-cylinder unit with automatic inlet valves, its "initial horsepower" was rated on a par with the power given by four-cylinder sets with mechanically operated valves deduced from tests made over very short periods and under their best conditions.

The quantity of steam generated per "initial brake horsepower" from the jacket alone averaged 3.28 lb. per brake horsepower-hour, and from the jacket and exhaust together 6 lb. per brake horsepower-hour, this being the average of the whole of the trials over periods varying from 20 minutes to over six hours. The final six hours of a 7½ hours' continued test gave a total recovery of 6.9 lb. of steam per initial brake horsepower.

Normal load.—The average mean effective pressure from the combustion stroke was 90 lb. per square inch. The steam evaporated by the "waste heat" gave 14 lb. per square inch mean effective pressure on every return stroke. This is equivalent to $90 + 28 = 118$ lb. per square inch mean effective pressure in a normal four-stroke engine.

Overload.—By admitting additional steam generated by fuel under the boiler, the steam mean effective pressure was raised to 72 lb. per square inch; the total mean effective pressure was therefore equal to $90 + 144 = 234$ lb. per square inch mean effective pressure in a normal four-stroke engine.

The Still engine was first shown at the Aero-Marine Show held in London in April, 1914. Since that exhibition much of development work has been done on the engine.

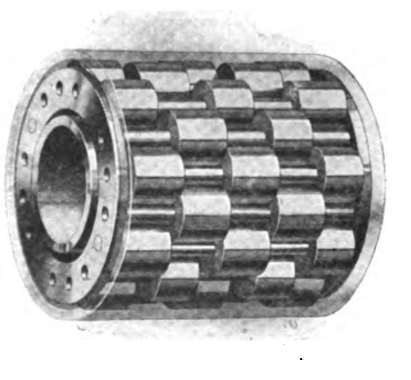
The Hart Roller Bearing

A NEW type of roller bearing with several staggered rows of rollers has been developed by the Hart Roller Bearing Co., East Orange, N. J. In the opinion of the designer of this bearing the great angular distance between adjacent rollers in an ordinary roller bearing with a single row of rollers is the cause of considerable strain on the bearing. This difficulty is overcome in the Hart bearing. Other improvements in the Hart construction are intended to promote the circulation of lubricant, to reduce the friction between the rollers and the cage, and to eliminate tilting of rollers due to variations in the position of the load on them.

In the Hart bearing the rollers are staggered, and two different widths of rollers are used, arranged with the staggered end in assembly and meshed, so that the entire surfaces of the shaft and the outer casing are covered. The rollers are mounted on alignment shafts supported at the end by retainer rings, in which they revolve freely.

The staggered arrangement of the rollers results in a reduction of the angular distance between adjacent lines of contact, which is claimed to reduce the strain to which the bearing rings are subjected. It also provides space for free circulation of oil or grease.

The Hart bearing can be arranged for operation in either a horizontal or a vertical plane, without any tendency to dragging due to frictional resistance between the rollers and cage, it is claimed. The end of any roller which is lightly loaded is free to rotate independently of the heavily loaded end. The result is a differential movement between individual sctions of a given roller, and the objectionable features of eccentric loading are thus overcome.



Hart roller bearings

It is claimed that the distinctive feature of the Hart roller bearing — its staggered and meshed roller arrangement—gives the bearing a greater load capacity than that of other bearings. The rollers are made of chrome-vanadium steel, and are carefully heat-treated. All parts of the bearing are accurately machined and ground. These bearings are designed for both light and heavy duty purposes, where radial bearing loads have to be supported. They are suited for use on trucks, farm tractors, jackshafts, marine shafts, line shafts, etc.

WRAPPING cross-grained struts with cotton tape according to standard methods has no appreciable effect on their strength. It is doubtful if any other methods of wrapping, such as cording, would increase the strength properties very greatly. There is also the probability that any wrapping or covering will be loosened by weather changes.

It is believed that canvas, tape or cord covering is of less value than the same volume of wood.

Farm Tractor Design

PART II

A Practical Example of Calculations Preceding the Design of a Tractor—Data Useful to the Tractor Engineer

By Joseph Jandasek, M. E., E. E.

IN plowing one acre of land the tractor travels a definite number of miles, depending on the number of bottoms and the width of each, as follows:

Plows	One 8-in.	One 10-in.	One 12-in.	One 14-in.
Miles	12.2	9.9	8.2	7
Plows	One 16-in.	Two 14-in.	Three 14-in.	
Miles	3.5	3.5	2.33	

A tractor pulling two 14-in. plows at a speed of 3½ m.p.h. plows just as much as a machine pulling three 14-in. plows at a speed of 2.33 m.p.h., viz., one acre per hour.

Acreage Per Mile Travel with Various Plowing Widths in Feet

Width	1	4	5	6	8	10
Acres	0.121	0.484	0.605	0.726	0.968	1.211

A strip 1 ft. wide and 43,560 ft. or 8.25 miles long equals one acre. A strip 99 in. wide and 1 mile long equals 43,560 sq. ft. or one acre.

What a two-plow tractor can accomplish in 8 hours' work at 2½ m.p.h. (no time being allowed for stops, though, of course, this amounts to a great percentage in some cases) is given herewith:

Plowing, two 14-in. plows.................. 5.5 acres
Discing, 16-disk, 8 ft. wide disk harrow......20 acres
Harrowing, 3-section harrow, 5 ft. wide each..35 acres
Drilling, one 12 x 8—8-ft. drill..............20 acres
Harvesting corn, one corn binder............ 9.5 acres
Harvesting grain, one 8-ft. grain binder......20 acres
Mowing, two 5-ft. mowers...................24 acres
Hay loading, one 8-ft. rake loader and picks up a 20-ton load ....13 acres
Planting corn, two planters, 40-in. rows......32 acres
42-in. rows......33.5 acres
44-in. rows......35 acres
Cultivating corn, one double-row cultivator,
40-in. rows ....16 acres
42-in. rows ....16.8 acres
44-in. rows ....17.6 acres

Table I—Speeds and Drawbar Pulls

Miles per Hour	Feet per Minute	Pull in Lbs. per 1 H.P.
1	88	375
1¾	154	214
2	176	187
2¼	198	166
2½	220	150
2¾	242	136
3	264	125
3¼	286	115
3½	308	107
3¾	330	100
4	352	93
4½	396	83
5	440	75
5½	484	69
6	528	63
7	617	53
8	705	47

Table II—Wheel Diameters, Speeds of Revolution and Miles Per Hour

Miles per Hour	Wheel Diameter in Inches					
	36	42	48	52	54	56
1	9.3	8	7.0	6.4	6.2	6.0
2	18.7	16	14.0	13.0	12.4	12.0
2¼	21.0	18	15.7	14.5	14.0	13.5
2½	23.4	20	17.5	16.2	15.5	15.0
2¾	25.7	22	19.2	17.7	17.0	16.5
3	28.0	24	21.0	19.5	18.6	18.0
3¼	30.4	26	22.7	21.0	20.2	19.5
3½	32.7	28	24.5	22.5	21.7	21.0
4	37.4	32	28.0	25.7	24.8	24.0
5	46.8	40	35.0	32.2	31.0	30.0
6	56.0	48	42.0	38.7	37.2	36.0
7	65.4	56	49.0	45.0	43.4	42.0
8	74.8	64	56.0	51.6	49.6	48.0

Table III—Acres Plowed in 10 Hours at Various Speeds (No Time Allowed for Stops)

Miles per pound	One 16-in.	Two 12-in.	Two 14-in.	Three 14-in.
1¾	2.8	4.2	4.9	7.4
2	3.2	4.8	5.6	8.4
2¼	3.6	5.5	6.3	9.5
2½	4.0	6.0	7.0	10.5
2¾	4.4	6.6	7.7	11.5
3	4.8	7.2	8.4	12.7
3½	5.6	8.5	9.8	14.8

Practical Calculations

The following are taken as requirements: We have to build a tractor capable of pulling three 14-in. plows, climbing a gradient up to 10 per cent in soils with ground resistance up to 15 per cent, equipped with two driving wheels in the rear and two front wheels for steering, with three speeds forward and one reverse, a low speed of 2 m.p.h., a plowing speed of 3 m.p.h. and a high speed of 8 m.p.h.

SOLUTION: Since one 14-in. plow requires a pull of 1000 lb., the drawbar pull at plowing speed must be..............................3000 lb.
and the rated pull at plowing speed, $0.80 \times 3000 =$ ....2400 lb.
Since weight = pull at plowing speed, the total weight should be about.....................3000 lb.
The actual weight, however, will probably run a little higher, about.........................3300 lb.

We also have:

Drawbar pull at low speed, equation

(2) $P_l = 1.5W = 4500$ lb.

Ground resistance (3) $t = 0.15$ (for stubble plowing)

grade resistance (5) $g = 0.10$

total rolling resistance $= (t + g)W = 750$ lb.

Drawbar horsepowers

(6) $\text{D.H.P.} = \dfrac{P_r}{375} S_p = 24$ hp. (not considered slippage)

(7) $$\text{B.H.P.} = \frac{P_p + (t+g)W}{375E_t} S_p = 35.3 \text{ hp.}$$

assuming $E_t = 0.84$.

Engine dimensions:

(27) $B = 0.765\sqrt{\text{B.H.P.}}$ (for 4-cylinder 4-cycle gasoline engines, 80 lb. mean effective brake pressure and 900 ft. per min. piston speed) $B = 4.55$ in.

$$L = 1.3B = 5.9 \text{ in.}$$

practically: $4\frac{1}{2} \times 6$

(11) $$N = 6\frac{W_p}{L} = \frac{6 \times 900}{6} = 900 \text{ r.p.m.}$$

Piston displacement: $c = \pi B^2 L$ (for 4 cyl.) $= 382$ cu. in.

$$\text{Checking: B.H.P.} = \frac{B^2LN}{12{,}600}4 = 35 \text{ hp.}$$

$$\text{Torque} = \frac{B^2L_p}{4} = 2420 \text{ in.-lb.}$$

Beltwork (one gearset between engine and pulley) using equation (14):

$$\text{Belt H.P.} = 0.95 \times 35 = 33.2 \text{ hp.}$$

Size of grain separator, 26 in.

Size of pulley:

(15) $$d = \frac{10{,}000}{n_p} (n_p = N = 900) d = 11 \text{ in.}$$

face, $8\frac{1}{2}$ in.

Selecting 48-in. diameter of driving wheels as smallest practical we have

(32) $$n = \frac{S}{D} \quad 336$$

and gear ratio at plowing speed

(30) $$G = \frac{N}{n}, \text{ we obtain:}$$

at 2 m.p.h.....$n = 14$ r.p.m., $g = 64.3$
at 3 m.p.h.....$n = 21$ r.p.m., $g = 42.8$
at 8 m.p.h.....$n = 56$ r.p.m., $g = 16.1$

Checking the pull and drawbar horsepowers:

(38) $$P = \frac{E_tG}{D} \times \frac{Cp}{2\pi} - (t+g)W$$

$$P_p = 2930 \text{ lb.}$$

(40) $$\text{D.H.P.} = \frac{NC4}{\pi 12{,}600} E_t - (t+g)W\frac{S_p}{375} = 23.5 \text{ hp.}$$

$$\text{Efficiency} = \frac{23.5}{35} = 0.67$$

Face of driving wheels,

(43) $$F = \frac{W}{34\sqrt{D}} = 12.4 \text{ in., we will take 12 in.}$$

Selecting a 36-in. diameter for the front wheels (largest possible), we have

(46) $$f = \frac{W}{100\sqrt{D_f}} = 4.9, \text{ we will take 5 in.}$$

Road work, for available pull on road we have

(55) $$P_r = \tfrac{2}{3} W = 2000 \text{ lb.}$$

and for weight which can be hauled on grades up to 10 per cent,

(58) $$W_h = 5P_s = 10{,}000 \text{ lb.}$$

Weight distribution: according to formula (71) $a = 1.5 (6 + 12) + 24 \times 0.25 = a = 33$ in.

(73) Wheelbase $H = 2.5\,a = H = 82$ in.

(74) Tread $A = 2.25\,c = A = 54$ in.

c equals about to R_d.

Weight on front at standstill, using the formula (60):

$$W_f = W\frac{a}{H} = 1210 \text{ lb., or 40 per cent.}$$

$$W_d = 1790 \text{ lb., or 60 per cent.}$$

Weight distribution on level under the following conditions: $P = 1500$ lb. (500 lb. per plow), $h = 17$ in.:

$$a' = \frac{1500}{3000}17 + 24 \times 0.15 = 12.1 \text{ in.}$$

$$a = a' = 33 - 12.1 = 20.9 \text{ in.}$$

$$W'_f = 3000\frac{20.9}{82} = 765 \text{ lb.}$$

$$W'_d = 2235 \text{ lb.}$$

Weight efficiency in this case 74.5 per cent. Weight on front required for side draft,

$$a_s = 1.5 \times 6 = 9 \text{ in.}$$

$$W_s = 3000\frac{9}{82} = 330 \text{ lb.}$$

At what pull will tractor tip over (not considering shocks, inertia of the machine and of the flywheel) when (a) $h = 12$ in., (b) $h = 17$ in.?

(a) $$33 = \frac{P}{3000}12 + 24 \times 0.25$$

$$P = 6750 \text{ lb.}$$

(b) $$33 = \frac{P}{3000}17 + 24 \times 0.25$$

$$P = 4750 \text{ lb.}$$

From the above we can see how important it is to have the drawbar hitch comparatively low when plowing at low speed. Otherwise, there is danger that the tractor will tip over.

Table IV—Calculated Data of Different Size Tractors

Calculated in the same way as the foregoing practical example, with the following assumptions: All engines of the 4-cylinder 4-cycle gasoline type: $P_e = W$; $p = 80$ lb.; $V_p = 900$ ft. p. m.; $t + g = 0.25$ lb.; $E_t = 0.84$; $E_b = 0.95$; $n_p = N$; $i = 17$ lb.; $d = 1$ in.

	Bore and Stroke	C	N, r.p.m.	B.HP.	T	D.HP.	Belt, HP.	Size of Thresher	Size of Pulley	Dimensions of Rear Wheels	P, 2 m.p.h.	P, 3 m.p.h.	P, 6 m.p.h.	No. of Plows	G, 2 m.p.h.	G, 3 m.p.h.	G, 6 m.p.h.	Acres Plowed in 8 Hrs. at 3 m.p.h.	
1	3 x4	113	1350	15.4	720	10.3	14.6	....	7½x5½	42x 6	1930	1290	645	1—14 in.	84.5	56.4	28.2	3.4	1
2	3⅛x4½	138	1200	16.7	878	11.2	15.9	....	8¼x6½	42x 7	2100	1400	700	1—16 in.	75.0	50.0	25.0	3.8	2
3	3¼x4½	150	1200	18.0	955	12.1	17.1	....	8¼x6½	42x 7	2270	1510	755	1—16 in.	75.0	50.0	25.0	3.8	3
4	3½x5	192	1080	21.0	1220	14.1	20.0	....	9¼x6½	48x 8	2640	1760	880	2—12 in.	77.0	51.4	25.7	5.8	4
5	3¾x5¼	232	1029	24.0	1480	16.1	22.8	18	9¾x7½	48x 9	3020	2000	1000	2—14 in.	73.5	49.0	24.5	6.7	5
6	4 x5	251	1080	27.4	1600	18.4	26.0	22	9¼x7½	48x10	3450	2300	1150	2—14 in.	77.0	51.4	25.7	6.7	6
7	4 x5½	276	982	27.4	1755	18.4	26.0	22	10 x7½	48x10	3450	2300	1150	2—14 in.	70.0	46.6	23.3	6.7	7
8	4 x6	302	900	27.4	1920	18.4	26.0	22	11 x7½	48x10	3450	2300	1150	2—14 in.	64.3	42.8	21.4	6.7	8
9	4¼x5½	311	982	30.8	1980	20.7	29.2	24	10 x7½	48x11	3880	2580	1290	3—12 in.	70.0	46.6	23.3	8.6	9
10	4¼x6	340	900	30.8	2160	20.7	29.2	24	11 x7½	48x11	3880	2580	1290	3—12 in.	64.3	42.8	21.4	8.6	10
11	4½x6	381	900	34.6	2425	23.2	32.8	26	11 x8½	48x12	4350	2900	1450	3—14 in.	64.3	42.8	21.4	10.2	11
12	4½x6¾	428	800	34.6	2720	23.2	32.7	26	12½x8½	48x12	4350	2900	1450	3—14 in.	57.0	38.0	19.0	10.2	12
13	4¾x6	425	900	38.5	2705	25.8	36.6	28	11 x8½	54x13	4830	3220	1610	3—14 in.	75.0	50.0	25.0	10.2	13
14	4¾x6¾	476	800	38.5	3030	25.8	36.6	28	12½x8½	54x13	4830	3220	1610	3—14 in.	66.6	44.5	22.3	10.2	14
15	5 x6½	510	831	42.7	3245	28.7	40.5	30	12 x9½	54x14	5380	3580	1790	4—14 in.	69.3	46.3	23.2	13.4	15

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, June 19, 1919 No. 25

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
Clyde Jennings, Managing Editor
P. M. Heldt Sydney Oxberry
DETROIT OFFICE WASHINGTON OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address .... Autoland, New York
Long Distance Telephone .... 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico .... One Year, $3.00
Canada .... One Year, 5.00
Foreign Countries .... One Year, 6.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.
Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.
Member of the Audit Bureau of Circulations.
Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Let Us Have Free Discussions

THE annual summer meeting of the Society of Automotive Engineers will soon be under way. Ottawa Beach will be the Mecca of hundreds of engineers in this industry. Others allied with the industry in such a way as to make their experience invaluable will also be present.

A number of important papers are going to be presented for discussion at this meeting. Let them be discussed freely. If there has been any criticism of S. A. E. meetings in the past, it has been that there has been inadequate discussion. Papers have been read and while many have been eager to discuss them, the time was so limited that this was not possible.

This year a more open program has been adopted with the result that there will be more time for discussion. Let the members use it to advantage in bringing out the full meaning and value of these papers.

The Non-Stop Trans-Ocean Flight

ANOTHER milestone in the history of mechanical flight was passed last Sunday when the two British aviators Alcock and Brown succeeded in crossing the Atlantic Ocean in an airplane without an intermediate landing. It was a fine mechanical performance and a fine piece of sportsmanship. Alcock and Brown took long chances. Luck was with them and they won. They are entitled to all the credit which naturally is due to the first crew successfully to cross the ocean in a single stage.

From the details of the flight, the machines, etc., published elsewhere in this issue, it is apparent that Alcock surrounded himself with more safeguards than did Hawker, and this no doubt was one of the reasons for his success. In the first place, Alcock had two engines instead of a single one and therefore did not have all his eggs in one basket, as it were, though according to all accounts both of his engines ran perfectly throughout the trip. Secondly, he seems to have had a materially greater fuel reserve, which would have been a great help had wind and weather been at all unfavorable. As it turned out, the wind throughout the trip seems to have been very favorable, since the maximum speed claimed for the Vickers is only a little over 100 m. p. h. and the plan was to throttle the machine to 90 m. p. h. for the sake of reducing strains and minimizing the fuel consumption. Actually an average speed of 121 m. p. h. was maintained, which shows an average favorable wind of over 30 m. p. h. for the whole trip, if the intention of flying at 90 m. p. h. relative to the air was adhered to.

Mention of the favorable conditions is not made here to detract from the achievement of the intrepid aviators. In fact, the good weather conditions under which the trip was achieved bear testimony to their perspicuity, for it is one of the problems of a transatlantic flight to start when the weather promises to be favorable for the approximate length of time required for the trip.

The great flight has been achieved and will be recorded in history as a memorable event. It is reported that some of the other contestants who are still waiting in Newfoundland for a chance to start the trip will try to better Alcock's time. But with the *Daily Mail* prize won and the ocean once crossed in the air, much of the incentive for the hazardous trip has been eliminated. An improvement on Alcock's time is not only going to be a very difficult task but would mean very little in the way of furthering commercial aviation. What would be of great importance in this connection would be a reduction of the chances of non-success or the presentation of convincing proof that these chances are small when the proper precautions are taken. A succession of flights might have both these desirable results and the aircraft industries of the world may consider the lessons to be learned and the propaganda to be achieved worth the cost of renewed attempts.

Super-Induction in Commercial Engines

IN the past, engine development has been along the lines of greater flexibility, more silent operation and increased power in proportion to weight or displacement volume. In all of these respects the automobile engine has attained a very high standard. Little attention has yet been given to the problem of improving the fuel economy of the engine and it is obvious that under present conditions fuel economy is a very important characteristic. While the achievements in engine design in regard to flexibility, silence and high weight efficiency are highly valued, it may be necessary in the future to sacrifice some of the progress made along these lines in order to increase the fuel economy or make possible the use of cheaper fuels than the present motor gasoline. At any rate, any new design of engine will be judged very largely on the basis of its fuel economy.

It is for this reason that not much can be expected from super-induction engines in which the working cylinder is filled with charge to a pressure above atmospheric. Such an engine may be justified for war plane service where cost is a negligible factor and maximum speed counts for everything. But it is not a commercial possibility in an age where fuel conservation is one of the great needs.

A gasoline engine of the conventional four stroke type receiving more than a normal charge of explosive mixture works under substantially the same conditions as a steam engine with late cut-off. Both will develop abnormal power at the expense of economy. The chief reason for the decreased economy in the gasoline engine is that at the end of the stroke, since there is a great deal more burnt gas in the cylinder, the pressure of the gases—that is, the exhaust pressure—is much higher, and much more energy is thrown away in the exhaust. It is a fundamental principle of heat engines that the efficiency depends upon the initial and final temperatures of the expanding charge, and if the final temperature of the charge is raised the efficiency is lowered. A higher exhaust pressure means a higher final temperature.

If the fuel situation becomes sufficiently acute we may even see engines built with sub-normal induction so as to gain the advantage of expansion practically down to atmospheric pressure. This could be done by closing the inlet valves before the end of the inlet stroke. The compression space would, of course, have to be reduced so as to obtain full compression with a partial charge, as the compression has a strong influence on the efficiency. In a conventional four stroke engine the exhaust pressure under full load is about 50 lb. per square inch gage, and by farther expanding the gas considerable additional energy can be recovered. But this end is attained at the expense of some loss in the maximum output from an engine of given size.

Develop Foreign Parcel Post

AN extensive foreign parcel post system equal in rates and privileges with those of other nations is invaluable in the development of American export trade. The parcel post is the battery of foreign business. It carries the spark of interest in catalogs and other trade literature. It lights the way to big export trade and works constantly after big trade is started, connecting the importer and exporter when small parts and supplies are needed.

The service must be equal to that enjoyed by our competitors. So long as American manufacturers must pay higher rates and meet unreasonable regulations abroad, our parcel post, like the battery, is undercharged and useless. American shippers can not compete for trade in India so long as British makers can ship an 11-pound package to Calcutta for 72 cents, while the American pays $5.40. They can not sell in Brazil or Argentina when the customs brokers' fees and delivery charges are in excess of the worth of the parcel. They might as well try to start with a dead battery as to compete with such handicaps.

Frequently exporters encounter difficulties in the parcel post abroad which our authorities are unaware of until they are brought to their attention. Exporters encountering such difficulties will find the postal authorities keenly appreciative of specific examples of wrongs that may be righted. Foreign parcel post problems sent to the Second Assistant Postmaster General will meet with prompt attention.

Good Roads Duties

IT is up to everyone in any way connected with the automotive industry to stand behind the good roads movement which is sweeping throughout the country in order that it may be kept moving in the right direction.

The development of roads within the next few years is vital to this industry. Every mile of new road built through the rural districts creates prospects for trucks, automobiles and tractor sales.

Parts manufacturers are just as much interested in the good roads movement as the vehicle manufacturers. Just because a manufacturer is making jacks, spark plugs, wrenches, or axles is no reason why he should let the passenger car, truck or tractor manufacturer do the work.

Millions have been appropriated by various states for road construction this year. The big task now is to see that these millions are expended in a way to encourage future activities. An active interest should be maintained by those interested in watching the expenditure of the money. Do not let these funds become side tracked or misused, but concentrate them in such a way as to get the most and best roads for the money expended.

By united action, the endorsement for good roads can be made so strong that no one could afford to ignore it, and bear in mind that the manufacturer of multiple spindle drills, artificial leather, porcelain and any other line of wares in just as vitally interested as the automobile manufacturer.

Latest News of the

Overland Factory Is Back in Production

4,000 Return to Work—Plant Under Government Protection—Returned Workers Not Molested

TOLEDO, OHIO, June 17—All departments of the Willys-Overland plant are running to-day for the first time since June 3, when rioting caused the company to suspend operations. Approximately 4000 men are back at work. No cars are being turned out, and it may be 2 weeks before the first machines are completed. In some of the departments almost full crews are on the job, while in others work is being carried on by skeleton organizations.

The plant is operating under the protection of the United States District Court and is guarded by 270 special deputy marshals, as well as hundreds of factory guards, soldiers and policemen. The plant opened last Thursday and there has been no violence, although several arrests have been made for contempt of court. The union has pickets on all gates. They pass out cards stating their case and asking those who pass them not to enter, but there is no disorder.

Clarence A. Earl, vice-president and general manager of the Willys-Overland plant, said that petitions will be filed before Judge Killets in the District Court to-morrow, asking the court to make the injunction under which the factory is now operating permanent. This injunction limits picketing and gives the company full government protection.

Earl's Statement

Vice-president Earl said to-day: "Our plant is now in operation in all departments. We are getting under way as rapidly as possible for an increase to full production. The time for talk is over. It is time the company and its employees got back to work.

"The number of men who came to work Monday was greater than we expected. With continued excellent protection there is no reason why any man who wants to work should stay at home. We have extended a cordial welcome to all desirable employees, and we wish to reiterate that all such employees are welcome and are invited to return.

"But, in order that no worker may be misled, it is important that every employee understand clearly that we shall be obliged, in order to maintain balanced production and carry out our program, to fill with other workers the places of those who do not return promptly.

"Men who think for themselves have known from the start that the company's position has been not only fair, but extremely liberal. This strike has been one of the most unfair impositions ever imposed upon a group of fair-minded workmen. It has from the beginning been clearly a case of the radical minority intimidating the majority. We have now, and have had from the beginning, unbounded faith in the loyalty of the large majority of our employees, and we sympathize with those who have been misled."

—

AERIAL NAVIGATION IN BRAZIL

WASHINGTON, June 13—The Handley-Page Co., London, England, has secured concessions to operate airplanes in Brazil. The concession is for ten years but does not give exclusive monopolies on privileges. It further provides that within two years the Government may demand that the pilots be Brazilian citizens, and that the machines must be registered with the Inspector of Navigation.

The Handley-Page Co. will inaugurate an aerial line between Buenos Aires and Pernambuco and will use machines of 3000 hp. and capable of transporting 7700 lb. at an average speed of 112 kilometers per hour. It is expected that the voyage between Buenos Aires and Pernambuco will be made in three days with stops at Porto Alegre and Rio de Janeiro. The planes will travel by day only and the passengers will stop at night in hotels to be operated by the company. It is expected the service will start within six months. The airships will have a capacity for 12 passengers, with baggage, and one ton of freight.

—

RAINIER FOREIGN CONNECTIONS

FLUSHING N. Y., June 13—The export department of the Rainier Motor Corp. will be represented in Australia and New Zealand by the New York Oversea Co., New York City; in Norway by Haller, Kopsland & Co., Christiania, and in Greece by the Youroveta Home & Foreign Trade Co., New York City.

—

25,000 DODGES BEHIND ORDERS

DETROIT, June 16—Dodge Brothers are 25,000 cars behind orders. Production is between 450 and 500 cars daily. There are several trucks in use in Detroit with Dodge chassis. The company denies that it has any intention of going into the truck manufacturing business, although there has been a rumor to that effect here.

French Accuse A. E. F. of Destroying Vehicles

Burn Army Material to Procure Scrap for Sale According to Government Contract

PARIS, June 18 (*Special Cable*)—A violent storm of protest has been raging in the French press around the allegation that the American army is burning complete cars and destroying motorcycles and tanks at Romorantin, because of the refusal of the French Government to allow these vehicles to be disposed of in France.

The truth of the matter is that the American army automobile organizations are now cleaning up with a view of quick return to America. Under the agreement with the French Government, the Army is permitted to sell scrap material but must not allow complete vehicles to get on the market.

Many of the cars in stock have been through the war and are in such condition that they are not worth shipping home. The bodies of these cars are, of course, composed of wood and metal, and to release the metal so that it can be sold as scrap, the bodies have been burned. To have separated the metal by other means would have been a waste of labor. Partially wrecked motorcycles and tanks were included in this burning.

Later is was found that the French junk dealers had recovered entire frames from this scrap and were putting these on the market as such. This was regarded as a violation of the order that only scrap should be sold. To meet this condition, an order has been given that a Holt caterpillar tractor shall be run over these fire ruins before the scrap is sold.

French newspapers have obtained pictures of this tractor breaking up the scrap motorcycles and are using them as proof that the American army is wilfully destroying good vehicles.

—

FORDSON REDUCED $135

DETROIT, June 16—Henry Ford & Son is wiring all distributers of a reduction of $135 in the price of the Fordson tractor. The new price, effective at once, is $750. The old price was $885. The price to the distributer is $600 and he turns it over to the dealer at $635.

The Fordson tractor plant is now getting back into heavy production. Approximately 100 machines are being completed daily. A carrier system similar to the one in the Ford Motor Co. plant at Highland park is being installed.

Automotive Industries

Sale of British War Vehicles Begins

High Prices Are Paid for 300 Motorcycles at Auction—Trucks Next

LONDON, ENGLAND, June 3—The first of the Government sales of war vehicles has been held in the Royal Agricultural Hall, Islington, and 300 motorcycles were disposed of at amazing prices. The entire sale was by auction. Thirty thousand trucks and hundreds of cycles will be sold in a series of auctions.

Many of the cycles offered at this sale were in bad condition. The first lots offered had been in service, and in many cases handle bars and wheels were missing and often cylinders were gone.

Solo cycles that were more like scrap than vehicles brought an average price of $150. Damaged cycles with side cars attached brought $210 to $350.

Douglas motorcycles, still in crates and unused, ranged in price from $383 to $650. These cycles have twin horizontal opposed cylinder engines.

The Board of Trade has announced an additional ruling for the import of American cars. This is in behalf of the importers not established in 1913, and who have no basis of apportionment under existing regulations. These firms are to be permitted cars to a number to be agreed upon by all members of the Automobile Section of the American Chamber of Commerce. Licenses will be in force until Sept. 1, when revision will be made.

AIRCRAFT TOOLS FOR SALE

WASHINGTON, June 14—Aircraft production machine tools valued at $11,000,000 are available for sale by the War Department. Terms and time of sale have not yet been announced. It is expected that some of these tools will be sold in Europe.

NO CARS TO ARMY OFFICERS

WASHINGTON, June 16—No passenger cars will be sold by the War Department supply to army officers, as a result of a ruling made here to-day, following requests of officers to purchase some of the non-standard cars owned by the War Department. The War Department issued rulings against such sales.

NAVY GETS HISPANO-SUIZAS

WASHINGTON, June 13—The Air Service has transferred to the Navy Department 50 500-hp. Hispano-Suiza engines and spare parts for replacement, according to an announcement of the War Department. The Navy Department acquired the engines and parts at their actual cost to the War Department, which was $227,000. These engines were purchased by the War Department to equip bombing planes.

CODE REGULATING ACETYLENE

MILWAUKEE, June 16—To assist in the work of framing a new code on acetylene gas hazards to promote safety in the use of the process in all its phases, the Industrial Commission of Wisconsin has appointed the following experts as members of an advisory committee: Sidney J. Williams, secretary, National Safety Council, Chicago; P. D. Estes, Chicago, U. S. Bureau of Explosives; W. J. Fairbairn, secretary, Metal Trades and Founders' Association, Milwaukee; Jerry Sullivan, Milwaukee, representing Wisconsin Inspection Bureau; Julius P. Heil, The Heil Co., Milwaukee, representing manufacturers maintaining acetylene gas producer plants; Frank Ohde, Milwaukee, Wisconsin Federation of Labor; Prof. O. L. Kowallke, University of Wisconsin; M. A. Edger, boiler inspector, Industrial Commission, Milwaukee office. Mr. Edger is secretary of the committee.

PONTIAC SPRING REBUILDING

PONTIAC, June 11—The Pontiac Spring Works, a unit of the Standard Parts Co., Cleveland, which was destroyed by fire last March, will be rebuilt. Work will start within three weeks. The building will be brick and steel construction, 186 x 100 ft. A 2-story office building 63 x 87 ft. will also be built. The new plant will cost approximately $100,000. The new unit will house the forge department. The company is employing 300 men and expects to increase to 800.

CHEMICAL CO. IN CANADA

MARIETTA, OHIO, June 14—The Northwestern Chemical Co. opened a factory in Montreal on June 1, to take care of its Canadian business.

DIVIDENDS DECLARED

Michigan Drop Forge Co., Pontiac, monthly dividend of 15 cents a share on common stock, payable July 1 to stockholders of record June 15. An extra dividend of 10 cents a share has been declared payable on same terms.

Reo Motor Car Co., Lansing, regular quarterly dividend, 2½ per cent on common stock, payable July 1 to stockholders of record June 15.

95 Per Cent of Claims Adjusted in Detroit

Aircraft Contracts Valued at $50,000,000—75 Per Cent Ordnance Claims Settled

DETROIT, June 16—Ninety-five per cent of all claims before the adjustment officials of the Bureau of Aircraft Production have been settled. In the Detroit district 75 per cent of the ordnance claims have been settled. All of those remaining are in the process of adjustment, but it may be August 1 before final payment is made.

It was stated to-day that Fisher Body, Wilson Body, Packard, Lincoln, General Motors, Cadillac, Ford Motor, and all other big claims, with the exception of Willys-Overland, had been approved at Washington and paid. The Willys-Overland claim is delayed by incomplete documents, consequent on distractions due to labor troubles. Adjustment is expected within a few days. No figures are given out here on any of the claims.

The claims board of the Bureau of Aircraft Production did not handle as much cash as it thought it would. It was estimated by aircraft officials that at least $300,000,000 would be paid out to cover this district. Not including building and construction, claims which were handled by another board, payment of claims due to cancellation was approximately $60,000,000. Building, construction and equipment claims, which were settled in Washington, totaled approximately $50,000,000, aircraft officials estimated.

There were approximately 800 aircraft contracts in the Detroit district. Of this number, 50 were prime contract claims, the rest sub-contract. The total completed value of all aircraft contracts here was $500,000,000.

The big problem now before both boards is the disposal of material. Separate departments have been established for this work. Machines, equipment and material on hand will run high into the millions. An inventory is being taken. A great portion of this material is of great value. Some of it is worthless. Officials say it may take a year before all material is disposed of.

The Aircraft Board is moving from its offices in the Ford Service Building to the new Saxon plant, which the government leased at the outbreak of the war as a supply depot. It is now being converted into a warehouse for machines and material. The lease runs almost a year.

European Demand Is for Low and Medium Priced Cars

C. C. Hanch, in Report to N. A. C. C., Sees Big Market There If Restrictions Pass

War Departments in Those Countries Not Selling Equipment to Public

NEW YORK, June 16—Europe (without restrictions) is considered by C. C. Hanch, secretary of the National Automobile Chamber of Commerce, the greatest market for automotive apparatus outside North America, according to his report to the N. A. C. C. after his investigation of conditions in Great Britain, France and Italy for four months.

The greatest market in these countries will be for low priced and medium priced cars, such as four-cylinder types at $1,200, or less, and six-cylinder types at $1,600, or less, with a limited demand for high priced American cars, much the same as there is a limited demand for high priced European cars in America.

The possibilities of these countries for absorbing motor cars cannot be calculated entirely on a population basis, as the consensus of opinion is that the ratio of car population cannot be so high in European countries as in America. Notwithstanding the fact that comparisons may not be of value, Mr. Hanch has compiled figures on several of the European countries which are of interest.

Country	Population	Number of Cars	Car-Population Ratio
Great Britain	45,000,000	200,000	1 to 225
France	40,000,000	100,000	1 to 400
Italy	35,000,000	50 000	1 to 840
Belgium	7,000,000		
Total	127,000,000	350,000	1465

Production in 1918

During 1918 the British manufacturers produced 3937 vehicles consisting of passenger car chassis, military cars, ambulances, etc. Only a very few of the manufacturers were permitted to engage in this manufacture. The practical prohibition of the use of motor cars in England during the war makes it certain that even to-day there are fewer cars in use by civilians than there were in August, 1914.

There is a great deal of money in circulation in Great Britain and a strong demand for motor vehicles of all kinds. It is doubtful whether the British manufacturers can turn out within the next 2 years the number of motor vehicles needed by the public during the next 6 months. According to Mr. Hanch, only two of the British manufacturers of passenger cars are ready to make deliveries in any appreciable quantities.

In France, at the beginning of the war, the 100,000 motor vehicles in use were classified approximately as follows:

Passenger cars for business use	48,512
Passenger cars for general use	42,447
Motor trucks	6,000
Total	96,959

In August, 1914, the French Government requisitioned 40,000 passenger cars and 6000 motor trucks and if we deduct these from the total there remains 50,959 in the hands of the French public.

In addition to this number the French Government is reported to have in its possession 50,000 vehicles. Of these, one-half are in good condition and the remainder must be repaired.

If the 25,000 vehicles in good condition were immediately available for civilian use it would make 75,959 vehicles, and if the remaining 25,000 were repaired and turned over to the public a total of 100,959 would be available, which is approximately the same as in the hands of the public at the beginning of the war. These figures indicate that there should be a strong demand for motor vehicles in France and Mr. Hanch thinks the French manufacturers are over-estimating their ability to meet this demand.

Italian and Belgian Situation

Situations in Italy and Belgium are handled as one in Mr. Hanch's report, as he was not able to get accurate information on the number of vehicles in each country. Assuming that the Belgian vehicles were practically eliminated, the figures largely apply to Italy. The ability of the Belgian factories to cope with conditions has been shown in the recent articles in AUTOMOTIVE INDUSTRIES by W. F. Bradley, who visited these factories.

Mr. Hanch is of the opinion that a considerable field for the sale of motor trucks exists in Europe, especially for medium priced trucks of good quality.

In Great Britain, the total delivery of motor truck chassis for 1918 was 11,244, practically all of which were for military use. To-day the British military authorities hold 82,000 trucks, and it has not been indicated how many of these will be disposed of to the public, but estimates are that 80 per cent could be repaired.

France, at the beginning of the war, had 6000 motor trucks, which number has been very greatly increased by purchases from Italy, Great Britain and the U. S. A. for war uses. Mr. Hanch does not give any estimate as to the number of trucks at present held by the French military authorities or any indication as to what disposition is to be made of them.

Nothing with regard to the Italian truck situation is contained in his report.

BOOSTING NIGHT PRODUCTION

LANSING, Mich., June 17.—The Gier Pressed Steel Co. is increasing its night force and will boost night production. Day production was up to capacity several months ago.

8-Hour Day Brings Strike in France

Shops Closed Following Dispute Over Pay of Piece Workers

PARIS, June 3 (*Special Correspondence*)—A strike was declared yesterday throughout the entire engineering industry of Paris and neighborhood. This comprises all the automobile and aviation factories and affects 150,000 work people.

The cause of dispute is in the application of the 8-hour day. A few weeks ago, an agreement was arrived at between workmen and employers in the engineering trade whereby the 8-hour day should be adopted before the new French law went into effect. It was agreed that there should be no reduction in pay in consequence of the shorter work day. On the other hand, the workers agreed to speed up so that the same output should be obtained with 8 hours labor as with 10.

Some of the factory managers refused to increase piece wages, as they claimed that, the same output being assured, workers on piece would not suffer any loss. The men pointed out that until more modern machinery is adopted, and better shop methods put into force, it is impossible for them to increase the amount of work performed: therefore, the adoption of the 8-hour day is for them equivalent to a reduction in wages.

The men claim that the standard wage for skilled workers in the engineering industry should be 150 francs ($30) a week; semi-skilled laborers claim $26 a week and laborers $22 a week.

It is not so much, however, a question of standard wage which has caused the dispute as the remuneration of piece workers under the 8-hour scheme.

In the automobile and aviation industry, dissatisfaction appears to be greatest at the Renault, Panhard and Farman factories. The majority of the automobile factories around Paris closed yesterday, among those affected being Lorraine-Dietrich, Unic, Clement-Bayard, Darracq, De Dion-Bouton, Hotchkiss, Citroen, Mors, Charron, Saurer, Aries, Hispano-Suiza and Gnome.

In certain individual cases the factory owners have, by explaining the situation to their men, induced them to remain at work. One instance of this is the Delage factory, which, this morning, was working at full speed, although most of the neighboring establishments were closed.

TRANSPORT FACTORY

MOUNT PLEASANT, Mich., June 16—A $175,000 factory will be built for the Transport Truck Co. and is to be completed by the middle of August. It will be of brick construction, with concrete floors and steel sash. It will have a saw-tooth roof. The office will be in the factory proper until a new office building is put up. Work has already started on the new plant.

Peugeot Victory Surprises French

Change of Wheels Made by Thomas Blamed for Defeat of Ballot Cars

PARIS, June 3 (*Special Correspondence*)—There is much surprise in French automobile racing circles at the result of the Indianapoils 500-mile race. It was believed that the struggle would be a close one, but no one here expected that the five year-old Peugeot cars would figure prominently in a contest 500 miles in length. The winner was looked for in one of the four Ballot cars, the new Duesenbergs, or in De Palma's Packard.

There is no doubt that the maximum speed of these cars, which embodied an accumulation of five years' experience and experiment, is much higher than that of the pre-war Peugeots. The new Ballot cars are the latest word in French automobile engineering, and for them to have been beaten seems to implicate poor management at the last moment.

Charles Faroux, who is undoubtedly the most competent French critic, throws all the blame for the Ballot failure on René Thomas. Faroux explains that, owing to wrong information given by Thomas, the cars were sent into the race with too high gear ratio. Thomas cabled for authority to change wheels and tires for a smaller diameter. This was granted for Thomas's car only, and refused for the three others. Notwithstanding this, the wheels on all cars were changed. This brought about considerable tire trouble and, it is believed here, caused the cars to lose the race. Faroux writes on this point as follows:

Asked to See Duplicate Orders

"The thing is so extraordinary that I asked to be allowed to see duplicate copies of the orders given by Ballot to his men. Here is a case of an important manufacturer who has accomplished an unprecedented task by building four special cars in less than 15 weeks. He had the service of Henry, one of the best engineers, who took the trouble to plot the power curve of the motor and to calculate the right gear ratios. All of this is swept away, annihilated, reduced to nothing by reason of the fad of a driver, who needs a strong master over him.

"Fortunately Peugeot saved French honor; or the consequence of the undisciplined Thomas might have been still worse. I affirm that neither Wagner, nor Guyot, nor Bablot would have made such a mistake. But Thomas is terrible. He is his own worst enemy. As a driver he can bear comparison with the best; his daring, his accuracy, his coolness in a race place him in the first class; but he has already lost a number of races by reason of his mania for tinkering at the last moment.

"Three elements are necessary in order to win a race: the manufacturer, the engineer, the driver. Ballot built wonderful cars, which started favorites in the race; Henry has already shown his qualities; Thomas might have been the winner if he had been content to remain a race driver. Personally, I am not surprised. Talking with friends on Saturday regarding this race, I made the following remark:

"'Ballot would certainly be the winner if he had any other team captain than Thomas; but with Thomas there is always the danger of some freak idea at the last minute. Thomas, the race driver, is fine, but I have no confidence in Thomas the mechanic.'

"I have elaborated this point because it is full of lessons for our manufacturers. I have no reason to fear regarding the Ballot cars; they will show their worth on the first occasion. And if, on that date, Thomas is satisfied to stick to his steering wheel, which he handles in a masterly manner, he will doubtless be the winner. It is a debt he owes to his employer."

—

SHELDON ENTERTAINS S. A. E.

WILKES-BARRE, PA., June 17—The Pennsylvania section of the Society of Automotive Engineers was entertained at its annual meeting here on Saturday as guests of the Sheldon Axle & Spring Co. About 60 members of the S. A. E. inspected the Sheldon plant in the morning and were then taken out to dinner. A short meeting was held after the dinner, at which the by-laws of the main section were unanimously adopted and the results of the election of new officers announced as follows: Chairman, I. K. Brombaugh, Autocar Co., Ardmore, Pa., succeeding C. Mussleman; secretary, G. W. Smith, Victor Talking Machine Co., succeeding H. E. Rice, and treasurer, William H. Sackman, Light Foundry & Manufacturing Co., succeeding George Newkirk.

—

CASE AGAINST PREST-O-LITE

WASHINGTON, June 14—The chief allegation in the complaint filed last week by the Federal Trade Commission against the Prest-O-Lite Co., Indianapolis, concerns the deposit for steel cylinders required from the company's dealers. The company must file answer by July 24 to the charge that its practices are in restraint of trade under the Clayton Anti-Trust Act.

The complaint alleges that the Prest-O-Lite Co. makes contracts with purchasers provided that the buyer will make deposit on the steel cylinders in which the gas is delivered and that, when the cylinders are exhausted, they must be returned to the Prest-O-Lite Co., which agrees to supply other filled cylinders for the additional price of gas contained, but does not provide for any refund to the buyer of his original deposit on the cylinders except where the Prest-O-Lite Co. "unreasonably refuses" to issue any further cylinders to the purchaser.

These operations, the Commission alleges result in loss to the purchaser of the cash deposits in the event that he does not require further acetylene gas or buys it from a competing manufacturer.

The complaint also alleges that the statement in the contract to the effect that it is not practical or safe to refill the cylinders through any company other than the Prest-O-Lite Co. is a subterfuge to obtain monopoly. The cylinders, the Commission states, can be and have been safely refilled by other concerns.

Program of S. A. E. Summer Meeting

Technical Sessions in Mornings—Wireless Telephony and Gas Warfare Subjects for Evening

NEW YORK, June 18—The New York members of the Society of Automotive Engineers will leave for Ottawa Beach, Mich., in a special car attached to the Wolverine, over the New York Central at 5 p. m., Sunday. There is promise of a large attendance. The arrangements at Ottawa Beach are working out well and there is every prospect of an excellent meeting. The program to date, with the social features eliminated, follows:

Monday, 10 a.m.—Standards Committee meeting. All members invited. The following Divisions are expected to present reports: Aeronautic, electrical equipment, iron and steel, lighting, miscellaneous, motorcycle, shaft fittings, stationary engine and lighting plants, tire and rim, tractor, transmission and truck standards. 2 p.m.—Continuation of Standards Committee meeting. 4 p.m.—Meeting of Council. 8 p.m., Business Session—Presidential address, treasurer's report, report of Membership Committee, election of Nominating Committee members, report of Meetings Committee, discussion of future policy with respect to parts and accessory exhibits at summer meetings, new business, report of Standards Committee.

Tuesday, 10 a.m., Truck and Fuel Session—"Tests of Truck Axle Worms and Bearings," K. Heindlhofer; "Motor Truck Ability and Its Relation to Trend of Truck Design," L. P. Kalb; "Steel Truck Wheels," P. W. Klinger; "Motor Fuel Problem," Dr. Joseph E. Pogue; "Protective Coatings for Metals," E. T. Birdsall. 8 p.m.—Lecture on Wireless Telephony (to be accompanied by demonstration), E. H. Colpitts, assistant chief engineer, Western Electric Co.

Wednesday, 9:30 a.m., Passenger Car Session—Symposium and discussion on the future passenger car, E. H. Belden, H. M. Crane, L. H. Pomeroy, H. C. Snow, W. B. Stout: "Liberty Engine Materials and Their Use in Automotive Industry," Harold F. Wood; "Load Carrying Possibilities of Angular Contact Type Ball Bearings," F. C. Goldsmith. 8:30 p.m.—Talk on Gas Warfare by Dr. John Johnston, Professor of Chemistry, Yale University.

Thursday, 9:30 a.m., Army and Navy Session—"Development of 'NC' boats and Other Naval Aircraft," Commander J. C. Hunsaker, U. S. N.; Future Relations between the automotive industry and various army departments are to be outlined by representatives of the Department of Military Aeronautics, the Ordnance Department and the Motor Transport Corps. 2 p.m.—Exhibits of tanks and other automotive war equipment in action. 8 p.m.—Talk on experiences with A. E. F. and the armistice commission (to be illustrated by motion pictures), Lieut.-Col. A. J. Slade, U. S. A.

Friday, 9:30 a.m., Engine and Tractor Session—"Working Processes of Future Combustion Engines," Prof. C. A. Norman; "Relation of Tractor to Implement," Prof. E. A. White; "Electric Heat Treatment of Steel," H. P. MacDonald.

Reservations to date total 681.

Daniels Urges Aviation Fund

Reduction of Appropriation Calls for Protest from Navy Department Head

WASHINGTON, June 16—The reduction of Naval appropriations from $45,000,000 to $15,000,000 by the House Committee of Naval Affairs is meeting with strenuous objection from Secretary Daniels. He is carrying the fight to the Senate Naval Committee. Secretary Daniels' letter to the Chairman of the Senate Committee states that Great Britain has appropriated $320,000,000 for aviation for the current year for both military and naval purposes, and that the United States Navy should be provided with at least $36,000,000. His letter follows:

"The general board of the Navy, after extended hearings covering the whole field of aviation, recommended a program for the next fiscal year which our experts estimated would require the $45,000,000 originally asked for by me in Congress. I feel very strongly that the figure of $36,000,000 reported by the Senate naval committee during the last session should at least be provided.

"The naval bill as reported to the House has cut the appropriation for Navy aviation to $15,000,000. I deem it my duty to bring to your attention the fact that with this amount Navy aviation will practically 'mark time' during the next year, which should be a year of rapid development, and will be a year of rapid development of this arm of the Navy in countries other than the United States.

"This is sufficiently indicated by the fact that in Great Britain the appropriation for aviation made for the current year amounts in round figures to $320,000,000.

"This includes all aviation for military purposes and should, of course, be compared with the total contemplated appropriations for both Army and Navy in the United States, amounting to something like $30,000,000."

WASHINGTON, June 19—Secretary of the Navy Daniels and naval officers appeared before the Senate Naval Affairs Committee to-day and protested against the reduction of naval appropriations from $45,000,000 to $15,000,000.

Senator Paige, Chairman of the Committee, called a session to-day and stated that he was in favor of restoring the appropriation to at least $36,000,000.

Secretary Daniels declared that the future of the American Navy will be seriously endangered unless sufficient money is provided to keep up with the rapid trend of development in aviation. He stated that plans had been made for a naval aviation force of 563 officers and 4630 men, and a Marine Corps aviation force of 100 officers and 1000 men.

If the appropriation of $15,000,000 is not increased the Marine Corps force would be completely wiped out, and the other organization would be seriously crippled. At present there are 12 naval air stations, four schools and one experiment station, and these will be considerably limited with all experimental work discontinued unless the appropriation is adequate.

MEXICAN PETROLEUM INQUIRY

WASHINGTON, June 14—An official commission from Italy is en route to Mexico to study the Mexican petroleum laws. It is anticipated that other countries will also send delegates.

NO MOTORCYCLE PURCHASE

WASHINGTON, June 14—The purchase of motorcycles for the War Department has been completely discontinued and instructions have been issued to the chiefs of the various bureaus that no more motorcycles are to be purchased without first securing the permission of the Secretary of War.

REDUCE WAR VEHICLE ORDERS

WASHINGTON, June 13—The contracts for motor vehicles placed by the War Department during the war and amounting in all to $416,528,000 on Nov. 11, 1918, were reduced by cancellation or completion to $17,970,000 on May 17. Of the total 67 per cent was cancelled, 29 per cent filled, and 4 per cent still remains on order.

TIN IMPORTS PERMITTED

WASHINGTON, June 17—Importations of pig tin and all metal alloys containing tin, including tin drosses, tin oxides, solder drosses, type metals, antifriction metals, waste metals, and other metals containing tin may now be licensed, according to a ruling of the War Trade Board, subject to the following conditions and limitations: That such licenses will permit the importation only of shipments made from points of origin on and after June 30, 1919; and that such import licenses will not be valid for entry until August, 1919.

TRAILER OWNERS FIGHT BILL

BOSTON, June 16—Owners of trailers are making an active fight on the proposed motor vehicle tax bill reported by the Committee on Roads and Bridges as House Bill 1748

It develops that this bill requires trailers fitted with solid rubber tires to pay the same tax as motor trucks, and that steel tired trailers pay double this tax. A 5-ton rubber tired trailer will be taxed $100 a year if this bill becomes a law and a 5-ton steel tired trailer must pay $200, or 15 per cent of the cost of the trailer annually.

AXLE FOR BENTON HARBOR

BENTON HARBOR, MICH., June 16—The Frederickson Axle Co. has purchased the Cutler warehouse here, where it will locate its plant, employing 40 to 50 men.

Argentina to Amend 1905 Trademark Law

New Bill Will Protect All Trademarks Recognized Through Treaty by U. S.

WASHINGTON, June 16—In order to protect trademarks and commercial names made and signed in Buenos Aires, Argentina, a bill has been introduced into Congress amending the trademark law of 1905 so that any trademark, registered in an international office or bureau, and recognized through treaty by the United States, will be considered a trademark for which application for registration has been filed, and on which the Patent Office can act accordingly.

The bill allows the same privileges as are afforded citizens of the United States on the application for registration of a trademark filed in an international bureau, provided that the application is made within six months of the date of original filing in the foreign country, and has been actually registered by the applicant in the country in which he is located.

Provision is also made to allow any individual to apply for cancellation of a trademark registration whenever he regards himself as being injured by it. Upon such application for cancellation, the Commissioner of Patents is authorized to investigate and withdraw the registration.

There is also a provision that any person who uses a deception in the selling of commodities by the use of a trademark which tends to falsify the origin of the merchandise when it is sold, either interstate or for export, will be liable for damages at the hands of anyone doing business in the locality that is falsely indicated as that of origin.

PATENT SYSTEM CHANGES

WASHINGTON, June 14—The patent committee of the National Research Council has approved proposed legislation to "increase the efficiency of the Patent Office in handling inventions and patents." The program calls for the establishment of a single court of Patent Appeals to take over the appellate jurisdiction now lodged in the nine independent Circuit Courts of Appeal, an increase in the personnel and in the salaries and a change in the law relating to the damages and infringement suits.

FOSTERING HOLLAND TRADE

NEW YORK, June 14—The Commercial Department of the Koninklyk Gezantschap der Nederlanden has been formed recently to foster trade between the United States and Holland, and is in a position to give commercial information about trade between the two countries to American merchants. Further information can be obtained from D. Andreae, Commercial Attaché, Koninklyk Gezantschap der Nederlanden, Washington, D. C.

Clifton Outlines the N. A. C. C. Work

Annual Address of President Shows Co-operation with Other Organizations

NEW YORK, June 16—The annual address of President Charles Clifton of the N. A. C. C., which has just been made public, tells some very interesting facts concerning the activities of the chamber and of the co-operation of the chamber with other automotive organizations.

As to the question of admitting tractor manufacturers to membership, the following paragraph is quoted from the address:

"A number of the tractor manufacturers have expressed the wish that they be admitted to the Chamber so as to take advantage of various departments like patents, traffic, legislative, publicity, etc. We find no uniform feeling among members interviewed in favor of such a plan, but later in the day all members here will be asked to express their thought on it."

There was some discussion, but no poll was taken.

Cross Licensing

The cross licensing agreement as to patents is referred to in the address. Since this address a motion has been filed to dismiss this suit, the attorneys for the Chamber setting forth that the Locomobile suit should be directed against other firms in the agreement and not against the Chamber. Of the suit, Mr. Coffin said:

"After operating successfully for four years, the Cross-Licensing Agreement has been made the subject of a suit by the Locomobile Company of America, which expresses the wish to be relieved of its obligations under it. The whole matter has been placed in the hands of Mr. Frederick P. Fish, who drew up the original Cross-Licensing Agreement. Mr. Riker, vice-president of the Locomobile Company, was a member of the Patents Committee during the formative period of the Cross-Licensing Agreement. The agreement generally has been looked upon as a broad piece of co-operative work, with no objection from any other source. Makers have gone on inventing and putting the results of their inventions into the Cross-Licensing Agreement. A big maker expressed it well the other day when he said that he was glad to take out patents as a protection from outsiders and to put them into the Cross-Licensing Agreement because his company always had at least a year's start on everybody else in their use, while in return they were getting the results of inventions by other parties to the agreement.

"The need for makers to continue inventing and taking out patents is evidenced by the fact that in the Cross-Licensing Agreement are 600 patents, while on file in our Patent Department are 117,000 patents (copies brought from Washington to our office here), all of which affect the automobile industry in some way. When the Attorney General of the United States was passing on the Cross-Licensing Agreement of the Aircraft Manufacturers, he had before him copies of the N. A. C. C. agreement and there never has been a suggestion from him that it was other than a legal document which attempted to lessen litigation. He did not object to a similar agreement, with many additions involving large sums of money, being put into operation by the aircraft manufacturers."

Listing Motor Vehicles as Commodities

Concerning the effort to have motor vehicles listed as commodities, so that the banking paper will be subject to rediscount in Federal Reserve Banks, the address says:

"Some time ago a presentation was made to the Federal Reserve Board with a view to having motor cars and motor trucks classed as marketable staples and the bankers acceptances in connection with them acceptable to the Federal Reserve Banks for rediscount, thus saving one-half to one per cent. While the board was unable to rule favorably on this subject and thus put the motor vehicles in the class with cotton, coffee, wheat and similar commodities, there was highly favorable expression of the importance of the industry, with a definite statement that the ruling did not detract from the worthiness of motor cars as security. Working with some of the western banks, a uniform campaign was started some time ago to insure a higher appreciation by the local banks throughout the country, of the products of our makers, to the end that even better accommodations can be given to dealers than during the past. Our interests lie with dealers and the Chamber's efforts are always directed toward those things which make for the dealer's prosperity."

Co-operation with Other Associations

On the subject of co-operation with other associations, Mr. Coffin says:

"We have co-operated in every way with other organizations in our line, in some cases contributing substantially to the helpful work that they were doing. These contributions include $10,000 to the American Automobile Association, $7,500 to the Society of Automotive Engineers, $5,000 to the National Industrial Conference Board, $1,000 to the Associated Advertising Clubs, $1,000 to the Highways Iudustry Association, $500 to the National Association of Credit Men, and $700 for membership in the U. S. Chamber of Commerce.

"In addition it has been felt that the helpful work of the dealers in New York and Chicago with whom we co-operate warrants their participation in the national shows we hold in these two cities. The dealers in Chicago were strongly opposed to conducting another show, declaring that only a national show brought the desired results for them and for the industry, with similar expressions from many of the dealers in New York. All felt, however, that their co-operation and help warranted their participation, and I know that members generally will agree that the directors have given only a proper recognition of their importance to our industry.

"It has been our pleasure to co-operate during the past year with the National Automobile Dealers' Association, Motor and Accessory Manufacturers, Automotive Jobbers' Association, Society of Automotive Engineers, American Automobile Association, National Traffic Association, Highways Industry Association, National Industries Conference Committee, Associated Advertising Clubs, National Association of Credit Men, and Chamber of Commerce of the U. S., together with a score or more of other organizations, all having interest in the making, selling or using of motor cars."

Menacing Legislation

Mr. Coffin points out that there is great need for legislative work, and declares means should be found to make the automotive interests a common one. He says:

"There is still more or less menacing legislation in the air. We have 6,000,000 owners of motor vehicles and while we have not hesitated even to advocate increased registration fees when the money is put on the roads, we do object to the singling out of our industry for taxes not placed on other users of the highway. We advocate the uniform bill prepared by the Highways Industry Association, the main points of which have been printed and distributed by the American Automobile Association, and which calls for certain limitations as to weights and sizes of vehicles for use on the road, together with proper sizes of tires and proper speeds. We have advocated taxes not in excess of 25c per horse power and 25c per hundred pounds in weight. Our committee has appeared and helped in various states throughout the country where the local associations require assistance. We have supplied literature and experts to give information to the legislators but your directors have never deemed it advisable to contribute financially to such work."

MOTOR VEHICLES RETURNED

WASHINGTON, June 14—The American Expeditionary Forces have been instructed to return all class B 3-ton standardized army trucks to the United States, together with all new truck dump bodies and all Dodges and Cadillacs that are boxed or crated.

The final disposition of these has not yet been determined, but it is anticipated that they will form a part of the permanent equipment of the United States Army. A total of 18,826 class B trucks, 2952 Dodges and 1399 Cadillacs were shipped to France up to the signing of the armistice. Many of these have been destroyed in battle or through wear and tear.

Effort to Reduce Car Taxes Abroad

Situation in Europe as Presented by C. C. Hanch—Gas Problems

NEW YORK, June 16—Interesting comment on the taxes on motor cars in European countries is contained in the report C. C. Hanch read to the National Automobile Chamber of Commerce on his return from a four months' investigating tour in Europe.

The annual taxes in Great Britain are tabulated as follows:

	About
Not over 6½ hp.	$10.50
Over 6½ hp. to 12 hp.	15.75
Over 12 hp. to 16 hp.	21.00
Over 16 hp. to 26 hp.	31.50
Over 26 hp. to 33 hp.	42.00
Over 33 hp. to 40 hp.	52.50
Over 40 hp. to 60 hp.	105.00
Over 60 hp.	210.00

On the subject of running cost Mr. Hanch says:

"Prices of gasoline in England vary from 75 cents to $1 per gallon, according to quality. Of this price until lately the tax has been 24 cents per gallon, but the surtax of 12 cents per gallon has recently been removed, leaving the Government tax of 12 cents per gallon.

Tax in France and Italy

"FRANCE—Purchasers of both new and second-hand cars pay a luxury tax amounting to 10 per cent of the value of the car. The annual or circulation tax is based on horsepower and varies in different places. As an example, the tax on a 15 hp. car varies from $35 to $100 according to locality. The present price of gasoline is $1.08 per gallon, of which 32 cents per gallon is tax. There is also an 80 per cent war profits tax. The prewar price of gasoline in France was 56 cents per gallon, of which 32 cents per gallon was tax.

"ITALY—The annual or circulation tax for an average car is about $120 per year. The tax on gasoline is about $4.60 per quintal, of 220 pounds, or about 12 cents per gallon."

As to efforts to obtain a reduction in taxes, Mr. Hanch says:

"The general Congress of the Inter-Allied Automobile Manufacturers held in Paris on March 5 and 6, 1919, decided that efforts should be made simultaneously in all Allied countries to obtain a reduction of annual taxes and license fees, these efforts to be supported by publicity pointing out among other arguments the following facts:

"That the automobile industry of the allied countries took first place in the intensive production of war supplies.

"That motor transport service rendered to the fighting armies was of the greatest importance.

"That transportation of passengers and materials by motor vehicles is now one of the necessary conditions of modern life.

"That the use of motor vehicles generally and for a long time past has ceased to be a luxury and has become the auxiliary of trade and industry.

"That the proceeds of license fees and taxes should be used for the maintenance and betterment of roads."

Used Passenger Cars Have Fabulous Value in England

Advertisement in London Times Offering Used Cars for Sale at Prices Doubling and Tripling Cost When New—French and Italian Models Included

LONDON, ENGLAND, May 27—Today's London *Times* carries an advertisement offering a number of used passenger cars at prices which are calculated to stagger motoring humanity when compared with the prices at which the same cars were sold when new. The explanation of the enormous increase is found in the fact that England is suffering from a car-famine of unparalleled severity. No passenger cars have been built, except for war service, for over four years, and one of the first military orders issued in August, 1914, commandeered all privately owned cars for army service.

The prices given in the table below have been reduced to dollars from pounds sterling at the current rate of exchange in New York.

*Used Car Price in 1919	Make and Type	Year	Original Price When New
$23,150.00	Rolls-Royce, 5-pass.	1915	$6,250.50
21,992.50	Rolls-Royce, All-weather	1915	6,945.00
20,140.50	Rolls-Royce, 5-pass.	1915	6,250.50
19,677.50	Rolls-Royce, 4-pass.	1914	6,250.50
18,520.00	Rolls-Royce, 5-pass.	1914	6,250,50
18,520.00	Rolls-Royce, All-weather	1914	6,482.00
17,262.50	Rolls-Royce, 5-pass.	1914	6,250.50
16,205.00	Rolls-Royce Coupé	1914	6,945.00
13,890.00	Rolls-Royce	1914	†
12,732.50	Rolls-Royce Sport	1913	6,019.00
11,575.00	Rolls-Royce, 5-pass.	1913	6,109.00
10,417.50	Rolls-Royce, Torpedo	1913	6,109.00
7.176.50	Fiat, Sport	1917	4,630.00
6 829.25	Nazzaro, All-weather	1915	3,935.50
6,019.00	Fiat, 5-pass.	1916	3,472.50
5,845.37	Fiat, Sport	1916	†
5,845.37	Minerva, Landaulet	1913	3,067.37
5,787.50	Fiat, Torpedo	1915	3,472.50
5,787.50	De Dion, All-weather	1915	3,241.00
4,861.50	Minerva, Landaulet	1914	3,067.37
4,167.00	Wolesley, Cabriolet	1913	†
4,051.50	Maudslay, Landaulet	1914	†
4,051.50	Darracq, Landaulet	1916	2,754.85
4,051.50	Oakland, All-weather	1917	†
4,051.50	Germain-Daimler, Sport	1914	3,067.37
3,680.85	Peugeot, Sport	1915	†
3,472.50	Hupmobile, Coupé	1915	2,291.85
3,067.37	King, All-weather	1915	†
2,650.67	Morris-Cowley, Coupé	1916	2,025.63
2,187.67	Calthorpe, Coupé	1917	†

*To arrive at the cost of any of these used cars delivered in the United States, add 45 per cent import duty; also freight and insurance. Possible loss through fluctuation of exchange rate would be another factor for consideration.

†Special models; original prices not obtainable.

DISPOSAL OF WAR VEHICLES

WASHINGTON, June 16—The transfer of the 39,100 surplus motor vehicles to other government departments as approved last week by the Director of Sales of the War Department included 3,600 motorcycles, 5,500 passenger cars and about 30,000 trucks. The Post Office Department will receive 10,064 of these vehicles, the Public Health Service 1,396, and the Bureau of Public Roads, Department of Agriculture, 27,983.

ENGLAND LICENSES 411,791 CARS

LONDON, ENGLAND, May 22—Car licenses in England, as reported including the 6th and 7th issues, in the Board of Trade Journal, total 411,791, which seems to be a fair estimate of all the cars in use at present in the country. Complete figures for the 6th and 7th issues follow:

	6th issue	7th issue
Form 1, Private cars	93,947	
Form 1A, Private cycles	56,309	
New series: 1 and 1A private cars and cycles	76,605	
Form 2, Doctors' cars	12,073	
Form 3, Hackney vehicles	25,827	
Form 4, Commercial vehicles	47,388	37,837
Form 5, Industrial processes	61,805	
Total	373,954	37,837

Allied Control of German Aeronautics

Peace Treaty Provides for Aeronautical Inter-Allied Commission—Restrictions on Trade

WASHINGTON, June 16—Complete control of German aeronautic activities by an Aeronautical Inter-allied Commission is forecast in a copy of the peace treaty which was published in the Congressional Record.

Clauses provide that the armed forces of Germany must not include military or naval air forces, that Germany may maintain a maximum of 100 seaplanes or flying boats up to Oct. 1, 1919, to be used exclusively for searching for submarine mines. These boats may carry one spare engine in addition to the engines installed. No dirigibles shall be kept. Within two months after the signing of the treaty the personnel of the German air forces on land and sea must be demobilized. Up to Oct. 1, 1919, a total organization of 1,000 men may be maintained.

The Allies retain freedom of passage through the air over Germany until after the complete evacuation of German territory by allied troops. Complete prohibition of the manufacture or importation of aircraft or parts including engines is ordered for six months following enforcement of the treaty, and on the coming into force of the treaty all military and naval aeronautical material, excepting that mentioned above, must be delivered to the allies within three months.

This material will include completed airplanes and seaplanes as well as those partly manufactured or assembled, dirigibles completed and partially completed, plans for the manufacture of hydrogen, dirigible sheds and shelters of every kind for aircraft, aircraft engines, nacelles and fuselages, all aeronautical armament, munitions, instruments, wireless and photographic apparatus and cinematograph apparatus for use on aircraft.

The German Government must further extend every aid to the Aeronautical Inter-allied Commission for the execution of these clauses. It will further give every aid to make inventory of the aeronautical material in German territory, to inspect airplane, balloon and engine fixtures and aircraft armament fixtures, to visit all aerodromes, sheds, landing fields, and to authorize, where necessary, removal and delivery of material.

The German government must further furnish the Commission all information and legislative, administrative or other documents which the Commission may consider necessary to insure the complete execution of the air clauses of the treaty and particularly a list of the German air service personnel and of the existing material as well as that in process of manufacture or on order and a list of all establishments engaged in aviation manufacture and of all sheds and landing grounds.

That the export of American automotive products into Germany and German territory will not be prohibited is assured by the clause providing that Germany will not prohibit the importation of any product from any of the allied countries without equally extended restriction to the importation of like products from any other states or foreign countries.

Protection against high and partial tariffs is insured by the clause which prohibits Germany from attaching such duties to products from any of the allied countries in excess of those duties placed on the same goods from any other foreign countries. Furthermore, Germany undertakes to make no discrimination against the commerce of any allied or associated country as compared with the commerce of any other foreign country, either by direct or indirect means, including customs regulations, methods of verification, conditions of payment, etc.

Furthermore, Germany is forbidden to impose any restriction on the exportation of any commodities from her territory to any of the allied countries without placing that same restriction upon the same commodities when exported to any foreign country and grants every privilege in regard to import, export or transport of goods given to any foreign country equal to the allied countries.

Protection against the sale of articles which bear trademarks or descriptions fraudulently is prohibited.

U. S. LOST 357 PLANES

WASHINGTON, June 16—The American Air Service inflicted double the loss upon the Germans which they suffered in airplanes and balloons. A total of 755 enemy planes and 71 balloons were destroyed. The American losses were 357 planes and 43 balloons.

AIR APPROPRIATION OF $13,000,000

WASHINGTON, June 16—Appropriations for the Army Air Service have been placed at $13,000,000 by the House Military Affairs Committee. It is claimed by military officials that this sounds the knell of aviation in the United States because it is insufficient.

AERONAUTICS IN COLLEGES

WASHINGTON, June 14—Aeronautics has been established as one of the optional subjects at several universities in England, according to a trade report, and chairs of aeronautics have been established at the universities of Cambridge and London. Aeronautical scholarships have been instituted. Several English schools have secured airplanes, engines and other equipment for their engineering classes.

TACOMA RACES

TACOMA, WASH., June 14—Eddie Rickenbacker will be official referee July 4 in the events on the speedway here. Louis Chevrolet, Dario Resta, Cliff Durant, Eddie Hearne and Ralph Mulford will take part in the races.

Exports of Tractor Engines During April, 1919

Countries	Number	Value
Belgium	6	$8,461
Denmark	49	48,200
France	542	536,067
Italy	83	164,715
Norway	42	36,689
Spain	10	16,030
England	217	136,154
Ireland	22	23,515
Canada	1,005	842,266
Costa Rica	1	1,685
Honduras	4	9,545
Mexico	67	53,059
Jamaica	2	3,244
Trinidad and Tobago	1	1,744
Cuba	34	27,350
Virgin Islands of United States	1	777
Argentina	100	82,941
Brazil	3	3,570
Chile	1	571
British Guiana	12	15,790
Peru	25	37,026
Venezuela	1	1,326
Other British East Indies (Exc. British India and Sts. Settlements)	2	1,552
Dutch East Indies	...	....
Japan	1	678
Australia	59	68,851
New Zealand	14	15,874
Philippine Islands	...	....
British South Africa	1	369
Total	2,305	$2,138,049

During wartime we exported thousands of tractor engines. Most of these were used in connection with the hauling of heavy field guns. Under post-war conditions figures are well maintained and the engines are being used for farm tractors.

REORGANIZE AIR COMMITTEE

WASHINGTON, June 13—The National Advisory Committee for Aeronautics has been reorganized so that the executive committee will include 6 sub-committees on aerodynamics, power plants for aircraft, materials for aircraft, personnel, buildings and equipment, publications and intelligence and governmental relations.

The committees on aerodynamics, power plants for aircraft and materials for aircraft will attack the various problems relating to these subjects, coordinate research, act as mediums for the exchange of information and conduct laboratory tests.

The committee on personnel, buildings and equipment will initiate projects concerning the erection or alteration of buildings. The publications and intelligence committee will collect and classify knowledge on aeronautics, including the results of research and experimental work done in all parts of the world, supervise the office of Aeronautical Intelligence and the foreign office in Paris.

AIRCRAFT CONTRACTS SETTLED

WASHINGTON, June 16—Contracts with aircraft manufacturers have in great part been settled by the War Department and will all be completed within the next ten days.

CHANGE IN FOREIGN FORD POLICY

LONDON, June 1—The announcement that Sir Percival Perry is retiring as managing director of the Ford interests in the United Kingdom is taken as an indication that there will be a change in the Ford policy on this side. It is believed that the English practices will be made to correspond with those in America.

The British management of the Ford interests has allowed certain picked territories exclusively to a few distributers, leaving it to them to adjust commissions with sub-dealers. This has caused a great deal of dissatisfaction among the smaller dealers as the discounts have ranged from 7½ to 10 per cent for the smaller dealers to as high as 20 to 25 for the big dealers. It is believed that the American Ford organization will take a controlling hand in the management of the selling policy over here.

It is understood that Sir Percival Perry will retain his interest in the Fordson plant so that he will continue to be associated with the Fords.

—

Asher Golden has been appointed by the Compagnie d'Applications Mécaniques, Paris, its exclusive agent in the United States for the sales of RBF bearings and retainers.

Miss Ruth Edwards, who has been treasurer of the Bantam Ball Bearing Co, Bantam, Conn., for the past three years, has resigned her position. She has been with the company for 12 years.

J. W. McCabe, formerly district sales manager of the Chicago Pneumatic Tool Co. at Buffalo, has been made special representative for that company's foreign trade department, and is about to make a trip through the Orient.

George W. Rowell, newspaper man, and formerly secretary and manager of the Upper Peninsula Development Bureau, has been made publicity and advertising manager of the Lloyd Mfg. Co., Menominee, Mich.

S. A. Schaeffer, foundry superintendent of the Fairbanks-Morse Co., Three Rivers, Mich., has resigned to become assistant superintendent of the Clarage Fan Co., Kalamazoo, Mich. He is succeeded by B. C. Page of Spokane, Wash.

F. L. Sanford will be in charge of the New York branch of the Dort Motor Car Co., Flint, which will be opened shortly in the Ehret Building, 58th Street and Broadway. Mr. Sanford was for several years manager of the Studebaker branch in New York.

DOBLE-DETROIT REORGANIZED

DETROIT, June 17—The Doble-Detroit Steam Car Co. is being reorganized. Details of the reorganization will be announced within 2 weeks. The company recently sold its manufacturing plant, but expects to build another. It is expected that the car will be placed on the market this fall. In the meantime the company will continue the manufacture of the Doble-Detroit heating system.

Men of the Industry

Changes in Personnel and Position

BEACHAM LEAVES BARLEY

E. H. Beacham, assistant to A. C. Barley, president of the Barley Motor Car Co., Kalamazoo, Mich., has resigned and gone to Chicago to accept a post with the Waldon W. Shaw Co., operating the Shaw Taxicab Co. and the Yellow Taxicab Co. He has been acting as general sales manager during the past six months. His successor has not been named.

—

H. L. Hall has resigned as branch manager of the Swinehart Tire & Rubber Co., and will return to the Troy Carriage Sunshade Co., with which he was previously connected for eight years. He will take charge of the Chicago office of the Troy Carriage Co. at 20 East Jackson Boulevard.

Charles M. Prendergast, recently general superintendent of the Briscoe Motor Corp., is general superintendent of the Auto Body Co., Lansing. He succeeds Alex Urquhart, who resigned after 18 years of service to become superintendent of the Lansing Body Co.

J. L. Justice, who for the past three years has been zone supervisor for the Maxwell Motor Co., Detroit, resigned to become general sales manager of the National Wire Wheel Works, Inc. He will have his office in the Book Building, Detroit.

C. E. Wilson, formerly of the Westinghouse Electric & Manufacturing Co., has been made manager of the motor equipment division of the Remy Electric Co., and will have charge of engineering and sales with headquarters in Detroit.

GOODYEAR PANAMA OFFICES

AKRON, June 17—The Goodyear Tire & Rubber Co. has opened central headquarters, with distributing warehouses, at Colon, Panama. J. H. Proeger, who has been branch manager at Havana, Cuba, for several years, is in charge.

The Panama office will serve Costa Rica, Nicaragua, Bolivia, Venezuela, Dutch Guiana, Guatemala, Panama, Chile, Peru, British Guiana, Honduras, Salvador, Colombia, Ecuador, French Guiana and the islands of the West Indies excepting Cuba, Porto Rico and the Dominican Republic.

NEW YORK REPRESENTATIVE

BAY CITY, MICH., June 17—The Machine Tool Engineering Co, 149 Broadway, New York City, will be the sales agent for the Smalley General Co. in New York and New England territory.

NEW BETHLEHEM VICE-PRESIDENT

H. B. Hall has been elected vice-president of the Bethlehem Motors Corp., Allentown, Pa. He will make his office in New York and look after the export activities of the company. He was formerly assistant general sales manager of the Bethlehem Motors Corp. and until recently president of the Chicago-Bethlehem Sales Co., Chicago.

—

Joseph Leopold has resigned as sales manager for the Jones-Motrola, Inc., to become sales manager of the Trego Motors Corp.

DINGEE INVENTOR DEAD

CHICAGO, June 13—W. W. Dingee, one of the pioneers in the manufacture of farm implements, died at his home here on May 25 at the age of 88. He perfected the Dingee horsepower and later was interested in machinery operated by steam. He was connected with the Sawyer Manufacturing Co. when the J. I. Case T. M. Co. purchased it in 1878, and was connected with the Case company until he retired from active business in 1906.

U. S. RUBBER HELPS SUBSIDIARY

DETROIT, June 13—The United States Rubber Co. will spend $3,000,000 this year in extensions and equipment to the works of Morgan & Wright, its subsidiary unit here.

TRACTOR BRAKE AND DRAWBAR HORSEPOWER RATING

(*Continued from page* 1383)

My idea of rating a tractor would be to first use a fixed piston speed in all formulæ and thus establish a brake horsepower which really means something. That is to say, engines so rated could be expected to endure and perform satisfactorily.

For the drawbar rating the S. A. E. or the Government should establish a laboratory equipment suitable for measuring the mechanical efficiency of the transmission, and also for finding the rolling resistance under a certain fixed condition. Each make of tractor could be thus tested, and the mechanical loss in the transmission and the rolling resistance subtracted from the brake horsepower would give a result which would be very close to correct in each special case, and would give manufacturers of lighter weight higher grade machinery actual credit in the rating of the tractor.

In figuring the brake horsepower of any tractor motor a reserve of power of approximately 25 per cent should be allowed for. In other words, if a motor actually develops 40 horsepower at a piston speed of, say, 850 feet per minute, the brake horsepower used in calculating drawbar pull should be 30. There are two reasons for this: First, the motor would always have power to meet the maker's rating and second, it is well known that an internal combustion motor of conventional type is most efficient in fuel consumption at 75-80 per cent of its capacity.

Tractors Conquer Colorado Desert

Farmers Convinced at Denver Demonstration That Machines Can Plow Virgin Land

DENVER, Col., June 13—Because of the tractor demonstration which has just closed here, it is believed that the work done in the 1200-acre sun-baked, virgin soil plain east of this city means the opening of 3,400,000 acres of such land to the tractors.

It has been a theory of the irrigated land farmer that the tractor was not suited to his work. He has pointed out that it often took 12 horses to draw a plow through this sort of earth, which never before was plowed. But he learned this week that the economic problem of plowing was the same, whether it was done by tractor or horse.

It is true that some of the smaller tractors did not run through this soil as they do the retilled soil in older country, but the fact remains that they did go through it. There was some backing and starting and heavy pulling, but in the end the soil was turned.

Almost every tractor maker in the country had a machine in this demonstration and most of them had all sizes. Also all kinds of implements and power utensils used on the farm were demonstrated. The mould board and the disk worked side by side. Reports are that in one or two instances the mould boards of the plows were ruined in a few hours' plowing. This may have been due to too fast plowing, for in many instances the mould board was functioning parallel with the disk plow. The disk reduces the draft in the very hard surface of sun-baked land, where the mould board plow leaves a glazed surface along the edge of the furrow.

The demonstration field was as dry as fields ever get outside a desert. The tractor has never figured prominently in the region where irrigation is needed to make farming possible, for reasons already stated. This demonstration has opened the eyes of the farmer to the possibility of big operations on this land.

There were farmers present from 15 States. The attendance was about 20,000 daily, and some days was estimated as high as 30,000. There are 4,000 tractors in use in Colorado. One revelation to many farmers was that the tractor would do all the work of the stationary engine, which represents heavy investments in this country because there is much need for power.

Manufacturers Learn Lessons

The manufacturer learned much. One thing was that too much must not be guaranteed for a tractor in this soil. It is a different proposition from that in older farming districts. He also learned that the big tractor, as a rule, was best suited for this job.

The demonstration was under the direction of the National Tractor Manufacturers' Association, aided by the Denver Civic and Commercial Association and the Denver Tractor Club.

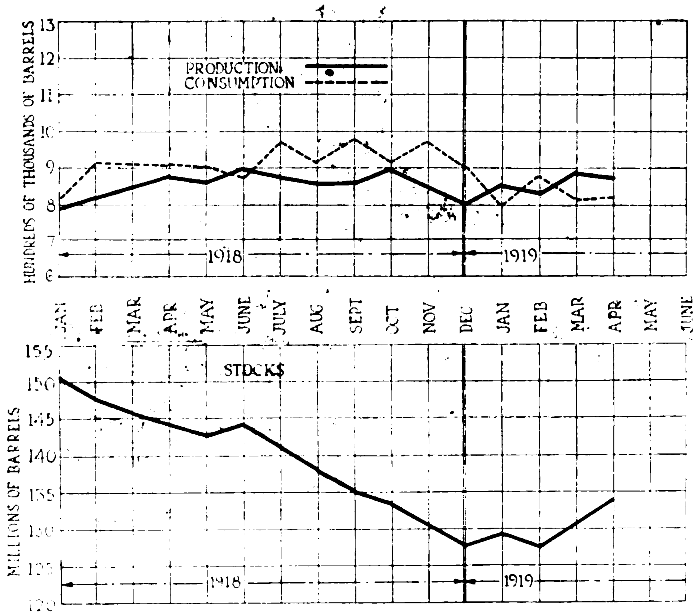
—

OIL PRODUCTION BULLETIN

WASHINGTON, June 13—A bulletin on the "Decline and Ultimate Production of Oil Wells with Notes on the Valuation of Oil Property," by Carl H. Beal, has just been issued by the Bureau of Mines, Department of the Interior, and and outlines methods for estimating the amount of oil that can be recovered from properties in the various oil fields of the U. S., and data on the application of these methods for the valuation of oil properties.

CRUDE PETROLEUM PRODUCTION IN EXCESS OF CONSUMPTION

WASHINGTON, June 12—The charts reproduced herewith show graphically the relatively great improvement in the crude petroleum position in comparison with that existing practically throughout 1918. During last year consumption was almost invariably in excess of production, the only exception being for a few days during the summer. This temporary gain was lost almost mmediately and the position became more unfavorable than before. Production is now well above consumption and stocks show a gratifying increase. Indications tend to show that the improvement is likely to be maintained.



Weird Cars Appear in Scandinavia

German War Loot Sold There—Skeleton Cars Offered on Long Credit

NEW YORK, June 17—Birger Jacobsson, who is in charge of automotive exports to Scandinavia for J. B. Crockett Co., has been in this country for two weeks seeking to expedite shipments of passenger cars. He says that his company has been unable to obtain all the cars needed for its trade, but that excellent truck deliveries are being made which are giving every satisfaction in the Scandinavian countries.

Scandinavia, according to Mr. Jacobsson, is practically a no man's land for the sale of cars, especially those coming from Germany.

"The Germans," he says, "are shipping some very strange cars into that country. Excellent Mercedes are arriving, with no tires and lacking decent paint and upholstering. While reports have it that there is rubber now in Germany, none is allowed for export. That country is still short of leather and textiles.

"These cars can be bought for 30,000 marks (about $2,000 at present value of the mark), but when the purchase is made the owner's troubles begin. He cannot buy tires to put on his car unless he disguises it. The Allies control the tires and they have a system of numbering that enables them to trace any tire found on a German car.

Rolls-Royce Cars Sold for $1,000

"Excellent Rolls-Royce and French cars are for sale in Scandinavia for $1,000 up, but they were all stolen from Belgium and France during the war. As soon as such a car is offered for export or is found outside Scandinavia by Allied officers, it is seized. The owners cannot buy supplies for these cars unless their origin is concealed.

"There are to-day some strange mixtures of equipment in the cars one sees in these countries. One finds Mercedes chassis with a Hall-Scott airplane engine installed. I have ridden in a Baby Peugeot equipped with a Ford engine.

"Strange engines of all makes are set in well known cars. Many of these engines were taken from captured airplanes and shipped abroad.

"The Germans are extending any credit desired on cars. They fear that money sent now will be taken away by the Allies."

Mr. Jacobsson returns to Scandinavia this week.

—

NEW PAINT MANUFACTURER

JACKSON, MICH., June 12—The Central City Paint Mfg. Co., with a capital stock of $300,000, has been formed here by John E. Van Horn. Mr. Van Horn started the Pontiac Mfg. Co. 16 years ago, disposing of this interest in 1918. The company will manufacture paint for the automotive industry.

Rules Governing National Tractor Demonstration at Wichita in July

Two Hours Are Allotted for the Public Exhibition—Land for Private Demonstrations Provided Daily—Draw for Positions on Opening Day

CHICAGO, June 16—The rules for the National Tractor Demonstration at Wichita have been drafted by the Tractor and Thresher Department of the National Implement & Vehicle Association. The rules are being demonstrated by the Chicago office of the Association. H. B. Dinneen, secretary of the Tractor Demonstration Committee, of Moline, Ill., is receiving entries. Other questions concerning the demonstration are being answered by A. E. Hildebrand, superintendent, at Bloomington, Ill.

The regional demonstration at Aberdeen, S. D., probably will be held the week of Aug. 18-23. No more regional demonstrations will be authorized. The rules for the Wichita demonstration follow:

1—Public demonstrations shall begin at 1 o'clock and end at 3, unless other hours are announced by the national demonstration committee at least 24 hr. before starting time. Private demonstrations may be held in the forenoon from 8 to 11:30 o'clock.

2—No exhibitor will be allowed more than one tractor of each size and type on the field during the public demonstration doing the same kind of work. He may have one or more machines performing different operations, namely: one plowing, one disking, one seeding, etc. Thursday morning from 9 to 11:30 will be devoted to seedbed preparation, seeding and cultivating.

3—Size of land for each tractor exhibitor for plowing demonstrations will be determined by the number of plow bottoms pulled, the width of plows and the highest plowing speed of tractor as given in entry blank. Each tractor exhibitor must plow out dead furrow to its left.

4—All exhibitors will be allotted land in the same field or adjoining field during each day's demonstration. Land for private demonstrations will be provided daily in one field or adjoining fields.

5—All plows on any given gang must be set at the same depth and kept there during the day's demonstration. This depth will be announced daily by general manager. Plows found operating otherwise will be ordered from the field for the balance of the day's work.

6—In all public demonstrations, the motor or tractor must not be run at more than 10 per cent above the highest speed of each as indicated in the entry.

7—Positions on field for each day will be arranged by lot in the following manner:

Separate drawings for each day's demonstration will take place at 10 a. m. Monday, the opening day of the demonstration. The drawings will be made from serial numbers representing total number of exhibitors.

Position on field for each public demonstration will be according to numbers, 1, 2, 3, 4, etc., as indicated by the drawing for that day.

The lowest number of land in each field shall be at point in field nearest general headquarters provided each exhibitor shall have all his land together.

Exhibitors who do not have representative at drawing will be represented by the general manager or someone appointed by him.

Each exhibitor will be required to finish his land daily in a workmanlike manner and assist in plowing the end lands as directed by the general manager.

8 Each field plowed will be surveyed and staked ready for afternoon demonstrations. These fields will be tested for the drawbar pull of a 14-in. plow, plowing at the depth specified previous to the demonstration. All manufacturers will be furnished information relative to drawbar pull so they can better determine the number of plows to use on each gang.

9—Each tractor shall bear a placard to be furnished by exhibitor, showing the brake horsepower of engine, the revolutions per minute, the plowing speed in miles per hour and the kind of fuel used and its Baume test. Tractors using more than 5 per cent of gasoline shall be classed as burning gasoline and be so placarded.

10—All tractors on the demonstration field belonging to one exhibitor must be kept on or along the land allotted him for that day's demonstration until the hour designated by management for returning to headquarters.

11—No machine will be allowed to operate with special equipment other than that designed for practical use with same. No spectacular methods will be permitted on the part of salesmen or others to attract crowds. The demonstration must speak for itself.

12—Each tractor exhibitor will have the privilege of burning any kind of fuel he desires, but no one will be permitted to burn fuel of a higher gravity test than that used by his competitor burning the same kind of fuel. All exhibitors will be required to obtain fuel from one source, such to be designated by general manager.

13—No time will be required of exhibitors to make moving pictures or group photographs for commercial purposes. Manufacturers can arrange to get photographs during the demonstration if they desire. Any manufacturer or representative of farm or trade papers or news agencies will be allowed to have their official photographer on the grounds to get pictures for their own use.

14—Manufacturers will be privileged to exhibit not more than one of a kind of belt-driven machines in connection with their exhibition.

15—The interpretation and enforcing of these rules shall be left to the national tractor farming demonstration committee and its general manager.

16—Each company exhibiting at these demonstrations shall appoint one manager who will be expected to report to the general manager not later than 8 o'clock each morning for instructions and information regarding the day's work. This manager of exhibits will be held accountable for the work of his company, and no instructions will be issued to anyone else, nor will requests, instructions or complaints be recognized from anyone but this exhibit manager. He shall wear a badge furnished him, specifying his being official exhibit manager.

17—Each exhibitor will be expected to keep plows, tractors, etc., around his tent arranged in first class order and the land allotted him for exhibiting purposes free from circulars, rubbish, etc., such as will be distributed around headquarters daily. They also will be expected to use care at all times in operating machinery with respect to its safety for all visitors. The management will appreciate co-operation of these exhibit managers in all matters.

18—Each entrant will sign the rules and thereby agree to live up to the rules and co-operate with the committee in every way to make the tractor demonstration a success.

19—The field manager shall have authority to order from the field any machine whose operator does not comply with the rules, and, further, any exhibitor who is manifestly disregarding the rules will not have land laid out or furnished for him on the succeeding days or until such time as he has met the condition.

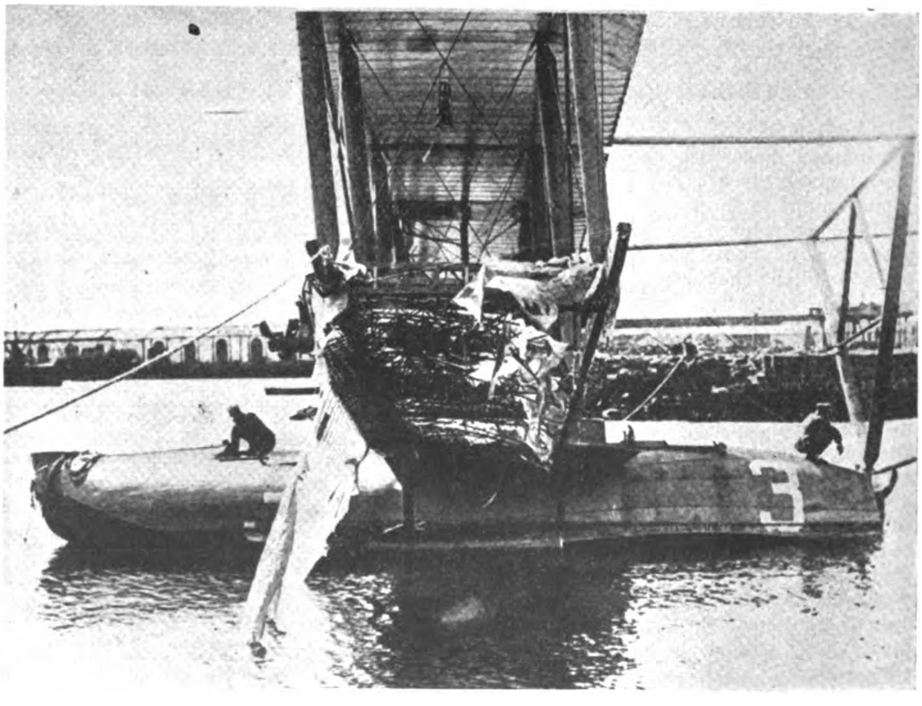
20—No exhibitor joining the national demonstration will be permitted to exhibit until he has given correctly the price that he is in position to furnish tractors at regular production, the correct weight of tractors and all data pertaining to their construction and rating, minimum and maximum, speed at which the motors are to run, the committee to have the right to have any such machines placed under test to prove the correctness of the data that is furnished.

21—No exhibitor shall have more than twenty-five tractors of all types and kinds on the demonstration grounds.

Each exhibitor who is a member of the National Implement & Vehicle Association shall pay $100 entry fee to participate in the National Tractor Farming Demonstration for 1919, and each non-member shall pay $200 entry fee for the same privilege. Remittance shall accompany entry application. Entry fees are to be used for defraying the expenses of the demonstration.

CARS AND TRUCKS FOR U. S.

WASHINGTON, June 14—The United States Indian warehouse at Chicago has asked for bids for 17 light weight touring cars and 7 motor trucks with light delivery bodies. Bids will be received either from manufacturers or regular dealers.



The NC-3 at Ponta Delgada, showing damage to wing. Official photo by U. S. Naval Air Service

REPUBLIC SURPLUS $900,770

NEW YORK, June 16—The Republic Motor Truck Co., Inc., reported to the Stock Exchange a surplus of $900,770, after the payment of interest and other charges and war taxes, in a statement summarizing its affairs for nine months ending March 31 last. Net sales aggregated $12,039,474, and costs reached $10,545,582, leaving net profits of $1,493,892. The profit and loss surplus was given as $5,765,848, all figures including the Republic Motor Truck Co. of California.

NAPOLEON MAKING CARS

TRAVERSE CITY, MICH., June 14—The Napoleon Motors Co., manufacturers of Napoleon trucks, has not gone out of the passenger car business as has been reported, but is diverting its production to a great extent to the manufacture of trucks.

NEMOURS TRADING CORP.

NEW YORK, June 14—The Nemours Trading Corp. has been formed with a capital of $12,000,000 to take over the Allied Industries Corp., French-American Constructive Corp. and the Merchant & Manufacturers Exchange, the last of which owns the Grand Central Palace, which is to be used as headquarters for the new corporation as soon as it is released by the Government. Associated with this corporation will be Bonright & Co., bankers.

The Nemours Trading Corp. is incorporated as domestic and foreign manufacturers' representatives and general shipping merchants. They are exclusive sales representatives of Wondermist polish, made by the Wondermist Mfg. Co., Boston, Mass.; Woodworth tire and bead spreaders, made by the Allied Industries Corp.; King crank holder and McCulloch timer, made by the A. P. McCulloch Machine Co., Boston, Mass. Other items will be added to the line from time to time. The officers are: President, Alfred I. du Pont; vice-president and general manager, J. N. Nixon; vice-presidents, L. P. Lawrence and R. H. Michels; and secretary-treasurer, G. W. Fay.

Blood & Wright, who specialize in automotive service at Detroit, have been appointed exclusive representatives in Michigan for the Nemours Trading Corp. and are also Michigan representatives for the K. & S. lock. They are opening a sales and installation store in Detroit for lock business exclusively.

COMPLAINT AGAINST TONKHEIM

FORT WAYNE, IND., June 13—Complaint against the Tonkheim Oil Tank & Pump Co., manufacturers of automatic measuring oil pumps, has been made by the Federal Trade Commission, charging that this concern systematically entices the employees of its competitors "with the purpose of annoying, embarrassing and obstructing them in their business." The company was cited to appear before a commission in Washington, July 22.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

934 FORDSON SALES IN MAY

NEW YORK, June 14—Continued heavy rains interfered with tractor sales during April, according to C. L. Herring, president of the Herring Motor Co., handling Fordson tractors in Iowa, Nebraska and South Dakota. Fordson sales in this territory for May totaled 934, as compared with 1340 in April. As May is not considered a tractor selling month it would scarcely be correct to infer that tractor sales have been slow this year.

There are approximately as many Fordsons sold in Iowa as in Nebraska and South Dakota combined. The sales in Nebraska are approximately double those in South Dakota. On this basis 156 were sold in South Dakota, 312 in Nebraska and approximately 476 in Iowa.

MOLINE PLOW FOUNDRY

MOLINE, ILL., June 17—The Moline Plow Co. is building a foundry at East Moline to cost $275,000. The contract calls for the completion of the structure by Oct. 15. The building will be 2 stories, 120 by 380, of reinforced concrete and steel. Tractor and agricultural implement castings will be produced at the new plant.

NEW CAR AND TRACTOR

PHILADELPHIA, June 17—The L. M. Heifner Manufacturing Co., with L. M. Heifner at the head, is being formed with a capital of $1,500,000, to manufacture cars and tractors. An option dating from July 1 has been taken on a building in Chester, Pa., having 100,000 sq. ft. of floor space, and operations are expected to begin by August 15. The tractor to be made will be composed of standard units, especially suitable for small farms, and will cost $1000. It will be designed to be used with a 2-bottom plow, having a clearance of 27 inches. Production of 3000 the first year is the goal.

All types of passenger cars are planned, having the following specifications: aluminum body, Continental Red Seal engine, 128-in. wheelbase, Bosch magneto, Brown-Lipe transmission, Borg & Beck clutch, Spicer universals, Timken axles, Parish & Bingham Co. frame, Perfection springs, Stewart vacuum feed, Fedders radiator, Delco starting and lighting system. The color will be optional.

The Smith-Davis Machinery Co., Market and 21st streets, of which Mr. Heifner is general manager, will represent the new line in Eastern Pennsylvania, New Jersey, Delaware, and part of Maryland.

BUILDING CANADIAN PLANT

OSHAWA, ONT., June 14—General Motors of Canada, Ltd., as planned, is erecting a 60 x 160 ft. plant at Walkerville, where engines, transmissions and all heavy parts of cars used in the Oshawa assembling plants will be manufactured. These operations are going ahead rapidly. For the time being motors, transmission, etc., for McLaughlin cars, Chevrolet cars and trucks and Oldsmobile cars and trucks will be made in Walkerville. Castings, engines and transmissions for Samson tractors and G.M.C. trucks will also be turned out.

In Oshawa, where McLaughlin and Chevrolet cars are now made, a 400 x 80 ft. 4-story building will be erected to assemble Oldsmobiles and trucks. It is planned to start production this fall.

In addition to this plant it has been decided to erect a central shipping building, 200 x 80 ft. In conjunction with this central shipping station there will be a large storage building with a capacity of 1000 cars. This building will be 4 stories, 400 x 80. An enameling plant to be erected will be 3 stories, 300 x 80 ft.

In addition there will be alterations in the present plant equipment of the General Motors unit at Oshawa. The south building, now used for Chevrolet parts and ge... storage, will be converted into a manufacturing plant t produce the Baby Grand Chevrole model.

The ground under the present 490-ft Chevrolet assembling plant will be excavated and a basement put under the entire space, thus adding one complete story.

All buildings are of steel and concrete.

G.M.C. CAPITAL $1,020,000,000

NEW YORK, June 16—Increase of the capital stock of the General Motors Corp. from $370,000,000 to $1,020,000,000 was voted at a stockholders meeting at Wilmington, Del., June 12. The stock division calls for $20,000,000 preferred, $500,000,000 debenture and $500,000,000 common shares.

The increase, according to John J. Rashob, director of the corporation, is intended to enable the company to take advantage of any opportunity that may develop in the motor field, extensions of plants being financed out of earnings rather than stock sale proceeds.

Reports that the enlarged capitalization would provide funds for absorption of the Ford Motor Co. were denied.

ACME TRUCK PRICES ADVANCE

CADILLAC, MICH., June 16—The Acme Motor Truck Co. will raise the price of its 3½- and its 5-ton models $100 each, effective July 1. The following is the new price schedule:

Capacity	New Price	Old Price
1-ton	$1,950	$1,950
2-ton	2,750	2,750
3½-ton	3,750	3,650
5-ton	4,850	4,750

Fisher Body Corp. Earns $1,603,289

DETROIT, June 16—The Fisher Body Corp. and its subsidiary, the Fisher Body Corp. of Canada, earned $1,603,289 last year after deducting interest, federal taxes and appropriation for dividends on the company's outstanding preferred stock. This earning is equivalent to $6.44 a share on the company's 200,000 shares of common stock of non par value.

Before deducting the federal tax, but deducting all expenses of the business, including expenditures for repairs, maintenance of the properties and an adequate allowance for accruing renewals and depreciation, the net earnings were $3,534,853.38. Interest deductions were $306,564.08 and the amount set apart for federal income and war excess profit taxes was $1,625,000.

The consolidated balance sheet lists assets aggregating $20,352,001 on April 30, 1919, with current assets of $12,889,541.37, and current liabilities of $8,635,265.76, indicating net working capital of $4,254,275.61. Investment in plant and properties after writing off $864,687.10 for depreciation and including $250,000 as the value of patents, was $320,813.97. Sinking fund assets for redemption of preferred stock amounted to $60,054.55 and deferred charges were $81,591.21.

Current assets comprise inventories of raw material work in progress and supplies appraised at $6,693,044.70, accounts receivable $2,589,092.54, investment in Liberty bonds at par $1,500,000 and cash $2,107,404.13.

Current liabilities include bank loans aggregating $4,065,000, of which $1,475,000 was for the purchase of Liberty bonds; accounts payable, $1,429,579.19, a balance of $251,503.31 due the U. S. government on airplane contracts, accrued salaries and payrolls $822,190.35, accrued interest $7,007.19, and provision for Federal taxes and Canadian business profits war tax, $2,059,985.72.

Capital liability was $6,445,324.98, consisting of $6,000,000 authorized 7 per cent cumulative preferred stock, of which $5,000,000 was issued and $666,000 retired, leaving $4,344,000 outstanding and 200,000 shares of common stock of no par value, which is given a book valuation of $2,111,324.98.

From surplus of $4,309,568.32 on May 1, 1918, there was deducted $403,000 additional provision for federal taxes of 1918. The balance was increased by $1,298,750.40, the part of the year's net earnings remaining after appropriating $304,538.80 for payment of preferred stock dividends, also by $66,091.66, the surplus arising from the retirement of preferred stock at a discount, making total accumulated surplus $5,271,400.36, on April 30, 1919.

CHIEF MOTORS ISSUES STOCK

PORT HURON, MICH., June 12—The Chief Motors Corp. has placed on sale 20,000 shares of 8 per cent participating preferred stock and 20,000 shares of common stock. The par value of both stocks is $10. According to the sales plan, one share of preferred and one share of common is selling for $12.50.

The company is raising additional capital to increase its production so that enough engines may be produced to fill orders already received. The Chief Motors Corp. builds a kerosene-burning tractor engine, and has assets totaling approximately $400,000, not including good-will, organization and other tangible assets.

John Erd, formerly of the Erd Motor Corp., Saginaw, Mich., is president and general manager of the Chief Motors Corp. The corporation has opened sales offices in Detroit.

HOLT COMPLETING PLANT

PEORIA, ILL., June 17—Orders were received this month to complete the addition to the Holt Caterpillar tractor plant at East Peoria, Ill. The buildings were partially finished when peace was declared and the work of construction has since been halted. It will require $1,000,000 to complete the plant according to the original plans. Capt. J. E. Hopkinson, of the regular army, will be assigned to duty at the Holt works and supervise the expenditure of the additional sum. The total cost of the plant will be $3,000,000.

TIRE PLANT FOR WARREN

WARREN, OHIO, June 17—Construction will commence immediately on the D. & M. Cord Tire Co., Cleveland, rubber plant here, to cost $2,500,000. The company was recently organized, with Walter D. Myers, attorney and banker, of Cleveland, president, and Walter R. Denman, secretary and general manager.

The plant here will manufacture cord tires, inner tubes and accessories. It will start with a single unit employing 500 and turning out 1000 tires a day. Eventually it will consist of three units with a daily capacity of 4,000.

WALLIS TRACTOR RESUMES

RACINE, WIS., June 12—The Wallis Tractor Co. resumed operations June 2 with a large force and on a greatly increased production schedule, after being closed down for a month, during which time the entire plant was overhauled. The Wallis company from now on is operating on an 8-hour-day basis, without overtime. Rates have been established which take into consideration present living conditions, and the voluntary proposition is meeting with the approval of all employees.

MACHINE SHOP FOR KALAMAZOO

KALAMAZOO, Mich., June 16—The Kalamazoo Motors Corp. is erecting a 1-story machine shop covering about 2000 sq. ft. A covered loading and unloading platform is included. Plans also provide for a building for the stock room. These changes will double the capacity of the present plant and permit the assembling of 125 to 150 trucks a month.

Army Trucks Cross Country

WASHINGTON, June 16—The first transcontinental trip of an army motor truck train will start from Washington, July 7, under direction of the Motor Transport Corps, and end at San Francisco within two months. Before the trucks start on this journey, which is intended to provide tests of the standard motorized army equipment, demonstrate long distance motor post and commercial transportation, and provide for other studies and training, President Wilson will dedicate a milestone in front of the White House to represent the starting point for highways radiating out of Washington. The train will follow the Lincoln Highway as far as possible. It will comprise two complete motor transport corps companies, include 5 passenger cars, 35 trucks of all army types, 2 ambulances, 6 motorcycles, 2 tank trucks, 2 kitchen trailers, 2 water tank trucks, 1 engineer shop truck and 1 searchlight truck.

Technical personnel from the motor transport corps, engineer corps, medical corps, field artillery and air service will make the journey.

ARMY EQUIPMENT FOR HIGHWAYS

WASHINGTON, June 14—The Department of Agriculture will receive tractors, road rollers and other highway building equipment from the American Expeditionary Force as quickly as it can be returned. The War Department has ordered shipment of this machinery from France at the request of the Department of Agriculture, which will use it in the construction and maintenance of federal highways. The equipment will be distributed to the states without charge, and apportioned together with the 27,000 army trucks which are being distributed by the Bureau of Public Roads at the request of the State Highway Department.

The equipment being returned from France includes 1500 tractors, 400 road rollers, steam and gas driven, concrete mixers, graders, rock crushers, electric motors, industrial locomotives, dump cars and quantities of smaller equipment.

TRANSPORTATION NEEDS

WASHINGTON, June 14—The Highway Transport Committee of the Council of National Defense has requested the assistance of congressmen in determining the necessary routes for the operation of rural motor express. In a letter addressed to members of Congress, the committee points out the need for every form of transportation at this time, and numerous examples of districts in which the transportation facilities are inadequate.

In various southern districts, it is stated, hundreds of bales of cotton are lying on the ground without cover because of lack of transportation, while in the Northwest millions of bushels of grain lack transportation to move them.

UNIVERSAL AVIATION CO. FORMED

DETROIT, June 14—The Universal Aviation Co. has been incorporated here for passenger service between Detroit and Cleveland, and to afford the public opportunity for pleasure trips in Michigan, Ohio and Indiana.

The officers and backers of the new enterprise are: President, Henry M. Leland, president of the Lincoln Motors Co.; first vice-president, E. E. Allyne, president of the Aluminum Castings Co., Cleveland; second vice-president, David Pell, director of the Hayes Mfg. Co., Detroit; secretary and treasurer, Harry D. McCullough, secretary and treasurer of the King Motor Car Co.; general manager, J. T. Patterson, Detroit; C. W. Leland and Le Roi J. Williams of the Lincoln Motors Co.; Frank P. Book of the Book estate; J. W. Murray, president of the J. W. Murray Mfg. Co.; Hal Smith of the Hayes Mfg. Co.; C. H. Haberkorn of the Haberkorn Furniture Co.; George D. Wetherbee, Thad Leland, Harold Armstrong, C. R. Short, chief engineer of the Northway Motors Co.; Clarence Chandler, B. F. Bertram and Messrs. Ryan and Sweeney of the Allyne-Ryan Co., Cleveland, and Harry D. Mills of Ann Arbor.

Land flying activities will begin immediately at Morrow Field, with four airplanes of the Curtiss type. Six more machines have been ordered. The company has two flying boats, which will land at the foot of Townsend Avenue. The pilots, all of whom have been in Government service, are S. H. Dicran, Edward Wismiller, C. R. Sinclair and C. R. Griffin.

$5,000,000 HOUSING CONCERN

DETROIT, June 12—Eugene W. Lewis, former vice-president of the Timken-Detroit Axle Co., and a director of the First & Old Detroit National Bank, has been elected president and general manager of the newly organized $5,000,000 house financing corporation of Detroit. This company, organized by leading bankers and manufacturers, aims to solve Detroit's serious housing situation, and incorporation papers will be filed at Lansing within a few days. Up to the present time Detroit has had no organization with facilities for transacting and disposing of all features of the problem of financing and building of homes. It aims to give the man with a few hundred dollars with which to start a home an opportunity to build on the easy-payment plan. It is estimated that Detroit has a shortage of approximately 60,000 homes.

On the board of directors are many men well known in the automotive field, including Frank L. Klingensmith, vice-president of the Ford Motor Co.; Alvin Macauley, president Packard Motor Car Co.; H. W. Alden, vice-president Timken-Detroit Axle Co.; D. A. Brown, president General Necessities; James Inglis, president American Blower Co.; R. B. Jackson, general manager Hudson Motor Car Co.; A. L. McMeans, secretary Dodge Brothers; A. W. and John R. Russel of the Russel Motor Axle Co.; James T. Whitehead of Whitehead & Kales Iron Works.

Housing Situation in Industry Still Critical

BATTLE CREEK. MICH., June 14—Five hundred new homes are needed here immediately to care for the increased population. The Chamber of Commerce is securing bids upon the construction of four different types of houses. The banks and private loan associations are co-operating by loaning money for home building on an easy payment plan. At the present time the manufacturing companies are not actively engaged in relieving the situation, but plans are under way which will result in the manufacturers building houses for their own employees.

PORT HURON NEEDS HOMES

PORT HURON, MICH., June 14—There is a shortage of from 300 to 400 homes here. The Chamber of Commerce is endeavoring to form an organization for the purpose of building 200 small homes for foundry employees. Several of the large manufacturing companies are also contemplating building homes for their workers. The building and loan associations and the banks are aiding in this campaign and a great number of individual parties have been financed.

Over $3,000,000 has been expended in additions to industrial plants. Upwards of 8000 persons have been added to the population in the last 2 years, with less than 300 homes constructed. The general demand is for homes renting from $15 to $25. It is estimated that 82 per cent of the men employed in industries own their own homes.

MORE HOUSES FOR SAGINAW

SAGINAW, MICH., June 14—Saginaw is responding to the demand for more houses for hundreds of families brought here by new and growing industries. During May 83 building permits were issued, besides three for factories. The total cost was $467,157.

JACKSON BUILDING HOMES

JACKSON, MICH., June 14—To relieve the serious shortage of homes here, the Jackson Co-operative Realty Co. is about to incorporate for $200,000, its mission being to build homes for workingmen. This company has been organized for several months and has already built 45 houses.

HOMES FOR PORT HURON

PORT HURON, MICH., June 14—The organization of a home building corporation capitalized at $1,000,000 is the plan proposed for the relief of the serious housing situation here.

The company will buy vacant lots and build houses where prospective purchasers desire, and will sell on the installment plan with easy payments. The sale will be at cost of lot and building plus 15 per cent, and if the purchaser keeps up the payments for 5 years the profit will be reduced.

500 HOMES NEEDED IN ANN ARBOR

ANN ARBOR, MICH., June 14—According to real estate dealers the city needs at least 500 homes. It is thought that the manufacturing interests will attempt to formulate a relief plan, inasmuch as they are all in need of men, whom they are unable to obtain because of dwelling shortage.

BAY CITY, MICH., June 14—This city proposes to build 800 new homes this year. The Chamber of Commerce is drafting plans to provide homes. It is asking its members each to build from 1 to 50 modern homes to sell on monthly payments at 6 per cent interest. A number of wealthy citizens' associations, etc., have agreed to this and a complete building program will be drawn up.

KALAMAZOO, MICH., June 14—Kalamazoo expects the housing situation to greatly improve within the next 30 days. There is a big shortage of houses here. The Chamber of Commerce has organized a committee and it is estimated that between 300 and 500 new dwellings will be put up.

AKRON ADDS DWELLINGS

AKRON, June 14—The Akron Home Owners' Investment Co. will start work in 10 days building 5000 homes at a cost of $25,000,000. All homes will be completed before the end of the year. This association was recently organized to care for the critical housing situation here. In addition to the building work the company will make loans to those who wish to build their own homes, on an easy payment plan. The cost of the houses to be erected will average $5,000 each. The work of the association will not conflict with that of the various industrial plants which are planning house-building campaigns of their own. It is estimated that by the end of the year Akron will have 9000 new dwellings.

The Coventry Land Co. has issued contracts for the construction of 100 houses to cost approximately $500,000. They are to be built in the Firestone park.

NEW DETROIT HOUSING CORP.

DETROIT, June 14—A new house-building corporation, the Banker's Land & Investment Corp., capitalized at $1,000,000, is preparing to aid Detroit in solving the critical housing situation. The company has opened offices and construction work will start at once. Within 12 months the corporation hopes to provide housing accommodations for at least 3,000. This concern is a merger of six operating subdivision and building companies controlled by Frederick H. Zeigen.

The officers of the corporation are: president and general manager, F. H. Zeigen; vice-president, Clarence E. Wilcox, Detroit corporation counsel; secretary, Leslie B. Robertson, former head of the Ford Motor Co. legal department; treasurer, Richard D. Cudmore, cashier of the People's State Bank. Cass Zeigen, former assistant auditor of Maxwell-Chalmers, is auditor.

Calendar

SHOWS

Aug. 30-Sept. 6—Minnesota. State Fair.

Sept. 1-6 — Indianapolis, Ind. State Fair, Cars and Accessories, Indianapolis Automobile Trade Assn., John B. Orman, Manager.

Sept. 13-20—Cincinnati, O. Ninth Annual, Music Hall, Cincinnati Automobile Dealers' Assn., H. K. Shockley, Manager.

Sept. 15-20 — Springfield, Mass. Eastern States Exposition.

*Oct. 9-19—Paris. Grand Palais. International Automobile Mfrs. Congress.

Nov. 7-16—London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December — Brussels. International Automobile Mfrs. Congress.

Jan. 3-10 — New York, N. Y. Grand Central Palace, National Automobile Chamber of Commerce, S. A. Miles, Manager.

Jan. 24-31—Chicago, Ill. Coliseum, Cars; Drexel Pavilion, Trucks; National Automobile Chamber of Commerce, S. A. Miles, Manager.

January — New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

July 14-19—Wichita, Kan. Automotive Committee of National Implement Assn.

July 28-29—Columbus, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 1-2 — Piqua, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 18-22—Aberdeen, S. D. Sectional Tractor Demonstrations.

October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

CONTESTS

July 4—Hohokus, N. J. Dirt Track Event.

July 4—Tacoma, Wash. Annual speedway races.

July 4—Atlantic City, N. J.—Airplane races—Aeronautic Convention.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15 — Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

*Tentative dates.
†Sanctioned.

CONVENTIONS

June 16-19—Detroit. American Society of Mechanical Engineers spring meeting, Hotel Statler.

June 23-28—Ottawa Beach, Mich. S. A. E. Mid-summer Meeting.

July 9-10—Buffalo. Motor and Accessory Mfrs. Assn. Mid-summer convention.

Sept. 22-24—Philadelphia. Annual Convention, National Association of Purchasing Agents. Bellevue - Stratford.

May 12-15, 1920—San Francisco. Seventh National Foreign Trade Convention.

January — Washington. Pan American conference.

De Palma in Packard Victor on Sheepshead Speedway

SHEEPSHEAD BAY SPEEDWAY, N. Y., June 14—Ralph De Palma, driving a 12-cylinder Packard, won the International Sweepstakes here to-day, covering the 50-mile course in 26:23:4, and establishing a new record for the track of 113.76 m.p.h. Ralph Mulford, in a 4-cylinder Frontenac, and Tom Milton, in a 4-cylinder Duesenberg, made local records in the 30 and 10-mile events, their times being, respectively, 16:01:20 and 5:20:20. Mulford also carried off the honors in the special 10-mile race.

Dave Lewis came in second and Joseph Boyer, Jr., third in the 50-mile event. Ralph Mulford was in second place and De Palma in third in the first race, a 10-mile event, which Tom Milton won. De Palma made second place and Joseph Boyer, Jr., again third in the 30-mile run, and in the special 10-mile event, which was won by Mulford; Joseph Boyer was second and Ralph De Palma third.

The winning Packard, equipped with a 24-valve engine with cylinders cast in threes, has a total piston displacement of 299.2 cu. in. The bore and stroke of the engine are 2 21-32 and 4½ in., respectively. The valves are located in the head, the pistons are of aluminum and there are two camshafts. The car has a 112-in. wheelbase and is equipped with the Delco ignition system.

The Frontenac, driven by a 16-valve engine of 3.87 in. bore and 6 in. stroke, has a 282.3 cu. in. piston displacement. The cylinders are cast in block, with valves in the head. The engine has a single camshaft, aluminum pistons, cone clutch and Bosch magneto. Its wheelbase in 110 in.

The Duesenberg also is equipped with a 16-valve engine, having the valves located in the head. The bore is 3¾ in., strokes, 6¾ in. and the piston displacement is 298.2 cu. in. It has two camshafts. The pistons are of Levett metal. Its other features include a cone clutch and Bosch magneto. The wheelbase is 116 in.

126,136 Motor Vehicles Held by A. E. F. According to Classified Inventory in Hanch Report of Trip Abroad

NEW YORK, June 16—A total of 126,136 motor vehicles, trailers and bicycles was in the hands of the A. E. F. in France, according to an analysis given by C. C. Hanch in his report to the National Automobile Chamber of Commerce recently. The report says that of this number, 7,368 were of foreign make, representing our purchases in Europe, practically one-half of which are motor trucks. We purchased 2,603 3 and 4-ton trucks from European makers.

The recapitulation is:

Type	American	Foreign	Total
Passenger cars	9,091	718	9,809
Light deliveries	10,110	41	10,151
½ and 2-ton trucks	12,651	681	13,332
3 and 4-ton trucks	19,285	2,603	21,888
5-ton trucks and over	2,696	78	2,774
Motorcycles	21,597	1,195	22,792
Ambulances	7,080	9	7,089
Tractors	144	125	269
Caterpillars	1,721	....	1,722
Trailers	3,745	1,552	5,297
Machine shop and repair trucks	1,575	16	1,591
Kitchen trailers	352	33	385
Omnibuses	14	3	17
Winch trucks	....	69	69
Reconnaissance cars	745	...	745
Fire engine and disinfectors	20	27	47
Laboratories	86	52	138
Machine shop trailers	94	15	109
Tank trucks	869	151	1,020
Anti-aircraft	20	....	20
Miscellaneous trucks	5	....	5
Bicycles	26,867	....	26,867
Total	118,768	7,368	126,136

GEORGIA DEALERS ORGANIZE

MACON, GA., June 14—Automotive dealers of this state have condemned a proposed bill to be introduced in the next legislature to assess truck license fees as high as $1,000 and $1,500 on trucks of 5- and 7-ton capacity. They are also against the Federal practice of confiscating cars carrying liquor. In order to handle these and other problems the Georgia Automotive Dealers' Association has been formed with about 200 members. R. C. Dunlap of this city is president. Harry C. Moock, St. Louis, business manager of the National Automobile Dealers' Association, spoke at the organization meeting.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XL
Number 26

PUBLISHED WEEKLY AT 239 WEST 39th STREET
NEW YORK, JUNE 26, 1919

Fifteen cents a copy
Three dollars a year

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, N. Y., under the Act of March 3, 1879

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, JUNE 26, 1919—CHICAGO No. 26

S. A. E. SUMMER MEETING

Lighter Cars; Smaller Engines

S. A. E. Speakers Agree as to the Tendency of Design of Automobiles but Vary Many Pounds as to Their Ideas of the Net Result —Changes Favor the Car Owner

900-Pound Five-Passenger Car Is Seen as a Possibility

OTTAWA BEACH, Mich., June 25.

LIGHTER cars, with correspondingly smaller engines and with a trend toward closed bodies, are probabilities of the future in passenger automobile design, in the belief of experts who to-day contributed a symposium of papers to the summer meeting of the Society of Automotive Engineers.

The discussion dwelt also upon the necessity of mechanism designing intended to reduce fuel consumption and to permit utilization of lower grade fuels, economies to be enforced by the country's failing gasoline supply.

The papers forecast the passing of the 8 and 12-cylinder engine, except in occasional construction, holding up as the future standard the 6-cylinder motor for the larger cars and the 4-cylinder for the smaller types.

While foregoing an actual prediction, William B. Stout, consulting engineer of the United Aircraft Engineering Corp., declared it should be possible to build a 5-passenger closed car of present-day performance standard with a weight of 900 lb. Engineering and construction lessons taught by the war, he asserted, had laid the foundation for such an accomplishment.

Herbert C. Snow, engineer of the Winton Co., expressed the belief that the weight of the 7-passenger touring vehicle would be reduced to 3500 or 4000 lb. Resorting on a large scale to the use of alloy steels and aluminum alloy, he forecast, as well, that 5-passenger cars would be brought down to 2500 to 3500 lb., and the smaller machines to 1500 to 2500.

Improvement in car quality, both in design and workmanship, was anticipated by Henry M. Crane, vice-president and chief engineer of the Wright-Martin Aircraft Corp., in a paper which conceded a popular movement toward the closed car, in itself a factor opposing decreased weight. There was a growing demand, in Mr. Crane's opinion, for greater comfort in riding and a nearer approach to noiselessness in the operation of cars, conditions which would call into play the best in creative genius.

Mr. Stout on the 900-Lb. Car

The 900-lb., 5-passenger car, Mr. Stout contended, "should give 30 to 40 miles on a gallon of fuel and 10,000 to 15,000 miles on a set of tires. In riding ease it should surpass anything in heavyweight construction.

THE FUTURE CAR
WILLIAM B. STOUT

We should have a 900-pound, 5-passenger car that will be a better riding car than any now on the market. This will be made possible through war experiments for airplane construction. The body will be of plywood and the engine of 15-horsepower, 6-cylinder, weight 120 pounds. This car should give 30 to 40 miles on a gallon of fuel. The problems are in unsprung weight and axles and drives.

In cost, it should be built for no more money than cars of to-day of equal passenger capacity and performance. The care required to keep the car in shape should be far less than in present construction, and all parts could be oiled from the engine. Freedom from noise and rattles would be a feature, and the life of the car in proportion to its price much increased."

Engines could undergo a real revolution, not only in performance but in design, Mr. Crane stated, adding that a movement toward air cooling was likely, "as it is now possible to build air-cooled engines with a mean effective pressure as high as the best motor-car engines and cool them under motor-car conditions."

He continued:

"A car of 900 lb. weight—and this would mean a revision of some of our suspension ideas to entirely new fundamentals—would need but a good 15-hp. engine and other parts in proportion. This engine, being small, could call to itself the very best workmanship and material, and would not be a success unless it did.

"By the use of many small cylinders, not less than six, and some of the constructional and cooling ideas that have been proved during the war, this powerplant could be laid out as a real thermal job, with no cooling difficulties, and with wonderful economy. It would, of necessity, be radically different from the present-day air cooling to obtain the mean effective pressure desired. Its weight complete need not be over 8 lb. per hp., or 120 lb. for the complete engine with starting equipment. It should turn up to 2600 r.p.m. without undue vibration or power loss. Its cost per pound need not be over twice that of present engines in equal quantities. Since the motor car has become for us an all-the-year proposition there is more reason than ever for eliminating the radiator and its recurrent winter troubles. With the low total weight of the car and the small-bore engine, fuel economy would be far beyond present types."

Mr. Stout looked for wider employment of wood in passenger-car manufacture, declaring that in the production of airplanes for war "we found for the first time what wood was and how to use it, both for strength and for production. We found that wood, combined with the new waterproof glues into multiple units, as a dependable basis of structure under all weather conditions and under severe vibrations and stresses. We found that we could mold it, press it, cut it, and form it in a real production way, and obtain structures with a fraction of the weight for the same strength that was possible with steel. Of course, it had to conform to certain rules of structure, just as steel does, but the result has been proved, and the comparatively low production cost of plywood parts demonstrated. A 5-passenger body on a moderate wheelbase car, without glass, need not weigh over 200 lb., and still be a more permanent structure than a steel-wood combination."

On the question of comfort he said:

"To obtain riding ease the problem of unsprung weight would have to be studied all over again, and many ideas on axles and drive revised to new bases. The load of five passengers being such a large proportion of the total weight, some special type of suspension would become a necessity in the car outlined to obtain easy riding, whether full or part load were on board.

"As to cost of manufacture, this can be figured on a per pound basis, and would allow of higher-class work and materials without increasing the final cost of the car. Because of the lightness and small size of the power and transmission units, great accessibility could be had, while the car of the future, too, should be designed primarily with the owner in mind rather than the factory. This means a car that can be taken care of by the owner, with small outlay of effort or skill and infrequent oiling; a car with no grease cups or unlubricated joints, and an outside design such that a minimum of washing will keep it clean. This refers primarily to wheels, the hardest part of a car to keep looking right. For this reason alone the newer disk wheels have great possibilities.

"The motor car to-day, in its present form, has probably reached a maximum of performance. If we would obtain a radical economy or sales basis or performance, we must look to radical but balanced ideas. We must all admit that the car of to-day is still crude, and even though our shops at present are full of work and our desks of orders, we should remember that the firms which undertake research have always been the leaders, looking ahead, not only toward better engineering for its own sake, but that the per car cost of sales effort may be minimized and the line of sales convincement be more direct."

Mr. Snow for Reliability

In his paper, Mr. Snow regarded reliability, good performance and good appearance salient requisites of a good passenger car.

"In considering reliability," he said, "more attention will be paid to the automatic lubrication of every moving part throughout the chassis with minimum trouble to the owner. Parts which require attention will be made more accessible, minimizing the effort required to keep the car at its best, and enabling worn parts to be replaced more readily. More owners nowadays drive their cars than in the past, and the maintenance of these cars should be as simple as possible. The take-up points for the various adjustments should be located so that they can be reached with ease.

Limit of Acceleration Reached

"In the past 3 or 4 yr. a considerable improvement has been made in the high-gear performance of passenger cars. Acceleration and hill-climbing ability has been increased to a point which might well be considered a maximum for practical service. A car acceleration of from $3\frac{3}{4}$ to 4 ft. per sec. on direct drive, at speeds of from 5 to 25 miles per hr., with two or three passengers, should be ample. This is equivalent to climbing an $11\frac{1}{2}$ to $12\frac{1}{2}$ per cent grade at a constant speed between 5 and 25 miles per hr. On a lesser grade the car would have surplus power for acceleration. In addition to this low-speed performance a high-grade touring car should be capable of a maximum speed of 60 to 65 miles per hr. The number of miles per gallon of fuel should also be a factor in the performance of the car.

"In designing a car to give this performance, the total

weight of the car is a large factor. The weight of the car in turn is partly dependent on the size and carrying capacity of the body. The present seven-passenger body of a high-grade car is as large and roomy as could be desired, and there should be no need for further increase in size on future cars. This being the case, I believe that the total weight of the large seven-passenger car will be reduced to a point between 3500 and 4000 lb. To make this reduction in weight without any sacrifice in durability means the greater use of alloy steels as well as an increased amount of aluminum alloys. The medium size five-passenger car will weigh between 2500 and 3500 lb., and the small car between 1500 and 2500 lb.

Number of Engine Cylinders

"The size of engine which will give the desired performance to a car of given weight is dependent on the gear ratio and diameter of wheels; or, in other words, the engine revolutions per mile. If a low gear ratio is used, a smaller engine can give the same performance as a large engine with a higher gear ratio. However, the use of the low gear ratio requires a very high engine speed to obtain maximum car speed, and the power may drop off so much at these high engine speeds as to be insufficient to propel the car at the maximum speed desired. In this case it is necessary either to raise the gear ratio and sacrifice the low-speed performance, or to reduce the maximum car speed. By using a transmission with direct drive on the third speed and a geared-up drive on the fourth it is possible still to retain the low axle ratio and have good low-speed performance on direct drive and at the same time to have a higher maximum car speed available on the fourth gear. The objection to this type of drive has been the noise of the fourth-speed gears. I believe that in the future this type of drive will gain in popularity. It is possible that the silent chain will be used in the transmission with considerable advantage in providing a quiet drive for the top speed.

"I believe that the engine for the large car weighing 3500 to 4000 lb. will have a total displacement of between 300 and 400 cu. in. The largest percentage of these engines will undoubtedly have six cylinders. Cars of this class require the best that can be obtained in smooth running and perfect balance. The six-cylinder engine fills this requirement. It also gives good fuel economy and can be made very accessible. In the medium weight class I believe that this type of engine will predominate, but not to quite as great an extent as in the 3500 to 4000 lb. class. The remainder of these cars will be equipped with four-cylinder engines for the most part, as I doubt very much whether there will be many eight or twelve-cylinder engines in cars under 3000 lb. in weight. In the lightweight class I believe that it will be about an even break between four and six cylinder engines.

"Taking up the design of the engine, we can look for the greatest improvement to be made in the cylinders, valve ports, valve mechanisms, manifolds and carbureters. With the fuels growing poorer all the time, the manifolds must be designed to give better distribution, and more heat must be applied to the manifolds to vaporize the liquid fuel on the walls at the lower speeds. To maintain good torque at high speeds the resistance in the manifold, valve ports and in the cylinder around the valves must be kept as low as possible. At the same time the size of these passages should not be made too large, for a high gas velocity must be retained at low speeds. The resistance which the exhaust gases meet when leaving the cylinders is often very high, and considerably reduces the power output. This resistance can be lowered by good valve location, large valve openings, and large and smooth ports and passages. The exhaust valve located in the top of the cylinder head offers much more resistance to the outgoing gases than the L-head location. With the inlet valve the reverse is true. Improvements in the engine of the future cars will be toward an increase in power per cubic inch of displacement, smoother and quiet operation, with freedom from trouble and good economy.

> **THE FUTURE CAR**
>
> **HERBERT C. SNOW**
>
> **All cars will be lighter. The 7-passenger car weight will come below 4000 lb. There will be fewer 8 and 12-cylinder engines. The heavy cars will have 6 cylinders and the lighter cars 4 cylinders. Changes in the engine will be with a view of meeting requirements of low grade fuels.**

"The ignition system is also important to the satisfactory operation of the engine. The single ignition will be more common. While the battery has been adopted as the only source of ignition on a majority of cars, still the magneto will continue to be used, especially on the higher priced cars.

"The location of the transmission as a unit with the engine will, I believe, be the most popular. The majority of the transmissions will have three speeds, but I believe that the four-speed transmission will be developed."

Mr. Crane Sees No Chance to Standardize Types

The industry is likely to retain its present multiplicity of car types, according to Mr. Crane's paper.

"The varying tastes and requirements of different people are such," he said, "that with human nature as it is we will see no great change in this direction. On the other hand, the passenger car is being considered more and more from the sole point of view of a means of transportation, and with less regard as to what might be called its sporting characteristics. We are, therefore, seeing the so-called open car, which in the early days was the backbone of production, being replaced more and more by cars with various types of closed bodies. It is easy to remember when the completely inclosed car, such as the sedan, was extremely rare. To-day it is a standard body type in quantity production on cars of practically every grade of price.

Trend Toward Lighter Weight

"While there has been a continuous effort toward obtaining lighter weight, it has barely been possible in any given car to make up by superior chassis design for a constantly increasing weight of body and equipment. Electric starting and lighting and power tire pumps have had to be provided for, while the use of closed bodies has made absolutely necessary a very considerable increase in the weight of chassis frames. Furthermore, the demand for quietness combined with durability has made it difficult to lighten any of the principal parts of the power plant and driving gear materially, some parts, such as crankshafts, being heavier than ever before. The call for easier riding has made necessary a continuous increase in the weight of springs.

Improvement in Quality Expected

"I hope to see in the near future a very considerable improvement in the quality of our production, both as to

THE FUTURE CAR

HENRY M. CRANE

The trend is toward lighter cars. The closed bodies will be made in increased proportion. There will be a greater mileage per gallon of fuel. Maintenance must be made less of a problem for the car owner.

design and workmanship, in all grades of cars, due to much greater attention being given to ease of maintenance and economy of operation than has ever been given in the past. Many of our lower priced cars are far more expensive to operate than they should be, in view of their light weight. It seems to me that a car in ordinary service which will not give from 25 to 35 ton-miles per gallon is open to serious criticism, in view of our failing supply of gasoline. In the future, cars requiring more than 1 gal. of engine oil for each 100 gal. of gasoline are not operating with an economy that should be readily obtainable.

"I think that we will see an increased use of oil for lubricating other chassis parts outside of the engine, and that this use will be simplified, as it has been in many other commercial lines, by a design allowing for carrying a supply of oil at the various points required, which will need only occasional replenishment."

Torque Recoil and Car Weight

In a paper on "Torque Recoil and Car Weight," L. H. Pomeroy, vice-president of the Institution of Automobile Engineers, London, said:

"In the evolution of the automobile few factors have aroused such discussion among users and engineers as that of the desirable number of cylinders that an automobile engine should possess. Certain American makers have pursued the policy of crowding as many cylinders as possible under the bonnet, with a commercial success that has justified this somewhat peculiar method of meeting the conditions with which they were confronted. The buying public were readily persuaded to accept the multi-cylinder engine, for two reasons: First, the plausibility of the argument that high-gear performance depended upon the number of cylinders per se, and, second, the fact that the said high-gear performance with these engines was beyond all question of a very commanding nature.

"For slow-speed running either throttled down on the level or with open throttle on hills the high-gear performance depends upon the ability of the engine to run slowly and upon the gear ratio. The slow running ability of a four-cylinder engine is practically limited only by its flywheel weight taken as an engine, but when mounted in a car the whole mass of the car may be considered as flywheel mass, provided no definite reversal of torque takes place, such as may be due to misfiring.

"On the other hand, the slow running ability of either a six, eight or twelve-cylinder engine involves a much greater accuracy of valve timing, carburetion and ignition. In my experience I have been able to obtain much better slow-speed running with four-cylinder engines than with six or twelve-cylinder units. It is quite easily possible to throttle a high efficiency engine of the four-cylinder type down to 160 r.p.m., giving a speed of about 4 m.p.h. with a gear ratio of 4 to 1. The impressive slow running performance of the multi-cylinder cars is, in my opinion, much more a function of the gear ratio than of the number of cylinders.

"Without going to extremes, flywheels can be made heavy enough on four-cylinder engines so that when running slowly there is no noticeable variation of angular velocity and hence a jerky motion of the car as a whole. In other words, to judge the uniformity of torque given by a four-cylinder engine as compared with a twelve-cylinder one by superposing the torque diagrams is a gross misrepresentation of the facts.

"It is when the subject of torque recoil is discussed that the advantages of the multi-cylinder engine become manifest. The torque produced by the explosion spends itself in part by accelerating the flywheel, thus producing an equal and opposite recoil which is transmitted to the engine supports. At high speeds this recoil vibration is so rapid as to be practically continuous. The speed at which, other things being equal, this continuity is produced depends upon the number of cylinders and the magnitude of each individual recoil, i. e., at part throttle the effective continuity will occur at a slower speed than at full throttle and will also occur at a slower engine speed, for say an eight-cylinder engine than for a four cylinder. It is clear, however, that with any number of cylinders there is a point at which the torque recoil ceases to be noticed. The point at issue is as to how far it is really necessary to increase the number of cylinders to avoid the manifestations of torque recoil to such a degree as to excite the sensitiveness of the expert driver. Upon this subject the following observations may be made:

"(1) There is in fact what may be called a recoil flywheel effect due to the mass of the cylinders and crankcase. If these were of great weight the torque recoil would be absorbed by these to a large extent instead of being transmitted to the engine support almost in full as is the case with engines of normal weight, particularly at low speeds.

"(2) The mounting of the engine itself plays an important part in the impression of torque recoil continuity. By suitable means the effect of torque recoil in a four-cylinder engine can be damped out, so that even at low speeds it is almost imperceptible. I refer particularly to the method of mounting the engine upon a subframe, thus avoiding the direct recoil which occurs when the engine is mounted directly upon the main frame. It is not possible to reduce this effect to figures easily, but a little consideration will show that even at comparatively low engine speeds the periodicity of the torque recoil is sufficiently rapid that during the time the recoil from one cylinder is being absorbed and delivered to the main frame, another is being imparted, and so on.

"For a given engine speed and gear ratio the torque recoil as has been stated is proportional to the mean effective pressure and the number of explosions per unit time. Increasing the size of cylinder, but keeping the torque the same, will, therefore, not affect the torque recoil, owing to the consequent reduction in brake mean pressure for a given torque. Torque recoil then is independent of the cylinder size for any given torque. Increasing the number of cylinders, keeping the torque the same, will reduce the torque recoil effect in proportion to the increase in the number of explosions per minute.

"From the point of view of power and acceleration cars may be classified in terms of the power exerted by the engine, the road speed at which this power is exerted and by the total weight. These factors determine the acceleration or liveliness of the car, its capacity to climb hills and to accelerate. For any given gear ratio, then, the horsepower of the engine should be in proportion to

the total weight. The low limit of the high-gear ratio is determined by the maximum speed at which the engine will run and give a satisfactory road speed.

"For automobile engines of moderate size, say not exceeding 4-in. bore and 6-in. stroke, the limiting speed, or that at which the maximum power is attained, does not vary greatly, being somewhere between 2500 and 3000 r.p.m. For the purpose of discussion, there is no reason why the same gear ratio should not be used with an engine of say 4-in. bore and 6-in. stroke, as with an engine of 3½-in. bore and 5-in. stroke. It is clear, then, that for the same high-gear ratio power in proportion to the total weight may be read as torque in proportion to the total weight.

"From the user's standpoint the multi-cylinder engine is regarded as advantageous in respect to high-gear work on the hills and on the level, characteristics in which such engines have certainly no advantage in respect of the number of cylinders per se. The prevalence of this opinion is a costly one for both the industry and the owners, however useful it may have been as a sales policy to save a situation endangered from other causes. It will be interesting to see how far the economic considerations which are the basis of all sound engineering will ultimately affect design in the respects discussed.

"I am strongly of the opinion that in the near future the chassis will be designed to suit the body work and that there will be broadly two types of chassis, the one suitable for heavy closed and open bodies and the other suitable for bodies of the roadster type. Such a development would lead probably to the conclusion that the light chassis would be capable of dealing with considerably heavier bodies than those for which it was originally designed. This would allow the lightening process to be repeated without involving the commercial danger of marketing a light chassis for all purposes. As has been shown, a reduction in car weight would enable the existing standards of performance to be maintained and even improved with the use of four-cylinder engines for the lighter chassis and a maximum of six cylinders for the heavier type and all that this means in its tremendous advantages to the automotive industry and to the user."

THE FUTURE CAR

L. H. POMEROY

The 4, or at most, the 6-cylinder engine will meet all demands. This change will be of an economic value. The future chassis will be made in 2 types, one for heavy bodies, the other for roadster type. I look for the lighter chassis to be used with the 4-cylinder engine and the heavier body with the 6-cylinder as a maximum.

New British Low-Priced Car

A LIGHT car, assumedly built to compete with American productions both as regards price and scale of manufacture, has just made its appearance in England. It is the product of Wm. Cubbitts & Sons of London.

The engine is a four-cylinder monobloc, with the head separate and integral with the water outlet pipe. The bore and stroke are 80 x 140 mm. (3.15 x 5.5 in.), giving a capacity of 2185 cc. (133 cu. in.). The crankshaft is a forging ground on the journals only, and there are three main crankshaft bearings of great length. At the end of the crankshaft itself is a helical gear operating the camshaft. Connecting rods of H section are used, with bronze bushings for the piston pins. Special bronze buffer pieces are fitted at the ends of each piston pin, to prevent it scoring the cylinder walls. The cams and shaft are in one piece, which runs in three bearings, the camshaft being increased in diameter at these three points.

The valves are of nickel steel, and are operated by discended tappets having adjustable heads, the cams striking these tappets in such a manner as to cause them to rotate.

The ignition, lighting and starting sets are on orthodox American lines. No magneto is fitted, the current being taken through a battery and coil from the lighting dynamo. The starter is of the usual Bendix drive type.

Crank bearings are lubricated by an automatic pump run off the camshaft. Enough oil escapes from the big-end bearings to lubricate the cylinder walls and piston-pin bushings, and the lowest of the three piston rings is fitted with a skirt to prevent too much oil reaching the combustion chamber.

The oil pressure gage is of novel character, and most ingenious. Oil is led from the engine to one side of a thin steel diaphragm. Any oil pressure must therefore bend the diaphragm. On the other side of this diaphragm is a chamber filled with red liquid, and leading out of this chamber is a single glass tube. As the oil pressure rises, it forces the red liquid up the tube in sight of the driver, the tube being placed in a special socket on the dashboard. As this would be difficult to see at night, the back of the tube is coated with a luminous preparation, which makes it clearly visible even on the darkest night.

The cooling is by gear pump through a very high radiator placed in front of the car. The carbureter intake manifold is waterjacketed.

Housed in a special coned ring bolted to the cast-iron flywheel is an inverted, fabric-lined cone clutch. The cone itself is an aluminum casting, and the pilot bearing consists of two ball races. The universal joints are of the fiber, or fabric, type, one in front of and one behind the gearbox. The latter is of cast iron and carries four speeds forward and one reverse. There is an exceptionally large cast-iron lid for the gearbox, which makes the whole mechanism readily accessible. At the rear end of the gearbox is a contracting fabric-lined brake, operated by a cam mechanism connected with a pedal. The arms for the forward fabric disc joint of the propeller shaft form part of this brake drum, and the propeller shaft itself is taken direct from this joint to another, similar in every way, bolted to the pinion shaft of the back axle. The back axle is of the helical-gear type.

The wheels are of the pressed-steel disc type and are easily detachable by unscrewing five nuts on the hub. From the owner's point of view the chassis lubrication of the car is exceptionally good, there being not a single grease cup on any part of the mechanism.

The standard body is a five-passenger touring, built entirely of steel by the Messrs. Cubbitts. An idea of the size of the machine may be gained from the fact that it has a 126-in. wheelbase.

The car will be completely equipped with a self-starting and lighting set, five lamps, top, adjustable windshield, and spare wheel with tire and tube. The price is $1,100 and it is hoped to produce more than 20,000 cars next year.

THE manufacture of parts to gages, so as to make them interchangeable, is believed to have been introduced by Colonel Colt in the manufacture of rifles at the time of the Civil War.

S. A. E. SUMMER MEETING

How the Automotive Industry Can Help Avert a Fuel Crisis

Do Not Attempt to Solve This Problem by Trial and Error, but Organize, Study and Build Co-ordinately for Industrial and Scientific Achievement, Advises Authority

OTTAWA BEACH, Mich., June 24.—Prof. Joseph E. Pogue made an earnest appeal at the S. A. E. Summer Meeting today for prompt and concerted action by the automotive industry toward solving the fuel problem. He said that the industry should assume its share of the responsibility for meeting the coming shortage of motor fuel, which he regarded as increasingly serious.

Prof. Pogue's paper was supplemental to his article published in AUTOMOTIVE INDUSTRIES on June 12 (Engineering Issue). In that paper he presented his reasons for believing that the shortage was inevitable, due to the shortage in the basic supply of petroleum and that this shortage, unless overcome, would develop into a serious handicap on the industry. The speaker represented the Division of Mineral Technology, U. S. National Museum.

In his paper read today Prof. Pogue outlines what he believes should be undertaken. He said in part:

"The automotive industry has an unescapable concern in the problem because the highly specialized fuel requirements of the prevailing type of automotive apparatus limits the quantity of engine fuel that may be commercially produced from the output of crude petroleum. * * *

"The low thermal efficiency or high fuel consumption of the prevailing type of automotive apparatus contributes strongly to the demand for engine fuel, requiring gasoline to be produced in far greater quantities than would be necessary if the fuel were more efficiently utilized. Every gain in thermal efficiency, therefore, means a corresponding increment to the fuel supply. Increased thermal efficiency may also be made to compensate the consumer for such advances in fuel prices as may develop. Thermal efficiency, therefore, has a pivotal bearing upon the quantity and price of engine fuel and though now tending to work to the disadvantage of the automotive industry may be turned to its advantage.

"On four counts, the automotive industry finds itself responsible in respect to fuel where it had no concern in the past. If the conclusion is correct that fuel is now to dictate to the engine, the engine should listen well to all that fuel has to say.

What Has Been Done

"In the past few years there has been a growing recognition that the rapid advance in automotive construction was creating a fuel problem which the automotive interests themselves would have to share in solving. This feeling, however, was scattered and ill-defined and did not find official recognition until the 1919 Annual Meeting of the Society of Automotive Engineers, when a session was devoted to a consideration and discussion of the engine-fuel situation.

"In the spring of 1919 the second stage in the solution of the problem was entered upon with the establishment of a committee of the Society of Automotive Engineers charged with considering ways and means for active work on the fuel problem. A fuel research organization was projected by this committee and the organization, scope and program of the new agency are now (June) under formulation. At the same time the newly formed American Petroleum Institute, representative of the oil industry, has under advisement the establishment of an agency of contact and co-operation with the automotive activity. Thus the initial machinery has been established." * * *

Functions of a Research Organization

According to the speaker the action necessary to secure a solution of the problem involves three stages:

1—Economic analysis to determine what is needed to be done.
2—Material research to build up new technology.
3—Co-ordination between the industrial activities concerned to facilitate the adoption of a new technology and to remove cross-purpose development.

"It cannot be emphasized too strongly that the problem is not one that will yield to dissociated research alone. The activity connoted by the term 'research' has unfortunately taken on a very narrow meaning in the popular mind, at the same time that it has assumed a sort of magic quality as being a panacea if only applied intensively enough. The gravest danger at the present stage in the development of a fuel research organization is that it will be projected along conventional lines too narrow to admit the full range of technique—analysis, material research, co-ordination—essential to adequate progress.

The Role of Economic Analysis

"The part that economic analysis should play in connection with material research has not been absolutely ignored in the past, but it has not been accorded its due rank as a matter open to rigorous scientific cultivation.

"It should be clearly appreciated that the factors in

the engine-fuel situation are in course of constant change, and no program of work can be effective which is not based upon careful, scientific evaluation of these variables. The problem, being composed of variables, then, is distinctly not a static matter, and accordingly it cannot be treated as if it were a fixed specific issue.

"More specifically still, it is conceived to be the function of economic analysis to study and interpret the various engine fuels, such as gasoline, kerosene, fuel oil, benzol,, alcohol, shale-oil distillate, etc., in respect to resources, production, trend of prices, economic status, interrelationships, technical development and so on. At the same time, in the light of their bearing upon fuel, the various automotive developments should be appraised, in respect to output, efficiency, trend of changes, price relationships, etc.

The Role of Research

"Research is a tool for building up technology in any direction desired. To be effective, it should be applied to critical and pivotal points. Results are too laggard and costly, if research is not directed by economic need, although the term should be given a broad interpretation in this respect.

"Enough is already known of the economics of the engine-fuel situation to feel that among the matters calling most insistently for research are carburetion to permit the use of difficulty vaporizable fuels and combustion to increase thermal efficiency.

"To secure proper research attention to these and related matters will require the co-ordination of the many individual research activities—industrial, governmental and university laboratories, etc., which now have facilities for conducting research; and a central laboratory to devote adequate attention to the more basic and elaborate lines of work not adequately being handled by the individual agencies.

The Role of Co-ordination

"There must in addition be a bringing together, a co-ordination, of the various industrial activities concerned under a consistent and harmonious policy, which will insure an appropriate adoption of technologic advances and especially smooth out such competitive cross-currents as may be blocking a favorable development of the matter. The utmost in investigation and research will avail nothing, if the aggregate of policy is not brought under a measure of scientific control sufficient to insure a harmonious development in respect to fuel.

"Since both fuels and engines are in course of change, though periodically standardized, it is obvious that a paramount problem is to insure, so far as possible, a parallel and complementary development of the two.

"If it should turn out that trucks and tractors adopt the heavy-oil engine as an outcome of experience, a remedial loss will have been sustained if this is allowed to come about by a process of trial and error.

"On the basic issue of fuel policy, competitive effort may advantageously give way to co-operation. As an illustration, the fuel policy most advantageous for the tractor industry is contingent upon the fuel policy adopted by the truck industry, and in turn is not unaffected by what is developing in respect to passenger cars. Without the closest understanding between the three, the tractor policy would stand only the vaguest chance of being correct.

The Type of Organization Requested

"It is probable that many who have given attention already to the engine-fuel problem have felt disappointed that a more definite and specific program for attack has not been offered. The present undeniable state of perplexity as to exactly what should be done is due to the fact that no one knows, nor can know, in advance, exactly what should be done. I think that the practical step now is to establish an organization broad enough to attack the problem at all its vulnerable points. If this is done on a scale commensurate with the magnitude of the issue and with a personnel equal to the responsibility, the industry may feel assured that it has taken the only practical step toward bringing the full quota of modern scientific methods to bear on the matter."

Lively Discussion of Dr. Pogue's Paper

In opening the discussion of Dr. Pogue's paper, Chairman Bachman outlined the activities of the S. A. E. in connection with the fuel problem since last February. Two meetings, he said, had been held, one at Washington and one at New York, at which the outlook had been discussed jointly by representatives of the automotive and of the oil industry. A joint committee was established, Mr. Bachman said, which would lay out a program of work somewhat as outlined in Dr. Pogue's paper.

Mr. Hinkley complained that engine builders were asked to design their engines to use very divergent fuels. The city of Detroit had approached the fuel problem and drafted comparatively simple specifications based on the distillation characteristics which the fuel sold in the city must meet. This had solved the problem there for the time being. The engine builders wanted "a mark to shoot at," he said, and would like to have the subject of fuel characteristics settled for five years at least. If a man bought a first-class car, he sometimes deluded himself that it would last him a lifetime, but in a few years it would not burn the fuel then available.

Mr. Cardulls said there were five lines of attack on the fuel problem that had occurred to him:

1—To forbid the use of the lighter petroleum fractions in fuel oil.
2—To encourage the development of an automatic gas generator for producing a fixed gas from the heavier hydrocarbons for use on trucks and tractors.
3—The development of engines and carbureters for heavy oil.
4—The induction of more economical vehicles, possibly of reduced high gear ability, and having a greater number of gears.
5—The production of a sympathetic fuel, drawing upon all the various fuel sources available.

Mr. Smith said that it was up to engine designers to meet the problem. Local restrictions would not solve it. It was also pointed out in the discussion that the public should be exhorted to economize.

As an instance as to what expenses we have gone in powering passenger vehicles, it was stated that on a certain high-grade car the throttle was opened 12 degrees 50 minutes when running at 50 m.p.h., over a smooth level highway. Another fact that tends to enhance the scarcity of motor fuel is that gas companies are using fuel oil to enrich their gas, as the practice

(*Continued on page* 1451)

S. A. E. SUMMER MEETING

Visualizing the Future Truck

Why It Will Have 4-Speed Transmission
Changes for the Pneumatic Tires
Developing an Ability Formula

OTTAWA BEACH, MICH, June 24—The future of the truck was the chief topic at the morning session. Louis P. Kalb discussed the relative high and low gear ability of the truck of the future and the changes that must be made in the design of the truck to make pneumatic tires an economical part of the equipment.

Mr. Kalb, who was assistant supervisor of engineering of the Standard Parts Co., Cleveland, Ohio, presented his paper under the title, "The Relation of Motor Truck Ability to the Trend of Design," as follows:

This article is intended, however, to treat the subject of motor truck ability from the standpoint of its relation to present trend of motor truck design, attempting to set forth some of the fundamental considerations involved therein.

All engineering calculations are based upon what may be termed "factors of experience." For example, in calculating the section of a front-axle I-beam, a formula is used containing that stress which experience has shown to be safe for this particular duty. The purpose, then, of an ability formula when applied to automotive vehicles is to determine a "factor of experience" from which the proper engine size and gear ratios can be calculated.

Measurement of Performance

The performance of automotive vehicles is properly measured by their comparative ability to perform the function for which they are intended. It is logical then that passenger car performance be measured in terms of speed and acceleration. In the case of motor trucks, however, these are not the most important considerations, it being almost universal practice to limit the speed by a governor, which in itself minimizes the importance of acceleration. Furthermore, wind resistance is negligible, so that practically the only resistances to be overcome by a motor truck are road friction and the force of gravity. The performance of motor trucks can therefore be measured simply by their ability to overcome these two forms of resistance.

Now both road and grade resistance are in direct proportion to the weight carried and can be expressed in unit terms such as pounds per pound and pounds per ton of total load.

If the tractive force which the driving wheels of a truck are capable of exerting be expressed in the same terms, it then becomes a simple matter to compare the resistance to be overcome with the force available for doing it. This unit tractive force is therefore the best index of the ability of a motor truck.

It might be well to call attention to the incorrectness of the idea held by some that a truck's ability is affected by the location of the driving wheels and the distribution of the load. The fact is that it makes no difference whether the drive be through the front, the rear, or all four wheels, or whether the load be carried on the truck or on a trailer; the total resistance and consequently the force required to overcome it will be the same. There are in more or less general use a number of ability formulas of indisputable merit, and, in addition to these, many engineers have their own pet ways of expressing ability which best serve their own purposes. All of these formulas are based upon the same fundamentals and to consider the subject in an intelligent manner, let us get a correct understanding of these fundamentals by building up from first principles.

Ability Formula

The maximum tractive force available at the tires of the driving wheels is expressed by the following formula:

$$F = \frac{2\,GA\,R\,E}{D} \text{ where} \qquad (1)$$

F = Tractive force in lb.
GA = Maximum brake torque of engine in in.-lb.
R = Total reduction of ratio of engine to wheel speed
E = Efficiency between engine and wheels
D = Diameter of driving wheels in in.

Now the engine torque may be expressed in terms of piston displacement as follows:

$$GA = \frac{Pb\,V}{12.56} \text{ where} \qquad (2)$$

GA = Engine torque in in.-lb.
Pb = Brake mean effective pressure in lb. per sq. in.
V = Total piston displacement in cu. in.

Substituting this value for GA in equation (1), we have the tractive force expressed in terms of piston displacement.

$$F = \frac{V\,R\,Pb\,E}{6.28\,D} \qquad (3)$$

The tractive force per unit of weight may be expressed

$$T = \frac{F}{W} = \frac{V\,R\,Pb\,E}{6.28\,D\,W} \text{ where} \qquad (4)$$

W is the total weight of the vehicle, body and load. Now if W is expressed in tons, T will be the tractive force in pounds per ton, and if in pounds T will be expressed in pounds per pound. Both methods of expression have their advantages. Road resistance being commonly expressed in pounds per ton, it is, of course, convenient to express ability in the same terms. However, as will be

shown later, grade resistance is more conveniently expressed in pounds per pound. It also seems that the formula should contain only one unit of weight. In my estimation, therefore, the best measure of truck ability is the tractive effort in pounds per pound.

All of the factors involved in equation (4) can be readily determined with the exception of mean effective pressure and efficiency. Both of these quantities are rather indeterminate. Not only do different designs of trucks vary considerably in respect to these features, but even trucks of the same make and type are quite likely to show an appreciable difference.

Pb being the index of engine output per unit of piston displacement, is, of course, affected by all the factors by which engine output is controlled, such as carbureter setting, ignition and valve timing, condition of valves, pistons, etc. Efficiency is also affected by many factors, such as design of transmission and axle, type of drive, effectiveness of lubrication, etc.

When possible it is, of course, desirable to use values determined by actual tests made on the truck under consideration. This generally involves much time and effort, which makes this information rather difficult to obtain. To make this formula general in its application and easy to apply, we will assume certain values of *Pb* and *E* which approximate as closely as possible the average values for various designs of engine and types of drive. A good average value for *Pb* is 85 lb. per sq. in. A number of truck engines develop more than this on the block, some giving as high as 93 lb. per sq. in. However, very few engines give this later output on the road, and the lower figure approximates very closely what can be expected from most truck engines in service.

It has been quite common to assume *E* to be 85 per cent on direct drive and 70 per cent in gear. Recent tests show that a more correct assumption would be 90 per cent on direct drive and 85 per cent in gear. Substituting these values in equation (4) we have

$$T = \frac{12.15\, V R}{D W} \text{ in direct drive} \qquad (5)$$

$$T = \frac{11.5\, V R}{D W} \text{ in gear.} \qquad (6)$$

to distinguish *T* from other factors for expressing ability, I shall hereafter refer to it as the "ability coefficient."

The hill-climbing ability of a truck may be expressed in terms of ability and road resistance by the following formula:

$$G = T\left(\frac{1 + R^2}{\sqrt{T^2 - R^2 + 1} - T R}\right) - R \text{ where} \qquad (7)$$

G = Per cent grade truck can just climb with road resistance R
T = Ability coefficient in lb. per lb.
R = Road resistance in lb. per lb.

For the average values of *T* and *R*, the quantity in the parenthesis is so close to unity that for all practical purposes, the formula can be expressed

$$G = T - R \qquad (8)$$

In other words, the grade that a truck will climb is equal to the net drawbar pull expressed in pounds per pound.

Let us compare equations (4), (5) and (6) with some of the other ability formulas now in use. H. K. Thomas's ability formula is expressed as follows:

$$Q = \frac{3000\, d^2 s n r}{D W}$$

C. T. Myers's vehicle coefficient is expressed

$$V C = \frac{8 n d^2 s r}{D W}$$

while the formula suggested by Mr. Roebuck is

$$K = \frac{14{,}550\, d^2 s n r}{D W}$$

The similarity of all these formulas is apparent. Each one involves piston displacement per unit of weight moved a unit distance and differs only in the constants and assumed values for engine output and efficiency.

The vehicle coefficient of Mr. Myers and the ability coefficient expressed in equations (4), (5) and (6) possess the advantage that they represent a concrete quantity and can be used to determine drawbar pull and hill-climbing ability. If it were desired to make the expression for ability an abstract quantity which could be used for comparative purposes only, the formula

$$K = \frac{V R}{D W}$$

would answer all requirements. This formula involves only known variables and is reduced to the simplest terms.

As stated previously, any expression of ability involves piston displacement per unit of weight moved a unit of distance. A rearrangement of equation (4) will illustrate this point.

$$T = \frac{Pb\, E}{2} \times \frac{V R}{\pi D W}$$

and the second factor equals cubic inches of piston displacement per pound moved 1 in. Motor truck fuel consumption is generally expressed in pints per ton-mile. On account of the varying throttle openings, it cannot be said that fuel consumption will vary directly as the piston displacement; nevertheless, other things being equal, the greater the piston displacement, the greater the amount of fuel drawn into the engine during a given number of revolutions, and consequently, the greater the ability, the greater will be the fuel consumption per ton-mile. Therefore the penalty that must be paid for ability is reduced fuel economy.

If road and grade resistance were constant it would be quite a simple matter to design for an ability just sufficient to overcome this resistance and we would thus have a maximum economy at all times. However, hills do exist and road resistance varies widely. In some localities the grades never exceed 6 per cent, while in others they run as high as 30 per cent. Road resistance varies from 0.0075 lb. per lb. for good asphalt, to 0.1800 lb. per lb. for a sand road, loose sand and plowed ground going even higher than this.

High-Gear Ability

To determine in advance just what the ability of a truck should be would appear a rather difficult task. In general, it can be said that high-gear ability should be sufficient to overcome average road resistance with a sufficient surplus to climb the grades that are encountered with such frequency that gear shifting would be objectionable. The low-gear ability should be sufficient to overcome practically the worst conditions of grade and road.

A study of the abilities of existing trucks shows that practice varies widely upon this point. In the smaller sizes, ranging from 1000 to 2000 lb. capacity, there seems to be a tendency toward passenger car ability. This seems quite logical, for most of these trucks run on pneumatic tires and at speeds which call for that ability necessary for acceleration and overcoming wind resistance.

Some of the most successful vehicles in this class have a high-gear ability coefficient of from 0.085 to 0.090. It might be noted that this is greater than foreign practice for passenger cars, but somewhat lower than American passenger car practice, which varies from 0.085 to 0.105.

In the larger sizes of truck, that is, from 1½ to 6 tons capacity, operating at moderate speeds and on solid tires, abilities vary from about 0.06 to 0.08 lb. per lb. A good average of present successful practice would be around 0.0675 to 0.074.

In determining the proper ability coefficient to use in new designs, it would be unwise to follow present practice blindly. In fact, it is my opinion that the proper high-gear ability for a truck is much lower than the average figure given above. There are a number of causes which tend to make the average engineer lean toward excessive ability. The fact that it is so difficult to determine just what proper ability is, leads the engineer toward unnecessarily high ability just for the sake of being on the safe side.

Until recently, the great majority of trucks on the market had three-speed transmissions with rather limited low-gear reductions. Undoubtedly excessive high-gear abilities were necessary in many cases to have anything like adequate ability on low gear. Furthermore, the great majority of truck buyers judge a truck merely by its power, forgetting entirely the effect that excessive ability has upon economy.

Engineers must, of course, design what the public wants or thinks it wants. An effort should be made, however, to educate users on this point and bring them to understand that high ability costs money. Some consistent propaganda along this line would undoubtedly cause truck users to modify their demands appreciably.

The use of trucks in country districts is increasing, but it is hardly right to penalize the great majority of trucks which are operated on improved roads for the sake of the few that operate in rural districts over unimproved roads.

The fuel problem is one which is becoming more serious daily, and the constantly increasing number of trucks in service is certainly not tending to alleviate the situation. If this growth is to continue unhampered, something must be done both to improve truck economy as well as to enable trucks to operate upon the poorer grades of fuel which are now available.

The truth of this statement is shown by the fact that marine engines, whose power factors are much lower than those of passenger cars or trucks, operate satisfactorily on kerosene. This has never been successfully done with either trucks or passenger cars.

Ideal Design of Truck

The ideal design of a truck is one which combines maximum economy with adequate ability. Now, since trucks operate at least 90 per cent of the time on high gear, the interests of economy will be served if we keep high-gear ability down to the minimum. In my opinion, the ability coefficient in high gear should be about 0.063 to 0.066 lb. per ton. As stated previously, the low-gear ability of a truck should be sufficient to overcome the worst conditions of road and grade. This is a requirement which it is impossible to fulfill entirely. The best that can be done is to utilize all of the ability that the adhesion of the driving tires will permit. This can be done by making the low-gear ratio sufficient to almost slip the wheels under full engine torque.

The coefficient of adhesion of solid tires to dry macadam is about 0.60, while on a sand or mud road it would not exceed 0.45. It is on the latter type that the greatest ability is required. Therefore, if the tractive force be made about 45 per cent of the load on the rear wheel, we will have the maximum ability that the traction of the driving tires will permit.

The proportion of total weight on the rear tires is about 77 per cent. The low-gear ability coefficient should therefore be

$$T\,L = 0.770 \times 0.450 = 0.346 \text{ lb. per lb.}$$

The low-gear ratio of the transmission should then be

$$r = \frac{0.346 \times 0.900}{0.063 \times 0.850} = 5.8 \text{ to } 1$$

Such a low-gear reduction as this would, of course, require a four-speed transmission. About the maximum ratio obtainable with a three-speed transmission is 4 to 1, and anything greater than this would cause very unsatisfactory gear changing. Four-speed transmissions have in the past been the exception, and even those which did exist did not have anything approaching the proper low-gear ratio. In fact, the idea of utilizing all of the available traction on low gear seems to have become popular in the last few years.

The Class B truck is, in a way, responsible for the rapid growth of the idea, although not for its inception, as it afforded engineers a large scale demonstration of the principle. Anyone who has seen the B truck negotiating roads and grades over which other very good trucks were unable even to move could not but be impressed.

Increasing Low-Gear Ability

Increasing low-gear ability will, of course, require a proportionate increase in the size of torque-carrying members back to the transmission, such as propeller-shafts and live axles. However, the design of such parts to meet these conditions is a very simple and exact proposition. Since the torque required for slipping the wheels is a definite proportion of the load upon the tires, the torque and load-carrying members of the axle can be proportioned accordingly. Since it is impossible to impress a torque upon the axle greater than the adhesion of the tires will transmit, it will be impossible with an axle so designed to over-stress the torque-carrying members no matter how large an engine or how low a gear ratio is used.

Propeller-shaft brakes also cease to be a bugaboo, for tire adhesion limits braking torque just as much as it does propelling torque. The advantages of this should appeal to axle manufacturers. Even without increasing the strength of the torque-carrying members increased low-gear ability should tend to reduce rather than to increase the strain on these parts. With adequate low-gear ability it is no longer necessary to speed up the engine and drop in the clutch suddenly to get out of bad holes. Instead, an even, steady torque is applied, which does much less harm than the shock of a suddenly applied torque. I know of an instance where the breakage of live axles was actually eliminated in a fleet of trucks operating in a very severe service by increasing the low-gear ability.

The objection raised to reducing high-gear ability is that such a move would not meet with favor in the eyes of truck users. To judge the merits of this objection, let us compare the hill-climbing abilities of two trucks, one with a high-gear ability coefficient of 0.072 and a three-speed transmission with a low-gear reduction of 4 to 1 and the other with a high-gear ability coefficient of 0.063 and with a four-speed transmission having a low-gear reduction of 5.8 to 1. Assuming that the road resistance is 0.03 lb. per lb., the three-speed truck will

be able to climb a grade of 4.2 per cent on high gear. On low gear this truck will have an ability coefficient of 0.272 lb. per lb., and will be able to climb a grade of 24.2 per cent. The truck with the four-speed transmission will be able to climb a grade of 3.3 per cent on high gear. On low gear this truck will have an ability coefficient of 0.345 lb. per lb., and will be able to climb a grade of 31.5 per cent.

Now where is there a driver who can distinguish between a 3 and a 4 per cent grade? The difference between a 24 and a 31 per cent grade, however, is quite appreciable.

The maximum ability of a truck is that on low gear, and consequently the power of a truck will be judged more by its low-gear than by its high-gear ability for the same reason that the speed of a truck is judged from its maximum or high-gear speed.

Any trend of design, to survive, must be fundamentally correct. I have endeavored to set forth some of the principles upon which the present trend toward four-speed transmissions is based and to show why the trend is bound to grow in spite of the inertia which all radical changes in design must overcome.

There is another trend in the motor truck field in connection with which the matter of ability should be given some careful consideration. That is pneumatic tires for large trucks. I will not attempt to discuss all of the problems involved in this subject which are perplexing truck engineers at the present time, such as brakes, turning radii, body height, etc., but will confine myself to the problems in which the question of ability is involved.

The strongest reason for the use of pneumatic tires on heavy trucks is to be able to increase the speed and consequently the ton-miles per day without injury to the vehicle. From a standpoint of dollars and cents, I do not see how pneumatic tires can be sold to replace solid ones unless this is accomplished. Undoubtedly the cost of pneumatic tires is higher than that of the solid type, and unless the owner is able to get an increased return on his total investment, due to an increase in ton-miles, he cannot be induced to invest the extra money in pneumatic tire equipment. Increasing the truck speed means an increase in engine speed or a reduction in gear ratio. It certainly is not desirable to increase engine speed, for, as surely as this is done, an increased amount of trouble will result.

Now any reduction in gear ratio will result in lowered ability. No one knows whether road resistance is more or less with pneumatic than with solid tires. This much we do know, however. When the speed of a truck is appreciably increased, the ability should approach closer to that of passenger cars. Road and grade resistance are no longer the only forms of resistance to be overcome. Not only does wind resistance become a considerable factor at higher speeds, but the car must have an ability reserve to accelerate to this increased speed within a reasonable length of time. Thus, the use of pneumatic tires calls for not only increased speed, but increased ability. Power being the product of force by velocity, it is evident that the engine must develop horsepower. It being inadvisable to increase the engine velocity, it is evident that the engine must develop greater horsepower. It being inadvisable to increase the engine speed, there is only one thing left to do, and that is to increase the size of the engine. This means a corresponding increase in the transmission drive shafts, and, in fact, in all the power-transmitting parts of the chassis. There is no doubt that the use of pneumatic tires will permit an appreciable reduction in the weight of all load-carrying parts of the chassis. I am inclined to believe, however, that this saving will be offset by the increase in the engine and other power-carrying members, so that there will be n ultimate saving in weight or cost.

PNEUMATIC TIRE TRUCK

KALB *says:*

The added cost of tires must be covered by the increased ton-miles per day by speed.

Reduction in gear ratio means less ability, so speed must be gained by larger engines.

Pneumatic tires will permit reduction in weight of carrying parts, but this will be overcome by heavier engines.

To operate successfully on pneumatic tires, the truck chassis should have characteristics of large passenger chassis.

Let us compare a 3½-ton truck, intended to operate on solid tires, with one designed especially for the pneumatic type. The specifications of the solid-tire truck may be assumed somewhat as follows:

Total weight of vehicle, lb.	15,300
Rear tire size, in.	36 x 5 dual
Speed, miles per hr.	14
Engine size, in.	4½ x 5¾
Piston displacement, cu. in.	365.8
Axle ratio	8¾ to 1
Engine speed, r.p.m.	1141
Ability coefficient, lb. per lb.	0.07

For the pneumatic-tire truck, let us assume a speed of 20 miles per hr. At this speed we should have an ability of about 0.08 lb. per lb. in order not to exceed 1200 r.p.m. engine speed. With 44 x 10-in. rear tires the axle ratio should be approximately:

$$\frac{1200}{152.6} = 7.87 \quad \text{say } 7\tfrac{3}{4} \text{ to } 1$$

The piston displacement would then be

$$V = \frac{D\,W\,T}{12.15\,R} = \frac{44 \times 15{,}300 \times 0.08}{12.15 \times 7.75} = 578 \text{ cu. in.}$$

This is approximately the displacement of a 5½ x 6 or a 5¼ x 6½-in. engine, and is even larger than is used for a 5-ton truck on solid tires.

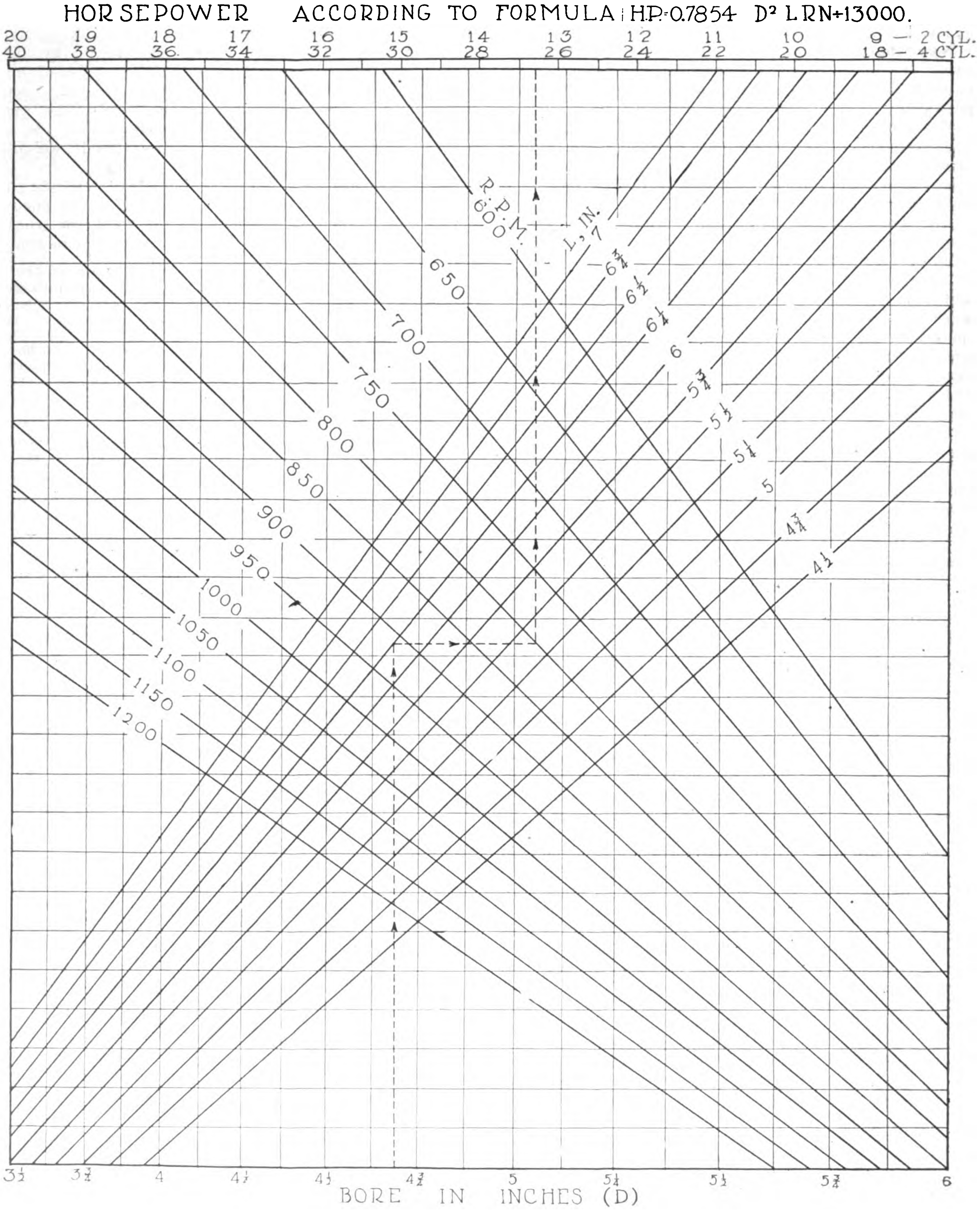
I do not wish to be understood as opposing pneumatic tires for trucks. In fact, I believe that the increased use of pneumatic tires will greatly widen the field of usefulness of motor trucks, and should be encouraged by all truck builders. **The point that I wish to bring out, however, is that high-speed pneumatic-tire trucks and slow-speed solid-tire trucks are fundamentally two very different propositions and should be treated as such. To operate successfully on pneumatic tires a truck should be especially designed for this service and should partake more of the characteristics of a large passenger chassis than do the trucks now operating on solid tires.**

In conclusion, I want to impress upon you the fact that ability is not an abstract quantity of purely academic interest, but is a factor having a direct bearing upon the most important problems of motor-truck engineering.

The Discussion

President Moseley asked A. B. Bachman, chairman of the Standards Committee to take the chair for the discussion, because of his practical knowledge of the truck situation. The rooms were filled to capacity for this session, as it was understood that there were to be interesting developments. (*Continued on page* 1451)

Tractor Rating Chart Prepared by the S. A. E.



S. A. E. SUMMER MEETING

Standards Committee Rejects Only One Proposal of Divisions

Tank and Radiator Cap Recommendation Fails—Lively Discussion Over Adoption of Formula Engine Rating as Suggested by Tractor Division

OTTAWA BEACH, MICH., June 23.

THE sharpest discussion in the session to-day of the Standards Committee considering the recommendations of the various divisions was brought about by the suggestion that the S. A. E. should depart from its usual practice and adopt a formula of engine rating as recommended practice. The question came up in connection with the tractor division report, particularly as regards the horsepower formula for tractor engines.

H. L. Horning expressed the view that the S. A. E., as an engineering body, should not depart from its precedents in this regard. He cited the action of the Society in not endorsing the A. L. A. M. formula and said he thought this was a question for the industry to solve, rather than this body. Dent Parrett gave notice of an appeal to the Society for action on the question, on the basis that the tractor division of the S. A. E. is the only technical body representing that industry.

John R. Cautley suggested that the committee do not pass the recommendation as a standard or as a recommended practice, but commend it to the manufacturers of tractors and stationary engines as a fair commercial rating. This met the approval of the committee.

The committee rejected only one recommendation, that of the tank and radiator cap. The suggestion made with the rejection was that S. A. E. threads be adopted if possible. J. J. Aull made this suggestion.

The remainder of the report of the miscellaneous divisions was approved with the comment that the drawing of the steering wheel hub was out of scale and should be revised.

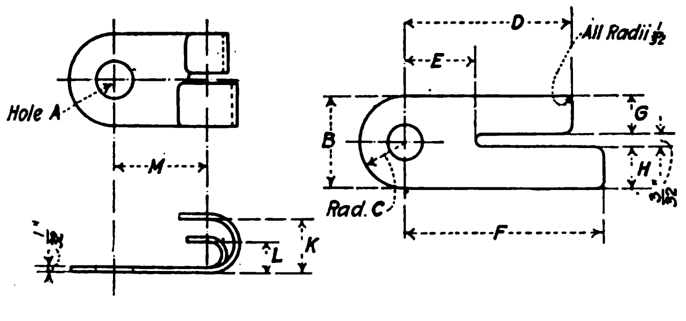
Report of Divisions as Revised and Approved by Standards Committee

The standard battery ratings shall be established at a standard temperature of 80 deg. fahr.

The rated capacity of storage batteries for farm lighting service shall be based on a final voltage of not less than 1.75 volts per cell.

The period of elapsed time at which the rated ampere-hour capacity is available shall be definitely stated.

In rating farm lighting batteries, the maximum available capacity can be obtained intermittently, or over prolonged discharge periods shall be limited to that obtainable over a

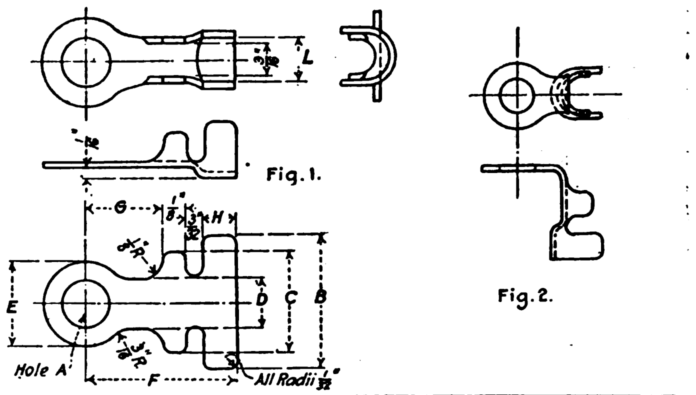


Terminal Stud Sizes.	Dia. of Hole.	B	Rad. C	D	E	F	G	H	K	L	M
No. 8 (0.1640")	0.171	3/8	3/16	19/32	5/16	3/4	1/8	5/32	5/32	5/64	11/32
No. 8 (0.1640") / No. 10 (0.1900")	0.171 / 0.201	13/32	13/64	43/64	5/16	27/32	1/8	3/16	3/16	3/32	3/8
No. 14 (0.2420")	0.2570	1/2	1/4	27/32	3/8	1 3/32	3/16	7/32	1/4	1/8	1/2

Material—To be Specified By User.

NOTE:—These Terminals are not intended for Use on Ignition Distributors.

The side-type cable terminal



Terminal Stud Sizes	Dia. of Hole	B	C	D	E	F	G	H	L	Thick.
No. 8 (0.1640") / No. 10 (0.1900")	0.171 / 0.201	11/16	15/32	7/32	3/8	3/4	3/8	5/32	7/32	0.031
No. 14 (0.2420")	0.2570	23/32	17/32	1/4	15/32	13/16	13/32	3/16	1/4	0.040

Material—To be Specified by User.

NOTE:—The Terminals as Formed in Fig. 1. may also be Formed as shown in Fig. 2.
These Terminals are not intended for Use on Ignition Distributors.

Spade-type cable terminal for generators, switches and meters

period of 72 hours. The capacity which can be obtained over a continuous discharge period of 8 hours shall be stated.

The standard test shall be at a rate of 1/24 of the ampere-hour capacity of the battery for an initial period of 4 hours, followed by a 16-hour rest; and then by two 8-hour periods, each followed by a 16-hour rest. After the last rest the final discharge period shall be 4 hours.

Note: All of the above is applicable to nickel iron batteries, except the final voltage per cell, which applies to lead batteries only. The short periods at the beginning and at the end of the test permit it to begin at noon of the first day and end at noon of the last day.

Barrel Mounting of Starting Motors

The present recommended practice for barrel mounting of starting motors is revised in that definite limits for the gear location of the starting motor with respect to the flywheel are provided, a pitch line clearance of 0.015 to 0.025 in. instead of 0.015 in. being recommended.

Focusing Lengths of Incandescent Lamps

Tolerances are placed on the location of the filament within the bulb with respect to the lamp axis, as follows:

Deviation along axis of base .... ± 3/32 in.
Deviation at right angles to axis of base .... ± 5/64 in.

It is recommended that the above deviations be reduced by the incandescent lamp manufacturers so that the allowable deviation from the axis of the base is no greater than one-half of the base of the filament field for any type of incandescent lamp.

Lens Sizes

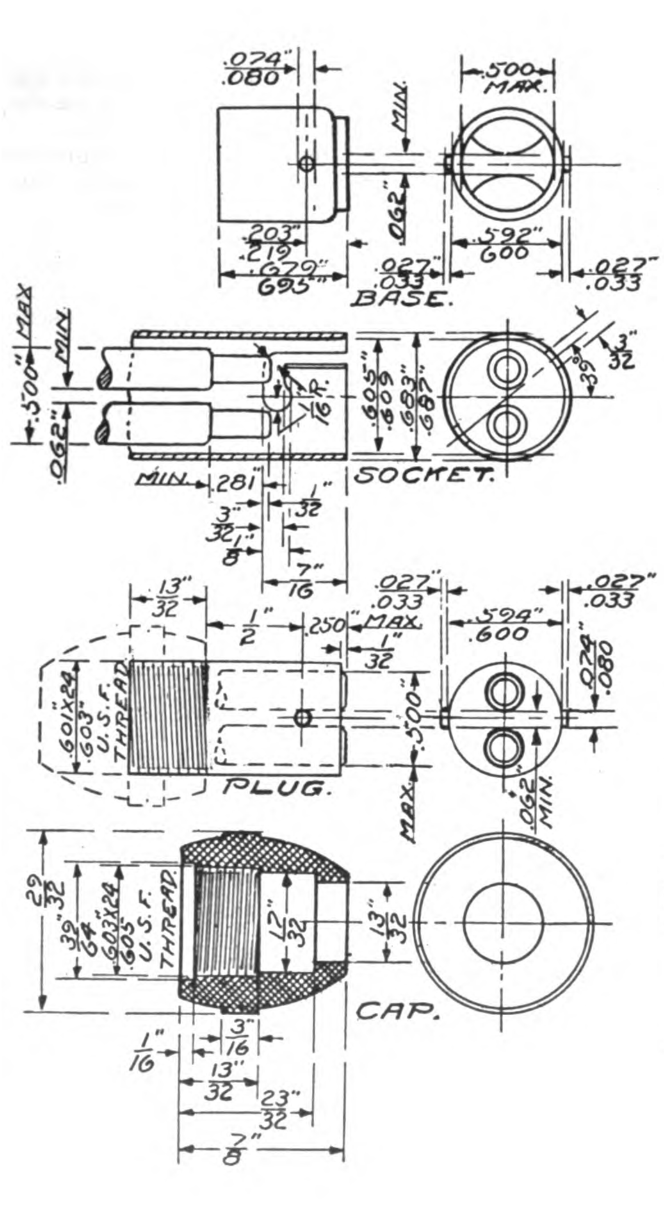
The following standard outside diameters and diameters of prism area are recommended:

Outside Diameter of Lens	Diameter of Prism Area
8⅛ + 1/32, — 0	6⅞ ± 1/32
8½ + 1/32, — 0	7¼ ± 1/32
9 + 1/32, — 0	7¾ ± 1/32
9½ + 1/32, — 0	8¼ ± 1/32

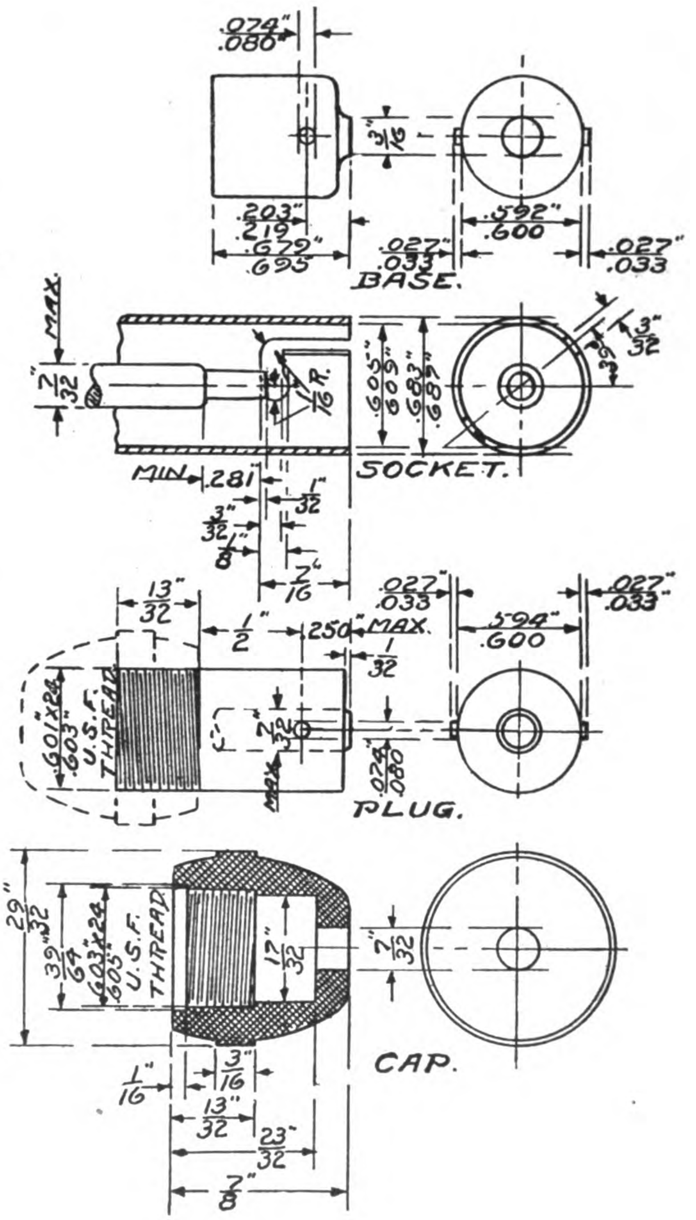
Thickness of bevel edge for all sizes is to be ⅛ in., plus 1/32, minus 0. This is commonly known as double thick American glass.

Bases, Sockets and Connectors

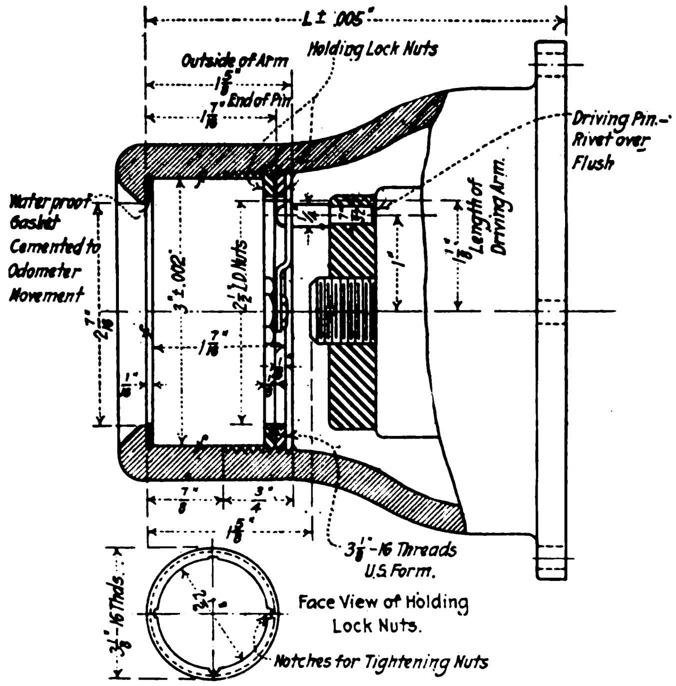
Revisions are recommended in the specifications for bases, sockets, plugs and caps for insulated- and ground-return sys-



Electric base, socket, plug and cap for insulated-return system



Electric base, socket, plug and cap for ground-return system



Hub odometer

tems, these revisions bringing the S. A. E. standards in line with present practice. The two accompanying cuts show the new standards.

Screw Stock

Two screw stock materials are recommended, both corresponding with specifications of the American Society for Testing materials. These are No. 1112, Bessemer screw stock, and No. 1120, open-hearth screw stock, these superseding No. 1114 S. A. E. specification, which included both Bessemer and open-hearth stock. These two steels are intended for general automatic screw machine products not requiring more particular properties.

S. A. E. Specification No.	Carbon	Manganese	Phosphorus	Sulphur
1112	0.08 to 0.16	0.60 to 0.80	0.09 to 0.13	0.075 to 0.15
1120	0.15 to 0.25	0.60 to 0.90	0.06 maximum	0.075 to 0.15

Chromium Steels

S. A. E. Specifications Nos. 5195, 51120 and 52120 are eliminated and the chromium limits of Specifications Nos. 5120, 5140 and 5165 are changed from 0.65 to 0.85 per cent with 0.75 per cent desired to 0.60 to 0.90 per cent with 0.75 per cent desired. Specification No. 5295 is replaced by Specification No. 52100 with the analysis given below. Steels that do not appear to be necessary are thus eliminated and replaced with one fully representative type of oil-quenching steel.

The S. A. E. Standard for chromium steels as thus revised by the Division is as follows:

	Carbon		Manganese				Chromium	
S. A. E. Specification No.	Minimum and Maximum	Desired	Minimum and Maximum	Desired	Phosphorus (Maximum)	Sulphur (Maximum)	Minimum and Maximum	Desired
5,120	0.15 to 0.25	0.20	*	*	0.04	0.045	0.60 to 0.90	0.75
5,140	0.35 to 0.45	0.40	*	*	0.04	0.045	0.60 to 0.90	0.75
5,165	0.60 to 0.70	0.65	*	*	0.04	0.045	0.60 to 0.90	0.75
52,100	0.95 to 1.10	1.00	0.20 to 0.50	0.35	0.03	0.03	1.20 to 1.50	1.35

*Two types of steel are available in this class, one with manganese 0.25 per cent to 0.50 per cent (0.35 per cent desired), and silicon not over 0.20 per cent; the other with manganese 0.60 per cent to 0.80 per cent (0.70 per cent desired), and silicon 0.15 per cent to 0.50 per cent.

Nickel-Chromium Steels

A change is to be made in the specification numbers, as follows:

Present Specification No. X3315 to be changed to No. 3415, No. X3335 to No. 3435, No. X3350 to No. 3450. The object of these changes is to obviate mistakes in telegraphic orders, etc.

Tungsten Steels

Two tungsten steel specifications, suitable for high tungsten steel for exhaust valves, are recommended, these corresponding to Signal Corps specifications W-60 and W-60-A. They are as follows:

	Carbon						
S. A. E. Specification No.	Minimum and Maximum	Desired	Manganese. Maximum	Phosphorus. Maximum	Sulphur. Maximum	Chromium	Tungsten
7060	0.50 to 0.70	0.60	0.30	0.035	0.035	3.00 to 4.00	12.00 to 15.00
7160	0.50 to 0.70	0.60	0.30	0.035	0.035	3.00 to 4.00	15.00 to 18.00

Hub Odometers for Trucks

It is recommended to standardize the housing dimensions as per the drawing below.

Steering Wheel Hub

The following table in connection with the dimension diagram gives the proposed steering wheel hub standards.

The nut dimensions in the table, which are submitted as general information only, allow for the proper seating of the nut on the pad (diameter F):

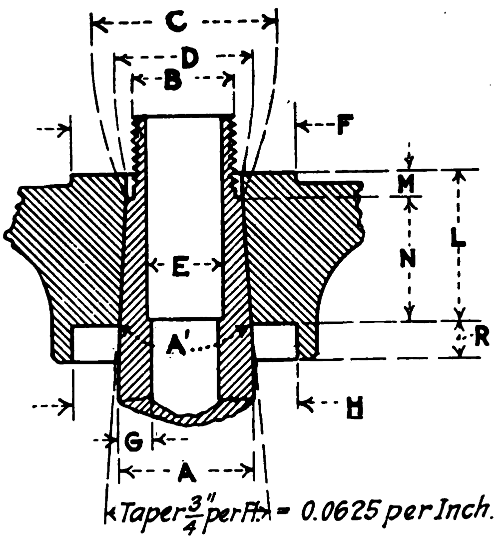
All Threads U. S. F.

	6	7	8	9	11
A	7/8	1	1 1/8	1 1/4	1 1/2
A'	0.870	0.994	1.118	1.242	1.490
B	3/4 20	7/8 20	1 20	1 1/8 18	1 1/4 18
C	(0.8075)	(0.92174)	(1.03597)	(1.150203)	(1.37672)
	0.8075	0.9217	1.0360	1.1502	1.3767
H	1 9/16	1 13/16"	1 13/16	2 1/16	2 5/16
F	1 1/2	1 3/4	2	2 1/4	2 5/8
L	1 1/8	1 5/16	1 15/32	1 5/8	2
M	1/8	5/32	5/32	5/32	3/16
N	1	1 5/32	1 5/16	1 15/32	1 13/16
R	3/8	7/16	1/2	9/16	5/8
D	(0.799687)	(0.91197)	(1.02620)	(1.14044)	(1.3650)
	0.7997	0.9120	1.0262	1.1404	1.3650
E	19/32	23/32	51/64	59/64	1 3/64
G	5/32	5/32	3/16	3/16	1/4

STEERING WHEEL NUT SEAT DIMENSIONS.

Screw Size	Wall	Short Diam.	Long Diam.	F
3/4—20	5/32	1 1/16	1 15/64	1 1/2
	1/4	1 1/4	1 7/16	
7/8—20	3/16	1 1/4	1 7/16	1 3/4
	1/4	1 3/8	1 19/32	
1 —20	3/16	1 3/8	1 19/32	2
	7/32	1 7/16	1 21/32	
1 1/8—18	3/16	1 1/2	1 47/64	2 1/4
	1/4	1 5/8	1 7/8	
1 1/4—18	3/16	1 5/8	1 7/8	2 5/8
	9/32	1 13/16	2 3/32	

All dimensions in inches.

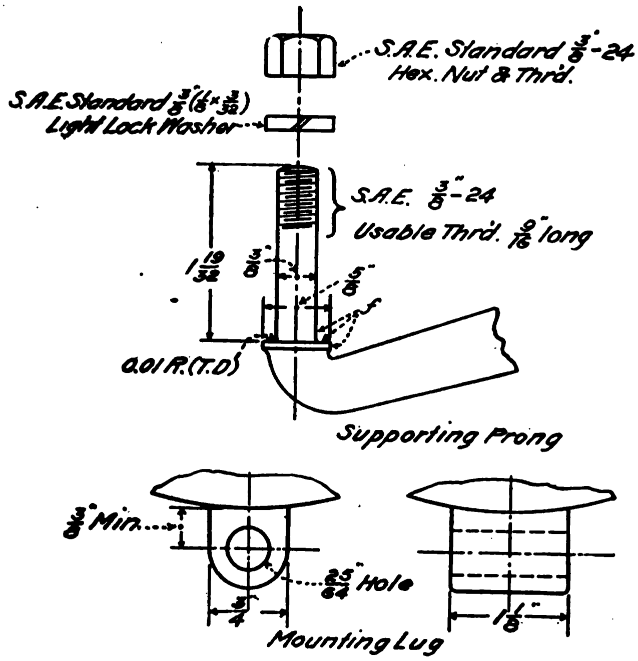


Steering wheel hub

Committee ruled drawing out of scale

Headlamp Mounting Lugs and Supporting Prongs

The following, which is established practice, is recommended as S. A. E. standard and to replace the present S. A. E. Recommended Practice on the subject:



Headlight mounting lugs
and rounded-edge taper holes

Motorcycle Chains

Motorcycle driving chains shall be of the roller type with the following dimensions: Pitch, ⅝ in.; roller width, ⅜ in.; roller diameter, 0.40 in.

Motorcycle Adoption of Existing S. A. E. Standards

The approval of the following existing S. A. E. standards and recommended practices for motorcycle practice is suggested:

Cotter pins, screws and bolts, screw threads, square broached fittings, taper fittings, 4-spline fitttings, taper fittings with castle nuts, steel specifications, babbitt metal, bearing metals, brass casting metals, cast manganese bronze, manganese bronze sheets and rods, hard cast bronze, gear bronze, aluminum alloys, brass sheets and strips, brass rods, Tobin bronze rods, non-ferrous metal tubing, nomenclature of roller-chain parts, roller chain dimensions, test specimens for iron and steel, cold-drawn seamless steel tubes, steel bands and strips, brake linings, annular ball bearings, light series; annular ball bearings, tolerances; electric bulbs oversize cylinders, piston-ring grooves.

Stationary Electric Engine Rating

The Tractor Division recommendation on nominal tractor engine ratings is proposed for adoption as S. A. E. standard for stationary engine practice.

Voltage and Capacity Ratings Electric Lighting Outfits

Farm lighting plant voltage and capacity ratings shall be according to the accompanying table.

Normal Ratings in K.W.	Nominal Voltage (16 cells)	Eng. and Gen. R.P.M. (Direct Coupled)
½	32	1200
¾	32	1200
1	32	1200
1½	32	1200
2	32	1200
3	32	1200
5	32	1200

S. A. E. Engine Testing Forms

The present S. A. E. Standard Engine Testing Forms are suitable for stationary engine work with certain additions and changes, as follows:

Sheet A—No additions or changes.

Sheet B—(a)—Addition of "Normal Horsepower" after "Name and Model."
(b)—Addition of "Normal R.P.M." as Item No. 2a.
(c)—Addition of the sub-division "Cooling System" after "Lubricating System" with the following items:
Air-Cooled .....Water-Cooled. { Radiator, Capacity, Gal....Lb...
Tank, Capacity, Gal....Lb...
Hopper, Capacity, Gal....Lb...
(d)—Addition of "Nominal Rated Horsepower" formula in Item No. 3:

$$\frac{0.7854\ D^2LRN}{13000}\ \ldots\ldots$$

Sheet C—Addition of "Weight of Water Evaporated" after "Temperature of Jacket Water-Out" under "Brake Horsepower and Fuel Consumption" and "Friction Horsepower" subdivisions.

Sheet D—Addition of R.P.M. ordinates from 0 to 1300 above that part of the present ordinates reading from 200 to 2800.

It is understood that these additions will be marked so as to refer to footnotes on all sheets reading "For use with stationary, gas and farm engines only."

Round Pipe Flanges for Stationary Farm Engines

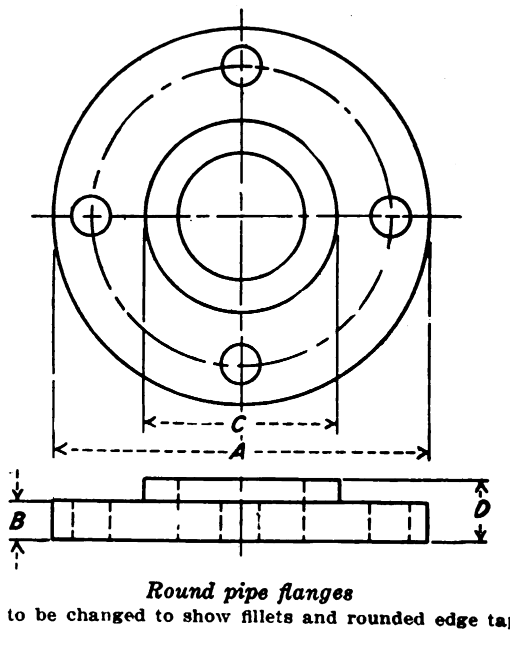
Size of Pipe in Inches	External Diameter, A	Thickness, B	Diameter of Hub, C	Length of Hub, D	Diameter of Bolt Circle	No. of Bolts	Size of Bolts
1	4	7/16	1 15/16	11/16	3	4	7/16
1¼	4½	½	2 5/16	¾	3⅜	4	7/16
1½	5	9/16	2⅝	⅞	3⅞	4	½
2	6	⅝	3⅛	1	4¾	4	⅝
2½	7	11/16	3⅝	1 1/16	5½	4	⅝
3	7½	¾	4 5/16	1⅛	6	4	⅝
3½	8½	13/16	4⅞	1 3/16	7	4	⅝
4	9	15/16	5⅜	1 3/16	7½	4	⅝
4½	9¼	15/16	5 13/16	1¼	7¾	8	¾
5	10	15/16	6 7/16	1 5/16	8½	8	¾
6	11	1	7 9/16	1 7/16	9½	8	¾

NOTE.—These dimensions conform with the A. S. M. E. and the American Manufacturers' Standard for 125-lb. American Standard Flanges.

Threads to be American Briggs Standards taper pipe threads (A. S. M. E. Sept. 17, 1913).

Motorcycle Spark Plug Shell

The ⅞-in. hexagon spark-plug shell and tapped hole dimensions and tolerances for the ⅞"-18 U. S. F. thread, are recommended for an S. A. E. motorcycle standard. As the tapped hole tolerances given are considered too wide for motorcycle practice, the following complete specifications for S. A. E. Recommended Practice are suggested:



Round pipe flanges
Drawing to be changed to show fillets and rounded edge taper hole

Spark Plug Thread Dimensions

Diameter	Maximum Mm.	Maximum Inch	Minimum Mm.	Minimum Inch
Outside (full)	....	0.709	....	0.706
Pitch (effective).....	....	0.670	....	0.667
Root (core)	....	0.626	....	0.623

Tapped Hole Dimensions

Diameter	Maximum Mm.	Maximum Inch	Minimum Mm.	Minimum Inch
Outside (full)	....	0.719	....	0.717
Pitch (effective) ...	....	0.674	....	0.672
Root (core)	....	0.636	....	0.634

These tolerances are now being specified and are suitable for standard, requiring only a little better grade of workmanship allowed in using the aeronautic tolerances.

Solid Tire Sizes

Inches	Mm.	Inches	Mm.
32x3	75/660	36x 6	150/762
32x3½	90/660	40x 6	150/864
34x3½	90/711	36x 7	176/762
36x3½	90/762	40x 7	175/864
32x4	100/660	36x 8	200/762
34x4	100/711	36x10	250/762
36x4	100/762	40x10	250/864
34x5	125/711	40x12	300/864
36x5	125/762	40x14	350/864
40x5	125/864		

NOTE—These tire sizes have already been adopted by N. A. C. C. and the Rubber Association of America.

Solid Tires for Single and Dual Wheels

The following definite front and rear wheel application of the proposed solid tire sizes is recommended as supplementary to the proposed standard:

Tires for single wheels		Tires for dual wheels		
32x3	36x4	36x4	36x 8	(Single tire fits 36x4 dual wheel)
32x3½	34x5	36x5	36x10	(Single tire fits 36x5 dual wheel)
34x3½	36x5	40x5	40x10	(Single tire fits 40x5 dual wheel)
36x3½	36x6	40x6	40x12	(Single tire fits 40x6 dual wheel)
32x4	36x7	40x7	40x14	(Single tire fits 40x7 dual wheel)
34x4				

Carrying Capacity of Solid Tires

Solid tire width	Up to and including 36 in. diameter	40 in. diameter
3	1000	....
3½	1300	....
4	1700	....
5	2500	2600
6	3300	3500
7	4200	4500
8	5200	5600
10	7000	7500
12	....	9500
14	....	11500

Solid Tire and Wheel Diameters, Wheel Circumferences

Nominal outer diameter of tires In.	Mm.	Actual diameter over steel bands In.	Mm.	*Actual circumference over steel bands In.	Mm.
32	810	26	660.4	81 11/16	2074.7
34	860	28	711.2	87 31/32	2234.3
36	910	30	762.0	94 1/4	2393.9
40	1010	34	863.6	106 13/16	2713.1

*These felloe circumferences are given with the tolerances neglected. The tolerances are shown at the bottom of page 8a, S. A. E. Handbook, Vol. I.

Base Bands for Solid Tires

Base Band Size	A	B	Limits of B	C	*Corrugations No.	*Corrugations D	E	G	F
3	23/32	3¾	±1/32	5/16	16	0.181	2 15/32	3 1/16	5/64
3½	¾	4¼	±1/32	11/32	18	0.191	3 1/16	3 9/16	1/16
4	25/32	4 13/16	±1/32	⅜	20	0.196	3 59/64	4 1/16	9/128
5	27/32	5⅞	±1/32	7/16	26	0.189	4 59/64	5 1/16	9/128
6	27/32	6⅞	±1/32	7/16	32	0.185	5 59/64	6 1/16	9/128
7	27/32	7⅞	±1/32	7/16	36	0.192	6 59/64	7 1/16	9/128
8	⅞	8⅞	±3/64	7/16	40	0.196	7 27/32	8	5/64
10	⅞	10⅞	±3/64	7/16	50	0.196	9 27/32	10	5/64
12	⅞	12⅞	±3/64	7/16	60	0.197	11 27/32	12	5/64
14	⅞	14⅞	±3/64	7/16	70	0.197	13 27/32	14	5/64

NOTE.—The above values correspond to those adopted by the War Service Committee of the Rubber Industry of the U. S. A.
*Either mill corrugated or dovetail facings may be used.

Solid Tire Sections

The 3-in. solid tire sectional area is to be included in the present standard so that it will conform to the proposed solid tire standard.

Solid tire widths, in.	*Minimum total sectional area or rubber, sq. in.
3	....
3½	6.75
4	7.75
5	10.75
6	13.75
7	16.75
8	19.75
10	25.75
12	31.75
14	37.75

*Includes both hard and soft rubber.
NOTE—The above values correspond to those adopted by the Solid Tire Division, War Service Committee of the Rubber Industry of the U. S. A.

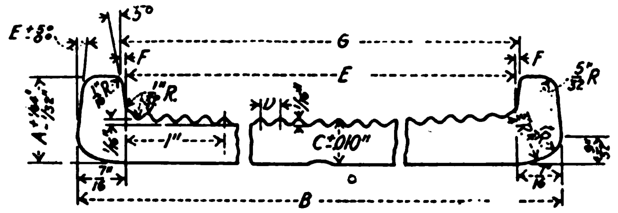
Section Dimensions of Single and Dual Solid Tire Wheels

The steel band thickness for the felloe bands for the 3½ and 4-in tires be changed from ¼ to 5/16 inches.

Pneumatic Tires and Rims for Passenger Cars and Commercial Vehicles

Nominal tire and rim sizes Inches	Mm.	Oversize tire Inches	Mm.	Tire-seat dia. (rim) Inches	Mm.	Type of rim
30x3½	90/585	31x4	105/585	23	585	Clincher
32x3½	90/635	33x4	105/635	25	635	Straight side
32x4	105/610	33x4½	120/610	24	610	Straight side
33x4	105/635	32x4½	120/635	25	635	Straight side
32x4½	120/585	33x5	135/585	23	585	Straight side
34x4½	120/635	35x5	135/635	25	635	Straight side
36x6	150/610	38x7	175/610	24	610	Straight side
38x7	175/610	40x8	200/610	24	610	Straight side
40x8	200/610	....	....	24	610	Straight side

NOTE—These tire and rim sizes will be the only ones used on manufacturers' equipment after January 1, 1919, and conform to Bulletin No. 267 of the National Automobile Chamber of Commerce.



Base band for solid tires

Carrying Capacities and Inflation Pressures of Automobile Pneumatic Tires

Tire size	Fabric tires for passenger cars: Maximum load per tire	Corresponding air pressure	Cord tires for passenger cars: Maximum load per tire	Corresponding air pressure	Cord tires for commercial vehicles: Maximum load per tire	Corresponding air pressure
3	375	45	400	40	....	....
3½	570	55	600	50	....	....
4	815	65	850	60	850	70
4½	1100	75	1200	70	1200	75
5	1500	85	1700	80	1700	80
6	....	....	....	....	2200	90
7	....	....	....	....	3000	100
8	....	....	....	....	4000	110
*9	....	....	....	....	5000	120
*10	....	....	....	....	6000	130

*The loads and pressures for these sizes are S. A. E. Recommended Practice only.

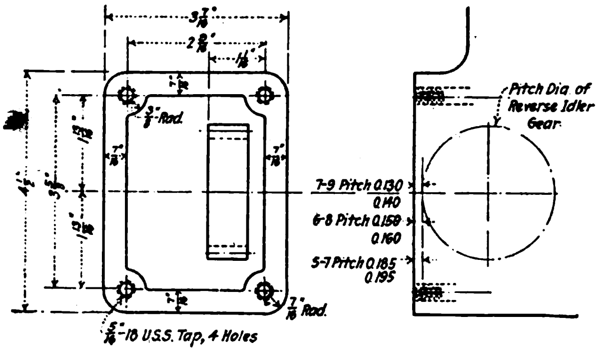
Wood Felloe Dimensions for Pneumatic Tire Rims

VALVE HOLE DIMENSIONS FOR DEMOUNTABLE RIMS
Wood Felloe Dimensions

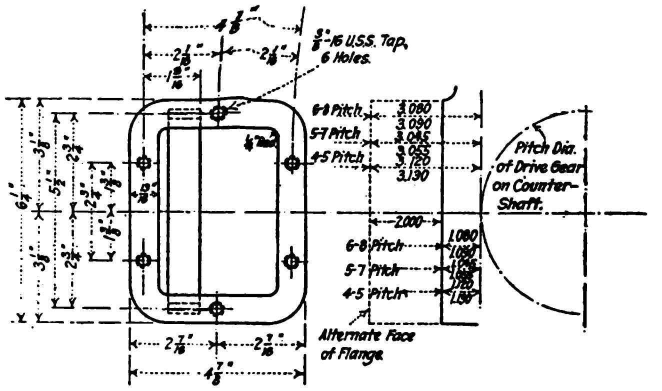
Nominal tire and rim size	†Width	†Depth
30x3½	1½	1¼ {+1/16 −0
32x3½	1½	1¼ {+1/16 −0
*32x4	1¾	
33x4	1¾	1¼ {+1/16 −0
*32x4½	2⅛	
34x4½	2⅛	1¼ {+1/16 −0
36x6	3¼	1⅝ ±1/16
38x7	3 29/32	1⅝ ∓1/16
40x8	4¼	1⅝ ∓1/16
*44x10	5¼	1⅝ ±1/16

Dimensions in inches.

*These sizes are new.
†Width of felloes for demountable rims on cold rolled bands.
NOTE—The above values correspond to those adopted by the Automotive Wood Wheel Manufacturers' Association.



Small type mounting for air pump



Large type mounting for air pump

Rims, Cleats and Lugs for Tractor Wheels

Tractor Front Wheels

PLAIN FLAT PLATE RIMS

Wheel Diameter, in.	Width of Face, in.	Thickness of Rim, in.
28	5 or 6	⅝
32	5 or 6	⅝
36	5 or 6	⅝
42	5 or 6	⅝
46	4, 5 or 6	⅝

FLANGED TYPE RIMS

28	5	3/16
32	5	3/16
36	5	3/16
42	5	3/16
46	4 or 5	3/16

Note: Stock from which flanged tires are made to be 1 in. wider than the face of the finished tire.

Tractor Rear Wheels

42	8 or 10
48	10 or 12
54	10 or 12
60	10 or 12

Diameter of holes for lugs and cleats.........11/16 in.
Diameter of bolts for locking cleats........... ⅝ in.

Power Take-Off

The Truck Standards Division recommended for adoption as S. A. E. Recommended Practice for Power Take-Off the recommendation of the Transmission Division on Tire-Pump Mounting.

Referred Back to Sub-Committee

Nominal Tractor Engine Rating

$$\text{Nominal rated horsepower} = \frac{0.7854D^2LRN}{13{,}000} \quad \text{where}$$

D = piston diameter in inches
L = stroke in inches
R = r.p.m. of crankshaft
N = number of cylinders.

Nominal Tractor Draw Bar Rating

The tractor drawbar rating shall be 50 per cent of the tractor engine (belt) horsepower rating.

If desired, this may be expressed

$$\text{Drawbar rating} = \frac{0.7854\ D^2LRN}{26{,}000}$$

$$\text{Drawbar pull, lb.} = \frac{\text{Rated drawbar horsepower} \times 375}{\text{miles per hour}}$$

Solid and Pneumatic Tire Equipment for Commercial Vehicles*

Front				Rear		
Size truck	Maximum wt. per wheel	Pneu. tire size	Solid tire size	Maximum wt. per wheel	Pneu. Tire size	Solid tire size
¾	800	33x4 or 35x5	None	1600	35x 5	None
1	1000	34x4½	34x3½ or 36x3½	2100	36x 6	34x 5 or 36x 5
1½	1200	34x4½	34x3½ or 36x3½	3000	38x 7	36x 6
2	1500	35x5	34x4 or 36x4	3500	40x 8	36x 7
2½	1800	36x6	36x5	4000	40x 8	36x 7
3	2000	36x6	36x5	5200	44x10	36x 5D 36x10
3½	2100	36x6	36x5	5700	44x10	40x 5D 40x10
4	2300	38x7	36x6	6500	48x12	40x 6D 40x12
5	2700	38x7	36x6	7800	48x12	40x 6D 40x12

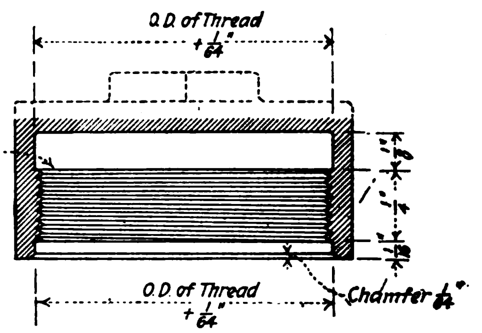
*These data are submitted as general information only as representing good present-day practice.
All pneumatic tires to be of cord construction.

Rejected by Committee

Use of S. A. E. Threads Suggested

Tank and Radiator Caps

Fifteen diameters, all having the same screw pitch, 16 U. S. F., are proposed for standardization, the diameters being, 1, 1⅛, 1¼, 1⅜, 1½, 1⅝, 1¾, 1⅞, 2, 2¼, 2½, 2¾, 3, 3½ and 4 in.

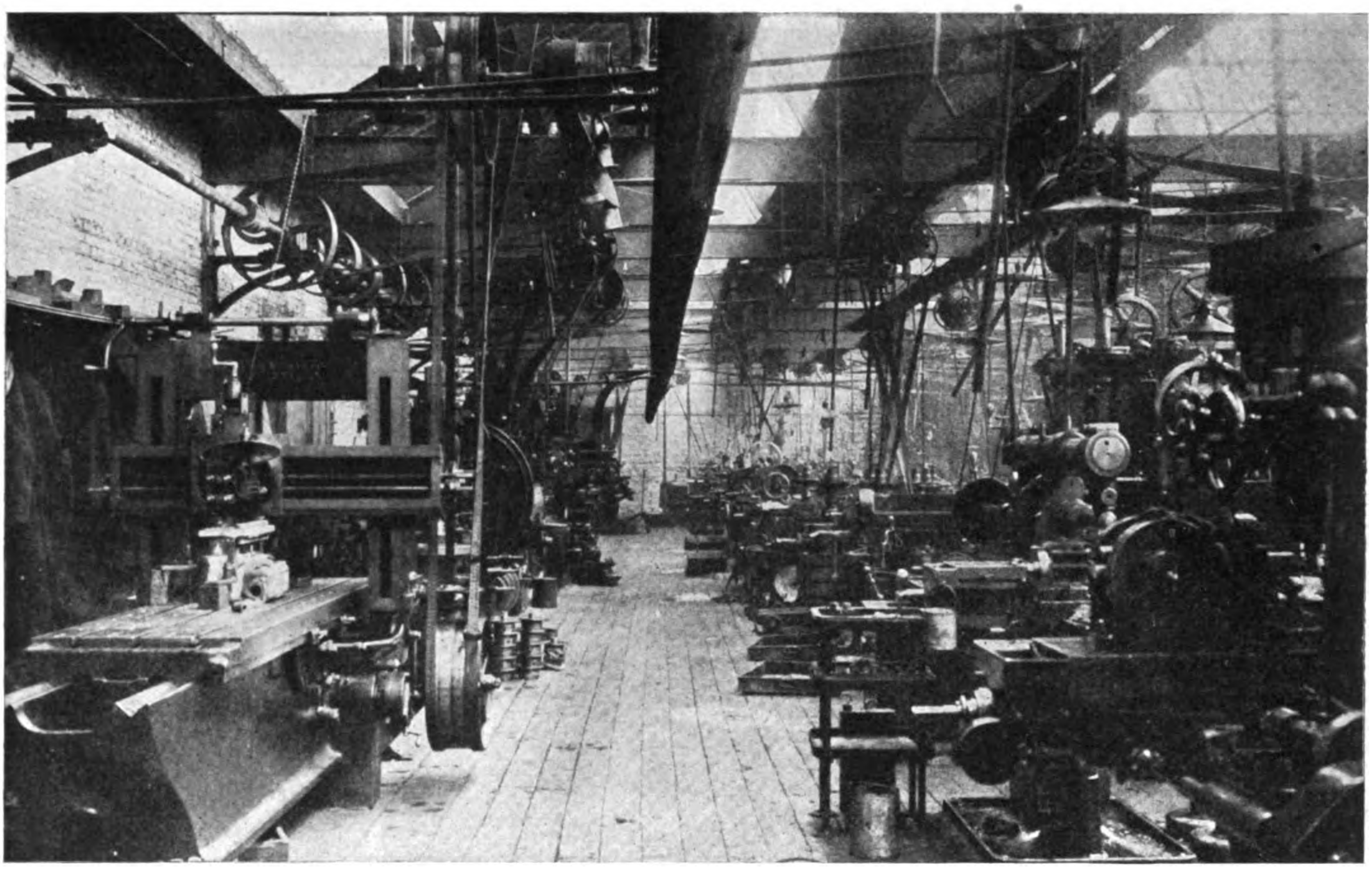


Tank and radiator cap

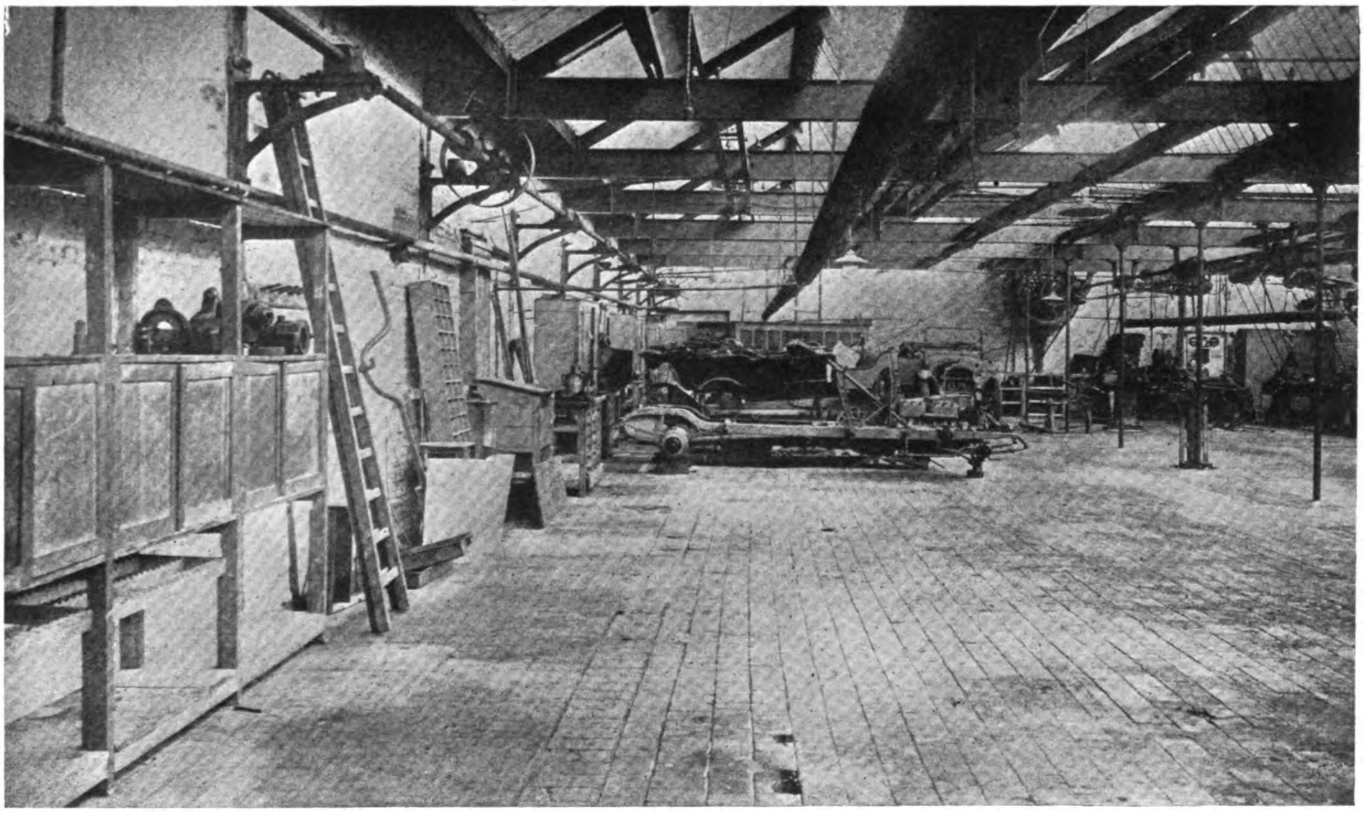
Testing Motorcycle Engines

IN the British motorcycle factory of J. A. Prestwich & Co., Ltd., all engines are given a fan dynamometer test. After the engine has been clamped in position on the test stand by means of two bolts, a chain is fitted on the sprocket wheel on the camshaft from a magneto on an adjustable bed, and the bed is adjusted to give the correct tension to the chain. The gasoline and exhaust pipes are then coupled up to the exhaust pipe leading into a main behind the bed. The final operation is to couple up a Walker fan brake and the starting gear.

How Germans Raided a Belgian Automotive Factory

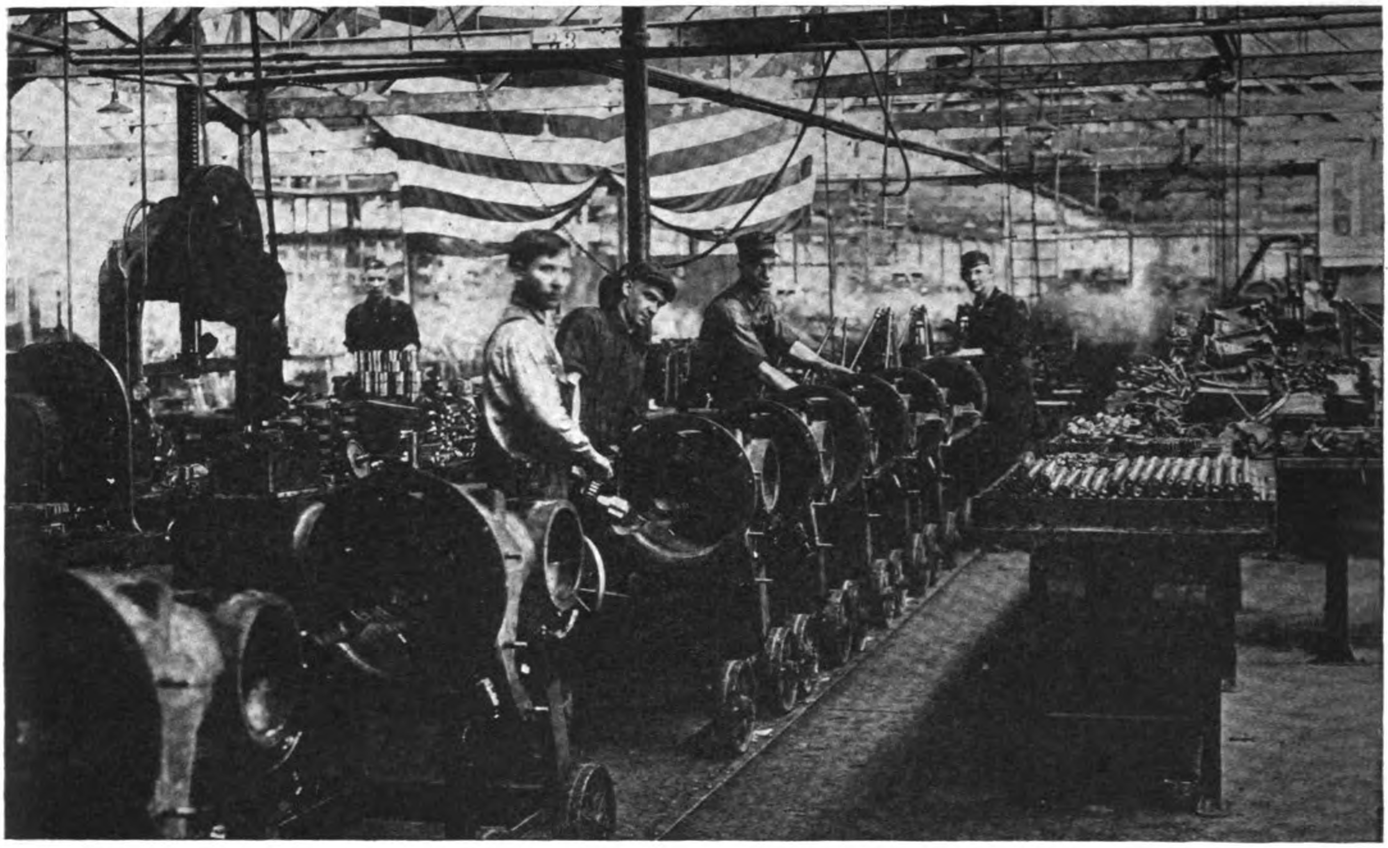


Machine shop of Excelsior factory in Belgium when the war opened

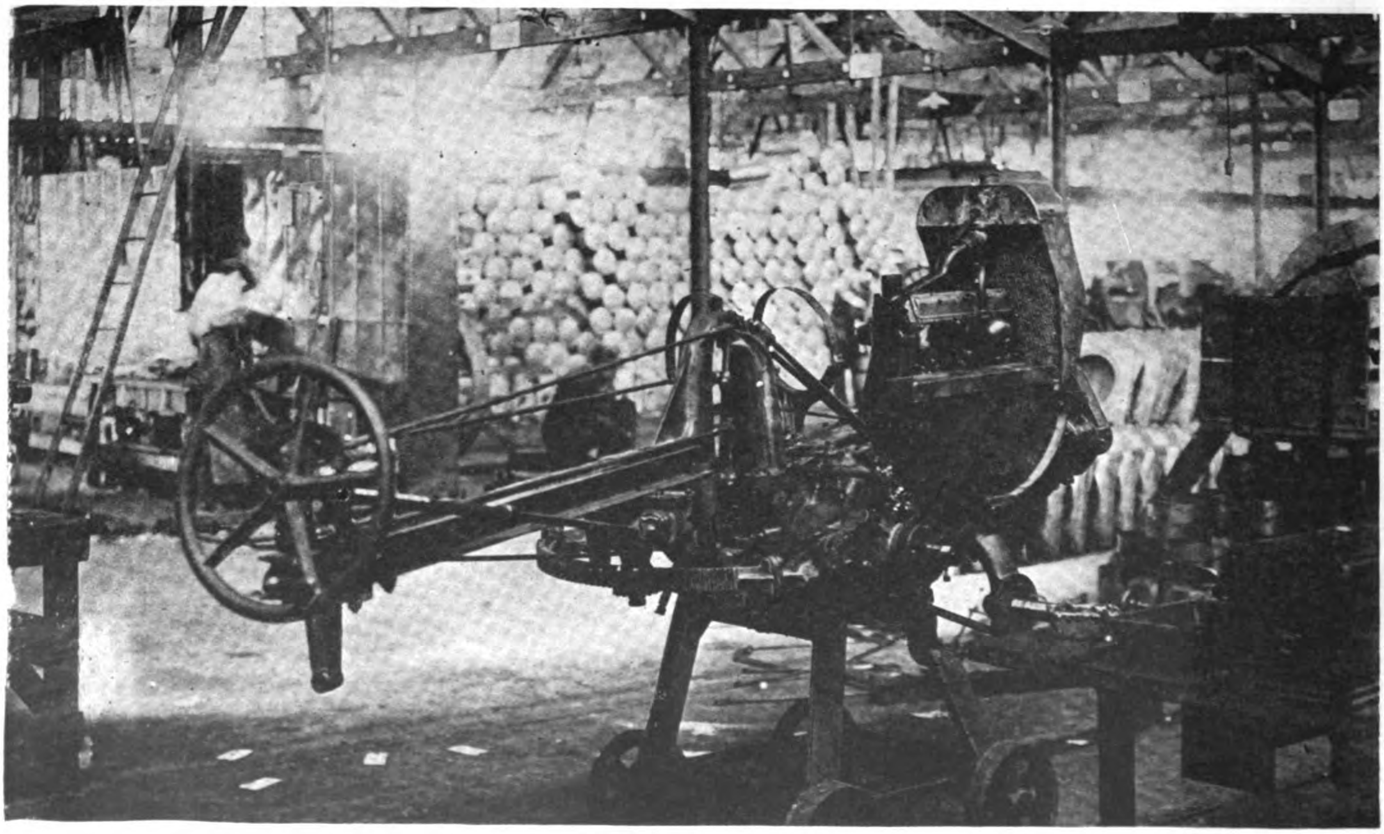


It was a poorly equipped repair shop in November, 1918

In the Moline Tractor Assembly Room



Beginning of the transmission assembly line



Primary assembly nearly completed

Putting the Human Element Into a Tractor Assembly Plan

LAST week Mr. Heldt told how the Moline tractor was produced. This week he tells how it is assembled. There is a thoroughness about the system that suggests an older industry; but, best of all, in two points the human elements are considered—first, in the pay of the men; second, in the daily conferences of the men responsible for the tractor.

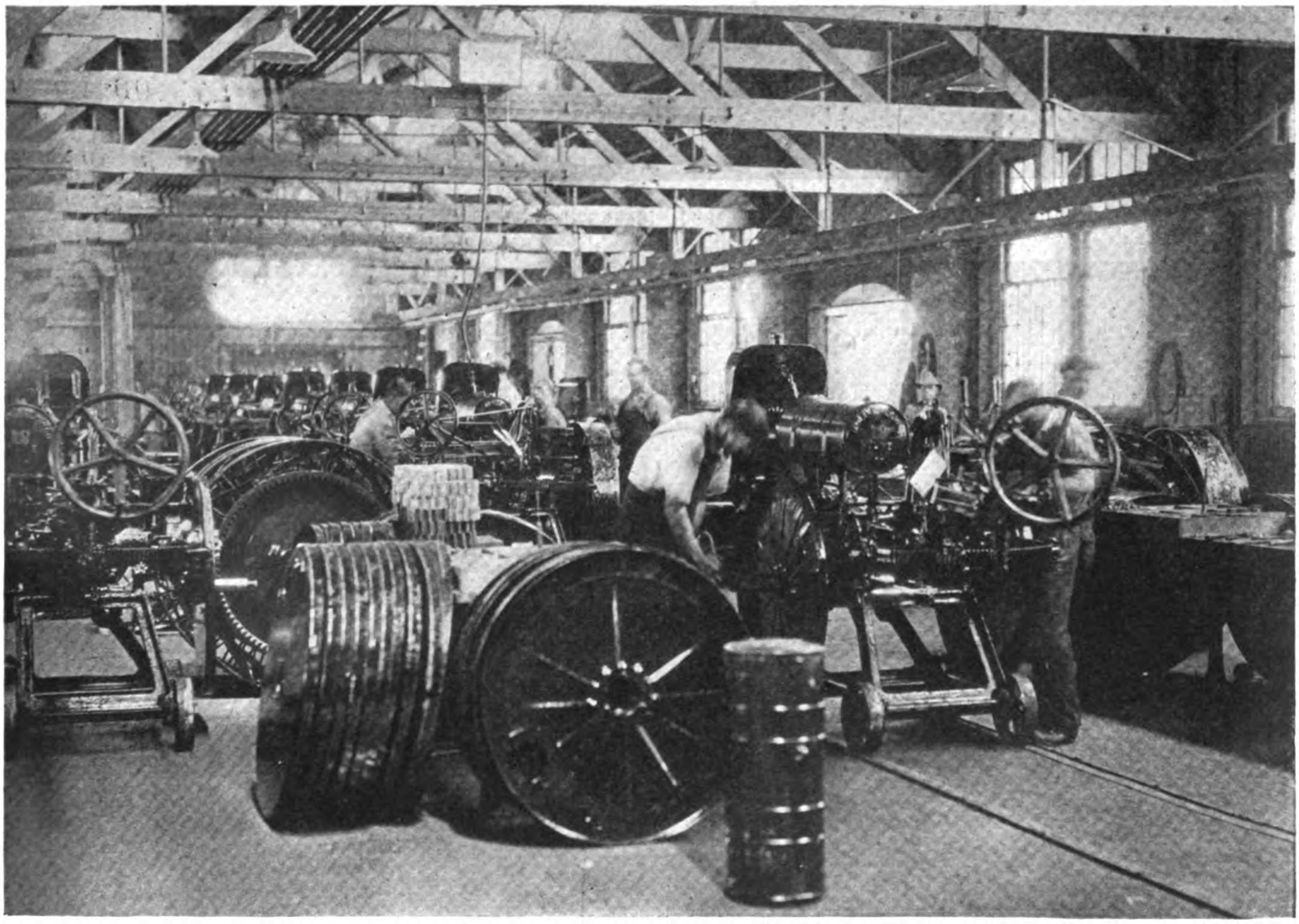
By P. M. Heldt

IN assembling the Moline tractor, first comes the transmission housing, which is placed on a transport truck, made up of two castings, which are bolted together by means of three heavy steel bars. These transport trucks are fitted with four metal wheels, and are of such design that the transmission housing fits to them exactly. The wheels run on the cement floor between guide rails, hence the trucks keep absolutely in line.

In putting in cap screws, use is made of a speed wrench, which consists of a socket wrench with a large flywheel. This flywheel is set to spinning and not only turns the screw to place, but also draws it up with the requisite force.

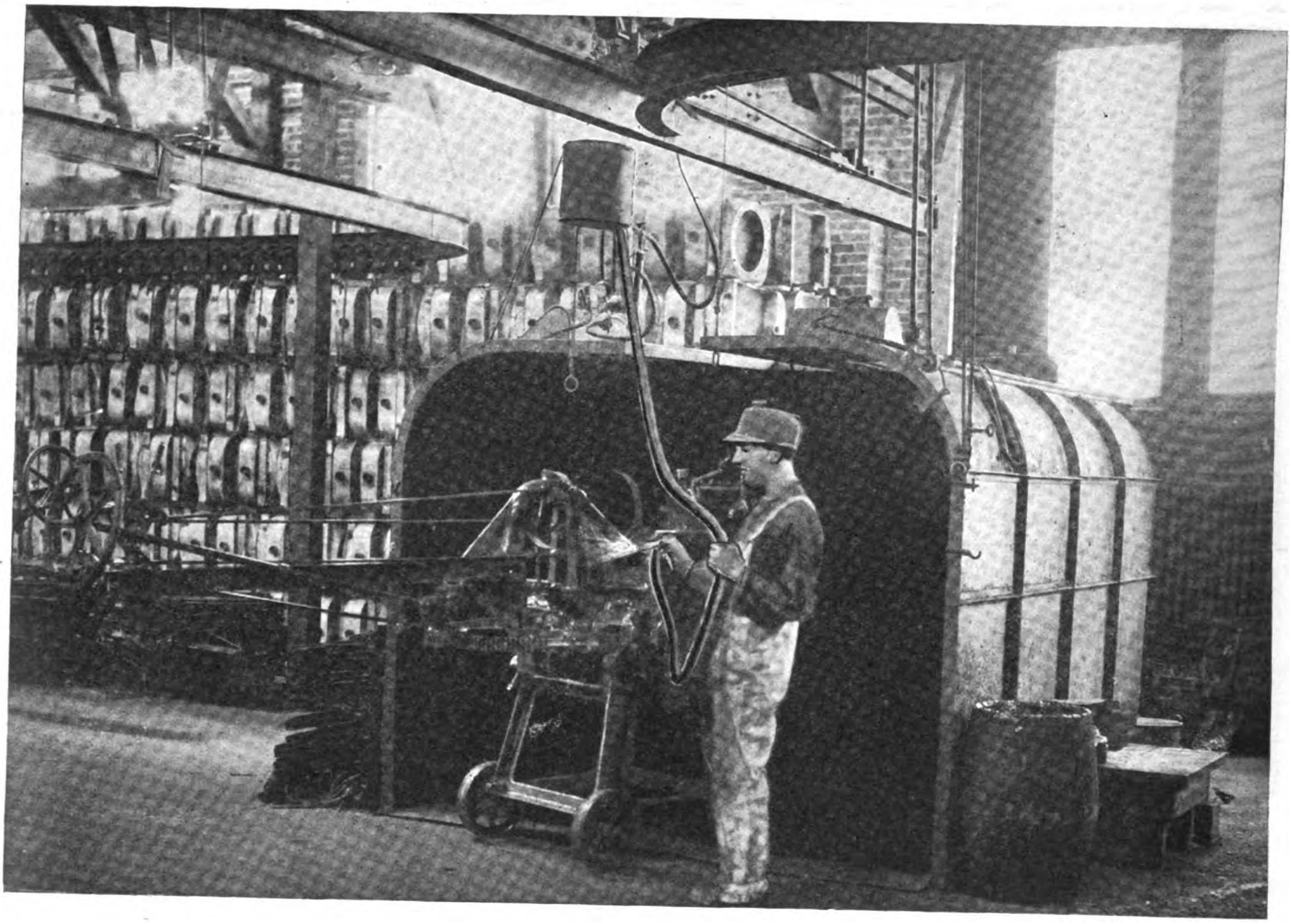
Along the line on which the assembly transport trucks move there are benches, especially designed, to hold the parts that go onto the tractor. Back of these benches there are so-called substations, where small assemblies are made up before they are put on the main assembly.

All assembly work is done on the piece price system. That is to say, a certain sum is paid for assembling each tractor, and the amount due for assembling each week is equally divided among the men engaged in this work. The object of this system is co-operation. While the work is divided among the different operatives as nearly equally as possible, it is impossible to prevent some of the men running behind occasionally with their jobs, and

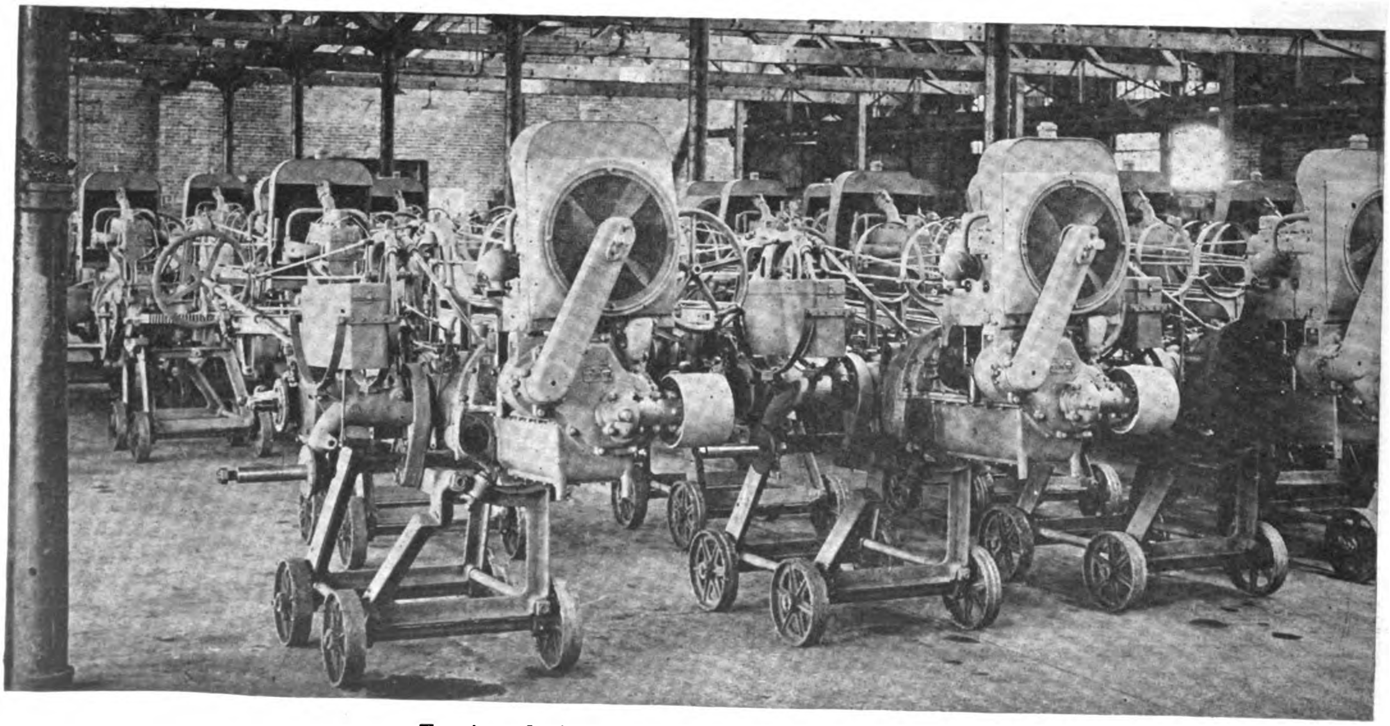


End of final assembly line, showing water box on rafter overhead, with radiator filling hose depending from it

In the Paint Shop



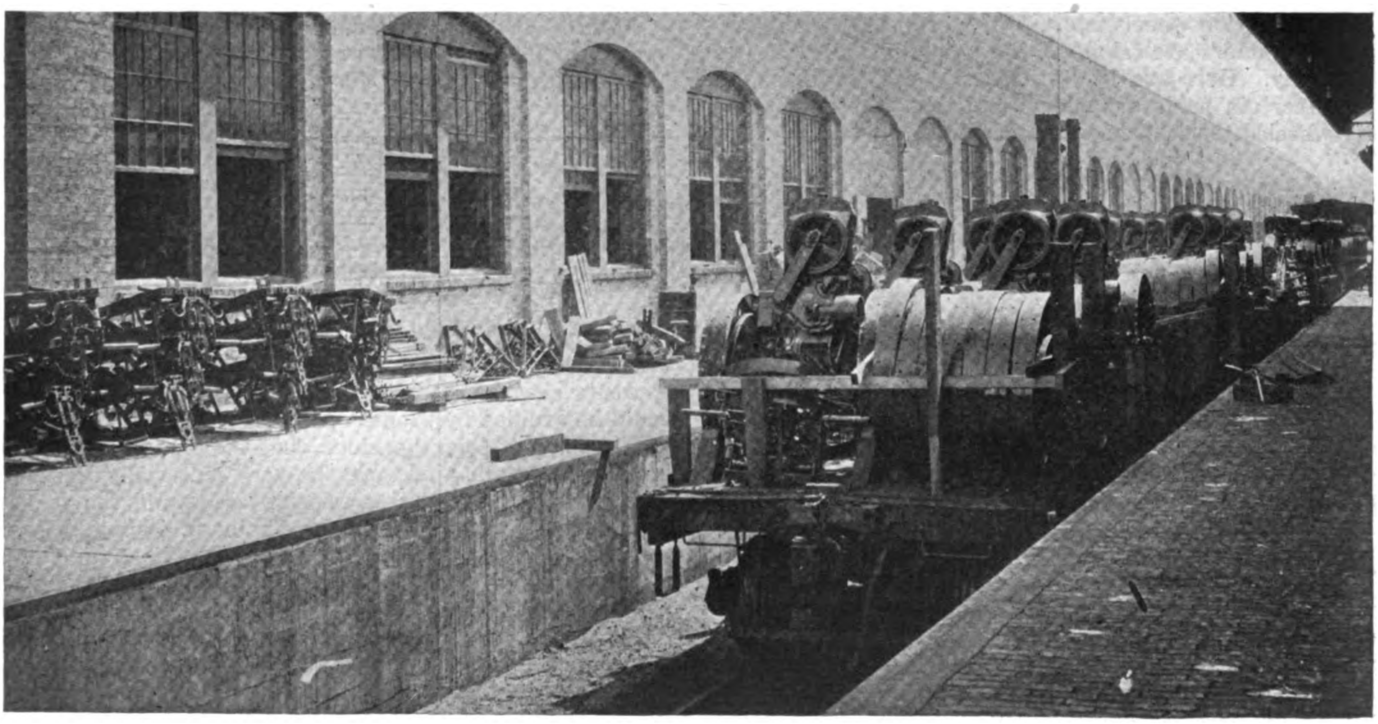
Painting tractor by the spray method



Tractors drying between successive coats of paint

Testing and Loading

A view in the tractor test room



Shipping platform and train of loaded cars. Note that in order to get as many tractors as possible on a flat car, the wheels are removed from the tractors

under this system they will be helped by their "neighbors," so that all keep busy at all times.

The engines and radiators are put on the main assembly at the end of the first assembly line, the engines being conveyed to the line by means of a monorail trolley system.

All engines are thoroughly tested before they are put into tractors, and quite a large testing room is required. At the time of the writer's visit, a considerable addition to the test room was under way, to allow for the increase in production contemplated. At that time there were 39 stands for engine tests in the room. Coal gas is used for making these tests instead of gasoline. The whole scheme of the test room is well worked out, and the latter presents a comparatively clean appearance, being free from the multitude of pipes, wires, etc., which one generally finds in a test room laid down without any prearranged plan.

The water and fuel pipes lie in a trench at the front of the stands, and there is a storage battery back of each stand. Only two pipe connections are required, one for water and one for gas, as the water, after leaving the engine jacket, runs into a trench centrally below the stand, whence it drains into the sewer pipe. There are two kinds of stands in the testing room, one for running in the engines, the other for testing them under power. The engines are started by means of a portable electric motor.

All of the painting is done by means of the air spray. The tractor unit, on its transport truck, stands in the forward part of a spray booth, in the rear of which there is an electrically driven exhaust fan, which draws the excess paint and varnish out through a stack. Two coats of paint and one of varnish are applied.

Owing to the enormous amount of storage space required for air drying, the company, at the time of the writer's call, was installing an oven-drying system, with continuous chain conveyor.

After the tractors have passed through the paint department, they go into the final assembly, alongside of which there is a large stockroom in which are kept such parts as generators, motors, gasoline tanks, strap bolts, nuts, electric wiring, searchlights, battery boxes, carbureters, drive wheels, etc.

The tractors are taken off the paint line into the final assembly. Here are 15 stations. At each of these stations certain parts are added, and then the machine, on its wheeled truck, is moved on to the next station. One of the interesting features of the final assembly department is an arrangement whereby the cooling systems of the tractors can be filled without the use of a floor hose, which is usually very short-lived because of the way in which it is handled, and the use of which is generally accompanied by considerable slopping. A water tank is built on a rafter above the point where the assembly work is completed, and is provided with a flushing valve, so made that when a string is pulled an amount of water exactly sufficient to fill the cooling system is released. The tank, of course, refills automatically.

In one corner of the building, housing the final assembly department, there is a battery room 50 x 60 ft. Among the equipment of this department may be mentioned a water-distilling apparatus which has a capacity of ½ gal. per hr., and a 25-kw. motor-generator set for transforming the charging current. The batteries used on the Moline tractor are of the 6-volt type, and 13 batteries are connected in series for charging in the battery room. All batteries arrive at the plant from the battery makers in the dry state.

After the wheels have been put on the tractor the latter is removed from the transport truck by means of an air hoist, and it is then taken over to the test shed. Here each tractor is given a 5-hr. test under its own power, on a special design of test block. These test blocks are of cast iron and are provided with a wood lining, on which the engine of the tractor slips the wheels. On the opposite side of the building the tractors, after the tests have been completed, receive their final inspection and are tagged.

A noteworthy feature of the organization is the dining room for department foremen and factory heads, in a dwelling adjacent to the plant. It is operated by the company. Here all of the department foremen and factory heads take lunch every day, for which there is no charge. The departments represented here are engineering, accounting and inspection. Among the problems discussed at these gatherings are those pertaining to manufacture, discipline and policy, complaints from customers, difficulties met with in inspection, contemplated shop alterations and improvements, tooling and methods. Topics discussed but not disposed of at one meeting are carried over to the next day. These meetings are presided over by Mr. Keith, the factory superintendent, who calls upon the different foremen to report on subjects pertaining to their respective departments, or on subjects which have been assigned to them.

Gluing Veneer at High Moisture Contents

It is common practice among plywood manufacturers to dry veneer down to very low moisture contents before gluing it. The object in doing so apparently is to prevent shrinkage of the veneer and consequent marring of the appearance of the finished panel. The drying is done in plate redriers, textile driers or similar apparatus, and adds appreciably to the cost of manufacturing panels.

That such preliminary drying may not be necessary is indicated by the results of a recent investigation by the Forest Products Laboratory. Veneer panels were glued with casein glue at various high moisture contents (some over 50 per cent), and in various tests proved as strong and as desirable as those made under drier conditions. In fact, in the moisture resistance tests a considerable proportion of the veneer which had been dried before gluing showed signs of failure, whereas veneer glued at a moisture content of 15 per cent or higher gave practically perfect results. Panels made at high moisture contents checked if dried too rapidly, but this difficulty could be avoided by proper operation of the kiln.

It seems possible, therefore, that the cost of producing panels of certain kinds may be very materially lessened through the use of water resistant glue and the reduction or even elimination of preliminary drying. Very dry veneer is more likely to break or split than damp veneer; an additional saving is therefore possible through a reduction of waste.

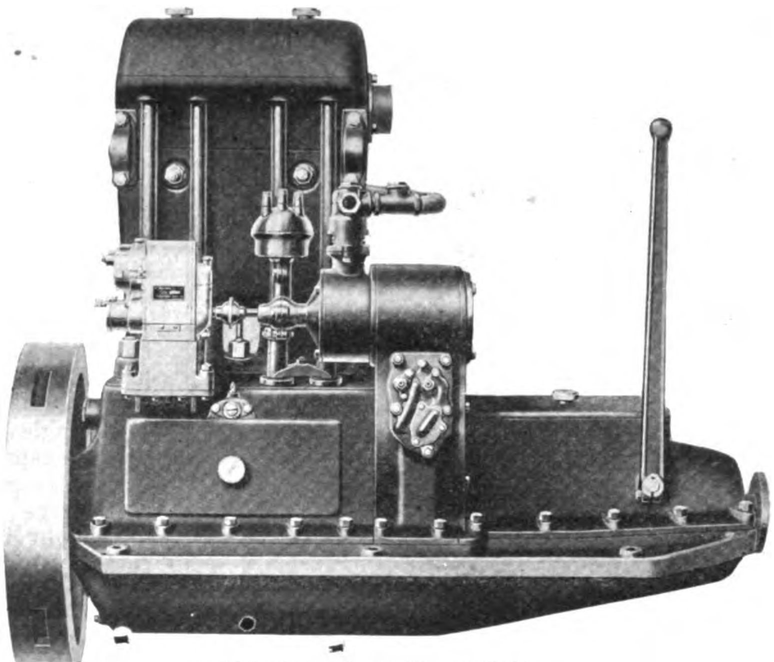
The use of moist veneer, of course, is not practicable for some purposes, but it is quite certain that much of the veneer which is now being painstakingly dried before gluing might advantageously be glued at a higher moisture content.

Novel Features in a Two-Cylinder Marine Set

Engine Is Combined with Reverse Gear in a Single Unit—Complete Inclosure of the Working Parts—Heavy Combustion—Force Feed Lubrication—Bilge Pump, Which Can Be Used as Cooling Water Pump, Is Supplied Extra

A TWO-CYLINDER marine set, comprising an engine and a reverse gear in one unit, is an interesting development. All the components of this set are of very substantial dimensions, and the engine is capable of working steadily under full load. The cylinders are of 5-in. bore and 8-in. stroke, and the engine is rated at 12 hp. at 400 r.p.m. and 25 hp. at 800 r.p.m.

The valve-in-head form of construction is used, which is generally associated with maximum power and fuel economy. One other advantage of this construction is that the entire compression chamber can be machined all over. The two cylinders are made in one casting of vanadium gray iron, and are heat-treated and seasoned. Heavy holding down lugs are cast on the cylinder block, and the studs for these lugs are screwed into substantial bosses in the upper half of the crankcase.


Trego marine unit complete

Both sets of valves are mechanically operated through tappet rods and rock levers, and the entire valve mechanism is completely inclosed and automatically lubricated. The cam followers are of the roller type, and there are long bearing surfaces in the push rod guides, which latter are secured to the crankcase by means of crow-foot clamps. The tappet rods are provided with ball and socket connections at both ends, and there is a simple and accessible adjustment at the upper end.

The entire valve mechanism is lubricated by oil under pressure from the main reservoir, which is forced through the hollow rocker arm shaft to the center of each rocker arm bushing. The surplus oil from these bearings lubricates the springs and other parts, and then returns to the engine base through the tappet rod tube and push rod guide, thus also lubricating these parts. The lubricating oil is carried in a tank separate from the engine, which permits of carrying a larger amount of oil than has been customary in marine installations. This tank is provided with a gage showing the amount of oil it contains. The tank can be filled or drained without disturbing the oil lines or other fittings. The surplus oil, accumulating in the crankcase bottom, is returned by a separate pump to the tank, and all oil is strained three times while making one complete circuit.

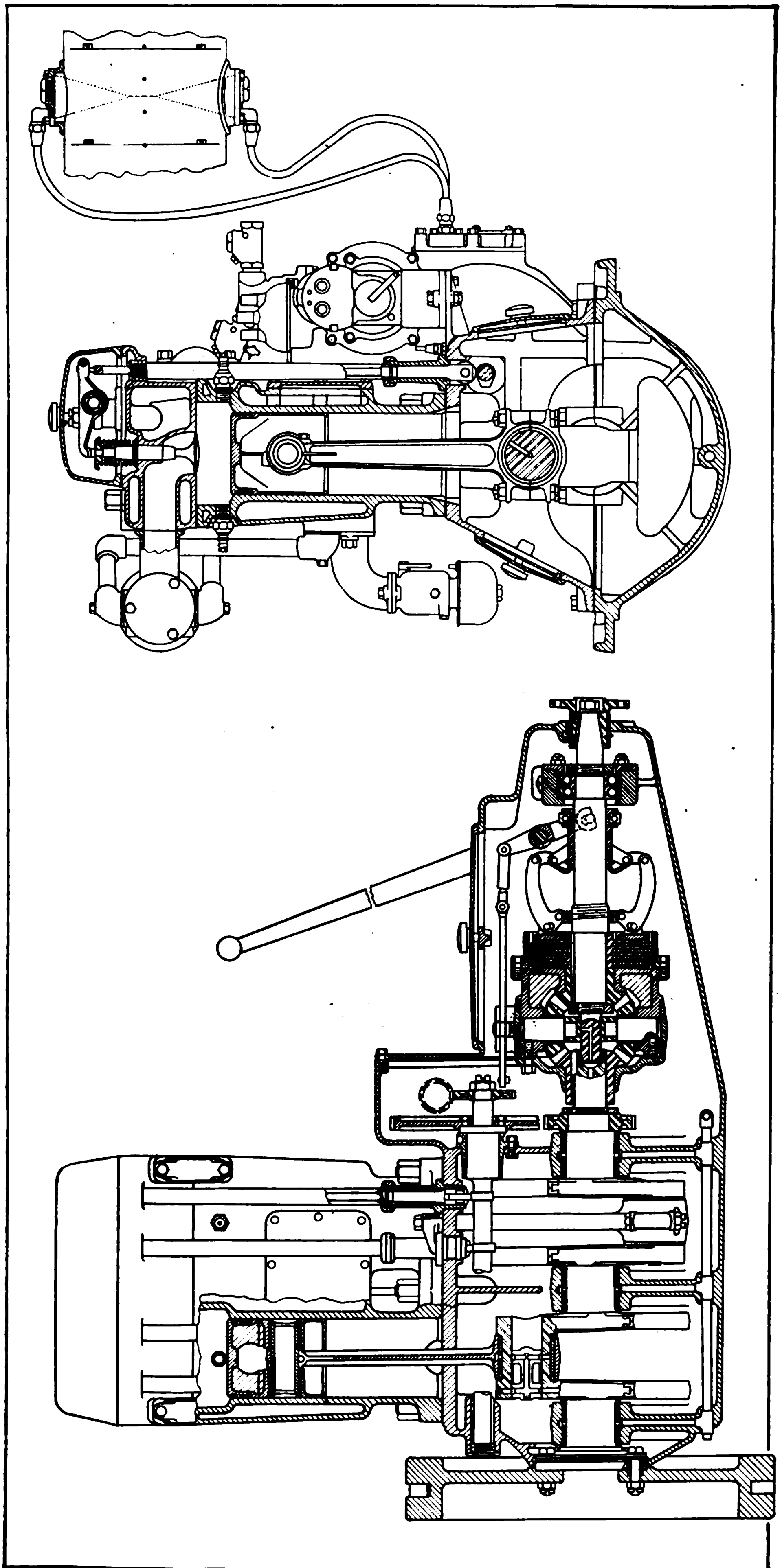
Force feed is used for the main and crankpin bearings, the reverse gear and the valve-operating mechanism, the pressure of feed being regulated by means of an adjustable by-pass valve. Cylinders, camshaft bearings and gears, distributor shafts and gears, water pump and accessories are lubricated by spray from the crankpin bearings. In addition to the main oil pump, which feeds oil under pressure to the main bearings, there is an auxiliary pump, which returns the surplus oil to the tank, and both pumps are combined in one assembly and can be instantly removed. An oil pressure gage, adapted to be mounted on the steering wheel, is furnished with the set.

The cylinder head is removable, which obviates the necessity for valve cages, and insures more thorough cooling of the valve seats. Cooling water is carried from the cylinder jacket to the head jacket through by-passes bolted to the sides of the cylinder blocks. This obviates the necessity for ports in the cylinder head gasket. The cast iron exhaust manifold is fully water jacketed. The inlet pipe is inclosed within the cylinder blocks, whereby a uniform temperature of the mixture entering the cylinder is insured for all seasons of the year. A kerosene attachment, which is said to give very satisfactory results, can be supplied as an extra.

There is a large hand hole on the water jacket, which permits of cleaning out the jacket and also serves to prevent injury to the cylinder castings by a freeze up, as the cover plate is of light material.

Before entering the cylinder jacket the cooling water is circulated through the jacket of the exhaust manifold, thereby greatly reducing the volume of the exhaust gases, and cutting down back pressure and noise.

A bronze plunger-type water pump is employed, the working parts of which are fully inclosed and lubricated



Longitudinal sectional view and cross-section of Trego marine unit

by splash, a dipper on the eccentric shaft dipping in the oil.

As an extra, the Trego Motors Corp., the manufacturer, also makes a bilge pump, which is a duplicate of the cooling water pump, and can be used for the purpose of the latter in an emergency. This bilge pump is provided with a clutch, operated by a hand button, and therefore operates only when required. All water piping is of brass, and all connections are of the flange and bolted type, the water inlet and outlet being both ¾-in. pipe sizes.

The pistons are made of gray iron castings, with 8 radial ribs inside, designed to distribute the heat. Three piston rings are fitted above the piston pins, and there are also a number of oil grooves on the piston. The piston pin, which is 1¼ in. in diameter, is made of steel, hardened and ground; it is securely locked in the connecting rod, and rocks in two bronze bushings secured in the piston bosses. Each bushing has an effective bearing length of 1 9/16 in. There are oil pockets in the piston bosses over the bearings. Conventional drop forged I-section connecting rods are used. The crankshaft is of very substantial design, and is fully counter-balanced. All main and crankpin bearings are of bronze, babbitt-lined, the dimensions of each bearing being 3 x 3 in.

Two sizes and weights of flywheel are furnished, 19½ in. and 23 in. in diameter respectively. These wheels are bolted to an integral flange on the crankshaft, the bolt passing through hardened steel dowels. The flywheel is located at the forward end of the power unit.

A single camshaft is used, which has the cams forged integral with it. The bearings of this camshaft are of extra large size, and are lubricated by oil caught in pockets directly above them. Gears with helical teeth are used for driving the camshaft.

There are large hand holes in the upper half of the crankcase. The latter is made of gray iron. The handhole plates are held in place by thumb nuts and are easily removed, whereupon access may be had to the main and crankpin bearings.

The lower half of the crankcase, which is made in one piece with the reverse gear extension, is also of gray iron. This casting is provided with a strong projecting ledge on either side, provided with heavy bosses for holding down bolts, and arranged with an oil trough to insure cleanliness. The crankcase is so designed that the bed timbers can be carried continuously from the bow to the stern, without interfering with the flyweel, except that when the 23-in. flywheel is used the bed timbers must be notched.

The reversing gear is of the Trego company's own design, and is of the bevel-gear type, employing heat-treated nickel steel gears. The tail shaft telescopes into the crankshaft, the latter being provided with a bronze bushing.

A multiple disk type of clutch is used, and is provided with a single nut adjustment and positive lock. The clutch is thrown in and out by a hand lever fitted to the outer end of a cross shaft. The entire reverse gear is completely inclosed, and runs in oil, which is forced outward from the center of the bearing by means of the oil pressure pump. There is a large handhole plate on the reverse gear housing, which can be instantly removed by unscrewing a single pump nut.

A double-thrust ball bearing is mounted inside the reverse gear housing, and runs in oil. There is a forged steel coupling with male and female members at the rear end of the reverse gear.

A standard float-feed carbureter is fitted, and the engine is furnished with two independent ignition systems, a high-tension inclosed waterproof type magneto and a battery system provided with waterproof boot. There are two spark plugs in each cylinder head, in water-cooled bosses.

Lively Discussion of Dr. Pogue's Fuel Paper

(*Continued from page* 1431)

to specify the b.t.u. per cubic foot, rather than the candle hours, is coming into use.

Road oil, which has been used in large quantities to lay dust, also contains some of the lighter fractions suitable for motor fuel.

How much fuel is wasted by incomplete combustion was illustrated by the remark that there had been cases in which forty per cent dilution had been found in crankcase oil after 200 miles driving.

Taking up Hinkley's request for the stabilization of fuel characteristics, Dr. Pogue said the situation was similar to that of a naval gunner who said he could make a hit all right if his own ship could be stopped and the enemy ship, forming the target, could also be compelled to stop. Fuel will always change and automotive engineers will have to shoot from a moving base at a moving mark.

Hugo Gibson suggested that if the fuel research committee has any funds at its disposal, it should set aside a certain sum for the development of a device for producing a combustible gas from the heavier hydrocarbons. He pointed out that the heavy fuels must be heated slowly and must not be over-heated, and this would call for the use of a thermostat to by-pass any excess heat.

Mr. Horning, who said he had attended every meeting of the fuel research committee, informed the meeting that the committee would be able to tell the character of the fuel to be marketed a year or two in advance. He depreciated the policy of furnishing alarming statements regarding an impending fuel shortage to the press.

First, because there was no ground for alarm during the present generation;

Second, because we are just beginning to apply remedial measures which may change the situation.

He said the only thing the public should be told was to use fuel economically.

Fuel Problem Prominent in the Truck Discussion

(*Continued from page* 1435)

The discussion was opened by H. L. Horning, general manager of the Waukesh Motor Co., who told of some experiments made to improve the fuel economy of a certain 5-ton truck. This truck was loaded to 8 tons and then run at a speed of 18 m.p.h. "to stimulate normal operating conditions," Mr. Horning said, jestingly, over a stretch of road 16⅛ miles, containing various classes of pavements and hills up to 9 per cent.

On the first trip 8 miles of gasoline were consumed. After some adjustment of the carbureter were made the run was repeated and the gasoline consumption reduced to 7 gallons. The truck had been fitted with a vacuum fuel feed and this was eliminated. Another saving of fuel was made on the next trip. Next a combination manifold was applied, which heated the charge, and this resulted in cutting the fuel consumption down to 5½ gallons. The fuel tank in the last experiment was located rather high and by bringing it to a lower lever this fuel consumption was reduced to 5 gallons 1 pint which was improved to 5 gallons ½ pint by very close adjustment of the carbureter.

Next the compression was lowered to sixty pound and kerosene was used as fuel 5 gallon 1½ pint being consumed on the 16⅛ mile run.

Mr. Hale of the Goodyear Tire & Rubber Co., gave some information on that company's experience with pneumatic tired trucks. They usually put a 5-ton truck power plant into a 3½-ton truck. This had a bearing on the formula presented in Mr. Kalb's paper and Mr. Hale counseled truck designers that, whatever results were arrived at by formula, they should be checked by comparison with practical results. The Goodyear Company has 5 trucks running without a differential on the rear axle and, although they have been in service for quite some time, no difference was noted in tire wear as compared with trucks having a differential.

Asked by Joseph Husson regarding the tire mileage obtained with the Goodyear company's pneumatic tired-trucks in service between Akron and Boston, Mr. Hale said that while he could give no definite figures the mileage was not very satisfactory, was due to the fact that the trucks were driven night and day by alternate drivers and the 750-mile trip was made practically without stop.

In the Canton-Cleveland service, where the roads are well paved and there are no hills, a mileage of 10,000 to 12,000 is obtained from 10-inch tires, which are still in the development stage and 15,000 to 20,000 from eight-inch tires. The company uses a 2-ton truck equipped with a 3½-ton power plant and pneumatic tires and loads it to 3½ tons.

Going to Advertise Abroad? Practice on Cuba

IN THESE days when so many American firms are trying their wings at export business there are many experiments to be tried. Our goods first went abroad because the other countries needed them? Now we have competition. If our merchants are to hold the trade against the before-the-war favorites they must advertise and create a demand.

This is an experiment which each merchant must try for himself. Here is some helpful advice, with the main facts set forth.

CUBA is a fine place to try out an export selling advertising campaign. Advertising abroad is a new field for a good many American firms and most of those who go into it will have to learn by experience. There are a number of reasons why Cuba may be the laboratory for this experiment.

One point, the Island is comparatively small and a campaign will not be as expensive as in larger countries. Another reason is that the Cubans are friendly and a mistake will not be as disastrous as in more critical countries. Finally, there are considerable data to guide the advertiser in Cuba.

So now, while European markets are practically closed to our automotive merchandise, the manufacturers must look elsewhere for an export market. Naturally they turn to Latin-America, where the first task is to create an American market of the demand that once was supplied by European manufacturers. This must be done by advertising. The Latin-American countries do not regard advertising as this country does, so the advertiser must learn new ways.

Cuba is essentially a Latin-American country. It is the nearest and the most friendly. It is more accustomed to American ways. So why not get the experience there?

Preparation for Campaign

But an advertising campaign in Cuba—or any other country—must not be undertaken without preparation. Unless complete investigation precedes the advertising, the money will be a waste. The value of Cuba as the "tryout" for American advertising to Latin America and the methods for such advertising are described at length by Trade Commissioner J. W. Sanger of the Bureau of Foreign and Domestic Commerce, Department of Commerce, in a bulletin describing advertising methods in Cuba. This pamphlet is the first of a series which will deal generally with advertising in all of the important Latin-American countries.

In his general description of the Cuban market, Mr. Sanger points out that the language of the island is Spanish and a knowledge of Spanish is essential for the transaction of general business, although many business men understand English and the latter language is taught in the schools.

Cuba is on a gold standard basis and its monetary system is modeled on that of the United States. The metric system is in general use, but other units are common. Postage rates between Cuba and this country are the same as our domestic postage. Mail distribution is prompt and the remote districts are reached by reasonably good service. Telegraph and telephone lines operate comprehensively. The population of Havana, which is the most important business center, is 95 per cent Latin and 75 per cent of its total business is in the hands of Spaniards.

American influence and business practices are gaining an increasing grip here, but business is generally conducted in a small way and is basically Latin in organization. Fixed prices are the exception and generally the price paid depends on the patience and shrewdness of the shopper.

The daily papers published in Havana are, practically speaking, the only island-wide media for news and advertising, says Mr. Sanger. There are no weeklies or monthlies similar to the American publications. The dailies carry considerable Cuban advertising, often crude and not always in good taste or truthful. Few American trade marks are known. No goods are asked for by name or brand, nor are prices displayed or advertised.

The leading merchants of Havana are almost unanimously of the opinion that the "bargain sales" methods of the United States would be useless in Cuba. They assert that native women, particularly, are not careful buyers. The natives buy for to-day and disregard to-morrow. Consequently offering of a quantity at a reduced prices does not appeal to them, because they can't use the increased quantity at one time. The Cuban woman is not the head of her home, as is the American woman.

Advertising in the Island comprises copy for the trade and for the consumer. The demarkation between the two is not always clear. Mr. Sanger found that consumer advertising frequently brings increase from the trade and vice versa.

American Export Journals

The use of American export journals printed in Spanish is approved by Mr. Sanger, who says that when these publications gain the proper standing they are used by the Cuban dealers as catalogs. Many manufacturers who have never had personal representation in foreign fields have received orders from advertisements in export journals. Because a number of export journals are of a questionable character, he suggests that advertisers should first inquire into the circulation of each issue in each Spanish speaking country, method of obtaining circulation, class of readers, affiliation with the Audit Bureau of Circulations, if

papers are sent in bulk or individually, source of the editorials and news articles, and if "write-ups" are permitted in the editorial pages, before buying space.

Personal letters, folders, small catalogs, etc., are freely used throughout the Island, not only as a means of reinforcing campaigns, but often as the main substance of the campaign itself. Sales letters from America should have the appearance of being written individually, must be courteous and friendly, yet should not take on that degree of familiarity used in this country. Familiarity implies lack of dignity and an ignorance of the proprieties to the Latin American. The letters should be signed individually and the higher the title of the signer the better. Under no circumstances should letters be marked, "dictated but not read," or "signed in the absence of."

Properly prepared catalogs have a value that scarcely can be overestimated in creating prospects, preparing the ground for salesmen and for aiding merchants to duplicate their orders. American merchants have used catalogs in Cuba successfully. A courteous, personal letter in the same mail with the catalog is important and aids a friendly reception. Not only Spanish, but idiomatic Spanish, should be used, and not the "so-called correspondence school Spanish," which Mr. Sanger states the Latin American "politely endures." Single catalogs sent by mail are not subject to customs duties, but printed matter in bulk, intended for distribution by the dealer, must pay Cuban tariff.

Havana daily newspapers are equal, mechanically, to American papers. Both the daily and Sunday editions are excellent mediums. They are well edited and compare favorably in appearance and text with papers published in the same size cities in the United States. The explanatory word "advertisement" is not required by law at the bottom of advertising reading notices, neither is a distinctive type used and, as a consequence, many papers carry paid items disguised as news. Cuban papers are willing to carry free publicity in connection with advertising.

The population of Havana is 400,000 and should support two morning and two evening papers, whereas thirteen dailies struggle for the circulation among a limited number of readers. The best papers in Havana, according to Mr. Sanger, are the El Mundo, Diario de la Marina, La Discusion, La Lucha and Heraldo de Cuba. These five dailies fairly well cover Havana, which means that they cover Cuba.

Copy Adapted to Conditions

Cuban copy must be written to conform to the Island idioms. It must be pictorial and it must portray enjoyment of emotions whenever possible. The "common sense copy" or the "reason why copy," common in the United States, finds little response in Cuba, excepting in the advertising of articles distinctly technical in nature. Cuban women do not read newspapers and take small part in home, club, civic or national affairs.

The necessity for giving full consideration to climate and social conditions is emphasized by Mr. Sanger, who cites, for example, the advertisement of an American manufacturer of cleaning wax for automobiles, in which the illustration pictured the man of the house and his wife deeply interested in cleaning their car. In Cuba, the work is done by the chauffeur or in a public garage. Even the cheapest automobiles are driven by chauffeurs, and the owner exerts no appreciable influence as to the kind of cleaning fluid or polishing wax used.

The free and easy, friendly and intimate copy much used in American advertising would be misunderstood and, in fact, regarded as impudent in Cuba. It is also well to remember, states the bulletin, that "United States" is preferable to the use of America or American, because America frequently means all of the two continents in the Latin-American countries. Coined words used as trademarks or trade names are not always advisable. They may be unpronounceable in Spanish or have a distinctly unfortunate meaning.

The Cuban has an almost Oriental tendency to speak and act indirectly. He talks and writes at great length. He will never make a plain answer of "No." His method is more courteous and roundabout. His tendency is not to be scientific or mechanical. He is less analytical than the Anglo-Saxon, and more easily impressed by an attractive picture. He is impressionable and likely to act on impressions; consequently a picture or illustration, indirect and simple, unhampered by technical arguments or "reason why" copy, is the surest to appeal to him.

Methods of placing advertising in Cuba vary. It can be done through Havana advertising agencies, through the local sales agents or dealers, or through United States advertising agencies. The latter has been found the best by Mr. Sanger. Advertising through local dealers is likely to produce waste. As a rule the dealers have no knowledge of advertising practice. The advantage of dealing through the Havana agency includes translation, placing of business, check of insertions, adjusting differences between publishers and advertisers and final settlement. These agencies, however, make no effort to analyze American conditions nor give the valuable co-operation extended by American advertising agencies. The more progressive American agencies have thoroughly analyzed the Cuban market, employ men who not only speak Spanish but know the Cuban idioms, habits and customs and are, consequently, to be preferred.

Practically all of the motion picture houses display advertising slides. The average theater is not open during the day, but has performances from 7 p. m. to midnight. Fees charged are from ten cents to twenty cents. There are no organizations in Havana through

When Advertising Abroad:

Remember that advertising is more highly developed in this country than elsewhere.

Study closely the people and the country you would reach.

Do not be imposed upon by mere translators.

Write your copy for and at the particular people you would reach.

Beware of local superstitions.

Study local prejudices as to pictures and colors.

Never translate an American advertisement; write local ones.

Advertising is not an international art, but always a national one.

UNVEILING THE SALMSON ENGINE MYSTERY

THE Salmson engine! You remember hearing much about it during the war. You heard, you well recall, that it was the only French engine that proved to be entirely satisfactory for airplane use. But you did not hear what you wanted to know about this engine. To most of us on this side it was a war mystery.

But the mystery is dispelled. W. F. Bradley, the European Correspondent of AUTOMOTIVE INDUSTRIES, *has lifted the veil. He has sent to us a comprehensive set of pictures of this engine and a technical description. He tells about the "water-cooled cylinders mounted around a single crankcase" and other outstanding features. Mr. Bradley was familiar with the performance of this engine before the war and he knows its history as well as its mechanical features. His article, with the pictures, will appear in an early issue.*

which advertising slides might be placed and it is necessary to make arrangements with each theater separately. The rates have not been standardized. Practically all of the motion picture houses in Havana are well patronized and screen advertising should be as effective as in the United States. There is an excellent opportunity for the use of motion picture films rather than slides.

Street car advertising in Havana cars is controlled by a New York firm. In addition to this card space in the cars, every street car in Havana carries advertisements in colored glass across the top of the windows, which can be read from the outside only.

Poster and painted-board advertising exists only in Havana, where its volume equals that of similar cities in the United States. This offers excellent opportunities for the use of pictorial copy. The colors should be the primary ones, the treatment simple and strong, and with the trademark reproduced in the same colors as the automobile.

Electric signs, hand bills, calendars and novelties can also be used to advantage. Because of the climate, the average store window is arranged for comfort rather than display purposes. The fronts of the stores are formed by rolling iron shutters. But often in these stores, cut-outs, signs and other advertising can be so placed that it attracts the passerby. Some of the newer class stores have plate glass windows.

In Cuba the rights of propriety in trademarks are derived entirely from the law and depend entirely on the registration of the mark and, once registered, its ownership is fixed for 13 years. The cost of registration is $12.50, with renewal at the same price. If a new trademark is selected for special use in the Latin-American countries, it is wise to select one that is easily pronounceable in all languages. Spanish has certain pecularities. It has no letter "W" and seldom uses the letter "K".

The greatest simplicity in trademark design is advised. and the design should be colored effectively. Mr. Sanger recommends registration of the trademark in every Latin-American country at the beginning of the export business. An International Bureau for trademark registration at Havana has been established. The payment of $50 obtains registration for the trademark in all of the countries represented in the Bureau.

Summarizing, Mr. Sanger declares Cuba is the logical "first point of attack" for any contemplated Latin-American advertising campaign. It is buying American goods in increasing quantities every year, is exporting most of its products to the United States. is a close geographical neighbor and is friendly to this country.

Small packages of engraving matrices or printed matter can be sent from the United States to Cuba without payment of duty. Copper electrotypes are dutiable at the rate of 20 cents per 2.2 lb. Duty is based on gross weight with a tare allowance of 13 per cent for cases and 5 per cent for other ordinary receptacles. Articles not especially mentioned, including type and electrotype of zinc or lead, are dutiable at 15 cents per 2.2 lb. Wooden electrotypes are dutiable at 25 per cent ad valorem. In each case the duty from the United States is one-fourth less than from all other countries.

Appendix attached to the bulletin includes a list of all of the publications, daily, weekly and monthly, in Cuba.

The following table shows the tariff numbers, the general rate of duty, and the rate for United States goods, on various articles of interest to advertisers:

Tariff No.	Articles	General rate	Rate on United States goods
		Per 100 kilos.	Per 100 kilos.
155	Books, bound or unbound, and similar printed matter (gross weight)	$1.625	$1.30
157	Pictures, lithographs, chromolithographs, oleographs, etc., printed from stone, zinc, aluminum, etc., used as labels, flaps, bands and wrappers for tobacco or other purposes:*		
		Per kilo.	Per kilo.
	a. 1 to 3 printings, including bronze (bronze printing counted as 3 printings) but not metal leafwork, other than maps and charts	$0.065	$0.0455
	b. 4 to 7 printings, inclusive, not including any metal leafwork, other than maps and charts	.26	.182
	c. 8 to 13 printings, inclusive (not metal leafwork), other than maps and charts	.52	.364
	d. More than 13 printings, including all metal leafwork, other than maps and charts	1.04	.728
		Per cent	Per cent
315	Chromolithographs for advertisements, provided the advertising renders them unfit for other purposes. ad valorem	32.5	26
345	Lithographs, posters, manufacturers' catalogs, calendars and folders for advertising purposes only, having no commercial value and intended for free public distribution	Free	Free

Articles classified under No. 345 are those only which have no commercial value, such as advertisements in the cheapest form, presented in small quantities. Those which come as an ordinary importation of merchandise or as part or the whole of an invoice and manifested consignment are dutiable under the appropriate tariff numbers. Articles excluded from No. 345 on account of having commercial value shall be classed under No. 315, unless dutiable as printed matter.

*Duty based on gross weight with tare allowance of 10 per cent for cases and 3 per cent for other receptacles.

Are You Considering

INDUSTRIAL REPRESENTATION?

IF you are, here is something well worth your reading? It is the fearless plan adopted by the Goodyear Tire & Rubber Co., with an introductory statement by Mr. Tipper, who has been making a study of this industrial development. No employer can afford to ignore this question to-day.

By Harry Tipper

FOR some time articles in these columns have noted progress in the adoption of plans calling for industrial representation in the factories in the automotive field and other fields. One of these plans which has several new points of significance is the plan adopted by the Goodyear Tire & Rubber Co. and was reported fully by them in the last issue of their publication.

It will be seen that this plan, for the first time in any industrial plan for joint consideration of working conditions, differentiates between executive powers and legislative powers as required in the industrial organization.

Those who have been following the articles which have been appearing in AUTOMOTIVE INDUSTRIES upon the subject of industrial organization, with particular reference to the human relations, will remember that one article, in the issue of Dec. 5, was devoted solely to the exposition of the two fundamental necessities in all human organizations—those required to govern the operating or executive functions of organization and those required to deal with the legislative necessities.

This fact has been recognized to some degree in political organization, but it has not received the attention it deserves in connection with industry, and it is vaguely understood by many manufacturers who confuse the machinery for legislative purposes with the machinery for executive or operating purposes. This is seen in the constant fear, before the average manufacturer, that legislative machinery will eventually assume operating control.

It will be noticed that the first two provisions of the Goodyear plan, which is given in detail here, differentiates carefully and clearly between the executive powers and the legislative powers. The wording of the first paragraph, in relation to executive powers, is thoroughly in accordance with the requirements of orderly industrial organization and carries into the plan the sense of the paragraph in the article printed in AUTOMOTIVE INDUSTRIES of Dec. 5, which states:

> "The operative functions require continuous decision, supervision and obedience to that supervision. They require the lodgment of large powers in the governor or leader and an equally large measure of acquiescence in those who are subject to the government."

It will be seen that the plan of the industrial representation is in all respects, as far as its operation is concerned, modeled upon the political plan which is contained in the Constitution of the United States.

It will be noted also that in Clause 9, the House and Senate by a two-thirds majority can pass a ruling or regulation for the factory over the veto of the factory manager. This is an interesting departure and is along the lines of the veto provision adopted by William Filene & Sons a number of years ago.

In paragraph 8 of the regulations is a provision allowing a bill to become a factory regulation within 30 days if the factory manager fails to sign it, so that no demand of the House and Senate can be permitted to die by inaction.

An additional feature of this plan, which is out of the ordinary, is indicated in paragraph 13 in the requirement of an oath of office. It has been found valuable in all government work and in all positions of public responsibility to require of the participants in that responsibility solemn agreement to the general provisions under which they are to work. The character of the oath in this case seems to be of the right kind and the demand upon the representatives and senators to agree to the provisions stated, by taking oath thereto, is only in accordance with public practice which has been justified by long experience.

YOU CANNOT AFFORD TO MISS THIS!

MANY questions are being asked regarding the program of the radicals of labor and the reasons for their apparent ease in turning unrest to their advantage.

These questions indicate that there is a great deal of interest in this particular development and next week Mr. Tipper's article will deal with the program of the radicals, their methods of working and the way in which they have used the prevailing unrest to further their purposes.

INDUSTRIAL REPRESENTATION PLAN

Proposed by the Council of Industrial Relations of the Factory of The Goodyear Tire & Rubber Co., Akron, Ohio

This Plan of Industrial Representation is unanimously approved by the Council of Industrial Relations, comprised of the following:

P. W. Litchfield	E. S. Rose	B. W. Waugh	D. R. Stevens
O. P. Kidder	E. Hartman	C. McClister	C. Slusser
H. D. Hoskin	F. B. Campbell	H. O. Allman	W. C. State
C. R. Johnson	F. H. Fuller	H. Grow	Wm. Stephens

THE Council of Industrial Relations, composed of representatives elected by Goodyear men and women, foremen elected by Goodyear foremen, and executives appointed by the Goodyear factory management, after having thoroughly considered the subject of industrial representation for securing justice to both men and management through co-operative methods has evolved the following plan for industrial co-operation at Goodyear, and presents this plan to Goodyearites in the sincere belief that its acceptance by management and men of the Goodyear factory will prove beneficial to all.

PLAN
For Akron Factory of The Goodyear Tire & Rubber Co.

1. Executive Powers.

All executive powers for operation of the Goodyear factory shall be vested in the management, and shall not be abridged in any way except in accordance with the legislative powers granted in this Industrial Representation Plan.

2. Legislative Powers.

All legislative powers granted in this Industrial Representation Plan shall be vested in an Industrial Assembly of the Goodyear factory which shall consist of two (2) houses, namely, a Senate and a House of Representatives.

3. The Industrial Assembly.

The Industrial Assembly shall be composed of forty (40) Representatives and twenty (20) Senators, elected by the Industrians of the Goodyear factory, who shall meet separately or jointly, on the first Monday in each month in Goodyear Hall. Representatives shall be elected for one year and Senators shall be elected for two years.

Each Representative and each Senator shall have one vote.

Each House shall vote independently of the other.

Each House shall determine rules for its proceedings and shall keep a record of its proceedings.

4. Unit of Representation—Precinct and District.

The Goodyear Factory shall be divided into forty (40) precincts. Precincts shall be determined so as to include substantially an equal number of people, and with due regard to departmental classification of the factory.

Each precinct shall have the right to elect one Representative.

The precincts shall be further arranged into groups of four, and each group shall be named a district, and each district shall have the right to elect two Senators.

5. Method of Election and Recall of Senators and Representatives.

Election of Senators and Representatives shall be held in the Goodyear Factory annually on the second Monday in October by secret ballot, and the Assembly shall be convened on the first Monday in November. At each annual election there shall be forty Representatives and ten Senators elected, except in the first election, when there shall be twenty Senators elected.

A Representative or Senator may be recalled on petition signed by two-thirds of the voters in his precinct or district, and approved by two-thirds of the House of which he is a member.

Upon severance of employment with the company, a Representative or Senator shall immediately and automatically cease to hold office.

6. Qualifications of Representatives and Senators.

No person shall be a Representative who shall not have attained the age of 21 years and who shall not be an Industrian of Goodyear, and not have had one year's continuous service record in the factory immediately prior to date of election.

No person shall be a Senator who shall not have attained to the age of 25 years, and who shall not be an Industrian of Goodyear, and not been in good standing on the pay roll of The Goodyear Tire & Rubber Company for five years, the last two of which shall have been a continuous service record immediately prior to election.

If vacancies in the seats of Representatives or Senators happen by resignation or otherwise, the one who shall have received the next highest number of votes from the precinct or district in which the vacancy shall have occurred shall fill the vacancy.

7. Qualifications of Voters and Definition of Industrian.

A Goodyear Industrian must be 18 years of age, must be an American citizen, understand the English language, and have a six months' continuous service record in the Goodyear Factory immediately prior to election. Each Goodyear Industrian is entitled to vote. [CONTINUED ON NEXT PAGE]

Industrial Representation Plan

[CONTINUED FROM PRECEDING PAGE]

8. Power and Procedure of The Industrial Assembly.

The Articles of Incorporation of The Goodyear Tire & Rubber Company and the laws of the State of Ohio fix the final authority and responsibility for management of the company in its Board of Directors. Therefore, subject only to the right of the Board of Directors to veto or annul, the power of the Industrial Assembly shall be as follows:

The Industrial Assembly shall have legislative power to make changes in Factory Rules and Regulations which from time to time have been or shall be made by the management as provided in Article 1, on the subject of wage adjustments, working conditions, and the adjustment of grievances in accordance with the following procedure:

Every bill which shall have passed the House of Representatives and the Senate, shall, before it becomes a Factory Rule or Regulation, be presented to the Goodyear Factory Manager. If he approves, he shall sign it, but if not he shall return it with his objections to the House in which it shall have originated, who shall enter the objections at large upon their record, and proceed to reconsider it. If after such reconsideration two-thirds of that House shall agree to pass the bill, it shall be sent, together with the objections, to the other House, by which it shall likewise be reconsidered, and if approved by two-thirds of that House it shall become a Factory Rule or Regulation. But in all such cases the votes of both Houses shall be determined by yeas and nays, and the names of the persons voting for and against the bill shall be entered on the record of each House respectively. If any bill shall not be returned by the Factory Manager within thirty days (Sundays excepted) after it shall have been presented to him, the same shall be a Factory Rule or Regulation in like manner as if he had signed it, unless the Assembly by failure to provide proper means to receive it shall prevent its return, in which case it shall not be a Factory Rule or Regulation.

9. Approval and Veto Powers of the Factory Manager.

Every order, resolution, or vote, to which the concurrence of the Senate and House of Representatives may be necessary (except on a question of adjournment) shall be presented to the Factory Manager of the Goodyear Company, and before the same shall take effect shall be approved by him, or being disapproved by him, shall be repassed by two-thirds of the Senate and House of Representatives according to the rules and limitations in the case of a bill.

10. Joint Conferences.

On matters of joint interest to men and management, such as wage adjustments, working conditions, and the adjustment of grievances, Joint Conferences may be called where representatives of the men meet an equal number of representatives of the management. Frequent conferences are desirable for the consideration of constructive suggestions of mutual interest.

11. Joint Conferences, How Formed.

The Industrial Assembly shall appoint six (6) Industrians, three from the Senate and three from the House of Representatives, and the Factory Management shall appoint six (6) Industrians to meet as a joint conference. Persons thus selected shall be duly accredited representatives of the Goodyear factory men and management for consideration of and co-operation upon subjects of mutual interest. The Industrial Assembly shall maintain standing committees composed of three members of each house to facilitate quick action in securing a joint conference.

12. Industrial Representation Plan — How Amended.

The Industrial Assembly whenever two-thirds of both Houses shall deem it necessary shall propose amendments to this Industrial Representation Plan, which shall be valid to all intents and purposes as a part of this plan when approved by the Factory Manager. In case amendments have been passed by a two-thirds vote of both Houses over the veto of the Factory Manager, such amendments must be approved by the Board of Directors of The Goodyear Tire & Rubber Company before becoming valid.

13. Oath of Office.

Before entering upon his duties, each Representative or Senator shall take and subscribe to the following oath, which shall be administered by any officer empowered to administer oaths under the laws of Ohio: "I solemnly swear (or affirm) that I will faithfully support the Constitution and laws of the United States and the State of Ohio and the Industrial Representation Plan of The Goodyear Factory, and that I will to the best of my ability faithfully and conscientiously discharge the duties incumbent on me as a Representative (or Senator) under such plan."

14. Guarantee Against Discrimination.

There shall be no discrimination against any Goodyearite on account of membership or non-membership in any labor organization, or against any Representative or Senator for action taken by him in performance of his duties as outlined in this Plan.

15. Industrial Representation Plan—How Ratified.

This Industrial Representation Plan shall become effective when a majority of the Industrians of the Goodyear Factory and the management of the Goodyear Factory shall have authorized the present Industrial Relations Council to place their signatures hereon.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE

PUBLISHED WEEKLY

Vol. XL Thursday, June 26, 1919 No. 26

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
U. P. C. Building, 239 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
Clyde Jennings, Managing Editor
P. M. Heldt

DETROIT OFFICE
J. Edward Schipper

WASHINGTON OFFICE
Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142
Philadelphia—Widener Bldg., Phone Walnut 5601

Cable Address - - - Autoland, New York
Long Distance Telephone - - - 8760 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - One Year, $3.00
Canada - - - One Year, 5.00
Foreign Countries - - - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

HORSELESS AGE SUBSCRIBERS
Subscriptions for the Horseless Age transferred to the subscription list of AUTOMOTIVE INDUSTRIES in the merging of the two publications will be completed in full by the weekly issues of AUTOMOTIVE INDUSTRIES to the dates of expiration shown on the records of the Horseless Age Co.

Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

How to Reach Congress

AMERICAN manufacturers are to-day aware of the needs of industry for constructive action by Congress to promote business along the new lines. Especially is this true of manufacturers who are entering the export field. The needs have been stated recently at conventions and are developing from day to day in business experience.

Never before has there been so great a need for clean-cut co-operation between industry and Congress. There are problems of railroad transport, marine transport, tariffs, commercial aeronautics, parcel post, and numerous other subjects, none of which can be solved by business without Congressional action and none of which Congress can properly handle without the advice of business.

But individual protests, criticisms or suggestions, sent singly and at spasmodic intervals, to the legislators at Washington are wasted energy. The Congressional Record prints daily petitions of this character, read into the Record by a Congressman, clipped and sent to the petitioner whose only satisfaction is reading his protest in print.

When the farmers set out to have the day-light law repealed, they did not employ such haphazard methods. They used concerted efforts. When labor wants legislation, members of unions do not write individual letters. Labor's demand is made through organization. And industry vitally in need of legislation—a legislation important to the entire public—must work concertedly with Congress to gain its end. Congress heeds popular demand. Popular demand is the employment of concerted effort.

Patent Office Needs

THE Patent Office Society has recently entered the lists of those seeking publicity. This society was organized by employees of the U. S. Patent Office with a view, according to the society statement, of improving the service of this office to those seeking patents and those using patents—or rather it might be put to the honest persons in these two classes. One of the important objects is to make possible more certain profit to the inventor and better protection for the legitimate buyer of a patent.

With these worthy objects in view, the society has published some exceedingly interesting pamphlets. One of these tells the history of the U. S. Patent Office and another tells of the legislation that the society members think is needed to carry out their objects.

The history of the patent office is an important document. It reviews briefly the patent history of the colonies, but the story really begins in 1790, when the first patent statute was written. Patents were placed under the care of the Secretaries of War and State and the Attorney General. Thomas Jefferson, as Secretary of State, was a member of that first board, and it is testified from the handwriting in the record books that Mr. Jefferson was a very active member.

By degrees the statutes were changed until the protection thrown around the inventor was fairly complete and then, the pamphlet says, the patent laws of this country began to attract attention of the world. The writer says that "all of the civilized nations of the world, save one, have modeled their patent laws after those of the United States."

There is an interesting bit of history in that part of this story which reviews the influence of inventions on the history of the country. The climax of this story is quoted from an Englishman, Sir Robert A. Haffield, himself a noted inventor, who tells of a conversation with a Japanese statesman. The Japanese told Sir Robert that when the leaders of that country set about making their country great, they looked up the history of the great companies and found that the United States had made the most rapid and substantial growth. They analyzed this development and concluded that it was due to "patents." So Japan modeled her patent laws after the United States.

This story, as told by the Society of the Patent Office, leads up to the great objective; that is—to get certain legislation passed by Congress. This proposed legislation is outlined as follows:

(1) The establishment of a single Court of Patent Appeals to take over the appellate jurisdiction now lodged in the nine independent Circuit Courts of Appeal.

(2) The establishment of the Patent Office as a separate institution independent of the Department of the Interior.

(3) An increase in the personnel of the Patent Office to enable it to render prompt and efficient service and an increase in the salaries to approximate those paid in outside patent work so that qualified examiners may be kept in the public service.

(4) A change in the law relating to damages in infringement suits to answer one of the most common and strongest reproaches against the patent system, namely, that a patent does not ordinarily pay the inventor any money.

Certainly no group has better reason to ask definite and well defined patent legislation and practices than the automotive industry. Patents are the vital factor in the present manufacture and in the advancement of the industry.

The object of this presentation of the subject is to interest the men of the industry in the U. S. Patent Office, so that they will investigate its needs and help to define a policy that will make for as great a scope of usefulness as is possible. We commend the publications of the Patent Office Society as a good place to begin this study.

Supply and Demand

THE material situation is rapidly getting back to a supply and demand basis. Since 1917 the market has more or less been controlled by the Government and even where this control has not been directly exerted, it has had a marked influence on the market. We are now practically free from any form of Government regulations and as a result the market is seeking its own level. Conditions more nearly approach an open and free market than they have since the war really got under way.

During the stage of readjustment to actual purchasing conditions, there are going to be sharp fluctuations, or, what amounts to the same thing, wide differences between purchase prices of material of a similar nature brought from different sources. This will soon readjust itself, however, and while prices can be expected to remain high, due to the placing of large orders, nevertheless the buyer has more of an opportunity to shop than he has had for four years. Taken as a whole, industry may be said to really welcome the return of the buyers' market. Conditions were extremely difficult during the period when the market was entirely on the sellers' side.

One important result is sure to be longer time buying, which ought to have a steadying influence on the market.

Cost of Tractor Plowing

THE complete cost of tractor operation involves a good many items, such as interest on investment, depreciation, etc., which it is difficult either to determine accurately for a given period or to apportion properly to the acre of ground plowed. However, two of the chief items of cost—at least if there is plenty of work for the tractor so that the pro rata fixed charges are low—are labor and fuel. In a recent demonstration at Delavan, Wis., these two items of cost were determined, and the results arrived at are interesting as throwing some light on the question of how the cost of plowing varies with the size of the machine used—that is, the number of plows pulled.

The great majority of the tractors demonstrated were three-bottom machines, and the figures of cost arrived at for this type may therefore be regarded as a good average of what may be expected. In the other classes the number of individual machines was smaller, and the average cost figures therefore do not bear quite so much weight. Each outfit was operated by one man. In estimating the results, labor was figured at 60 cents per hour, kerosene at 12.7 cents per gallon and gasoline at 23.7 cents per gallon.

One thing that tends to prevent a logical comparison of the different classes on the basis of cost per acre plowed is that some of the machines ran on gasoline, which costs about twice as much per gallon as kerosene. Both of the tractors in the single bottom class burned the more expensive fuel, as did one of the four tractors in the two-bottom class.

As might be expected, the cost of plowing decreases as the size of the machine used increases (if only the items of labor and fuel are considered), the average cost figures for the four sizes of machines demonstrated being as follows: Single-bottom, $2.67 per acre; two-bottom, $1.20 per acre; three-plow, $1.14 per acre; four-plow, $1.12 per acre. The very large difference in the plowing cost between single-bottom and two-bottom tractors and the comparatively slight difference between the cost with the other tractors are explained by the fact that both single-bottom tractors used gasoline for fuel, which practically doubled their fuel cost, while, on the other hand, most of the two-plow tractors plow at considerably higher speed than the rest, which tends to keep down the labor cost with them. These two factors, one forcing the single-bottom plowing cost up and the other the two-bottom plowing cost down, are together responsible for the wide gap between the two figures.

There is one rather peculiar item in the published data of the demonstration. These data are arranged in tabular form and the last column of the table gives the fuel and labor cost per acre per bottom. This means that the fuel and labor cost per acre, which is undoubtedly the factor that most interests the farmer, was divided by the number of bottoms used—for what reason it is hard to conjecture. The quotients thus obtained are certainly without any practical value.

Summer Meeting at Ottawa Beach Pleases Engineers

Entertainment Vies with Discussion in Attracting 800 S.A.E. Members and Families

Fuel Situation Given Prominent Attention, Dr. Pogue's Paper Leading Open Talk

OTTAWA BEACH, MICH., June 26—As a climax to the program of entertainment and recreation arranged to lighten the technical side of the summer meeting of the Society of Automotive Engineers, 800 members and their associates, with the wives and families of many, witnessed or took part to-day in the field sports. With the cares of the wartime period laid aside, the engineers entered heartily into the day's events and into the tournament that began on Monday and will continue until the final session to-morrow.

Division of the meeting into sections gave virtually unlimited opportunity for discussion of papers, at the same time adding to the hours of pleasure and sociability, of which the members and their companions took full advantage. The Lake Michigan resort, combining water and shore life and offering an endless variety of amusements, proved popular with the visitors, who patronized in large numbers the golf courses, tennis courts and ballrooms, also "seeing Michigan," in a limited degree at least, in tours over the automobile highways.

As a means of entertainment, along with practical demonstration, E. H. Colpitt, assistant chief engineer of the Western Electric Co., talked to the engineers and their guests on the wireless telephone, coincidentally putting the apparatus into operation between the auditorium and a motor boat a mile and a half off shore. A sound intensifier had been installed, and the audience heard the conversation between the lecturer and the boat crew, which was followed by an exchange of questions and answers between the boatmen and persons in Chicago, part of the way over a wire circuit.

Mr. Colpitt reviewed the development of the wireless telephone and discussed its future use, at the same time stating its limitations.

Under the sectional plan, the members found the technical papers grouped logically, with opportunity for informal discussions intended to assist the development of the various branches of the industry. There were spirited sessions on the passenger car and motor truck situations, with large attendances.

Keenest interest was shown in Dr. Joseph E. Pogue's fuel paper, and the discussion following it emphasized the necessity of concerted action to insure a continued supply and to make available advance information regarding impending changes in its character. It was felt that the action of the automotive and fuel industries in naming a committee jointly to study the problem would dismiss tendencies toward panic over the situation, and prove of assistance to engine and carbureter designers who must know in advance the fuel which their products must be made to utilize. The meeting room was crowded during the discussion.

The standards committee's meeting on Monday resulted in submission of a considerable number of proposed standards and recommended practices to the society.

Following the custom of previous meetings, section reports were printed and distributed to members in advance of the time set for their consideration, facilitating discussion and voting.

DAYTON-WRIGHT SOLD

WASHINGTON, June 24—Attempts made yesterday in Congress to prevent the purchase of the Dayton-Wright Airplane Factory, Dayton, Ohio, for $3,260,000, which was appropriated last week in the Army appropriation bill, were defeated. The sum appropriated will buy the factory and adjoining land, which includes 1586 acres. The factory and land will be used as an Air Service Engineering Experimental Station.

REO PLANS EXPANSION

LANSING, June 22—The Reo Motor Car Co. is breaking ground for a new machine shop, 200 x 514 ft., containing 132,518 sq. ft. of floor space. This is the first step of an expansion program which will revolutionize production and increase the pay-roll by 1500 men. The completion of this program will occur in the fall. A part of the building will be 3 stories high while the rest will be 2 stories. When this building is completed the motor building department will be moved to the former truck plant. It is the plan to build engines complete.

BETHLEHEM IN MERGER

NEW YORK, June 24—Formation of a company under the laws of Delaware, to purchase the stock of the Bethlehem Motors Corp., Allentown, Pa., and the North American Motors Co., Pottstown, Pa., is announced.

The new company, which will have an authorized capital of 130,000 shares of stock of no par value, is headed by Arthur T. Murray, with D. G. Dery, S. C. Potter and H. B. Hall, vice-presidents; treasurer, Martin E. Kern, and secretary, M. H. Deary. Allan A. Ryan, recently chosen head of the Stutz Motor Car Co. of America, is one of the directors.

A report of the new company after refinancing shows: Cash in banks and on hand of $1,494,188; notes receivable, $29,301; accounts receivable net, $293,227; notes payable, $868,757; accounts payable, $184,291; common stock, no par value, and surplus, $3,393,966, and total assets and liabilities of $4,466,039.

Plan to Build Up S. A. E. Membership

Society to Seek Out Unenrolled Among 20,000 Prospects—President's Address

OTTAWA BEACH, MICH., June 24—The question of future membership came up prominently in the business session of the S. A. E. summer meeting last night. By C. C. Hinkley's report for the membership committee it was shown that the roster on June 1 contained 4,045 names of all grades, a gain of 772 during the last year. It was stated that there were almost 20,000 eligibles in the country, and plans to recruit these prospective members were discussed.

The present membership includes 4,045 members of different grades, 99 offiliated members of different grades, 99 affiliated point was raised as to the advisability of limiting the section associates in proportion to the number of full members of each section. This question is a result of the rivalry of the Metropolitan and Detroit sections. There was a difference of opinion as to whether a section associateship should be limited to one year or two years.

The treasurer's report, read by Coker F. Clarkson, showed a balance of $128,281.99.

G. P. Dorris of St. Louis, C. C. Hinckley of Detroit, and W. H. Conant of Cleveland were made members-at-large of the nominating committee to serve with members from the sections in arranging at once for organization.

A summary of the standards committee report, as read by A. B. Bachman, was adopted, making all the material in the issue S. A. E. standard, subject to ballot of the membership.

David Beecroft reported for the meetings committee that the large number of reservations for the summer session, aggregating 750, had dictated choice of the Ottawa Beach meeting place, which he characterized as likely to prove satisfactory, despite some disadvantages. Charles M. Manly, president of the society, declared, in his annual address, that opportunities and obligations facing the automotive industry called for earnest devotion of talents and energies, particularly to solve problems connected with the resumption of peace.

Of the future of the industry, Mr. Manly said:

"In the subdivision of automotive engineering work having to do with motor trucks, the real work of the engineer has hardly as yet been begun. True it is that motor trucks are being sold and are daily hauling thousands of tons of merchandise and general freight, but the careful study and collection of data for accurately pre-determining the best operating equipment, organization and personnel to meet given conditions at a definitely predetermined cost has hardly been started. This single phase of automotive engineering presents more problems for the engineer

(*Continued on page* 1461)

French Automotive Restrictions Lifted

Cars, Tires and Parts May Be Exported Freely — New Ad Valorem Surtax Applied

WASHINGTON, June 23—The restrictions against the importation of automobiles, tires and parts have been lifted by France and these commodities can now be exported from the United States to that country freely. This information was received officially by the Department of Commerce here to-day.

It is expected by Government officials here that Great Britain, as a result of France's action, will also remove restrictions in the near future and allow automobiles to be imported from the United States.

Information also received by the Department of Commerce provides for a new ad valorem surtax, based on c.i.f. or landed values at French customs houses. Twenty per cent ad valorem is the extreme limit of the surtax under the minimum and 40 per cent ad valorem under the general tariff. The amount of surtax to be applied to pamphlets could not be learned here, but it is anticipated that regardless of the tax, automobiles will be ordered in great quantities.

Although it is not known in Washington just what plans the Liquidation Office of the American Expeditionary Force has formulated for the disposition of the motor trucks and cars in France, it is understood here that the removal of the motor restrictions will allow the taking over of trucks and cars by the original manufacturers if they so desire, and if the War Department should consent to the resale of these trucks and cars to consumers in France upon payment of the French duties. It is also possible, under the new regulations, that the War Department may sell trucks and cars to consumers in France upon payment of French duties. What disposal will take place has not been determined.

France has decreed that all trucks and cars sold to consumers for use in France by the American Expeditionary Forces will entail the payment of the French duties, but if these cars and trucks are sold in France for use outside of French territory, there is no necessity for payment of French duties.

—

Another View

PARIS, FRANCE (*Special Cable*), June 20—From date automobiles weighing a minimum of 5511 lb. can be imported into France on pre-war duties, plus an ad valorem tax of 20 per cent maximum and 10 per cent minimum. The rate on tractors is 40 per cent maximum and 20 per cent minimum.

Automobile parts are now admitted on a pre-war basis plus an ad valorem tax varying from 20 to 30 per cent per ton to 15 per cent minimum, according to the nature of the article. The decree covering these changes does not especially mention touring cars, and while the situation as governing these is obscure, it is believed that they are still subject to 70 per cent duty.

Pre-war French duties on all automobiles were 70 francs general and 50 francs minimum per hundred kilos.

—

The foregoing is a reproduction of a cablegram received from W. F. Bradley, special representative of AUTOMOTIVE INDUSTRIES in France. It seems to indicate that the new ruling applies to trucks, as the minimum weight limit of 5511 lb. obviously is too great to affect the majority of passenger cars. As a kilogram equals 2.2046 lb. it is apparent that the new French ruling applies to vehicles in excess of 2500 kilos.

The restrictions mentioned in the Bradley cable are not noted in the cables received by the Department of Commerce at Washington from the commercial official attache at Paris. These official cables make no mention of weight restrictions but, as told in a dispatch from Washington on this page, indicate that all restrictions except duty have been removed. The Department of Commerce, when informed of the cable from Bradley, undertook to verify it, but at time of publication a reply had not been received from Paris.

PROPOSED SAXON PURCHASE

DETROIT, June 25—At the meeting of Saxon creditors called for to-day, a proposed purchase plan of the Saxon Motor Car Corp. will be outlined, according to information gained from an official of the company. No details are available for publication at this time. Should the deal go through, it is understood that Saxon financial interests would be in a strong position, and all creditors will receive payment in full.

MASSACHUSETTS AMENDS BILL

BOSTON, June 23—The Massachusetts truck and trailer bill, which caused so much protest because of its prohibitive fees, was amended June 12, passed in the House and is now in the Senate. The bill, as amended, materially reduces fees for the larger size trucks, but they still remain nearly three times the present fees. Fees for capacities over 7 tons probably relate to trailers as the law in this state prohibits gross weight in excess of 28,000 lb. This schedule, as applied to trailers, is still prohibitive.

The amended schedule follows:

Before Amendment, Capacity		After Amendment, Capacity	
1 ton or less	$10	1 ton or less	$10
Over 1 ton to 1¼ tons	15	Over 1 ton to 2 tons	20
Over 1¼ to 2 tons	20	Over 2 to 3 tons	30
Over 2 to 2½ tons	25	Over 3 to 4 tons	40
Over 2½ to 3 tons	30	Over 4 to 5 tons	50
Over 3 to 3½ tons	40	Over 5 to 6 tons	60
Over 3½ to 4 tons	50	Over 6 to 7 tons	70
Over 4 to 4½ tons	75	Over 7 to 8 tons	80
Over 4½ to 5 tons	100	Over 8 to 9 tons	90
Every additional ½ ton	50	Any capacity over 9 tons	100

Rules for French Show Next October

Regulations Received by N.A.C.C. Place American Exhibitors at Disadvantage

NEW YORK, June 25—The National Automobile Chamber of Commerce has received application blanks and regulations governing the International Automobile Show to be held at the Champs Elysées October 9 to 19.

Applicants are required to agree not to enter any other show in France before 1921, a prohibition which would stand against American exhibitors participating in an American exposition in France. To be rated on a par with the French, foreign exhibitors must have shown at three previous French exhibitions and be from countries imposing no greater than 15 per cent import duty prior to 1914.

On the latter provision, the N. A. C. C. says: "This places American exhibitors at a disadvantage, for the inference is that some provision will be made for them only after the others are cared for."

There will be 12 classes of exhibitors: Automobiles and chassis complete, motor trucks and buses, engines, etc., bodies and their parts, automobile dealers (established at least six months), bicycles and motorcycles, tires and tubes, accessories and parts makers, accessories parts dealers, forges and furnaces, sporting goods, automobile schools.

Plan to Build Up S. A. E. Membership

(*Continued from page* 1460)

to solve than if all of our records and data were suddenly swept away in railroad transportation engineering and it became necessary to immediately reestablish such data for the determination of proper freight rates.

"Similarly, in that newest of the branches of automotive engineering, which is destined to grow to be one of the biggest of the brothers in the family of giants spring from the union, under the magic influence of the electric spark, of atmospheric air and petroleum in the internal combustion engine, the commercial operation of aircraft, the scope and importance of the problems that must be given immediate and careful attention and study by the engineer are so great that I venture the prediction that within the next ten years there will be a larger number of engineers engaged exclusively on them than there are to-day in the total membership of this society."

FACTORY ADDITIONS

PORT HURON, MICH., June 21—Work on the first new unit of the Holmes Foundry Co. is well under way and will be completed by July 1. A new foundry plant is nearing completion at the United Brass & Aluminum Co. This plant is also building a large storehouse.

Goodyear Industrial Plan Put in Effect

Organization Follows Lines of National Legislature—Will Regulate Factory Conditions

AKRON, OHIO, June 24—Voice in the management of the Goodyear Tire & Rubber Co. has been given its employees by a new industrial representation plan. At a special election Monday, 92 per cent of the workers voted for it. The plan as outlined by the Council of Industrial Relations at the factory follows the lines of the national and state legislatures.

Executive powers are vested in the management, and legislative powers in the Industrial Assembly consisting of a House and Senate. The House is composed of 40 members and the Senate of 20, all elected by the workers. Members of the assembly are elected for 1 year, and members of the senate for 2 years.

An assemblyman must be not less than 21, and in the continuous employ of the company for not less than 1 year. A senator must be not less than 25, and in the continuous employ of the company for not less than 5 years. They may meet separately or jointly on the first Monday each month. Each representative and each senator has one vote.

A representative or senator may be recalled on petition signed by two-thirds of the voters in his precinct or district, and approved by two-thirds vote of the house of which he is a member. Upon his severance of employment with the company, a representative or senator automatically ceases to hold office.

Voters must be not less than 18, and in the continuous employ of the company for not less than 6 months.

The final authority for the management of the company, it is stated, is fixed by the laws of Ohio, in the board of directors. But subject only to the right of the directors to veto and annul, the industrial assembly shall have the power to make changes in factory regulations on the subject of wage adjustments, working conditions and grievances.

Provision is also made to consider such questions by joint conferences where the men meet an equal number of representatives of the management.

Legislative power of the assembly is exercised by the adoption of resolutions and measures which are signed or vetoed by the factory manager. When vetoed by the factory manager the bills may be passed by a two-thirds vote in each house, when they become a part of the factory rules and regulations. It is planned that there shall be no discrimination against any one whether a member in a labor organization or not, or against any member because of any vote he may cast.

WESTERN GOODYEAR PLANT

AKRON, OHIO, June 24—It is said here that the Goodyear Tire & Rubber Co. has secured options on 480 acres of land in Los Angeles, Cal., and will build a branch plant there. A capitalization of $7,500,000 is contemplated and has already been underwritten by a banking syndicate.

F. A. Seiberling, president of the company, stated that an option has been taken on Pacific coast land, but no definite decision has been made on the erection of a plant.

If the move materializes it will be the first expansion of any of the Akron rubber companies outside of this city. Los Angeles is on the route to the Goodyear rubber plantations in the Far East, and not far from the company's cotton plantations in Arizona.

WRIGHT-MARTIN MERGER

NEW YORK, June 26—Stockholders of the Wright-Martin Aircraft Corp. and the International Motor Truck Corp. will vote shortly on the proposed merger of the two companies, for which the following detailed plan has been worked out: Wright-Martin preferred will receive International first preferred, par for par, and accumulative, dividends to date not earlier than Sept. 1, 1919, nor later than date of issuance of new stock; Wright-Martin common stock will receive 2.8 shares of International second preferred and two shares of common of no par value for each 100 shares of Wright-Martin; Wright-Martin common will be reduced so that for each 100 shares now outstanding 25 shares will remain in hands of holders in addition to International stock received in exchange.

WADSWORTH PRODUCING AGAIN

DETROIT, June 24—The Wadsworth Mfg. Co., whose production has been greatly curtailed by a strike for several weeks, had practically a full force of new workers on the job. This fact so aroused the strikers that nearly 1000 stormed the plant, smashed 100 windows and badly beat a score of employees. Police reserves scattered the mob and made several arrests. The police have placed heavy guards at the plant and there has been no more rioting. This is the second riot at this plant.

PUBLIC AVIATION FIELD

DETROIT, June 24—Morrow Aviation Field, which cost the government $500,000, was opened to the public Saturday. This field was turned over by the War Department to the Universal Aviation Co., of which Henry M. Leland of the Lincoln Motor Co. is president. During the day several flights were made. The aviation company has four planes on the field. Six more are expected soon. The field's nine hangars will hold about 60 airplanes.

Regular passenger service between Detroit and Cleveland will start at once. Private owners of airplanes are making arrangements to keep their machines in Morrow field hangars. The field will be a landing and general service station for all visiting aviators.

Willys-Overland in Full Production

Normal Output Expected in 30 Days — Operating on 48-Hour Week

DETROIT, June 24—The Toledo, Elmira and Elyria plants of the Willys-Overland Co. are in full operation. Protected by the United States Government, the company believes that the crisis in their 2 months' labor difficulty has been passed. Approximately 5000 men are back in the Toledo plant, and fully 75 per cent of employees have returned in Elmira and Elyria. All departments are now in operation and production is being gradually increased.

Monday saw the first completed cars leave the Toledo plant's assembly line since the calling of the strike. While production is small at present, it will be back to normal within 30 days if present conditions continue. The company has invited all old employees to return with the exception of the radical leaders. The plants are operating on an 8-hr. 36-min.-a-day basis, and one half day Saturday, making a labor period of 48 hr. per week. The day the strike was called there were 13,000 men in the Toledo plant.

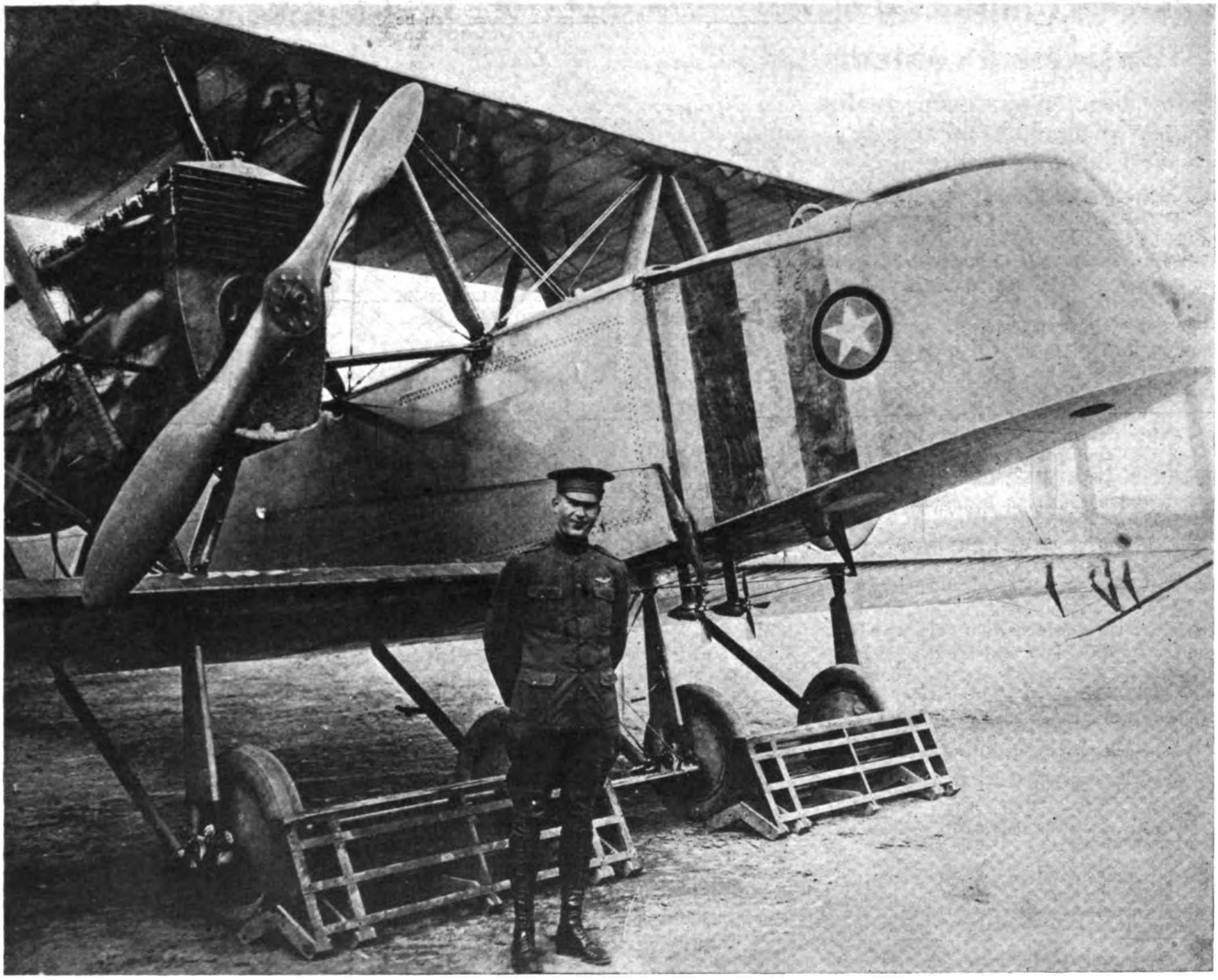
The injunction issued by Judge John M. Killets of the United States District Court, which ordered the Willys-Overland Co. to resume operations at once and continue the plant in operation for a period of 10 days, has been made permanent. This injunction also limits picketing and provides the deputizing of a large number of United States marshals to enforce the order. The action was brought in the United States Court by the Dail-Overland Co., distributer in a Southern state. This company named the Willys-Overland Co., the Toledo Lodge 105 International Association of Machinists, Automobile District Council, and 50 labor leaders as defendants in the action. This injunction will be lifted at the discretion of the court.

For 2 or 3 days following the enforcement of the first temporary injunction there was more or less trouble with strikers, but nothing serious. Several arrests were made.

S. F. BOWSER CO., LTD.

TORONTO, ONT., June 23—S. F. Bowser Co., Ltd., manufacturer, has been organized in Canada as a separate concern under the United States company. It has for a number of years been manufacturing and selling Bowser gasoline and oil pumps, tanks and storage systems under the control of the parent company at Fort Wayne, Ind.

H. C. Christie, who has been for a number of years connected with the Canadian factory of the Bowser company, recently as sales manager, has been elected manager, and R. E. Cummings, factory manager. Other officers are: President, S. F. Bowser; vice-president, S. B. Bechtel, secretary, H. J. Grosvenor; treasurer, W. G. Zahrt.



Capt. Roy N. Francis and the Martin Bomber in which he expects to make a one-stop flight from the Mineola field to San Francisco under the direction of the War Department. The plane carries U. S. Martin twin motors

Labor Approves of Scientific Research

Federation of Federal Employees Passes Resolution to Aid and Support Federal Research

ATLANTIC CITY, June 25—The newest section of the American Federation of Labor, the Federation of Federal Employees, has made its presence felt in the larger body by bringing about the adoption of the following resolution in the convention here:

"Whereas, scientific research and the technical application of results of research form a fundamental basis upon which the development of our industries, manufacturing, agriculture, mining, and others must rest; and

"Whereas, the productivity of industry is greatly increased by the technical application of the results of scientific research in physics, chemistry, biology and geology, in engineering and agriculture, and in the related sciences; and the health and well-being not only of the workers but of the whole population as well, are dependent upon advances in medicine and sanitation; so that the value of scientific advancement to the welfare of the nation is many times greater than the cost of the necessary research; and

"Whereas, the increased productivity of industry resulting from scientific research is a most potent factor in the ever-increasing struggle of the workers to raise their standards of living, and the importance of this factor must steadily increase, since there is a limit beyond which the average standard of living of the whole population cannot progress by the usual methods of readjustment, which limit can only be raised by research and the utilization of the results of research in industry; and

"Whereas, there are numerous important and pressing problems of administration and regulation now faced by federal, state, and local governments, the wise solution of which depends upon scientific and technical research; and

"Whereas, the war has brought home to all the nations engaged in it the overwhelming importance of science and technology to national welfare, whether in war or in peace, and not only is private initiative attempting to organize far-reaching research in these fields on a national scale, but in several countries governmental participation and support of such undertakings are already active; therefore be it

"Resolved, by the American Federation of Labor in convention assembled, that a broad program of scientific and technical research is of major importance to the national welfare and should be fostered in every way by the Federal Government, and that the activities of the Government itself in such research should be adequately and generously supported in order that the work may be greatly strengthened and extended; and the Secretary of the Federation is instructed to transmit copies of this resolution to the President of the United States, to the President pro tempore of the Senate, and to the Speaker of the House of Representatives."

This resolution is of peculiar interest to manufacturers whose business is confronted with the needs of research and who have been, during recent months, depending largely upon government bureaus to aid with this work. The Federation of Federal Employees includes in its membership many scientists and others who have been considered far separated from the average members of the Federation of Labor. But these men believe that their work is common with those who would improve labor conditions and they have enlisted. In the passage of their resolution, they were assisted by the teachers' organization.

P. G. Agnew of the Federal Federation, who was one of those who appeared before the resolutions committee, says that the sponsors of the resolution were closely questioned by the practical workers on that committee and that the practical miners, metal workers and other skilled trades questioned them sharply as to the nature of the work done by the bureaus.

WELLS ADDS TO MACHINE SHOPS

KENOSHA, WIS., June 20—The Frank L. Wells Co. is adding to its plant at a cost of about $50,000 fully equipped.

Allies to Confer on Business Problems

U. S. Chamber of Commerce Invites England, France, Italy and Belgium to Meeting

WASHINGTON, June 21—Invitations have been sent by the Chamber of Commerce of the United States to the United Kingdom, France, Belgium and Italy to send joint commercial missions to the United States in the fall as guests of the Chamber. The missions will arrive some time in October and will include representatives of the four governments. Full details are yet to be received from representatives of the Chamber abroad, who are arranging for the trip. The Executive Committee of the Chamber appointed a committee to-day to arrange entertainment for the missions and for conferences between members of the missions and American business men.

A canvass to-day by the Executive Committee of the Chamber shows that 12 of the 13 principles of industrial relations, sent to a referendum vote April 16, was carried. The thirteenth, recommending a system of national employment offices, received a majority vote, but not the two-thirds necessary to carry.

The principles submitted to vote are as follows:

1. Industrial enterprise, as a source of livelihood for both employer and employee, should be so conducted that due consideration is given to the situation of all persons dependent upon it.

2. The public interest requires adjustment of industrial relations by peaceful methods.

3. Regularity and continuity of employment should be sought to the fullest extent and constitute a responsibility resting alike upon employers, wage earners and the public.

4. The right of workers to organize is as clearly recognized as that of any other element or part of the community.

5. Industrial harmony and prosperity will be most effectually promoted by adequate representation of the parties in interest. Existing forms of representation should be carefully studied and availed of in so far as they may be found to have merit and are adaptable to the peculiar conditions in the various industries.

6. Whenever agreements are made with respect to industrial relations they should be faithfully observed.

7. Such agreement should contain provision for prompt and final interpretation in the event of controversy regarding meaning or application.

8. Wages should be adjusted with due regard to the purchasing power of the wage and to the right of every man to an opportunity to earn a living at fair wages, to reasonable hours of work and working conditions, to a decent home, and to the enjoyment of proper social conditions.

9. Fixing of a basic day as a device for increasing compensation is a subterfuge that should be condemned.

10. Efficient production in conjunction with adequate wages is essential to successful industry. Arbitrary restriction on output below reasonable standards is harmful to the interests of wage earners, employers and the public and should not be permitted. Industry, efficiency and initiative, wherever found, should be encouraged and adequately rewarded, while indolence and indifference should be condemned.

11. Consideration of reduction in wages should not be reached until possibility of reduction of costs in all other directions has been exhausted.

12. Administration of employment and management of labor should be recognized as a distinct and important function of management and accorded its proper responsibility in administrative organization.

13. A system of national employment offices, with due provision for co-operation with existing state and municipal systems, can be made, under efficient management and if conducted with due regard to the equal interests of employers and employees in its proper administration, a most helpful agency, but only if all appointments are made strictly subject to the Civil Service law and rules. Policies governing the conduct of a national system of employment offices should be determined in conjunction with advisory boards—national, state and local—equally representative of employers and employees.

Reorganization of the Chamber into departments to conform with the industrial, economic and social divisions of its membership is proceeding and will be completed this year. The best men obtainable for the places will be secured as heads of the departments.

The Chamber's board of directors will hold its meeting in Seattle in July. Members of the board living in the East will travel to Seattle together from Chicago, stopping at Denver, Salt Lake City and California cities for conferences with business interests. The return trip will be made by way of Minneapolis.

INDUSTRIAL CONFERENCE

WASHINGTON, June 20—A national conference for the consideration of industrial problems and the adjustment of differences between capital and labor is proposed in a joint resolution offered in the House by Representative Kelly of Pennsylvania.

It provides that the President be authorized to call a national conference to be composed of the following persons representing both employers and employees: E. H. Gary, William H. Johnston, Frank P. Walsh, Charles E. Hughes, A. B. Garretson, William K. Vanderbilt, Franklin K. Lane, William B. Wilson, John D. Rockefeller, Samuel Gompers. Daniel Guggenheim, Charles H. Moyer, J. P. Morgan, Andrew Furuseth, F. S. Peabody, Frank J. Hayes, J. Ogden Armour, J. Fitzpatrick, E. L. Stotesbury, W. D. Mahon and such other persons as the President may name, equally divided among leading representatives of labor and capital.

It shall be the duty of the conference to consider, with a view of the permanent solution of the same, such problems as may be presented to it relating to permanent relations of capital, labor, industrial management, adjustment of wages, settlement of industrial disputes, promoting improved conditions and greater industrial efficiency as a nation.

AMERICAN STEEL UNRESTRICTED

LONDON, June 10—Though American steel is selling in Great Britain at approximately $22 a ton less than the British product, the government is not prepared to restrict importations, Sir Auckland Geddes, president of the Board of Trade, stated in response to a question in the House of Commons.

The American Chamber of Commerce here reports that Sir Auckland declared an adequate supply of iron and steel was essential to the manufacture of articles for the British export trade, even if it had to come from the United States.

U. S. War Vehicles for Disposal by France

American Equipment Comprises 100,000 Vehicles—Manufacturers Will Maintain Stocks

PARIS, May 24—All automotive material held by the American army in France will be disposed of by the French Government. This material comprises 100,000 vehicles, of which 65,000 are trucks and touring cars, and about 35,000 motorcycles with or without side cars. Although it was decided that the American army should sell nothing direct, the French do not state when they will put this American material on the market.

It is understood that the intention of the French Government is to dispose of the whole of its own automotive material before allowing any American machines to be sold. Until now not a single American automobile has been sold in France, although a certain number have been disposed of for shipment to other European countries.

Telegrams have been received by the Motor Transport Corps in France from practically all American manufacturers who supplied cars or trucks to the army stating that they are prepared to maintain stocks and spare parts in France for the benefit of purchasers of their vehicles.

The first sales of American vehicles having any connection with the Motor Transport Corps took place at Verneuil this week. These vehicles comprise 68,000 rolling kitchens, water wagons, and other horse-drawn vehicles or trailers belonging to the Quartermaster Corps.

This is not Motor Transport Corps material and its presence at the Motor Transport Corps reconstruction park is explained by the fact that Verneuil undertook to repair not only motor vehicles, but also most of the Quartermaster Corps' rolling stock.

EXPORTS DECREASE IN MAY

WASHINGTON, June 20—Exports for May totaled $606,000,000, a falling off of $108,000,000 from the record set in April, but an increase of $55,000,000 over May, 1918, according to a statement issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce. For the 11 months ended May, the export trade amounted to $6,308,000,000, an increase of $872,000,000 over the corresponding period of the previous year.

May imports were the largest in the history of that country's foreign trade—$329,000,000, a gain of $56,000,000 over April, and of $6,000,000 over May, 1918, which was the previous high mark. Imports for the 11 months ended May were valued at $2,803,000,000, an increase of $118,000,000 over a similar period in 1918.

The excess of exports over imports during the 11 months was $3,505,000,000, as compared with $2,751,000,000 for the corresponding period in 1918, and $3,364,000,000 in 1917, the previous record.

Tractors in 6 Classes for English Trials

Royal Agricultural Society Makes Public Comprehensive Regulations for 1920 Events

LONDON, June 10—The Royal Agricultural Society has made public the regulations drawn by that body for the Agricultural Tractor and Plow Trials to be held under its auspices in the autumn of 1920.

These regulations are especially interesting when compared with the regulations announced to govern the tractor trials to be held at Lincoln, England, in September of this year. These regulations, which were printed in the June 5 issue of AUTOMOTIVE INDUSTRIES, on page 1243, were drawn by the Society of Motor Manufacturers' and Traders', Ltd., which is the great national automotive organization of Great Britain.

The Royal Society regulations are more comprehensive in several particulars. They require demonstrations of hauling and of driving barn machinery. The price of the machine is also to be made a consideration in the awards. The exhibitor must set out very clearly the amount of fuel, the number of assistants and any other equipment he will require.

There are six classes with prizes of $100 and of $50 in each. The classes are as follows:

Class 1—Internal combustion direct tractor engine not exceeding 30 B.hp., suitable for plowing 2 or 3 furrows, 10 in. by 6 in. deep.

Class 2—Internal combustion direct traction engine over 30 B.hp., suitable for plowing 4 furrows, 10 in. wide by 8 in. deep.

Class 3—Direct traction steam engine plant, suitable for plowing 4 furrows, 10 in. wide by 8 in. deep. Engines to comply with the requirements of the Light Road Locomotive Acts.

Class 4—Internal combustion double engine set, with wire rope haulage, for plowing 3 or 4 furrows, 10 in. wide by 8 in. deep. Engines to comply with the requirements of the Light Road Locomotive Acts.

Class 5—Double steam engine set, with wire rope, haulage, for plowing 3 or 4 furrows, 10 in. wide by 8 in. deep. Engines to comply with the requirements of the Light Road Locomotive Acts.

Class 6—Self-propelled plow for plowing not more than 4 furrows, and not more than 10 in. wide by not more than 8 in. deep.

CLASSES I–V

1. For the purpose of these trials, an "agricultural tractor" shall be capable of:
   (a) Hauling direct in work or on the road, a plough, cultivator, harvester, or other agricultural implement.
   (b) Driving barn machinery.

2. The machines shall be tested for efficiency in carrying out the various classes of work.

3. Competitors will have to plow a given area of land with their own tractor and plow, commencing with the size of furrows specified for each class, during which the fuel and water consumption will be recorded, and subsequently varying the depth and width at the discretion of the judges.

4. Further trials on various classes of land with multiple plows and with other cultivating implements to be provided by the competitors, or which the society may have at its disposal and with which they may wish their tractors to be tried, may be made at the discretion of the judges.

5. Special attention will be paid, in the plowing and cultivating trials, to the compression of the land by the machine, the space and time occupied in turning, the uniformity of the furrow ends and evenness of the furrow.

6. The engines in classes 2, 3, 4 and 5 shall be capable of road haulage and will be tested in that respect over courses which will be set out over the roads and land selected by the society, and each competitor shall declare before starting what weight he is prepared to haul over such course; the fuel, water and other supplies consumed will be noted on the road trial. With selected motors hill-climbing trials may be made. Motors fitted with winding gear may have the opportunity of demonstrating its advantages. Motors must conform to the requirements of Acts of Parliament.

7. Each motor will be tested driving on to a pulley on a countershaft fitted with a brake. The diameter of the pulley, speed of countershaft, and load on brake assimilating to those of a threshing machine.

8. The time taken and attendance given will be noted in all trials.

9. Implements, except plows, unless otherwise stated, will be provided by the society.

10. The fuel, whether solid or liquid, will be provided by the society. The coal will be Welsh steam coal of uniform quality, and the petroleum or other liquid of one of the recognized brands.

11. Each competitor to state how many men will be required to attend to the machine.

12. The following are some of the points to which special attention will be directed:
   (a) Weight of machine.
   (b) Weight per inch width of wheel and diameter of wheel.
   (c) Mechanical design and construction.
   (d) Adaptability to various kinds of work, such as harvesting and the like.
   (e) Time taken to prepare for work.
   (f) Ease and safety of handling.
   (g) Ease of turning and space required for same.
   (h) Efficiency of winding gear.
   (i) Facility of attachment.
   (j) Wheel devices.
   (k) Attendance necessary.
   (l) Consumption of fuel, water and other supplies per unit of work done.
   (m) Price.

SELF-PROPELLED PLOWS—CLASS VI

The trials of these will be on the same lines as the plowing trials in Classes I and II.

13. The judges' decision, when duly recorded, will in all cases be final.

14. The society's Implement Regulations will apply to these trials generally.

FIELD FOR TRACTOR DITCHERS

LONDON, June 10—Demonstrations near Glasgow of a Buckeye tractor ditcher have revealed the comparative absence of plants of this sort in Great Britain. This affords an opportunity for American enterprise to benefit by an apparent need of machinery for ditch clearing and field drainage.

The new appliance, brought out with funds of the Board of Agriculture for Scotland, is the first of its kind in the British Isles and is intended to overcome the prohibitive cost of drainage by manual labor and the impossibility of obtaining enough labor.

The demonstration, arranged by the Highland and Agricultural Society, covered a period of ten days. The ditcher consists of a revolving wheel suspended to the rear of the tractor. On this wheel are the cutters or buckets, after the style of a dredger, and with the revolution of the wheel the earth is carried to the surface, where it is deposited on an endless canvas which takes it from the machine and places it about 2 ft. from the edge of the drain. One man and a helper operate the machine. On the first day of the demonstration it cut a field drain 200 yd. long, by 2 ft. deep and 12 in. wide, in 35 minutes. The ditcher can cut varying depths and widths. The consumption of gasoline works out as something like 0.9 gal. per hp. for a working day of ten hours.

British Tractor Scheme Expensive

Heavy Loss Sustained by Food Bureau in Ploughing Farmers' Lands

LONDON, June 3—Net losses of $4,199,850 were sustained by the Food Production Department in connection with its motor tractor ploughing scheme in 1917-18. It was expected when the project was organized that the entire cost would be recovered from the farmers.

Working expenses, depreciation of machinery, administration and other charges amounted to $5,812,210, while the total recovered or due for service performed was only $1,662,360.

The department obtained 6000 motor tractors through the Ministry of Munitions at $750 each, in addition to the cost of freight from America and assembling in this country. There was delay in delivery, and 2500 machines were re-sold to the contractors at $1000 each, and were subsequently re-sold by them to farmers at $1250 each.

In reply to the Auditor General's request for information as to why it was decided to re-sell to the contractors instead of direct to the farmers, it was stated that the department had no organization for obtaining orders from farmers, whereas the contractors already possessed such an organization.

As the bulk of the tractors were Fordsons, it is obvious that the Ford interests were indicated, and it is a fact that the bulk of the organization of the national tillage scheme was in the hands of Ford agents, a preference which was resented by the implement dealers at large.

It was in connection with this scheme that the organizing services of Sir Percival Perry were used.

The Fordson tractor is now listed at $1400. Reports of the machine is on the whole favorable.

In connection with its general work the Food Production Department placed 6000 tractors at the disposal of the farmers, trained drivers and plowmen and cultivated private land at less than cost.

TRACTOR ON PIKE'S PEAK

DENVER, COL., June 21—A tractor has scaled Pike's Peak. Following the demonstration here a Holt 5-ton caterpillar tractor, such as was used by the A. E. F., was sent to Colorado Springs and from there ascended Pike's Peak. In the last two miles 15-ft. snow drifts were overcome. Col. M. A. Champlin, recently of the A. E. F., was in charge of the tractor.

CHAMPION PLUG IN CANADA

DETROIT, June 23—The Champion Spark Plug Co., Toledo, has started work on its $225,000 Canadian branch in Windsor, Ont.

Automotive Steel Purchases Heavy

Change in Price Not Likely—Contracts on Sliding Scale Basis

DETROIT, June 19—More and larger orders for steel have been placed during the last 2 weeks than for any like period since the signing of the armistice.

The General Motors Corp. has just contracted for 200,000 tons. The Ford interests, including the Ford Motor Co., Henry Ford & Son, and the Ford Shipbuilding Co., have bought and most of the big automotive concerns in the Detroit district are protecting their source of supply by contract. The industry is apparently convinced that the price of steel is about stationary.

Few of the companies are binding themselves with "iron-clad" contracts. They are contracting to use a specified amount of steel during a period varying from 1 to 1½ years. All contracts are of the sliding-scale variety, based upon the market price of steel at the time of delivery.

None of the companies are agreeing to use a certain amount of steel each month, although some are furnishing estimates as to their approximate monthly consumption. They will not commit themselves to any agreement, however, which might force them to accept a fixed amount of steel each month.

While the big concerns are buying by contract the smaller companies continue to buy as they need material. This hand-to-mouth policy has been followed in a majority of cases ever since the signing of the armistice.

Not Waiting for Price Reductions

Automobile companies are buying heavily. The truck industry is beginning to place larger steel orders. The same also applies to the machinery men and parts makers.

Placing of steel orders by the railroad administration under protest is the big factor in steadying the steel market. While the administration was holding out for a lower price, the industry awaited expectantly and was prepared to take advantage of any price reduction. The purchasing agents were farily confident that the railroad administration would succeed in bringing prevailing prices down several points and no large orders were placed. It appears that the railroad administration has given up the fight and is preparing to buy at present prices. This action caused the industry to discard its watchful-waiting tactics.

As compared with 1914 prices, the cost of steel to-day is high, although 40 per cent less than it was 7 months ago. Blue annealed steel is priced at $3.55 per 100 lb. Plate steel at $2.65, and hot rolled steel, $3.05. The price on Nov. 19, 1918, for blue annealed steel was $4.25, which is 70 cents higher than the price now paid for the same material. In 1914, however, this same grade of steel was selling at $1.40 per 100 lb., the price increase in 5 yr., based on the above figures, being more than 200 per cent.

Indications do not point to further steel price decreases, the biggest factor preventing price reduction being the labor situation, both in the mining and rolling mill districts.

PAIGE BUILDING IMPROVEMENTS

DETROIT, June 21—The Paige-Detroit Motor Car Co. is spending $400,000 in plant equipment and other improvements which will permit an increase in production facilities of approximately 25 per cent. It applies to both the passenger car and truck divisions of the plant.

No new buildings are being built, but the new units completed for war work and containing approximately 66,000 sq. ft., are being utilized. The company expects to have the improvements completed and to be operating on an increased production schedule within 60 days.

The present capacity of the automobile department is 125 cars daily, while the truck department has facilities for 50 a day. The new arrangement will permit the manufacture of 175 passenger cars and 75 trucks daily.

The Paige company has been hard hit by a shortage of materials. During the month of May, 1500 passenger cars were produced, the daily production being approximately 55. From 3 to 10 trucks are turned out daily.

KELLY-SPRINGFIELD BUILDS

NEW YORK, June 24—To finance erection of a new plant at Cumberland, Md., the Kelly-Springfield Tire Co. is issuing $5,800,000 of 8 per cent preferred cumulative stock. The issue will be offered to both common and preferred shareholders at par ($100) and will be underwritten by a syndicate.

With completion of the first unit of the Cumberland plant, according to A. L. Scheuer, chairman of the board, the company's production will be materially increased over the combined output of the Akron and Wooster, Ohio, and Buffalo, N. Y., factories.

BOHNET READY FOR PRODUCTION

LANSING, MICH., June 18—The John Bohnet Co., which recently entered the truck body business, has completed alterations necessary for body production. The company, which utilized a part of the old Clark shops for its painting and all-season top departments, has leased the entire property and will occupy all floors of the old plant. By July 1 body production will begin.

This fall the company plans to erect a new plant on land on which it has options in another part of the city. While the company will move its body building activities to the proposed new factory building, the entire Clark property will be retained for the repainting department.

Stutz Pioneer Quits Office

Harry Stutz Retires as Active Head of Parent Company

NEW YORK, June 24—Harry C. Stutz, pioneer in the manufacture of the car which bears his name, will retire July 1 as active head of the Stutz Motor Car Co. of America. He will give up both the presidency and general managership, remaining in the organization merely as a member of the board of directors.

In the presidency Mr. Stutz will be succeeded by Allen A. Ryan, head of Ryan & Co., bankers, and vice-president of the Stutz concern during the past year. His successor as general manager has not yet been selected.

The reorganization, effected at the recent annual meeting, included the election of Frederick E. Gunnison of the directorate to the vice-presidency and the naming of George F. Lewis as secretary to succeed Kenneth R. Howard. William N. Thompson was re-elected treasurer.

Directors chosen, in addition to Messrs. Ryan, Stutz, Gunnison and Thompson, were: George H. Saylor, John J. Watson, Jr., and Hicks A. Weatherbee. The last named, the only new member of the board, succeeded Mr. Howard, who is connected with the Ryan banking firm.

Mr. Stutz, who organized the original Stutz company in Indiana, became head of the Stutz Motor Car Co. of America upon its incorporation in 1916.

Mr. Ryan said there would be no change in the manufacturing or sales policies of the Stutz concern as a result of the reorganization. Neither he nor his associates were aware of the future plans of Mr. Stutz.

INDIANA S. A. E. MEETS

INDIANAPOLIS, June 23.—The Indiana Section of the Society of Automotive Engineers held one of its summer meetings last week. It was attended by 91 members and guests. L. H. Pomeroy, formerly chief engineer of the Vauxhall Co., England, spoke on the difference between English and American manufacturing, and the engine of the future.

PACKARD INCREASES CAPITAL

DETROIT, June 26—Stockholders of Packard Motor Car Co. met to-day to vote on a plan authorizing an increase in the company's capital stock from $21,000,000 to $50,000,000.

Only $7,000,000 of 7 per cent preferred stock will be sold at this time. This will be underwritten by a New York syndicate. The $7,000,000 issue anticipates the retirement of $5,000,000 in gold notes due in October, and provides $2,000,000 working capital.

Under the new capitalization $30,000,000 will be common stock and $20,000,000 preferred stock. In 1915 sales totaled $15,000,000 and in 1919, $64,000,000.

26 Flying Fields Retained by U. S.

14 to Be Used for Storage—Present Proposed Disposition of Fields Shown

WASHINGTON, June 20—Twenty-six flying fields will be retained permanently by the Air Service of the United States War Department, and 14 will be retained temporarily for storage and other purposes. No fields are being abandoned or sold at present. Following is a table showing the present proposed disposition of the fields:

1. Owned by U. S.
2. Being purchased.
3. Retained under lease.
4. Retained temporarily for storage.
5. Retained temporarily.
6. To be abandoned.
7. Being sold.

AVIATION FIELDS, ETC.	
Wilbur Wright Field, Ohio	4
Barron Field, Texas	4
Bolling Field, D. C.	5
Brooks Field, Texas	2
Call Field, Texas	4
Carlstrom Field, Fla.	2
Carruthers Field, Texas	4
Chapman Field, Fla.	2
Chanute Field, Ill.	2
Dorr Field, Fla.	2
Eberts Field, Ark.	4
Ellington Field, Texas	2
Gerstner Field, La.	4
Hazelhurst Field, N. Y.	3
Kelly Field, No. 1, Texas	1
Kelly Field, No. 2, Texas	2
Langley Field, Va.	1
Love Field, Texas	4
March Field, Cal.	2
Mather Field, Cal.	3
Mitchell Field, L. I.	2
Park Field, Tenn.	2
Payne Field, Miss.	4
Post Field, Okla.	1
Rich Field, Texas	4
Rockwell Field, Cal.	1
Scott Field, Ill.	2
Selfridge Field, Mich.	2
Souther Field, Ga.	2
Taylor Field, Ala.	4
Taliaferro Field, Texas	4
AVIATION GENERAL SUPPLY DEPARTMENT AND BALLOON SCHOOL.	
Middletown, Pa.	2
Richmond, Va.	*1
San Antonio, Texas	1
Dallas, Texas	5
Montgomery, Ala.	2
Fairfield, Ohio	1
Garden City, L. I.	5
Arcadia, Cal.	2
Lee Hall, Va.	1

*Purchased. Passed into hands of United States about June 15.

Note.—The Aerial Coast Defense Station, New Dorp, Staten Island, N. Y., was omitted from the list. This station is owned by the United States.

AVIATION APPROPRIATION INCREASED

WASHINGTON, June 21—The House Military Affairs Committee has increased the appropriation for the Army Aviation service to $55,500,000. Special provisions in the new Army bill allow $982,000 for the purchase of the Curtiss-Ellwood aviation plant at Buffalo, $3,260,000 for the purchase of the Dayton-Wright airplane plant at Dayton, $3,500,000 for the purchase of the dirigible landing field and hangars in Burlington County, N. J., and $470,000 for Rockwell Field, San Diego, Cal.

$35,000,000 FOR NAVAL AVIATION

WASHINGTON, June 20—The Senate Naval Affairs Committee to-day voted to allow $35,000,000 for naval aviation during the coming year. Secretary of the Navy Daniels yesterday asked for $36,000,000, but said he could get along on $35,000,000.

FRENCH AVIATION LOSSES

PARIS, June 1—From Aug. 4, 1914, to armistice day the losses of the French air service at the front were 1945 pilots and observers killed, 1461 missing and now assumed to be dead, and 2922 wounded. These losses cover the fighting zone only.

In the interior zone, which covers the lines of communication, schools, etc., the losses were 1927 pilots and observers. This gives a total loss for the French air service of 7,757 pilots or observers.

The French flying staff on Dec. 1, 1918, consisted of 12,919 men. The losses therefore represent 61 per cent of the total.

AIRCRAFT FOR EDUCATION

WASHINGTON, June 20—A joint resolution offered to Congress this week authorizes the Secretary of War to loan airplane engines, airplanes, aeronautic equipment and parts to educational institutions which maintain scientific departments. This equipment is to be loaned for educational purposes only under such regulations as may be prescribed by the Secretary of War. The resolution was referred to the Committee on Education and Labor.

Training Planes and Engines Sold

WASHINGTON, June 23—Eleven hundred Standard J-1 planes, 4608 Curtiss OX-5 engines and 1616 Curtiss JN-4 planes without engines have been sold by the War Department to the Curtiss Aeroplane & Motor Corp. for approximately 12 per cent of the original cost. The following table shows the types sold, with the approximate cost and selling price:

Type	No. sold	Approx. unit cost price	Unit sale price	Sale price in per cent of cost
SJ-1 plane	1,100	$4,750	$200	4
JN-4 plane	1,616	4,750	400	8
OX-5 motor	4,608	2,100	400	19

ONE ENGINE ON ORDER

WASHINGTON, June 20—All outside orders for airplane service engines have been completed, according to the War Department, except one order for a Hispano-Suiza 300-hp. engine. This original order was for 10,000, but 9500 have been cancelled, leaving 500 on order. Of these, 499 have been completed, leaving but one engine still on order, which is expected to be delivered this week.

Air Regulations for Flight and Passengers

Provisions for Number of Passengers, Landing and Starting, Sale of Gasoline and Oil

WASHINGTON, June 20—The Director of Air Service has issued regulations for flights in aircraft under the control of the Air Service and for carrying passengers, landing and taking-off from flying fields, and for the sale of gasoline and oil to pilots not in military service. Flights can be made:

(a) For the proper execution of any approved project of the Air Service, or of the Air Service in co-operation with any other branch of service or department of the government—special approval of this office to be secured in each case.

(b) For the demonstration of aircraft, and aircraft development to officers of the executive, legislative and judicial branches of the government.

(c) For the rapid transportation of military or civilian officials of the government, of messages or parcels in cases of urgent necessity and for the convenience of the government.

(d) For the assistance of stranded civilian aviators or where it is necessary for the saving of human life.

The following may be carried as passengers in aircraft under the control of the Air Service:

(a) Any person necessary to be carried as a passenger to accomplish the purpose of any of the flights authorized in Paragraph No. 1 above.

(b) Officers and enlisted men of the army, navy and marine corps, both active and reserve.

(c) Officers and enlisted men of foreign armies, as a courtesy when they are visiting the United States.

Aircraft Pilots

No person will be permitted to pilot aircraft under the control of the Air Service except regularly authorized Air Service pilots or bona fide student-pilots of the Air Service.

Persons operating aircraft who are not in the military service or who are not under the jurisdiction of the Air Service, will be permitted to use Government facilities at Air Service stations contingent upon their proper observation of the air and ground rules in force at the particular station in question, and subject to the discretion of the commanding officer thereof, as not interfering with the proper conduct of official business of his station, as follows:

(a) They may be permitted to land and take-off from flying fields.

(b) They may be permitted to place airplanes in government hangars over night or for a short time pending repairs.

The sale of gasoline, oil, spare parts, etc., or the furnishing of the labor of Air Service mechanics in any form to pilots not in military service is forbidden.

16,000 More Surplus Vehicles Possible

Likely to Be Turned Over to Various Government Departments

WASHINGTON, June 24—That there may be 16,000 more vehicles surplus above the 39,000 already so classified and distributed to Government Bureaus was indicated by testimony before the Senate Military Affairs Committee when C. W. Hare, Director of Sales, Colonel Fred Glover and others testified with regard to the disposition of surplus munitions.

Testimony showed that there were 64,334 trucks and 11,179 passenger cars in the Army, a total of 75,513. Of this number, 5676 cars and 33,485 truck, a total of 39,161, are held, and 5503 cars and 30,849 trucks, a total of 36,352, have been declared surplus and are being transferred to other Government Bureaus.

Colonel Glover stated that the temporary reserve of 16,000 additional vehicles is included in the 39,161 which are still held by the Army, and these may be turned over later as surplus, so that the army will retain from 18,000 to 22,000 vehicles. There are also 23,543 trailers which are to be divided into permanent and surplus quantities and disposed of.

The testimony also developed the sales of tanks, tractors and airplanes. Mr. Hare showed that through the Department of Sales considerably higher prices were being secured, and cited two 6-ton tanks which the Ordnance Department had expected to sell for scrap at $1,000. These tanks were sold for $3,000 each by the Director of Sales. Likewise, thirty 45 hp. Holt tractors, costing the Government $5,800 each, were to be distributed for less than $1,000 each by one of the army camps.

Clevelands Go to Agriculture Department

The Department of Sales took over the tractors and distributed them to other divisions of the War Department. Forty-eight Gray wide drive drum tractors, reported surplus by the Ordnance Department, costing the Government $105,000, were to be sold back to the Gray Tractor Company at $50,000. Negotiations by the Department of Sales increased the offer to $65,000. This offer was not accepted and the tractors were sold in part to the Department of Commerce and Bureau of Fisheries for use in the Arctics, and the remainder have been transferred to the Bureau of Public Roads. Twenty-eight Cleveland tractors, appraised by the Ordnance Department at $400 each, were offered for sale, and the sale was stopped by the Department of Sales, and all but two of these tractors turned over to the Department of Agriculture. The remaining two were sold for $600 each.

Letters introduced, combined with discussions, show that the War Department, which recently sold 4608 Curtiss OX-5 engines, 1616 JN-4 airplanes without engines and 1100 Standard J1 airplanes without engines, valued at $20,000,000, to the Curtiss Aeroplane & Motor Corp., Buffalo, for $2,720,000, had offered these to the entire aeronautical industry and was unable to secure bids from others than the Curtiss company. It was shown that before the sale was consummated contracts were carefully drawn up, and the approval of Major General C. T. Menoher, Director of Air Service, and Secretary of War Newton D. Baker, was secured.

General Menoher pointed out that there is no general market for airplanes or airplane engines, that the industry is in its infancy, that designs change rapidly and that consequently it was to the general welfare to sell these planes and engines to a reliable manufacturer to be overhauled and sold with his guarantee. The Standard Aeroplane Corp. also made bids on the material but their tentative offer wos not as high as that made by the Curtiss company.

Approximations of the surplus supplies still held by the various Bureaus show the total surplus valued at $62,000,000 held by the Aircraft Production Division of the Air Service, of which practically $60,000,000 worth remains to be sold; $85,000,000 worth held by the Division of Military Aeronautics, Air Service, of which more than $80,000,000 worth remains to be sold.

MACHINERY MANUFACTURERS MEET

NEW YORK, June 20—Time, labor and money saving benefits derived from the use of motor trucks, trailers and kindred equipment in the handling of materials were described by J. M. Van Harlingen, of the Republic Motor Truck Co., in an address before the recent annual meeting of the Material Handling Machinery Manufacturers' Association. He told how the Fiske Rubber Co. had synchronized its factory transportation by using industrial trucks, trailers, elevators, etc., handling all of this under the management of one transportation superintendent, with the result that the first year the direct economies showed an actual saving of over $50,000 in payroll and plant maintenance costs, to say nothing of the great advantages which accrued to the plant through better delivery, and facilitated movement of all raw materials and finished products.

United States Senator Burton of Ohio urged attention of the members to development of transportation and other devices to hasten the loading and unloading of ships. He cited the profit which might be derived through the saving of only one day for every trip of every ship and urged the prompt installation of any modern means which would help speed up the return of ships to home ports, this of itself helping to offset the shortage of world shipping tonnage which has resulted from the activity of the German submarine war program. He termed expansion of port facilities the controlling factor in upbuilding the American merchant marine.

France Encouraging Peace-Time Aviation

American Aviation Mission to Suggest Development in U. S.—To Visit England

PARIS, June 21 (*Special Cable*)—Its work in France practically completed, the American Aviation Mission, headed by Assistant Secretary of War Benedict Crowell, left Paris this week, the main party proceeding to England, while some of the members, with Howard E. Coffin, representing the Council of National Defense, went to Italy.

The commissioners were impressed with the fact that the French government is giving more encouragement to airplane manufacturers to continue in peace-time business than is the case in the United States.

The mission has been in close touch with all the French aircraft producers and with various French government departments, gathering material for a report to be presented to Congress, suggesting means of developing commercial aviation in the United States.

The mission, having gone abroad without the technical advisers, whose proposed trip was cancelled because of lack of American government authorization, has done no work on standardization, though it received from British aviation authorities in France a full report on the standards situation as it exists in France.

Mr. Coffin's section, returning from Italy, will join Assistant Secretary Crowell and his associates in England, the entire party having planned to sail for home in about two weeks.

BUREAU OF MANUFACTURERS

WASHINGTON, June 24—The establishment of a Bureau of Manufacturers in this city by Congress was proposed yesterday by Senator Sheppard. The Bureau, as proposed, is to study manufacture in all forms and distribute information as a result of the investigations.

In proposing the resolution Senator Sheppard declared that Government Departments are devotel to agriculture, commerce and labor but there are no departments established for manufacture. The great quantities of basic raw materials, which are being shipped abroad, should be converted into finished products in this country. This, he said, can only be done by the development of our manufacturing facilities.

ENLARGING MARMON PLANT

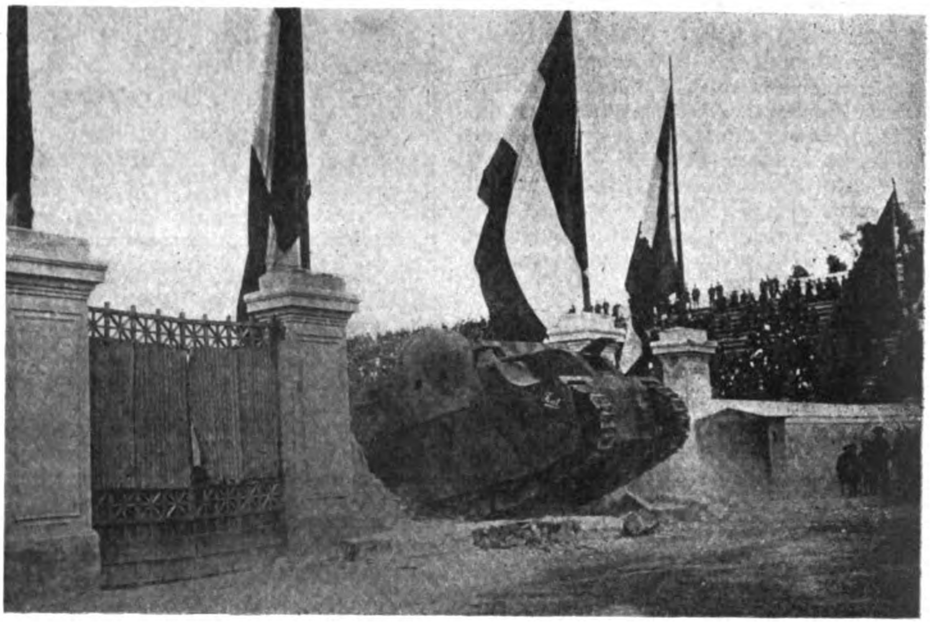
NEW YORK, June 26—The Nordyke & Marmon Co., Indianapolis, is negotiating with underwriters to issue at once $2,500,000 bonds to finance construction of additions to its factory, putting the plant on an extensive production basis. It is believed that the bonds will be put out next week.

Standards Formulated for Women in Industry

U. S. Department of Labor Regulates Hours, Wages and Occupations for Women

WASHINGTON, June 23—Standards for the employment of women in industry have been formulated by the United States Department of Labor, regulating the hours of labor to no more than 8 per day, providing for equal wages with men, prohibiting the employment of women in poisonous occupations, prohibiting home work, and providing for representation for women in organization necessary for collective bargaining.

Following are the complete standards recommended:



A contrast of the old and the new. Recently a war exhibition was arranged for the benefit of the Italian royalty in the Coliseum. There were trenches, huts, wire entanglements and other equipment. Finally came a tank, which destroyed many of these and then turned to leave the grounds, but instead of passing through the gate broke down a part of the wall and went over the ruins

I. Hours of Labor

1. Daily hours—No woman shall be employed or permitted to work more than eight hours in any one day. The time when the work of women employees shall begin and end and the time allowed for meals shall be posted in a conspicuous place in each workroom, and a record shall be kept of the overtime of each woman worker.

2. Half holiday on Saturday—The half holiday on Saturday should be the custom.

3. One day of rest in seven—Every woman worker shall have one day of rest in every seven days.

4. Time for meals—At least three-quarters of an hour shall be allowed for a meal.

5. Rest periods—A rest period of 10 minutes should be allowed in the middle of each working period without thereby increasing the length of the working day.

6. Night work—No woman shall be employed between the hours of 10 p. m. and 6 a. m.

II. Wages

1. Equality with men's wages—Women doing the same work as men shall receive the same wages, with such proportionate increases as the men are receiving in the same industry. Slight changes made in the process or in the arrangement of work should not be regarded as justifying a lower wage for a woman than for a man unless statistics of production show that the output for the job in question is less when women are employed than when men are employed. If a difference in output is demonstrated, the difference in the wage rate should be based upon the difference in production for the job as a whole and not determined arbitrarily.

2. The basis of determination of wages—Wages should be established on the basis of occupation and not on the basis of sex. The minimum wage rate should cover the cost of living for dependents and not merely for the individual.

III. Working Conditions

1. Comfort and Sanitation—State labor laws and industrial codes should be consulted with reference to provisions for comfort and sanitation. Washing facilities, with hot and cold water, soap, and individual towels, should be provided in sufficient number and in accessible locations to make washing before meals and at the close of the workday convenient.

Toilets should be separate for men and women, clean and accessible. Their numbers should have a standard ratio to the number of workers employed. Workroom floors should be kept clean. Dressing rooms should be provided adjacent to washing facilities, making possible change of clothing outside the workrooms. Rest rooms should be provided. Lighting should be so arranged that direct rays do not shine into the workers' eyes. Ventilation should be adequate and heat sufficient. Drinking water should be cool and accessible, with individual drinking cups or bubble fountain provided. Provision should be made for the workers to secure a hot and nourishing meal, eaten outside the workroom, and if no lunch rooms are accessible near the plant a lunch room should be maintained in the establishment.

2. Posture at work—Continuous standing and continuous sitting are both injurious. A seat should be provided for every woman employed, and its use encouraged. It is possible and desirable to adjust the height of the chairs in relation to the height of machines or work tables, so that the worker may with equal convenience and efficiency stand or sit at her work. The seats should have backs. If the chair is high, a foot rest should be provided.

3. Safety—Risks from machinery, danger from fire, and exposure to dust fumes, or other occupational hazards, should be scrupulously guarded against by observance of standards in State and Federal codes. First-aid equipment should be provided. Fire drills and other forms of education of the workers in the observance of safety regulations should be instituted.

4. Conditions needing correction—Work is more efficiently performed by either men or women if healthful conditions are established. It is usually possible to make changes which will remove such hazards to health as the following:

a. Constant standing or other posture causing physical strain.
b. Repeated lifting of heavy weights, or other abnormally fatiguing motions.
c. Operation of mechanical devices requiring undue strength.
d. Exposure to excessive heat or excessive cold.
e. Exposure to dust, fumes, or other occupational poisons, without adequate safeguards against disease.

5. Prohibited occupations—Women must not be employed in occupations involving the use of poisons which are proved to be more injurious to women than to men, such as certain processes in the lead industries.

6. Work dress—Work dresses with caps and comfortable shoes are desirable for health and safety in occupations for which machines are used or in which the processes are dusty.

IV. Home Work

No work shall be given out to be done in rooms used for living or sleeping purposes or in rooms directly connected with living or sleeping rooms in any dwelling or tenement.

V. Employment Management

1. Hiring, separations, and determination of conditions—In establishing satisfactory relations between a company and its employees a personnel department is important, charged with responsibility for selection, assignment, transfer, or withdrawal of workers and the establishment of proper working conditions.

2. Women in supervisory positions—Where women are employed, a competent woman should be appointed as employment executive with responsibility for conditions affecting women. Women should also be appointed in supervisory positions in the departments employing women.

3. Choice of occupation—The opportunity for a worker to choose an occupation for which she is best adapted is important in insuring success in the work to be done.

VI. Co-operation of Workers in Establishing Standards

The responsibility should not rest upon the management alone to determine wisely and effectively the conditions which should be established. The genuine co-operation essential to production can be secured only if provision is made for the workers as a group, acting through their chosen representatives, to share in the control of the conditions of their employment. In proportion to their numbers women should have full representation in the organization necessary for collective bargaining.

VII. Co-operation with Official Agencies

The United States Government and State and local communities have established agencies to deal with conditions of labor, including standards of working conditions, wages, hours, employment, and training. These should be called upon for assistance, especially in the difficult problems of adjustment in the period of reconstruction following the war.

PROBE WAR DEPARTMENT

WASHINGTON, June 20—The Congressional Committee named by the House of Representatives to investigate the expenditure of $16,000,000,000 has divided itself into five sub-committees to make the inquiry. No date has been fixed for the beginning of investigations.

The special Committee on Aviation comprises Congressman Frear, chairman, and Congressmen Magee and Lea. The Committee on Quartermaster's supplies comprises Congressman Reavis, chairman, and Congressmen MacGregor and Donovan. The Committee on Ordnance includes Congressman Graham, chairman, and Congressmen Jefferis and Garrett. The Committee on Expenditures in Foreign Countries includes Congressman Johnson, chairman, and Congressmen Bland and Flood.

MERWIN HEADS NATIONAL TIRE

EAST PALESTINE, OHIO, June 23—C. L. Merwin was elected president of the National Tire & Rubber Co. at the annual meeting of the board of directors. Other officers are: Vice-president and general manager, S. L. Warner; secretary, C. W. Helman; treasurer, R. B. Taggart. C. E. Miley will become vice-president and general sales manager on July 1. Mr. Miley has been associated with the McGraw Tire & Rubber Co. for the past ten years.

C. E. Albright has been made Pacific Coast field manager of the Acason Motor Truck Co. of Detroit. He will work under Dan Gilkey, Pacific Coast manager.

Carlos Grant, of Concepcion, Chile, has been made resident export manager in charge of export sales in most of the South American countries for the Saxon Motor Car Corp.

A. L. Ditter, former general manager of the Northwest Body Co., Minneapolis, has been appointed sales manager for the Field Manufacturing Co., Owosso, Mich.

C. R. Mabley has been appointed Michigan sales manager for the S. K. F. Industries, Inc. He will open headquarters in Detroit.

C. S. Coler has been appointed manager of the educational department of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., succeeding C. R. Dooley, who resigned.

Hilton W. Sofield has been elected vice-president and general manager of the Commercial Car Unit Co., Philadelphia. He started with the company as service manager in 1917. He has been responsible for the Keystone 2-ton truck added to the company's line of Truxton and Unitrux units.

George S. Shugart has been appointed general sales manager of the United States Tire Co., succeeding J. C. Weston, whose resignation becomes effective July 1. Mr. Shugart, who has been in the U. S. Tire ranks for 23 years, goes to his new office from the sales managership of the New York branch, which he assumed after 12 years of similar work with headquarters in Chicago.

CANADIAN RUBBER ELECTS

MONTREAL, June 20—Sir Charles B. Gordon, K. B. E., and Lieut.-Col. Herbert Molson, M. C., were elected to the board of directors of the Canadian Consolidated Rubber Co., Ltd. The board of directors of the company, besides the newly elected members, includes: Sir Mortimer Davis, E. W. Nesbitt, J. B. Waddell, Victor E. Mitchell, K. C., W. A. Eden, R. E. Jamieson, A. D. Thornton, H. Wellein, Col. Samuel P. Colt, Charles B. Serger, Homer E. Sawyer, J. Newton Gunn and Elisha S. Williams.

100 FORDSONS A DAY

DETROIT, June 20—The production of Fordson tractors is approximating 100 per day.

Men of the Industry

Changes in Personnel and Position

HANCH TO MANAGE MAXWELL-CHALMERS

DETROIT, June 21—C. C. Hanch, for years treasurer of the Studebaker Corp., has resigned to become general manager of all Maxwell-Chalmers interests. At the outbreak of the war Mr. Hanch was made chief of the automobile products section of the War Industries Board. Since the armistice he has been in Europe investigating export conditions for the National Automobile Chamber of Commerce. Prior to joining the Studebaker Corp. in 1915, he was for 19 years treasurer of the Nordyke-Marmon Co. In recent years he was secretary of the National Chamber of Commerce and is at present a director of that body.

O. E. Szekely, chief engineer and production manager of the tractor department of the Velie Motors Corp., has severed his connection with that company to take over the engineering and production end of the Grid-Iron-Grip Co., Rock Island, Ill., maker of track-laying shoes for tractors and trucks. In addition a general engineering laboratory will be operated as the O. E. Szekely Co. and will furnish drawings and designs in all automotive lines.

F. R. Mead, recently discharged as captain in the Ordnance Department, where he acted as head of the Gage Section Inspection Division, has been appointed Eastern representative of the Wilton Tool & Manufacturing Co., Boston.

George T. Bryant, sales manager of the Hide Leather & Belting Co., Indianapolis, who spent several months in Europe during the first part of the year investigating trade conditions, will leave for a second trip on the Nieuw Amsterdam, sailing from New York on July 2. He will visit France, Switzerland, Belgium, Holland, Denmark, Norway, and Sweden, and plans to return about Nov. 1.

REPRESENTATIVES FOR FOREIGN COUNTRIES

JEANNETTE, PA., June 26—D. D. F. Yard, sales director of the export division of the Pennsylvania Rubber Co., will sail from San Francisco on July 1 for Honolulu, en route to Australia, Straits Settlement, New Zealand, China, Japan, India, and South Africa. R. W. Palm, South American representative, will sail on the same date for Latin America, where the company has agencies. The export office in the Woolworth Building, New York, opened recently, will be in charge of F. B. Beck in the absence of Mr. Yard.

RYAN HEADS STUTZ

NEW YORK, June 23—Allan A. Ryan, head of Ryan & Co., bankers, and formerly vice-president of the Stutz Motor Car Co. of America, was elected president at the annual meeting last week, succeeding Harry C. Stutz.

At the company's offices it was said that Mr. Stutz is still in active charge of the business, but information was unobtainable as to whether he would continue in that capacity.

Other officers elected were: Vice-president, Frederick E. Gunnison; treasurer, William N. Thompson, re-elected; secretary, George F. Lewis, succeeding Kenneth R. Howard.

Directors elected, in addition to officers, were: Harry C. Stutz, George H. Saylor, John J. Watson, Jr., and Hicks A. Weatherbee, succeeding Mr. Howard.

PERRY REMAINS WITH FORD

LONDON, June 10—Sir Percival Perry, who resigned recently as managing director of the Ford interests in Great Britain, will remain with the organization, dividing his time between the London offices and the tractor factory at Cork, it is said in trade circles here.

The factory, delayed in completion by war conditions, is making castings, but no finished products have yet appeared. Work also is under way on the Ford garage at Brook Green, Hammersmith, London, W.

CANADIAN OVERLAND OFFICIAL

TORONTO, ONT., June 20—J. F. Mackay, formerly business manager of the Toronto *Globe* and until lately treasurer of the Russell Motor Car Co., has been appointed secretary-treasurer of Willys-Overland, Ltd., West Toronto.

In his new work Mr. Mackay will be associated with T. A. Russell, president of Willys-Overland, who is also president of the Russell Motor Car Co. Mr. Mackay joined the Russell company last August.

PAIGE APPOINTMENTS

DETROIT, June 23—Frederick L. Jewett has been elected first vice-president of the Paige-Detroit Motor Car Co. Other promotions and appointments were as follows: Vice-president, manufacturing division, W. A. Wheeler; vice-president in charge of passenger car sales, Henry Krohn; vice-president in charge of truck sales, Charles S. Pike; vice-president, purchasing division, Thomas Bradley; vice-president, engineering division, Andrew Bachle; chief engineer, G. C. Mather; production manager, J. V. Quinlan; general superintendent, George Petersen; sales manager of the passenger car division, C. B. Gaunt, and sales manager of the truck division, Frank E. Caulk.

R. Jackson Jones has been appointed district sales supervisor of the Traffic Motor Corp., St. Louis. He returned recently from 15 months' service with the Canadian army in the British West Indies.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

DUESENBERG CARS

ELIZABETH, N. J., June 20—The Duesenberg Motors Corp. is considering entrance on a large scale into the field of passenger car manufacture. Though no decision has been reached, the company still being under government control, E. P. Decker, general manager, stated that a tentative plan was being worked out for the projected expansion. Until a settlement is effected for War Department contracts pending, Mr. Decker said, the project would remain in abeyance.

CANADIAN PLANT FOR STICKNEY

PETERBORO, ONT., June 20—The Stickney Motors, Ltd., St. Paul, Minn., will take over the cordage works recently vacated by the Renfrew Mfg. Co. and manufacture farm tractors, motor trucks and gasoline engines, employing for nine months each year for ten years a minimum of 50 employees.

PERFEX DISCHARGED

RACINE, WIS., June 21—The Perfex Radiator Co. was discharged from bankruptcy by Judge F. A. Geiger of the Federal Court at Milwaukee on June 18, after a hearing on the application of the company in which it developed that arrangements have been effected to pay creditors 100 per cent of claims.

An involuntary petition in bankruptcy was filed against the company March 28, and Julius J. Goetz, Milwaukee, was appointed trustee and later made receiver with authority to continue operations as before. The schedules filed on the petition admitted liabilities of $227,319 and claimed assets of $1,300,000. The discharge from bankruptcy was granted after creditors who filed the involuntary petition indorsed the application and consented to the dismissal of the proceedings.

QUALITY TIRES TAKEN OVER

ELYRIA, OHIO, June 23.—The Long-Wear Rubber Co. has taken over the production and sales of the Quality Tire & Rubber Co., Anderson, Ind. This adds a daily production of 200 casings and 2000 tubes. Both factories will be under the supervision of Frank W. O'Brien, general manager of the company, with headquarters here. Plans for expansion call for the production of 20,000 pneumatic and solid tires daily.

NEW CANADIAN TIRE CONCERN

KITCHENER, ONT., June 23—The Ames-Holden-McCready Co., wholesale shoe manufacturer, has completed arrangements for the formation of a tire manufacturing concern at Kitchener, the new enterprise to be known as the Ames Holden Tire Co., Ltd., and will, it is understood, begin building operations at once.

The new company will have a capitalization of $1,000,000 bonds and $2,000,000 common stock. The board of directors will include T. H. Reider and D. Lorno McGibbon.

MAXWELL-CHALMERS PLANT

NEW YORK, June 23.—The plans for the $10,000,000 plant to be erected for the recently merged Maxwell-Chalmers interests call for 11 manufacturing units and a loading dock. A new office building and power house will also be erected. The machine shop will be the largest. It will be 1-story, 200 by 1,000 ft. The dimensions of the other buildings are as follows: Two storage buildings for assembly parts and finished cars, 4 stories, 100 by 800 ft.; axle plant, 1-story, 150 by 600 ft.; heat treat plant, 1-story, 200 by 300 ft.; engine assembly plant, 1-story, 200 by 300 ft.; pressed steel plant, 1-story, 250 by 600 ft. The loading dock will be 100 by 800 ft.

A body plant will be erected later. Plans for this unit call for a structure 4 stories high, 400 by 600 ft. The two storage buildings will have space for 8,000 unfinished cars and 3,000 finished products. All buildings will be of concrete, brick and steel.

The pressed steel plant, which consists of several 1-story buildings, will gradually be razed, and the buildings of the new plant will take their place.

CONTINENTAL EXPANSION PLANS

DETROIT, June 23.—The Continental Motors Corps. will increase production at both the Detroit and Muskegon plants at once. Every effort will be made to reach capacity production within the next 60 days. The Detroit plant is manufacturing 300 engines daily, and the Muskegon plant 350.

Expansion plans calling for doubling the floor area and increasing production facilities of the Muskegon plant will be put into effect at once. Within the next 2 years the Muskegon plant will be doubled in size. The first units to be built include a power plant, 560 by 180 ft., additions to the engine department, a drop forge plant, and an addition to the screw machine department.

Additional units will be erected on 25 acres of land which the company will reclaim from Lake Michigan. One thousand more men will be employed, and the new plant will have a capacity of approximately 1,000 engines daily.

LION MOTOR PLANT PURCHASED

ADRIAN, MICH., June 21—The old Lion Motor Co.'s site has been purchased by the United Electric Mfg. Co., and an engine plant will be erected soon at a cost of $100,000. The Lion plant has been unoccupied for 7 years. The United Electric Mfg. Co. began operations 3 years ago.

SAVOLD TO OPEN PLANTS

NEW YORK, June 23—The Savold Tire Corp. has completed or has in process incorporation in 21 states. The concern, which has patented processes for rebuilding tires, will operate factories in all the 21 states, it was said at the headquarters here. One of several plants to be opened in New York City will be in operation within a few weeks.

AUTO BODY BUYS ENGINE PLANT

LANSING, June 20—The Auto Body Co. has purchased the plant of the Acme Engine Co. and has obtained a 10-year lease on the land on which the building stands. The Acme Engine Co., reorganized from the Peerless Engine Co., went out of business at the start of the war, most of its machinery being purchased by the Government.

NOVO ENGINE BUILDING

LANSING, June 20—Work has been started on two new buildings for the Novo Engine Co., which are to be ready for occupancy within 40 days.

KALAMAZOO MOTORS ENLARGES

KALAMAZOO, MICH., June 20—The Kalamazoo Motors Corp. has let contracts for the erection of a machine shop having 2,000 sq. ft. of floor space, loading docks and a building for stock purposes. These additions will double the capacity of the plant and permit assembly of from 125 to 150 trucks a month.

REPLACES BURNT BUILDING

DETROIT, June 20.—The Commerce Motor Car Co. had a $100,000 fire Friday, but it is said that production would not be affected in any way. The flames were confined to the paint department. The loss was fully covered by insurance. A new structure to take the place of the destroyed paint shop will be started as soon as the debris is cleared away.

BRISCOE TRIPLES PRODUCTION

JACKSON, MICH., June 20—The Briscoe Motor Corp. will build plant additions which will permit triple production. The present output of 70 cars daily will be increased to 250 cars. The additional units will be ready for production in about 7 months. The company is putting night shifts at work in an effort to increase its output. It has 1300 persons on the pay-roll, 300 of whom are women, and is proposing to go after the truck business, being in production of a 1½ ton truck.

COMPANY NAME CHANGED

ROCKFORD, ILL., June 23—The Bergie National Spark Plug Co. has changed its name to the National Spark Plug Co. to correspond with the name of its product, National spark plugs. There will be no change in the management of the company.

Detroit Needs Men and Houses

Skilled and Common Labor in Demand—Radicals Cause Trouble

DETROIT, June 20—Detroit automotive industries need thousands of workers, but they dare not bring more men to the city because of inadequate housing facilities. Following the signing of the armistice and temporary suspension of manufacturing to permit reconstruction work, a large labor surplus developed. Fifty per cent of all men out of work at that time left Detroit, a fact which aided materially in decreasing the serious surplus.

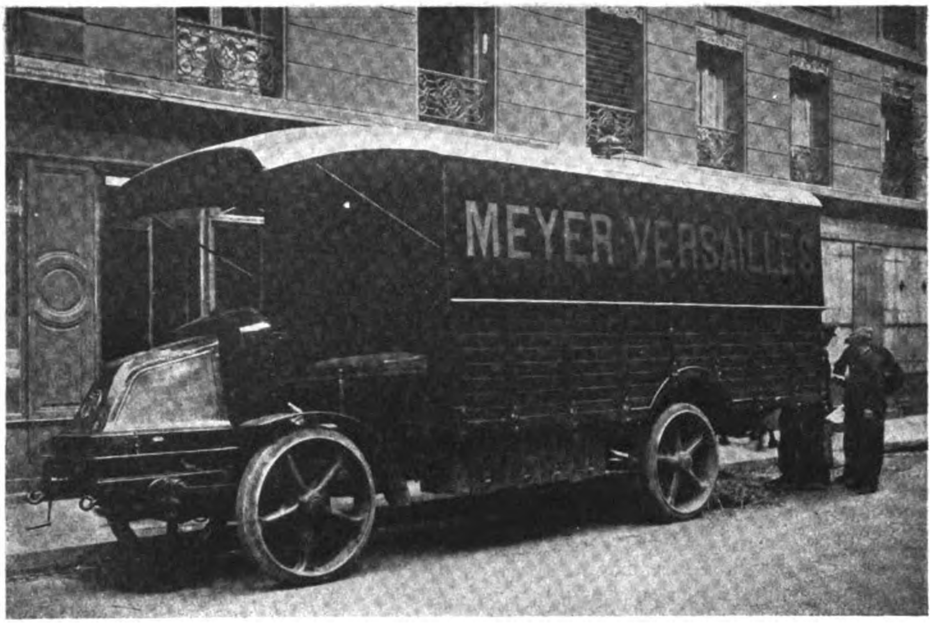
With the resumption of manufacture the surplus that existed here after the exodus of its war workers was quickly assimilated by the industries. As production increased a shortage soon developed, and the Detroit Employers' Association took action to bring more workers into Detroit.

For 3 months this association has brought approximately 2000 men into Detroit every week. Two weeks ago, however, the housing situation became so critical that the importation of workers was brought to a halt. Every available dwelling has been sold or rented, hotels, apartments and rooming houses filled up, and in most cases there is a waiting list.

Hundreds of new homes are being built here, but the number is inadequate. House-building associations have been formed and work on thousands of structures will be started at once, but it will be early winter before the results of this housing campaign bring relief. It is conservatively estimated that the city is short from 30,000 to 50,000 homes.

The housing situation has had a very detrimental effect upon labor conditions. Of the thousands of men brought here within the last 3 months, fully 60 per cent left town within 2 weeks, it is estimated. There has been considerable labor trouble here. A canvass of 115 metal trade industries shows that all have experienced from one to ten strikes during the last 3 months. Most of the trouble was confined to single departments, although in some cases the entire plant was forced to shut down.

The demand for men naturally brought many undesirables. This radical element is responsible for the labor unrest here. A remarkable feature in many strikes recently is the fact that one or two men usually caused the trouble. In the case of the L. A. Young Industries, 700 workers walked out as the result of the efforts of one individual. The employees were averaging 75 cents an hour and working an 8-hr. day. The disgruntled worker appealed to the union, cited many alleged grievances and asked that a strike be called. The union investigated and decided against a strike, whereupon the agitator and a handful of fellow radicals called a mass meeting of the employees, and 700 men quit their jobs the next day.



The first motor-driven furniture removal van to go into service in France. The chassis is a Latil 4-wheel drive

While production was badly cut for several days, the company was quick in getting back into operation, and within 2 weeks most of the men had returned to their jobs under old conditions and were apparently satisfied.

At the Studebaker factory 1200 workers at Plant No. 3 were out 10 days, at the end of which time they decided that the issues involved were too trivial to merit a continuance of the strike; so they went back to work. The trouble here was brought about by less than a dozen men.

In the Timken-Detroit Axle case the whole force walked out, and the strike is still in effect. The company is getting back into fair production, hundreds of its men have returned to their jobs, and vacancies are being filled. An unusual feature of this strike lies in the fact that men making as high as $2.35 an hour struck in sympathy and have been idle for 5 weeks.

The Michigan Malleable Iron Works is operating with about one-half its force. The Bowen foundries are not yet back in full production. The situation at both of these plants is rapidly clearing, however. The general foundry strike has fizzled out and all of the gray iron foundries are again at 100 per cent production.

The shortage is of highly skilled and common labor. There is no shortage of semi-skilled labor. In fact, Detroit has always found plenty of semi-skilled men available. The common labor situation is the most critical, and the employers' association is seeking a remedy. It is fighting the immigration bill now before Congress, which, if it passes, will bar immigration into the United States for a period of 4 years. The association holds that it is bad enough to have European countries bar its citizens from entering the United States without the United States throwing up an effective barrier on this side of the ocean. Thousands of foreigners, mostly of the common labor class, are returning to their native lands, and this exodus is already felt here.

Wages in Detroit are higher than ever. Common labor is making from 45 to 55 cents an hour in the shops, and from 60 to 65 cents an hour in the open. Skilled and semi-skilled trades are drawing from 60 to $2.35 an hour, the latter rate being paid to heavy hammer men who work on a piece rate basis.

RICKENBACKER CELEBRATION

LOS ANGELES, June 20—A three-day Rickenbacker celebration will be held here to-morrow, Sunday and Monday, opening on the first day with a large street parade. Sunday, Capt. Rickenbacker will be the guest of honor at an Elks' annual barbecue and will receive a gift from members, and on Monday a reception will be held in his honor in the Shrine Auditorium, when he will be presented with a gift from the people of Southern California.

SHEEPSHEAD PRIZES ANNOUNCED

NEW YORK, June 23—The contest board of the Automobile Association of America announced to-day that the purse for the 100-mile event at Sheepshead Bay July 4 will be $100,000. A $3,000 prize is offered the winner of the special race.

DETROIT SHOW IN MARCH

DETROIT, June 23 — The Detroit Automobile Dealers' Association, at its regular weekly meeting, decided to hold the annual automobile show some time in March.

ESSENKAY ADDITION

CHICAGO, June 23—The Essenkay Products Co has added a 5-story building to its factory.

MOTOR VEHICLES ON ORDER

WASHINGTON, June 24—Motor vehicle orders on May 31, 1919, were $4,077,000 as compared with $416,498,000 on Nov. 11, 1918, showing that about 1 per cent of the orders which were outstanding on the day the armistice was signed, remain for completion. Of the total orders placed, 67 per cent were cancelled and 32 per cent were delivered.

The liquidation of $215,434,000 worth of air service contracts out of a total of $268,400,000 makes a saving of 80 per cent.

PLANES FOR SOUTH AMERICA

NEW YORK, June 23—To develop a South American market for its land and seaplanes, the Curtiss Aeroplane & Motor Corp. will send a mission of aviators and mechanics, together with a number of demonstration machines, to Buenos Aires and Rio de Janeiro on July 1. C. W. Webster, supervisor of sales for South America, will be in charge.

AIRCRAFT LINEN SOLD

NEW YORK, June 23—Cable advices from London announce the sale of the entire linen stock of the Aircraft Equipment Section of the British government, a total amount of 30,000,000 yds., to Leonard J. Martin of the London Mineries. The linen, used in covering airplane wings, represents three-fifths of a year's output of the Belfast looms.

GLOVER TO RESIGN

WASHINGTON, June 24—Colonel Fred J. Glover, who prior to the war was associated with the Emerson-Brantingham Co., and who, during the war, served as Chief of the Motor Vehicle Section, Quartermaster Department, and later as Assistant Director of Sales, will resign on July 1 to enter private business activities, which will be announced later.

STEEL PRODUCTS BUYS PLANT

DETROIT, June 18—The Steel Products Co. of this city and Cleveland has acquired the plant of the Parker Rust Proof Co. of America. The property comprises approximately 4½ acres, on which there is a main building and three other structures, giving a combined floor area of about 65,000 ft. The value of the property is estimated at $250,000.

The purchaser is to take possession as soon as the Parker Rust Proof Co. vacates the premises. The latter is to continue its operations in another plant.

ACME FOREIGN REPRESENTATION

CADILLAC, MICH., June 23—The Acme Motor Truck Co. will be represented in Denmark, Norway, Sweden and Finland by the Aktieselkabet Autocar Co., Copenhagen, Denmark. Frantz Nehammer is president of the new company. Gmo. Verduzco & Co., Avenida, Jaurez, is the Mexican representative for the company.

One of the motor lorries photographed outside Electric House, Westminster, on Saturday. These are being used to help relieve the shortage of motor buses, which are at present inadequate

FOUNDRY COMPANIES MERGE

CLEVELAND, June 22—The Acme and the Palmer & De Mooy Foundry Co. have been merged into a $400,000 company and will operate under one roof at the Acme Foundry Co.'s plant after July 1. The Acme plant will be enlarged and new machinery installed. The Palmer & De Mooy Foundry Co. was organized 37 years ago. For a number of years it has been under the active management of W. B. Greene, secretary and treasurer. The Acme Foundry Co. was organized 20 years ago and has been managed by William Greenbaum, secretary, since its organization. The new company will be under the management of W. B. Greene who will act as president of the concern.

DEFIANCE MACHINE EXPANDING

DEFIANCE, OHIO, June 24—Work on the new foundry building of the Defiance Machine Works is about to start. The company will make other expansions rapidly. It is hoped to have 300 additional men at work in the shop by the middle of July. To accommodate the new workers, Defiance is preparing to start a home-building campaign. There is a great shortage of homes here.

ENGINEERING CO. CAPITAL

MOLINE, ILL., June 20—The capital stock of the Root & Van Dervoort Engineering Co. has been increased from $1,346,200 to $7,500,000. Of the issues under the new capitalization, $2,500,000 is to be common and $5,000,000 in the form of 8 per cent preferred stock. Increased capitalization will in no way affect control of the business. The board of directors will be increased from 7 to 9 members. The new capital will enable the company to increase its manufacturing facilities. New model cars are being developed.

AMERICAN RIM PARTS SCARCE

LONDON, June 18—Frequent satisfied inquiries for replacement of parts from a large number of users of American cars equipped with Stranweld or Baker detachable rims show that these lines are inadequately represented in Great Britain.

ROBINSON INITIAL PAYMENT

DETROIT, June 24—The Security Trust Co., trustee in bankruptcy, has sent to persons with approved claims against the Robinson Machine Co. checks covering an initial payment of 10 per cent. It is expected that a subsequent payment of a like amount will be made when the machine company's war contract claims have been closed up. The company's liabilities aggregated $175,000.

FOREIGN TRADE OPPORTUNITIES

WASHINGTON, June 20—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has received requests for automobile or parts agencies of business from individuals and companies in foreign countries. For further information address the Bureau of Foreign and Domestic Commerce and specify the Foreign Trade Opportunity number.

Scandinavia—Automobiles and Accessories, motorcycles, hardwoods, drugs and chemicals. References. No. 29731.

England—"Scudders." Terms, payments against documents. No. 29607.

Australia—Automobiles and accessories No. 29609.

India—Cars, motorcycles, bicycles and all accessories; kerosene oil, engines, electric light sets and electrical accessories, lamps, fans, etc. General catalogs requested. No. 29653.

Calendar

SHOWS

Aug. 30-Sept. 6—Minnesota. State Fair.

Sept. 1-6 — Indianapolis, Ind. State Fair. Cars and Accessories, Indianapolis Automobile Trade Assn., John B. Orman, Manager.

Sept. 13-20—Cincinnati, O. Ninth Annual, Music Hall, Cincinnati Automobile Dealers' Assn., H. K. Shockley, Manager.

Sept. 15-20 — Springfield, Mass. Eastern States Exposition.

*Oct. 9-19—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-16—London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December — Brussels. International Automobile Mfrs. Congress.

Jan. 3-10 — New York, N. Y. Grand Central Palace, National Automobile Chamber of Commerce, S. A. Miles, Manager.

Jan. 24-31—Chicago, Ill. Coliseum, Cars; Drexel Pavilion, Trucks; National Automobile Chamber of Commerce, S. A. Miles, Manager.

January — New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

July 14-19—Wichita, Kan. Automotive Committee of National Implement Assn.

July 28-29—Columbus, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 1-2 — Piqua, O. Tractor show in charge of Prof. H. C. Ramower, head of agricultural engineering department of Ohio State University.

Aug. 18-22—Aberdeen, S. D. Sectional Tractor Demonstrations.

October—Ottawa, Ont., Can. Interprovincial Plowing Match and Tractor Demonstration.

CONTESTS

July 4—Hohokus, N. J. Dirt Track Event.

July 4—Tacoma, Wash. Annual speedway races.

July 4—Atlantic City, N. J.—Airplane races—Aeronautic Convention.

July 4—Sheepshead Bay, L. I. Speedway race.

July 19—Uniontown, Pa. Speedway race.

*Aug. 15 — Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

*Tentative dates.
†Sanctioned.

CONVENTIONS

June 16-19—Detroit. American Society of Mechanical Engineers spring meeting, Hotel Statler.

June 23-28—Ottawa Beach, Mich. S. A. E. Mid-summer Meeting.

July 9-10—Buffalo. Motor and Accessory Mfrs. Assn. Mid-summer convention.

Sept. 22-24—Philadelphia. Annual Convention, National Association of Purchasing Agents. Bellevue - Stratford.

May 12-15, 1920—San Francisco. Seventh National Foreign Trade Convention.

January — Washington. Pan-American conference.

TRACTOR SALES IN CANADA

WINNIPEG, CAN., June 20—In 1906, 237 tractors were sold in western Canada. In 1907 the sales were 580. In 1908 the sales were around 660. In 1909 there were not quite 600, but in 1910 they went to over 1500 In 1911 something over 1700 were sold. In 1912, 3700; 1913, 4600; 1914, 4200; 1915, 4400, and in 1916 they barely passed the 5000 mark. In 1917, 6400 machines were sold, and in 1918 approximately 7300.

There were in use up to Nov. 1, 1918, in western Canada, 19,777 tractors. Of the number sold in 1918, 1115 were Fordsons. The gas tractors in use were divided as follows:

Saskatchewan	11,105
Manitoba	3,655
Alberta	5,017

There were up to the first of the year approximately 219,000 farms of 160 acres and over divided as follows:

Saskatchewan	99,341
Manitoba	67,490
Alberta	51,663

In Saskatchewan there were up to Nov. 1, 1918, 8.94 farms per tractor. In Manitoba there were 18.40 farms per tractor, and in Alberta 10.29 farms per tractor.

The value of farm tractors in operation in western Canada at the close of 1918 was approximately $26,000,000.

LABOR LEGISLATION

LANSING, MICH., June 18—Following is a synopsis of new labor laws and amendments passed during the 1919 session of the Michigan legislature and approved by the governor:

Equal pay for equal service regardless of sex; also to protect female workers in industry by forbidding their employment in an industry where the load is disproportionate to their strength, or in any employment where their morals are in jeopardy or their potential capacity for motherhood will be impaired.

Some of the features of the amendments of the working men's compensation law are the reduction of the waiting period from 2 weeks to 1 week, hospital and medical attendance increased from 3 weeks to 3 months, the minimum pay per week for disability increased from $4 to $7 and the maximum increased from $10 to $14, and disability for which compensation is paid extended from 300 weeks to 500 weeks, making the total that may be collected $7,000 instead of $5,000.

A commission will be created to investigate and report on the industrial conditions affecting labor, including wages, hours of labor, sanitation, safety and health, old age pensions and, in fact, the promotion of the industrial welfare of the state, and to recommend such legislation as will be of benefit to the industrial workers of the state.

Labor associations will be permitted to incorporate for the purpose of building a labor temple and to sell stock to individual members of unions eligible to affiliate with the American Federation of Labor.

Lien laws will be amended to give better protection to mechanics in the collection of wages due.

Joint resolution was passed submitting an amendment to the constitution giving the legislature power to enact laws relative to male labor.

TRADEMARK BUREAU

WASHINGTON, June 20—Plans are under way for the establishment of an International Trademark Registration Bureau at Rio de Janeiro, which will be similar to the Bureau at Havana, and will do for the South American countries what the Havana Bureau is doing for the North American Republics.

The Bureau at Havana enables merchants and manufacturers to deposit their trademarks in the North American Republics and secure protection thereby through one payment and one contract.

AUTO ACCIDENTS IN A. E. F.

PARIS, JUNE 23—That the great majority of automobile accidents are due to carelessness and lack of attention to recognized rules of the road is indicated by American Army statistics compiled during the period of active operations. Ambulances, which are the vehicles most entitled to speed while on the road, have the lowest percentage of accidents, being only 0.5 per cent of the whole. The proportions of accidents for the American Army in France during a period of 12 months are as follows:

Touring cars	67.0 per cent
Trucks	16.5 per cent
Sidecars	14.4 per cent
Unclassified	01.6 per cent
Ambulances	00.5 per cent

The big percentage of accidents among touring cars is attributed almost exclusively to the practice of driving on the horn.

PLAN PETROLEUM INSTITUTE

WASHINGTON, June 21—The establishment of a Petroleum Institute with headquarters here, to investigate the depleting stocks of petroleum and increasing export demands, and the possibilities of accelerating production, has been suggested by refiners at a meeting with Mark L. Requa, who has just resigned as Director General of the Oil Division of the U. S. Fuel Administration.

It was stated that the tremendously increased demands for petroleum, both domestic and export, are problems which will grow in the next few years, and must be solved by scientific production.

Mr. Requa stated that an institute offering means for co-operation of producers with the government, fostering foreign and domestic petroleum trade and promoting the interests of the industry in all its branches, would be lawful and of great importance. No definite steps have yet been taken.

AIRPLANE STATION

NEW YORK, June 23—I. M. Uppercu, president of the Cadillac-Detroit Automobile Co. and sole owner of the Aero Marine Plane & Motors Co., proposes to erect hangars and launching platforms on the New York and New Jersey shores of the Hudson, the former at Fort Washington Point, 177th Street, and the latter opposite 181st Street.

Mr. Uppercu has made proposals to the New York City authorities and to the Palisades Interstate Park Commission, which controls the Jersey shore, for the necessary leases.

In co-operation with other aircraft manufacturers expected to join his project, he contemplates holding demonstrations of flying boats, giving instruction in aviation and generally enlightening the public on air dynamics. Foreign as well as American manufacturers, he added, would be invited to participate.

FINANCE EXPORTERS

WASHINGTON, June 23—An amendment to the Federal Reserve Act that would make available a capital of $100,000,000 to finance export trade has been recommended to Congress by the Federal Reserve Board.

The amendment as recommended would permit any national bank to invest not more than 5 per cent of its capital and surplus in the stock of domestic corporations engaged in foreign trade. Under the present law only national banks having a capital and surplus of $1,000,000 may invest in such stock, though such institutions may use 10 per cent of their capital and surplus for such a purpose.

The proposed change will not only help foreign trade and restore normal conditions to the extent of actual investments by national banks, but the moral effect of the participation of national banks will be stimulating to trade and finance generally.

The change will be temporary, as national banks would be allowed to purchase stock in foreign trade corporations only until Jan. 1, 1921.

UNIFORM TRAILER LEGISLATION

NEW YORK, June 24—The Trailer Manufacturers' Association of America has drafted recommendations covering uniform legislation for the use of trailers, submitting the proposals to the committee in Washington which drew up the uniform traffic bill for introduction into state legislatures.

The draft, pointing to the value of trailer usage in reducing highway freight costs, urges lower license fees for trailers than for trucks, owing to their lesser destructive tractive effect on the roads; repeal of laws prohibiting trailers or more than one trailer to a motor vehicle; changes in state regulations to permit greater gross weights for trucks and semi-trailers than for trailers alone owing to greater distribution of the weight, and to allow greater weights per inch width of tires than in the case of self-propelled vehicles.

Omaha-St. Louis Air Mail Service

WASHINGTON, June 23—Air mail service from Chicago to Omaha and St. Louis is planned to commence in the Fall. It is expected that this service will reduce mail delivery between the Atlantic and Pacific coasts by 16 to 24 hours. Consecutive trips of 325 miles have been made between Cleveland and Chicago without delays, forced landings or engine trouble of any sort, according to reports just made public.

The flights have been made in weather, which a short time ago would have been regarded prohibitive. The planes carry 400 lb. of letter mail daily, and as letters range from 40 to 45 a pound this means that 16,000 letters were transported on each trip. Notwithstanding the weather and the heavy loads, the postal planes, which are the L.W.F.-De Havilands, equipped with Liberty engines, maintain an average speed of 98.5 m.p.h.

Twelve of the L.W.F.-De Havilands are in the Cleveland service, four being stationed at each terminal and four at Bryan.

Some Interesting Time Results

The service shows some interesting time results. Short as this link is in comparison with a transcontinental line, Pacific Coast mail is already advanced 16 hours to Boston and New England points. Pacific Coast mail, routed via airplane link, is delivered in New York in the morning instead of the afternoon.

Westbound, a similar saving is achieved by taking the mail from the 7 a. m. express at Cleveland, transferring it to the postal plane and carrying it on to Chicago at almost double the speed of steam transportation.

From now on, the mail planes will leave Chicago for the East at 2.30 p. m. It was found that 151 great business concerns sent special messenger mail each noon in an effort to catch the two fast mail trains to the Atlantic seaboard. This meant that much of the correspondence had to be completed the night previous. The 2.30 airplane service means that often 8 hours to an entire day is saved and even in the case of the special messenger delivery to the train, from two and a half to three hours are saved.

Operation of the air mail between Cleveland and Chicago has been the means of relieving rail congestion, and one distributing car each way each day has been cut from that division. Distribution of airplane mail is done in the postoffices. This means that $52,000 yearly is saved, while at the same time, rail equipment is released for service elsewhere and mail expedited.

The Department is able to state that experiments are now being carried on looking toward the delivery and taking aboard of mail bags while the airplane is in flight. It is not so many years since it was thought remarkable for a fast steam train to accomplish this feat. It is now regarded as possible for the lightly loaded "ships," those carrying 1000 lb. of mail or less, to come close to the earth and snatch bags from specially prepared apparatus. In the case of the large multi-motored "ships," for which the Department shortly will let bids, no attempt will be made to come near the ground, but a scheme is proposed for dropping mail and possibly taking on from the roofs of buildings. If this proves practicable it will be possible on the New York-Washington route to make non-stop runs, serving both Philadelphia and Baltimore, and eliminating 15 min. stops at each place.

Another interesting development which it is now possible to announce is the construction of fireproof walls between the mail compartment and the engine and the compartment and the gas tank. A fireproof, airtight bag exactly the size of the compartment will be installed and within this a second fireproof bag containing the mail pouch. In this manner, tests have demonstrated danger of destruction by fire is practically eliminated.

BRAZIL AVIATION PLANS

WASHINGTON, June 21—The government of Brazil has issued a decree giving permission to two citizens of that country to use airships for the transportation of passengers and merchandise between the principal cities of Brazil. The concession is not exclusive and the service must be inaugurated within two years. The concession allows the transportation of passengers and merchandise with the understanding that all mail is to be carried gratuitously, it being understood, however, that no mail is to be transported unless it has been duly stamped by the National Post Office.

The number of voyages and passenger and freight rates will be subject to control of the Brazilian government. The regular service of transporting passengers and merchandise cannot be initiated without prior license from the government, which will regulate all conditions. The owners of the airships obligate themselves to admit apprentices of the National Aviation School on their airships and in their shops. In case of war the government has the privilege of taking over the service.

OLYMPIAN SELLS WAR MATERIAL

PONTIAC, MICH., June 24—War material which was to have been used in the manufacture of aerial drop bombs by the Olympian Motor Co. will be sold at auction June 27. The material consists of sheet steel, steel stampings, steel tubing, brass rods, steel rivets, wire brazing brass, welding iron wire, wire solder, coated nails, wrought staples, cotter pins and hemp rope. The sale will be for cash to the highest bidder. The material has been divided into separate lots upon which individual bids may be made. It will be conducted under the auspices of the United States Navy. Bids will be open at 10 a. m. More than 3000 aerial drop bombs were made by the Olympian company.

SHIPMENTS TO DENMARK

WASHINGTON, June 23.—Shipments recently gone forward to Denmark should have been consigned to actual consignees instead of the Merchants' Guild of Copenhagen or to the Danish Chamber of Commerce, as was done, according to a report of the War Trade Board.

In view of the fact that consignment to these associations causes inconvenience to the associations and delay in releasing the goods to the actual consignees, instructions have been issued to the Collector of Customs to permit shipments to Denmark only when the commodities are consigned directly to the actual consignees.

The attention of exporters is further directed to the War Trade Ruling 784, issued June 18, 1919, giving the details of Special Export License RAC-81, permitting the shipment of nonconserved commodities to Denmark.

GERMAN SCIENTIFIC BOOKS

WASHINGTON, June 21—The War Trade Board will consider applications for licenses to import into the United States from Germany or elsewhere, scientific books and journals which were printed in Germany. Licenses covering such importations will not, however, be issued until the importer in the United States has made effective arrangements to make the purchase price of such books or journals available for the purchase of foodstuffs for Germany.

TIRE FACTORY IN MEXICO

WASHINGTON, June 21—A tire company has been organized under the name of the Fomenot de Comercia Internacional, S. A. (International Commerce Exchange), in Mexico City, to manufacture rubber tires and tubes. It is a private enterprise according to Vice Consul McEnelly, with an investment of $350,000, employing 110 men at present and with capacity for 350. The plant is modern and operated by electricity and oil for fuel. It is turning out 25 tires and inner tubes daily.

PANHARD FOREIGN BUSINESS

GRAND HAVEN, MICH., June 24—The Panhard Motors Co. is pushing its foreign business and has closed contracts in England, India, Sweden, Finland, Denmark, Brazil, New Zealand, Japan, and China.

SINGLE STATE TAX FAVORED

WASHINGTON, June 20—A petition, favoring the bill introduced by Congressman Fuller, providing that anyone found qualified to operate an automobile in one state will not be obliged to make additional registration or take out additional licenses or pay additional taxes when traveling on pleasure or business in other states, was filed with Congress this week by the National Automobile Dealers' Association.

The bill provides that the certificate of local officers of a state should be accepted in all states of the country as competent and sufficient evidence that the owner has complied with the laws and regulations of his residential state. It was referred to the Committee on Interstate and Foreign Commerce as it is intended to regulate the interstate use of automobiles and all "self-propelled" vehicles using public highways for interstate commerce.

AIRPLANES FOR SALE

DETROIT, June 24—The Thompson Auto Co. has purchased 20 Curtiss airplanes from the United Aircraft Corp., New York, and is introducing them with a canvas sign announcing "Airplanes for Immediate Delivery."

EXPORT CO. DIRECTORATE

NEW YORK, June 24—Gaston, Williams & Wigmore, Inc., exporters of automobiles and other commodities, added the name of John W. Prentiss to its directorate at the recent annual meeting. Other directors are Charles H. Sabin, George A. Gaston, George M. Dahl, Harry Payne Whitney, Charles A. Corliss and James J. Phelan. Mr. Sabin, president of the Guaranty Trust Co., is chairman of the board.

The net income for the year ending April 30, was $1,262,401, and dividends aggregated $1,050,000.

NEW MACHINE SHOP

BOUND BROOK, N. J., June 23—The Bound Brook Oil-less Bearing Co. is having a 2-story office building and machine shop erected, 100 by 180 ft., of concrete and steel. By the addition of this building, the entire factory will be located at one point.

NEW TREATY WITH PANAMA

WASHINGTON, June 20—A commercial treaty between the United States and Panama, ratified to-day by the Senate, facilitates the development of commerce and the work of traveling salesmen.

Manufacturers, merchants or salesmen can operate as commercial travelers in either country if a resident of one, upon the payment of a single fee for a license which will be valid in all of the territorial jurisdiction of the country. To secure a license the applicant must file a certificate secured from the country of residence of the employer declaring him to be a commercial traveler. Samples may be sold without securing a special importer license. Samples without commercial value will be admitted free of duty, and those having a commercial value will be admitted under bond for lawful duties if not withdrawn within 6 months after entrance.

All customs formalities are to be simplified to avoid delay in the dispatch of samples. No license will be required of anyone traveling to study trade even though they initiate commercial relations, provided they make no sales.

AMERICAN BRANCHES IN MEXICO

WASHINGTON, June 23—Reports from the Vice-Consul at Mexico City indicate the need for establishing branches of American automobile manufacturers in Mexico. Large numbers of sales have been reported, but complaints are made by buyers that poor service is tending to ruin the reputations of many high-class passenger cars.

The accompanying illustration is of a photograph taken nineteen years ago, in front of Rhode Island's first "Horseless Carriage" factory in Providence, and operated by Hughes & Atkin. Now known as the Wm. Hughes Company, the oldest exclusive Reo car dealer in New England, having taken on the Reo line some thirteen or fourteen years ago. The "Horseless Carriage" as shown here is one of the eighteen built by Mr. Hughes in 1899 and 1900, the first in New England, for which he made nearly all parts by hand. As late as thirteen months ago one of these cars was seen operating on the highways of Rhode Island

In Keeping With Good Cars

Keen competition demands that every item you put into your cars be the best of its kind.

RUSCO BRAKE LINING, CLUTCH FACING,

and other Rusco Automotive Products measure up to this high standard.

For 88 years the name "Rusco" has stood for all that is best in webbing products. Rusco quality is pre-eminent in

Brake Lining, Clutch Facings, Anti-Squeak Webbings, Woven Auto Top Straps, Tire Straps, Fan Belts, Hood and Radiator Lacings, etc.

Rusco Brake Lining is guaranteed for one year

Write for our interesting, instructive book on Rusco Automotive Products. It contains the complete story of Rusco Quality.

The Russell Manufacturing Co.

Home Office and Factories: 503 Russell Avenue, Middletown, Connecticut

New York City	Chicago	Detroit	Atlanta
349 Broadway	1438 Michigan Ave.	18 Alexandrine Ave., E.	60 So. Forsythe St.

RUSCO

38 Factory Buildings 25,000 Shuttles


FAFNIR
The ball bearing's work consists in reducing friction, eliminating wear, and increasing durability. In these respects, the high grade ball bearing has no equal.
Largest Assortment of Types and Sizes in America
THE FAFNIR BEARING COMPANY
Conrad Patent Licensee
New Britain, Conn.
DETROIT Office: 752 David Whitney Bldg.
CHICAGO Office: 1301 So. Michigan Ave.

AUTOMOTIVE INDUSTRIES
THE AUTOMOBILE
THE CLASS JOURNAL COMPANY
231—241 W. 39th STREET NEW YORK CITY

CONTENTS

VOL. XL NEW YORK, June 26, 1919 No. 26

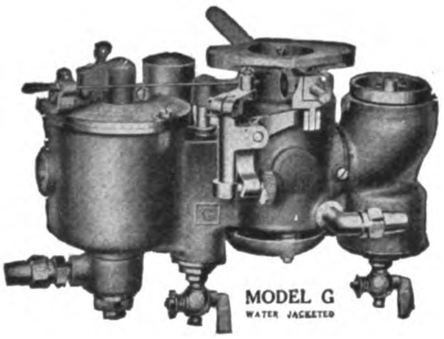
Gradually the industrial effort in this and other countries is working round to the peace requirements and adjusting itself to the after war period of industry. The demand for raw materials, metals, etc., is beginning to move and there are signs of an export revival in these lines. Construction is being started in housing and some of the larger building problems. In the automotive field the market is still ahead of the production and the outlook for progress in this field is excellent.

It is probable that the economic changes brought about by the war and realized as of great importance in this post war period will demand keener attention in merchandising and advertising and in all problems having to do with distribution of goods. As in selling so in advertising, the most profitable line of development is the shortest line of attack between the manufacturer and the most important buyers and users of the product.

"AUTOMOTIVE INDUSTRIES" offers a direct line between those who have products to sell to the manufacturer of automotive equipment and the manufacturer who must use them.

RAYFIELD CARBURETORS

Rayfield Superiority Acknowledged by Leading Motor Car Manufacturers



Model G—Water Jacketed

Rayfield results are obtained by many years' experience, not by chance.

Backed by years of acknowledged superiority Rayfield carburetors are now standard on many of America's finest cars.

The good judgment of these manufacturers is reflected in the keen enjoyment of the motorist in the knowledge that his motor will respond eagerly under all conditions. In addition to this great flexibility Rayfield carburetors will save from 20% to 50% in gasoline consumption.

More than a thousand dealers operating under the Rayfield service station sign found that the reputation of Rayfield efficiency is bringing them a constantly increasing profit from satisfied users.

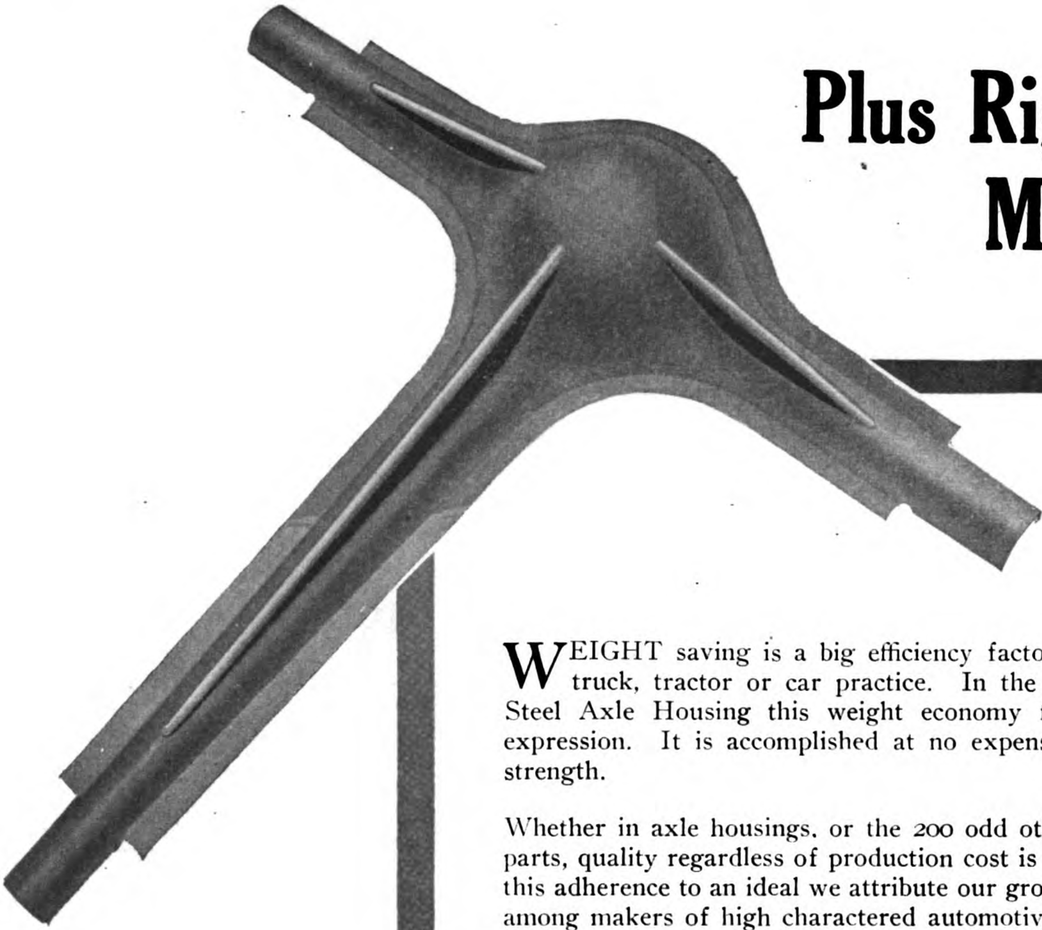
Specified for Efficiency
—Not bought on Price

BENEKE & KROPF MFG. CO.

Successors to Findeisen & Kropf Mfg. Co.

2100 Rockwell Avenue CHICAGO, ILLINOIS

Plus Rigidity Minus Weight



Axle Housings that combine the qualities of Rigidity, Strength and Light Weight have been made possible only through Bossert Facilities.

WEIGHT saving is a big efficiency factor to consider, in truck, tractor or car practice. In the Bossert Pressed Steel Axle Housing this weight economy finds its highest expression. It is accomplished at no expense of rigidity or strength.

Whether in axle housings, or the 200 odd other pressed steel parts, quality regardless of production cost is maintained. To this adherence to an ideal we attribute our growth and prestige among makers of high charactered automotive products.

From small parts to axle housings this high standard is maintained in both material buying and production.

This, the largest plant of its kind in the world, is the best equipped. Its factory personnel is the most highly specialized. Its engineering departments the most capable.

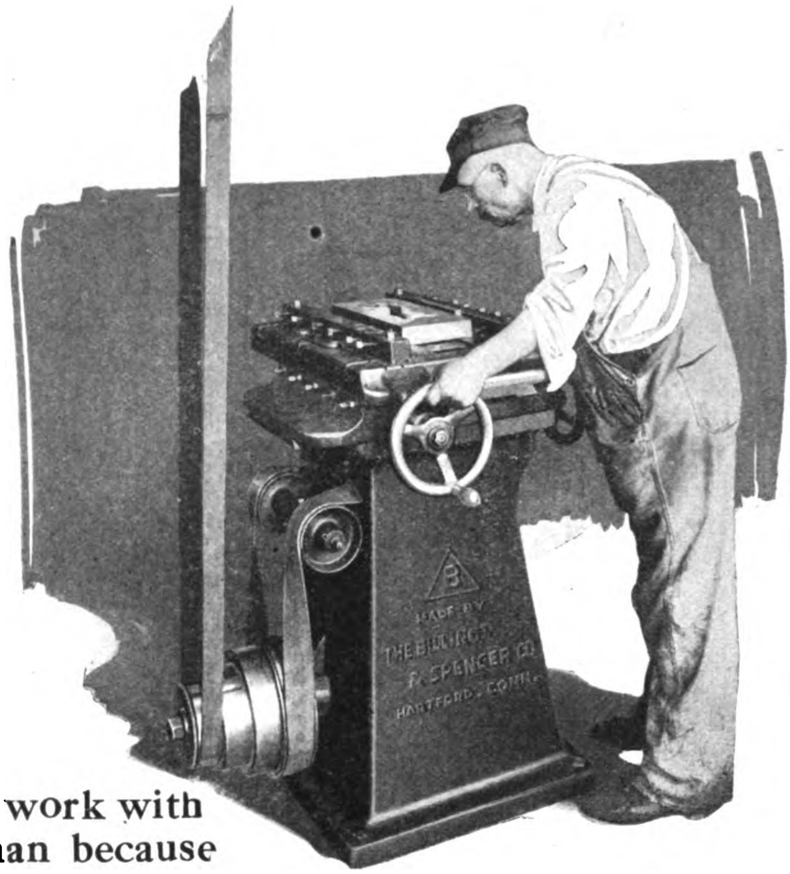
It follows, then, that "The Bossert Way" offers quality products at moderately consistent prices, and that its facilities for quick work and delivery leave nothing to be desired.

Our engineers will show you where pressed steel parts will replace drop forgings, steel and malleable iron.

THE BOSSERT CORPORATION
Utica New York

BOSSERT

With Infinite Care!



MAN and machine, they work with infinite care—The man because he has been trained for a lifetime in tasks requiring the utmost exactness—The machine because it is made by Billings & Spencer for their own use, and for the use of other drop forgers of reputation.

This trimmer miller of improved design quickly and cleanly mills the irregular outlines of trimming press dies, and at the same time their necessary draft or clearance. It also cuts the flash from drop forgings, and mills cutting dies of all descriptions for press work.

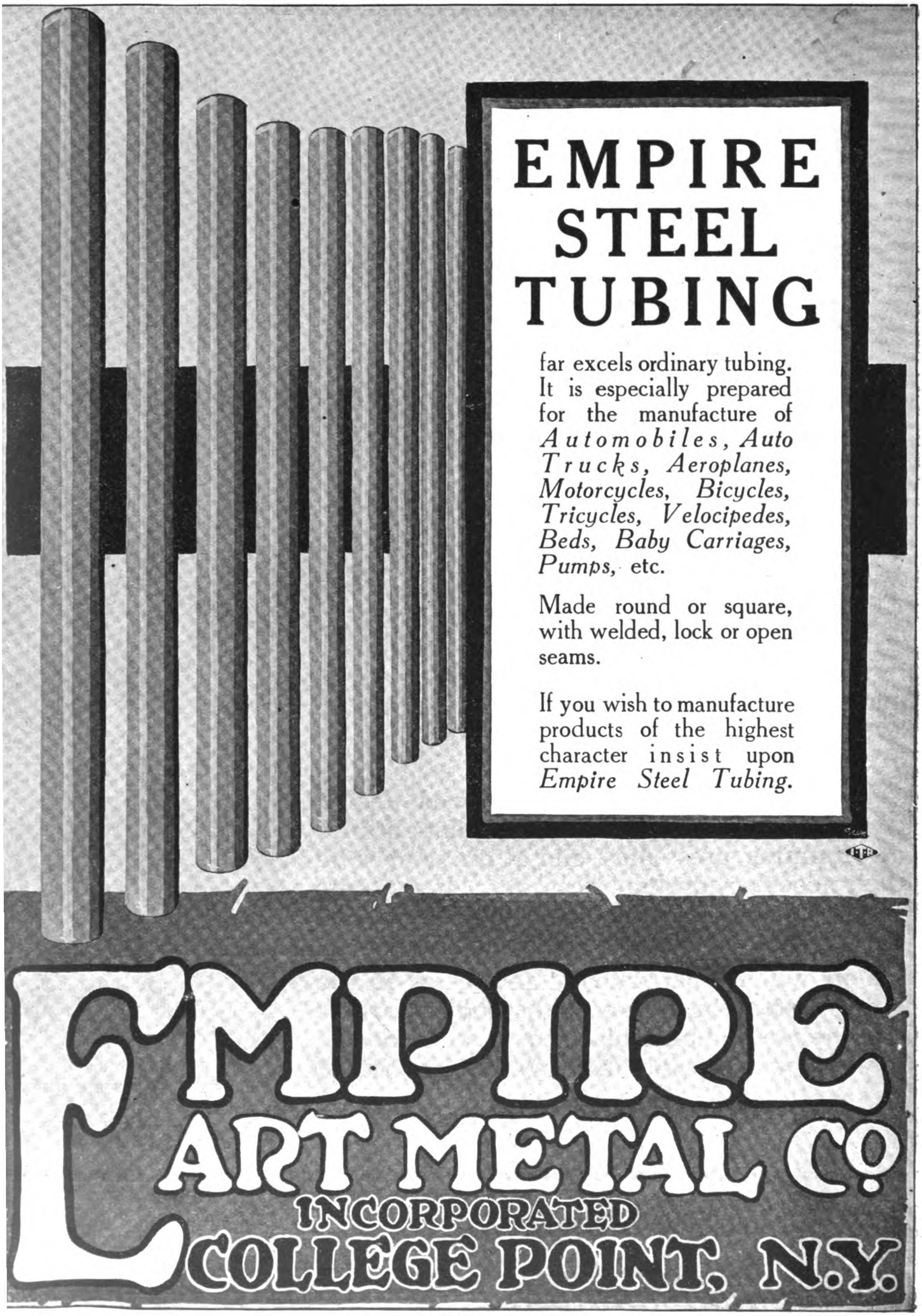
You will be particularly interested in the oiling system for the vertical spindle bearings and the method of chip disposal so as not to interfere with the moving parts of the machine.

Full details upon request.

RELY ON ME!

The Billings & Spencer Co., Hartford, Conn.

"The First Commercial Drop Forging Plant in America"


EMPIRE
STEEL
TUBING
far excels ordinary tubing. It is especially prepared for the manufacture of *Automobiles, Auto Trucks, Aeroplanes, Motorcycles, Bicycles, Tricycles, Velocipedes, Beds, Baby Carriages, Pumps,* etc.
Made round or square, with welded, lock or open seams.
If you wish to manufacture products of the highest character insist upon *Empire Steel Tubing.*
EMPIRE
ART METAL CO.
INCORPORATED
COLLEGE POINT, N.Y.

HOFFMAN PROCESS

Indications and record of the temperature at which Hoover balls are heat treated insures fine grained structure as shown above. This, of course, results in the production of a ball of maximum durability.

Failure to make positive that control as mentioned above may result in the coarse grained and weak structure as illustrated. A ball of such structure is apt to fail even under normal strains. Avoiding defects of this nature is one of the functions of the Hoover Research and Control Laboratories.

Hoover Testing Methods Remove Hoover Balls from the Domain of Chance

There is never an opportunity for a doubt concerning the finished quality of Hoover Steel Balls.

That is because "Research" establishes Hoover specifications—and "Control" sees that they are carried out.

By "Research" we mean the careful tests and investigations which are made in the Hoover laboratory to establish definite standards for the steel, the oils and greases, the grinding and polishing wheels, the abrasives and other materials which are used in the manufacture of Hoover Steel Balls.

By "Control" we mean the daily routine tests also made in the Hoover Laboratories—to see that there isn't the slightest deviation, either in materials or manufacturing methods, from the specifications which have been been so rigidly laid out.

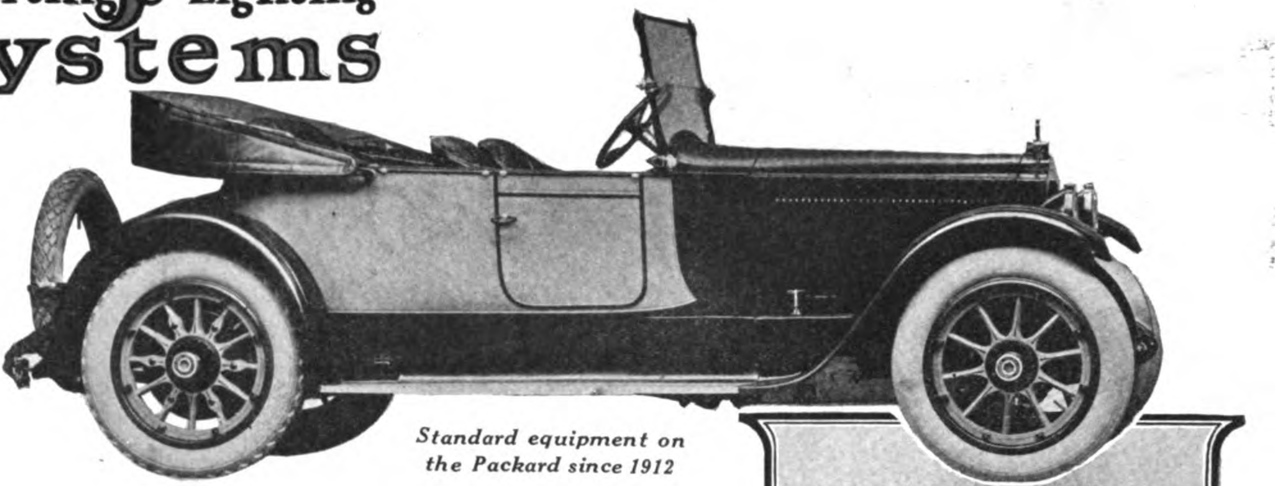
As the backbone of the great Hoover plant, the Hoover Research and Control Laboratories labor unceasingly to maintain the well known superiority of Hoover Steel Balls. The result is a product as perfect as it is possible to manufacture.

As the largest steel ball plant in the United States we are prepared to meet practically any shipping specification which may be submitted to us.

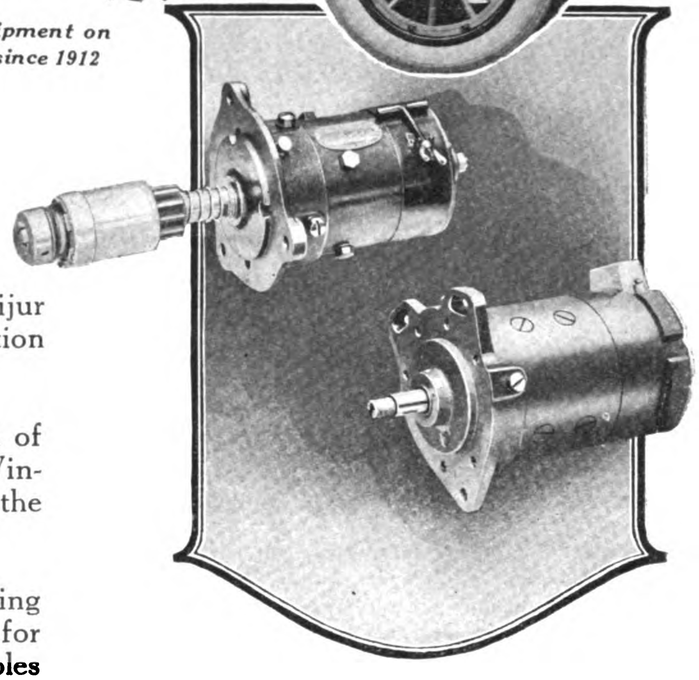
HOOVER STEEL BALL COMPANY
ANN ARBOR, MICHIGAN

HOOVER
STEEL BALLS

Bijur Starting & Lighting Systems



Standard equipment on the Packard since 1912



On Fine Cars the Bijur System Is an Assurance of Dependability

THE quality of the cars which use the Bijur Starting and Lighting System is an indication of merit.

Beginning with the Packard in 1912, adoption of the Bijur System has extended to the Marmon, Winton, Apperson, Jordan, King, Roamer and the Peugeot of France.

Besides meeting the requirements for the leading passenger cars the Bijur System has been adopted for use on motor trucks, air and sea planes, dirigibles and tanks.

The Starting of DePalma's 150 mile an hour Packard was not too heavy, the transatlantic flight of the NC Planes was not too far, and the design of the Bijur Starters is such that no application can be too small for the Bijur System to meet effectively.

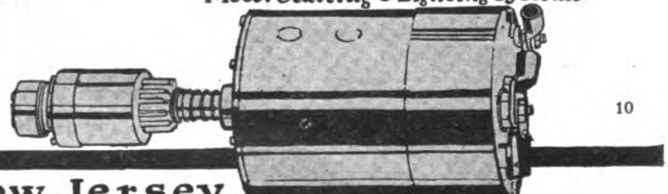
Bijur Engineers are prepared to discuss plans and suggest designs for the incorporation of the Standard Bijur System to any form of automotive starting and lighting duty.

THE BIJUR LIST

Apperson
Atlas
Commerce Truck
Grant
Jordan
King
Marmon
National
Packard
Peugeot of France
Roamer
Templar
Winton
Curtiss Aeroplane Co. The "Oriole"
U. S. Army and Navy
NC Planes
C Blimps
Tanks

Bijur Motor Appliance Company

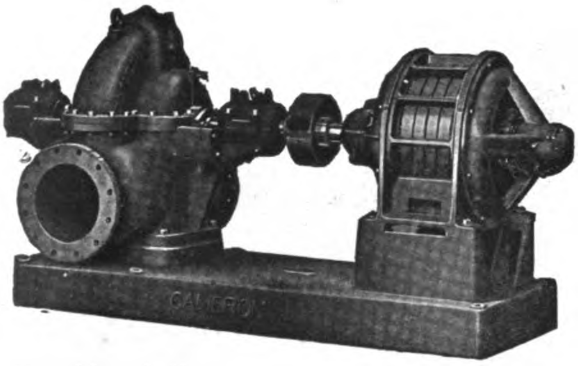
Motor Starting & Lighting Systems



10

Hoboken New Jersey

CAMERON PUMPS



Motor-driven double-suction volute pump.

On Hospital Duty

Here is what the chief engineer thinks of the Cameron—

Hospital St. Boniface,
St. Boniface, Man.,
March 4, 1919.

Canadian Ingersoll-Rand Co.,
Montreal, Quebec.

Dear Sirs—Regarding two Cameron Class DV volute type pumps furnished by your people to the hospital, I am pleased to say they are giving good satisfaction. They have been pumping 250 gals. P. M. against a head of 160' for as long as 11 months without a shutdown. They are still running without noise or repairs of any kind. No. 1 is direct connected to steam turbine and running 2500 R. P. M. No. 2 is a duplicate of No. 1, except the latter is electric-motor driven. I can recommend the Cameron Pump to any firm wishing a real pump to do real work, as we forget to notice our pumps unless some person wishes to see them running.

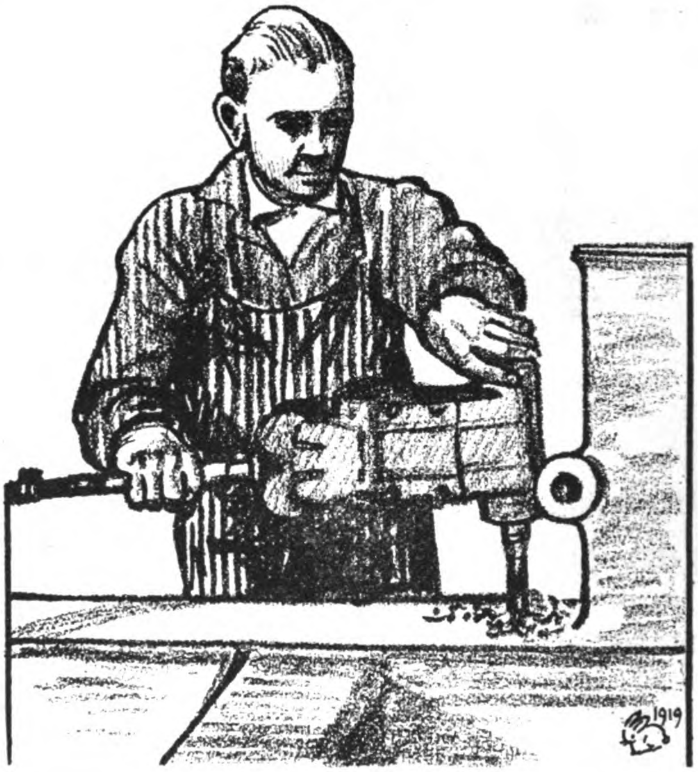
Yours sincerely,
GEO. K. BEERS,
Chief Engineer.

The Cameron line is complete and contains pumps for nearly all uses and sizes to suit every requirement. Send for Bulletins 7150, 7204.

49-DV

"LITTLE DAVID"

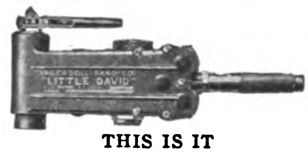
Close Quarter Drill



The position of the spindle in a close-quarter drill brings up special problems in the design of the tool. In the "Little David" these have been solved in a most satisfactory way.

The spindle is operated by ratchets on three rocking levers, which are connected direct to the pistons. The levers also operate the crankshaft, the only function of which is to control the single rotary valve and the pistons on the return stroke.

The "Little David" is easier and cheaper to operate and repair and contains less than one half the number of parts of any other close quarter drill on the market.



THIS IS IT
Ask for Catalog 8000

PT-51-7

INGERSOLL-RAND COMPANY

✦ ✦ ✦ GENERAL OFFICES, 11 BROADWAY, NEW YORK ✦ ✦ ✦

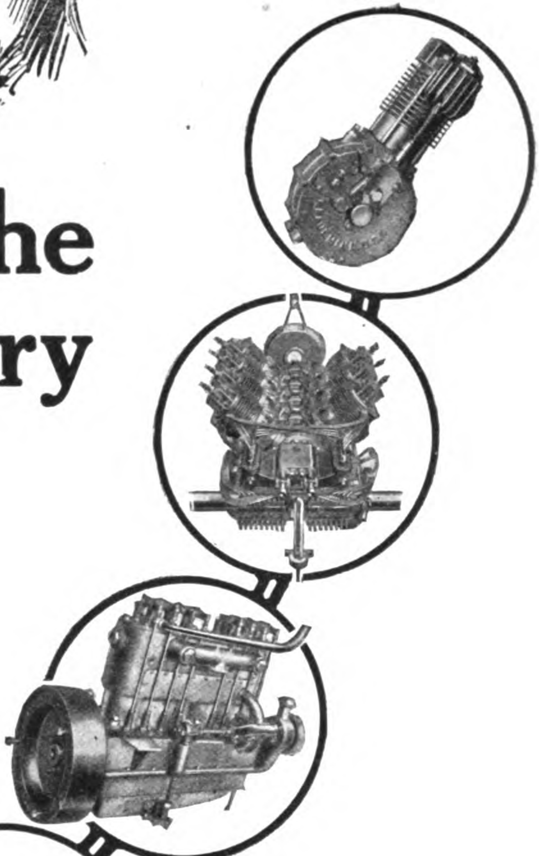
DOMESTIC OFFICES

BUTTE, JUNEAU, DULUTH, DENVER, BOSTON, EL PASO, SEATTLE, ST. LOUIS, CHICAGO, NEW YORK, KNOXVILLE, SCRANTON, HOUGHTON, CLEVELAND, PITTSBURGH, BIRMINGHAM, LOS ANGELES, DETROIT, NEW ORLEANS, PHILADELPHIA, SAN FRANCISCO, SALT LAKE CITY, JOPLIN

FOREIGN OFFICES

LONDON, PARIS, MADRID, MILAN, RIO DE JANEIRO, MONTREAL, MEXICO CITY, MELBOURNE, KALGOORLIE, JOHANNESBURG, SANTIAGO, CHILE, LIMA, PERU, KOBE, JAPAN, MANILA, TOKIO, HONOLULU, HAVANA, BUENOS AIRES, ANTOFAGASTA, LA PAZ, BOLIVIA, VANCOUVER, B. C.

APPLY TO NEAREST OFFICE



The Problems of the Automotive Industry

are like the problems of every industry in the Nation's great fields of achievement. Many of the problems of the automotive industry have been taken to Taft-Peirce. The Taft-Peirce organization has developed or co-operated in the development of countless machines and tools (from the typewriter to heavy machinery), involving exceptional ingenuity and requiring great engineering experience and ability.

If you have a designing or manufacturing problem, let the cumulative experience of the Taft-Peirce organization help you solve it.

Taft-Peirce Automotive Engineering Experts Are at Your Service.

TAFT-PEIRCE

Woonsocket, R.I., U.S.A.

New York: Woolworth Building

Detroit: Majestic Building

Mighty in strength

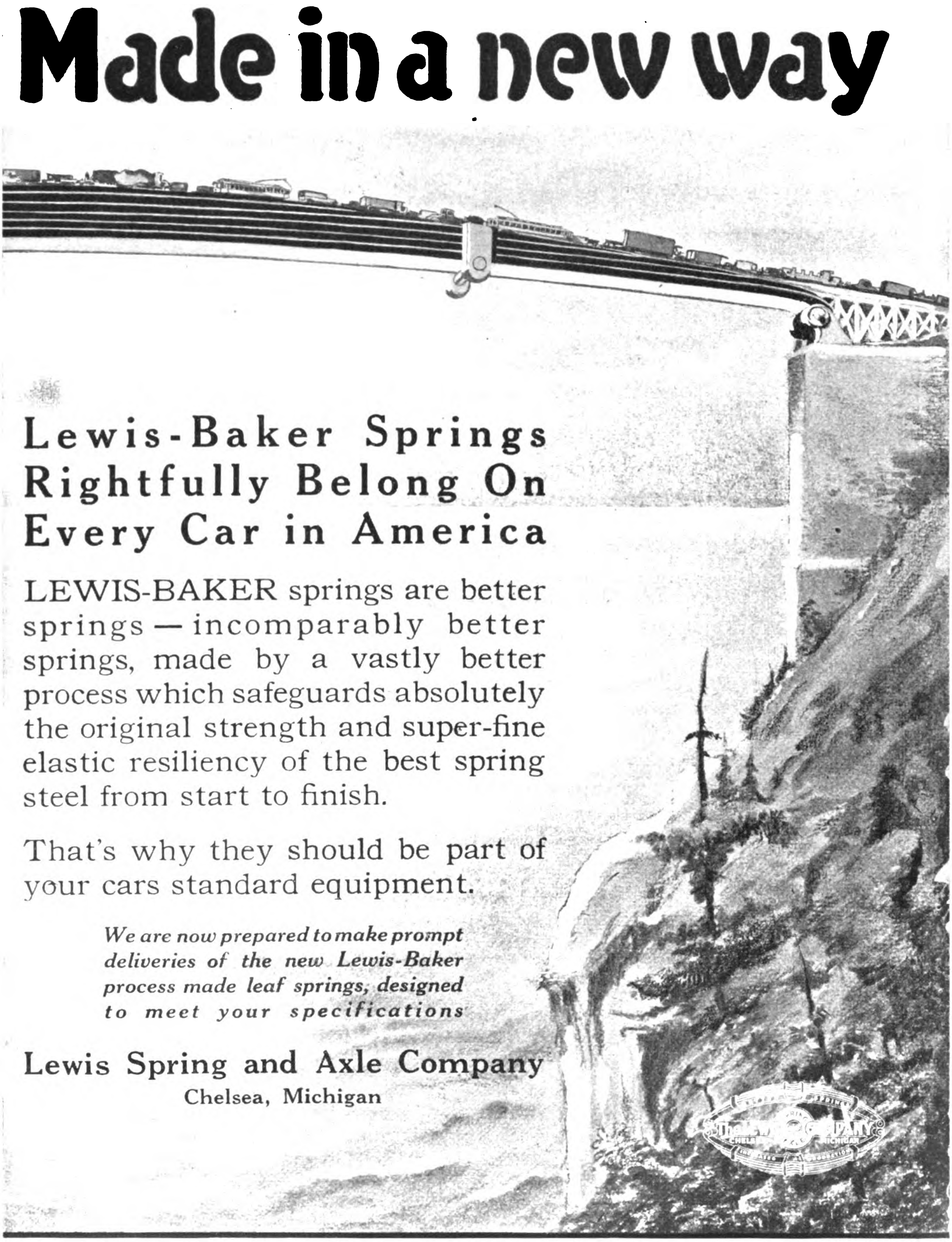
Lewis-Baker Springs Have Greater Resistance Longer Wearing Qualities

LEWIS-BAKER process of spring making not only eliminates the old bugbear—the dangerous and harmful weakening effect of concealed fractures and "spotty" steel, but turns out a more perfectly formed and closer fitting leaf.

That's why they excel in rugged strength and longer service.

Let us furnish you price quotations on the wonderful Lewis-Baker springs made up especially to fit your requirements

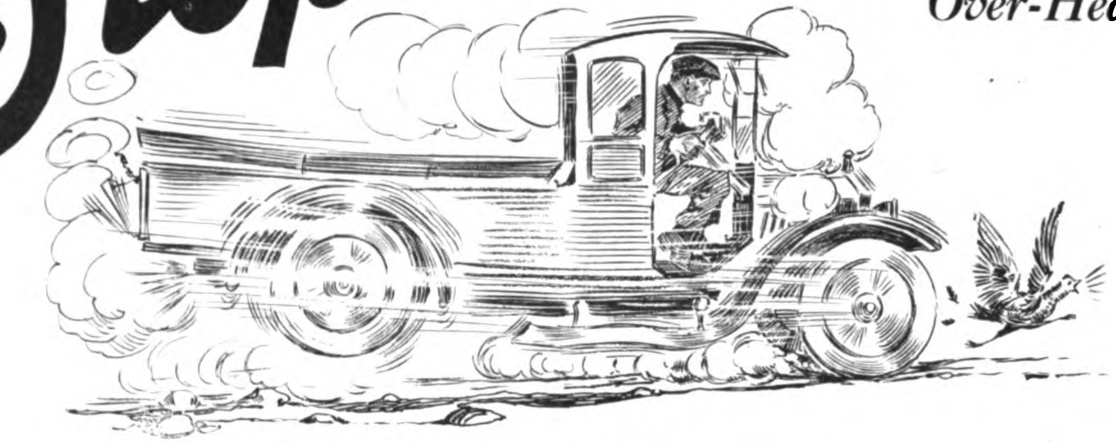
Lewis Spring and Axle Company
Chelsea, Michigan


Made in a new way
Lewis-Baker Springs Rightfully Belong On Every Car in America
LEWIS-BAKER springs are better springs — incomparably better springs, made by a vastly better process which safeguards absolutely the original strength and super-fine elastic resiliency of the best spring steel from start to finish.
That's why they should be part of your cars standard equipment.
We are now prepared to make prompt deliveries of the new Lewis-Baker process made leaf springs, designed to meet your specifications
Lewis Spring and Axle Company
Chelsea, Michigan


INTERCHANGEABILITY
HARTFORD accuracy means absolute interchangeability. There is no loss of time in assembling when the turned parts are H. M. S. quality, for their accuracy is maintained by rigid and constant inspection.
When you deal with us you are assured of real service backed by a reputation of forty-three years, a factory of over 200,000 square feet floor space, vast resources of the highest type raw materials, and an efficient and highly-trained working force.
Our capacity ranges from the smallest size wire to six inches diameter. All H. M. S. products are milled from the solid bar, insuring maximum strength and accuracy.
Let us figure on your specifications, particularly if they are most exacting and difficult.
HARTFORD
MACHINE SCREW
COMPANY
HARTFORD, CONN.
New York - Detroit - San Francisco - Richmond, Va.

Stop

Over-Speeding
Over-Feeding
Over-Heating

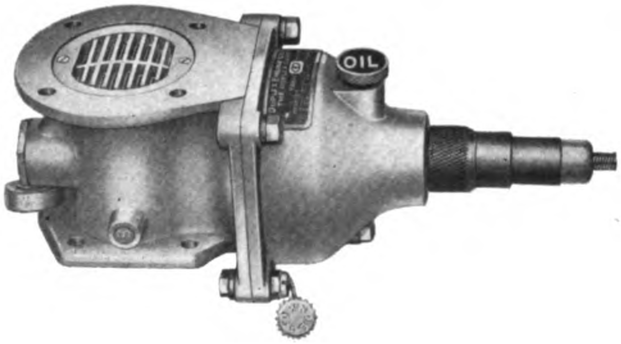


The SIMPLEX-UNIVERSAL GOVERNOR for FORDS will do it

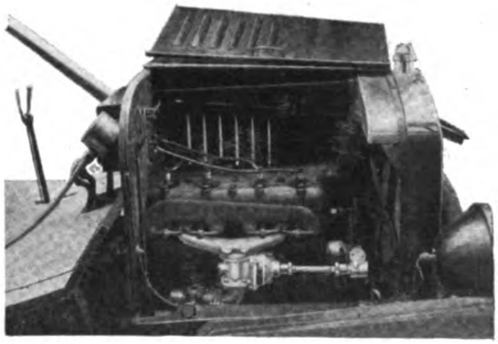
Saves	*Prevents*	*Insures*
GASOLINE	OVER-SPEEDING	AMPLE POWER
OIL	OVER-HEATING	INCREASED AVERAGE SPEED
TIRES	OVER-FEEDING	FEWER Repairs—LESS Depreciation
MOTOR	ABUSE	LONGER LIFE

Made Especially for Ford Trucks, Ford Commercial Delivery Cars, Make-A-Trucks and Make-A-Tractors.

WILL FIT ANY FORD ENGINE



THE SIMPLEX-UNIVERSAL GOVERNOR



SIMPLEX-UNIVERSAL Governor and Manifold Installed on Ford Engine

The Ford Motor will develop its maximum torque or pulling power at approximately 1100 revolutions per minute. The motor's maximum speed is about 2200 r. p. m. Think of all the extra gas and oil it is using in those excess 1100 r. p. m. without added power! Think of the vibration, wear and tear you can eliminate by governing the motor at 1100 r.p.m. with a SIMPLEX-UNIVERSAL Governor! Figure the saving in gasoline, oil, tires, wear, tear, and depreciation in dollars and cents.

Ask any Dealer to install a SIMPLEX-UNIVERSAL Governor on your Ford for ten days' free trial.

The DUPLEX ENGINE GOVERNOR CO., Inc.

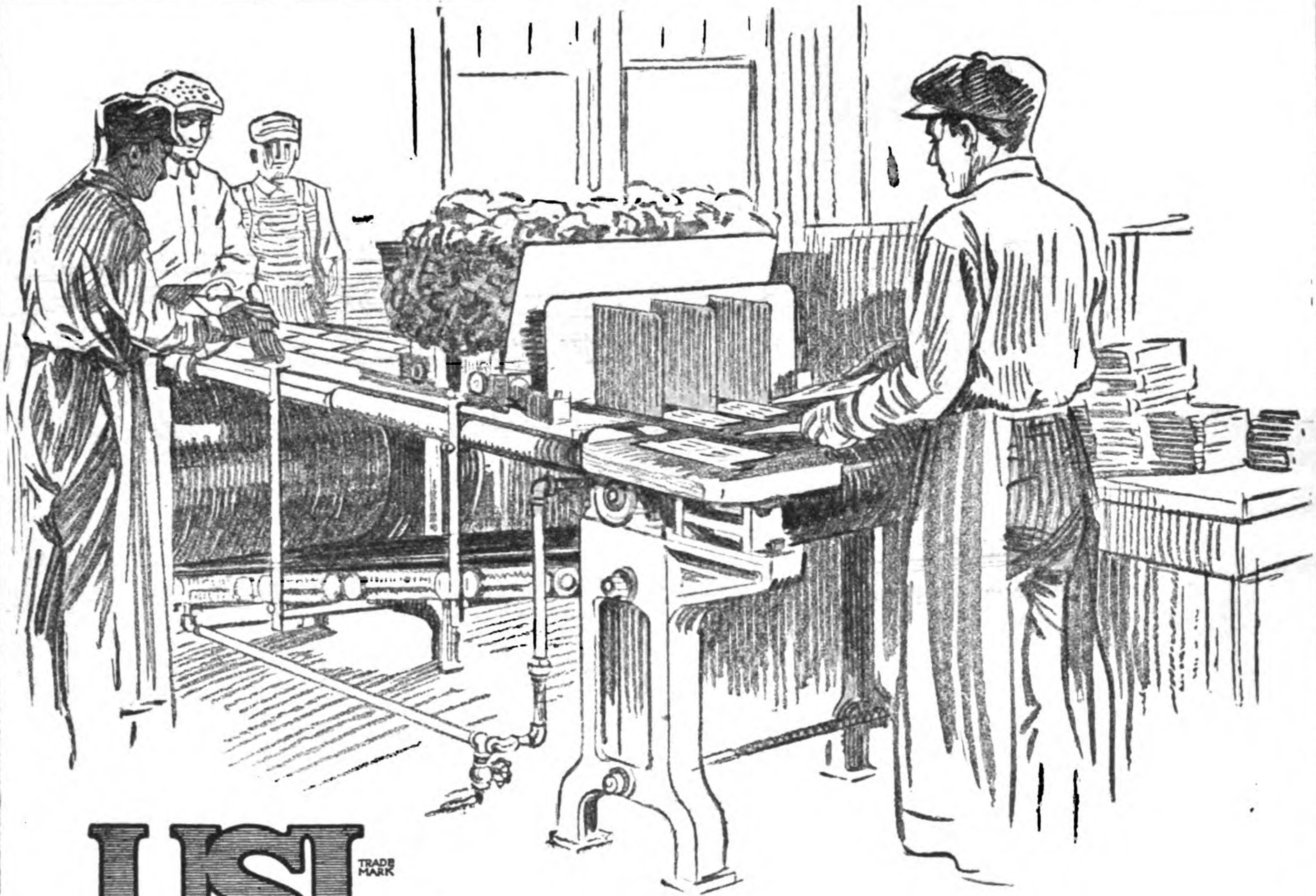
Manufacturers of DUPLEX and SIMPLEX PRECISION GOVERNORS for TRUCK and TRACTOR SERVICE

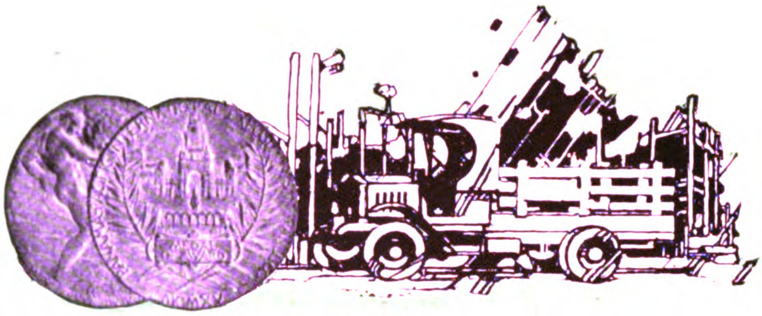
Main Office and Factory
42 Flatbush Avenue Extension

BROOKLYN, N. Y.

Branch Offices in CHICAGO, DETROIT, SAN FRANCISCO SERVICE STATIONS IN ALL PRINCIPAL CITIES

DEALERS: *Write or wire for Bulletin No. 110 and Discounts on this Big Selling Governor*





SHELDON AXLES ARE NOW TO BE ADVERTISED in a much more vigorous manner than ever before, through a campaign which will reach practically every source of demand for high grade motor trucks. Repeated use of large space in the magazines of widest circulation and greatest influence will feature the campaign.

PERIODICALS OF NATIONAL CIRCULATION are to be employed—among them *The Saturday Evening Post* and the leading business and trade publications.

IN LANGUAGE FREE from mystifying technical phraseology, the story of Sheldon's great achievement in axle construction will be unfolded before the layman. A straight appeal that puts it squarely up to his sense of values, performance and economy will show *the man you want to reach* why the truck he buys should have a Sheldon Worm Drive Axle.

FOR YEARS THE NAME SHELDON, among technically trained men, has been a symbol of supreme quality in axle design. And Sheldon copy will show clearly why Sheldon has won the unqualified endorsement of engineering opinion the world over.

See next two pages for reproduction of Saturday Evening Post advertisement for June 28th

1901 Double Page S. E. P. ★ ★

Sheldon

FOR MOTOR

Automatic Adjustment

Expansion due to heat is compensated automatically in Sheldon Worm Gear Axles.

The Sheldon thrust bearing is a ball bearing—the only type of bearing that will take the thrust of the worm in both directions. The Sheldon front bearing is free to move as the worm expands, and thus adjusts itself to expansion and wear.

Sheldon Axles are Self-Adjusting

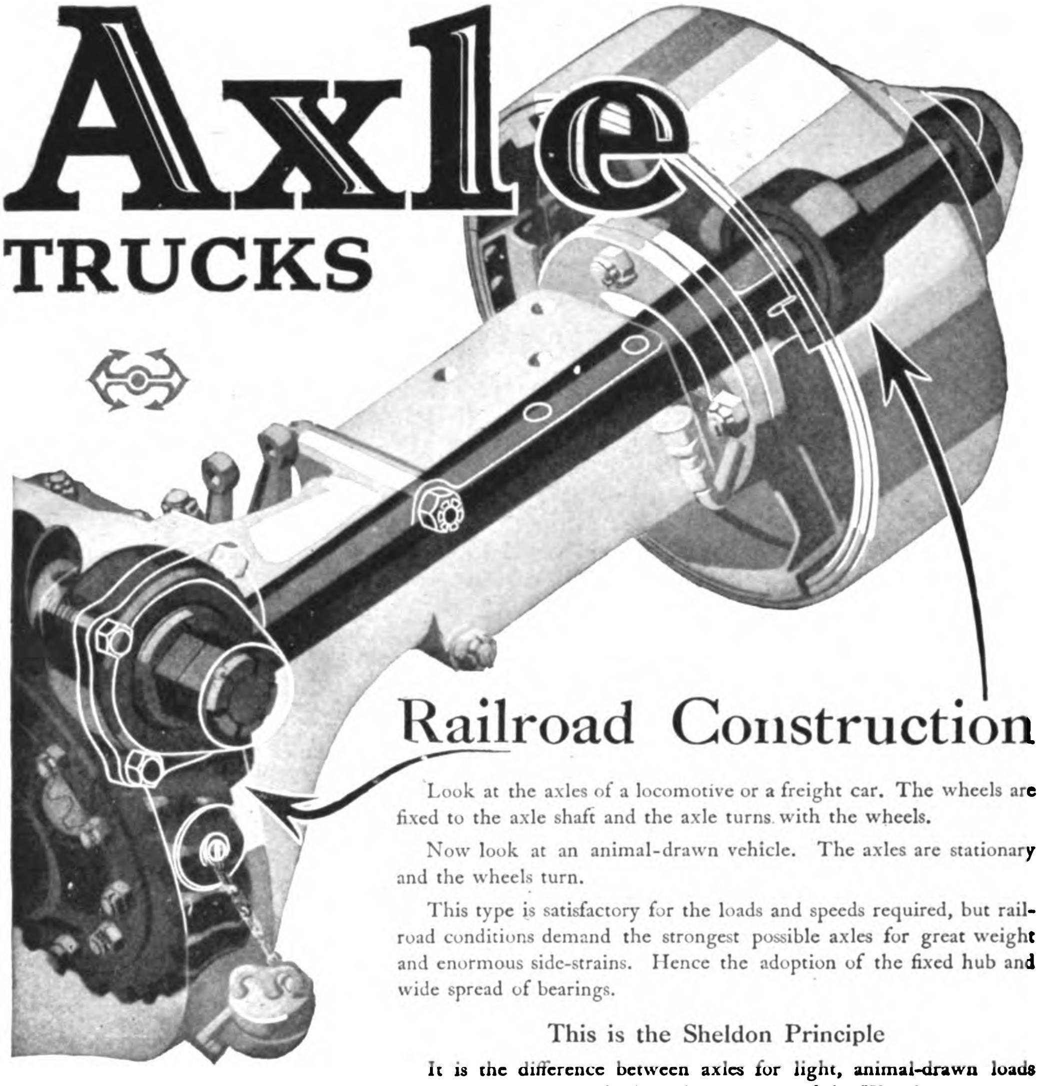
No external adjustment is necessary—therefore it is not provided.

In the Sheldon thrust bearing adjustment is automatic, which takes care of the expansion in the worm and prevents tight bearings and loss of power.

In addition to this feature, ball thrust bearings take all combinations of radial and thrust load directly through the center of the balls, so that wedging is impossible and friction is reduced to the minimum.

THIS is the first of a series of dominating advertisements which will appear in leading publications of national circulation.

Axle
TRUCKS



Railroad Construction

Look at the axles of a locomotive or a freight car. The wheels are fixed to the axle shaft and the axle turns with the wheels.

Now look at an animal-drawn vehicle. The axles are stationary and the wheels turn.

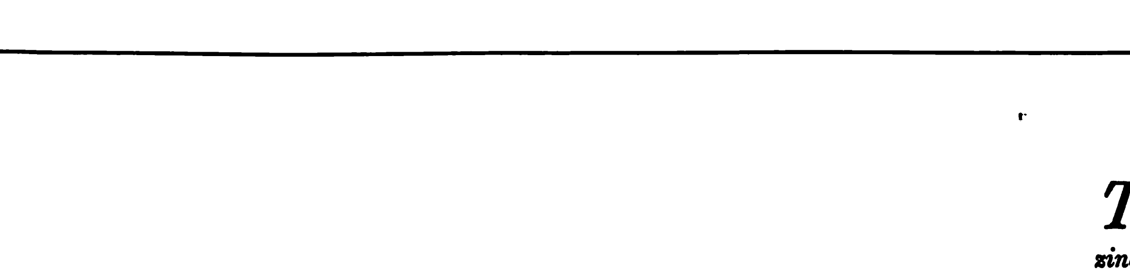
This type is satisfactory for the loads and speeds required, but railroad conditions demand the strongest possible axles for great weight and enormous side-strains. Hence the adoption of the fixed hub and wide spread of bearings.

This is the Sheldon Principle

It is the difference between axles for light, animal-drawn loads and Axles that Carry the Freight Tonnage of the World.

Send for catalogue explaining the Sheldon points of superiority

SHELDON AXLE & SPRING COMPANY, Wilkesbarre, Pa.



THE Saturday Evening Post and other magazines will carry the message of SHELDON quality to many millions of readers this year.

SLOCUM-AVRAM-SLOCUM MANAGEMENT

A Service That Eliminates Labor Difficulties

Did you ever figure out what labor turnover costs you in a year?

The problem of getting and keeping skilled help is but one of the many labor difficulties that beset both the old established as well as the new manufacturer.

The fact that the "manufacturing aid" service offered by the Slocum, Avram & Slocum Laboratories eliminates labor difficulties has very often been the dominant reason for manufacturers having all or part of their product manufactured in the plant shown below.

Other features of this service are outlined at the right.

Your communication will receive our prompt and efficient attention.

Real Manufacturing Aid

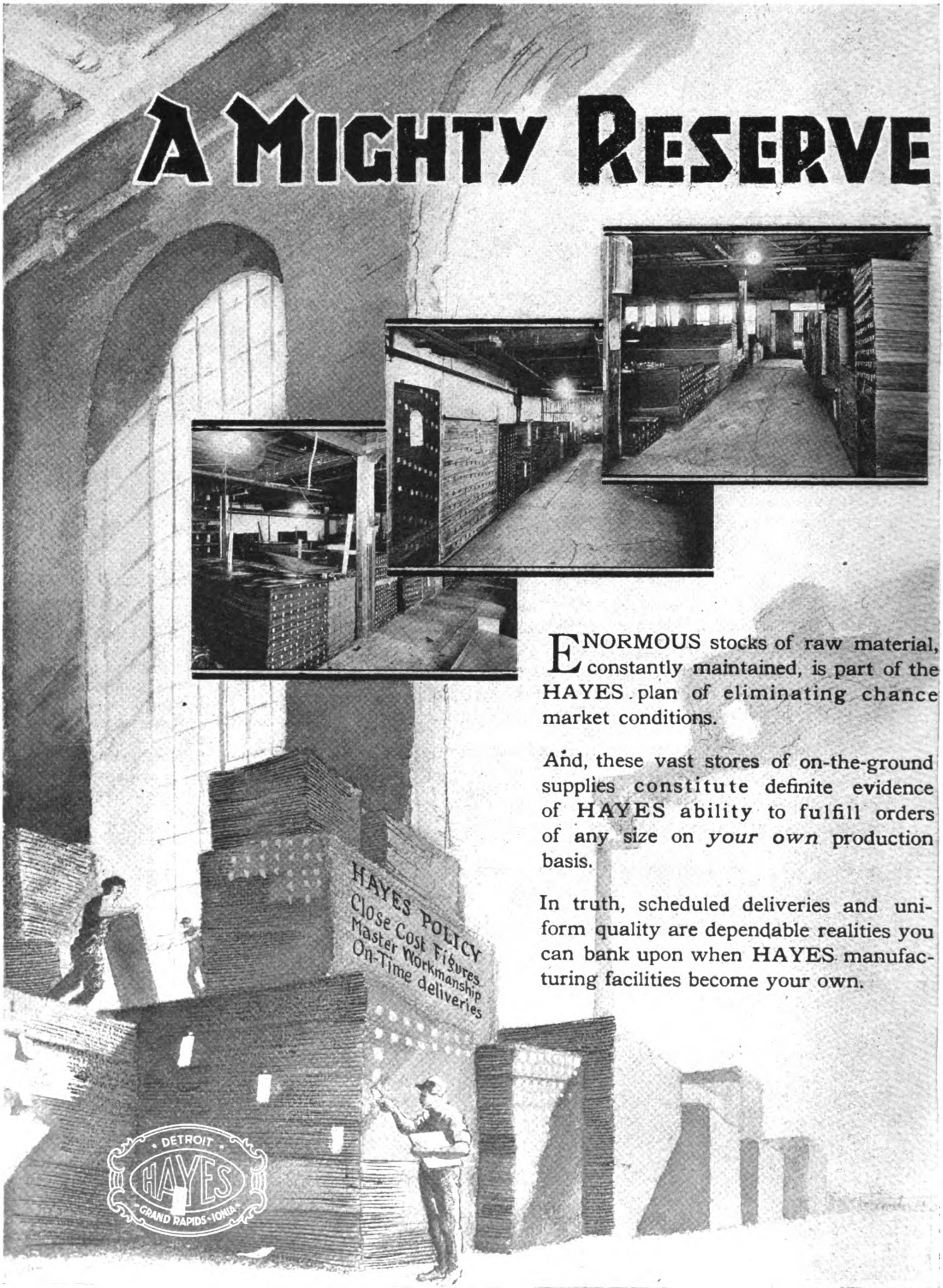
If yours is a problem of greater production—the development of a new part or the redesigning of an old one—new tools, jigs, fixtures or special machines—or if you are looking for a complete and efficient organization to take over the manufacture of certain parts send your problems to Slocum, Avram & Slocum Laboratories.

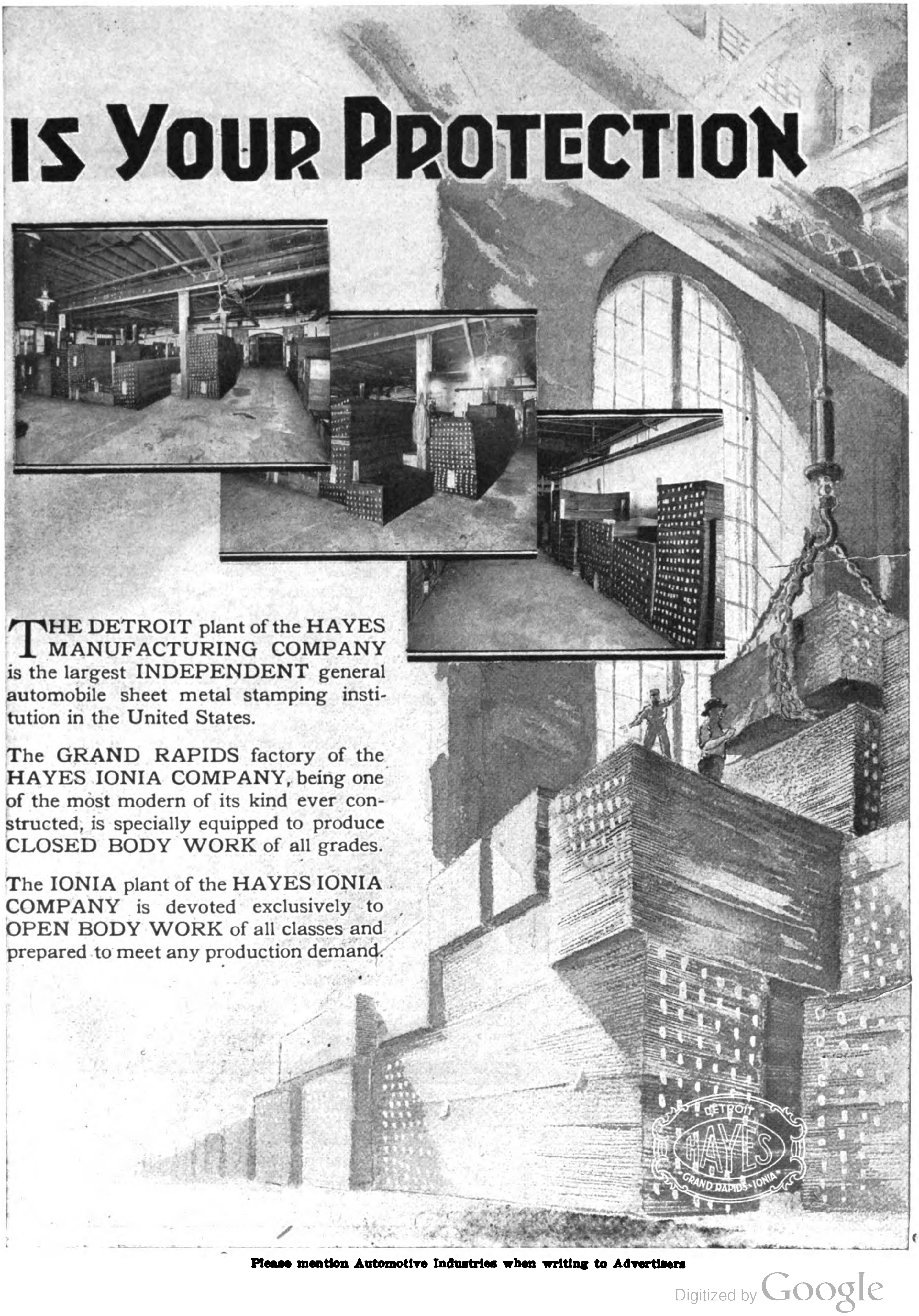
Slocum Avram & Slocum Laboratories Inc.

Newark N.J. U.S.A.

New York Office, Woolworth Building

MAKE THIS PLANT PART OR ALL OF YOUR MANUFACTURING ORGANIZATION


A MIGHTY RESERVE
ENORMOUS stocks of raw material, constantly maintained, is part of the HAYES plan of eliminating chance market conditions.
And, these vast stores of on-the-ground supplies constitute definite evidence of HAYES ability to fulfill orders of any size on *your own* production basis.
In truth, scheduled deliveries and uniform quality are dependable realities you can bank upon when HAYES manufacturing facilities become your own.
HAYES POLICY
Close Cost Figures
Master Workmanship
On-Time deliveries
DETROIT
HAYES
GRAND RAPIDS - IONIA


IS YOUR PROTECTION
THE DETROIT plant of the HAYES MANUFACTURING COMPANY is the largest INDEPENDENT general automobile sheet metal stamping institution in the United States.
The GRAND RAPIDS factory of the HAYES IONIA COMPANY, being one of the most modern of its kind ever constructed, is specially equipped to produce CLOSED BODY WORK of all grades.
The IONIA plant of the HAYES IONIA COMPANY is devoted exclusively to OPEN BODY WORK of all classes and prepared to meet any production demand.
DETROIT
HAYES
GRAND RAPIDS-IONIA

Asbestos Rock

Sorting Fibre

Have your jobber check us up on this

THE uncertain supply of special grades of asbestos fibre gives the phrase "From Mine to Brake" a deeper significance for Jobber and Dealer than ordinarily.

The ability of Johns-Manville to continuously supply you with a uniformly high-grade brake-lining—Non-Burn—was never so clearly shown as today, when all markets are uncertain.

The fact that we do mine, spin and weave this lining from beginning to end, in a sense underwrites and makes valid our sales policy, which has for years assured the trade of not only a good lining, but the best lining, honestly merchandised and always obtainable.

There must never be any doubt as to the quality of this lining, or the spirit back of its sale. Ask your jobber about it.

P.S.—All indications from everywhere point to a straight-through-the-summer lining business. Your customers know Non-Burn because they know Johns-Manville. You can tell them that we stand back of it. They know what that means.

H. W. JOHNS-MANVILLE CO.
New York City
10 Factories—Branches in 63 Large Cities

Other Johns-Manville Automotive Equipment—**Clutch Facings, Industrial Brake Blocks, Speedometers, Odometers, Recorders, Speedometers with Instrument Board for Ford Cars, Fire Extinguishers.**

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

Through—
Asbestos
and its allied products
JOHNS-MANVILLE
Serves in
Conservation

Heat Insulations, High Temperature Cements, Asbestos Roofings, Packings, Brake Linings, Fire Prevention Products

JOHNS-MANVILLE
AUTOMOTIVE EQUIPMENT


A PLANT WITHIN A PLANT
THE SPECIAL PRODUCTION DEPARTMENT of The Stanley Works has the floor space of an ordinary factory completely equipped, devoted to stamping, forming and drawing steel. Modern in every way with facilities for turning out quantity as well as quality products.
We Are Estimating From Samples and Blue Prints of All Sorts.
Your correspondence is solicited.
The Stanley Works
NEW BRITAIN, CONN.
NEW YORK
100 Lafayette St
CHICAGO
73 E. Lake St.
S.W.
"Specialists in Wrought Steel Specialties"

Auto-Lite

Starting, Lighting & Ignition

The Big Little Generator

ONLY 4½ inches in diameter, this Auto-Lite Round Type Generator is one of the smallest and lightest made. Yet it has a marvelously large output capacity.

Frame and four poles are of rolled steel. It is self regulating through the Third Brush System, which means no sticking, corrosion or variation in its adjustments.

It begins to charge into the battery at the low speeds used in city driving and automatically decreases the charge at higher speeds, thus preventing depreciation of the battery.

A generator that is wonderfully compact and trustworthy.

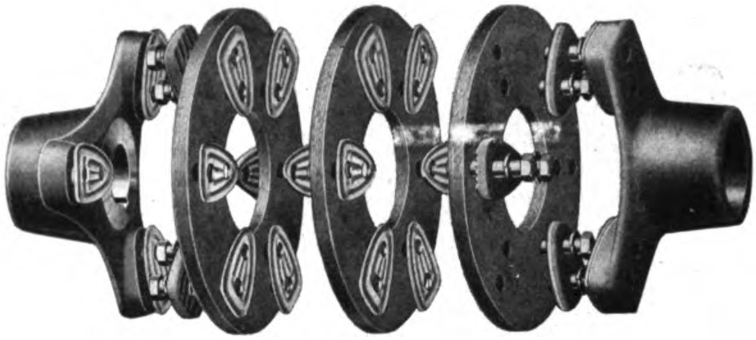
Electric Auto-Lite Corporation

Head Office and Factory, Toledo, Ohio **Detroit Sales Office, 1507 Kresge Bldg.**

FLEXITE

Trade Mark Registered

HEAVY DUTY UNIVERSAL JOINTS



PARTS OF A FLEXITE HEAVY DUTY UNIVERSAL JOINT

THE FLEXITE DISC

The Disc Carries the Load

Flexite discs are correct mechanically, because both in design and production they follow sound engineering practice.

Each careful step in their manufacture has an ultimate purpose in the proper functioning of the finished product.

This is why Flexite Discs secure strength without stiffness and flexibility without weakness.

Each Flexite Disc acts as a series of flexible links in transmitting the power.

The load on the disc is evenly distributed over its entire width.

The Flexite Discs carry the load without transmitting the shocks of sudden starting and stopping.

Write for Bulletin

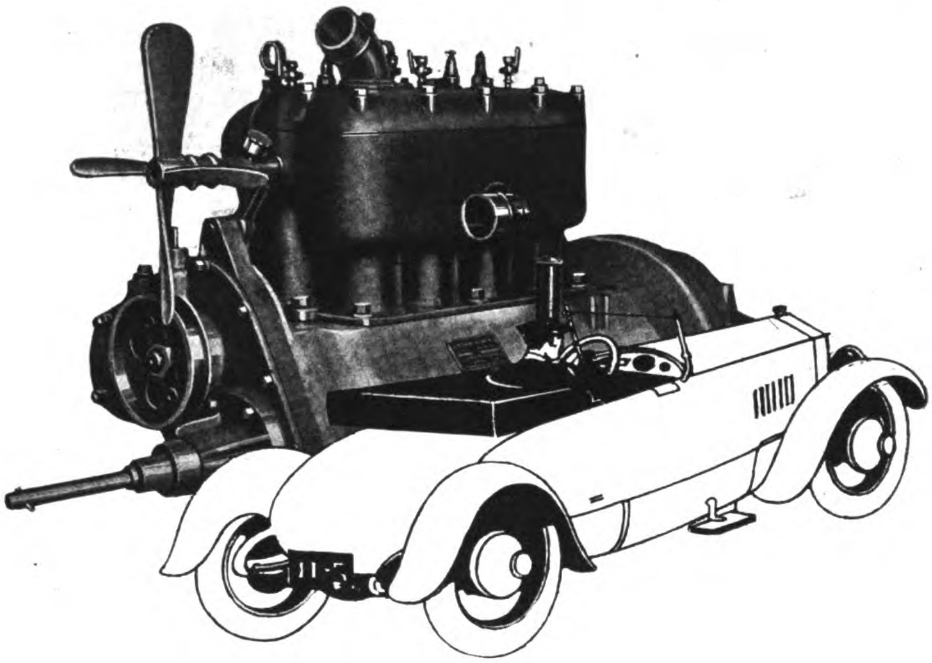
F. R. BLAIR & CO. INC.
50 CHURCH STREET
NEW YORK

Makers of FLEXITE Standard Magneto and Generator Couplings

LYCOMING FOUNDRY & MACHINE Co
WILLIAMSPORT PENNA.

LYCOMING

MOTORS



You Sell Your Car on a Promise of Performance

ON its ability to live up to that promise, depends its reputation with the motorists and dealers to whom you must look for future sales.

The essential factor in the performance of any car is its engine. Before anything else you must insure its power producing qualities and its capacity to stand up under service.

If your car is equipped with a Lycoming Motor you are certain of these fundamentals. You know that its reputation for power and reliability is safe. You know you have laid the foundation for its lasting popularity.

A study of the blueprints and specifications of the Lycoming Motor will convince you of this. Write for them today and find out for yourself what the Lycoming Motor offers you in the way of simple, efficient design, quality materials and high grade workmanship.

Model K, 4 cylinder, L-head, 3 point suspension. Bore, 3½", by 5" stroke. S.A.E. h.p. 19.6; 30 B.H.P. at 1450 R.P.M.

Lycoming Foundry and Machine Co.

Williamsport, Pa.

THE MOTOR FOR THE DISCRIMINATING CAR BUILDER

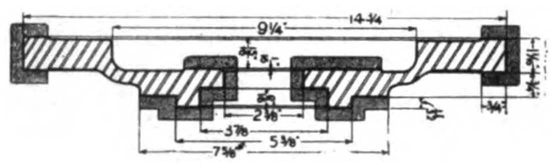
BULLARD

Released 60 Men and a Roomful of Machines

THOUSAND after thousand of the flywheel shown here have been produced on the BULLARD MULT-AU-MATIC in an average time of 2 min. and 15 sec. each. Best previous time, in machines selected and tooled to obtain highest efficiency, 15 min. each. And the work of the Mult-Au-Matic was of a higher and more uniform quality. It is an evidence of the dependableness of the Mult-Au-Matic and its capacity for maintaining production at a high rate.

On another job the Mult-Au-Matic is producing in one hour 80 pieces. Best former record 20 pieces in one hour.

Still another Mult-Au-Matic job shows an increase of ten to one over former methods.



Motor Fly Wheel

Cast Iron

Total Time, Two Chuckings,	2 Min. 15 Sec.
First Chucking..............	1 Min. 22 Sec.
Second Chucking............	0 Min. 53 Sec.

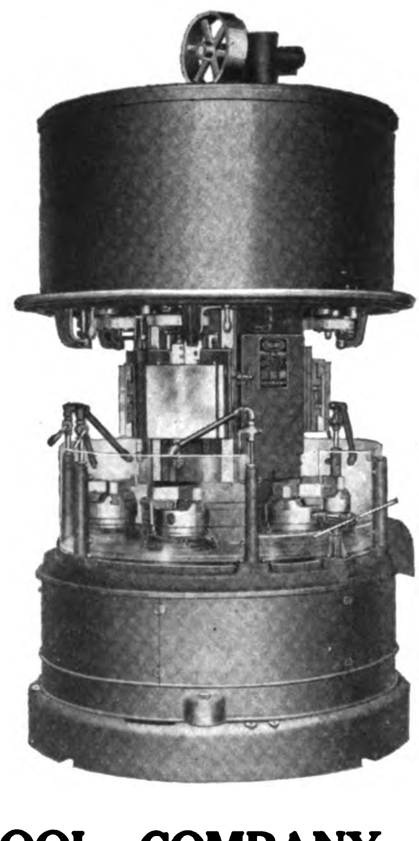
BULLARD

MULT-AU-MATIC

is six machines in one, and requires but one operator. It is a saver of money, men and machines. Less investment is required, less floor space, less tool expense, lower maintenance charges, and but one man is required to obtain its maximum production.

The Mult-Au-Matic includes in its scope all classes of castings, forgings and bar stock cut to lengths, coming within its capacity and requiring boring, turning, facing, etc., operations either singly or in combination.

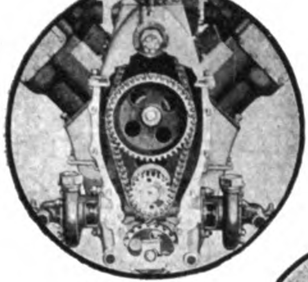
If you have work for this machine, write us for an estimate. Let us show you that your cost can be reduced, time saved, and overhead cut down.



Deliveries Are Good

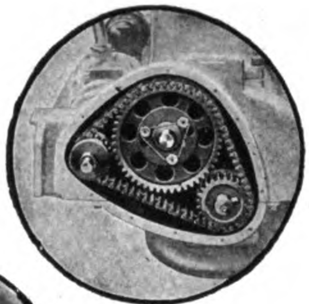
THE BULLARD MACHINE TOOL COMPANY

Bridgeport Conn., U. S. A.

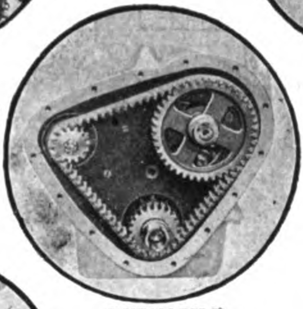


CADILLAC
4-cyl.-1912-13-14
8-cyl.-1915-16-17-18-19

PACKARD "12"
1916-17-18-19



WINTON "6"
1916-17-18-19

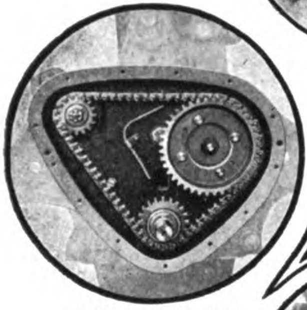


HUPMOBILE
Model N-1915-16-17
Model R-1918-19

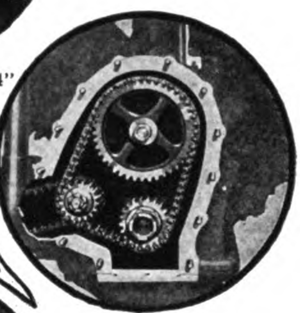
STEARNS-KNIGHT "4"
1914-15-16-17-18-19

Morse Front End Drives

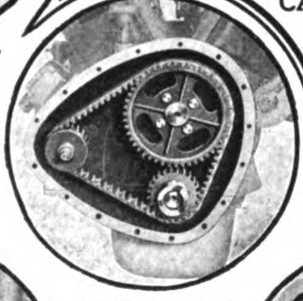
THE ACCESSORY THAT HAS KEPT PACE WITH MOTOR CAR DEVELOPMENTS



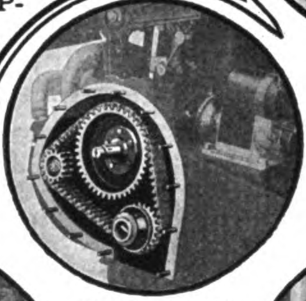
CHALMERS "6"
1917-18-19



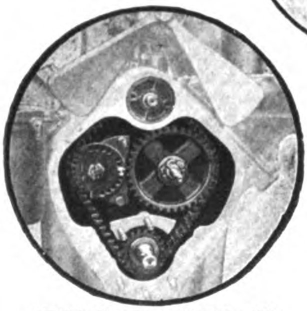
KING "8"
1917-18-19



HAYNES "12"
1917-18-19

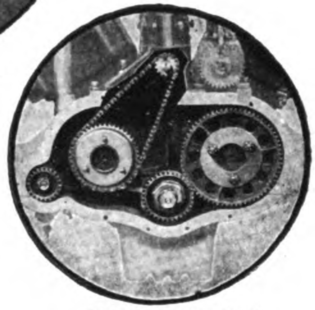


TEMPLAR "4"
1918-19



STEARNS-KNIGHT "8"
1916-17-18-19

SCRIPPS 4 & 6
1918-19



NATIONAL "12"
1916-17-18-19

THESE SPACES ARE SOLD. WHO TO?

? ? ? ? ?

Five new customers have been added so far this year. As announcements are made of their new models, new faces will appear in these circles. Watch for the new faces and more circles. Many more to follow this year.

MORSE CHAIN CO., Gen'l Office and Works: Ithaca, N. Y.

Largest Manufacturers of Silent Chains in the World

Detroit Sales Office and Display Rooms, 1003 Woodward Ave.

KISSEL TRUCKS

"Uninterrupted Transportation"

Solving the Nations Readjustment Problems

THERE is no question as to the productive ability of America—that has been proven.

The real problem that confronts the American business man is to keep up an endless flow of supplies, materials, goods, etc., to port of shipment.

In other words, there must not be the slightest uncertainty of delivery on schedule time, of necessary living supplies and necessities which not only Europe is looking to us to provide, but on which our Nation's commercial and social life depends.

No truck purchaser can afford to purchase motor trucks backed up by doubtful manufacturing facilities. He cannot afford to trust his transportation problems to trucks that have not demonstrated their mechanical superiority. It is plain, good business judgment to place your choice of trucks in trucks that—value for value—quality for quality—measure second to none; trucks that are backed up by intensive as well as extensive manufacturing and service facilities—trucks that are the result of studying the peculiarities that characterize the delivery and hauling problems of your own business.

The Kissel Truck owners of today made their final choice because investigations proved that they were built on correct mechanical principles, insuring satisfactory and continuous service and performance.

Take the nationally known corporations and industries that employ fleets of Kissel Trucks. Their purchasing experts made no half-hearted investigations; they knew that the rise or fall of their business institutions depended on the successful solution of their transportation problems. Consequently their investigations were sweeping in every detail—they were investigations that only transportation experts know how to make.

Their experience had taught them that a truck in order to endure and survive the grill of exceptional demands and conditions must be built unusually strong. They found that this was the dominating thought in every step of Kissel truck construction, from the selection of material, the testing of the steel and other components, the liberal dimensions and highest grade construction of the frame, axles, springs, brakes, etc.—up to the famous Kissel-built power-plant specially designed for motor truck requirements.

And when it came to a final checking up, the result which caused their decision was that a Kissel Truck chassis was a scientific achievement, strongly built and perfectly balanced.

The unusual transportation demands now being made on every manufacturer and industry, necessitates every truck purchaser taking the chance out of truck buying—the uncertainty out of truck performance—the risk out of truck investing. The great importance of your transportation equipment keeping pace with your production facilities is too vital to trust to any truck but the one that fits your problems.

Kissel long ago found that no two transportation problems are alike. Each requires individual study, intelligent analysis. Your nearest Kissel dealer is prepared to show you how the perfection to which Kissel Trucks have been brought is your protection—protection in your investment—in your haulage delivery and shipping department—in your present and future volume of business.

Every Kissel Truck represents eleven years of truck experience and experiments—investigations and tests—with never a failure—and the first Kissel Truck still in active service.

This calls for a truck with unlimited hill-climbing power, speed ability on good roads, wear-durability on bad roads, emergency capacity, rapidity of loading and unloading, ease of operating and driving in traffic zones at low upkeep. These truck requisites that are built into Kissel Trucks are absolutely necessary to solve the unusual readjustment transportation problems which every manufacturer and industry has been called upon to face.

Purchase motor trucks as you purchase any other part of your equipment. You will find it's a good business practice from every standpoint.

Kissel Truck dealers are in every principal city. Literature on request.

Kissel Motor Car Co.
Hartford, Wis., U.S.A.

To Tractor Manufacturers

Reconstruction has given birth to countless tractor problems.

Sources of raw materials are uncertain — trade channels are blocked — local conditions in your new territories unknown —problems of manufacturing and equipment are many.

Appreciating the need of the tractor industry for an absolutely reliable source of supply for bolts and nuts, we are now in a position to give special attention to the tractor manufacturer.

A Tractor Is Often Operated Far From the "Base of Supplies"

UNLIKE the driver of the touring car or limousine the operator of a tractor cannot run his machine around the corner to a garage. Repairs must often be made on the field and the successful tractor must be as near "repair proof" as it is possible to make it.

Bolts, nuts and rivets form a super-important part of tractor assembly if a "repair proof" condition is to be attained. Protect the tractors you build from bolt, nut and rivet breaking and stripping by using the brand that has won nation wide renown.

RUSSELL, BURDSALL & WARD BOLT & NUT COMPANY

PEMBERWICK, CONN **PORT CHESTER, NEW YORK** ROCK FALLS, ILLINOIS

Makers of Bolts, Nuts and Rivets Since 1845

WANTED—A MAN

THE President of a well-known nationally advertised motor truck concern desires to be relieved of some of the important details of administering the affairs of the organization. He requires the services of

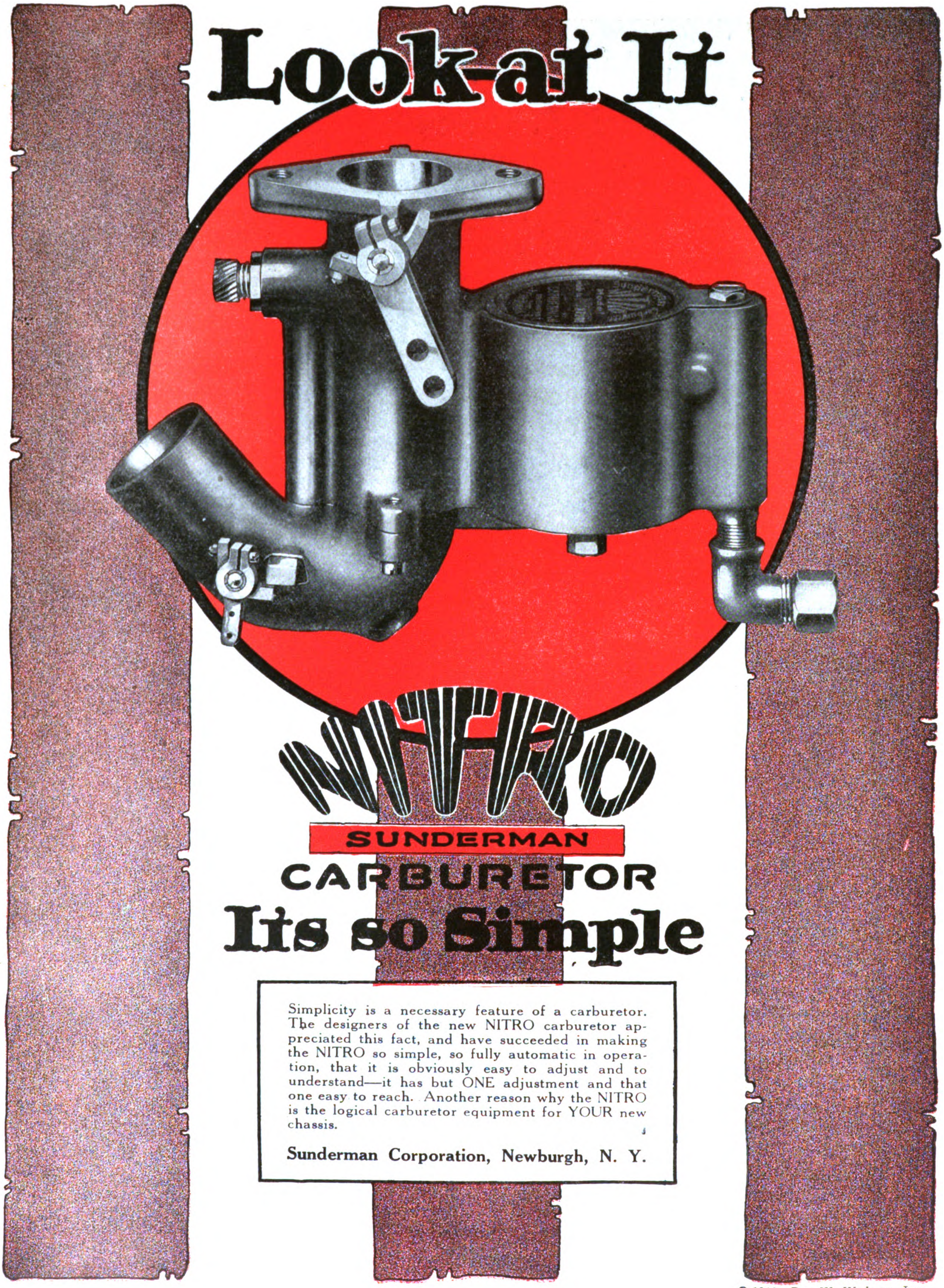
A General Manager

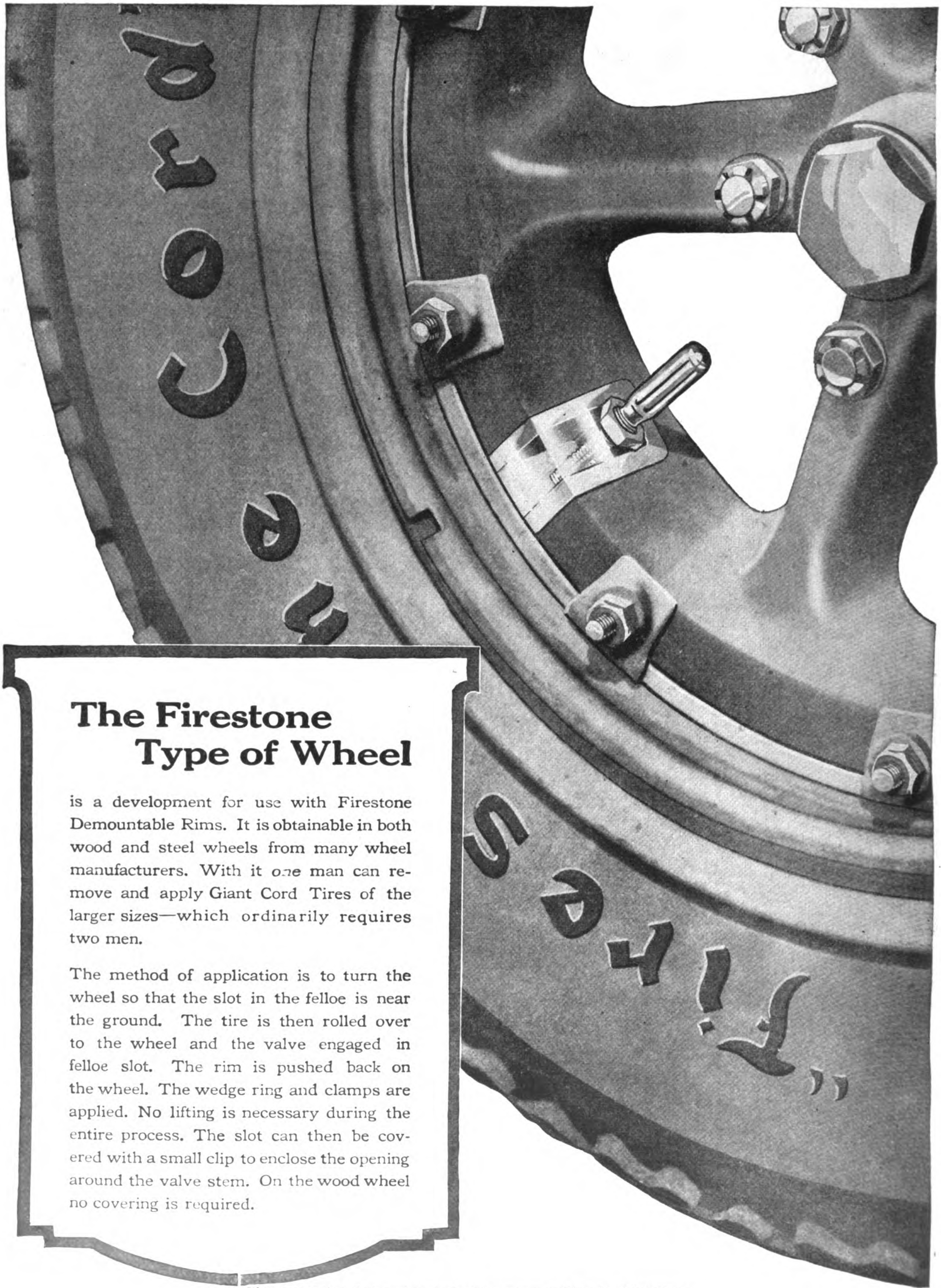
A man with a record of success in the truck field—a man who thoroughly understands the merchandising of a high grade truck—who knows the retail selling angle—the distribution problems—the manufacturers' problem and can make good. Of course, he must have energy, initiative and progressiveness enough to shoulder responsibility and discharge it with promptness and efficiency. To such a man an unusual opportunity is offered and a salary commensurate with the size of the job will be forthcoming.

Applicants are requested to write in complete detail in their first letter, the contents of which will be held in strict confidence.

Address—The President—personal, Box 411

AUTOMOTIVE INDUSTRIES


Look at It
NITRO
SUNDERMAN
CARBURETOR
It's so Simple
Simplicity is a necessary feature of a carburetor. The designers of the new NITRO carburetor appreciated this fact, and have succeeded in making the NITRO so simple, so fully automatic in operation, that it is obviously easy to adjust and to understand—it has but ONE adjustment and that one easy to reach. Another reason why the NITRO is the logical carburetor equipment for YOUR new chassis.
Sunderman Corporation, Newburgh, N. Y.

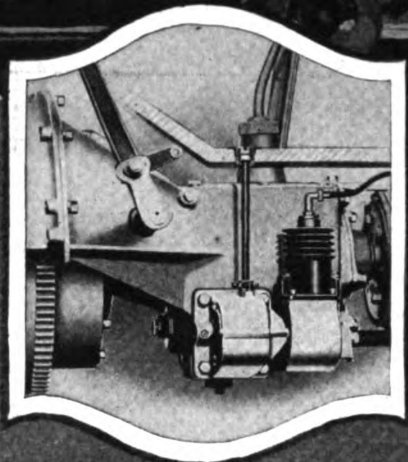


The Firestone Type of Wheel

is a development for use with Firestone Demountable Rims. It is obtainable in both wood and steel wheels from many wheel manufacturers. With it one man can remove and apply Giant Cord Tires of the larger sizes—which ordinarily requires two men.

The method of application is to turn the wheel so that the slot in the felloe is near the ground. The tire is then rolled over to the wheel and the valve engaged in felloe slot. The rim is pushed back on the wheel. The wedge ring and clamps are applied. No lifting is necessary during the entire process. The slot can then be covered with a small clip to enclose the opening around the valve stem. On the wood wheel no covering is required.


FIRESTONE has given to the Motor Truck Industry a new wheel design which puts added efficiency into the use of Giant Pneumatic Tires.
When the demand for speed in trucking centered the interest on the perfection of Giant Pneumatics, Firestone produced the rim which aided so materially the practical use of Giant Pneumatic Tires.
To further aid the industry, Firestone now offers a new thought in wheel design which makes more practicable the removal and application of Giant Pneumatics.
With this combination, it is possible for *one* man to remove the largest tire and apply an *inflated* spare tire in five minutes. It is not necessary that the man have experience to accomplish this result.
Firestone does not build wheels. But the Firestone type of wheel is obtainable from many wheel manufacturers, who have incorporated the Firestone idea in their standard wheels, thus permitting them to carry the Firestone type C Rim.
There are no royalties or restrictions involved in the use of the idea. It is the Firestone hope that the industry may profit by the use of this wheel design. Its success to date indicates that it has great value both to truck operators and drivers.
The Firestone Steel Products Co.
FIRESTONE PARK
AKRON, OHIO



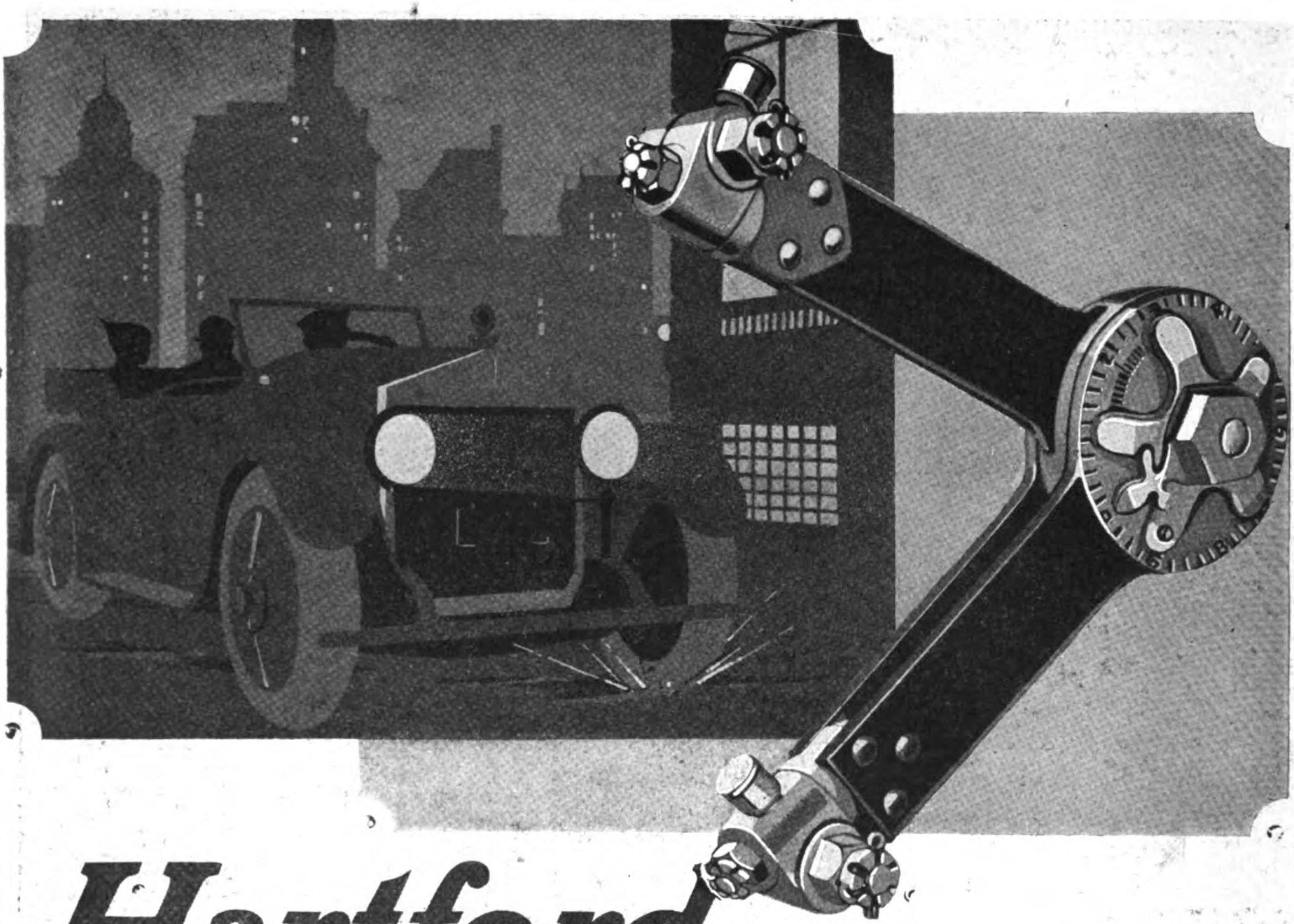
"Both are Passenger Cars"

THE light sport car and the 5th Avenue Bus are both passenger cars—but what a difference! Where the ordinary tire carrying an air pressure of 60 to 90 pounds will do for the passenger car, the heavy bus when it uses pneumatics must adopt the masterpiece of the tire maker's craft, the giant pneumatic with its pressure of from 150 to 175 pounds.

And yet the terrific pressure requirements of this big "passenger car's" tires can be met by the same make of air compressor as has served so well for its little brother—the Kellogg Engine Driven Tire Pump.

KELLOGG MFG. COMPANY
Rochester N. Y.

KELLOGG
Engine Driven
Tire Pump



Hartford SHOCK ABSORBER

THE TEST

NIGHT driving is a sure test of dependability. Irregularities in road surfaces are hard to gauge. The sledge-hammer blows dealt a car by these bumps hasten it to the junk pile, and are a source of continual discomfort to occupants.

Recommend that your customers protect their cars and themselves by equipping with Hartford Shock Absorbers. Night driving will be made a pleasure, for the Hartford will take a car over the ordinary bumps smoothly and evenly. You will win happy, satisfied customers, who will bring you new friends.

And then figure the net profit to yourself. If you handle this line in addition to your agency, you get a generous profit on the sales of the Hartford plus your original profit on the car you sell.

The Hartford is part of the factory equipment of most of America's finest cars. This, in itself, is proof positive that it is the leader in its field. It has been the leader for fifteen years.

Write us for our dealer proposition and details regarding our national advertising campaign and attractive literature and dealer helps.

The Hartford line includes two other big sellers that it will pay you to stock—**Hartford Spring Bumper** and **Hartford Auto Jack.**

EDWARD V. HARTFORD, Inc. **144 Morgan Street, Jersey City, N. J.**

Factory Branches—BOSTON: 319-325 Columbus Ave. CHICAGO: 1716 Michigan Ave.

"The Pick of the Field"

The Peak of Power

The Herschell-Spillman "4" tops its class in power—develops driving force enough to propel your passenger car or light truck into fame and demand on a performance basis.

The Herschell-Spillman "4" is a 100% Engine. It has the ability to perform and the courage to endure on this basis.

Write for Facts

THE HERSCHELL-SPILLMAN MOTOR CO.

North Tonawanda **New York, U. S. A.**

Jack your car on ball bearings

A FEW easy turns on the long handle and your car is raised. To lower it, merely reverse the turns and pull the jack out by the handle.

You perform every operation without once getting under the car.

The diamond point hardened steel top with *bull-dog* grip bites the axle and holds it firm. There is no danger of slipping. You can avoid having the tire rim fall on a deflated tire.

Kimball Jacks sell fast because every time you use this jack you give a demonstration. Motorists everywhere want the Kimball because it is reliable and easy to use. Stock it and sell more jacks.

PRICES

Size	Minimum Height	Extended Height	Price
No. 1	9 in.	15 in.	$7.00
No. 3	11 in.	18 in.	7.00
No. 4	12 in.	20 in.	7.00

Kimball Special Truck Jack that easily raises any style truck sells for $15.00.

Every operation of raising and lowering ***without even*** *stooping. You can avoid dirt and grease, eliminate all chance of ruining clothing and injuring hands.*

KIMBALL AUTO BALL BEARING JACK

SALES DEPARTMENT

Edward A. Cassidy Company, Inc.

Madison Ave. at 40th St., New York

Manufacturers, F. W. Mann Company, Milford, Mass.

Ralph K. Mulford, Jr., in Daddy's Car day of race

Same tires after the race

AGAIN BRAENDER TIRES WIN!

On Ralph Mulford's Frontenac Car
at Sheepshead Speedway, June 14, 1919

First in Thirty Mile Race. Time, 16 min. 20 3/5 sec.
Beats old record by 11 1/5 sec.
First in Ten Mile Special. Time, 5 min. 24 1/5 sec.
Second in First Ten Mile Race (1/5 second behind the winner).
Time, 5 min. 20 2/5 sec.
Beats old record by 3 2/5 sec.

Leading the first 9 laps in the 50 mile Race. Discontinued on account of broken piston.

WORLD'S RECORDS SMASHED

for 10 and 30 mile events.
Average speed 110 and 112 Miles per hour.

BRAENDER TIRES

Unequalled for Speed, Endurance and Economy.

Not a single Braender Tire was changed at Indianapolis Speedway May 30, 1913, when the four Braenders on Mulford's Mercedes carried the heaviest car in the race the entire 500 miles.

BRAENDER RUBBER & TIRE COMPANY, Factory, Rutherford, N. J.

BRANCHES:

Chicago	New York	Philadelphia
64-72 E. 14th St.	32 Broadway	1352 W. Girard Ave.

New York Sun, June 8, 1919

NASH QUADS WIN ARMY SHOW HONORS

Get First and Third Prizes in Sayn, Germany.

From "across the Rhine" comes testimony by the American Army of Occupation of further distinction accorded the famous Nash Quad. Word that two Quads have been awarded first and third prizes respectively in the Divisional Motor Show of the Thirty-second Division has just been received by the Nash Motors Company.

Requirements under which the prizes were awarded were based upon military standards and were very rigid. That the two Quads secured top honors is another tribute to the dependability, durability and performance of the Quad.

Information concerning the outcome of the divisional show came in the form of a letter from Capt. Edward Dayton. The show was held at Sayn, Germany, near Coblenz, and was looked upon by army officers as one of the most important events to be held during the period of occupation.

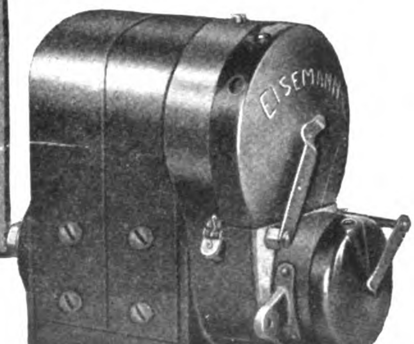
The winning Quad, Capt. Dayton states, had to its credit a record of 5,000 miles, the awards, he says, having been based on the number of miles driven, the mechanical condition and the general appearance.

"The Quads had seen considerable usage," relates Capt. Dayton, "and the men in this organization were especially interested in the outcome."

During the war period the Nash Motors Company built more than 12,500 Nash Quads for military purposes.

Of Course, They're Equipped with the

EISEMANN MAGNETO



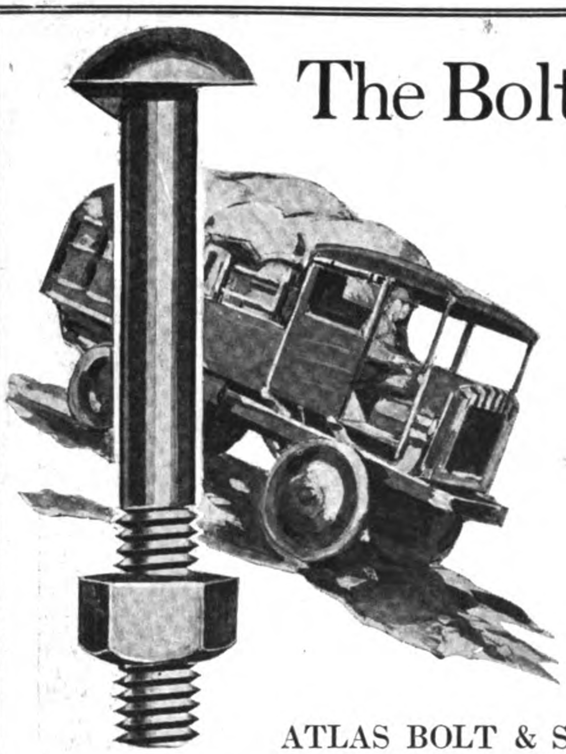
The vast majority of all trucks used by our Government in France were Eisemann-equipped—in the Ordnance, Signal Corps, Quartermaster, Ambulance and Medical Departments.

The magneto is the best ignition—
The Eisemann is the best magneto!

THE EISEMANN MAGNETO CO.

32 Thirty-third St., Brooklyn, N. Y.

Chicago: 910 So. Michigan Ave. Detroit: 85 Willis Ave., West.



The Bolts That Hold Their Own

in service—in accuracy—in delivery are the ones you will choose to uphold your reputation as a builder of trucks, tractors or passenger cars that will stand the strain of unexpected stresses.

ATLAS

BOLTS—SCREWS—RIVETS

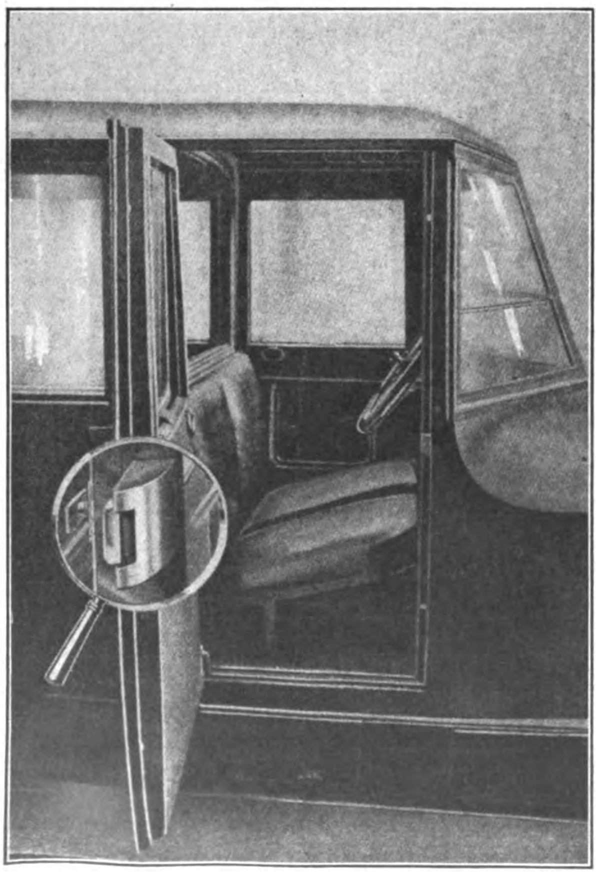
are proof against breakage and stripping because they are made right and carefully all the way through from the raw material (carefully tested steel) to the final exacting inspection to insure accuracy. The accuracy of Atlas Products counts big in assembling—it steps up production.

Highest Quality—Exacting Accuracy—Prompt Delivery

ATLAS BOLT & SCREW CO., Cleveland, Ohio

BOLT AND SCREW MAKERS TO THE AUTOMOTIVE INDUSTRY

Send for Our Interesting, Useful Catalog



Above illustration shows the "SEARS-CROSS LOCK" (as magnified) installed on door of a closed body

"SEARS-CROSS LOCK"

FOR AUTOMOBILE DOORS

"The Lock With The Expanding Latch"

(Manufactured under the Ottinger Patents)

It Prevents Rattling of Doors
Insures Positive Safety Protection Against Doors Opening Accidentally
Overcomes Present Difficulty in Opening and Closing of Doors
and
Automatically Takes Up Wear

The outward pressure of the rubber stops is taken care of by the inward pressure of the Expanding Latch which holds the doors tight so that they cannot rattle. The holding pressure is supplied by the lock and not by the rubber stops.

The only perfect automobile door lock. Brings about economy in cost of installation. Made for all priced cars, open and enclosed bodies.

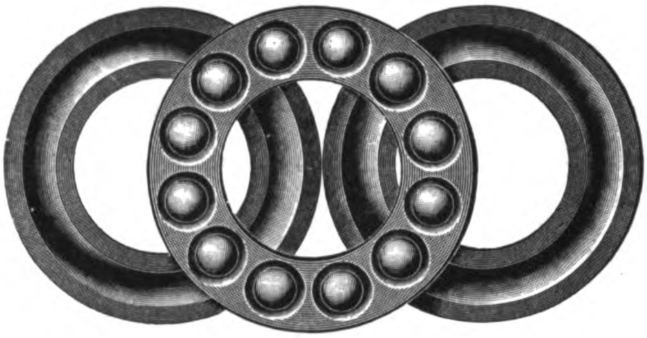
SEARS-CROSS CO.

Bush Terminal BROOKLYN, N. Y.

BANTAM = QUALITY DURABILITY SERVICE

BALL THRUST BEARINGS

20 YEARS EXPERIENCE



20 YEARS SUCCESS

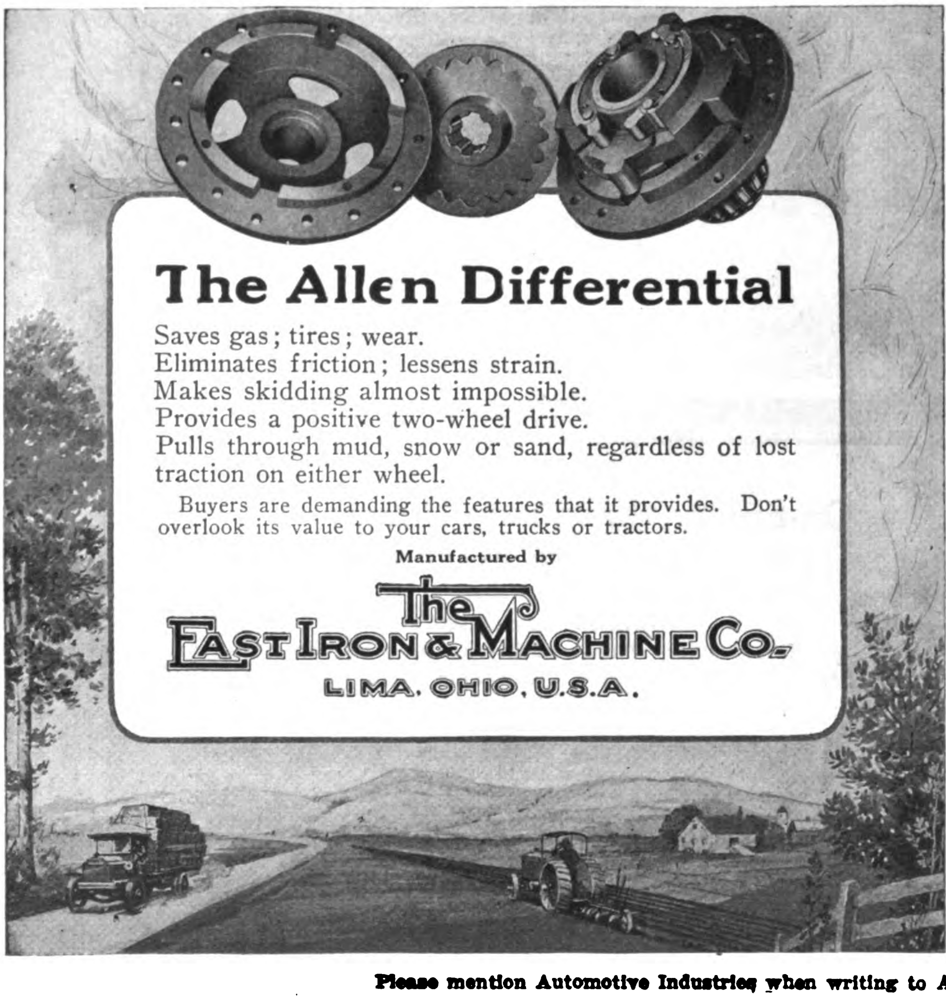
OUR CATALOG TELLS THE STORY

PACIFIC OFFICE
F. M. Cobbledick Co.
693 Mission Street
San Francisco, Cal.

THE BANTAM BALL BEARING COMPANY

BANTAM, CONN.

DETROIT OFFICE
905 Dime Bank Building
DETROIT, MICH.



Why Skid?

The Allen Differential Will Stop It

It is a wonderfully efficient mechanism; gearless, frictionless, self-locking. The nearest approach to a solid axle of any mechanism, as yet invented, that affords positive compensation.

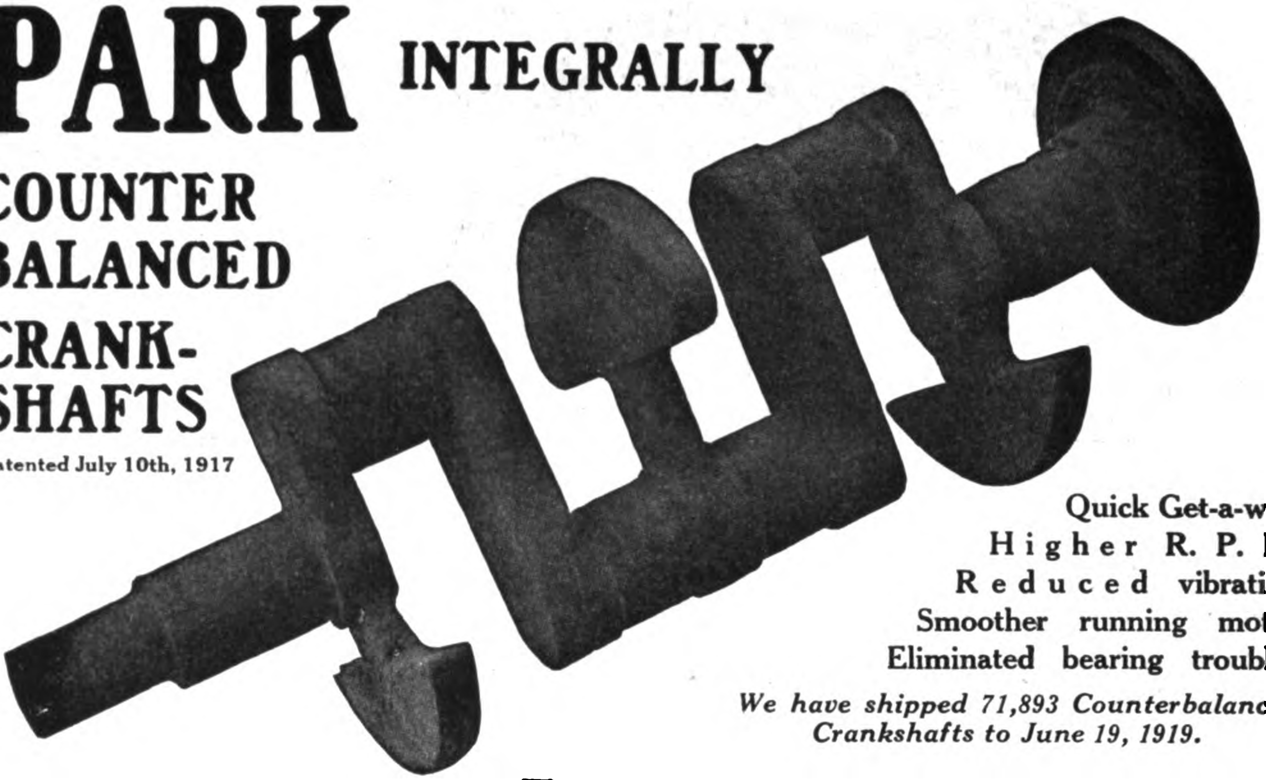
Eliminates all mechanical resistance against the motor, and greatly increases motive power.

A positive safety device; saves lives; trouble; worry; expense.

Think what these features mean as selling points for your cars or trucks.

PARK INTEGRALLY COUNTER BALANCED CRANK-SHAFTS

Patented July 10th, 1917



Quick Get-a-way
Higher R. P. M.
Reduced vibration
Smoother running motor
Eliminated bearing troubles

We have shipped 71,893 Counterbalanced Crankshafts to June 19, 1919.

The Park Drop Forge Co.
Cleveland

NUTS

READY FOR DELIVERY

Plain and Castellated—
S.A.E.

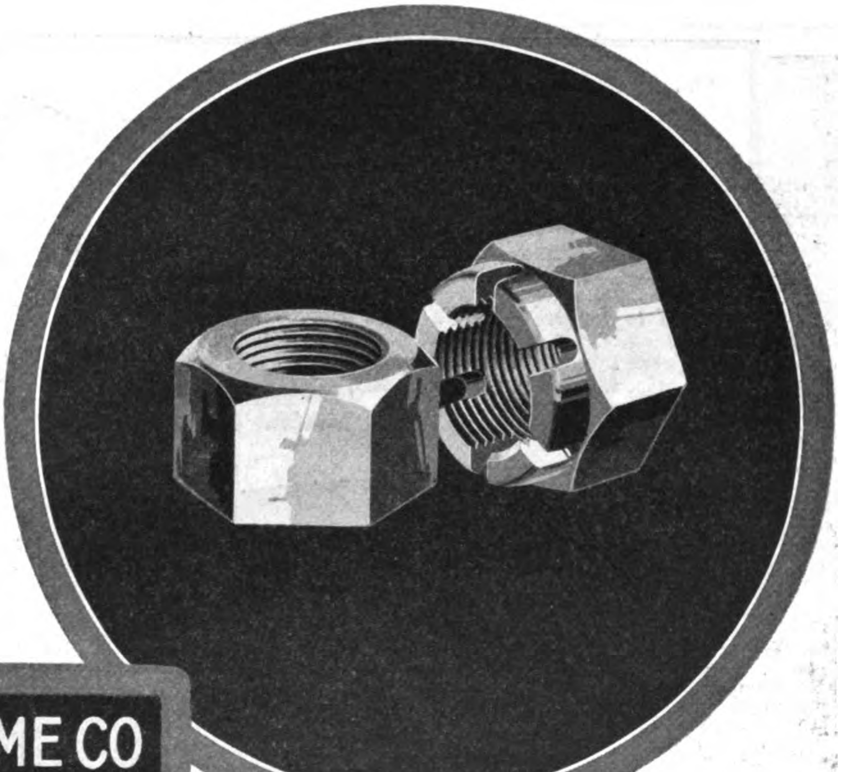
Also

SCREWS

Cap—S.A.E. and U.S.S.
Set—U.S.S.

SPECIALS

made to customers' specifications up to 2¼" diameter, 10½" long. Quotations on samples or blue prints.



THE NATIONAL ACME CO
CLEVELAND OHIO
NEW YORK BOSTON CHICAGO
DETROIT SAN FRANCISCO ATLANTA

Quality

ENGINEERING practice in America has established the ball bearing as an essential in the best motor vehicles.

Based on competitive tests and actual past experience the preference of engineers seems to be focused on the New Departure line of Double Row, Single Row, Radax and Magneto Ball Bearings.

The "Ball Bearing Manual" is a new booklet of special value to those interested in bearing care and methods of assembly.

THE NEW DEPARTURE MFG. CO.,
Bristol, Conn.
451

New Departure Ball Bearings

Try Diamond Fibre

If you need a tough, light weight material—high in tensile, shearing and compression strength—a non-conductor of electricity—a material with a high coefficient of friction—and one not affected by oil or grease—use Diamond Fibre.

If you need a material that will cut, thread, stamp or machine into any conceivable shape—with little wear on tools—a material that will do almost anything but mould—use Diamond Fibre.

Manufacturers in almost every line, Engineers, Electricians, Automobile Makers everywhere are daily finding new uses for this remarkable material. Perhaps it will help you in your business.

Supplied in sheets, rods, tubes and special shapes.

Diamond-F

We manufacture CELERON and CONDENSITE-CELERON—two remarkable, new water-resisting materials.

We also make the well-known line of DIAMOND-F PROTECTIVE PAPERS for food products, etc.

Diamond State Fibre Company

Bridgeport, Pa. Near Philadelphia.

Chicago Factory, 1656 Besley Court

The Super-Strong Link

Built to withstand solidly the severest road shock

A careful selection of the raw material, constant supervision during manufacture, a modern daylight plant and satisfied workmen combine to insure a product that is truly the best. Send us specifications of your drag link, starting crank, torque and spark-and-throttle control joint assemblies. You will find our prices and delivery right.

Cincinnati Ball Crank Company

1224 Dime Bank Bldg. Detroit, Mich. Oakley, Cincinnati, Ohio.

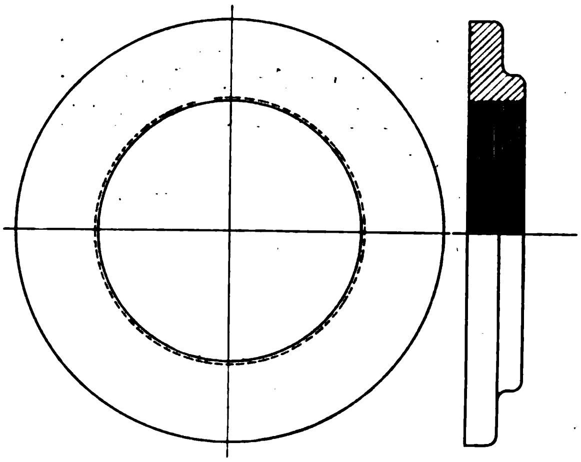
Actual Jobs—Actual Time Actual Proof

Of the Great Production Possibilities of

Smalley-General Thread Miller

No. 5

OF A SERIES



Thread 8⅜" dia., 1¾" long, 8 p. Briggs Tapered

MACHINE—Smalley-General Thread Miller No. 1 air operated collet chuck.

TIME STUDY

	Min.	Sec.
Chucking, from floor		15
Facing ⅛" feed	1	40
Adjusting hob		10
Milling	2	30
Removing from chuck		10
	—	—
Time Complete Operating, floor to floor	4 min.	45 sec.

MILLING FEED—10½" per minute. Limits .003.

Entire flange finished in one chucking. Face and threads in perfect alignment.

While this particular job may not be directly applicable to your particular business it shows the possibilities of thread milling if you cut threads in quantities.
Smalley-General Thread Millers reduce costs, increase output and insure accurate work. Send blueprints for solution of your particular Thread Milling Problems.

Smalley-General Co., Inc.

Machinery Builders

Trumbull and Water Sts., Bay City, Mich.

Eight Excellent Reasons For the Installation of a MIDDLETOWN

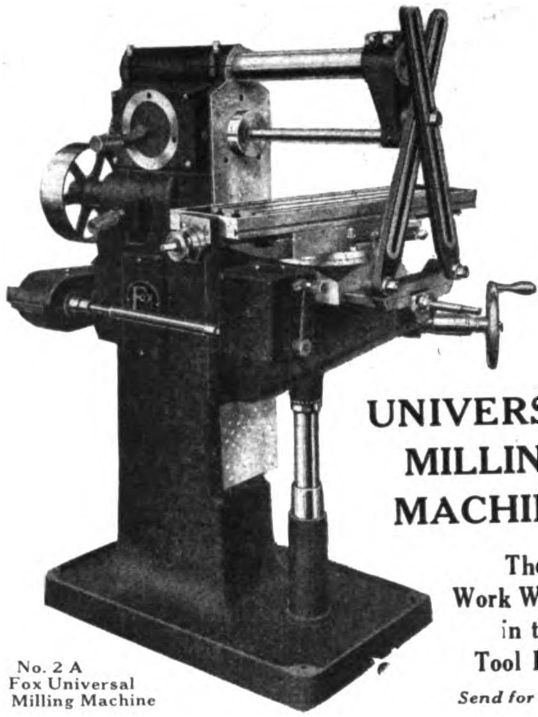
Improved CENTERING MACHINE

1. It centers round, square and octagon stock.
2. It is accurate to within one-thousandth of an inch of the outside surface.
3. It is equipped with adjustment that insures such accuracy.
4. It is provided with two speeds for hard or soft stock.
5. It is equipped with a rest for long pieces to relieve the strain on the jaws.
6. It can be easily adjusted off center for eccentric work.
7. It will take round stock from 3/16 to 3¾" diameter.
8. It is provided with a stop so that all work can be centered to a uniform depth.

Write for prices and full information.

MIDDLETOWN FIREARMS AND SPECIALTY CO.,
Incorporated
32 Warwick Street
Middletown, Conn.

FOX



No. 2 A
Fox Universal
Milling Machine

UNIVERSAL MILLING MACHINE

They Work Wonders in the Tool Room

Send for Catalog

FOX MACHINE CO.
1812 West Ganson St. Jackson. Mich.
Formerly of Grand Rapids, Mich.

The Schatz "Universal" Annular Ball Bearing

WE DO NOT HESITATE

to say that the Schatz "Universal" will operate with less attention and less lubrication without deterioration on account of the balls coming in direct contact with the races through absence of lubricant

WE DO NOT BELIEVE

that our bearing should be operated with less expensive oils or greases than other makes, but we can safely claim that improper lubrication is less likely to result in burnt bearings in the Schatz "Universal" design.

Please Send for Our Catalog.

THE FEDERAL BEARINGS CO., Inc.
26 William Street, Poughkeepsie, N. Y.
Great Britain: 37 Sheen Road, Richmond, London.

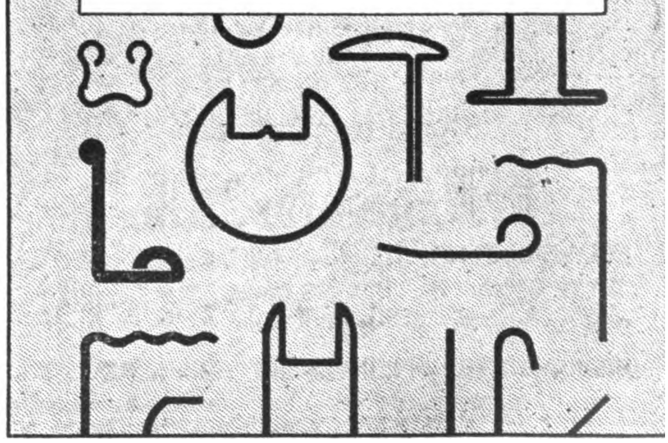
Special Steel Mouldings

We are fully equipped for quick production on all kinds of Drawn Metal Work, Mouldings and Special Shapes.

Motor Car and Body Mouldings a Specialty

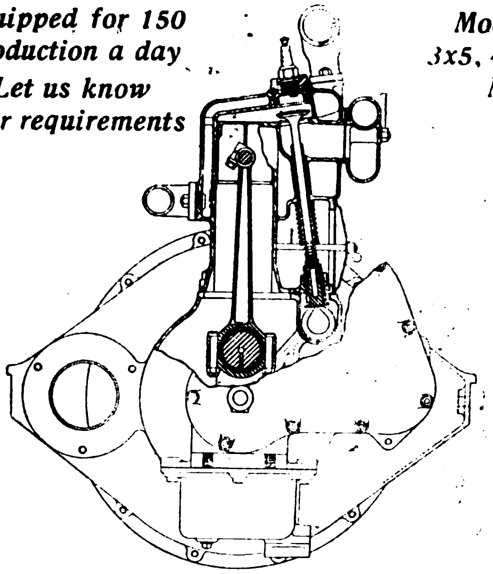
Send Blue Prints for Quotations

KAWNEER MFG. CO.
1429 Front Street Niles, Mich.



Equipped for 150 production a day
Let us know your requirements

Model "O" 3x5, 4-Cylinder Motor



3x5 Pressure feed lubrication to every bearing by geared oil pump submerged in oil pan.
Camshaft runs in a tunnel and is covered with oil at all times insuring long life and quietness. Cooling system—Thermo-syphon. Valves set at an angle bringing head of valve close to cylinder wall, insuring perfect scavenging.
Camshaft driven by noiseless gear. All gears in front end running in oil.
Crankshaft and crank pin bearings 2" in diameter, of ample length to insure long life.
Furnished with either open or enclosed flywheel. 3-point suspension. All working parts completely enclosed.

We make motors for large or small passenger cars, trucks and tractors. Write us for full information.

TURNER & MOORE MFG. CO.
Detroit, U. S. A.

WIRE

IGNITION AIRPLANE SPRINGS

Everything in Wire

SEND FOR DESCRIPTIVE CATALOGUES

American Steel & Wire Company

CHICAGO
NEW YORK
CLEVELAND
PITTSBURG
DENVER
U. S. STEEL PRODUCTS CO.

RADIATORS

AUTOMOBILE
TRUCK
TRACTOR

Capacity 600 Radiators per day

(Cores for all makes)

B. & W. Manufacturing Co.
5235-57 Ravenswood Avenue

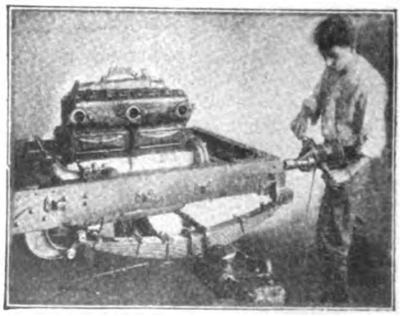
CHICAGO ILLINOIS

It Is Economical to Take the Drill to the Work

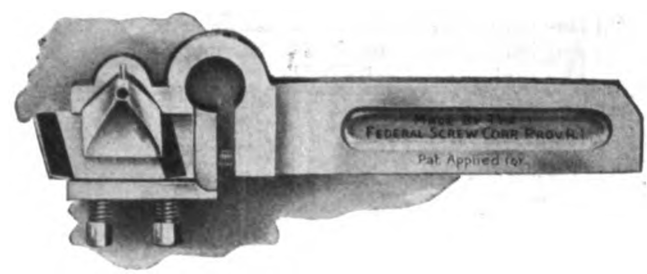
"The Standard" Portable Electric Drill

is the tool for such work. Easily portable to the job.

And when on the job it works efficiently — without fear of breakage or burn-outs. High-powered, force-ventilated, it does not overheat. It is ball bearing throughout — bearings running in grease. The motor is dustproof, oil-proof, waterproof. Upkeep practically eliminated. Operates on either direct or alternating current.



The Standard Electric Tool Co.
Cincinnati, Ohio, U. S. A.



Parallel Sides

Make it possible to remove the cutter and return it to place without changing the original position of the holder, when a

FEDERAL Threading Tool Holder

is used. For the same reason the cutter can be reversed for roughing and finishing cuts without disturbing the holder.

Three hardened screws hold the cutter in position and FEDERAL cutters, being standard, are interchangeable. Specify form and pitch of cutters you require and send for a FEDERAL on

10 DAYS' TRIAL

Descriptive folder sent on request.

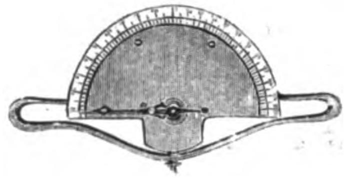
FEDERAL PRODUCTS CORP.

393 Harris Ave. Providence, R. I.

The Test of Strength

If you want to test the draught of motors, tractors, etc., there is a particular

CHATILLON Dynamometer



which will best meet your requirements.

The accuracy, serviceability and reliability of Chatillon Dynamometers are universally recognized. Each type is designed, constructed and perfected to meet the requirements of the class of work for which it was developed. Equipped with extra pointers, which are loose and remain at the point of maximum strain after the load is removed. This facilitates ease and rapidity of testing.

Write for Particulars

JOHN CHATILLON & SONS

Established 1835

85 Cliff Street New York City

Where Higher Price Means Lower Cost

Balance the perfected workmanship of the Wisconsin—the fact that there is no fitting, adjusting, running-in to do after the motor is delivered—against its slightly higher price and you will readily understand why the Wisconsin actually costs less in the end than lower-priced engines.

A Wisconsin leaves the shop **ready to run**—all working parts adjusted to the thousandth of an inch, perfectly fitted, run-in and assembled with absolute accuracy. Then thoroughly tested and rigidly inspected.

Write for Specifications.

Connecting Rods That Stand Up

I-beam section, drop forged, of 35% carbon steel, heat treated. Babbitt-lined bronze bearings on crank shaft end; bronze bushing on wrist pin end.

WISCONSIN MOTOR MFG. CO.

Station A Dept. 310

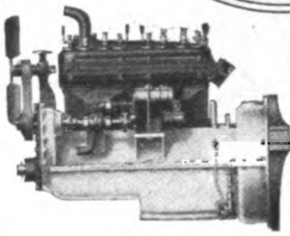
Milwaukee, Wis.

Distributors:

New York Branch: T. M. Fenner, 21 Park Row, Factory Rep.

Marine Equipment & Supply Co., 610 Arch St., Philadelphia, Pa.

Pacific Coast Distributor: Earl P. Cooper Co., 1310 So. Los Angeles St., Los Angeles, Cal.



Wisconsin

CONSISTENT

CS

DROP FORGINGS

For Every Branch of the Automotive Industry

Careful selection of steel;
New and up-to-date equipment;
Thorough inspection after each operation;
Competent supervision;
Skilled mechanics;
These are the things that enable us to turn out strictly high quality forgings from a fraction of a pound to forty or fifty pounds, either rough, partly machined, or completely machined ready for assembling.

We also manufacture and offer to the trade Electric Alloy Steels in forging bars and billets.

Send us your blueprints for estimates.

GENERAL STEEL CO.

Milwaukee Wisconsin

AUTOMOBILE Sheets

Body, Hood and Fender

This Company manufactures Sheets adapted to every phase of the industry, Auto Body Stock, Fender and Hood Stock, Crown Fender Stock; also material for Tanks, Guards, Radiators, Frames, etc.

"THURITE" Deep Drawing Stock—remarkable for its drawing qualities and behavior under dies. Write us for full information on Deep Drawing Stock, Enameling and Japanning Stock, Black Sheets of every description, Galvanized Sheets, Formed Roofing and Siding Products, Tin and Terne Plates, Black Plate, etc.

AMERICAN SHEET AND TIN PLATE COMPANY, Frick Bldg., Pittsburgh, Pa.

Export Representatives: UNITED STATES STEEL PRODUCTS COMPANY, New York, U. S. A.

GET IN TOUCH WITH

THE CROSBY COMPANY

BUFFALO, N. Y.

For Sheet Metal Stamping

of Auto Parts

A Complete Plant with Superior Equipment

Detroit Office
914 Ford Building

Cleveland Office
415 Schofield Building

Union Drawn Steel Co

Beaver Falls, Pa.

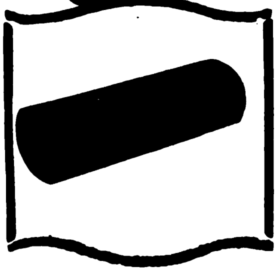
Manufacturers of

BRIGHT FINISHED STEEL SHAFTING, SCREW STEEL, CHROME NICKEL and CHROME VANADIUM STEELS in FLATS, SQUARES, ROUNDS, HEXAGONS and SHAPES; also ELEVATOR GUIDES.

BRANCH OFFICES: Boston, Buffalo
BRANCH OFFICES AND WAREHOUSES: Chicago, Cincinnati, Detroit, New York and Philadelphia

---

Champion



Tanks—Hoods—Fenders

The name Champion signifies quality—service for the life of the truck.

These parts are constructed of the best material by skilled workmen. Prompt deliveries will be made to any part of the country.

Quotations furnished on request.

Champion Milk Cooler Co.
Cortland New York

Aluminum Company of America

General Sales Office, 2400 Oliver Bldg.
PITTSBURGH, PA.

PRODUCERS OF ALUMINUM

Manufacturers of

Electrical Conductors for Industrial Railway and Commercial Power Distribution

also

Ingot, Sheet, Tubing, Rod, Rivets, Moulding, Extruded Shapes

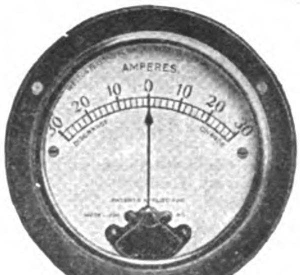
also

Litot Aluminum Solders and Flux

Canada: Northern Aluminum Company, Ltd., Toronto.
England: Northern Aluminum Company, Ltd., London.
Latin America: Aluminum Co. of South America, Pittsburgh, Pa.

Don't Kill the Joy of Motoring!

If the driver has to worry perpetually over the condition of his storage battery, never knowing definitely whether he is recharging or discharging, there is very little real comfort in motoring. Sooner or later this will react upon the manufacturer. Put a



Weston

MODEL 354 AMMETER

on the Dashboard or Cowl

and a glance will always tell the driver whether he is maintaining the proper condition of his battery. Don't fool with unknown substitutes, which will injure the prestige of your product. Write us.

Weston Electrical Instrument Co.
8 Weston Ave., Newark, N. J.
Branch Offices in the Larger Cities

"Sterling" Universal Joint

Designed and built for passenger automobiles and trucks
A Joint typical of its name

The **BEARINGS COMPANY of AMERICA**
LANCASTER PENNA.
Western Sales Office
1012 Ford Building. Detroit. Mich.

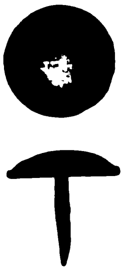
IF you would have your workmen take pride in their work then supply them with good tools—tools to be proud of—like Lakeside *guaranteed* Tools.

These drop forged, case-hardened—absolutely accurate Lakeside Tools delight the master workman. They are right in design, material and workmanship.

Write for catalog and prices.

Lakeside Forge Company
Erie Penna.

LAKESIDE FORGINGS



Lethermet Nails

Body builders who use these nails demand something more than the ordinary upholstery nail—that's why they use Lethermet Nails.

Lethermet Nails come enameled to match practically any shade of leather or upholstering in plain or Spanish effects. Send for our catalog containing prices.

THE BREWER-TITCHENER CORP.

Makers of Standard Body Parts

CORTLAND NEW YORK

The Production Doctor:

If you are in a position to do more work than you have facilities for:

Turn the whole job over to the Wilton Organization. From the initial step to the finished job Wilton can handle it all—drawings, tools, jigs, dies, fixtures, gauges, shop methods, production parts and—finished jobs if necessary.

WILTON TOOL & MFG. CO.

BOSTON, MASS.

Cleveland Detroit Chicago

Our Metal Stampings Will Substantially Improve Your Product.

Let Us Show You.

100% STAMPINGS

For Every Purpose

Inquiries to Nearest Office

PHILADELPHIA

New York Chicago Detroit
Washington St. Louis San Francisco

HALE & KILBURN CORP.

When You Hear of 90-10 It Means

The Famous Tin-Copper Alloy

FAHRIC ANTI-FRICTION METAL

THE BEST BEARING METAL ON THE MARKET

For service in Aeroplane, Truck or any other engine bearing. This alloy made by our special process is used like a regular babbit, but is superior in anti-friction qualities and durability.

The only one we make—the only ones that make it

FAHRIC METAL COMPANY

34 COMMERCE STREET, NEW YORK

Any Style Hood — Custom Made

Hoods for truck, tractor or passenger car made to your specifications. They are accurately formed, carefully inspected and assure a perfect fit.

Our plant takes care of the entire job—we make our own dies and our own large presses turn out work according to schedule. finished either dip or painting process in our enameling room.

We make sheet metal parts for automobiles, trucks and tractors.

York Corrugating Company

York Penna.

LIGHT AND HEAVY METAL

STAMPING

WORCESTER PRESSED STEEL COMPANY

WORCESTER MASS.

For Automobiles, Tractors, Trucks

HENRY & ALLEN, AUBURN, N.Y.

THE "RACINE"

"Standard The World Over"

High Speed Metal Cutting Machine

Is Built on Scientific Principles

A Complete Line—Advise us of your requirements and we will quote you on a machine adapted to your particular demands.

Use "Racine" H. S. Tungsten Power Blades

Our catalog "K" will show you how. Write for i today

RACINE TOOL AND MACHINE COMPANY,

Racine, Wis., U. S. A.

Dyneto TRADE MARK REGISTERED

Electric Starting and Lighting Systems

SINGLE UNIT and TWO UNIT Equipments

Booklet on Special Ford Equipment

DYNETO ELECTRIC CO., Syracuse, N. Y.

ECLIPSE BENDIX DRIVE

ECLIPSE

For Electric Starters

AUTOMATIC ENGAGING AND DISENGAGING

Used by 170 motor car and truck builders

ECLIPSE MACHINE CO. ELMIRA, NEW YORK.

MATTHEWS Auto & Truck MOTORS

Now released from Government service, 4-cylinder, 3½-in. x 5-in. Prompt deliveries. Write for full information.

The Matthews Engineering Co., Sandusky, Ohio

HERCULES Heavy Duty Truck and Tractor MOTORS

5 SIZES

For a dependable motor to fit your requirements

WRITE

STAY PUT

The Hercules Motor Mfg. Co. Canton, Ohio

RLM

The Superior Radium Self Luminant FOR WATCHES, CLOCKS, INSTRUMENTS.

Radium Luminous Material Corporation

55 Liberty Street, New York City.

O'BANNON COATED FABRICS

O'BANNON LEATHER REG. U. S. PAT. OFF.

Top and Upholstery Material

O'Bannon Corporation

200 Fifth Ave. New York, N. Y.

Strom BEARINGS

U. S. BALL BEARING MFG. CO.

(Conrad Patent Licensee)

PALMER STREET AND KOLMAR AVENUE, CHICAGO, ILL.

Waukesha TRADE MARK

4-CYLINDER MOTORS

FOR TRUCKS AND TRACTORS

Are the Product of the World's Largest Organization Devoted to the Building of Truck and Tractor Motors Exclusively.

WAUKESHA MOTOR CO.

WAUKESHA, WIS.

Truck Manufacturers Are Furnishing Detroit Weatherproof Cabs as Standard Equipment.

On motor truck cabs this trade mark is a symbol of highest quality just as it so identifies weatherproof bodies for passenger cars.

Sturdy, roomy, "non-rattling" truck cabs are in universal demand. Comfort to drivers is as essential as warmth, light and good ventilation are to factory operators.

Detroit Weatherproof cabs are light in weight, have ample capacity to seat three husky men, plenty of leg room, doors slide up and down (not on hinges), and the reinforcements result in great resistance to vibration and severe service.

We invite discussion of cabs with manufacturers and distributors of trucks.

Detroit Weatherproof Body Co.
Pontiac, Michigan.

SOCKET WRENCHES
FOR EVERY
MOTOR NECESSITY

WALDEN WORCESTER WRENCHES

TRUCKS TRACTORS
PASSENGER CARS
GENERAL MECHANICAL SERV CE

WALDEN-WORCESTER
Incorporated
General Offices and Factory: Worcester, Mass.

CHICAGO 452 Monadnock Bldg. — NEW YORK 295 Broadway — SAN FRANCISCO 643 New Call Bldg.

Write for Catalog No. 400

"DEFIES TIME AND THE ELEMENTS"

CHASE DREDNAUT Motor Topping

Write for Samples and Particulars

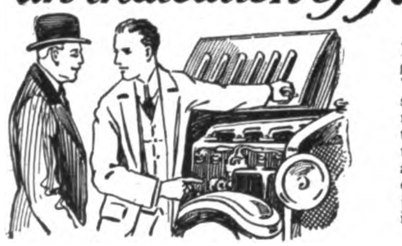
L. C. CHASE & CO., BOSTON
New York San Francisco Detroit Chicago

MERCER MOTOR CARS

THE Mercer shield is the badge of fastidious taste in automobiles. Mercer means the utmost in substantial smartness, riding comfort, and power. The possessor of a Mercer invariably feels a bit better satisfied than the owner of another car. Correspondence from dealers invited.

MERCER AUTOMOBILE COMPANY
400 Whitehead Road Trenton, N. J.

"NORMA" Equipped -an indication of full Value



Magnetos and lighting generators with "NORMA" Bearings are standard equipment on so many high-grade cars, trucks and tractors, that to say that its electrical apparatus is "NORMA" equipped is a conclusive indication of full value in any machine.

THE NORMA COMPANY OF AMERICA
1790 Broadway NEW YORK

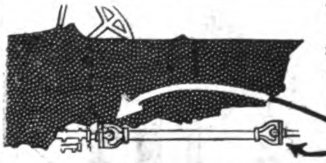
THE HOUSE OF SUNSHINE

HOTEL HAMILTON

73d St., bet. Col. Ave. and Broadway
New York City

An ideal family hotel situated in a refined section, catering to a select clientele. All the comforts of a private home without housekeeping cares.

A Short Distance from the Leading Shops, Theatres, etc.

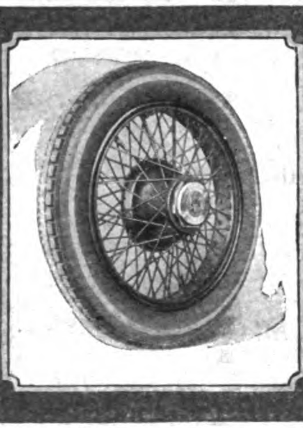


Use it in the Universal Joints

TRADE MARK NON-FLUID OIL REGISTERED IN UNITED STATES PATENT OFFICE

Stands the severe test of hard rubbing-won't let Joints get hot

"KOOO" for Bearings • "KOO Special" for Gears
IN ORANGE CANS AT ALL DEALERS
New York & New Jersey Lubricant Co. 165 Broadway, New York



PASCO WIRE WHEELS

Every Pasco wheel is perfectly balanced and absolutely true. These rust proof wheels are of standard tread—interchangeable with wooden wheels. The spokes will not interfere with any valve stem.

Pasco wheels have indestructible metal hubs, strong web spoke lacing and are locked to axle with double lock nuts. Write for dealer proposition.

NATIONAL WIRE WHEEL WORKS, Inc.
GENEVA, NEW YORK

Ignition Cable
Starting Cable
Lighting Cable

Our cables are used on many of the leading makes of Automobiles.

BOSTON INSULATED WIRE & CABLE CO.
BOSTON, MASS. DETROIT, MICH.

The PERFECT STARTER for Trucks, Farm Tractors and Airplanes

(See page advertisement in last issue of Automotive Industries)

The MOTOR-COMPRESSOR Co.
Makers of Starting Devices and 2-Stage Compressors
52-60 DICKERSON ST., NEWARK, N. J.

HOUDAILLE HYDRAULIC SUSPENSION
(Hoo-die)

Endorsed by the leading foreign and American engineers—the equipment on ultra quality cars—the Houdailles are the only suspensions for fine cars. They check the rebound that racks a car to ruin. Write for particulars.

HOUDE ENGINEERING CORP.
1400 West Ave. Buffalo, N. Y.

Make Your Hand Miller a UNIVERSAL MACHINE

Export Dept., 77 Broad St., New York City

Whiting & Comstock's Semi-Universal Dividing Head does it.
The head swivels 180° on base, 90° each side of center line. Also 30° above and 10° below. Capacity ¾ collet.
Built by Whiting & Comstock Hartford, Ct.

Verilite Castings Ingots The Matchless White Metal

LIGHT AS ALUMINUM
DURABLE AS STEEL

Verilite Metals Company
Brass, Bronze and Aluminum Castings
438 E. Girard Avenue
PHILADELPHIA

MEMBER A. S. M. E. MEMBER S. A. E.

CORNELIUS T. MYERS
(Detroit, Mich.)
CONSULTING ENGINEER

Design—Tests—Reports—Construction—Development. Magazine Oiling System for Chassis Parts and Universal Joints

Box 25, Avenel, N. J.

J. H. W. KERSTON, M. E.

TRADE MARK

INTERNAL COMBUSTION ENGINES
—MOTOR CARS

Temporary Address, Hotel McAlpin, New York

CONSULTING ENGINEER

J. N. LAPOINTE CO.
of
NEW LONDON, CONN.

Makers of Broaching Machines and Broaches.

BROWN-LIPE
TRANSMISSIONS
Factories & General Offices Syracuse N.Y.
DIFFERENTIALS
BROWN-LIPE-CHAPIN

A gear engineering knowledge gained through 30 years of gear designing and gear building.

New Process Gears

Syracuse N. Y.

MAXILENT
HOMOGENEOUS
STEEL TUBING
THE MAXIM SILENCER COMPANY
5 HOMESTEAD AVE., HARTFORD, CONN.

G&O Radiators

For Trucks, Passenger Cars, Airplanes and Tractors

THE G & O MFG. CO., New Haven, Conn.

Seamless Helical Tube Radiators

are used on the best and highest priced trucks and tractors. They are guaranteed for the life of the motor.

Rome-Turney Radiator Company, Rome, N. Y.

Duesenberg
The Power of the Hour

DUESENBERG MOTORS CORP. 120 BROADWAY, NEW YORK CITY
Contractors to the United States Government

Weidely for Trucks and Tractors

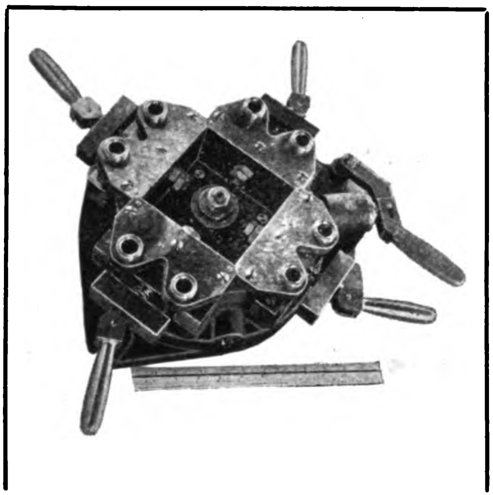
BULL DOG MOTORS

4-cylinder, valve-in-head motors, with ample bearing surfaces and lubrication for heavy duty
Details and Specifications on request
WEIDELY MOTORS COMPANY
Indianapolis, U. S. A.

FEDDERS
GENUINE HONEYCOMB RADIATORS
FEDDERS MFG. CO., Inc., BUFFALO, N. Y.

CONTRACT WORK

TOOL — TRADE MEHL MADE MARK — SERVICE



A Conference Was Held In Our Offices

A large manufacturer found that his entire product was being held up by the sluggish production of just one part. He came to Mehl with his problem. Mehl pointed to an easy solution.

This Jig Did More Than We Promised

The Mehl-Made solution of this problem was the use of a correctly designed jig—we show it above—which when placed in service did more than we claimed for it. Today Mehl-Made Jigs, Fixtures, Dies, Gages and Special Machines are helping this same manufacturer all over his plant.

The Mehl-Made staff of tool experts is at your service. Call, write, wire or 'phone.

Mehl Machine Tool & Die Co.
ROSELLE, N. J.
30 Minutes from New York City.

Send for our 32-page "Tool Service" Prospectus—it's free.

Clip the Coupon and Send TODAY

To Mehl Machine Tool & Die Co., Roselle, N. J.

Please send me my copy of your tool prospectus.

Name ....

Position ....

Company ....

Address ....

CONTRACT WORK

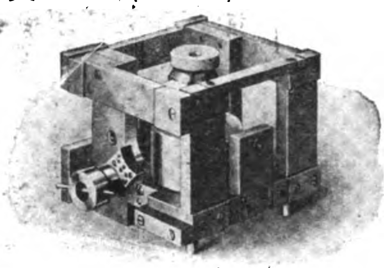
LET US BE YOUR TOOLROOM

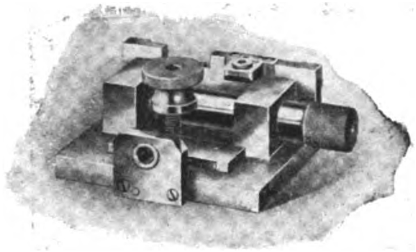
QUALITY PROMPT DELIVERY PRICE

Counts When You Contemplate Ordering

TOOLS AND PRECISION MACHINERY

35,000 Sq. Ft.
Floorspace
in Modern
Concrete
Building





New Modern
Equipment
for 300
Toolmakers

LET US TELL YOU WHAT WE CAN DO FOR YOU

ARTHUR BROCK, Jr., TOOL & MFG. WORKS, 533 North 11th Street PHILADELPHIA, PA.

Tools-Dies-Jigs Fixtures Special Machinery

Every piece of work leaving our shops carries with it our personal guarantee for absolute accuracy and endurance qualities. 25 years devoted to this business have fitted us to produce the kind of work that meets the most exacting requirements.

Write for detailed information and estimates on your work.

J. C. HEARN MACHINE WORKS
Columbus, Ohio

"A QUARTER OF A CENTURY IN THE BUSINESS"

CONTRACT WORK

Carroll
ENGINEERING SERVICE

Designing Department

Large Layout Board used for laying out all work

The Success of Your Production Plan Begins Right Here

If you're going to get into production ON TIME and with all the wheels working smoothly, your special production tools must be **correctly designed!**

We're Tool Engineers—Specialists in Tool designing and building. We **guarantee** delivery on time of **correctly designed** tools for your particular purpose—tools that will not have to be returned because of errors.

Some of the biggest and best Automotive Manufacturers rely upon us for their most important work of this character.

Our Designing Department (shown above) is of a quality and completeness far out of the ordinary. The large "Layout Board" shown is used for laying out all work before starting upon it. Our methods practically preclude the possibility of error.

We can place at your disposal a highly efficient Tool Engineering and Tool Building organization. Beginning with pattern making, every branch of our organization, including selling, engineering, designing, foundry work, heat-treating and actual tool making, is devoted to tools and tools only.
Let us send a representative to tell you about our service with a view to assisting in your tooling for manufacture.

The Carroll Engineering Company

Tool Engineers and Builders

DAYTON OHIO U. S. A.

Detroit Office:
2023 Dime Bank Bldg.

Foreign Sales Office:
American Machinery Syndicate
37 West 39th St., New York

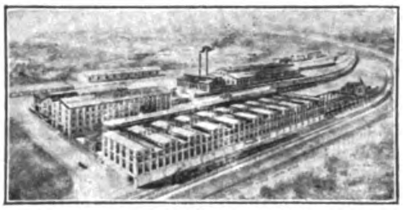
CONTRACT WORK

"ELIMINATE your Second Problem In Tractor Production"

Dies and tools form your second problem in production just as mechanical drawings form the first. Why not turn over the responsibility of producing perfect dies and tools to an organization that will prove its ability to relieve you of all cares and worries in connection with this work? Why not eliminate your second problem of production in this way and at the same time get the benefit of an organization that "works *with* you as well as *for* you?"

Drop us a line for full particulars.

MODERN TOOL, DIE & MACHINE COMPANY, North First Street COLUMBUS, OHIO



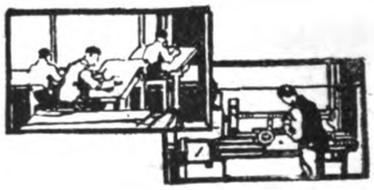
We Have Exceptional Facilities for

Quantity Production of Machine Parts

A battery of Gisholt Turret Lathes of from 13" to 24" capacity makes it possible to handle your order with speed and precision.

Write to-day, submitting blueprints.

TRAYLOR ENGINEERING & MFG. CO.
ALLENTOWN, PA.



Making Quality Castings

Automotive Parts made complete from drafting to finished product to fit the particular need. Our complete machine shops, foundry and skilled workmen turn out first quality work.

Send blue print or sample of work for estimate.

NEPTUNE METER CO.
50 E. 42d Street NEW YORK CITY

NEPTUNE

WE DESIGN AND MANUFACTURE

Tools, Dies, Jigs, Fixtures

and special machinery for the efficient production of duplicate parts.

C. F. SWISSGABEL MFG. CO.
DAYTON, OHIO

DRIVE SHAFTS

FLOATING AXLES (chain or gear), WRIST PINS, BRACKETS, SPRING HANGERS and other parts machined for the more-than-ordinarily-particular manufacturer. We make a specialty of mufflers for every automotive purpose. Write for quotations.

The Dunkirk Corporation
DUNKIRK, N. Y.

CASTINGS

Brass—Bronze—Aluminum

ALLOY FOUNDRY & MACHINE CORPORATION
73 Cedar Street, New Rochelle, N. Y.
"THE FOUNDRY THAT DELIVERS THE GOODS"

CAN YOU MANUFACTURE A TRACTOR?

We want a manufacturer to produce a farm tractor in its entirety. We have all necessary drawings. If you have the proper facilities, equipment and experience, get in touch with us.

SCIENTIFIC FARMING MACHINERY CO.
912 Andrus Bldg., MINNEAPOLIS, MINN.

SCHROEDER BROS. MFG. CO.

Tool and die work, stampings, gauges, jigs, cutter work, special machinery. We can give good deliveries if anybody can. Low overhead.

Torrington, Conn.

GEAR CUTTING
SPUR AND BEVEL GEARS

If you want an accurate, prompt and satisfactory job, try us. We specialize.
Also equipped to do cylinder grinding and guarantee high class workmanship.

AUTO ENGINE WORKS
ST. PAUL, MINNESOTA

TOOLS—DIES—JIGS FIXTURES—GAUGES

MACHINE PARTS AND SPECIAL MACHINERY
JOHANSSON SYSTEM INSURES ACCURACY

LINK TOOL AND MACHINE CORP.
174-182 Worth St., NEW YORK

CONTRACT WORK

CONTRACT WORK

TOOLS — DIES — JIGS FIXTURES — GAUGES

MANUFACTURING MACHINISTS

DESIGNERS AND BUILDERS OF SPECIAL MACHINERY

PRODUCTION OF
MACHINE PARTS IN QUANTITY

UNIVERSAL MACHINE CO.
Mechanical and Electrical Engineers
501-509 E. Preston St., Baltimore, Md.

TRACTOR GEARS

When in Pittsburg drop in and see us in action. Make a note of it now, so you won't forget. Just call Grant 6518 or 6519 and we'll take care of you.

Pittsburg Gear & Machine Company
Smallman Street, PITTSBURG, PA.

PELTON STEEL CO.

Chicago Avenue and Elliot Place
MILWAUKEE, WISCONSIN

High Grade
Electric Steel Castings

Our Trade Mark Is a Test Bar
Signifying Quality

P

FINEST and BEST EQUIPPED PLANT WEST of the MISSISSIPPI at your DISPOSAL

For the Manufacture of

TOOLS, DIES, JIGS, GAUGES and FIXTURES
QUICK ACTION

DODGE QUALITY SERVICE TOOLS

EXPERIMENTAL and SPECIAL MACHINE WORK

Our Tools are Famous for Quality

We Will Figure on Anything from a Small Order to our Whole Capacity. Write Now.

DODGE TOOL CO., Grinnell, Iowa

WANTED MACHINE WORK

Let us quote on your blueprints. Service and prices right.

Auto Parts Mfg. Co.
443 Trombly Ave., DETROIT

STEEL BALLS FOR BEARINGS

SPECIAL MACHINERY,
GAUGES, FIXTURES, TOOLS, JIGS

THE McINTYRE MACHINE WORKS
78 Grove St. HARTFORD, CONN.

SCREW MACHINE PRODUCTS

Work up to 2¼" diameter can be handled with our increased facilities.

Send us your specifications.

Thos. H. Dallett Co.
1301 Federal St., PHILADELPHIA, PA.

CONTRACTING MACHINISTS

MACHINE PARTS IN QUANTITY

NATIONAL ENGINEERING CORP.
617 Liberty Bldg. PHILADELPHIA, PA.

"ON THREE TRUNK LINES AND A WATER WAY."

A HIGH CLASS MACHINE SHOP

amply equipped with lathes, millers, shapers, planers, grinders, bores and other machinery. WANTS TO MANUFACTURE A PERMANENT PRODUCT.

Stratton & Bragg Company
PETERSBURG, VIRGINIA

SUPERIOR QUALITY METAL STAMPINGS

AUTOMOBILES, MOTORCYCLES, PRESSED STEEL SOCKET WRENCHES

New England Pressed Steel Co.
NATICK, MASS.

QUALITY CASTINGS

Grey Iron, Brass, Bronze

MACHINING OF "LIBERTY MOTOR" STANDARD CONTRACT WORK—QUANTITY PRODUCTION

Stevens Aylsworth Co., Inc.
253 B'way NEW YORK CITY

SHEET METAL STAMPINGS

BRASS, STEEL, ALUMINUM, NICKEL SILVER, SCREW MACHINE PRODUCTS, SMALL GEARS AND PINIONS.

THE ANSONIA NOVELTY CO.
ANSONIA, CONN.

Screw Machine Products

ACCURATE WORK QUICK DELIVERY

Always willing to give estimates.

D. M. WATKINS CO.
Eddy and Pine Sts. PROVIDENCE, R. I.

Tools, Dies, Jigs, Fixtures

OUR work has created a high degree of confidence in the automotive field for its absolute accuracy and precision on Tools, Dies, Jigs and Fixtures. Every detail of your blue print is given close attention. Write for detailed information.

STEINER BROS.
LIMA, OHIO

STANDARD PATTERN WORKS

Patterns of Every Description

614-616 West 12th Street ERIE, PA.

MACHINE CONTRACT WORK

One of the largest and most flexible machine shop equipments in the East. Experts on experimental work in the automotive field.

Newark Engineering & Tool Co.
476-482 18th Ave., Newark, N. J.

AUTOMOBILE ACCESSORIES HARDENING and GRINDING

Modern plant for special automobile and tractor accessories. Automatic and hand screw machines, milling, drilling, castellating and tapping equipment. Complete heat treating and grinding equipment.

THE CINCINNATI SCREW COMPANY
TWIGHTWEE, OHIO

TELEPHONE—MELROSE 9832-3

DIES Including Automatic
FIXTURES
GAUGES
JIGS

Send for Catalogue"

NELSON TOOL CO., Inc.

Tools
Models and
Experimental Work
Sheet Metal Mfg.
Screw Machine Products

Main Office—781-3 E. 142d St., N. Y. City

CONTRACT WORK

STEEL STAMPINGS

Deep Drawing Pressed Metal Parts

First-class Polishing and Plating, Japanning, Electric and Acetylene Welding and Assemblies.

Send us samples or blueprints for prompt estimates

THE AMERICAN TUBE AND STAMPING CO.
BRIDGEPORT, CONN.

120 Broadway New York — Park Building Worcester, Mass.

High Grade Automobile Manufacturers Buy Our Springs Because of Quality and Service

CLUTCH BRAKE and VALVE SPRINGS

TRANSMISSION ACCELERATOR AIR CONTROL FAN BELT and STARTER SPRINGS

RAYMOND MFG. CO., Ltd., Corry, Pa.

Three Large Plants to Take Care of Your Requirements

We are production engineers, designers and builders of dies, tools, jigs and special machinery and wood and metal pattern makers.

Our entire organization is made up of trained men who know the problems of the automotive industry.

Our company is owned and actively operated by Mechanical Engineers with years of experience to their credit.

Three large plants, superbly equipped in every detail, make possible an unusually prompt and efficient service.

Let us help you solve your problems. Drop us a line giving your requirements. We will gladly send quotations.

REYNOLDS ENGINEERING COMPANY
First Street and Third Avenue — MOLINE, ILLINOIS

SPRINGFIELD TOOL CO.

Designers and Builders of
SPECIAL TOOLS
JIGS — GAGES — FIXTURES — DIES

SPECIAL MACHINERY — STCo — HAND SCREW MACHINE WORK

and
Acme Automatic Work a Specialty
Springfield, Mass.

CONTRACT WORK

OUR SPECIALTY

TOOLS, DIES, JIGS AND SPECIAL MACHINERY

The Lucas-Miner Tool & Production Co.
Dayton, Ohio.

METAL STAMPINGS and Punch Press Work

Our product used on Allen cars and others. Prompt deliveries.

The Varley Manufacturing Co.
FINDLAY, OHIO.

PATTERNS

WOOD AND METAL
ACCURACY, SERVICE, QUALITY
Our patterns win when production counts.

CENTRAL PATTERN WORKS
CANTON, OHIO

NATIONAL STAMPINGS

For full information see our half-page advertisement in last or next week's AUTOMOTIVE INDUSTRIES. Over one hundred and thirty machine units.

National Metal Stamping & Manufacturing Co.
Mulberry & Murray Sts. — NEWARK, N. J.

G—E—A—R—S

NOTHING BUT GEARS

OUR LATEST **CATALOG** CONTAINS GEAR DATA YOU NEED. Send for It

PHILADELPHIA GEAR WORKS
1128 Vine Street — Philadelphia, Pa.

CASTINGS

GRAY IRON AND SEMI-STEEL
MACHINING AND WELDING

Nazareth Foundry & Machine Co.
32 Broadway, New York — NAZARETH, PA

DESIGNERS AND MAKERS

TOOLS—DIES—JIGS—FIXTURES

We Specialize in this Work and Can Give Prompt Service

LET OUR REPRESENTATIVE CALL

THE KNOWLES-TOOL MFG. CO., Dayton, Ohio

MANUFACTURERS

Are you interested in tools and fixtures that will save 70% in cost of machining and 40% in scrap? Consult us. We can be of service to you.

Manufacturer's Consulting Engineer
SYRACUSE, N. Y.

Metal Stampings

TOOLS, DIES, JIGS, FIXTURES, LATHE AND PLANER WORK

Send us your inquiries.

Great Lakes Pressed Steel Corp.
1400-1410 Niagara St. — BUFFALO, N. Y.

METAL STAMPING

Forming, spinning and finishing up to 3/32" thick.

G. T. SUTTERLEY & CO.
A. S. VALENTINE, Prop.
1722 N. Second St., — PHILADELPHIA, PA.

AUTOMOTIVE PARTS

Gauges, Jigs, Fixtures, Dies and Screw Machine Products. Experimental Work Done.

GRAND TOOL & MACHINE WORKS, INC.
161 Grand Street, — NEW YORK CITY

TOCK

Screw Machine Products

"ACCURACY FIRST"

We are equipped with the finest new machines and know how to turn out a quality product.

Prompt deliveries. LET US ESTIMATE.

Tock Screw Machine Products Corp.
199-203 Eighth St. — LONG ISLAND CITY, N. Y.

DIES, TOOLS JIGS FIXTURES
PRODUCTION WORK

CAPITAL DIE, TOOL & MACHINE CO.
619-21-N. Fourth St.
COLUMBUS, OHIO

MACHINE PARTS ON CONTRACT BASIS

Machine Work of All Kinds

HOPE MACHINE CO.
2310 N. 2nd St., — Phila., Pa.

CONTRACT WORK

Screw Machine Products

CAPACITY ⅛ to 1¾—Accuracy our Specialty—Prompt Deliveries. Send blueprints or samples for quotations.

Eastern Machine Screw Corp.
NEW HAVEN, CONN.

STAMPINGS
MACHINE WORK
ING-RICH MFG. COMPANY
BEAVER FALLS, PA.

SPECIAL MACHINERY
DESIGNED — DEVELOPED — PERFECTED

Our reputation of many years standing guarantees the HIGH QUALITY of our work.

TOOLS — DIES
JIGS — FIXTURES — GAUGES

ACCURACY IS OUR MOTTO

Also, Machine Parts Made on a Production Basis

New Process Specialty Co., Inc.
330-32 Hanover St. MILWAUKEE, WIS.

Light and Medium STAMPINGS
made in all metals. Finishing Washers a Specialty.

MASSACHUSETTS MACHINE SHOP, Inc.
817 Albany St. BOSTON, MASS.

ESPECIALLY EQUIPPED
WITH AUTOMATIC AND HAND SCREW MACHINES, LATHES, MILLERS, DRILLERS, WELDERS, FOR MANUFACTURING AUTOMOBILE AND TRACTOR ACCESSORIES AND SPECIAL ASSEMBLED UNITS.

The Cincinnati Ball Crank Co.
North St., Oakley, CINCINNATI, OHIO

Peck & Young Mfg. Co.
SPRINGS
AND
SCREW MACHINE PRODUCTS
FORESTVILLE, CONN.

SPECIAL MACHINES or MACHINE PARTS
Machined to sample or blueprints.
Located on three trunk line railroads.
Waverly Machine & Tool Corporat'n,
Waverly, N. Y.

LET US GIVE YOU AN ESTIMATE ON YOUR WORK or PARTS
WE REPRESENT THE MANUFACTURERS OF THE MIDDLE WEST

U. S. Trade Service Co., Inc.
Suite 718-721, Railway Exchange Bldg.
MILWAUKEE, WIS.

MACHINE PARTS
SPECIAL MACHINERY DEVELOPED AND BUILT. TOOLS, DIES, GAUGES, FIXTURES.
Let us estimate.

FULTON MACHINE TOOL CO.
1422 W. Randolph St. CHICAGO, ILL.

TOOLS AND DIES
Screw Machine and Turret Lathe Work

General Utility Co.
807 New Stock Exchange Bldg. PHILADELPHIA, PA.

TRACTOR DEALERS
Bring us the general repair work on your tractors. We are equipped to give you special service on replacing of parts, cylinder grinding and repairing. GENERAL MACHINE WORK FROM THE AUTOMOTIVE FIELD SOLICITED.

J. C. ARMSTRONG MACHINE CO.
1001 South Washington St. PEORIA, ILLINOIS

METAL STAMPINGS
Deep Drawn—Punch Press Work—Japanning—Tool and Die Work

THE ATLAS MFG. CO.
125 Water St. NEW HAVEN, CONN.

MACHINE PARTS
SPECIAL MACHINERY
Tools, Dies, Gauges, Fixtures
Let us estimate

MODERN TOOL & MACHINE WORKS
344 Mulberry St. NEWARK, N. J.

WE will manufacture and assemble your entire product or take your work on contract.

Complete Machine Shop, Brass and Aluminum
foundry at your disposal. Write.

E. U. SCOVILLE CO.
MANLIUS, NEW YORK

Recutting Milling Cutters Without Annealing
GRINDING OF ALL KINDS

KING TOOL COMPANY
225 So. 2nd St. SAGINAW, MICH.

MACHINE WORK
LIGHT, ACCURATE MACHINE WORK
CONTRACT MANUFACTURING

York Electric & Machine Co.
30-34 N. Penn. St. YORK, PA

ROLLS—ROLLER BEARINGS GRINDING
VALVE LIFTERS — PISTON PINS
SHACKLE BOLTS — BUSHINGS, ETC.
TOOLS AND SPECIAL MACHINERY

THE F. C. SANFORD MANUFACTURING CO.
2060 Fairfield Ave., BRIDGEPORT, CONN.

GEARS
ACME CO.

WE SPECIALIZE IN TRANSMISSION GEARS

Send us your inquiries, our prices are right.

ACME GEAR CO.
7th and Wood Sts., PHILADELPHIA, PA.

Sheet Metal Parts
FENDERS, HOODS, MUD-PANS, GASOLINE TANKS, BATTERY BOXES, MUFFLERS, RUNNING-BOARD SHIELDS.

York Corrugating Co.
YORK, PA.

BRASS BRONZE CASTINGS
HIGH GRADE COMPOSITION
From 1 to 10,000 pounds each.

Caskey's Anti-Friction

For High-Duty Bearings

Trucks Tractors Automobiles

BEARING METAL

Caskey's Brass & BronzeWks.
Richmond & York Sts., Philadelphia, Pa.

CASTINGS
GRAY	BRASS	DIE CASTINGS
MALLEABLE	BRONZE	DROP FORGINGS
STEEL	ALUMINUM	STAMPINGS

Complete service—any size—any quantity—rough or finished. Send for our suggestions.

LOUGH BROS.
90 West St. NEW YORK

Light Gray Iron, Brass and Bronze Castings
FINISHING, POLISHING AND PLATING
SCREW MACHINE WORK

I. S. SPENCER'S SONS, Inc.
GUILFORD, CONN

METAL STAMPINGS
Light and Heavy

WORCESTER STAMPED METAL

To Order

• QUALITY •
STAMPINGS

Worcester Stamped Metal Company
Worcester, Mass.

POSITIVE ACCURACY

HIGHEST TYPE OF SKILLFUL WORKMANSHIP. UNEXCELLED MECHANICAL EQUIPMENT FOR

Screw Machine Products—Turret Lathe Work—Nickel Plating—Milling—Drilling

F. C. PHILLIPS
West Street
STOUGHTON, MASS

Write for quotations

Dies, Jigs, Gauges and Fixtures

SPECIAL TOOLS OF ALL KINDS

General Machine Work

BREMER & COMPANY

139 No. 7th St., PHILADELPHIA, PA.

A COMPLETE SERVICE
FOR AUTOMOTIVE MANUFACTURERS

TOOLS, DIES, JIGS, FIXTURES, GAUGES, EXPERIMENTAL WORK and SPECIAL MACHINERY

We can furnish your **SPLINE GAUGES** and **LAMINATION DIES.**

LATHE and **MILLING MACHINE WORK** and **GRINDING.**

Our **ENGINEERING** and **TOOL-MAKING** departments will prove to be a profitable adjunct to your organization.

Johansson accuracy on all work.

Reasonable estimates—Prompt deliveries.

Let us quote on your requirements.

FROSTHOLM BROS. 1809 PARK STREET SYRACUSE, N. Y.

THE FEENEY TOOL CO., Inc.

We Will { make TOOLS for the production of all MECHANICAL PARTS—small and large. Build SPECIAL MACHINERY and develop your inventions.

OFFICE AND FACTORY

751 Central Ave. BRIDGEPORT, CONN.

LEVERS

All Cars and Trucks Made and Machined

M. J. FORD MFG. CO.

OF NEW JERSEY

398 Grand Street Jersey City, N. J.

SHEET METAL GOODS

STAMPINGS, TOOLS, DIES, SPECIAL MACHINE PARTS

Satisfaction is our motto.

THE METAL SPECIALTY CO., Inc.

Hillcrest Ave. and Tulip St. NEW BRITAIN, CONN

Screw Machine Products

GOOD DELIVERIES ON SCREW MACHINE PRODUCTS

Ontario Machine Screw Co.

PHILADELPHIA, 3415 Rober St., PA.

METAL STAMPING

LATHE, MILLING - MACHINE, SCREW - MACHINE WORK up to 1½ inches, and DRILLING on a contract basis. Send us prints for estimate.

HARVEY-HANES MACHINE CO.

369 Ellicott Street BUFFALO, N. Y.

LATHE, MILLING MACHINE AND SCREW MACHINE WORK

CASTINGS

BRASS, BRONZE, GRAY IRON PATTERN WORK
We are in a position to turn out complete job.

P. J. FLANNERY CO.,

33 Whiting St. NEW BRITAIN, CONN

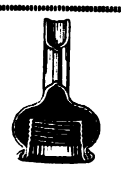
CONNECTING RODS, ETC., FOR FORD CARS

TURRET LATHE WORK, PRESS WORK MOTOR CAR PARTS, MACHINE PRODUCTS.

Let us estimate.

Specialty Products Co.

494 Mulberry St., NEWARK, N. J.



Light Metal Stampings

From Sheet Steel, Brass, Copper, Aluminum, Gold or Silver. Finishing, Plating and Japanning. Small parts and Accessories, Manufactured to Order.

METAL SPECIALTIES CO.

ATTLEBORO, MASS.

FRAMINGHAM SCREW WORKS

SCREWS—NUTS—BOLTS

Specialists in Screw Machine Products

Capacity 0—to 4¼"

FRAMINGHAM, MASS.

WANTED
A small article to manufacture;

one for which there is a market in large quantities. Necessary that it be one in the manufacture of which it would be possible to utilize the Thomson Process of Electric Welding to good advantage. Address: "WELDING," SB-6, care AUTOMOTIVE INDUSTRIES

TOOLS-DIES-JIGS

FIXTURES-SPECIAL MACHINERY

AUTO, TRUCK & TRACTOR PARTS

MORAN MACHINE CO.

SYRACUSE · · · · NEW YORK

SHEET METAL WORK

Our drafting department and entire organization is at your disposal for sheet metal work of all kinds

G. Drouvé Co., Bridgeport, Conn.

We are organized to help you get quantity or quality production at the right price. No matter what you make we know how and where to get prompt deliveries. Bring your problem to Bound Brook—our staff of 75 Consulting Engineers are at your service.

J R Weiner

Hub Engineering & Machinery Co.

BOUND BROOK NEW JERSEY

CYLINDERS REGROUND

Best equipment and expert mechanics mean high class work our kind. Special attention given to tractor work. Yes we duplicate part and do welding. Prompt service.

McDONALD AUTO PARTS

ST. MARYS, OHIO

FOR IMMEDIATE SERVICE
15 LATHES 6 GRINDERS

Gears—Dies—Tools

Connery Machine & Tool Co.

56 Harrison Ave. SPRINGFIELD, MASS.

GRINDING

We are completely equipped to work on plain cylindrical grinding up to 6" in diameter.

We design and manufacture automotive specialties and machine parts. Special machinery, tools, fixtures and gauges.

Send blueprints for estimates.

THE STEARNS AERO PARTS CO.

203 St. Claire Ave., N. E.,
CLEVELAND, OHIO

MACHINE WORK WANTED

For turret and engine lathes, millers' drill presses, shapers, planers, etc.
All work done promptly and at reasonable cost.

H. A. INMAN CO., Inc.
NEWARK, NEW YORK

Production Manufacturing
METAL STAMPING
DIES AND TOOLS

KUCHER & MILLER, Inc.
34 Barclay St. NEW YORK

Screw Machine Products
CAPACITY ¼" TO 2¼"

The Brown Bag Filling Machine Co.
FITCHBURG, MASS.

HUNDREDS of machine shops are ready for Contract Work. Tell us your needs and we will find the shop that will handle the work for you. Automotive Industries, Contract Work Department, 239 West 39th Street, New York.

Hardened Steel Bushings

We have special equipment for the production of hardened and ground steel bushings of every description. Send us your specifications for estimate.

Triangle Steel Bushing Co.
63 Brady St., DETROIT, MICH.

SCREW MACHINE PRODUCTS
THREAD MILLING MACHINE WORK

WICACO
Screw & Machine Works, Inc.
7th and Wood Sts. PHILADELPHIA, PA.

Screw Machine Work Wanted

Send your work to Omaha. At least let us make an estimate on your requirements. Our facilities enable us to serve you well.

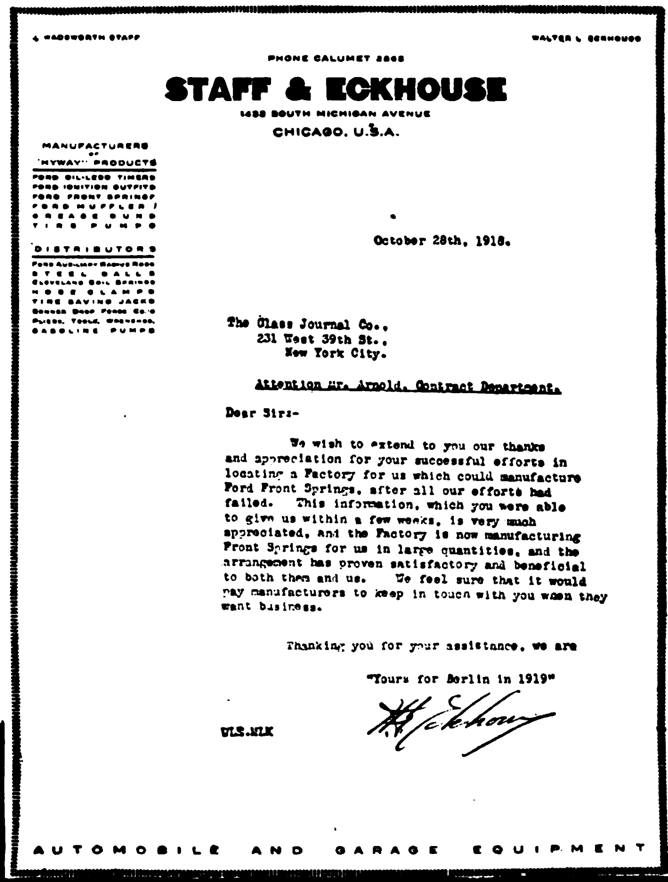
Bertschy Engineering and Manufacturing Co.
20th and Harney Sts. OMAHA, NEBR.

If your manufacturing requirements cannot be handled by firms now advertising, we should appreciate the opportunity of locating a firm that can render such special service as your business may demand. Our investigation of the contract situation as it now stands places us in a position in which we can be of valuable service to the manufacturers of the automobile industry. If interested, please communicate the Contract Work Department.

Automotive Industries, 239 W. 39th St., New York City

When seeking manufacturing assistance consult with the Contract Work Service Department of AUTOMOTIVE INDUSTRIES.

Our Manufacturing clientele, interested in securing contract work and opportunities to figure on the manufacturing of motors, kerosene carburetors, shock absorbers, tractors and other new devices find it to their advantage to confer with the Contract Work Service Dept. of the AUTOMOTIVE INDUSTRIES.



STAFF & ECKHOUSE
SOUTH MICHIGAN AVENUE
CHICAGO, U.S.A.

MANUFACTURERS OF "HYWAY" PRODUCTS
FORD OIL-LESS TIMERS
FORD IGNITION OUTFITS
FORD FRONT SPRINGS
FORD MUFFLERS
GREASE GUNS
TIRE PUMPS

DISTRIBUTORS
STEEL BALLS
HOSE CLAMPS
TIRE SAVING JACKS
GASOLINE PUMPS

October 28th, 1918.

The Class Journal Co.,
231 West 39th St.,
New York City.

Attention Mr. Arnold, Contract Department.

Dear Sirs-

We wish to extend to you our thanks and appreciation for your successful efforts in locating a Factory for us which could manufacture Ford Front Springs, after all our efforts had failed. This information, which you were able to give us within a few weeks, is very much appreciated, and the Factory is now manufacturing Front Springs for us in large quantities, and the arrangement has proven satisfactory and beneficial to both them and us. We feel sure that it would pay manufacturers to keep in touch with you when they want business.

Thanking you for your assistance, we are

"Yours for Berlin in 1919"

WLE.MLK

AUTOMOBILE AND GARAGE EQUIPMENT

CONTRACT WORK

Manufacturing and Merchandising Opportunities

The items appearing in these columns form a part of the inquiries received by our Contract Work Service Department during the past three weeks. Manufacturers or concerns interested in these or similar inquiries can secure full information as to how this service is operated by communicating with the Contract Work Service Department, Automotive Industries, 239 W. 39th Street, New York City.

6052 Quotations desired on 8" and 3" brass bushings in lots of 1000.

6053 Inquiry received relative to a concern who can handle casting in 500, 1000 and 5000 lots. The casting to be about half the length of a sample on file in this department and is of cast steel.

6058 Manufacturers of electric specialties, located in Chicago, would like to get in touch with concerns who are equipped to manufacture high quality reflectors for automobile lamps. (Silver plated brass reflectors.)

6067 Inquiry received from New Jersey for a manufacturer of spark plugs in small lots, as samples of patent plug.

6068 French interests desire to represent American firms along lines of commercial or industrial relation connected with automotive work.

6072 A Missouri automobile sales company want to get in touch with a firm that will manufacture a blowout patch in quantities.

6073 Builders of high grade bodies are in the market for a quantity of wood carvings which they need for hearse and undertaker wagons.

6074 A New York firm desires to be placed in touch with manufacturers of standard equipment, such as front axles, rear axles, wheels, steering gears, frames, springs, in fact all parts of automobile except radiator, power plant and transmission.

6075 Inquiry received from Syracuse from company desirous of placing work covering forgings (bar) flattened small rounds; screw machine, pins (small) large head cap screws; springs, market spring wire (steel) springs, light wire, wound ⅝ dia. They are desirous of communicating with firms producing finished miscellaneous soft grey iron castings delivery same machined to drawings.

6076 New York concern desire to get in touch with a manufacturer equipped to handle what is known as a security robe rail, which is a two-piece rail, the upper bar being hinged at one end with a lock at the other; parts of this device will necessitate die-casting. They want these turned out in quantities of approximately 5,000 per month.

6078 Connecticut concern want to be placed in touch with gray iron foundries.

6080 Minnesota manufacturers of agricultural implements want to get in touch with a manufacturer in a position to produce a farm tractor in its entirety.

6048 Party owning an audible signal for road vehicles which device is automatic and can be used on commercial as well as on pleasure cars, is looking for manufacturing and merchandising assistance.

6049 Company owning a patented automobile signal, due to lack of funds to carry on the production of same, is looking for manufacturing and merchandising assistance. The signal is so constructed that it can be seen in daylight or dark, from the right or left and from the front or rear.

6050 Inquiry received relative to manufacturers who might be interested in a radiator that is non-breakable which is claimed to be far superior to the ordinary radiators in that it will freeze but will not burst, is more accessible for repairs and has enlarged cooling surface.

6051 Party located on the Pacific Coast is looking for manufacturing and merchandising assistance in connection with a circuit breaker and distributor on which he owns a patent; the system he claims is very simple.

6054 The owner of a patented baggage rack which folds down and makes a regular mat foot scraper when not in use as luggage carrier, wants to dispose of same on either a royalty basis or sell outright. It can be made of woven wire matting, cast iron or aluminum.

6055 Interests back of this inquiry are desirous of getting in touch with manufacturers who would like to investigate a tractor truck for railway passenger cars. Possibilities ahead are almost unlimited. Consultation is invited.

6056 This inquiry has to do with a shock absorber, the owner of which is looking for a manufacturer to place same on the market. This shock absorber is a new and highly improved method in Ford suspension.

6057 Party located at Wisconsin owning patents on a new automobile tire which he claims will outlast any tire on the market to-day, also that the tire is non-skid and blowouts are excluded, is desirous of disposing of the patents on a royalty basis or some other satisfactory arrangement.

6059 The holder of patents on an ignition lock for automobiles that is applicable to 90 per cent of the American cars, (all those using battery ignition) is desirous of getting in touch with some one who will manufacture the lock on a royalty basis or by purchasing the lock outright, or is willing to make any arrangement satisfactorily to the manufacturer, whereby he will net some profit.

6060 Owner of a patented differential and lock for motor vehicle drive axle is looking for manufacturing and merchandising assistance.

6061 This proposition has to do with an internal combustion engine, interests back of which are ready to place same on the market and want to get in touch with manufacturers.

6062 Inquiry received from party owning a patented kerosene and gasoline carburetor who wishes to sell same either outright or take small cash payment with the balance in royalties.

6063 Manufacturing and merchandising assistance required to place on the market an adjustable radiator fan.

6064 This proposition covers a safety stop on any auto in case of failure of brakes to hold on going up-hill when stalling motor or failure of getting into second or first gears, owner of which is looking to dispose of same and will consider any kind of an arrangement.

6065 A roller-bearing, the principal object of the invention being to provide an improved form of anti-friction bearing so arranged that both rotary and thrust friction will be reduced, party owning patents on this device is looking for a firm that will take this over on a royalty basis, or buy it outright.

6066 A New Yorker wants to enter into a satisfactory arrangement with a manufacturer in regards to disposing of trademark on a valve grinding compound with material and equipment necessary to commence manufacturing at once, would consider entering into a royalty arrangement.

6069 Tractor engineers have developed a small creeper type tractor which they wish to place on a royalty basis. Power steering, no brakes used and no loss of power when steering, three speeds forward and reverse, 18-10 h.p., thoroughly covered by eight patents and patent applications. Will submit proposition and demonstrate tractor to responsible manufacturers.

6070 This inquiry has to do with a ground gripping device for vehicle wheels which the owner wants to dispose of either outright or on a royalty basis.

6071 The owner of a new spark plug the object of which is to provide a novel means by which carbon may be kept from accumulating on the electrodes, and also to provide a way to prime an internal combustion engine through the spark plug, wants to get in touch with manufacturers in a position to finance the proposition.

6077 The owner of a positive gear drive transmission wants to sell the patents, or license its manufacture on a royalty basis.

6079 A wheel and rim corporation located in Ohio are seeking arrangements for the manufacture of a suspension wheel in a larger way, on royalty or some other business basis.

6081 New York interests are looking for a plant to manufacture a heavy duty 6" bore motor. It has been designed for use on rail cars, also for marine use.

6082 Owner of a permanent dust-proof grease-tight casing for steering connections is open to any equitable proposition, for sale outright, for manufacture and marketing on a royalty basis, or for marketing only.

THE CLEARING HOUSE

OF THE MOTOR INDUSTRY

For Parts, Accessories. Tires, Machinery, Rebuilding, Repairing, Welding and Used Cars. Also Help and Situations Wanted and Miscellaneous Classified Advertising.

QUICK SERVICE

When you need it quickest, THEN we serve you best. Immense Stocks backed with our Guarantee of "Money Refunded if Not Perfectly Satisfied." Buy where it is safest at a certain bargain of

50% TO 75% SAVING!!

FOR INSTANT SERVICE! WRITE, WIRE OR PHONE

AUTO WRECKING CO.

We tear 'em up and sell the pieces

13th and Oak Sts. Kansas City, Mo.

SAMUEL L. WINTERNITZ & CO.

AUCTIONEERS

Largest Liquidators of Motor Plants

First National Bank Bldg. CHICAGO, ILL.

LOZIER OWNERS

Why buy COUNTERFEIT REPAIR PARTS? We have all ORIGINAL PARTS made from Original Patterns. Order from headquarters LOZIER MOTOR CO.

LOZIER MOTOR COMPANY

Fort and 6th Sts. DETROIT, MICH.

Service Stations—E. A. Cornely, Inc., 1445 Bush Street, San Francisco, Cal.; Lozier Motor Co. of New York, Inc., 47th Street and 11th Avenue, New York City.

American-Underslung

ADAMS TRUCKS

M-A-R-I-O-N — NYBERG — RIDER — LEWIS— WAVERLY—ELECTRIC

PARTS AND REPAIRS. ALL MODELS

V. A. LONGAKER CO.

Catalogs Free. INDIANAPOLIS, IND.

ATTENTION! MARION OWNERS

ALL PARTS FOR ALL MODELS

SAVE MONEY—BUY YOUR TRANSMISSION, DIFFERENTIAL, REAR AXLE AND MOTOR PARTS FROM US

Liberal Discount Allowed on All Parts

MARION MOTOR CAR CO. OF CHICAGO

2450 Michigan Avenue. CHICAGO, ILL.

USED PARTS See full page Ad in Motor Age

PARTS FOR 600 MODELS OF CARS

AUTO SALVAGE CO., Inc.

Kansas City, Mo. St. Louis, Mo. Cincinnati, Ohio

GEARS

New gears for all cars. Transmission, Rear Axle, Pump and Motor Timing Gears. New gears for over 350 different makes and models of cars.

PURITAN MACHINE COMPANY

145 PURITAN BLDG., DETROIT, MICH.

Eastern Branch 245 W. 55th Street, New York City, N. Y.

FOR SALE

24—7" x 15	lb.	I-Beams	10' 6"
40—5" x 9¾	lb.	I-Beams	7' 11"
24—5" x 9¾	lb.	I-Beams	7' 9½"
39—5" x 9¾	lb.	I-Beams	8' 0"
40—5" x 9¾	lb.	I-Beams	7' 9"
35—5" x 9¾	lb.	I-Beams	7' 2"
38—5" x 9¾	lb.	I-Beams	6' 6"
37—5" x 9¾	lb.	I-Beams	5' 4"
40—5" x 9¾	lb.	I-Beams	3' 9"
42—6" x 12¼	lb.	I-Beams	5' 6"
12—6" x 12¼	lb.	I-Beams	7' 4½"

1400—No. 10 B. & S. (4.16 lb.) Blue Annealed Sheets, 51⅛" x 60"
872—No. 10 B. & S. (4.16 lb.) Blue Annealed Sheets, 53⅞" x 77"
1356—No. 10 B. & S. (4.16 lb.) Blue Annealed Sheets, 57½" x 78¼"
550—3/16" O. H. Plates, 56" x 56"
19—O. H. Flat Circles, 5/16" thick x 42" dia.
6—O. H. Flat Circles, ¼" thick x 32¾" dia.

THE STACEY BROS. GAS CONSTRUCTION CO.

CINCINNATI, OHIO

CYLINDERS REGROUND

Over 800 Piston Patterns

ALWAYS IN STOCK

Our Expert Mechanics and our Highest Grade Equipment are your guarantee for highest class workmanship.

Our Special Light Alloy Pistons Will Give You More Power—More Speed.

We also do Gear Cutting of Spur and Bevel Gears

Write Us To-day.

AUTO ENGINE WORKS

St. Paul, Minn.

Cylinder Grinding Pistons and Rings

LARGEST BECAUSE BEST

In our new plant, added facilities enable us to give better service than ever.

Houpert Machine Company

Harris Ave. & Marion St., LONG ISLAND CITY.

Phone—Hunterspoint 916.

CLUTCH WANTED

Manufacturer of FRICTION CLUTCH PULLEYS is desirous of obtaining a Clutch for TRACTORS, TRUCKS or PASSENGER CARS, preferably of the Dry Plate Type, to add to their line. Also will consider having experienced engineers design a suitable Clutch. Address inquiries Box F-639, care AUTOMOTIVE INDUSTRIES.

TRUCK AND TRACTOR MOTOR MANUFACTURERS—ATTENTION

Please send us specifications on your 25 H.P., 900 R.P.M. Motors with governor and complete prices of motor equipped with fan and radiator.

WILSON WELDER and METALS CO., INC.

2 Rector Street NEW YORK

CRANK SHAFTS REGROUND

NOT FILED AND LAPPED—BUT REGROUND!! ON SPECIAL GRINDERS!!

CYLINDERS REGROUND

STAFFORD SUPREME SERVICE

STAFFORD MOTOR CO.

2201-09 Campbell Ave. KANSAS CITY, MO.

CYLINDERS REGROUND

Including new pistons and rings. Any size up to 5 inch bore—$5 to $10 per cylinder. All our work guaranteed. Quick Shipments.

Let us prove our ability on your next job.

NEUPERT MFG. CO.

82 Lark St. BUFFALO, N. Y.

Attorney-at-Law and Solicitor of Patents Formerly Member Examining Corps, United States Patent Office

C. L. PARKER

American and foreign Patents secured. Searches made to determine patentability and validity. Patent suits conducted. Pamphlet of instructions sent upon request.

McGill Building, WASHINGTON, D. C.

Telephones {4257 / 4258} Spring

Henry C. Griffin & Co., Inc.

Automobiles Boxed for Export

143-145 Varick Street, Near Spring Street

NEW YORK

World's Largest Cylinder Repairing Co. Over Twenty Thousand Satisfied Customers Throughout the Country

Ship to Our Nearest Plant Your **SCORED POROUS & DEFECTIVE CYLINDERS** Repaired by "Lawrence Patent Process"

Work guaranteed for life of engine. 24-hour service. Tested and approved by all motor manufacturers. Fused electrically with silver-nickel alloy. **No Warping or enlarging of bore.** Same piston and rings used.

L. LAWRENCE & CO.

CHICAGO, 1522 Michigan Ave. NEWARK, N. J., 292 Halsey Street
CLEVELAND, 1810 Prospect DETROIT, 1246 E. Jefferson
NEW YORK CITY, 791-793 11th Ave. SAN FRANCISCO, 116 Hyde St.

ATTENTION

Garagemen, Dealers and Mechanics.

We manufacture Electrical Testing, Charging and Magnetizing Instruments and Publish Books covering all Motor Car Electric Systems and Tire Repairs and Vulcanizing. New illustrated catalogue ready. Write for it today. Dealers wanted.

H. E. PHILLIPS & COMPANY

DAYTON, OHIO

Miscellaneous. | Parts and Repairs. Help Wanted. | Parts and Repairs. Help Wanted.

TO MANUFACTURERS OF INTERNATIONAL VISION!

Poughkeepsie, New York, presents one of the best opportunities in the United States as a manufacturing location for export trade development. Freight shipments North and South by the N. Y. C. R. R. and East and West by the C. N. E. R. R. (N. Y., N. H. & H. System); by bridge over the Hudson. Poughkeepsie is 72 miles from New York City, giving advantage by water communication on the Hudson River of the greatest port facilities in the world. Electric power as low as 1.5c. per K.W.H.; ample labor supply; a $300.000 Industrial Expansion Fund for building purposes. America's gigantic Merchant Marine of 25,000,000 tons is for your use. Locate at Poughkeepsie, New York, and take full advantage of the after-the-war trade. Address Chamber of Commerce.

FOR SALE

1 300-400 H.P. Sprague Electric Cradle Type Dynamometer with complete equipment.

Practical reading from 25 R.P.M. to 3000 R.P.M.

Trego Motors Corporation
NEW HAVEN, CONN.

FOR SALE

One hundred 8-cylinder motors, 3 in. bore by 4½ in. stroke. Brand new and block tested, $100.00 each. New equipment, including Atwater-Kent distributor and coil, Stewart carburetor, Dyneto starter and generator, $100.00 extra.

REGAL MOTOR CAR CO.
216 Piquette Avenue DETROIT, MICHIGAN

BODY DRAFTSMEN

Wanted for detailed construction drawings of open and closed high grade automobile bodies. For further information, stating ability and experience, write to Body Engineering Dept.,

MITCHELL MOTORS COMPANY, Inc., Racine, Wisconsin

Factory Superintendent Wanted

for small plant in NEWARK, N. J., doing high-class automobile work. Must have thorough knowledge of steels, gear cutting, heat treating and laying out of work generally. Address Box J-307, care AUTOMOTIVE INDUSTRIES.

SALESMAN WANTED

with ability to sell automobile accessories. Must be a high-grade man, able to put over large deals and who has a record for doing so. Applicant is requested to send full particulars as to his employment the last five years, together with references. Address Box J-219, care AUTOMOTIVE INDUSTRIES.

WANTED

First Class Body Designer

with experience on very highest grade closed bodies. Give age, years of experience and former employer.

Box No. N 188, care of Automotive Industries

Manufacturers Looking for Help

Manufacturers looking for men of ability such as Engineers, Salesmen, Mechanics, etc., etc., will always find it to their advantage to use these columns. The Automotive Industries is read almost daily by the men who know and are accomplishing things daily. The men worth while will read your advertisement in this paper. Try it for results.

SALESMAN

"Where can we locate a live wire?" was the query of a well-known New York house. The expert salesman keeps in close touch with the automobile authority of the industry. Your message therefore in this paper will bring results.

Your Patented Automobile Accessory Manufactured

Many practical accessories are never placed on the market, due either to lack of manufacturing facilities, merchandising organization, or capital.

There are many automotive concerns prepared to consider and take hold of worth-while opportunities.

It is the work of this Department to bring these interests together.

There is no charge for this service.

Send blueprints, specifications and full information as to the kind of material and manufacturing equipment necessary to manufacture the article in question.

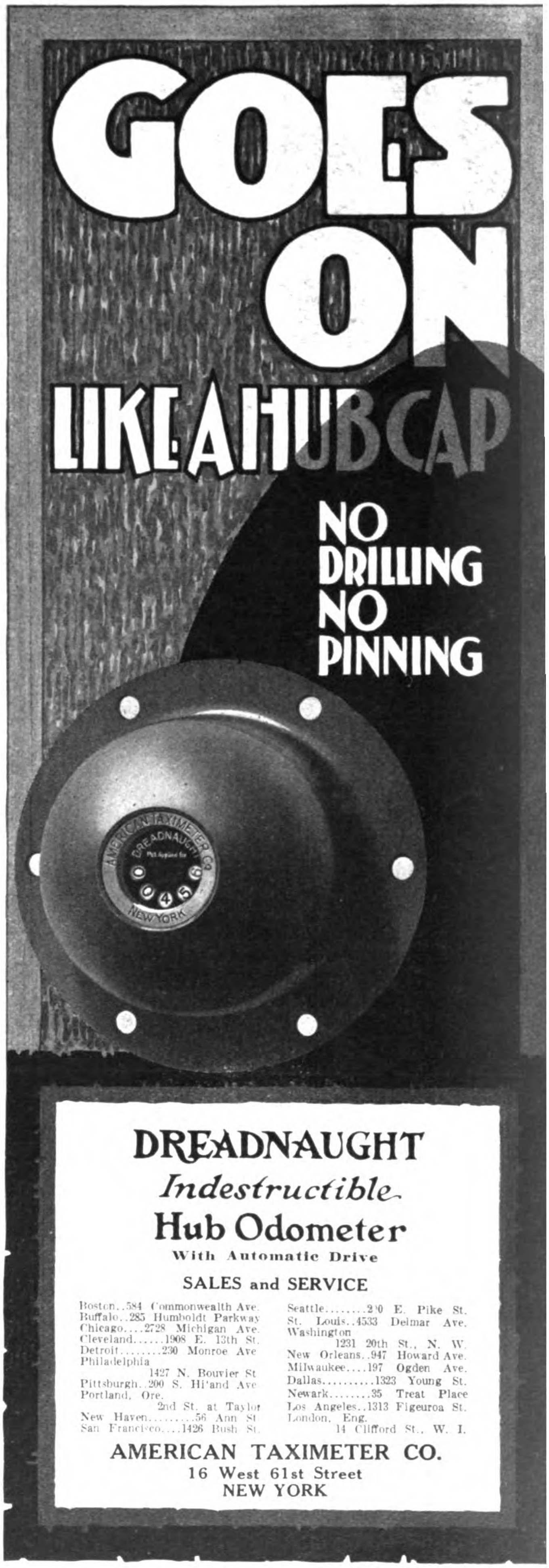
It is also important that you state whether you are in a position to finance the proposition or if it is to be manufactured on a royalty basis.

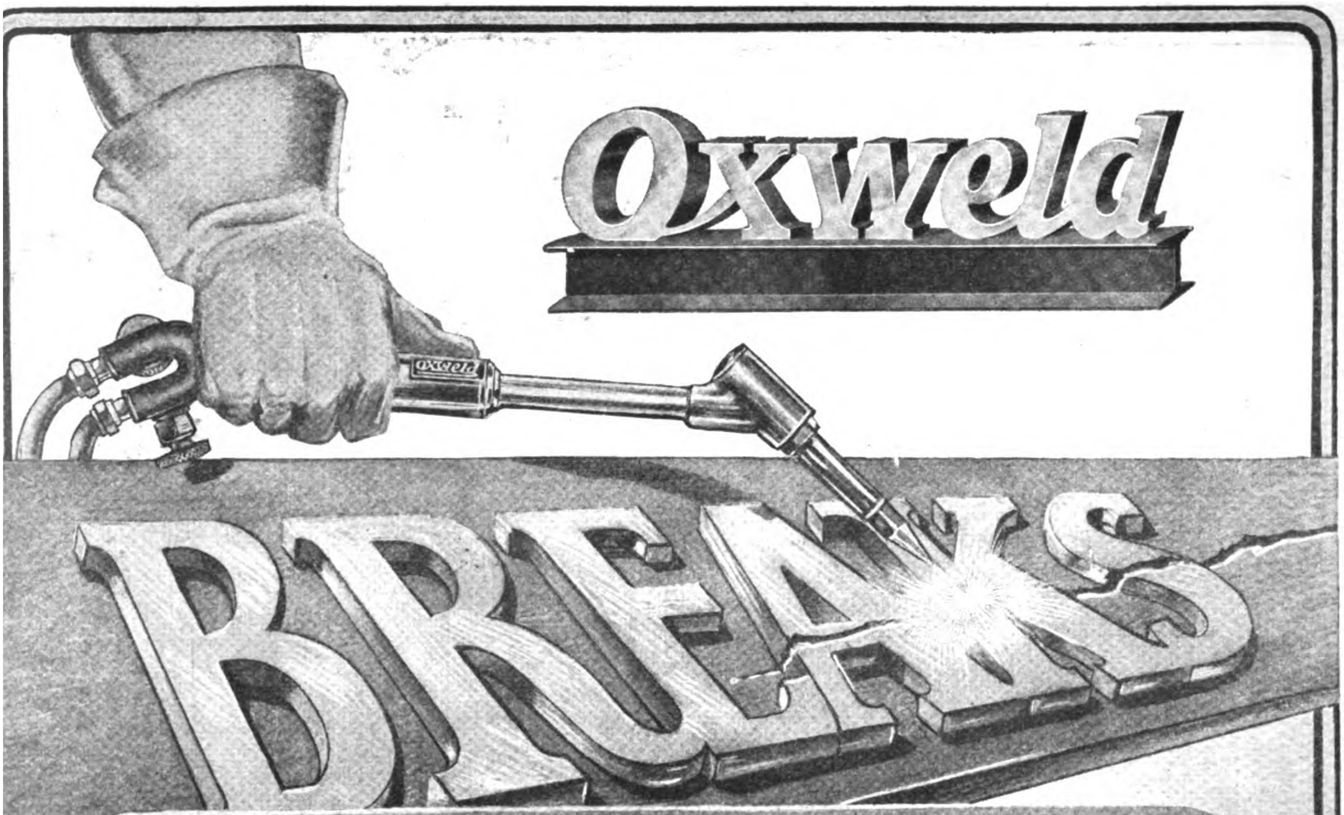
For co-operation along the above lines address the

AUTOMOTIVE INDUSTRIES Service Department, Contract Work
239 WEST 39th STREET, NEW YORK CITY

Index to Advertisers

THE ADVERTISERS' INDEX is published as a convenience and not as a part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.


GOES ON
LIKE A HUB CAP
NO DRILLING
NO PINNING
AMERICAN TAXIMETER CO.
DREADNAUGHT
NEW YORK
DREADNAUGHT
Indestructible
Hub Odometer
With Automatic Drive
SALES and SERVICE
Boston..584 Commonwealth Ave.
Buffalo..285 Humboldt Parkway
Chicago....2728 Michigan Ave.
Cleveland......1908 E. 13th St.
Detroit.........230 Monroe Ave.
Philadelphia
1427 N. Bouvier St.
Pittsburgh..200 S. Hi'and Ave.
Portland, Ore.
2nd St. at Taylor
New Haven..........56 Ann St.
San Francisco....1426 Bush St.
Seattle........220 E. Pike St.
St. Louis..4533 Delmar Ave.
Washington
1231 20th St., N. W.
New Orleans..947 Howard Ave.
Milwaukee....197 Ogden Ave.
Dallas..........1323 Young St.
Newark........35 Treat Place
Los Angeles..1313 Figeuroa St.
London, Eng.
14 Clifford St., W. I.
AMERICAN TAXIMETER CO.
16 West 61st Street
NEW YORK



OF COURSE no big plant would be without Oxweld Service. Important equipment will break. They must have Oxweld to safeguard production speed and to keep down "idle-time" losses.

"The one-man machine shop," as Oxweld Equipment is called, is equally vital to small plants. Reclaiming broken and defective parts—building up worn surfaces in the quickest, most economical way.

The Oxweld Injector Type Blowpipe does its work with greater speed and certainty, and at less cost, than any other welding or cutting device.

Write for the Bulletins applying to your business.
They're interesting.

WRITE FOR OUR BULLETIN

OXWELD ACETYLENE COMPANY

NEWARK, N. J. CHICAGO LOS ANGELES

World's Largest Maker of Equipment for Oxwelding and Cutting Metals

173